Bayer Corporation Blood Glucose Meter

Computer Interface Specification

November 21, 2006

Part No. 99993952

Revision C

Questions on this document should be referred to:
Bayer HealthCare LLC
Technical Customer Services
Mishawaka, IN 46544 USA
In USA,
Telephone: 1-800-348-8100 prompt 1, then 2

Revision History:

Rev	Description of Change	Author	Date
-	Initial release	J. Perry	
A	- Added information for Ascensia® BREEZE® and Ascensia® CONFIRM™ meters. - Reorganized document to enhance readability. - Updated text for Ascensia™ branding.	G. Johnson	Nov 1, 2002
B	- Revised information for Ascensia® DEX® 2 and Ascensia® ESPRIT® 2 meters. - Added information for Ascensia® CONTOUR™ meter. - Added information for Ascensia® Data Cable. - Updated photos with Ascensia® branded meters. - Updated text for Ascensia® branding. - Reorganized document to enhance usability.	G. Johnson	Sep 5, 2003
C	- Added information for Ascensia® CONTOUR™ (5-second version): 1. Updated and added information for the Communication Mode when the meter is in Memory Recall Mode. 2. Added Meter Remote Command Setting for the Test Time Alarm and the Meal Markers. 3. Added Example Result Record data. 4. Added meter pictures. - Added BREEZE® 2 meter to list of BREEZE® family and added pictures of BREEZE® 2 meter. - Updated Table 12: Filed 9 – changed the result status marker “E/D” to “E\D” for the result record. - Updated the Header and Footer information. - Updated the Technical Center contact information on the cover page.	Kevin Chang	Nov 21, 2006

Table of Contents

List of Figures

List of Tables

1.0 Scope

Bayer Corporation produces a variety of blood glucose meters, both with and without a computer interface. This document describes the computer interface used by all Bayer Corporation blood glucose meters that have a computer interface. For simplicity, only Bayer Corporation blood glucose meters that have a computer interface are discussed within this document.

All Bayer Corporation blood glucose meters (with a computer interface) are organized into families within this document. All of the members within each meter family share an identical computer interface protocol message definition, although the physical and electrical interfaces vary slightly among and within the Bayer Corporation Blood Glucose meter families.

The meter families and family members are defined in "Table 1: Bayer Corporation Blood Glucose Meter Families".

Table 1: Bayer Corporation Blood Glucose Meter Families

Meter Family	Meters Contained in Class
BREEZE®	Ascensia® BREEZE® Ascensia® BREEZE® 2 Ascensia® CONFIRM®
CONTOUR™	Ascensia® CONTOUR™ (15-second and 5-second versions)
DEX®	Glucometer® DEX® Glucometer® DEX® 2 Ascensia® DEX® 2 Glucometer® ESPRIT® Glucometer® ESPRIT® 2 Ascensia® ESPRIT® 2 Glucometer® Dexter-Z® Ascensia® DEXTER–Z® II
ELITE® XL	Glucometer ELITE® XL Ascensia ELITE® XL Ascensia ELITE® XL^{MC}

This document is intended to provide technical information in order to facilitate the writing of computer programs that communicate with Bayer Corporation blood glucose meters. This document describes:

- Relevant meter behavior (see "Section 3.0 Meter Operating Modes")
- The physical/electrical connection to the meter (see "Section 4.0 Physical/Electrical Interface and Connection")
- The communication protocol for transmitting test results through the computer interface (see "Section 6.1 *Data Transfer Mode*")
- The communication protocol for configuring the meter and interrogating the meter configuration through the computer interface (see "Section 6.2 *Remote Command Mode* Protocol")
- Example Communication Sequences (see "Section 6.4 Example Communication Sequences")
- Data Communication Hints (see "Section 7.0 Data Communication Hints")

2.0 Referenced Documents

The following documents are referenced in this specification.

ANSI/EIA-232-D-1986	"Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange", Electronic Industries Association, January 1987.
ANSI X3.4-1986	"Coded Character Sets – 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII)", American National Standards Institute, 1986.
ASTM E 1381-95	"Standard Specification for Low-Level Protocol to Transfer Messages Between Clinical Laboratory Instruments and Computer Systems", 1997 Annual Book of ASTM Standards, volume 14.01, American Society for Testing and Materials, 1997.
ASTM E 1394-91	"Standard Specification for Transferring Information Between Clinical Instruments and Computer Systems", 1997 Annual Book of ASTM Standards, volume 14.01, American Society for Testing and Materials, 1997.

3.0 Meter Operating Modes

"Table 2: Meter Operating Mode and Capability Summary" summarizes the operating modes for the Bayer Corporation blood glucose meter families. The operating modes are described for each meter family in the following paragraphs.

Table 2: Meter Operating Mode and Capability Summary

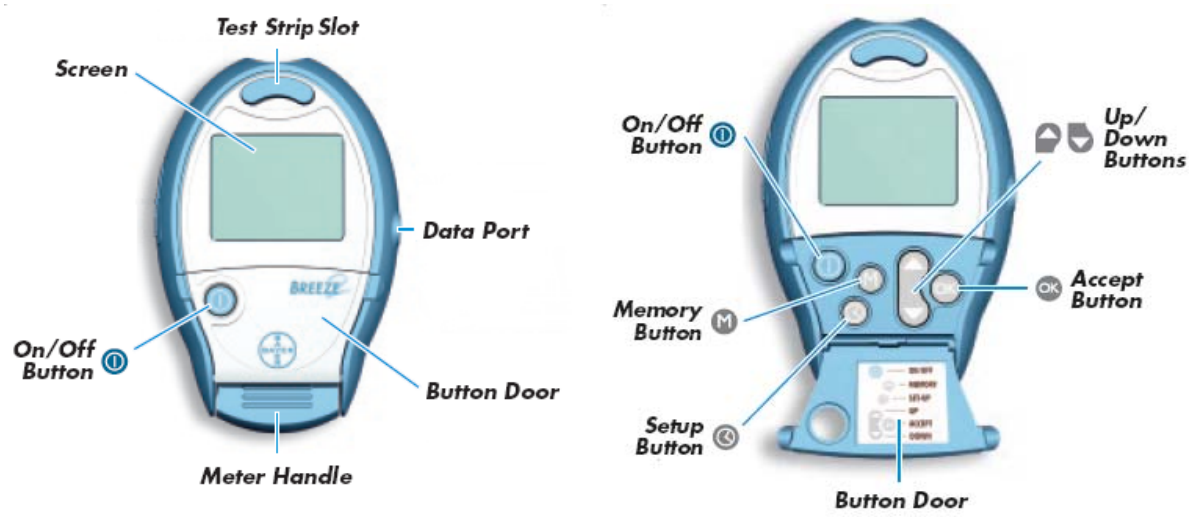
Meter Family	Run a blood glucose test	Computer Communication	Display Results in memory	Manual Configuration Mode
BREEZE®	*Test Mode*	*Home Mode*	*My Results Mode*	*My Setup Mode*
CONTOUR™	*Test Mode*	*Communication Mode*	*Memory Recall Mode*	*Setup Mode*
DEX®	*Testing Mode*	*Features Mode*	*Features Mode*	*Features Mode*
ELITE® XL	*Testing Mode*	*Communication Mode*	*Memory Recall Mode*	*Setup Mode*

3.1 BREEZE® Meter Operating Modes

When off, the BREEZE® meter appears as shown in "Figure 1: BREEZE® Meter Off". The BREEZE® meter may be turned on in various modes, including *Test Mode*, *My Setup Mode*, *My Results Mode*, and *Home Mode*.

Figure 1: BREEZE® Meter Off

Figure 2: BREEZE® 2 Meter Off



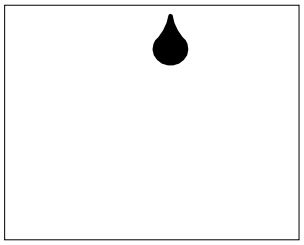
When the BREEZE® meter is turned on, the meter runs a power-on display test during which all display elements are briefly on. The meter will then enter the operating mode as described in the following sections.

The BREEZE® meter is turned off from any mode by pressing the On/Off button.

3.1.1 BREEZE® Meter in *Test Mode*

When the BREEZE® meter is turned on by pulling the Slide all the way out and pushing the Slide all the way back, a sensor is presented for a test and the meter is operating in *Test Mode*. "Figure 3: BREEZE® Meter in *Test Mode*" depicts the initial *Test Mode* display. The BREEZE® meter does not attempt to communicate with a computer when in *Test Mode*.

Figure 3: BREEZE® Meter in *Test Mode*



3.1.2 BREEZE® Meter in *My Setup Mode*

When the BREEZE® meter is turned on by pushing the Setup Button inside the advanced features door, the meter is operating in *My Setup Mode*. *My Setup Mode* is used to view and set various meter configuration settings. *My Setup Mode* may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information on the operation of *My Setup Mode*. The BREEZE® meter does not attempt to communicate with a computer when in *My Setup Mode*.

3.1.3 BREEZE® Meter in *My Results Mode*

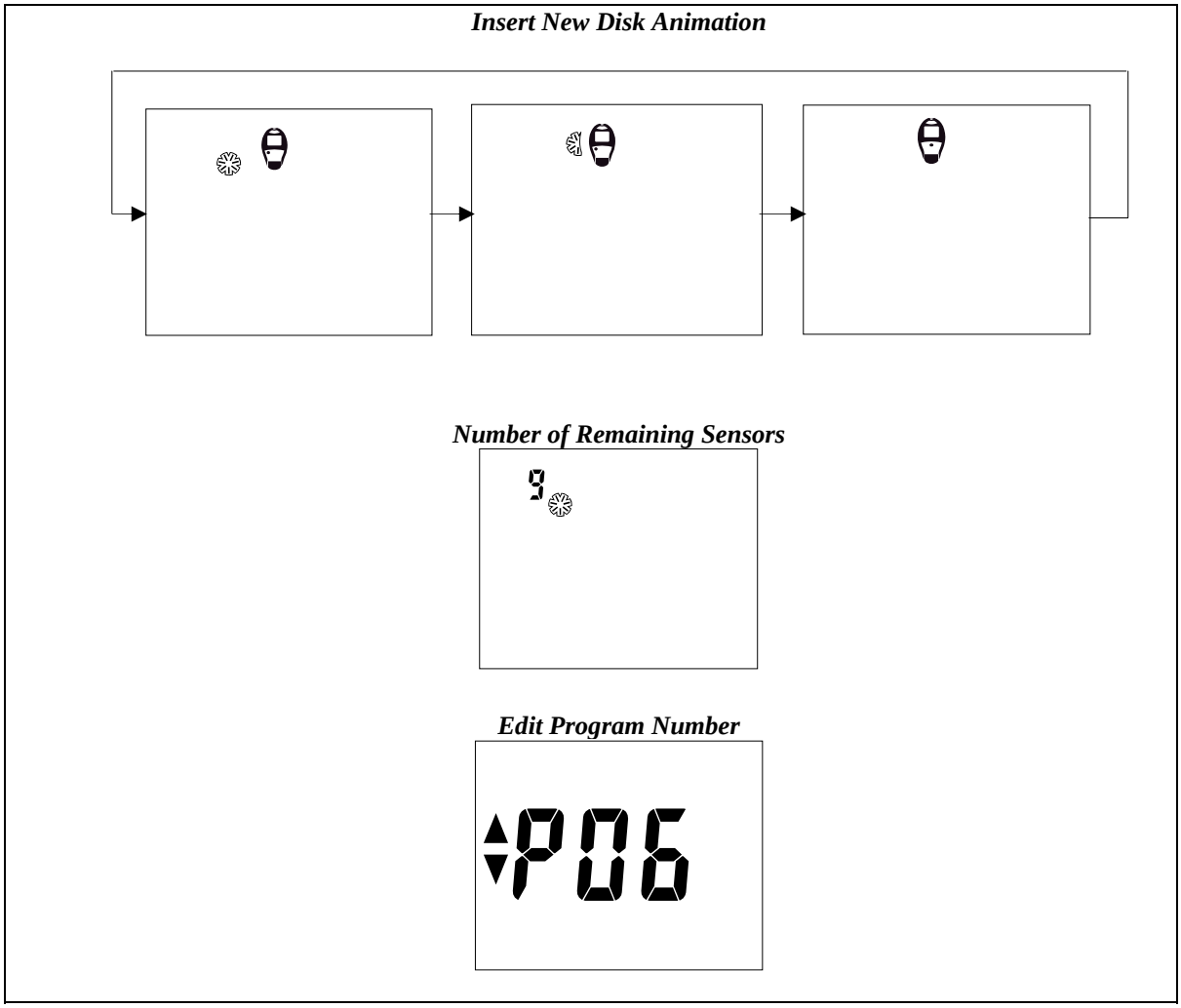
When the BREEZE® meter is turned on by pushing the Memory Button inside the advanced features door, the meter is operating in *My Results Mode*. *My Results Mode* is used to view and clear blood glucose results stored in the meter. *My Results Mode* may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information on the operation of *My Results Mode*. The BREEZE® meter does not attempt to communicate with a computer when in *My Results Mode*.

3.1.4 BREEZE® Meter in *Home Mode*

When the BREEZE® meter is turned on by pushing the On/Off button, the meter is operating in *Home Mode*. There are three possible displays that will appear in *Home Mode*. They are the *Insert New Disk Animation* display, the *Number of Remaining Sensors* display, and the *Edit Program Number* display. "Figure 4: BREEZE® Meter in *Home Mode*" depicts the three *Home Mode* displays.

The BREEZE® meter attempts to communicate with a computer only when in *Home Mode*. The meter will attempt to communicate whether or not the meter is physically connected to a computer or cable. If a connection to a computer is established, the meter will automatically switch into *Data Transfer Mode*. If the meter remains idle and no connection is established, the meter will automatically switch off.

Figure 4: BREEZE® Meter in *Home Mode*



3.1.5 BREEZE® Meter in *Data Transfer Mode/Remote Command Mode*

When the BREEZE® meter enters *Data Transfer Mode*, the meter will display three dashes while the initial header information is sent (*Initial Data Transfer Mode Display*).

While the meter is sending test results, the meter will display animated dashes and the number of results that remain to be sent (*Data Transfer Mode Animated Display).*

After all test results stored in the meter are sent, the meter will display three dashes while the meter waits for *Remote Command Mode* to start and while the computer sends remote commands to the meter *(Remote Command Mode Display)*. "Figure 5: BREEZE® Meter *Data Transfer Mode/Remote Command Mode*" depicts each of the possible *Data Transfer Mode/Remote Command Mode* displays. "Figure 6: BREEZE® Meter in *Data Transfer Mode*" depicts the BREEZE® meter with a representative *Data Transfer Mode* display.

Figure 5: BREEZE® Meter *Data Transfer Mode/Remote Command Mode* Displays

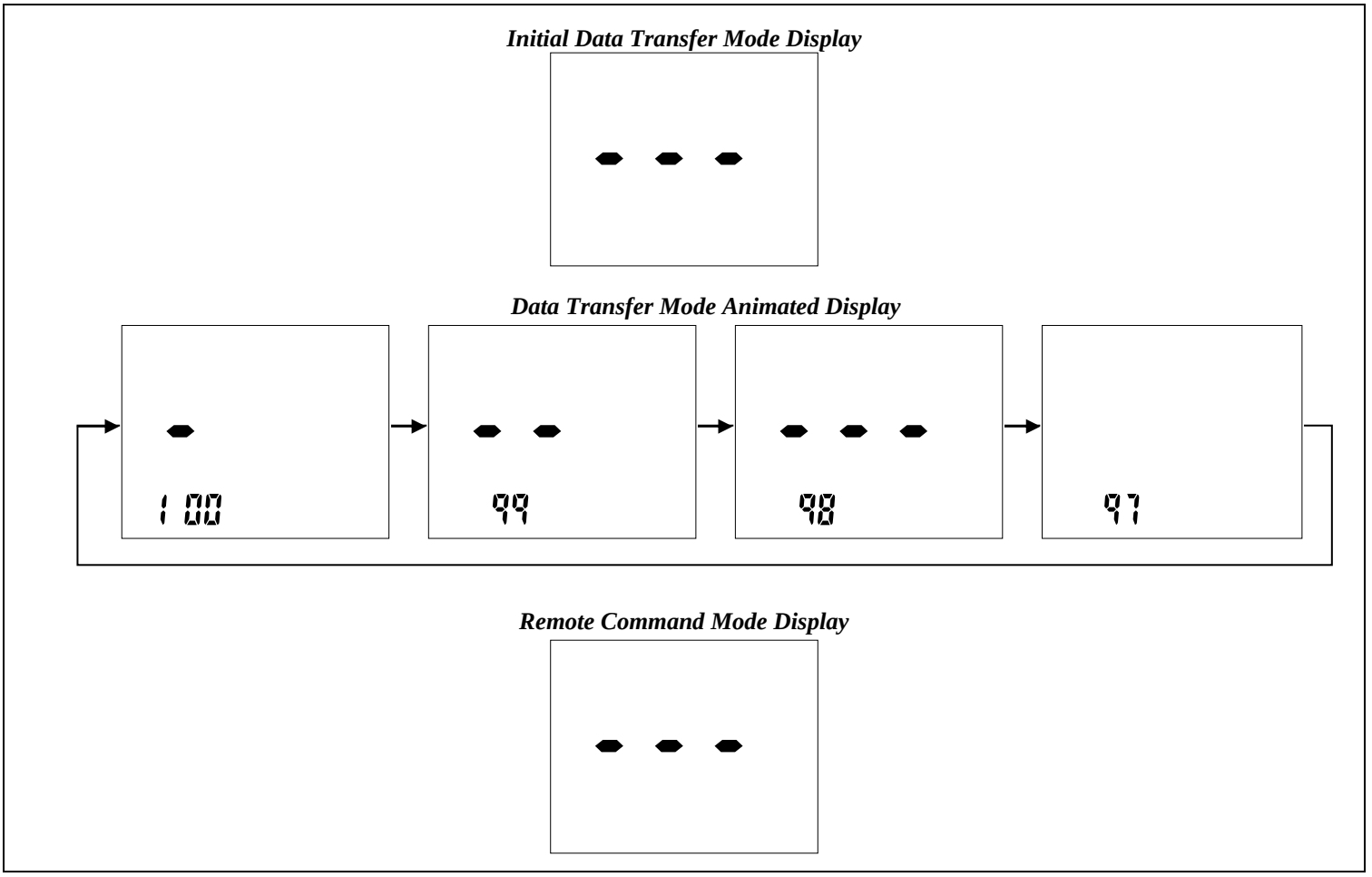


Figure 6: BREEZE® Meter in *Data Transfer Mode*

3.2 CONTOUR™ Meter Operating Modes

When off, the CONTOUR™ meter appears as shown in "Figure 7: CONTOUR™ Meter Off". The CONTOUR™ meter may be turned on in various modes, including *Test Mode, Setup Mode, Memory Recall Mode,* and *Communication Mode*.

Figure 7: CONTOUR™ Meter Off

(15-second version)

(5-second version)

When the CONTOUR™ meter is turned on, the meter runs a power-on display test during which all display elements are briefly on. The meter will then enter the operating mode as described in the following sections.

The CONTOUR™ meter is turned off from *Communication Mode* by unplugging the interface cable. The CONTOUR™ meter is turned off from *Test Mode, Setup Mode,* or *Memory Recall Mode* by pressing the M button.

3.2.1 CONTOUR™ Meter in *Test Mode*

When the CONTOUR™ meter is turned on by inserting a Test Strip into the Test Slot, the meter is operating in *Test Mode*. See "Figure 8: CONTOUR™ Meter (15-second version) in *Test Mode*". The CONTOUR™ meter does not attempt to communicate with a computer when in *Test Mode*.

Figure 8: CONTOUR™ Meter (15-second version) in *Test Mode*

3.2.2 CONTOUR™ Meter in *Setup Mode*

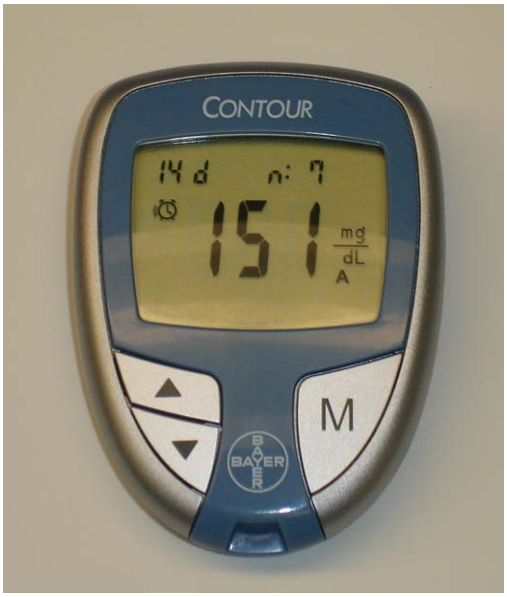
When the CONTOUR™ meter is turned on by pushing and holding the "M" Button, the meter is operating in *Setup Mode*. The CONTOUR™ meter does not attempt to communicate with a computer when in *Setup Mode*. *Setup Mode* is used to set and view various meter configuration settings. Refer to the User's Guide packaged with the meter for more information on the operation of *Setup Mode*.

3.2.3 CONTOUR™ Meter in *Memory Recall Mode*

When the CONTOUR™ meter is turned on by briefly pressing the "M" Button, the meter is operating in *Memory Recall Mode*. See "Figure 9: CONTOUR™ Meters in *Memory Recall Mode*". The 5-second CONTOUR™ meter will attempt to communicate with a computer if the cable is inserted while the meter is in *Memory Recall Mode*. The 15-second CONTOUR™ meter will not attempt to communicate with a computer while the meter is in *Memory Recall Mode*. *Memory Recall Mode* is used to view and clear blood glucose results stored in the meter. *Memory Recall Mode* may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information on the operation of *Memory Recall Mode*.

Figure 9: CONTOUR™ Meters in *Memory Recall Mode*

(15-second version)



(5-second version)

3.2.4 CONTOUR™ Meter in *Communication Mode*

When the CONTOUR™ meter is turned on by first inserting the computer interface cable and then briefly pressing the "M" button, the meter operates in *Communication Mode*[1]. The CONTOUR™ meter attempts to communicate with a computer when in *Communication Mode*, whether or not the meter is physically connected to a computer.

While the CONTOUR™ meter is in *Communication Mode*, the meter will display three flashing horizontal segments (*Dash Display*) under the following conditions:

1) prior to connection being established
2) while the initial header information is transmitted
3) while the interface is inactive, but the meter has not timed out
4) after all test results stored in the meter are transmitted
5) while the computer sends remote commands to the meter

If communication is established, glucose results in memory will be transmitted upon request of the host computer. While the clinical results in memory are being transmitted, the meter will display the number of results remaining to transmit (*Number of Results Display*).

When the interface cable plug is removed from the meter, the meter turns off.

"

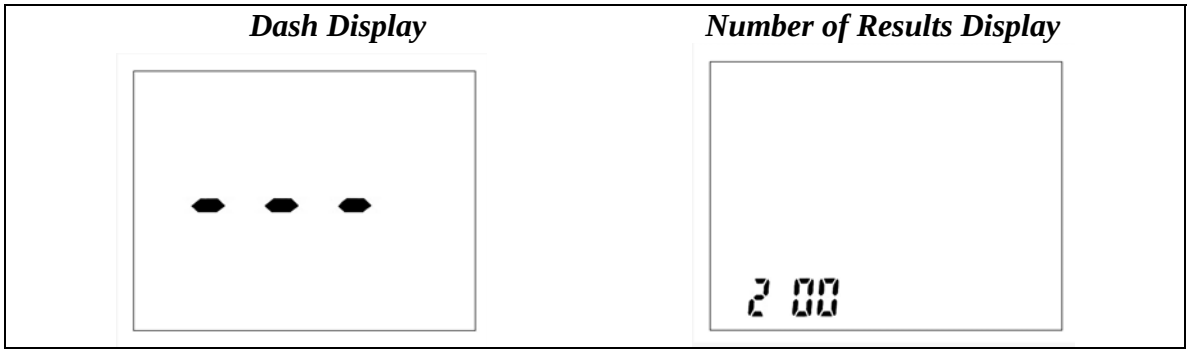
Figure 10: CONTOUR™ Meter *Communication Mode Displays*" depicts each of the possible *Communication Mode* displays.

"Figure 11: CONTOUR™ Meters in *Communication Mode*" depicts the CONTOUR™ meter with a representative *Communication Mode* display.

[1] Special cases:
- If the computer interface cable is inserted into the data port after the meter is already On (and the Power On Self Test screen is no longer displayed), the 15-second CONTOUR™ meter enters *Memory Recall Mode*, not *Communication Mode*.
- If the meter is turned on by pressing and holding the "M" button for more than three seconds and a cable is connected to the meter, the meter will enter *Communication Mode*, instead of *Setup Mode*.
- If the meter is turned on by inserting a sensor into the meter, inserting the computer interface cable into the data port at any time will have no effect. The meter will enter and stay in *Test Mode*.

1

2 **Figure 10: CONTOUR™ Meter *Communication Mode Displays***



3

4 **Figure 11: CONTOUR™ Meters in *Communication Mode***

(15-second version)

(5-second version)

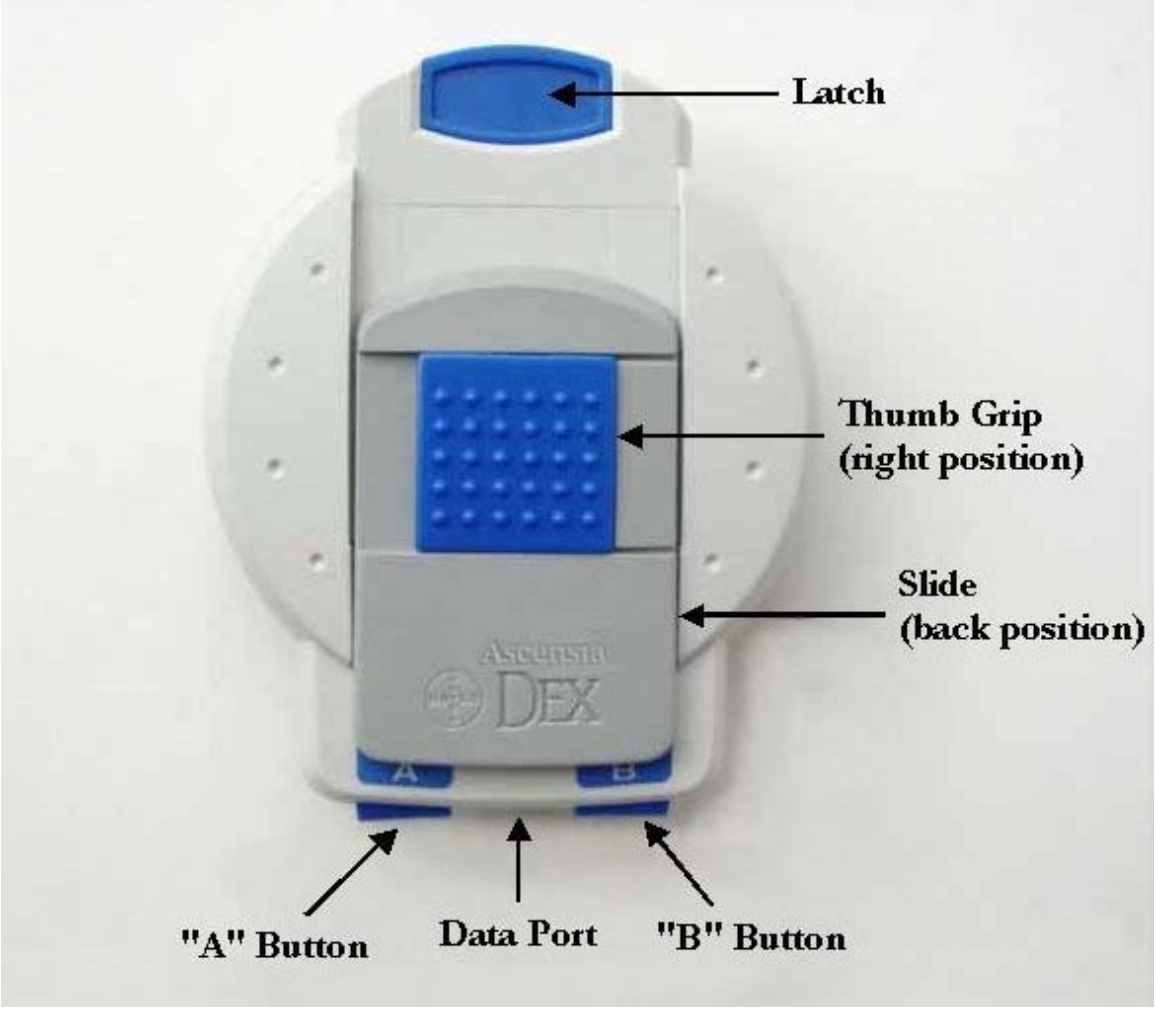
5

6

3.3 DEX® Meter Operating Modes

When off, the DEX® meter appears as shown in "Figure 12: DEX® Meter Off". The DEX® meter may be turned on in various modes, including *Testing Mode* and *Features Mode*.

Figure 12: DEX® Meter Off



When the DEX® meter is turned on, the meter runs a power-on display test during which all display elements are briefly on. The meter will then enter the operating mode as described in the following sections.

The DEX® meter is turned OFF by moving the slide to the back position and remains off while the Slide switch is in the backward position.

3.3.1 DEX® Meter in *Testing Mode*

When the DEX® meter is turned on by sliding the Slide forward with the Thumb Grip in the left position, a sensor is presented for a test and the meter is operating in *Testing Mode*. See "Figure 13: DEX® Meter in *Testing Mode*". The DEX® meter does not attempt to communicate with a computer when in *Testing Mode*.

Figure 13: DEX® Meter in *Testing Mode*

3.3.2 DEX® Meter in *Features Mode*

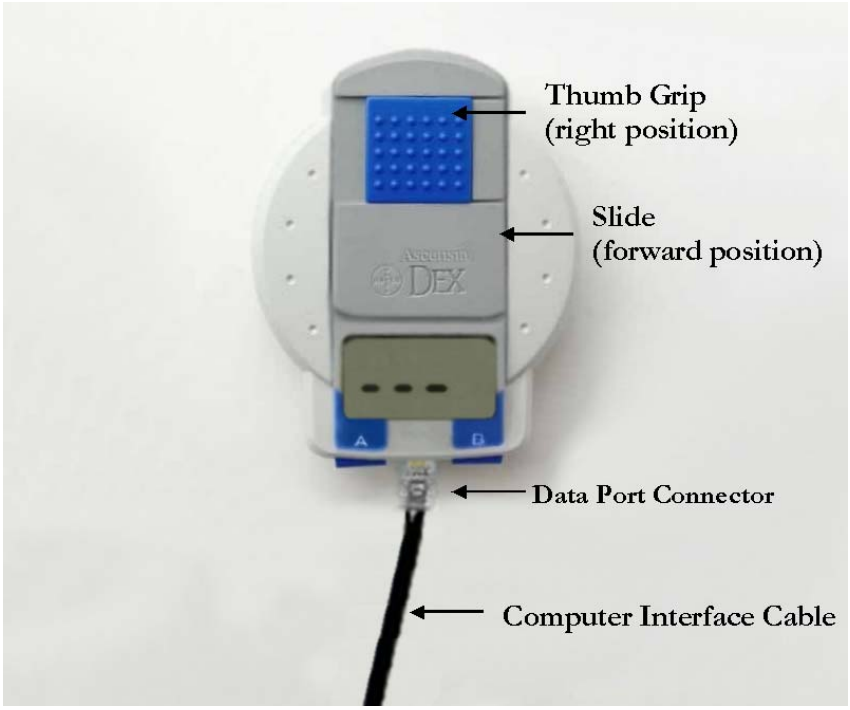
When the DEX® meter is turned on by sliding the Slide forward with the Thumb Grip in the right position, the meter is operating in *Features Mode*. See "Figure 14: DEX® Meter in *Features Mode*". The DEX® meter attempts to communicate with a computer when in *Features Mode*, whether or not the meter is physically connected to a computer.

Features Mode is also used to set and view various meter configuration settings and to view blood glucose test results stored in the meter. These *Features Mode* capabilities may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information.

When the DEX® meter is operating in *Features Mode* and establishes a connection with a computer, the meter will initially display three dashes ("---") in the result area of the display and the meter will beep. During the transfer of the stored results in memory (*Data Transfer Mode*), as results are sent, the number of results remaining to be transferred is displayed in the result area of the display. Leading zeroes are shown when showing the number of results remaining to be transferred; the display counts down to "000". When all results have been sent and during *Remote Command Mode*, three dashes ("---") are displayed in the result area of the display and the meter will beep.

On the DEX® meter, if the key labeled "A" is pushed or the meter is turned "OFF" before *Data Transfer Mode* is entered, then *Data Transfer Mode* is not entered.

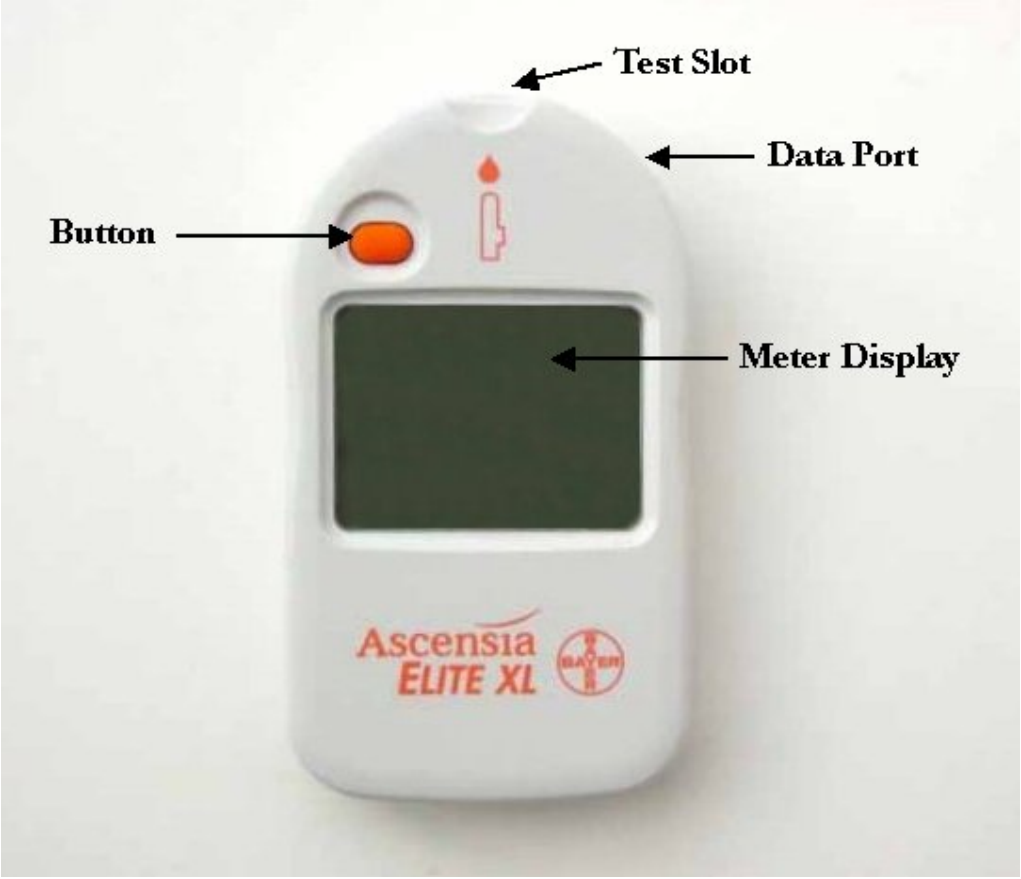
Figure 14: DEX® Meter in *Features Mode*



3.4 ELITE™ XL Meter Operating Modes

When off, the ELITE™ XL meter appears as shown in "Figure 15: ELITE™ XL Meter Off". The ELITE™ XL meter may be turned on in various modes, including *Test Mode*, *Setup Mode*, *Memory Recall Mode*, and *Communication Mode*.

Figure 15: ELITE™ XL Meter Off



When the ELITE™ XL meter is turned on, the meter runs a power-on display test during which all display elements are briefly on. The meter will then enter the operating mode as described in the following sections.

The ELITE® XL meter is turned off from *Communication Mode* by unplugging the interface cable. The ELITE® XL meter is turned off from *Test Mode*, *Setup Mode*, or *Memory Recall Mode* by pressing the button.

3.4.1 ELITE™ XL Meter in *Testing Mode*

When the ELITE® XL meter is turned on by inserting a Test Strip into the Test Slot, the meter is operating in *Testing Mode*. See "Figure 16: ELITE™ XL Meter in *Testing Mode*". The ELITE® XL meter does not attempt to communicate with a computer when in *Testing Mode*.

Figure 16: ELITE™ XL Meter in *Testing Mode*

3.4.2 ELITE™ XL Meter in *Setup Mode*

When the ELITE™ XL meter is turned on by pushing and holding the Button, the meter is operating in *Setup Mode*. *Setup Mode* is used to set and view various meter configuration settings. *Setup Mode* may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information on the operation of *Setup Mode*. The ELITE® XL meter does not attempt to communicate with a computer when in *Setup Mode*.

3.4.3 ELITE™ XL Meter in *Memory Recall Mode*

When the ELITE® XL meter is turned on by briefly pressing the button, the meter is operating in *Memory Recall Mode*. See "Figure 17: ELITE™ XL Meter in *Memory Recall Mode*". *Memory Recall Mode* is used to view blood glucose test results stored in the meter. *Memory Recall Mode* may be useful in developing software to communicate with the meter. Refer to the User's Guide packaged with the meter for more information on the operation of *Memory Recall Mode*. The ELITE® XL meter does not attempt to communicate with a computer when in *Memory Recall Mode*.

Figure 17: ELITE™ XL Meter in *Memory Recall Mode*

3.4.4 ELITE™ XL Meter in *Communications Mode*

When the ELITE® XL meter is turned on by first inserting the computer interface cable and then briefly pressing the button, the meter is operating in *Communications Mode*.[1] See "Figure 18: ELITE™ XL Meter in *Communications Mode*". The ELITE® XL meter attempts to communicate with a computer when in *Communications Mode*, whether or not the meter is physically connected to a computer. When the interface cable plug is removed from the meter, the meter turns off.

Upon entering *Communication Mode*, the ELITE® XL meter will initially display three dashes ("---") in the result area of the display and the meter will beep. The 3-dash display will continue throughout the establishment phase and while the message header is sent. While results are sent, the number of results remaining to be transferred is displayed in the result area of the display. Leading zeroes are shown when showing the number of results remaining to be transferred; the display counts down to "000". When all results have been sent and during *Remote Command Mode*, three dashes ("---") are displayed in the result area of the display and the meter will beep.

Figure 18: ELITE™ XL Meter in *Communications Mode*

[1] Note: When interfacing the Elite XL to some Windows 2000 and Windows XP computers, the port will need to be opened on the computer prior to turning the meter on.

4.0 Physical/Electrical Interface and Connection

Certain Bayer Corporation blood glucose meters are equipped with a data communication port for communication with a computer. The meter's computer interface port connects to the EIA-232 interface port (serial port) of a computer through a Bayer Corporation computer interface cable. See "Section 4.2 Serial Interface Cables" for more information about the Bayer Corporation computer interface cable.

4.1 EIA-232 Based Interface

The serial interface used by all Bayer Corporation blood glucose meters is based upon the EIA-232 standard. The electrical and physical characteristics of the serial interface for all Bayer Corporation blood glucose meters are summarized in "Table 3: Meter Serial Interface Physical and Electrical Characteristics".

Table 3: Meter Serial Interface Physical and Electrical Characteristics

	Meter Family			
Interface Characteristic	**BREEZE®**	**CONTOUR™**	**DEX®**	**ELITE® XL**
Connector on meter	3.5 mm stereo phono jack	3.5 mm stereo phono jack	Custom connector jack	3.5 mm stereo phono jack
EIA-232 variant type (see note 1)	type 2	type 2	either type 1, or type 2 (see note 3)	type 2
Data Signal levels	Marking: –15 V to –3 V Spacing: +15 V to + 3 V	Marking: –15 V to –3 V Spacing: +15 V to + 3 V	Marking: –15 V to –3 V Spacing: +15 V to + 3 V	Marking: –15 V to –3 V Spacing: +15 V to + 3 V
Communication	asynchronous	asynchronous	asynchronous	asynchronous
Data Code	7-bit ASCII serial	7-bit ASCII serial	7-bit ASCII serial	7-bit ASCII serial
Character Format	1 start bit 8 data bits, MSB set to 0 one stop bit no parity	1 start bit 8 data bits, MSB set to 0 one stop bit no parity	1 start bit 8 data bits, MSB set to 0 one stop bit no parity	1 start bit 8 data bits, MSB set to 0 one stop bit no parity
Baud Rate	9600 bps	9600 bps	9600 bps	9600 bps
Handshake	None	None	None	None
duplex (see note 2)	half	half	half	half

Notes:

1. See "Section 4.1 EIA-232 Based Interface" for an explanation of the EIA-232 variations used by the Bayer Corporation blood glucose meters. See "Table 4: EIA-232 Variants Descriptions" for a list of Interface connections used by each interface variant.
2. The mode of operation of all Bayer blood glucose meters' serial interface is half-duplex. None of the meters supports full-duplex operation; i.e., the meter and computer cannot both transmit characters at the same time.DEX® meter will have either type 1 or type 2, never both types.

4.1.1 EIA-232 Variants

The Bayer Corporation blood glucose meters' serial interface is not fully compliant with the EIA-232 standard. The deviation from the EIA-232 standard is required in order to extend meter battery life.

As indicated in "Table 3: Meter Serial Interface Physical and Electrical Characteristics", Bayer Corporation blood glucose meters employ two distinct variants of the EIA-232 interface. An explanation of each of the EIA-232 variants is provided in "Table 4: EIA-232 Variants Descriptions".

Table 4: EIA-232 Variants Descriptions

<table>
<tr><th>Type</th><th>Meters</th><th>EIA-232 Variant Description</th></tr>
<tr><td>1</td><td>DEX® meter family:
Units with all numeric serial numbers</td><td>The meter uses power from the TxD signal line of the computer to generate the negative voltage level for the marking state of the RxD signal line. The computer must maintain the marking level (negative voltage) on its output line (TxD) when the meter is transmitting characters. If the meter's receive line (TxD) is in the spacing state (positive voltage) during meter transmission, the meter transmit line (RxD) will not go more negative than zero volts. During spacing, the meter transmit line (RxD) voltage level will typically be +4 volts.
The following table summarizes the computer connections required for the type 1 EIA-232 variant:
<table>
<tr><th>Signal Name</th><th>Signal Definition</th><th>DB-9M</th><th>DB-25F</th></tr>
<tr><td>GND</td><td>Ground</td><td>5</td><td>7</td></tr>
<tr><td>TxD</td><td>Serial data, computer to meter</td><td>3</td><td>2</td></tr>
<tr><td>RxD</td><td>Serial data, meter to computer</td><td>2</td><td>3</td></tr>
<tr><td>Cable Shield</td><td>Shield</td><td>metal shell</td><td>metal shell</td></tr>
</table></td></tr>
<tr><td rowspan="2">2</td><td>DEX® meter family:
Units whose serial numbers begin with an alpha character</td><td rowspan="2">The meter uses power from the TxD signal line of the computer to generate the negative voltage level for the marking state of the RxD signal line and power from the DTR signal line to generate the positive voltage level for the spacing state of the RxD signal line. The computer must maintain the marking level (negative voltage) on its output line (TxD) and the "ON" level (positive voltage) on its DTR line when the meter is transmitting characters. If the meter's receive line (TxD) is in the spacing state (positive voltage) during meter transmission, the meter transmit line (RxD) will not go more negative than zero volts. During spacing, the meter transmit line (RxD) voltage level will typically operate at a voltage slightly less than the DTR line.
The following table summarizes the computer connections required for the type 2 EIA-232 variant:
<table>
<tr><th>Signal Name</th><th>Signal Definition</th><th>DB-9</th><th>DB-25</th></tr>
<tr><td>GND</td><td>Ground</td><td>5</td><td>7</td></tr>
<tr><td>TxD</td><td>Serial data, computer to meter</td><td>3</td><td>2</td></tr>
<tr><td>RxD</td><td>Serial data, meter to computer</td><td>2</td><td>3</td></tr>
<tr><td>DTR</td><td>interface control line from computer</td><td>4</td><td>20</td></tr>
<tr><td>Cable Shield</td><td>Shield</td><td>metal shell</td><td>metal shell</td></tr>
</table></td></tr>
<tr><td>All units in the following meter families:
BREEZE®, CONTOUR™, ELITE® XL</td></tr>
</table>

4.2 Serial Interface Cables

In order to connect a Bayer blood glucose meter to a computer, Bayer Corporation provides custom serial interface connector cable(s). The Bayer Corporation custom serial interface connector cable(s) provide compatibility with one or more meter family by incorporating one or more combination of the following characteristics, as appropriate:

- EIA-232 variant — type 1 and/or type 2
- Meter connector(s) — 3.5mm stereo phono and/or custom
- Computer connector — DB-9F or DB-25F
- Signal level conversion circuitry

"Table 5: Serial Interface Cable Characteristics and Compatibility" summarizes the operating characteristics of the various Bayer Corporation serial interface cables and the meter compatibility for each cable.

Each Bayer Corporation Serial Interface cable provides a computer connector and one or two meter mating connector(s). Bayer Corporation blood glucose meters employ two types of connector ports (custom and 3.5 mm stereo phono) as well as two different EIA-232 variants (type 1 and type 2, as defined in "Section 4.1.1 EIA-232 Variants"). See "Table 3: Meter Serial Interface Physical and Electrical Characteristics". Each custom Bayer Corporation Serial Interface cable contains a level conversion circuit to permit connection to the EIA-232 interface port (serial port) of a computer since the computer's and meter's serial signals operate at different voltage levels.

Bayer recommends using the Ascensia® Data Cable (part number 40453276) to communicate with all Bayer blood glucose meters because the Ascensia® Data Cable is compatible with all Bayer Corporation blood glucose meters.

Caution: Use of any cable other than the compatible Bayer Corporation cable shown in "Table 5: Serial Interface Cable Characteristics and Compatibility" may damage the meter or cause electrical interference with other devices.

Note: When the computer is connected to any Bayer Corporation blood glucose meter with the Ascensia® Data Cable (part number 40453276), the computer must turn on the DTR interface line before data communication is possible (see "Section 4.1 EIA-232 Based Interface").

Note: The Glucometer® DEX® Data Cable (part number 40453244) and the Glucometer ELITE® XL Data Cable (part number 40453249) are obsolete.

1

Table 5: Serial Interface Cable Characteristics and Compatibility

						Meter Family Compatibility			
Cable Name	**Part Number**	**Product Code**	**Computer Connector**	**Meter Connector**	**Interface Type (see note 1)**	**DEX®**	**ELITE™ XL**	**BREEZE®**	**CONTOUR™**
Ascensia® Data Cable (see note 2)	40453276	3479	DB-9F	Custom plug **and** 3.5 mm stereo phono plug	1 **and** 2	all	all	all	all
Glucometer® DEX® Data Cable (see notes 3 and 4)	40453244	3427	DB-9F (see note 5)	Custom plug	1	partial (see note 4)	n/a	n/a	n/a
Glucometer ELITE® XL Data Cable (see note 3)	40453249	3437	DB-25F (see note 6)	3.5 mm stereo phono plug	2	n/a	all	all	all

Notes:

1. See "Section 4.1 EIA-232 Based Interface" for details.
2. Cable 40453276 is compatible with all Bayer Corporation blood glucose meters. Bayer recommends using cable 40453276 exclusively.
3. Cables 40453244 and 40453249 are obsolete; compatibility is listed for reference purposes. Bayer recommends use of cable 40453276.
4. Cable 40453244 is compatible only with DEX® family meters having all numeric serial numbers. DEX® family meters with serial numbers beginning with an 'A' character are compatible only with cable 40453276.
5. The Glucometer® DEX® Data Cable package (Bayer Part Number 40453244) includes a DB-9F to DB-25F adapter. The cable and adapter are both marked with part number 40453244. The adapter marked with part number 40453244 should NOT be used with the Ascensia® Data Cable, regardless of which type of meter is connected.
6. The Glucometer ELITE® XL Data Cable package (Bayer Part Number 40453249) includes a DB-25F to DB-9F adapter (Bayer Part Number 4000006).

4.2.1 Ascensia® Data Cable

The Ascensia® Data Cable (part number 40453276) is compatible with all Bayer Corporation blood glucose meters. Bayer recommends using the Ascensia® Data Cable exclusively to communicate with all Bayer Corporation blood glucose meters.

The Ascensia® Data Cable is available as Bayer Corporation Product Code 3479. The Ascensia® Data Cable is also bundled with the latest versions of the Bayer Corporation Diabetes Information Management System software package (Ascensia™ ^{WIN}Glucofacts® and Ascensia™ ^{WIN}Glucofacts® Professional).

If necessary, a standard DB-9M to DB-25F adapter may be used with the Ascensia® Data Cable. Bayer does not provide an adapter with the Ascensia® Data Cable since most computers utilize a DB-9M connector.

Figure 19 through Figure 22 provide descriptions of the Ascensia® Data Cable and standard DB-9F to DB-25F adapter (optional, user supplied).

Figure 19: Ascensia® Data Cable Illustration

Figure 20: Ascensia® Data Cable Connector Diagrams

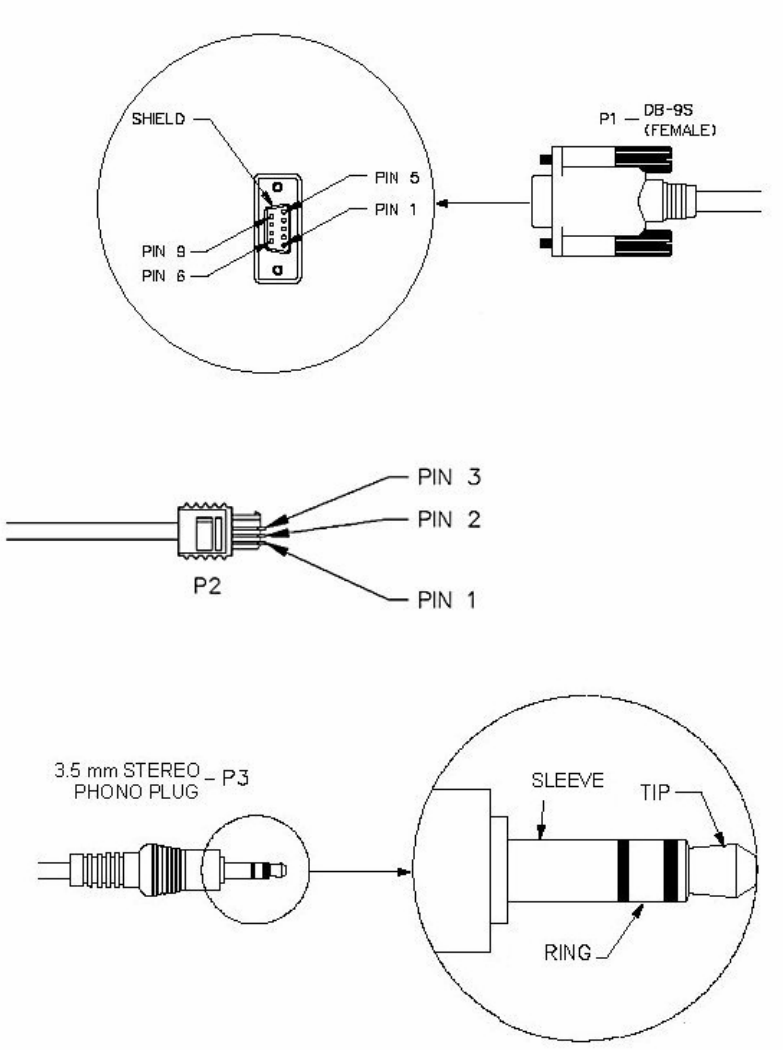
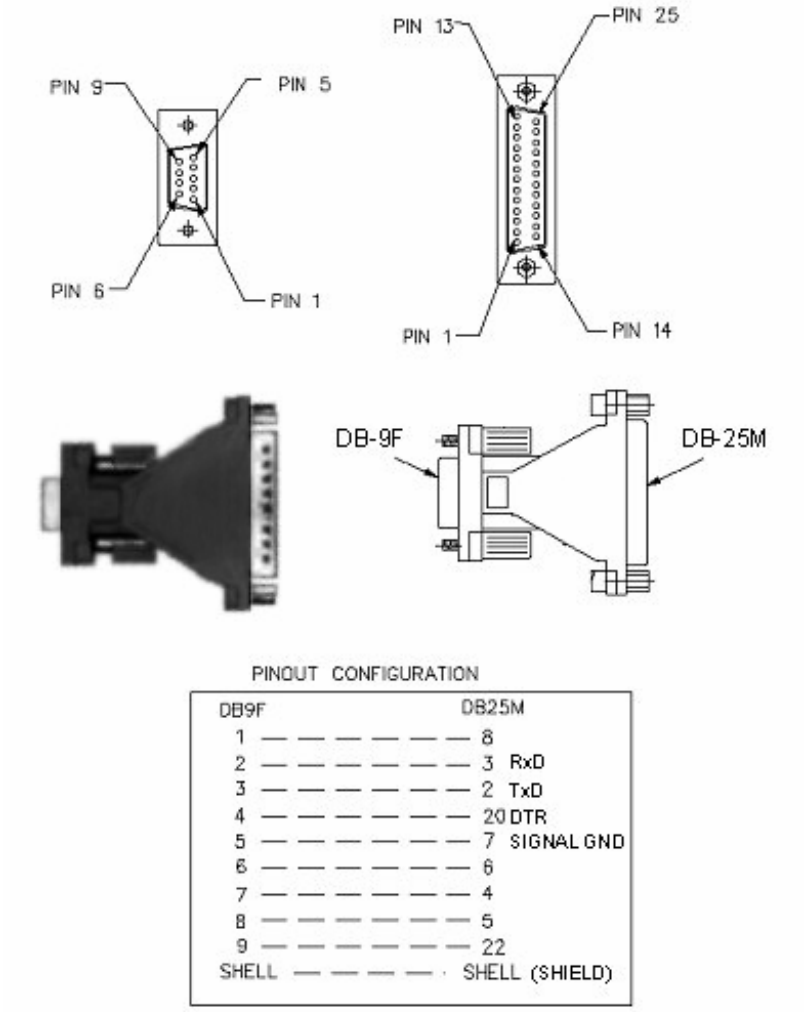


Figure 21: Ascensia® Data Cable Connector Pinout

COMPUTER SIGNAL	P1 PIN #	P2 PIN #	P3 PIN #
GND	5	SLEEVE	2
TxD	3	TIP	3
RxD	2	RING	1
DTR[3]	4	n/a	n/a
CABLE SHIELD	METAL SHELL	SLEEVE	n/a

[3] The DTR signal is used by the signal level conversion circuitry within the cable. No connection to the meter is required.

Figure 22: Ascensia® Data Cable Adapter (Optional, User-Supplied)



Note: The signals identified above must pass through the adapter on the pins indicated. The obsolete adapter formerly supplied with the Glucometer® DEX® Data Cable (part number 40453244) should not be used with the Ascensia® Data Cable because the 40453244 adapter does not pass through the DTR signal.

4.2.2 Glucometer® DEX® Data Cable

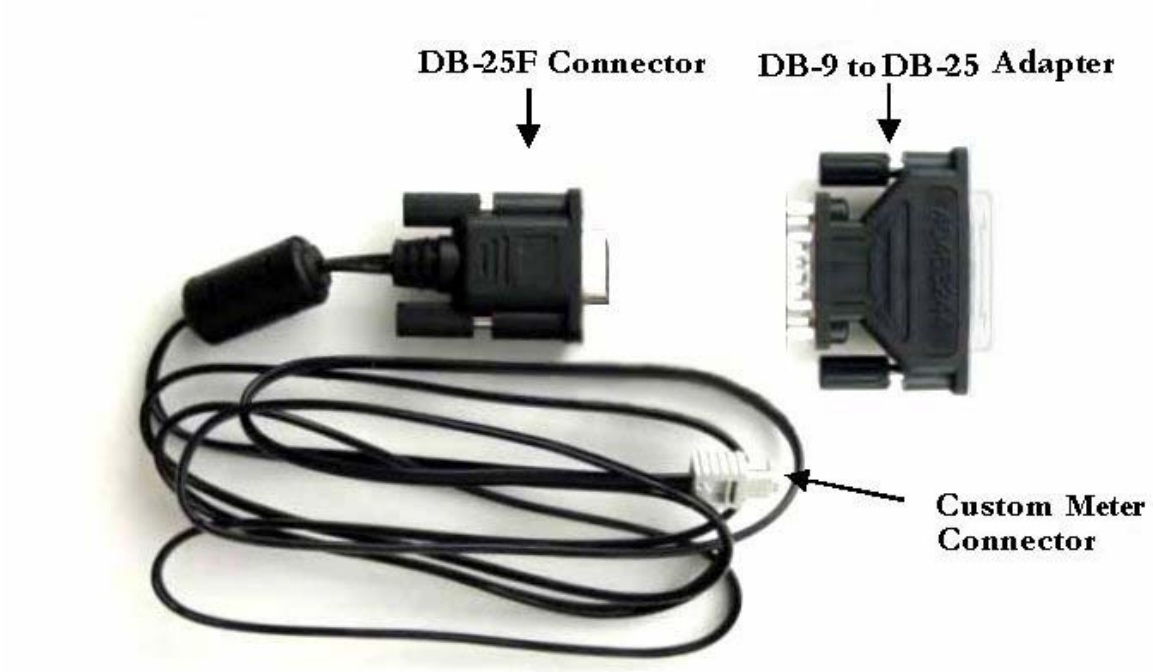
The Glucometer® DEX® Data Cable (part number 40453244) is obsolete. The Glucometer® DEX® Data Cable is only compatible with "older" DEX® family blood glucose meters and is incompatible with "newer" DEX®[4] family meters and is incompatible with all ELITE™ XL, BREEZE®, and CONTOUR™ family meters. See "Table 5: Serial Interface Cable Characteristics and Compatibility, especially Note 4".

Bayer recommends using the Ascensia® Data Cable exclusively to communicate with all Bayer Corporation blood glucose meters. The Ascensia® Data Cable is compatible with all Bayer Corporation blood glucose meters. See "Section 4.2.1 Ascensia® Data Cable".

The Glucometer® DEX® Data Cable was formerly bundled with obsolete versions of the Bayer Corporation Diabetes Information Management System software packages, [WIN]Glucofacts® and WinGlucofacts® Professional.

Figure 23 through Figure 25 provide descriptions of the Glucometer® DEX® Data Cable and adapter.

Figure 23: Glucometer® DEX® Data Cable and Adapter Illustration



[4] "Newer" DEX® family blood glucose meters have serial numbers beginning with an "A" character. "Older" DEX® family blood glucose meters have serial numbers beginning with a numeric character ("0" to "9").

Figure 24: Glucometer® DEX® Meter Computer Interface Cable Connector Diagram

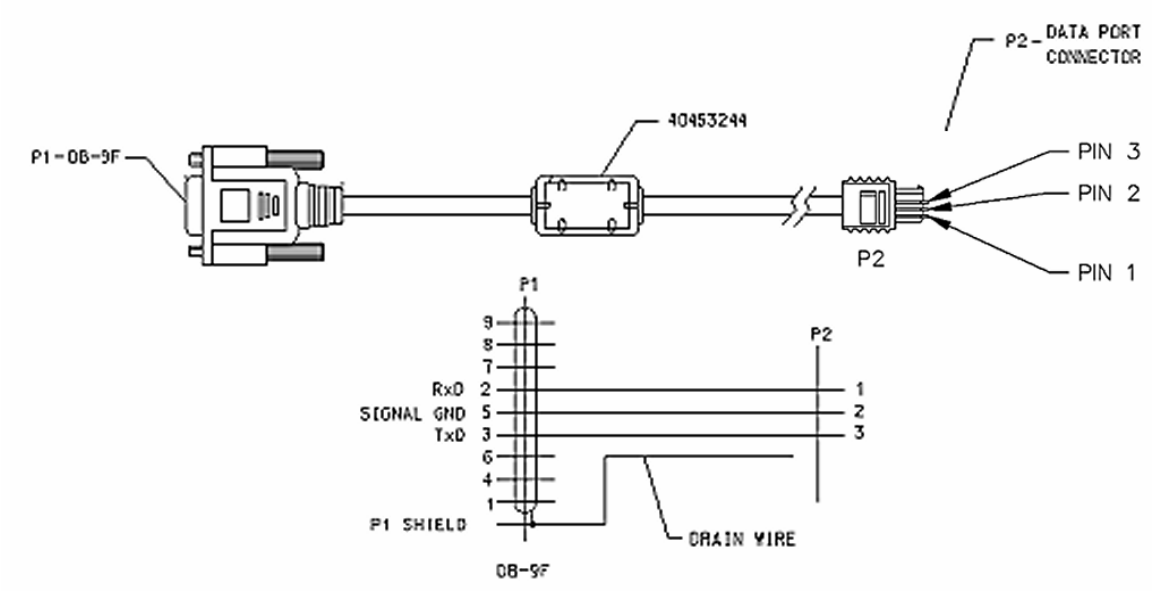
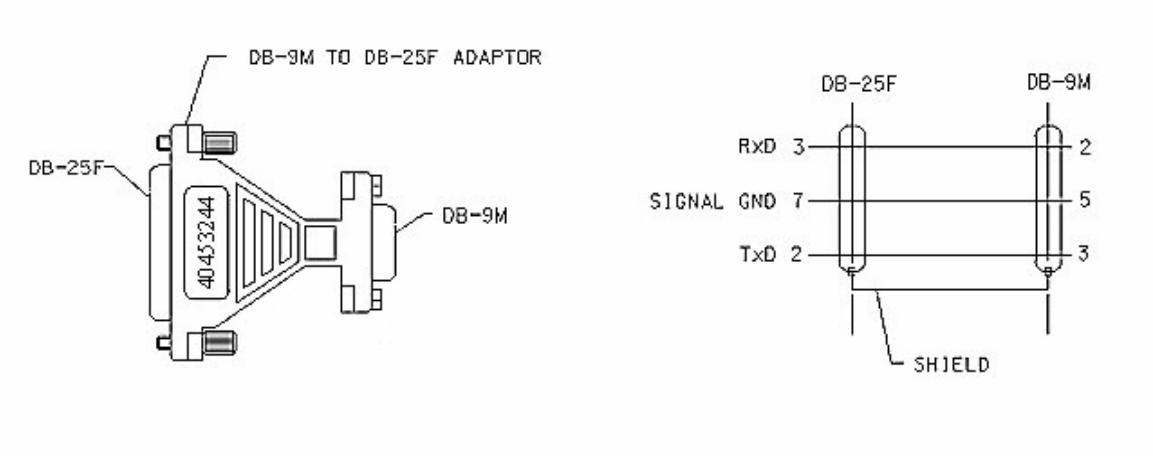


Figure 25: Glucometer® DEX® Meter Computer Interface Cable Adapter Diagram



4.2.3 Glucometer ELITE® XL Data Cable

The Glucometer ELITE® XL Data Cable (part number 40453249) is obsolete. The Glucometer ELITE® XL Data Cable is compatible with all ELITE™ XL, BREEZE®, and CONTOUR™ family blood glucose meters but is incompatible with all DEX® family meters. See "Table 5: Serial Interface Cable Characteristics and Compatibility".

Bayer recommends using the Ascensia® Data Cable exclusively to communicate with all Bayer Corporation blood glucose meters. The Ascensia® Data Cable is compatible with all Bayer Corporation blood glucose meters. See "Section 4.2.1 Ascensia® Data Cable".

The Glucometer ELITE® XL Data Cable was formerly bundled with obsolete versions of the Bayer Corporation Diabetes Information Management System software packages, [WIN]Glucofacts® and WinGlucofacts® Professional.

Figure 26 through Figure 28 provide additional descriptions of the Glucometer ELITE® XL Cable and Adapter.

Figure 26: Glucometer ELITE® XL Data Cable and Adapter Illustration

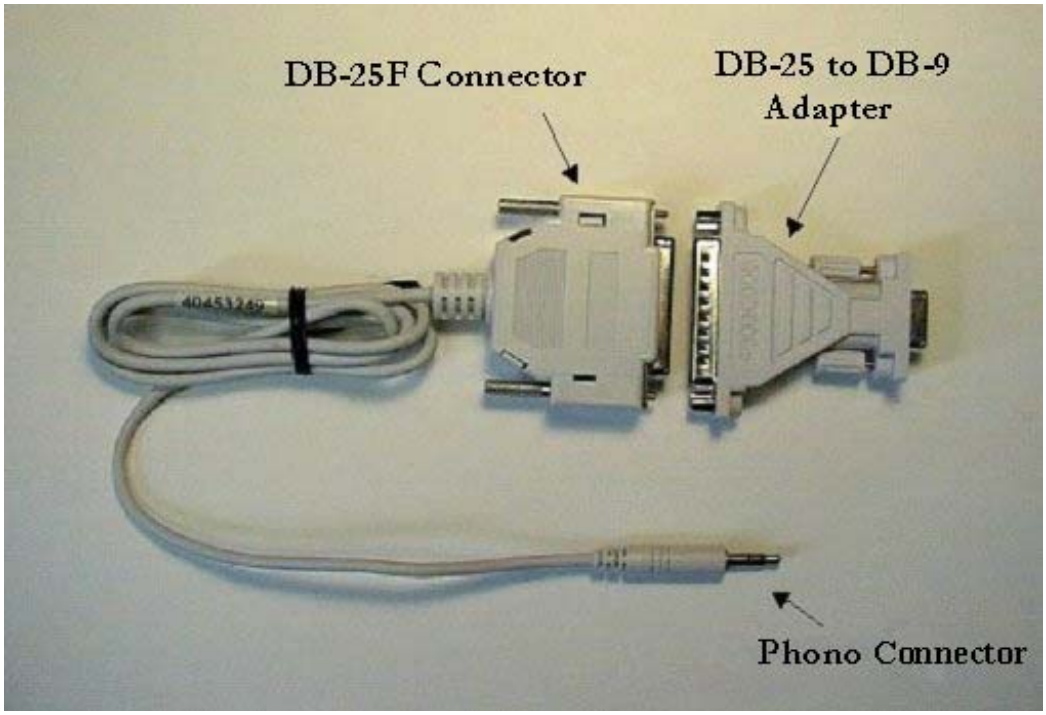


Figure 27: Glucometer ELITE® XL Data Cable Connector Diagrams

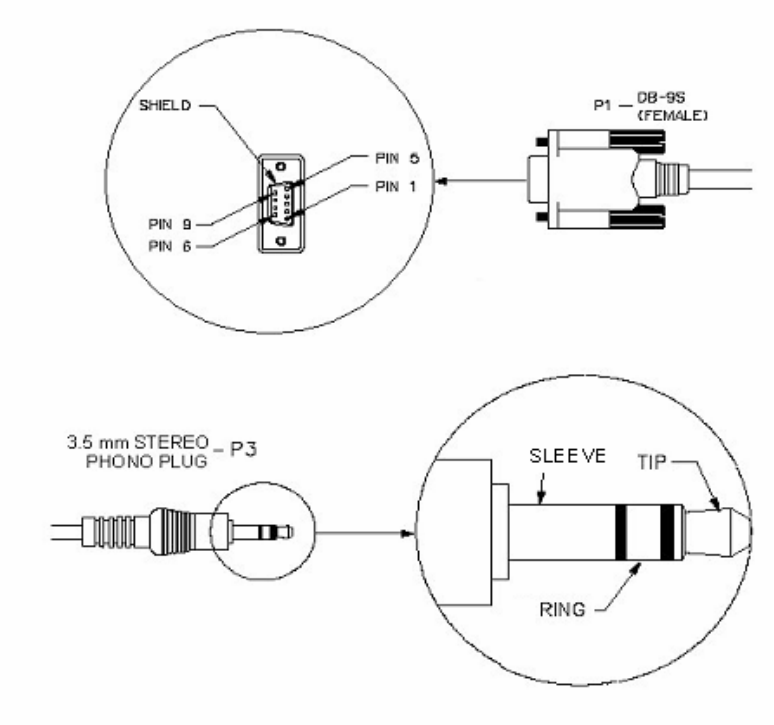
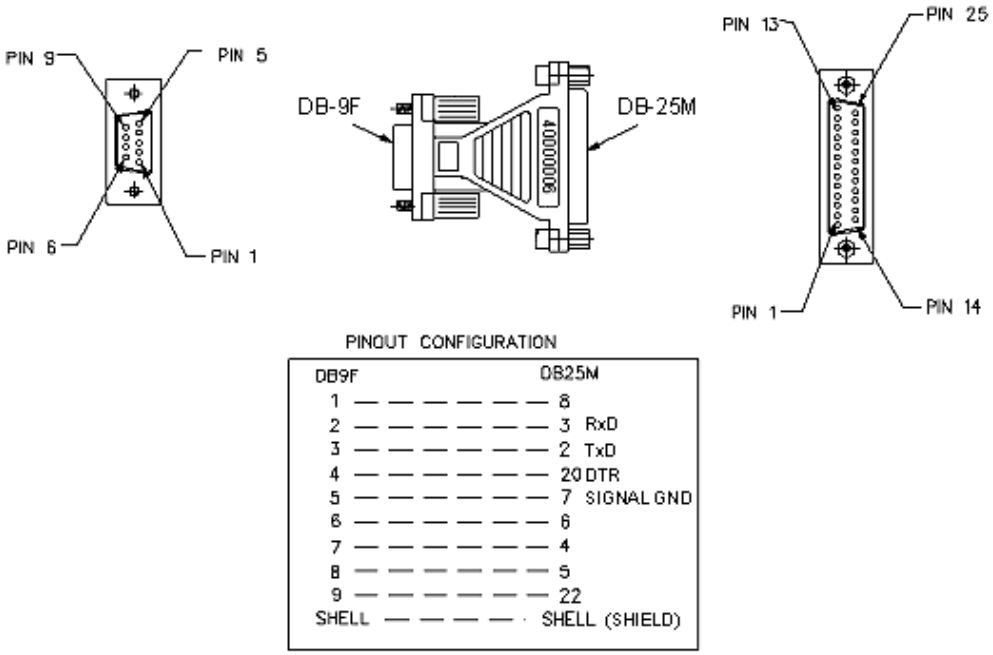


Figure 28: Glucometer ELITE® XL Data Cable Adapter Diagram



5.0 ASCII Control Character Notation

The communication protocol utilizes the ASCII (American Standard Code for Information Interchange) character set, as defined in the ANSI (American National Standards Institute) standard ANSI X3.4-1986, "Coded Character Sets – 7-Bit American Standard Code for Information Interchange (7-Bit ASCII)".

The ASCII character set includes non-printable control characters. In this document, the convention for displaying control characters uses the notation <XYZ>. This indicates the single control character whose mnemonic is XYZ not the sequence of characters "<", "X", "Y", "Z", ">". For example, <CR> stands for the Carriage Return control character that is represented by decimal value 13 or hexadecimal value 0x0D.

The ASCII control characters referenced in this document are listed in "Table 6: ASCII Control Characters".

Table 6: ASCII Control Characters

ASCII Character Abbreviation	Meaning	Hexadecimal Character Code	Decimal Character Code
<ACK>	Acknowledge	0x06	6
<CR>	Carriage Return	0x0D	13
<ENQ>	Enquiry	0x05	5
<EOT>	End of Transmission	0x04	4
<ETB>	End of Transmission Block	0x17	23
<ETX>	End of Text	0x03	3
<LF>	Line Feed	0x0A	10
<NAK>	Negative Acknowledge	0x15	21
<STX>	Start of Text	0x02	2

6.0 COMMUNICATION OVERVIEW

Data Transfer Mode provides the capability to transfer test result information from the meter to a connected computer. See "Section 6.1 *Data Transfer Mode*" for a description of *Data Transfer Mode* capabilities and protocol.

Remote Command Mode provides the capability to interrogate and set meter configurations via the meter/computer serial interface. See "Section 6.2 *Remote Command Mode* Protocol" for a description of *Remote Command Mode* capabilities and protocol.

DEX® family meters with software version 1.27 or newer provide a modem-dialing feature for *Data Transfer Mode* and *Remote Command Mode*. See "Section 6.3 DEX® Meter Smart Modem Dialing" for a full description of the modem-dialing feature.

6.1 *Data Transfer Mode*

In *Data Transfer Mode*, all clinical test results stored in the meter are transferred to a computer through the serial interface, including the following, as applicable to the specific meter:

- patient's clinical results
- results with special markers (such as "deleted", "edited", "control", and/or "temperature")
- 14-day computed average or averages

When a meter is turned on in the appropriate mode for the particular meter (see "Section 3.0 Meter Operating Modes"), the meter attempts to determine if it is connected to a computer by entering the Establishment Phase. If a computer connection is established during the Establishment Phase, the meter enters *Data Transfer Mode*. As long as the meter remains in the appropriate operating mode (as indicated in "Table 2: Meter Operating Mode and Capability Summary"), then *Data Transfer Mode* can be reentered by re-establishing a connection. See "Section 6.1.2 Establishment Phase" for details about the Establishment Phase.

The data transfer (*Data Transfer Mode*) will be terminated if the operator turns the meter OFF during data transfer. See "Section 3.0 Meter Operating Modes". If the data transfer (*Data Transfer Mode*) is terminated prior to the receipt of the Message Terminator Record, the test results data should not be used by the receiving computer.

Note: When clinical results are sent in *Data Transfer Mode*, all results in the meter's memory are sent. This might include results that were previously transmitted. If the computer system maintains a database of clinical results by patient, it must properly account for the fact that the meter may have previously sent some of the patient's clinical results. It should not treat this repeated information as new data for the patient.

During *Data Transfer Mode*, test results are sent in the order they were run on the meter, regardless of the "time stamp" of the result. The most recently produced result is sent last (first-in, first-out). Clinical results (including results marked as deleted and/or edited) may be mixed with control solution results; the preceding Test Order Record indicates the specimen type. The glucose average reading, or readings and average preset times, are sent preceding the test results, as appropriate based upon meter type.

A summary of the information transmitted during *Data Transfer Mode* is provided in "Table 7: *Data Transfer Mode* Summary ".

Table 7: *Data Transfer Mode* Summary

<table>
<tr><th>Data</th><th>Description</th></tr>
<tr><td>Version</td><td>Meter software version</td></tr>
<tr><td>Meter Identification</td><td>Meter product code and meter serial number.

The "meter product code", which is transmitted in the Header Record as a component of the Sender ID field, defines the meter family to which the individual meter belongs.

Valid meter product codes are:
<table>
<tr><td>Meter Family</td><td>Product Code(s)</td></tr>
<tr><td>BREEZE®</td><td>Bayer6115 or Bayer6116</td></tr>
<tr><td>CONTOUR™</td><td>Bayer7150</td></tr>
<tr><td>DEX®</td><td>Bayer3950</td></tr>
<tr><td>ELITE® XL</td><td>Bayer3883</td></tr>
</table>
The "meter serial number", which is transmitted in the Header Record as a component of the Sender ID field, is unique for each Bayer blood glucose meter and may be used to associate a particular meter to a specific patient’s blood glucose test results.</td></tr>
<tr><td>Clinical Results for Blood Samples</td><td>Glucose value, glucose units of measure, date, time, result markers and flags, reference method, clinical result designation</td></tr>
<tr><td>Control Solution Results for Control Samples</td><td>Glucose value, glucose units of measure, date, time, result markers and flags, reference method, control solution designation</td></tr>
<tr><td>Calculated Results</td><td>Computed average or averages of clinical results (14 day averages)</td></tr>
</table>

6.1.1 ASTM Standards

For *Data Transfer Mode*, ASTM Standard E 1381-95, "Specification for Low-Level Protocol to Transfer Messages Between Clinical Laboratory Meters and Computer Systems", defines the low-level data transfer protocol. ASTM Standard E 1394-91, "Standard Specification for Transferring Information Between Clinical Meters and Computer Systems", defines the data format. The serial data characteristics of the meter are defined in "Section 4.0 Physical/Electrical Interface and Connection".

6.1.2 Establishment Phase

When the meter initiates the Establishment Phase, the meter determines if the computer is connected by initially sending an <ENQ> character.

If the computer responds within 15 seconds by sending an <ACK> character, the meter proceeds with *Data Transfer Mode*.

If the computer responds within 15 seconds with a <NAK> character, the meter sends an <EOT> then attempts to enter *Remote Command Mode*, by looking for an <ENQ> character from the computer. Also see "Section 6.2 *Remote Command Mode* Protocol".

Any response within 15 seconds to the meter's <ENQ> other than an <ACK> or <NAK> character causes the meter to send an <EOT>, delay one second, then send another <ENQ>.

If the computer does not respond within 15 seconds, then the meter sends an <EOT>, delays one second, then sends another <ENQ> and waits again for a response from the computer.

Note: One second after sending an <ENQ>, the meter may enter a low power mode. Thus, there is a possibility that the first <ACK> sent by the computer is not read correctly. In this case, the meter responds with an <EOT>, delays one second, then sends another <ENQ>.

If a modem is detected by the DEX® meter during the Establishment Phase, it commands the modem to call the computer of the healthcare provider. See "Section 6.3 DEX® Meter Smart Modem Dialing".

6.1.3 ASTM E-1381 Frames

Frames are formatted per ASTM Standard E-1381.

6.1.3.1 Frame Structure

A frame is either an intermediate frame or an end frame. The ASTM Standard E-1381 frame structures are shown in "Table 8: ASTM E-1381 Frame Structures".

Table 8: ASTM E-1381 Frame Structures

Frame Type	Frame Fields
Intermediate Frame	<STX> FN text <CR> <ETB> C1 C2 <CR> <LF>
End Frame	<STX> FN text <CR> <ETX> C1 C2 <CR> <LF>

where fields are defined as follows:

Field	Description
<STX>	Start of Text transmission control character
FN	single digit Frame Number ("0" to "7")
text	data content of the frame
<ETB>	End of Transmission Block transmission control character
<ETX>	End of Text transmission control character
C1	most significant character of encoded checksum ("0" to "9" and "A" to "F")
C2	least significant character of encoded checksum ("0" to "9" and "A" to "F")
<CR>	Carriage Return ASCII control character
<LF>	Line Feed ASCII control character

Each frame begins with an <STX> character.

The FN, Frame Number, is a single ASCII character in the range from "0" to "7". The Frame Number permits the receiver to distinguish between new and retransmitted frames. The Frame Number is sent immediately following the <STX> character. The Frame Number begins with "1" with the first frame of the transfer phase and is incremented by one for every frame transmitted. After "7" the Frame Number rolls over to "0", and continues in this fashion.

The text is the data content of the frame.

In intermediate frames an <ETB> character follows the message text. In end frames an <ETX> character follows message text. The <ETB> or <ETX> is followed by a two-character checksum (C1 and C2), carriage return <CR>, and a line feed <LF>. During *Data Transfer Mode*, the <ETX> character will accompany the Message Terminator Record. All other records will include an <ETB> character.

C1 and C2 represent the encoded checksum of the frame. The checksum permits the computer to detect defective frames. The checksum is encoded as two ASCII characters transmitted after the <ETB> or <ETX> character.

Any characters that appear before the <STX> or after the <ETB> or <ETX> are to be ignored by the computer during frame validation.

6.1.3.2 Frame Checksum

The checksum is computed by adding the binary values of the ASCII characters, but keeping only the least significant eight bits of the result. The checksum is initialized to 0 by the <STX> character. The first character included in the checksum computation is the Frame Number. Each character in the text is added to the checksum (modulo 256). The last character included in the checksum computation is the frame type character (<ETB> or <ETX>). The checksum computation does not include the <STX>, the checksum characters, or the trailing <CR> and <LF>.

The checksum is an 8-bit integer that can be considered as two groups of 4 bits. The checksum is encoded by converting the groups of 4 bits into the ASCII characters of hexadecimal representation ("0" to "9" or "A" to "F"). The two ASCII characters are transmitted as the encoded checksum with the most significant character first (C1).

Example: Suppose the value of the checksum is computed to be decimal 122. The decimal number 122 can be represented as 01111010 in binary or as 0x7A in hexadecimal. The encoded checksum is transmitted as the ASCII character "7" followed by the ASCII character "A".

6.1.3.3 Defective Frames

A Frame Number is valid if it is equal to the last accepted Frame Number (indicating a retransmit) or is one number higher than the last accepted Frame Number.

The computer indicates it has received a defective frame by transmitting a <NAK> to the meter. A frame is to be rejected for any of the following reasons:

- a character parity error is detected by the computer
- a character framing error is detected by the computer
- the checksum computed on the received frame does not match the encoded checksum value received in the frame
- the Frame Number is not valid

Upon receiving a <NAK> or any character except an <ACK> or <EOT> in response to a transmitted frame, the meter increments a retransmit counter and retransmits the frame with the same Frame Number. If the retransmit counter indicates that a particular frame was sent, but not acknowledged, six times, then the meter aborts *Data Transfer Mode* by going to the termination phase (sending an <EOT>). An abort provides an escape from a condition where the transfer phase cannot continue.

6.1.4 ASTM E-1394 Records

Each E-1394 record is sent as a separate E-1381 frame. This structure is a design decision, not a requirement of the ASTM standards (record boundaries do not have to be tied to frame boundaries).

A message is transmitted as a number of variable length records. Each record contains multiple variable length fields. A message always starts with a Header Record. A Patient Record follows the Header Record. One or more Test Order Records and Result Records follow. The message always ends with a Message Terminator Record.

The following sections provide detail about the record types listed above. Example records/frames are shown complete with the E-1381 framing characters (i.e. <STX>, Frame Number, <ETB>, <ETX>, checksum characters, and trailing <CR><LF>).

6.1.4.1 Header Record

The format of the Header Record is shown in "Table 9: Header Record".

Table 9: Header Record

Field #	Field Name	Contents	Field Type	Field Length
1	Record type	H	Char	1
2	Delimiter Definition	|\^& | = field delimiter \ = repeat delimiter ^ = component delimiter & = escape delimiter	Char	4
3	Not used	Not used	N/A	N/A
4	Access Password	Used as authorization to communicate with Bayer Corporation Diabetes Information Management System software	Int	1 to 6
5	Sender ID	p^v^s p = meter product code v = meter software version\EEPROM version s = meter serial number The "meter product code" defines the meter family to which the individual meter belongs. Valid meter product codes are: BREEZE®: Bayer6115 or Bayer6116 CONTOUR™: Bayer7150 DEX®: Bayer3950 ELITE® XL: Bayer3883 The "meter serial number" is unique for each Bayer blood glucose meter and may be used to associate a particular meter to a specific patient's blood glucose test results.	p – Char v – Char\Char s – Char	p – 9 v – 0 to 7\0 to 7 s – 0 to 15
6	Not used	Not used	N/A	N/A
7	Not used	Not used	N/A	N/A
8	Not used	Not used	N/A	N/A
9	Not used	Not used	N/A	N/A
10	Not used	Not used	N/A	N/A
11	Not used	Not used	N/A	N/A
12	Processing ID	P (indicates production meter)	Char	1
13	Version Number of Specification	1 (indicates meter follows E1394-91 standard)	Char	1

Table 9: Header Record

<table>
<tr><th>Field #</th><th>Field Name</th><th>Contents</th><th>Field Type</th><th>Field Length</th></tr>
<tr><td>14</td><td>Date & Time of Message</td><td>YYYYMMDDhhmm format
YYYY – year
MM – month
DD – day
hh – hour
mm – minute
Valid YYYYMMDD ranges are:
<table><tr><td>BREEZE®:</td><td>20010101 to 20321231</td></tr><tr><td>CONTOUR™:</td><td>20010101 to 20211231</td></tr><tr><td>DEX®:</td><td>19800101 to 20791231</td></tr><tr><td>ELITE® XL:</td><td>19970101 to 20161231</td></tr></table>Valid hhmm range is
0000 to 2359 (24-hour clock format)</td><td>Char</td><td>12</td></tr>
</table>

Note:

Unused fields are not transmitted, but the delimiters are transmitted since the unused fields are in the middle of the record.

Example Header Record 1:

```
<STX>1H|\^&||-15013|Bayer6116^1.08\0.01^6116-0000096||||||P|1|200302031432<CR><ETB>7E<CR><LF>
```

Record Number	1
Record type	H
Delimiter Definition	|\^&
Access Password	-15013
Sender ID meter product code meter software version EEPROM version meter serial number	 Bayer6116 (**BREEZE® meter family**) 1.08 0.01 6116-0000096
Processing ID	P (indicates production meter)
Version Number of Specification	1 (indicates meter follows E1394-91 standard)
Date & Time of Message	200302031432
Checksum	7E

Table 9: Header Record

Example Header Record 2:

<STX>1H|\^&||27719|Bayer7150^1.05\0.00^7150-0002193||||||P|1|200302031412<CR><ETB>59<CR><LF>

Record Number	1
Record type	H
Delimiter Definition	|\^&
Access Password	27719
Sender ID meter product code meter software version EEPROM version meter serial number	 Bayer7150 (**CONTOUR™ meter, 15-second version**) 1.05 0.00 7150-0002193
Processing ID	P (indicates production meter)
Version Number of Specification	1 (indicates meter follows E1394-91 standard)
Date & Time of Message	200302031412
Checksum	59

Example Header Record 3:

<STX>1H|\^&||-16638|Bayer7150^2.04\0.02^7150A0001001||||||P|1|200302031412<CR><ETB>2D<CR><LF>

Record Number	1
Record type	H
Delimiter Definition	|\^&
Access Password	-16638
Sender ID meter product code meter software version EEPROM version meter serial number	 Bayer7150 (**CONTOUR™ meter , 5-second version**) 2.04 0.02 7150A0001001
Processing ID	P (indicates production meter)
Version Number of Specification	1 (indicates meter follows E1394-91 standard)
Date & Time of Message	200606211756
Checksum	2D

Table 9: Header Record

Example Header Record 4:

<STX>1H|\^&||10876|Bayer3950^3.08\2.03^3952MA000461||||||P|1|200302031501<CR><ETB>9A<CR><LF>

Record Number	1
Record type	H
Delimiter Definition	|\^&
Access Password	10876
Sender ID meter product code meter software version EEPROM version meter serial number	 Bayer3950 (**DEX® meter family**) 3.08 2.03 3952MA000461
Processing ID	P (indicates production meter)
Version Number of Specification	1 (indicates meter follows E1394-91 standard)
Date & Time of Message	200302031501
Checksum	9A

Example Header Record 5:

<STX>1H|\^&||7580|Bayer3883^1.06\1.01^3899-3344530||||||P|1|200302031353<CR><ETB>4A<CR><LF>

Record Number	1
Record type	H
Delimiter Definition	|\^&
Access Password	7580
Sender ID meter product code meter software version EEPROM version meter serial number	 Bayer3883 (**ELITE™ XL meter family**) 1.06 1.01 3899-3344530
Processing ID	P (indicates production meter)
Version Number of Specification	1 (indicates meter follows E1394-91 standard)
Date & Time of Message	200302031353
Checksum	4A

6.1.4.2 Patient Information Record

The format of the Patient Information Record is shown in "Table 10: Patient Information Record".

Table 10: Patient Information Record

Field #	Field Name	Contents	Field Type	Field Length
1	Record type	P	Char	1
2	Sequence number	1	Integer	1
3-35	Not used	Not used	N/A	N/A

Note:

Unused fields are not transmitted, nor are the delimiters transmitted since the unused fields are at the end of the record.

Example Patient Information Record (all meter families):

<STX>2P|1<CR><ETB>53<CR><LF>

6.1.4.3 Test Order Record

The format of the Test Order Record is shown in "Table 11: Test Order Record".

Table 11: Test Order Record

Field #	Field Name	Contents	Field Type	Field Length
1	Record type	O	Char	1
2	Sequence number	1, 2, etc.	Int	1 to 3
3	Specimen ID	Not used	N/A	N/A
4	Meter specimen ID	Not used	N/A	N/A
5	Universal ID	Not used	N/A	N/A
6	Not used	Not used	N/A	N/A
7	Not used	Not used	N/A	N/A
8	Not used	Not used	N/A	N/A
9	Not used	Not used	N/A	N/A
10	Not used	Not used	N/A	N/A
11	Not used	Not used	N/A	N/A
12	Action code	Q for control specimens, otherwise Not used	Char N/A	1 N/A
13-31	Not Used	Not Used	N/A	N/A

Example Test Order Record (all meter families):

<STX>30|1<CR><ETB>53<CR><LF>	*blood results*
<STX>50|2|||||||||Q<CR><ETB>7F<CR><LF>	*control solution results*

Notes:

1. Unused fields are not transmitted. No delimiters are transmitted for unused fields at the end of the record. For unused fields in the middle of the record, delimiters are transmitted.
2. Caution: For DEX® meter software version 1.23, the formatting of clinical data ASTM records varies from the standard. If the oldest glucose readings in the meter memory are marked as glucose control specimens, they are sent in the same ASTM Test Order Record as the glucose average readings, not in a separate Test Order Record. The Result Status field of the Result Record must be used to determine that these results are for control specimens (the result status is "E" for edited).
3. For all meter families, an Order Record as follows precedes control solution results:

   <STX>50|2|||||||||Q<CR><ETB>7F<CR><LF>

   For CONTOUR™ meters, the Result Record will also contain an 'E' marker for control solution results that are detected automatically by the meter. If the user marks a test result on the CONTOUR™ meter, then the Result Record will contain 'E' and 'D' markers and the result record will NOT be preceded by an Order Record with a 'Q'.

6.1.4.4 Result Record

The format of the Result Record is shown in "Table 12: Result Record".

Table 12: Result Record

Field #	Field Name	Contents	Field Type	Field Length
1	Record Type	R	Char	1
2	Sequence Number	1, 2, etc.	Int	1 or more
3	Universal Test ID	^^^Glucose (for blood, deleted blood, or control solutions), or ^^^GlucoseA (for glucose grand 14 day average), or ^^^GlucoseA1 (for glucose average 1, DEX® only), or ^^^GlucoseA2 (for glucose average 2, DEX® only), or ^^^GlucoseA3 (for glucose average 3, DEX® only), or ^^^GlucoseA4 (for glucose average 4, DEX® only) Note: ^^^ indicates that only part 4 of field 3 is used.	Char Char Char Char Char Char	10 11 12 12 12 12
4	Data or Measurement Value	Clinical result, depending on the meter setup the valid range is: BREEZE®: 0, 9–601 mg/dL or 0.00, 0.50–33.39 mmol/L CONTOUR™: 0, 9–601 mg/dL or 0.00, 0.50–33.39 mmol/L DEX®: 0, 9–601 mg/dL or 0.00, 0.50–33.39 mmol/L ELITE® XL: 0, 19–601 mg/dL or 0.00, 1.06–33.39 mmol/L Notes: • 0 mg/dL or 0.00 mmol/L is applicable only for glucose averages, and indicates that the average is not available. • LO results are transmitted as 9 mg/dL or 0.50 mmol/L for BREEZE®, CONTOUR™, and DEX® • LO results are transmitted as 19 mg/dL or 1.06 mmol/L for ELITE® XL • HI results are transmitted as 601 mg/dL or 33.39 mmol/L for BREEZE®, CONTOUR™, DEX® and ELITE® XL	Int Int Int Float Float	1 1 to 3 1 to 3 4 to 5 4 to 5
5	Units^Reference Method	mg/dL or mmol/L (depends on meter setup) ^ reference method (depends on meter setup): B: whole blood: BREEZE®, CONTOUR™, or DEX® P: plasma: BREEZE®, CONTOUR™, or DEX® C: capillary: ELITE™ XL	Char ^ Char	5 ^ 1
6	Reference Ranges	Used for DEX® only. If the Universal Test ID field is ^^^GlucoseA1, ^^^GlucoseA2, ^^^GlucoseA3, or ^^^GlucoseA4, used to report glucose average preset time for glucose average number indicated by the Universal Test ID field. Format is MMMM (minutes since midnight, 0 to 1439)	Int	1 to 4

Table 12: Result Record

<table>
<tr><th>Field #</th><th>Field Name</th><th>Contents</th><th>Field Type</th><th>Field Length</th></tr>
<tr><td>7</td><td>Result Abnormal Flags</td><td>None, <, >, T, <\T, or >\T (note use of repeat delimiter)
Where:
<table>
<tr><td><</td><td>result is below absolute low meter scale</td><td>10 mg/dL
or
0.56 mmol/L</td><td>BREEZE®, CONTOUR™, or DEX®</td></tr>
<tr><td></td><td></td><td>20 mg/dL or 1.11 mmol/L</td><td>ELITE® XL</td></tr>
<tr><td>></td><td>result is above absolute high meter scale</td><td>600 mg/dL or 33.33 mmol/L</td><td>all meter families</td></tr>
<tr><td>T</td><td>marginal temperature</td><td>This marker will be placed on results generated with meter temperature between 0 and 10 degrees Celsius or between 40 and 50 degrees Celsius</td><td>BREEZE® meter only</td></tr>
</table>
Note: For CONTOUR™ and ELITE® XL, this field is unused when reporting the GlucoseA Result Record. For BREEZE® and DEX®, the < and > markers are used when reporting the GlucoseA and GlucoseA1 through GlucoseA4 Result Records.</td><td>N/A, Char, or Char\Char</td><td>N/A, 1, or 1\1</td></tr>
<tr><td>8</td><td>User Marks</td><td>Used by CONTOUR™ 5-second meter only.
B: Before meal (Pre-meal)
A: After meal (Post-meal)
D: Logbook</td><td>N/A</td><td>N/A</td></tr>
<tr><td>9</td><td>Result Status Markers</td><td>None, E, D, or E\D (note use of repeat delimiter)
Where:
E - indicates edited
D - indicates deleted
E\D – used as described below

Deleted results and control solution results are represented as follows for the meter families:</td><td>N/A, Char, or Char\Char</td><td>N/A, 1, or 1\1</td></tr>
<tr><td></td><td colspan="3">
<table>
<tr><th></th><th></th><th>BREEZE®</th><th>CONTOUR™ 5-second</th><th>CONTOUR™ 15-second</th><th>DEX®</th><th>ELITE® XL</th></tr>
<tr><td rowspan="2">User-marked control</td><td>Order Record</td><td>Q-type</td><td rowspan="2">Not used</td><td>non-Q-type</td><td>Q-type</td><td>Q-type</td></tr>
<tr><td>Result Status</td><td>E\D</td><td>E\D</td><td>E</td><td>E</td></tr>
<tr><td rowspan="2">User-deleted results</td><td>Order Record</td><td>non Q-type</td><td rowspan="2">Not used</td><td rowspan="2">Not used</td><td>non-Q-type</td><td>non-Q-type</td></tr>
<tr><td>Result Status</td><td>E\D</td><td>E\D</td><td>E\D</td></tr>
<tr><td rowspan="2">Self-detected control</td><td>Order Record</td><td rowspan="2">Not used</td><td>Q-type</td><td>Q-type</td><td rowspan="2">Not used</td><td rowspan="2">Not used</td></tr>
<tr><td>Result Status</td><td>E</td><td>E</td></tr>
</table>
</td><td></td></tr>
<tr><td>10</td><td>N/A</td><td>Not used</td><td>N/A</td><td>N/A</td></tr>
</table>

Table 12: Result Record

Field #	Field Name	Contents	Field Type	Field Length
11	Operator ID	Not used	N/A	N/A
12	Date & Time Test Performed	Not used when reporting glucose average values. YYYYMMDDhhmm format YYYY – year MM – month DD – day hh – hour mm – minute Valid YYYYMMDD ranges are: BREEZE®: 20010101 to 20321231 CONTOUR™: 20010101 to 20211231 DEX®: 19800101 to 20791231 ELITE® XL: 19970101 to 20161231 Valid hhmm range is 0000 to 2359 (24-hour clock format).	Char	12
13-14	Not Used	Not Used	N/A	N/A

Notes:

1. Unused fields are not transmitted. No delimiters are transmitted for unused fields at the end of the record. For unused fields in the middle of the record, delimiters are transmitted.
2. The units and reference method will be the same for all readings in any one *Data Transfer Mode* message from a meter.

1

Table 12: Result Record

Example Result Records

The following examples illustrate variations of the Result Record. The examples do not include framing characters or checksum characters**.**

Example Result Record 1

`R|1|^^^GlucoseA|224|mg/dL^B||<CR>`

Universal Test ID	Glucose Average
Glucose Level	224
Fixed Units Label	mg/dL
Reference Method	whole blood
Flags	None
Markers	None
Notes	All meter families, except ELITE® XL (see below)

Example Result Record 2

`R|1|^^^GlucoseA|224|mg/dL^C||<CR>`

Universal Test ID	Glucose Average
Glucose Level	224
Fixed Units Label	mg/dL
Reference Method	Capillary
Flags	None
Markers	None
Notes	ELITE® XL only (differs from above only by reference method)

Example Result Record 3

`R|1|^^^GlucoseA|120|mg/dL^P||<CR>`

Universal Test ID	Glucose Average
Glucose Level	120
Fixed Units Label	mg/dL
Reference Method	Plasma
Flags	None
Markers	None
Notes	CONTOUR ® uses preset averages (15-second test time version)

Table 12: Result Record

Example Result Record 4

R|1|^^^Glucose|113|mg/dL^B|||A||||200611081013<CR>

Universal Test ID	Glucose
Glucose Level	113
Fixed Units Label	mg/dL
Reference Method	Whole blood
Flags	None
Result Marker	A: After meal (post-meal)
Result Status	None
Year, Month, Day	20061108
Hour, Minute	1013
Notes	CONTOUR meter with 5-second test time

Example Result Record 5

R|1|^^^Glucose|9|mg/dL^P||<|D||||200611081045<CR>

Universal Test ID	Glucose
Glucose Level	9 (Displays “LO”)
Fixed Units Label	mg/dL
Reference Method	Plasma
Flags	Yes (Low)
Result Marker	D: Logbook
Result Status	None
Year, Month, Day	20061108
Hour, Minute	1045
Notes	CONTOUR meter with 5-second test time

Example Result Record 6

R|1|^^^Glucose|609|mg/dL^P||||E|||200611081212<CR>

Universal Test ID	Glucose
Glucose Level	609 (Displays “HI”)
Fixed Units Label	mg/dL
Reference Method	Plasma
Flags	None
Result Marker	None
Result Status	E: Meter automatically marked result as Control
Year, Month, Day	20061108
Hour, Minute	1212
Notes	CONTOUR meter with 5-second test time

Table 12: Result Record

Example Result Record 7

```
R|1|^^^Glucose|99|mg/dL^B|||B||||20060808080948<CR>
```

Universal Test ID	Glucose
Glucose Level	99
Fixed Units Label	mg/dL
Reference Method	Whole blood
Flags	None
Result Marker	Before meal (pre-meal)
Result Status	None
Year, Month, Day	20060808
Hour, Minute	0948
Notes	CONTOUR meter with 5-second test time

Example Result Record 8

```
R|1|^^^Glucose|5.5|mmol/L^P||||E\D|||200612121108<CR>
```

Universal Test ID	Glucose
Glucose Level	5.5 (99 mg/dL)
Fixed Units Label	mmol/L
Reference Method	Plasma
Flags	None
Result Marker	None
Result Status	E\D: User marked result as Control or Deleted
Year, Month, Day	20061212
Hour, Minute	1108
Notes	CONTOUR meter with 15-second test time version

Example Result Record 9

```
R|2|^^^GlucoseA1|82|mg/dL^B|450|<CR>
```

Universal Test ID	Glucose Average 1
Glucose Level	82
Fixed Units Label	mg/dL
Reference Method	whole blood
Reference Ranges	450 (7:30 AM preset time)
Flags	None
Markers	None
Notes	only DEX® uses preset averages

Table 12: Result Record

Example Result Record 10

R|3|^^^GlucoseA2|120|mg/dL^B|720|<CR>

Universal Test ID	Glucose Average 2
Glucose Level	120
Fixed Units Label	mg/dL
Reference Method	whole blood
Reference Ranges	720 (12:00 Noon preset time)
Flags	None
Markers	None
Notes	only DEX® uses preset averages

Example Result Record 11

R|4|^^^GlucoseA3|271|mg/dL^B|1080|<CR>

Universal Test ID	Glucose Average 33
Glucose Level	271
Fixed Units Label	mg/dL
Reference Method	whole blood
Reference Ranges	1080 (6:00 PM preset time)
Flags	None
Markers	None
Notes	only DEX® uses preset averages

Example Result Record 12

R|5|^^^GlucoseA4|0|mg/dL^B|1260|<|<CR>

Universal Test ID	Glucose Average 4
Glucose Level	0 (average not available)
Fixed Units Label	mg/dL
Reference Method	whole blood
Reference Ranges	1260 (9:00 PM preset time)
Flags	below absolute low meter scale
Markers	none
Notes	only DEX® uses preset averages

Table 12: Result Record

Example Result Record 13

R|6|^^^Glucose|9|mg/dL^B||<||||200208311007<CR>

Universal Test ID	Glucose
Glucose Level	9 (< 10)
Fixed Units Label	mg/dL
Reference Method	whole blood
Flags	below absolute low meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1007
Notes	All meter families, except ELITE® XL (see below)

Example Result Record 14

R|6|^^^Glucose|9|mg/dL^C||<||||200208311007<CR>

Universal Test ID	Glucose
Glucose Level	19 (<20)
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	below absolute low meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1007
Notes	ELITE® XL only

Example Result Record 15

R|7|^^^Glucose|100|mg/dL^B|||E\D|||200208311008<CR>

Universal Test ID	Glucose
Glucose Level	100
Fixed Units Label	mg/dL
Reference Method	whole blood
Flags	none
Markers	edited and deleted
Year, Month, Day	20020831
Hour, Minute	1008
Notes	1. For BREEZE®, record represents a user-marked control result when preceded with a Q-type Order record. 2. For BREEZE® and DEX®, record represents a user-deleted result when preceded by a non-Q-type Order record. 3. For CONTOUR™, record represents a user-marked control result when preceded by a non-Q-type Order record.

Table 12: Result Record

Example Result Record 16

```
R|7|^^^Glucose|100|mg/dL^C||||E\D|||200208311008<CR>
```

Universal Test ID	Glucose
Glucose Level	100
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	none
Markers	edited and deleted
Year, Month, Day	20020831
Hour, Minute	1008
Notes	For ELITE® XL, record represents a user-deleted result when preceded by a non-Q-type Order record.

Example Result Record 17

```
R|8|^^^Glucose|37|mg/dL^B||||||200208311009<CR>
```

Universal Test ID	Glucose
Glucose Level	37
Fixed Units Label	mg/dL
Reference Method	whole blood
Flags	none
Markers	none
Year, Month, Day	20020831
Hour, Minute	1009
Notes	All meter families, except ELITE® XL (see below)

Example Result Record 18

```
R|8|^^^Glucose|37|mg/dL^C||||||200208311009<CR>
```

Universal Test ID	Glucose
Glucose Level	37
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	none
Markers	none
Year, Month, Day	20020831
Hour, Minute	1009
Notes	ELITE® XL only

Table 12: Result Record

Example Result Record 19

R|9|^^^Glucose|47|mg/dL^P||||E|||200208311010<CR>

Universal Test ID	Glucose
Glucose Level	47
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	none
Markers	edited
Year, Month, Day	20020831
Hour, Minute	1010
Notes	1. For DEX®, record represents a user-marked control result when preceded by a Q-type Order record. 2. For CONTOUR™, record represents a self-detected control result when preceded by a Q-type Order record.

Example Result Record 20

R|9|^^^Glucose|47|mg/dL^C||||E|||200208311010<CR>

Universal Test ID	Glucose
Glucose Level	47
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	none
Markers	edited
Year, Month, Day	20020831
Hour, Minute	1010
Notes	3. For ELITE® XL, record represents a user-marked control result when preceded by a Q-type Order record.

Example Result Record 21

R|10|^^^Glucose|2.61|mmol/L^P||||||200208311011<CR>

Universal Test ID	Glucose
Glucose Level	2.61
Fixed Units Label	mmol/L (47 mg/dL)
Reference Method	plasma
Flags	none
Markers	none
Year, Month, Day	20020831
Hour, Minute	1011
Notes	All meter families, except ELITE® XL (see below)

Table 12: Result Record

Example Result Record 22

```
R|10|^^^Glucose|2.61|mmol/L^C||||||200208311011<CR>
```

Universal Test ID	Glucose
Glucose Level	2.61
Fixed Units Label	mmol/L (47 mg/dL)
Reference Method	capillary
Flags	none
Markers	none
Year, Month, Day	20020831
Hour, Minute	1011
Notes	ELITE® XL

Example Result Record 23

```
R|11|^^^Glucose|600|mg/dL^P||||||200208311012<CR>
```

Universal Test ID	Glucose
Glucose Level	600
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	none
Markers	none
Year, Month, Day	20020831
Hour, Minute	1012
Notes	All meter families, except ELITE® XL. ELITE™ XL would have capillary reference method (^C).

Example Result Record 24

```
R|12|^^^Glucose|601|mg/dL^P||>||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	601 (> 600)
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	above absolute high meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	All meter families, except ELITE® XL.

Table 12: Result Record

Example Result Record 25

```
R|12|^^^Glucose|601|mg/dL^C||>||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	601 (> 600)
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	above absolute high meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	ELITE™ XL only.

Example Result Record 26

```
R|13|^^^Glucose|601|mg/dL^P||>||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	601 (> 600)
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	above absolute high meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	All meter families, except ELITE® XL.

Example Result Record 27

```
R|13|^^^Glucose|601|mg/dL^C||>||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	601 (> 600)
Fixed Units Label	mg/dL
Reference Method	capillary
Flags	above absolute high meter scale
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	ELITE® XL.

Table 12: Result Record

Example Result Record 28

```
R|13|^^^Glucose|9|mg/dL^P||<\T||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	9 (<10)
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	1. below absolute high meter scale 2. temperature out of range
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	Only BREEZE® uses the Temperature flag.

Example Result Record 29

```
R|13|^^^Glucose|601|mg/dL^P||>\T||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	601 (> 600)
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	3. above absolute high meter scale 4. temperature out of range
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	Only BREEZE® uses the Temperature flag.

Example Result Record 30

```
R|14|^^^Glucose|100|mg/dL^P||T||||200208311013<CR>
```

Universal Test ID	Glucose
Glucose Level	100
Fixed Units Label	mg/dL
Reference Method	plasma
Flags	temperature out of range
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	Only BREEZE® uses the Temperature flag.

Table 12: Result Record

Example Result Record 31

R|14|^^^Glucose|100|mg/dL^B||T||||200208311013<CR>

Universal Test ID	Glucose
Glucose Level	100
Fixed Units Label	mg/dL
Reference Method	whole blood
Flags	temperature out of range
Markers	none
Year, Month, Day	20020831
Hour, Minute	1013
Notes	Only BREEZE® uses the Temperature flag.

6.1.4.5 Message Terminator Record

The format of the Message Terminator Record is shown in "Table 13: Message Terminator Record".

Table 13: Message Terminator Record

Field #	Field Name	Contents	Field Type	Field Length
1	Record Type	L	Char	1
2	Sequence Number	1	Int	1
3	Termination Code	N (Normal Termination)	Char	1

Note:

Although other values for Termination Code are specified in the ASTM standard, the only Termination Code ever generated by the meter is N, Normal Termination. If the computer does not receive a Message Terminator Record (containing the N Termination Code), then any preceding data should not be used.

Presence of the Message Terminator Record indicates validity of the preceding *Data Transfer Mode* test results message transmission from the meter. The absence of the Message Terminator Record should be interpreted as indicating that the preceding *Data Transfer Mode* test results message transmission from the meter is invalid, and the data should not be used. There is no other error reporting mechanism used to indicate validity of the test results data sent during *Data Transfer Mode*.

Example Message Terminator Record (all meter families):

```
<STX>3L|1|N<CR><ETX>06<CR><LF>
```

6.2 *Remote Command Mode* Protocol

In *Remote Command Mode*, various meter configurations can be both interrogated and modified through the serial interface. During *Remote Command Mode*, remote commands are sent from the computer to the meter. See "Section 6.2.3 Remote Commands" for a description of the remote commands.

The capabilities of *Remote Command Mode* are summarized in "Table 14: Remote Command Mode Summary" for each meter family.

Table 14: Remote Command Mode Summary

Capability	BREEZE®	CONTOUR™	DEX®	ELITE® XL
Buzzer	Read/Write Range: High, Low, Off	Read/Write Range: On or Off	Read/Write Range: On or Off	Read/Write Range: On or Off
Glucose units	Read/Write mg/dL or mmol/L	Read/Write mg/dL or mmol/L	Read/Write mg/dL or mmol/L	Read/Write mg/dL or mmol/L
Time format	Read/Write 12 or 24 hour	Read/Write 12 or 24 hour	Read/Write 12 or 24 hour	Read/Write 12 or 24 hour
Temperature format	N/A	N/A	Read/Write °F or °C	N/A
Date format	Read/Write month-day or day-month	Read/Write month-day or day-month	N/A	Read/Write month-day or day-month
Reference method	Read-only whole blood or plasma (see note 1)	Read/Write whole blood or plasma (see note 2)	Read-only whole blood or plasma (see note 1)	N/A (see note 3)
Time of day	Read/Write	Read/Write	Read/Write	Read/Write
Date	Read/Write	Read/Write	Read/Write	Read/Write
Average 1 thru 4 preset times	N/A	N/A	Read/Write	N/A
Test Time Alarm & Result Marker enable	N/A	15-second version – N/A 5-second version – Read/Write	N/A	N/A
Clinical results (see note 3)	Read/Write	Read/Write	Read/Write	Read/Write

Notes:

1. In the BREEZE® , DEX® and 5-second CONTOUR™ meters, the reference method is treated as read-only by the meter.
2. In the 15-second CONTOUR™ meter, it is incumbent upon the computer software that interfaces with the meter to treat the reference method as read-only. Altering the reference method setting in the meter will erase all results currently stored in the meter as well as change the reference method for all glucose tests subsequently performed.
3. In the ELITE® XL meter, the reference method is not available in Remote Command Mode.
4. Write command erases all clinical results (blood, deleted, and control solutions) from meter's memory. Read command reads the number of clinical results (blood, deleted, and control solutions) stored in memory.

The user can also modify meter configurations manually. See "Section 3.0 Meter Operating Modes" for a description of the manual configuration modes for each meter family. Note that there may not be a one-to-one correlation between the manual and remote configuration capabilities.

6.2.1 Initiating *Remote Command Mode*

Upon receipt of an <ENQ> from the meter, the computer may request control of the interface in order to transition to *Remote Command Mode*. The computer indicates it has remote commands to send by transmitting an <ENQ> character, the meter responds with an <ACK> to indicate it is ready to receive. Upon receipt of an <ACK> response, the computer may then send one or more remote commands to the meter. If the computer receives a <NAK> response, the computer must wait at least 10 seconds before transmitting another <ENQ>. If the computer receives an <ENQ> response, the computer must stop trying to transmit.

The computer may also take control of the interface after the completion of a *Data Transfer Mode* message. In order to establish communications, the computer must send <ENQ> within five seconds after the meter sends an <EOT> to complete the *Data Transfer Mode*. Once communications is established, remote commands must be sent within 15 seconds of each other, otherwise the meter automatically exits *Remote Command Mode*.

Also see "Section 6.1.2 Establishment Phase".

6.2.2 Terminating *Remote Command Mode*

In order to terminate *Remote Command Mode*, the computer must send an <EOT> to indicate it has completed sending remote commands.

Remote Command Mode will be terminated by the meter whenever any error condition is detected. See Section 6.2.3.2 Remote Command Protocol and Error Checking.

6.2.3 Remote Commands

The ASTM instrument interface protocols are not used for the remote commands because the information the meter receives from the computer is not standardized and because the meters have a limited amount of memory to buffer received data. The protocol for receiving data requires the meter to store only a few bytes of data rather than an entire ASTM frame.

6.2.3.1 Remote Command Format

There are two basic remote command formats, one with a data token and one without. In addition, the BREEZE® meter family remote command format includes a checksum while the remote command format for the remaining meter families does not include a checksum. See "Table 15: Remote Command Formats".

Table 15: Remote Command Formats

Meter Family(ies)	Remote Command Formats
BREEZE®	action, delimiter, address token, delimiter, checksum, terminator action, delimiter, address token, delimiter, data token, delimiter, checksum, terminator
CONTOUR™, ELITE® XL	action, delimiter, address token, delimiter action, delimiter, address token, delimiter, data token, delimiter
DEX®	action, delimiter, address token, delimiter, terminator action, delimiter, address token, delimiter, data token, delimiter, terminator

6.2.3.2 Remote Command Protocol and Error Checking

The two permissible values for the remote command action field are W (write) and R (read).

The command delimiter is the '|' character. The character immediately preceding the first delimiter is interpreted as the command. The command terminator is the <CR> character. Characters received after the terminator and preceding the next command are ignored by the meter (e.g., a <LF> character following the <CR> terminator would be ignored).

The computer must stop transmitting after each delimiter (and after the terminator for BREEZE®) and wait until the meter responds. After receiving the delimiter, the meter will respond within 500 milliseconds with an acknowledgment (<ACK> or <NAK>). In response to receiving the delimiter, the meter sends an <ACK> to indicate information received so far is acceptable and the computer may continue. If it is the final delimiter of the command (or if it is the terminator for BREEZE®), then the <ACK> will be preceded with the command response data, if applicable.

The meter sends a <NAK> to indicate the information received is faulty in some way. After sending a <NAK>, the meter returns to the Establishment Phase. This partial message verification mechanism enables the computer to better determine causes of interface errors.

For the DEX® meter, the computer must send a terminator (<CR>) after receiving the meter response. The terminator must be sent after receiving the meter response in order to avoid a collision on the interface. For CONTOUR™ and ELITE® XL, the terminator is optional.

For the BREEZE® meter, in response to receiving the terminator the meter validates the message checksum and responds within 500 milliseconds according to the validity of the

checksum. The message checksum includes all message characters beginning with the action and ending with the delimiter preceding the checksum characters. The message checksum provides further protection against transmission errors.

If the message checksum is valid, the meter sends an <ACK> to the computer. The <ACK> will be preceded with the command response data, if applicable.

If the message checksum is invalid, then the meter sends a <NAK> to indicate the command received is invalid; after sending a <NAK>, the meter returns to the Establishment Phase.

6.2.3.3 Remote Command Response

The format of the Remote Command Response data sent by the meter is shown in "Table 16: Remote Command Response Formats". For Remote Command Responses, the **action** code is always the character D.

Table 16: Remote Command Response Formats

Meter Family(ies)	Remote Command Response Format
BREEZE®	action, delimiter, data token, delimiter, checksum, terminator
CONTOUR™, DEX®, ELITE® XL	action, delimiter, data token, delimiter, terminator

For the remote commands that cause the meter to send data, the meter continues to transmit after each delimiter until the terminator and <ACK> are sent. The computer must not send any characters until the meter has finished sending all of the response information, including the **terminator** and an <ACK>. The computer must not respond to the delimiters sent by the meter in the Remote Command Response. . After receiving the command to send data, the meter will complete its response within 500 milliseconds, including the **terminator** and an <ACK>.

6.2.3.4 Remote Command Details

The available Remote Command **address token**s and the **data token** formats for the commands differ among the Bayer blood glucose meter families. "Table 17: Meter Remote Commands" provides a list of available Remote Command address tokens and defines the data token format for each command and meter family. In "Table 17: Meter Remote Commands", integer data is transmitted as sequential ASCII character codes representing each integer digit. Remote Command examples are provided in Table 18 through Table 21.

6.2.3.5 Remote Command Considerations

To avoid corrupting any field in a compound data token (such as for the configuration command), a "write" command should be preceded with a "read" command. All fields other than the field or fields to be altered should be preserved. To confirm that the changes in the meter settings are made as expected, "write" commands should be followed by the corresponding “read" commands and the data values compared.

Refer to the Notes sections of "Table 17: Meter Remote Commands" for additional considerations.

Table 17: Meter Remote Commands Details

<table>
<tr><th>Address Token</th><th>Action</th><th>Command</th><th colspan="4">Data Field Format</th></tr>
<tr><td></td><td></td><td></td><td>BREEZE®
(see note 1)</td><td>CONTOUR™</td><td>DEX®</td><td>ELITE™XL</td></tr>
<tr><td rowspan="2">C</td><td rowspan="2">R
or
W</td><td rowspan="2">Meter Configuration</td><td>Type: Char
Length: 2, fixed
Format: hexadecimal number
(bit mapped, bit weights as follows):
<table><tr><th>bit wt</th><th>contents</th></tr><tr><td>1</td><td>Buzzer Enable:
0 = disabled, 1 = enabled</td></tr><tr><td>2</td><td>Time Format:
0 = 12 hr, 1 = 24 hr</td></tr><tr><td>4</td><td>Glucose Units (see note 6):
0 = mg/dL, 1 = mmol/L</td></tr><tr><td>8</td><td>Buzzer Level (see note 2):
0 = Low, 1 = High</td></tr><tr><td>16</td><td>Reference Method
(read only, see note 3):
0 = plasma, 1 = whole blood</td></tr><tr><td>32</td><td>Date Format:
0 = month-day, 1 = day-month</td></tr><tr><td>64</td><td>Reserved
set to 0</td></tr><tr><td>128</td><td>Reserved:
set to 0</td></tr></table></td><td>Type: Char
Length: 2, fixed
Format: hexadecimal number
(bit mapped, bit weights as follows):
<table><tr><th>bit wt</th><th>contents</th></tr><tr><td>1</td><td>Buzzer Enable:
0 = disabled, 1 = enabled</td></tr><tr><td>2</td><td>Time Format:
0 = 12 hr, 1 = 24 hr</td></tr><tr><td>4</td><td>Glucose Units (see note 6):
0 = mg/dL, 1 = mmol/L</td></tr><tr><td>8</td><td>For 15-second Meter only:
Reserved: set to 0
(read only, see note 3)

For 5-second Meter only:
0: Disable Test Time Alarm and Result Markers,
1: Enable Test Time Alarm and Result Markers.</td></tr><tr><td>16</td><td>Reference Method
(see note 4)
0 = plasma, 1 = whole blood</td></tr><tr><td>32</td><td>Date Format:
0 month-day, 1 day-month</td></tr><tr><td>64</td><td>Calibration Curve
(see note 5)
0 = F2, 1=F3, 2=F4, 3=Invalid
(defaults to 0)</td></tr><tr><td>128</td><td></td></tr></table></td><td>Type: Char
Length: 1 to 3, variable
Format: decimal number
(bit mapped, bit weights as follows):
<table><tr><th>bit wt</th><th>contents</th></tr><tr><td>1</td><td>Buzzer Enable:
0 = disabled, 1 = enabled</td></tr><tr><td>2</td><td>Date/Time Format
0 = 12 hr, month-day
1 = 24 hr, day-month</td></tr><tr><td>4</td><td>Glucose Units (see note 6):
0 = mg/dL, 1 = mmol/L</td></tr><tr><td>8</td><td>Temperature Units
0 = °C, 1 = °F</td></tr><tr><td>16</td><td>Reference Method
(read only, see note 3)
0 = plasma, 1 = whole blood</td></tr><tr><td>32</td><td>Reserved: set to 0
(read only, see note 3)</td></tr><tr><td>64</td><td>Reserved: set to 0
(read only, see note 3)</td></tr><tr><td>128</td><td>Reserved: set to 0
(read only, see note 3)</td></tr></table></td><td>Type: Char
Length: 2, fixed
Format: hexadecimal number
(bit mapped, bit weights as follows):
<table><tr><th>bit wt</th><th>contents</th></tr><tr><td>1</td><td>Buzzer Enable:
0 = disabled, 1 = enabled</td></tr><tr><td>2</td><td>Time Format:
0 = 12 hr, 1 = 24 hr</td></tr><tr><td>4</td><td>Glucose Units (see note 6):
0 = mg/dL, 1 = mmol/L</td></tr><tr><td>8</td><td>Reserved: set to 0
(read only, see note 3)</td></tr><tr><td>16</td><td>Reserved: set to 0
(read only, see note 3)</td></tr><tr><td>32</td><td>Date Format:
0 month.day, 1 day.month</td></tr><tr><td>64</td><td>Reference Method
(read only, see note 3)
0 = capillary</td></tr><tr><td>128</td><td>Reserved: set to 0
(read only, see note 3)</td></tr></table></td></tr>
</table>

Table 17: Meter Remote Commands Details, Continued

Notes:

1. The Remote command format for the BREEZE® meter includes a checksum between the last delimiter and the <CR> character. This checksum is calculated in the same fashion as the ASTM Frame Checksum described in Section 6.1.3.2. The remaining meter families do not include a checksum in the remote commands.
2. The Buzzer Level field has no meaning if the Buzzer Enable field is set to disable.
3. Writing to any read only field in the configuration word will NOT change the setting in the meter. In the BREEZE® , DEX® and 5-second CONTOUR™ meters, the reference method is treated as read only by the meter.
4. In the 15-second CONTOUR™ meter, it is incumbent upon the computer software that interfaces with the meter to treat the reference method as read-only. Altering the reference method setting in the meter will erase all results currently stored in the meter as well as change the reference method for all glucose tests subsequently performed.
5. In the CONTOUR™ meter, it is incumbent upon the computer software that interfaces with the meter to treat the Calibration Curve field as read-only.
6. In all meters, it is incumbent upon the computer software that interfaces with the meter to treat the Glucose Units field as read-only. Altering the Glucose Units field may change the units of measure used by some meters.

Table 17: Meter Remote Commands Details

Address Token	Action	Command	Data Field Format			
			BREEZE®	CONTOUR™	DEX®	ELITE™XL
M	R	Read Clinical Result Memory	Type (response): Integer Length (response): 3, fixed Format (response): Meter reports the number of clinical results available in the response data field (integer fixed length 3). Valid Range: 000 to 100 (or 000 to 500, depending upon meter setup) Note: No data field is sent to the meter in the 'R|M|' command.	Type (response): Integer Length (response): 3, fixed Format (response): Meter reports the number of clinical results available in the response data field (integer fixed length 3). Valid Range: 000 to 240 Note: No data field is sent to the meter in the 'R|M' command.	Type (response): Integer Length (response): 1 to 3, variable Format (response): Meter reports the number of clinical results available in the response data field (integer variable length 1 to 3). Valid Range: 0 to 100 Note: No data field is sent to the meter in the 'R|M' command.	Type (response): Integer Length (response): 3, fixed Format (response): Meter reports the number of clinical results available in the response data field (integer fixed length 3). Valid Range: 000 to 120 Note: No data field is sent to the meter in the 'R|M' command.
	W	Clear Clinical Result Memory	Type (response): None Length (response): N/A Format (response): N/A Valid Range: N/A Writing clears the clinical result memory. Note: No data field is sent to the meter in the 'W|M' command. No data is sent by the meter for the 'W|M' command.	Type (response): None Length (response): N/A Format (response): N/A Valid Range: N/A Writing clears the clinical result memory. Note: No data field is sent to the meter in the 'W|M' command. No data is sent by the meter for the 'W|M' command.	Type (response): None Length (response): N/A Format (response): N/A Valid Range: N/A Writing clears the clinical result memory. Note: No data field is sent to the meter in the 'W|M' command. No data is sent by the meter for the 'W|M' command.	Type (response): None Length (response): N/A Format (response): N/A Valid Range: N/A Writing clears the clinical result memory. Note: No data field is sent to the meter in the 'W|M' command. No data is sent by the meter for the 'W|M' command.

Table 17: Meter Remote Commands Details

Address Token	Action	Command	Data Field Format			
			BREEZE®	**CONTOUR™**	**DEX®**	**ELITE™XL**
D	R or W	**Date**	Type: Integer Length: 6, fixed Format: YYMMDD YY = year MM = month DD = day Valid range: 010101 to 321231.	Type: Integer Length: 6, fixed Format: YYMMDD YY = year MM = month DD = day Valid range: 010101 to 211231.	Type: Integer Length: 1 to 5, variable Format: Days since December 31, 1979. (January 1, 1980 is day 1; December 31, 2079 is day 36525) Valid range: 1 to 36525.	Type: Integer Length: 6, fixed Format: YYMMDD YY = year MM = month DD = day Valid range: 970101 to 161231.
T	R or W	**Time of Day**	Type: Integer Length: 4, fixed Format: hhmm hh = hour mm = minute Valid range: 0000 to 2359 (24-hour clock format).	Type: Integer Length: 4, fixed Format: hhmm hh – hour mm - minute Valid range: 0000 to 2359 (24-hour clock format).	Type: Integer Length: 1 to 4, variable Format: Minutes since midnight Valid Range: 0 to 1439 0 = 12:00 AM, 1 = 12:01 AM, … 1439 = 11:59 PM (see Note 1)	Type: Integer Length: 4, fixed Format: hhmm hh – hour mm - minute Valid range: 0000 to 2359 (24-hour clock format).

Note:

1. With the DEX® meter, after writing the time of day (with the command string "W|T|n|<CR>") wait at least two seconds before reading back the time of day (with the command string "R|T|<CR>"), otherwise the time read back may not reflect the time just set. The time of day value read may be one minute later than the time just set because the internal seconds counter may be nearing the 60 second minute rollover when the time is set. This restriction on writing then reading the time of day only affects the DEX® meter family.

Table 17: Meter Remote Commands Details

Address Token	Action	Command	Data Field Format			
			BREEZE®	**CONTOUR™**	**DEX®**	**ELITE™XL**
a	R or W	**Average 1 Preset Time**	Not used	Not used	Type: Integer Length: 1 to 4, variable Format: Minutes since midnight Valid Range: 0 to 1439 0 = 12:00 AM, 1 = 12:01 AM, … 1439 = 11:59 PM	Not used
b	R or W	**Average 2 Preset Time**	Not used	Not used	Same as Average 1 Preset Time field	Not used
c	R or W	**Average 3 Preset Time**	Not used	Not used	Same as Average 1 Preset Time field	Not used
d	R or W	**Average 4 Preset Time**	Not used	Not used	Same as Average 1 Preset Time field	Not used

6.2.3.6 BREEZE® Meter Remote Command Examples

The examples below demonstrate various Remote Commands for the BREEZE® meter. The examples include the commands from the computer and the responses from the meter, including the checksums (which are unique to the BREEZE® meter for Remote Command mode). In these examples the handshaking (meter <ACK> responses) is not shown. See Section 6.4 for examples including all handshaking (meter <ACK> responses, computer waits).

Table 18: BREEZE® Meter Remote Command Examples

Assuming that we start with a meter with the following configuration: (Buzzer: Disabled, Time format: 24 hours, Units: mg/dL, Date format: day/month/year), the following command sequence demonstrates setting the meter configuration to (Buzzer High, Time format: 12 hours, Date format: month/day/year). Note that the configuration word is first read, then reserved and read-only bits are preserved in the write command, finally the written value is read for confirmation.
Computer command sequence to read BREEZE® meter configuration.
`R|C|8D<CR>`
Meter Response
`D|22|A0<CR><LF>`
Computer command to set meter configuration:
`W|C|09|77<CR>`
Computer command to read meter configuration:
`R|C|8D<CR>`
Meter's response is to send:
`D|09|A5<CR><LF>`

Computer command to clear clinical result memory:
`W|M|9C<CR>`
Computer command to read number of clinical results available:
`R|M|97<CR>`
Meter's response is to send (0 results):
`D|000|CC<CR><LF>`

Computer command to set date (December 31, 2032):
`W|D|321231|3B<CR>`
Computer command to read date:
`R|D|8E<CR>`
Meter's response is to send (YYMMDD):
`D|321231|68<CR><LF>`

Computer command to set time of day (9:45 PM, hhmm in 24 hr. clock format):
`W|T|2145|EB<CR>`
Computer command to read time of day:
`R|T|9E<CR>`
Meter's response is to send (hhmm, 24 hr. clock format):
`D|2145|08<CR><LF>`

6.2.3.7 CONTOUR™ Meter Remote Command Examples

The examples below demonstrate various Remote Commands for the CONTOUR™ meter. The examples include the commands from the computer and the responses from the meter. In these examples the handshaking (meter <ACK> responses) is not shown. See Section 6.4 for examples including all handshaking (meter <ACK> responses, computer waits).

Table 19: CONTOUR™ Meter Remote Command Examples

Assuming that we start with a meter with the following configuration: (Buzzer: Disabled, Time format: 24 hours, Units: mg/dL, Date format: day/month/year), the following command sequence demonstrates setting the meter configuration to (Buzzer High, Time format: 12 hours, Date format: month/day/year). Note that the configuration word is first read, then reserved and read-only bits are preserved in the write command, finally the written value is read for confirmation.
Computer command sequence to read CONTOUR® meter configuration.
`R|C|<CR>`
Meter Response
`D|62| <CR><LF>`
Computer command to set meter configuration:
`W|C|41|<CR>`
Computer command to read meter configuration:
`R|C|8D<CR>`
Meter's response is to send:
`D|41|<CR><LF>`

Computer command to clear clinical result memory:
`W|M|<CR>`
Computer command to read number of clinical results available:
`R|M|<CR>`
Meter's response is to send (0 results):
`D|000|<CR><LF>`

Computer command to set date (May 28, 2003):
`W|D|030528|<CR>`
Computer command to read date:
`R|D|<CR>`
Meter's response is to send (YYMMDD):
`D|030528|<CR><LF>`

Computer command to set time of day (9:45 PM, hhmm in 24 hr. clock format):
`W|T|2145|<CR>`
Computer command to read time of day:
`R|T|<CR>`
Meter's response is to send (hhmm, 24 hr. clock format):
`D|2145|<CR><LF>`

6.2.3.8 DEX® Meter Remote Command Examples

The examples below demonstrate various Remote Commands for the DEX® meter. The examples include the commands from the computer and the responses from the meter. In these examples the handshaking (meter <ACK> responses) is not shown. See Section 6.4 for examples including all handshaking (meter <ACK> responses, computer waits).

Table 20: DEX® Meter Remote Command Examples

Computer command to set DEX® meter configuration (buzzer on, 24 hr, mmol/L, °F, plasma reference, value is 00001111 binary or 15decimal):
`W|C|15|<CR>`
Computer command to read meter configuration:
`R|C|<CR>`
Meter's response is to send:
`D|15|<CR><LF>`

Computer command to clear clinical result memory:
`W|M|<CR>`
Computer command to read number of clinical results available:
`R|M|<CR>`
Meter's response is to send (0 results):
`D|0|<CR><LF>`

Computer command to set date (12 June 2003 in days since December 31, 1979):
`W|D|8564|<CR>`
Computer command to read date:
`R|D|<CR>`
Meter's response is to send (days since December 31, 1979):
`D|8564|<CR><LF>`

Computer command to set time of day (9:45 AM, minutes since midnight):
`W|T|585|<CR>`
Computer command to read time of day, after at least a 2 second delay:
`R|T|<CR>`
Meter's response is to send (minutes since midnight):
`D|585|<CR><LF>`

Table 20: DEX® Meter Remote Command Examples

Computer command to set average 1 preset time (6:00 AM, minutes since midnight):
`W|a|360|<CR>`
Computer command to read average 1 preset time:
`R|a|<CR>`
Meter's response is to send (minutes since midnight):
`D|360|<CR><LF>`

Computer command to set average 2 preset time (noon, minutes since midnight):
`W|b|720|<CR>`
Computer command to read average 2 preset time:
`R|b|<CR>`
Meter's response is to send (minutes since midnight):
`D|720|<CR><LF>`

Computer command to set average 3 preset time (6:00 PM, minutes since midnight):
`W|c|1080|<CR>`
Computer command to read average 3 preset time:
`R|c|<CR>`
Meter's response is to send (minutes since midnight):
`D|1080|<CR><LF>`

Computer command to set average 4 preset time (9:00 PM, minutes since midnight):
`W|d|1260|<CR>`
Computer command to read average 4 preset time:
`R|d|<CR>`
Meter's response is to send (minutes since midnight):
`D|1260|<CR><LF>`

6.2.3.9 ELITE™ XL Meter Remote Command Examples

The examples below demonstrate various Remote Commands for the DEX® meter. The examples include the commands from the computer and the responses from the meter. In these examples the handshaking (meter <ACK> responses) is not shown. See Section 6.4 for examples including all handshaking (meter <ACK> responses, computer waits).

Table 21: ELITE™ XL Meter Remote Command Examples

Computer command to set ELITE® XL meter configuration (buzzer on, 24 hr, mmol/L, day.month format, capillary calibration, value is 00100111 binary or 0x27 hex):
`W|C|27|<CR>`
Computer command to read meter configuration:
`R|C|<CR>`
Meter's response is to send:
`D|27|<CR><LF>`

Computer command to clear clinical result memory:
`W|M|<CR>`
Computer command to read number of clinical results available:
`R|M|<CR>`
Meter's response is to send (0 results):
`D|000|<CR><LF>`

Computer command to set date (May 28, 2003):
`W|D|030528|<CR>`
Computer command to read date:
`R|D|<CR>`
Meter's response is to send (YYMMDD):
`D|030528|<CR><LF>`

Computer command to set time of day (9:45 PM, hhmm in 24 hr. clock format):
`W|T|2145|<CR>`
Computer command to read time of day:
`R|T|<CR>`
Meter's response is to send (hhmm, 24 hr. clock format):
`D|2145|<CR><LF>`

6.3 DEX® Meter Smart Modem Dialing

Note: The modem-dialing feature is only available for DEX® meters with software version 1.27 or later.

When connected to a compatible modem, the DEX® meter supports establishing a connection to a remote computer over the public telephone lines. The remote computer must be connected to a modem that automatically answers the call from the patient's modem. In addition, the remote computer must be running a program that understands the meter communication protocol.

Commands sent to the modem by the DEX® meter are listed in "Table 22: Modem Commands". This command set is supported by modems manufactured by 3Com™ (US Robotics™). In order to be compatible with the meter, the modem connected to the meter must support the commands listed in Table 22.

Table 22: Modem Commands

Modem Command	Meaning
AT	Attention – precedes all other commands, sets the modem's serial interface baud rate
DS0	dial telephone number stored in NVRAM at position 0
E0	local echo off - don't echo commands
H	hang up (go on hook)
V0	numeric response codes
X0	simplest result code option
&A0	disable error control response codes
+++	escape code to return the modem to the command state (must be preceded and followed by one second of silence)

When operating in *Features Mode*, the DEX® meter attempts to detect a compatible modem. If the modem is detected within 2 seconds, the meter commands the modem to dial the healthcare provider's telephone number stored in the modem's non-volatile memory (NVRAM). Once the modem-to-modem communication link is established, the meter communicates with the remote computer with the protocol described in Section 6.1. If the modem is not detected within 2 seconds, the meter attempts to communicate with a directly connected computer.

The modem must have serial asynchronous data characteristics of 9600 baud, eight data bits, one stop bit, and no parity. The modem must be able to store a telephone number in NVRAM and dial that number with the commands described in the following paragraphs. The modem must be pre-configured by the data management software (e.g.

WinGlucofacts™ Professional) to store the healthcare provider's phone number in NVRAM at location 0 (zero).

After sending X0 and &A0 to set simple result code options and disable error control response codes, possible responses of the modem are listed in "Table 23: Modem Responses".

Table 23: Modem Responses

Numeric Response	Equivalent Verbose Response	Comment
0	OK	Normal response when accepting a command. Doesn't occur after the dial command
1	CONNECT	after the modems synchronize together
2	RING	Not used
3	NO CARRIER	if modems can not connect after dialing out
4	ERROR	Not used

The data management software (e.g. WinGlucofacts™ Professional) is expected to set the modem for the following commands and store them in NVRAM.

E0 – echo off.
'P' or 'T' – prefix for dialing ('P' for pulse and 'T' for tone).
Data rate locked at DTE speed.
Health care provider's telephone number stored in position 0.

When the DEX® meter is turned on in *Features Mode*, it sends the string "ATE0V0X0&A0<CR>" to the modem. The meter then waits for a response of "0<CR>" from the modem. While waiting for this response there is a two second timer running, so if this response does not occur within two seconds, the meter will assume a direct connection (i.e. no modem is present).

If a modem response of "0<CR>" is received, then the dialing string of "ATDS0<CR>" is sent. Then, if the single character "1" immediately preceding a <CR> is received within 45 seconds, the meter will assume a modem-to-modem connection has been established. Otherwise the meter displays a "Modem Can't Connect" error message code ("E-55").

Once a modem-to-modem connection is established, the normal ASTM protocol transfers the DEX® meter data. If data transfer fails during the transfer, the meter will hang up the phone (which takes at least two seconds), display a "Modem Data Transfer Failure" error message code ("E-56") for a maximum of three minutes and shut down. If the meter data is successfully transferred, the meter will hang up the phone (which takes at least two seconds) then shut down (nothing is displayed on the LCD, it is blank).

To set the modem back to the command state, the meter does not transmit anything for one second, transmits three plus characters ("+++"), and then does not transmit anything for one second. Once the modem is in the command state, then the meter transmits "ATH<CR>", which hangs up the phone. (Note: During this time the meter will not respond to user input.)

6.4 Example Communication Sequences

The following sections provide an example *Data Transfer Mode* message (meter to computer only) and an example *Remote Command Mode* command sequence (computer to meter only) for each of the meter families. For clarity, the message framing and acknowledgments are not included in these examples. See "Section 6.4.5 BREEZE® Meter Communication Example with Framing" for an example with framing and acknowledgements.

6.4.1 BREEZE® Meter Send Results and Receive Configuration

To report the 14 day average, six clinical results, and three control solution readings, the ASTM E-1394 records transmitted by the BREEZE® meter are:

```
H|\^&||31620|Bayer6115^1.08\0.01^6115-000740||||||P|1|200208311945<CR>
P|1<CR>
O|1<CR>
R|1|^^^GlucoseA|224|mg/dL^B||<CR>
R|2|^^^Glucose|19|mg/dL^B||<|||||200208311007<CR>
R|3|^^^Glucose|20|mg/dL^B||||E\D|||200208311008<CR>
R|4|^^^Glucose|488|mg/dL^B|||||||200208311009<CR>
O|2|||||||||Q<CR>
R|5|^^^Glucose|47|mg/dL^B||||E|||200208311010<CR>
O|3<CR>
R|6|^^^Glucose|322|mg/dL^B||||E\D|||200208311011<CR>
R|7|^^^Glucose|600|mg/dL^B|||||||200208311012<CR>
O|4|||||||||Q<CR>
R|8|^^^Glucose|113|mg/dL^B||||E|||200208311013<CR>
R|9|^^^Glucose|107|mg/dL^B||||E|||200208311014<CR>
O|5<CR>
R|10|^^^Glucose|601|mg/dL^B||>|||||200208311015<CR>
L|1|N<CR>
```

The computer sets the BREEZE® meter configuration, clears the clinical result memory, sets the date to December 31, 2032, and the time to 9:45 PM. The computer then verifies the changed settings. The remote commands and command responses are as follows:

Computer to Meter	Meter to Computer
W|C|09|77<CR>	
W|M|9C<CR>	
W|D|321231|3B<CR>	
W|T|2145|EB<CR>	
R|C|8D<CR>	
	D|09|A5<CR><LF>
R|M|97<CR>	
	D|000|CC<CR><LF>
R|D|8E<CR>	
	D|321231|68<CR><LF>
R|T|9E<CR>	
	D|2145|08<CR><LF>

6.4.2 CONTOUR™ Meter Send Results and Receive Configuration

To report the 14 day average, six clinical results (note that two readings are user marked as Control and not included in the average calculation), and three control solution readings, the ASTM E-1394 records transmitted by the CONTOUR ™ meter are:

```
H|\^&||31616|Bayer7150^1.05\1.01^7150-000740||||||P|1|200206041945<CR>
P|1<CR>
O|1<CR>
R|1|^^^GlucoseA|425|mg/dL^P<CR>
R|2|^^^Glucose|9|mg/dL^P||<|||||200205311007<CR>
R|3|^^^Glucose|20|mg/dL^P||||E\D|||200205311008<CR>
R|4|^^^Glucose|488|mg/dL^P|||||||200205311009<CR>
O|2||||||||||Q<CR>
R|5|^^^Glucose|47|mg/dL^P||||E|||200205311010<CR>
O|3<CR>
R|6|^^^Glucose|322|mg/dL^P||||E\D|||200205311011<CR>
R|7|^^^Glucose|600|mg/dL^P|||||||200205311012<CR>
O|4||||||||||Q<CR>
R|8|^^^Glucose|113|mg/dL^P||||E|||200205311013<CR>
R|9|^^^Glucose|107|mg/dL^P||||E|||200205311014<CR>
O|5<CR>
R|10|^^^Glucose|601|mg/dL^P||>|||||200205311015<CR>
L|1|N<CR>
```

The computer sets the meter configuration, clears the clinical result memory, sets the date to May 28, 2003, and the time to 9:45 PM. The computer then verifies the changed settings. The remote commands sent by the computer are:

Computer to Meter	Meter to Computer
W|C|27|<CR>	
W|M|<CR>	
W|D|030528|<CR>	
W|T|2145|<CR>	
R|C|<CR>	
	D|27|<CR><LF>
R|M|<CR>	
	D|000|<CR><LF>
R|D|<CR>	
	D|030528|<CR><LF>
R|T|<CR>	
	D|2145|<CR><LF>

6.4.3 DEX® Meter Send Results and Receive Configuration

To report six clinical results, five averages (there are not enough clinical results in this example to obtain meaningful averages 1 through 4), and three control solution readings, the ASTM E-1394 records transmitted by the DEX® meter are:

```
H|\^&||31620|Bayer3950^1.23\1.01^3950-000740||||||P|1|199908311945<CR>
P|1<CR>
O|1<CR>
R|1|^^^GlucoseA|224|mg/dL^P|CR>
R|2|^^^GlucoseA1|0|mg/dL^P|360|<<CR>
R|3|^^^GlucoseA2|0|mg/dL^P|720|<<CR>
R|4|^^^GlucoseA3|0|mg/dL^P|1080|<<CR>
R|5|^^^GlucoseA4|0|mg/dL^P|1260|<<CR>
R|6|^^^Glucose|9|mg/dL^P||<|||||199908311007<CR>
R|7|^^^Glucose|10|mg/dL^P||||E\D|||199908311008<CR>
R|8|^^^Glucose|488|mg/dL^P|||||||199908311009<CR>
O|2|||||||||Q<CR>
R|9|^^^Glucose|47|mg/dL^P||||E|||199908311010<CR>
O|3<CR>
R|10|^^^Glucose|322|mg/dL^P||||E\D|||199908311011<CR>
R|11|^^^Glucose|600|mg/dL^P|||||||199908311012<CR>
O|4|||||||||Q<CR>
R|12|^^^Glucose|113|mg/dL^P||||E|||199908311013<CR>
R|13|^^^Glucose|107|mg/dL^P||||E|||199908311014<CR>
O|5<CR>
R|14|^^^Glucose|601|mg/dL^P||>|||||199908311015<CR>
L|1|N<CR>
```

The computer sets the DEX® meter configuration, clears the clinical result memory, sets the date to 12 June 2003, the time to 9:45 AM, and the average 2 preset time to noon. The computer then verifies the changed settings. The remote commands sent by the computer are:

Computer to Meter	Meter to Computer
W|C|15|<CR>	
W|M|<CR>	
W|D|8564|<CR>	
W|T|585|<CR>	
W|b|720|<CR>	
R|C|<CR>	
	D|15|<CR><LF>
R|M|<CR>	
	D|0|<CR><LF>
R|D|<CR>	
	D|8564|<CR><LF>
R|T|<CR>	
	D|585|<CR><LF>
R|b|<CR>	
	D|720|<CR><LF>

6.4.4 ELITE™ XL Meter Send Results and Receive Configuration

To report six clinical results, the 14 day average, and three control solution readings, the ASTM E-1394 records transmitted by the ELITE® XL meter are:

```
H|\^&||31620|Bayer3883^1.05\1.01^3883-000740||||||P|1|199908311945<CR>
P|1<CR>
O|1<CR>
R|1|^^^GlucoseA|224|mg/dL^C||<CR>
R|2|^^^Glucose|19|mg/dL^C||<|||||199908311007<CR>
R|3|^^^Glucose|20|mg/dL^C||||E\D|||199908311008<CR>
R|4|^^^Glucose|488|mg/dL^C|||||||199908311009<CR>
O|2||||||||||Q<CR>
R|5|^^^Glucose|47|mg/dL^C||||E|||199908311010<CR>
O|3<CR>
R|6|^^^Glucose|322|mg/dL^C||||E\D|||199908311011<CR>
R|7|^^^Glucose|600|mg/dL^C|||||||199908311012<CR>
O|4||||||||||Q<CR>
R|8|^^^Glucose|113|mg/dL^C||||E|||199908311013<CR>
R|9|^^^Glucose|107|mg/dL^C||||E|||199908311014<CR>
O|5<CR>
R|10|^^^Glucose|601|mg/dL^C||>|||||199908311015<CR>
L|1|N<CR>
```

The computer sets the ELITE® XL meter configuration, clears the clinical result memory, sets the date to March 28, 2004, and the time to 9:45 PM. The computer then verifies the changed settings. The remote commands sent by the computer are:

Computer to Meter	Meter to Computer
W|C|27|<CR>	
W|M|<CR>	
W|D|040328|<CR>	
W|T|2145|<CR>	
R|C|<CR>	
	D|27|<CR><LF>
R|M|<CR>	
	D|000|<CR><LF>
R|D|<CR>	
	D|040328|<CR><LF>
R|T|<CR>	
	D|2145|<CR><LF>

6.4.5 BREEZE® Meter Communication Example with Framing

The following example demonstrates the ASCII characters sent and received by a BREEZE® family meter during a communication session. Note that no transmission errors occurred during the sequence (so no frame retries are needed).

meter sends <ENQ> to start *Data Transfer Mode*
meter waits for <ACK> response from computer
meter sends
<STX>1H|\^&||8974|Bayer6116^1.08\0.01^6117-P996411|||||||P|1|200306111939<CR><ETB>72<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>2P|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>3O|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>4R|1|^^^GlucoseA|0|mg/dL^P||CR><ETB>BD<CR><LF>
meter waits for <ACK> response from computer
[etc., etc. for all readings in meter memory]
meter waits for <ACK> response from computer
meter sends <STX>5L|1|N<CR><ETX>08<CR><LF>
meter waits for <ACK> response from computer
meter sends <EOT> to complete *Data Transfer Mode*
computer sends <ENQ> to start *Remote Command Mode*
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends C|
meter sends response of <ACK>
computer sends 09|
meter sends response of <ACK>
77<CR>
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends M|
meter sends response of <ACK>
computer sends 9C<CR>
meter sends response of <ACK>
[etc., etc.]
computer sends R|

```
    meter sends response of <ACK>
    computer sends C|
    meter sends response of <ACK>
    computer sends 8D<CR>
    meter sends D|09|A5<CR><LF><ACK>
    computer sends R|
    meter sends response of <ACK>
    computer sends M|
    meter sends response of <ACK>
    computer sends 97<CR>
    meter sends D|000|CC<CR><LF><ACK>
     [etc., etc.]
    computer sends <EOT> to complete the session
```

6.4.6 CONTOUR™ Meter Communication Example with Framing

The following example demonstrates the ASCII characters sent and received by a CONTOUR™ family meter during a communication session. Note that no transmission errors occurred during the sequence (so no frame retries are needed).

meter sends <ENQ> to start *Data Transfer Mode*
meter waits for <ACK> response from computer
meter sends
<STX>1H|\^&||-7880|Bayer7150^1.05\0.00^7150-SAM2193||||||P|1|200305121635<CR><ETB>AE<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>2P|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>3O|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>4R|1|^^^GlucoseA|0|mg/dL^P<CR><ETB>89<CR><LF>
meter waits for <ACK> response from computer
[etc., etc. for all readings in meter memory]
meter waits for <ACK> response from computer
meter sends <STX>5L|1|N<CR><ETX>08<CR><LF>
meter waits for <ACK> response from computer
meter sends <EOT> to complete *Data Transfer Mode*
computer sends <ENQ> to start *Remote Command Mode*
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends C|
meter sends response of <ACK>
computer sends 27|
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends M|
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
[etc., etc.]
computer sends R|
meter sends response of <ACK>
computer sends C|

```
    meter sends D|27|<CR><LF><ACK>
    computer sends R|
    meter sends response of <ACK>
    computer sends M|
    meter sends D|0|<CR><LF><ACK>
     [etc., etc.]
    computer sends <EOT> to complete the session
```

6.4.7 DEX® Meter Communication Example with Framing

The following example demonstrates the ASCII characters sent and received by a DEX® family meter during a communication session. Note that no transmission errors occurred during the sequence (so no frame retries are needed).

meter sends <ENQ> to start *Data Transfer Mode*
meter waits for <ACK> response from computer
meter sends
<STX>1H|\^&||8595|Bayer3950^3.08\1.40^1031CA001259|||||||P|1|200306121101<CR><ETB>62<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>2P|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>3O|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>4R|1|^^^GlucoseA|0|mg/dL^B||<CR><ETB>AF<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>5R|2|^^^GlucoseA1|0|mg/dL^B|360|<<CR><ETB>7B<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>6R|3|^^^GlucoseA2|0|mg/dL^B|720|<<CR><ETB>7E<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>7R|4|^^^GlucoseA3|0|mg/dL^B|1080|<<CR><ETB>B1<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>0R|5|^^^GlucoseA4|0|mg/dL^B|1260|<<CR><ETB>AC<CR><LF>
meter waits for <ACK> response from computer
[etc., etc. for all readings in meter memory]
meter waits for <ACK> response from computer
meter sends <STX>1L|1|N<CR><ETX>04<CR><LF>
meter waits for <ACK> response from computer
meter sends <EOT> to complete *Data Transfer Mode*

computer sends <ENQ> to start *Remote Command Mode*
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends C|
meter sends response of <ACK>
computer sends 15|
meter sends response of <ACK>
computer sends <CR>W|

```
    meter sends response of <ACK>
    computer sends M|
    meter sends response of <ACK>
    computer sends <CR>W|
    meter sends response of <ACK>
    [etc., etc.]
    computer sends <CR>R|
    meter sends response of <ACK>
    computer sends C|
    meter sends D|15|<CR><LF><ACK>
    computer sends <CR>R|
    meter sends response of <ACK>
    computer sends M|
    meter sends D|0|<CR><LF><ACK>
    computer sends <CR>D|
    meter sends response of <ACK>
    [etc., etc.]
    computer sends <CR><EOT> to complete the session
```

6.4.8 ELITE® XL Meter Communication Example with Framing

The following example demonstrates the ASCII characters sent and received by an ELITE® XL family meter during a communication session. Note that no transmission errors occurred during the sequence (so no frame retries are needed).

meter sends <ENQ> to start *Data Transfer Mode*
meter waits for <ACK> response from computer
meter sends
<STX>1H|\^&||-12397|Bayer3883^1.06\1.01^3899-3344530|||||||P|1|200306121735<CR><ETB> B1<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>2P|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>3O|1<CR><ETB>53<CR><LF>
meter waits for <ACK> response from computer
meter sends <STX>4R|1|^^^GlucoseA|0|mg/dL^C<CR><ETB>7C<CR><LF>
meter waits for <ACK> response from computer
[etc., etc. for all readings in meter memory]
meter waits for <ACK> response from computer
meter sends <STX>5L|1|N<CR><ETX>08<CR><LF>
meter waits for <ACK> response from computer
meter sends <EOT> to complete *Data Transfer Mode*
computer sends <ENQ> to start *Remote Command Mode*
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends C|
meter sends response of <ACK>
computer sends 27|
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
computer sends M|
meter sends response of <ACK>
computer sends W|
meter sends response of <ACK>
[etc., etc.]
computer sends R|
meter sends response of <ACK>
computer sends C|

```
    meter sends D|27|<CR><LF><ACK>
    computer sends R|
    meter sends response of <ACK>
    computer sends M|
    meter sends D|0|<CR><LF><ACK>
     [etc., etc.]
    computer sends <EOT> to complete the session
```

6.4.9 DEX® Meter Send Results Including Frames with Attached Modem

This example is similar to the previous DEX® example, except it illustrates communication through a modem. Remote commands are not supported when the meter is communicating through a modem, i.e. the DEX® meter disconnects the telephone line after the test results are uploaded to the computer. Note: the modem-dialing feature is only available for DEX® meters with software version 1.27 or later.

The following example demonstrates the ASCII characters sent and received by the meter during a session where no transmission errors occur (so no frame retries are needed).

meter sends ATE0V0X0&A0<CR> to sense modem

modem replies with 0<CR> within 2 seconds

meter sends ATDS0<CR> to cause the modem to dial the stored telephone number

after the modem to modem connection is established the modem replies with 1<CR> (within 45 seconds), the meter is now communicating with the remote computer

meter sends <ENQ> to start *Data Transfer Mode*

meter waits for <ACK> response from computer

meter sends

<STX>1H|\^&||8595|Bayer3950^1.27\1.01^1031CA001259|||||||P|1|199908311945<CR><ETB>62<CR><LF>

meter waits for <ACK> response from computer

meter sends <STX>2P|1<CR><ETB>53<CR><LF>

meter waits for <ACK> response from computer

meter sends <STX>3O|1<CR><ETB>53<CR><LF>

meter waits for <ACK> response from computer

meter sends <STX>4R|1|^^^GlucoseA|0mg/dL^P||<<CR><ETB>BD<CR><LF>

meter waits for <ACK> response from computer

meter sends <STX>5R|2|^^^GlucoseA1|0|mg/dL^P|0|<<CR><ETB>89<CR><LF>

meter waits for <ACK> response from computer

[etc., etc.]

meter waits for <ACK> response from computer

meter sends <STX>3L|1|N<CR><ETX>06<CR><LF>

meter waits for <ACK> response from computer

meter sends <EOT> to complete *Data Transfer Mode*

meter delays one second then sends +++

meter delays one second then sends ATH<CR> to cause the modem to hang-up the telephone connection, then the meter turns itself off

7.0 Data Communication Hints

The following are useful hints for communicating with any Bayer Corporation blood glucose meter.

7.1 Determine Presence of Meter

To determine if a meter is prepared to communicate with the computer, the program could just wait up to 16 seconds while listening for an <ENQ> character from the meter. To speed up this process, the computer can send any character except an <ACK> or <NAK> to the meter, e.g. the character "X". In response, the meter will send an <ENQ> character within 2 seconds, possibly preceded by an <EOT> character.

The following conditions will cause the computer to fail to receive a response from the meter:

1. the interface cable is disconnected or severed,
2. an incorrect computer communication port is selected,
3. the meter is in a mode where data communications is not possible,
4. the meter has automatically shut off as a battery savings measure,
5. the computer has not turned on the DTR interface line

7.2 Determine Which Meter is Connected

The Header Record contains the meter product code, meter software version, and meter serial number. Follow these steps if you do not want to read all the blood glucose readings from the meter, but wish to only determine the meter identity.

1. Send "X" to the meter.
2. Meter responds with an <ENQ> within 2 seconds, possibly preceded by an <EOT>.
3. Send an <ACK> to start data transfer from the meter.
4. Meter responds with the Header Record that contains the desired information in the Sender ID field.
5. Send an <ACK> to acknowledge the frame containing the Header Record.
6. Meter responds with the Patient Information Record.
7. Send a <NAK> to reject the frame containing the Patient Information Record.
8. Repeat steps 6 and 7 until the meter has sent the Patient Information Record 6 times. See Section 6.1.3.3 on defective frames.
9. Meter sends an <EOT> to indicate it is aborting the transfer phase.

7.3 Configure Meter without Receiving Test Results

It is possible to bypass the data transfer and enter Remote Command mode in order to configure the meter without receiving the results in meter memory. However, because the meter families have different remote command data formats, the meter type must be known prior to writing the meter configuration. Therefore, use this method only if the meter type is known.

If the meter type is known, follow these steps to read or change the meter configuration without first transferring results from the meter.

1. Send "X" to the meter.
2. Meter responds with an <ENQ> within 2 seconds, possibly preceded by an <EOT>.
3. Send a <NAK> to reject data transfer from the meter.
4. Meter responds with an <EOT> to indicate it is exiting the transfer phase.
5. Send an <ENQ> to the meter to initiate sending remote commands.
6. Meter responds with an <ACK> to indicate it is ready to receive remote commands.
7. Send remote commands as described in Section 6.2.3.
8. Send an <EOT> to the meter to indicate remote commands are complete.