OPTI™ R

Blood Gas Analyzer

Interface Specifications

OPTIMedical

INTERFACE SPECIFIATIONS REVISION LOG

(Please record any changes made to this manual)

Revision Number	Release Date	Approved By	Description
A	April 2007		Initial release per CO 070166
B	05 Feb 09		Updated per CO 090030
C	13JUL10		Updated per PCR100206 • Changed baud rate to 57600. • Updated establishment phase in section 3.2.2.1.

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PD7061 REV C

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1 Preface

This Interface Specification applies to OPTI Medical OPTI R. This document, along with your OPTI Medical OPTI R Operator's Manual will help guide you through interfacing the OPTI Medical OPTI R to your laboratory data manager or LIS/HIS system.

Your OPTI Medical R has an RS232 serial port and a 10baseT Ethernet port as alternative digital communications interfaces. Communication through these ports is configurable (depending on port) for ASCII, ASTM, and Mobile-ASTM protocols. Consult your OPTI Medical OPTI R Operator’s Manual, Section 3.3.2.8, for details on configuring your analyzer to suit your particular laboratory's needs.

- ASCII Format - Data in easy to read OPTI Medical custom format. The OPTI Medical OPTI R exports a data string identical to the internal printer output.
- ASTM Format - Complies with ASTM standard 1394-97 with handshaking and data formatting. ASTM format is recommended for use with stationary RS232 operation, where the OPTI Medical OPTI R is always in communication with the host system.

2 Overview of Interface Hardware for Instrument to Computer Communications

2.1 RS-232 Serial Port

The OPTI R includes a standard 9-pin female RS-232 serial port for direct-to-computer communications.

2.1.1 RS-232 Communication Port Hardware Settings

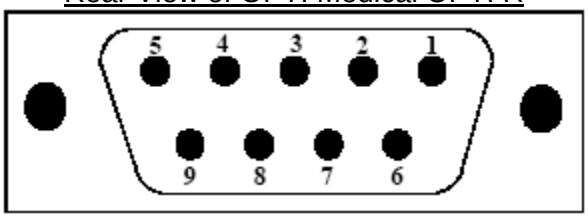
Table 1

Setting	Default
Start bit	1
Data bit	8
Parity	None
Stop bit	1
Baud Rate	57600

2.1.2 RS-232 Pinouts

The following pin connection configurations should be utilized for PC to LIS/HIS connections:

Rear View of OPTI Medical OPTI R



Pin Number	Designation	Host
Pin 1	No Connection	
Pin 2	RxD	Transmit
Pin 3	TxD	Receive
Pin 4	DTR	
Pin 5	GND	Signal Ground
Pin 6	DSR	
Pin 7	No Connection	
Pin 8	CTS	
Pin 9	No Connection	

2.1.3 Establishing Connections

The RS-232 interface is of an “always-on” nature. So long as the instrument is on, a connection with the host computer is presumed present.

2.1.4 Standards

Further details of this interface are available in ASTM standard E1381-02.

2.2 Ethernet Port

The OPTI R includes a standard RJ45 10baseT Ethernet port for networked computer communications.

2.2.1 Establishing Connections

The instrument’s MAC address, IP address, IP port, and target computer’s IP address & port are software configurable. Consult the instrument’s user manual for more details on how these configuration settings are implemented.

Shortly after powerup, the instrument will persistently attempt to establish a socket connection with the target computer’s IP address and port as configured.

2.2.2 Standards

Further details of this interface are available in ASTM standard E1381-02.

3 Overview of Communications Protocols for Instrument to Computer Communications

3.1 ASCII Protocol

The ASCII protocol is a straightforward duplication of the content produced via the instrument's printer.

3.2 ASTM 1394 Protocol

3.2.1 Control Characters

Control characters that are used for ASTM communications:

Table 2

ASCII	Decimal	Hex	Control Character	Comment
STX	2	0x2	^B	**S**tart of Te**X**t
ETX	3	0x3	^C	**E**nd of **T**e**X**t
EOT	4	0x4	^D	**E**nd **O**f **T**ransmission
ENQ	5	0x5	^E	**ENQ**uiry
ACK	6	0x6	^F	**ACK**nowledge
LF	10	0xA	^J	**L**ine **F**eed
CR	13	0xD	^M	**C**arriage **R**eturn
NAK	21	0x15	^U	**N**egative **A**c**K**nowledge
ETB	23	0x17	^W	**E**nd of **T**rans. **B**lock

3.2.2 Communication Phases

There are three (3) distinct phases to each communication session. They are the Establishment phase, the Transfer phase, and the Termination phase. Each of these phases will be discussed in the following paragraphs.

3.2.2.1 Establishment Phase

When the OPTI Medical OPTI R is ready to send data, it transmits an ENQ character. After the ENQ is sent, instrument waits for 15 seconds for a response from the host. If there is no response from the host within 15 seconds, the instrument terminates the establishment phase and sends EOT.

Host < ACK or NAK. If an ACK character is received from the host, the Establishment phase is successful, and the OPTI R will go immediately to the transfer phase. If a NAK character is received from the host, the instrument waits 10 seconds and then resends the ENQ to establish communications and repeat this loop until an ACK is received.

This ends the establishment phase of the communication session.

3.2.2.2 Transfer Phase

The transfer phase is when the sender transmits the message to the receiver. The transfer continues until all messages have been sent.

Sender>

STX	FN	Data	ETB or ETX	CR	LF

Receiver<

ACK

3.2.2.3 Explanation of fields

STX

Start of text: ASCII decimal 2. This control character identifies the starting point of the data that is being sent from the analyzer. This character must accompany all data transmissions.

FN

Frame number: A single digit field that distinguishes between new and re-transmitted frames. Legal characters are ASCII `0' to `7'. The frame number ***must start at 1*** with the first frame of the transfer phase. The frame number is incremented by one for every new frame transmitted. After `7', the frame number rolls over to `0', and continues in this fashion.

Data

Data is the instrument information, demographic information, and actual results (measured or calculated) from the instrument. The length of the fields should accommodate the result name, actual result, result unit, and any instrument-generated alarms for that result.

ETB
or
ETX

The ETB character is End of Transmission Block and is only sent when there are multiple frames. When a message contains over 240 characters it must be broken into two or more frames. Each frame other than the final must be terminated with an ETB (end of transmission block), CS (checksum), CR (carriage return) and LF (line feed). The final frame is terminated with an ETX (end of text), CS (checksum), CR (carriage return) and LF (line feed). The structure is below:

STX FN data ETB CS CR LF Ü Intermediate frame(s)

STX FN data ETX CS CR LF Ü End frame

3.2.2.4 Termination Phase

The termination phase returns the communication link to the clear or neutral state. The sender notifies the receiver that all messages have been sent.

Sender	**Receiver**
EOT	**No response**

The termination phase is a sequence of conditions that will cause communication between the devices to cease. The termination phase is entered when the sender has no more data to transmit. Termination is accomplished by transmitting an EOT. When the EOT is sent, no acknowledgment is needed, do not expect an ACK. The receiver, upon receiving EOT, considers the communication to have ended and sends no further data or acknowledgments.

3.2.2.5 Special Characters & Fields

Each phase of communication also contains special characters and fields, as described below:

3.2.2.5.1 Checksums

The CS (checksum) is used for checking data integrity. The checksum is computed by adding the binary values of the characters in the message, keeping the least significant 8 bits of the result. The checksum is initialized to zero with the STX character. The first character used in computing the checksum is the frame number. Each character in the message text is added to the checksum (modulo 256). The calculation of the checksum does not include the STX, the checksum characters, or the trailing CR and LF (the ETX/ETB is included in the calculation).

The checksum is converted to two ASCII characters of the hexadecimal representation.

The two characters are transmitted as the checksum, with the most significant character first (C1). For example, a checksum of 122 can be represented as 0x7A (0x stands for hexadecimal). The checksum is transmitted as the ASCII character `7' followed by the character `A'.

The CR (carriage return) and LF (line feed) combination is used as the end termination characters of the message text.

3.2.2.5.2 Acknowledgments

After each frame is sent, the sender must wait up to 15 seconds for a reply. The receiver shall transmit one of three replies:

ACK (Decimal 06)

The ACK reply signifies the last frame was successful and it is OK to send another frame.

The sender increments the frame number and sends a new frame or terminates the transmission (see termination phase).

NAK (Decimal 21)

The NAK reply signifies the last frame was not received successfully and the receiver is prepared to receive the frame again. The sender will re-transmit the last frame with the same frame number.

EOT (Decimal 04)

The EOT reply signifies the last frame was received successfully and the receiver is prepared to receive another frame, but is requesting the sender stop transmitting data. See interrupts below.

3.2.2.5.3 Interrupts

During the transfer phase, if the receiver responds to a frame with an EOT in place of an ACK, the sender must interpret this as an interrupt request. The EOT signifies the last frame was successful, but the receiver is requesting the sender stop transmitting. If the sender chooses to ignore the EOT, the receiver must re-send the EOT for the interrupt to remain valid. If the sender chooses to honor the interrupt, the sender must enter the termination phase (See termination phase below). The sender must not enter the establishment phase for at least 15 seconds or until the receiver has finished a message cycle (establishment, transfer, termination).

3.2.3 Error Recovery

The receiver checks every frame for valid data. To check data, the receiver calculates the checksum on the received data and compares this calculated checksum to the checksum that was transmitted by the sender and sent with the data stream. If the checksums match, the data is valid; if the checksums do not match the data is not valid and the receiver must send a NAK. Upon receiving the NAK, the sender re-transmits the last frame with the same frame number.

A frame should be rejected for the following errors:

- Any character errors are detected (parity error, framing error, etc.)
- The calculated frame checksum does not match the checksum in the received frame.
- The frame number is not the same as the last accepted frame or one higher.

Upon receiving a NAK, or any character except ACK or EOT, the sender increments a retransmit counter and retransmits the same frame (with the same frame number). If the counter shows the frame was not accepted after six times the sender must abort the message and proceed immediately to the termination phase.

3.2.4 Time-outs

If the reply after sending an ENQ is not received within 15 seconds, the sender enters the termination phase.

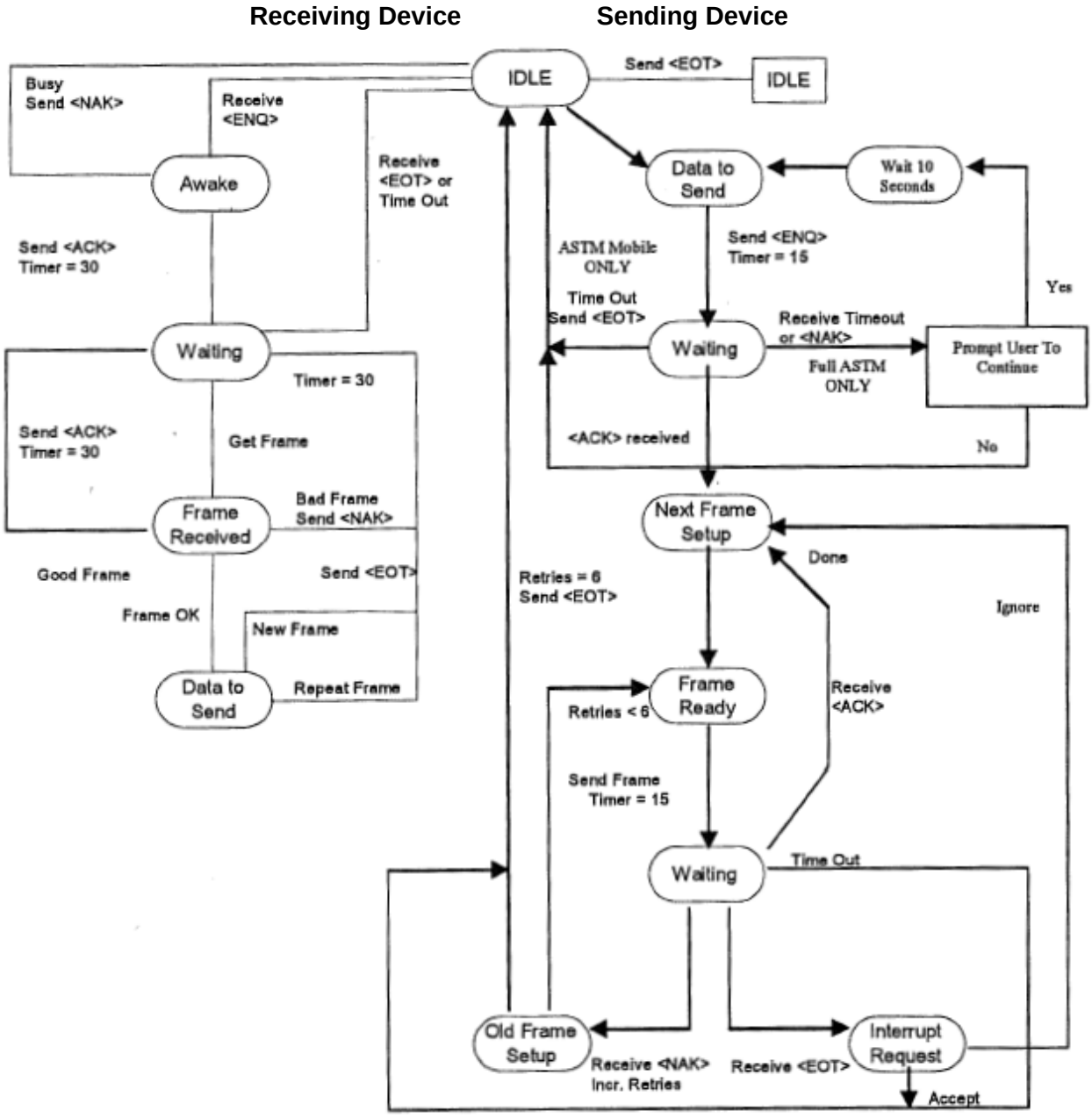
If the receiver detects contention and no ENQ is received within 20 seconds, the receiver regards the data link to be in the neutral state.

If the sender receives no reply within 15 seconds after transmitting the last character of a frame, it aborts the message by entering the termination phase.

During the transfer phase, the receiver sets a timer when first entering the transfer phase or when replying to a frame. If a frame or an EOT is not received within 30 seconds, the receiver discards the incomplete message and regards the line to be in the neutral state.

The receiver can delay its reply for up to 15 seconds. Longer delays cause the sender to abort the message.

3.2.5 State Diagram



3.2.5.1 Restricted Characters

None of the ten transmission control characters, the line feed control, or the four device control characters may appear in message text. The following characters are not permitted to appear in the message text:

Table 3

Illegal Message Text Characters

SOH	STX	ETX	EOT	ENQ
LF	ACK	DLE	NAK	SYN
ETB	DC1	DC2	DC3	DC4

3.2.5.2 Message Structure

A *message* is a group of records that begins with a Header record and ends with a Terminator record, with one or more other types of records between the Header and Terminator. Each record has a number of fields, separated by the vertical bar | character. Below is a description of the records and the fields within each record.

Table 4

ID	Record Types	ID	Record Types
H	HeaderRecord	Q	Request Record Record N/A
P	PatientRecord	S	Scientific Record Record N/A
O	Test Order Record	M	Manufacturer Record N/A
R	Result Record	L	Message Terminator
C	Comment Record		

Note: Record type ID is not case sensitive, however it is suggested to always use upper case.

3.2.5.2.1 Delimiters

Delimiters are ASCII characters used to separate fields within a record and to separate sub-components within fields. Below is a description of the delimiters and how they should be used:

Table 5

Character	Name	Used As:
|	Vertical bar	Field delimiter
\	Backslash	Repeat delimiter
^	Caret	Component delimiter
&	Ampersand	Escape delimiter
CR	Carriage return	Record delimiter

Field delimiter

Separates adjacent fields | field |

Repeat delimiter

Must be defined in the message header and is used to separate various numbers of descriptors for the same field. For example, a patient has two phone numbers. |555-5555\444-4444|

Component delimiter

Used to separate data elements within a field that has a hierarchical or qualifier nature. For example, the components of an address field would be separated. |street^city^state^zip|

Escape delimiter

The escape delimiter is used to identify special case operations within a text field. For example, if text were supposed to be highlighted, the field would be |&H&DoctorsName&N&| the &H& signifies begin highlighting text and the &N& signifies start normal text.

The application of the escape delimiter is optional and may be ignored, however all applications must accept the escape delimiter and use it to correctly parse fields within the record.

3.2.5.3 Null values

All fields are position dependent and are obtained by counting field delimiters by their position starting from the front of the record. This means if a field is null (no information available) the field delimiters must be included in the record. This ensures each field can be identified by counting *n+1* delimiters. Trailing null fields do **NOT** need to be included. Delimiters are not needed after the last field containing data.

Null values may be sent for the following reasons:

- The value is not known
- The sender knows the field is irrelevant to the receiving system.
- The value has not changed since the last transmission

A field containing only a pair of double quotes "" should be treated by the receiving system as an instruction to delete any existing contents of that field.

Note: The receiving system may ignore any field it does not require. However, fields must always be transmitted in the positional order specified.

3.2.5.4 Header Record

This record must always be the first record in a message transmission. This record contains information about the sender and receiver, instruments, and computer system whose records are being exchanged. It also identifies the delimiter characters. The minimum information that must be sent in a Header record is: 1H|\^&<cr>4

- The 1 corresponds to the Frame Number.
- The H corresponds to the record type, H=Header.
- The `|' (vertical bar) is used as a field delimiter. The `\' (backslash) is a repeat delimiter. The `^' (caret) is a field component delimiter. The `&' (ampersand) is an Escape delimiter. The <cr> is identified as a Carriage Return (ASCII decimal 13). The Carriage Return signifies the end of the record.

The entire header record consists of the following fields:

1|2|3|4|5|6|7|8|9|10|11|12|13|14<cr>

Examples:

```
P|\^&|||OPTI Medical OPTI R^1.01.0001^4850|||||| Meas|P|2.2|↵
20050108132841<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `H' for header records.
2	Delimiter definitions	Required, see table 5, and in the format shown in above example the first character is the field delimiter, the second is the repeat delimiter, the third is the component, and the fourth is the escape character.
3	Message Control ID	Not used by OPTI. Used in network systems that have defined acknowledgement protocols.
4	Access Password	Not used by OPTI. This is a level security/access password as mutually agreed upon by sender and receiver.
5	Sender Name or ID	Name of manufacturer/instrument,<version string> and <serial number>. E.g. OPTI Medical OPTI R^1.01.0001^4850
6	Sender Street Address	Not used by OPTI. Text containing street address of sender.
7	Reserved Field	Not used by OPTI. Reserved for future use, not currently specified.
8	Sender Telephone #	Not used by OPTI. Identifies telephone number for voice communication with the sender.

9	Characteristic of Sender	Not used by OPTI. Parity, checksums, other protocol information necessary for establishing a communication link with the sender.
10	Receiver ID	Not used by OPTI. Text value of name or other ID of the receiver. Used to verify data being transmitted is indeed for the receiver.
11	Comment or Special Instructions	User-defined comment. The name of the report is sent here.
12	Processing ID	Indicates how message should be processed: The OPTI R always sends a "P". P-Production, use standard processing.
13	ASTM Version #	Required, currently version 2.2
14	Date and Time of message	Always sends the current date and time as it is set in the OPTI R. Format=YYYYMMDDHHMMSS
<cr>	Carriage return	Required, Record Terminator

3.2.5.5 Patient Information Record

This record contains information about an individual patient. The Patient Information record consists of the following fields:

1|2|3|4|5|6|7| 8|9|10|11|12|13|14| 15|16|17↵

|18|19|20|21|22|23 |24|25|26|27|28|29| 30|31↵

|32|33|33|34|35<cr>

Example:

```
P|1||321225432||||| M|||||||||||||||||||||||| <cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required, Always `P' for patient records.
2	Sequence#	Required, Always `1'. The OPTI R only sends one patient sample at a time.
3	Practice assigned Patient ID	Not used by OPTI. A unique ID assigned and used by the practice to identify the patient and his/her results. Used by practice to identify the results returned by the tester (lab).
4	Patient ID	Laboratory assigned ID. This is a unique processing number generated by the lab, the LIS, or the HIS (bar code number).
5	Patient ID No. 3	Not used by OPTI.
6	Patient Name	Not used by OPTI.
7	Mother's Maiden Name	Not used by OPTI.
8	Birth date	OPTI R only: “YYYY-MM-DD”
9	Patient Sex	Format M (male), F (female), or U (unknown) or if not entered.

10	Patient Race	Not used by OPTI.
11	Patient Address	Not used by OPTI.
12	Reserved	Not used by OPTI.
13	Patient Telephone #	Not used by OPTI.
14	Attending Physician	Not used by OPTI.
15	Special field 1	Not used by OPTI.
16	Special field 2	Not used by OPTI.
17	Patient Height	Not used by OPTI.
18	Patient Weight	Not used by OPTI.
19	Known or suspected diagnosis	Not used by OPTI.
20	Patient active medications	Not used by OPTI.
21	Patient diet	Not used by OPTI.
22	Practice field 1	Not used by OPTI.
23	Practice field 2	Not used by OPTI.
24	Admission and discharge dates, separated by a ^	Not used by OPTI.
25	Admission status	Not used by OPTI. OP-outpatient, PA-pre-admit, IP-inpatient, ER-emergency room
26	Location	Not used by OPTI.
27	DRG or AVG	Not used by OPTI.
28	DRG or AVG #2	Not used by OPTI.
29	Patient Religion	Not used by OPTI.
30	Marital Status	Not used by OPTI.
31	Isolation Status	Not used by OPTI.
32	Language	Not used by OPTI.
33	Hospital Service	Not used by OPTI.
34	Hospital Institution	Not used by OPTI.
35	Dosage Category	Not used by OPTI.
<cr>	Carriage return	Required, Record Terminator

3.2.5.6 Test Order Record

The order record defines the particular type of tests run or performed for each specimen and is transmitted back to the host computer system as part of the results.

The Test Order record consists of the following fields:

1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26|27|28|29|30|31<cr>

Example:

```
O|1||MEASUREMENT^456||||||||||Blood^Arterial|||||||20050531132840|||||||<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `O' for order records
2	Sequence#	Required, Always `1'
3	Specimen ID	Accession Number
4	Instrument Specimen ID	A unique identifier assigned by the instrument. For Patient records: MEASUREMENT^<sequence #> For QC records: QC^<Lot#> For Auto QC records: AQC^<packlot#> For Calibration records: CALIBRATION^SYSTEM CAL
5	Universal test ID	Not used by OPTI.
6	Priority	Not used by OPTI.
7	Requested/Order Date and Time	Not used by OPTI.
8	Spec imen collection	Not used by OPTI.
9	Collection end time	Not used by OPTI.
10	Collection volume	Not used by OPTI.
11	Collector ID	Not used by OPTI.
12	Action code	Not used by OPTI.
13	Danger code	Not used by OPTI.
14	Relevant clinical information	Not used by OPTI.
15	Date/Time specimen received	Not used by OPTI.
16	Specimen descriptor	For Patient records: Includes the specimen type and source, separated by a component delimiter. E.g.: Blood^Arterial as selected by the user, the list of possible selections is located in the appendix of this document and is also in the Operator's Manual, Appendix A; Input values; Sample Type. For Liquid QCrecords: Includes the QC type and level, separated by a component delimiter. E.g.: OPTI-check^1 Other^1
17	Ordering Physician	Not used by OPTI.
18	Physician's Telephone #	Not used by OPTI.
19	User field 1	Cassette Lot Number (Patient & LQC);
20	User field 2	Pass/Fail
21	Laboratory Field 1	Not used by OPTI.

22	Laboratory Field 2	Not used by OPTI.
23	Date/time results reported or Last instrument	Sends the date and time as it is set in the OPTI when the completed the results or they were last Modified modified. Format: YYYYMMDDHHMMSS
24	Instrument Charge to Computer System	Not used by OPTI.
25	Instrument Section ID	Not used by OPTI. OP-outpatient, PA-pre-admit, IP-inpatient, ER-emergency room
26	Report Types	Not used by OPTI.
27	Reserved Field	Not used by OPTI.
28	Location or Ward	Not used by OPTI.
29	Nosocomial Infection Flag	Not used by OPTI.
30	Specimen Service	Not used by OPTI.
31	Specimen Institution	Not used by OPTI.
<cr>	Carriage return	Required, Record Terminator

3.2.5.7 Result Record

The Result Record is used to send actual patient results that were performed on an instrument. The Result Record consists of the following fields:

1|2|3|4|5|6|7| 8|9|10|11|12|13|14<cr>

3.2.5.7.1 Result Record Measured Parameters

Example:

```
R|2|^^^PCO2^M^^|24.1|mmHg|30.0 to 50.0|L|||OPID1234567||↵
20050531132803|OPTI Medical OPTI R^1.01.0001^4850<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `R' for result records.
2	Sequence#	Required, sequentially generated number identifying the number of each record.
3	Universal Test ID	^^^Sensor Name^how value was derived, M Measured^. Note: A "t" is inserted after the <Sensor Name> if the result was temperature corrected. E.g.^^^<Sensor Name>t^M^^
4	Data measurement	Results from instrument XX.X XX.X=value (number or value of significant digits depends on analyte and instrument setup as described in the Operator's Manual section 3.3.2.3

5	Units	SI or Conventional Units of measurement. Depends on instrument setup as described in the Operator's Manual section 3.3.2.3
6	Reference Ranges	Current Ranges for the particular analyte as setup in setup; patient info; limits. In the case of an LQC sample the field contains the LQC Pass/Fail ranges as set up in Setup - QC - Control. See Operator's Manual 4.5.1.2
7	Result Abnormal Flags	Dilution information, Errors, etc. Characters identifying these flags are: L Below reference low H Above reference high < Off low scale of instrument > Off high scale of instrument A Abnormal O SRC failed due to noise D SRC failed due to drift ? Inserted if sensor did not endpoint or calibrate correctly * - Inserted in Patient or Auto QC output if parameter failed user limits for Auto QC.
8	Nature of abnormality	Not used by OPTI.
9	Result Status	Not used by OPTI.
10	Date of Change in Instrument Normative Values	Not used by OPTI.
11	Operator Identification	Identifies operator who performed the test (instrument operator).
12	Date/Time Test Started	Not used by OPTI.
13	Date/Time test Completed	Sends the date and time as it is set in the OPTI R when the instrument completed the test. Format: YYYYMMDDHHMMSS
14	Instrument Identification	Name of manufacturer/instrument, <version string> and <serial number>. E.g. OPTI Medical OPTI R^1.01.0001^4850
<cr>	Carriage return	Required, Record Terminator

3.2.5.7.2 Result Record Calculated Parameters

Example:

```
R|1|^^^BE^C^^|3.9|mmol/L|||||654871351|||↵
OPTI Medical OPTI R^1.01.0001^4850<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `R' for result records.
2	Sequence#	Required, sequentially generated number identifying the number of each record.
3	Universal Test ID	Sensor Name^how value was derived, C-Calculated E.g. ^^^<Sensor Name>^C^^
4	Data measurement or value	Results from instrument XX.X XX.X=value
5	Units	SI or Conventional Units of measurement
6	Reference Ranges	Not used by OPTI.
7	Result Abnormal Flags	Not used by OPTI.
8	Nature of abnormality	Not used by OPTI.
9	Result Status	Not used by OPTI.
10	Date of Change in Instrument Normative Values	Not used by OPTI.
11	Operator Identification	Identifies operator who performed the test (instrument operator).
12	12 Date/Time Test Started	Not used by OPTI.
13	Date/Time test Completed	Not used by OPTI.
14	Instrument Identification	Name of manufacturer/instrument, <version string> and <serial number>. E.g. OPTI Medical R R^1.00.0001^4850
<cr>	Carriage return	Required, Record Terminator

3.2.5.7.3 Result Record Baro

Example:

```
R|1|^^^BARO^M^^|731.2|mmHg|||||654871351||20050531132840|↵
OPTI Medical OPTI R^1.01.0001^4850<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `R' for result records.
2	Sequence#	Required, sequentially generated number identifying the number of each record.
3	Universal Test ID	^^^^BARO^how value was derived, M Measured^. E.g. ^^^BARO^M^^
4	Data measurement or value	Results from instrument XX.X XX.X=value
5	Units	SI or Conventional Units of measurement

6	Reference Ranges	Reference ranges of that particular analyte; For more information see the Operator's Manual: 3.3.2.1 Customization - Ranges
7	Result Abnormal Flags	Not used by OPTI.
8	Nature of abnormality	Not used by OPTI.
9	Result Status	Not used by OPTI.
10	Date of Change in Instrument Normative Values	Not used by OPTI.
11	Operator Identification	Identifies operator who performed the test (instrument operator).
12	12 Date/Time Test Started	Not used by OPTI.
13	Date/Time test Completed	Sends the date and time as it is set in the OPTI R when the instrument completed the test. Format: YYYYMMDDHHMMSS.
14	Instrument Identification	Name of manufacturer/instrument, <version string> and <serial number>. E.g. OPTI Medical OPTI R^1.01.0001^4850
<cr>	Carriage return	Required, Record Terminator

3.2.5.7.4 Result Record Input Parameters

Example:

```
R|1|^^^Temp^S^^|37.0|°C|||||654871351||20050531132840|↵
OPTI Medical OPTI R^1.01.0001^4850<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `R' for result records.
2	Sequence#	Required, sequentially generated number identifying the number of each record.
3	Universal Test ID	^^^Input Value Name^how value was derived, S Input^. E.g. ^^^<Input Value Name>^S^^
4	Data measurement or value	Results from instrument XX.X XX.X=value
5	Units	SI or Conventional Units of measurement
6	Reference Ranges	Not used by OPTI
7	Result Abnormal Flags	Not used by OPTI.
8	Nature of abnormality	Not used by OPTI.
9	Result Status	Not used by OPTI.
10	Date of Change in Instrument Normative Values	Not used by OPTI.

11	Operator Identification	Identifies operator who performed the test (instrument operator).
12	Date/Time Test Started	Not used by OPTI.
13	Date/Time test Completed	Sends the date and time as it is set in the OPTI R when the instrument completed the test. Format: YYYYMMDDHHMMSS.
14	Instrument Identification	Name of manufacturer/instrument, <version string> and <serial number>. E.g. OPTI Medical OPTI R^1.01.0001^4850
<cr>	Carriage return	Required, Record Terminator

3.2.5.8 Comment Record

Comment records may be inserted anywhere except after the message terminator record.

Each comment record applies to the first non-comment record preceding it. The comment record consists of the following fields:

1|2|3|4|5<cr>

Example:

```
C|1|I| ph under 7.20 (Ref. Lim)^PCO2 over 50 (Ref.Limit)|G<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `C' for comment records
2	Sequence#	Always `1', the OPTI only sends one comment record at a time.
3	Comment Source	Always `I', I Clinical Instrument
4	Comment Text	Sends applicable text; in this case the Sodium result was over the reference limit of the instrument.
5	Comment Type	Always inserts `G' G Generic/Free Text
<cr>	Carriage return	Required, Record Terminator

3.2.5.9 Calibration Record

Calibration records are only available when the Mini-Cal feature is turned on.

Calibration records are inserted after the test order messages and before the terminator record. The calibration records apply to the test order records preceding them. The calibration record consists of the following fields:

1|2|3|4|5|6|7| 8|9|10|11|12|13<cr>

Example:

```
R|1|^^^pH|7.426||||OK|||20050531132354<cr>
```

Field #	Field Name	Comment
1	Record Type ID	Required. Always `R' for result records.
2	Sequence#	Required, sequentially generated number identifying the number of each record.
3	Universal Test ID	^^^Sensor Name E.g. ^^^<Sensor Name>
4	Calibration Value	Results from instrument XX.X XX.X=value
5	Units	SI or Conventional Units of measurement
6	Reference Ranges	Not used by OPTI
7	Result Abnormal Flags	Not used by OPTI.
8	Nature of abnormality	Not used by OPTI.
9	Result Status	Either "OK" or "NO"
10	Date of Change in Instrument Normative Values	Not used by OPTI.
11	Operator Identification	Not used by OPTI
12	Date/Time calibration completed	Sends the date and time as it is set in the OPTI R when the instrument completed the test. Format: YYYYMMDDHHMMSS
<cr>	Carriage return	Required, Record Terminator

3.2.5.10 Message Terminator Record

This is the last record in the message. A header record may be transmitted after this record to signify the start of another message. The Message terminator record consists of the following fields:

1|2|3|<cr>

Example:

L|1|N<cr>

Field #	Field Name	Comment
1	Record Type ID	Required. Always `L' for terminator records
2	Sequence#	Always `1'. The OPTI only will send one Message Terminator Record at a time.
3	Termination code	Always `N' Normal Terminator
<cr>	Carriage return	Required, Record Terminator

3.2.6 Data Examples for ASTM

Legend:

Control codes will be enclosed in <xxx>. This is for clarity and example purposes only.

The ↵ character will be used to show the data stream continues on the next line. It is not in the actual data stream.

The <CS> denotes checksum, the modulo 256 checksum should be calculated and inserted in each data stream.

3.2.6.1 Patient Sample

OPTI:

<ENQ>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337||||||Meas|P|2.2|↵

20050531132840<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1||PatientID123456||||1979-03-15|M<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3O|1|AccessionNum|123456789012|MEASUREMENT^3|||||||||||| ↵
Blood^Arterial|||219400||||20050531132840<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4C|1|I|pH over 7.600 (Ref.Lim)|I<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|1|^^^pH^M^^|7.604||7.200 to 7.600|H||||OPID1234567||↵

20050531132803|Osmetch OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|2|^^^PCO2^M^^|34.1|mmHg|30.0 to 50.0|||||OPID1234567||↩
20050531132803| OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|3|^^^PO2^M^^|136.6|mmHg|70.0 to
700.0|||||OPID1234567||↩
20050531132803| OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|4|^^^Na^M^^|140.3|mmol/L|135.0 to 145.0↩
|||||OPID1234567||20050531132803|OPTI Medical OPTI R↩
^1.01.0001^4337 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|5|^^^K^M^^|5.79|mmol/L|3.50 to 5.10|||||OPID1234567||↩
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|6|^^^iCa^M^^|1.27|mmol/L|1.12 to
1.32|||||OPID1234567||↩
20050531132803|OPTI Medical OPTI R^1.01.0001^4337
<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|7|^^^ctHb^M^^|15|g/dL|12.0 to 17.0|||||OPID1234567||↩
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|8|^^^SO2^M^^|78|%|90.0 to 100.0|||||OPID1234567||↵
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|9|^^^BE^C^^|3.6|mmol/L||||||OPID1234567|||↵
OPTI Medical OPTI R^1.01.0001^4337 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|10|^^^tCO2^C^^|24.1|mmol/L||||||OPID1234567|||↵
OPTI Medical OPTI R^1.01.0001^ 4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|11|^^^HCO3^C^^|23.4|mmol/L||||||OPID1234567|||↵
OPTI Medical OPTI R^1.01.0001^ 4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|12|^^^Hct(c)^C^^|0.0|%||||||OPID1234567|||↵
OPTI Medical OPTI R^1.01.0001^4337

Receiver:

<ACK>

OPTI:

<STX>1R|13|^^^Baro^M^^|734.3|mmHg||||||OPID1234567||↵
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|14|^^^AccNum^S^^|OPID123456712|||||||OPID1234567||↵
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|15|^^^Temp^S^^|37.0|C|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|16|^^^O2 Mode^S^^|Room Air|||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|17|^^^Bypass^S^^|On_Pump|||||||OPID1234567||↵

20050531132803|OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|18|^^^FR^S^^|1.00|Lpm|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|19|^^^FIO2^S^^|0.21|||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|20|^^^SamType^S^^|Art|||||||OPID1234567||20050531132803↵

|OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|21|^^^Puncture Site^S^^|LR|||||||OPID1234567||↵

20050531132803|OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|22|^^^Vent Mode^S^^|SIMV||||||OPID1234567||↵
20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|23|^^^VT^S^^|1000|mL||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|24|^^^VE^S^^|100|L||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|25|^^^PIP^S^^|100|||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|26|^^^Pplat^S^^|1.0|||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|27|^^^PS^S^^|1|||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|28|^^^PEEP^S^^|10|||||||OPID1234567||20050531132803|↵
OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|29|^^^CPAP^S^^|10||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|30|^^^f^S^^|100|bpm|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R ^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|31|^^^IE^S^^|1.0:1.0||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|32|^^^BiLevel^S^^|2.0/2.0||||||OPID1234567||↵

20050531132803|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|33|^^^HbType^S^^|Adult||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|34|^^^tHb^S^^|15.0|g/dL|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|35|^^^MCHC^S^^|33.3|%|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|36|^^^RQ^S^^|0.84||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|37|^^^P50^S^^|26.7|mmHg|||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|38|^^^UserDef^S^^|123456789||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|39|^^^UserDef2^S^^|123456789||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|40|^^^UserDef3^S^^|123456789||||||OPID1234567||20050531132803|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5L|1|N<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI R^1.01.0001^4337||||||Cal|P|2.2|↵

20050531132848<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3O|1||CALIBRATION^System Cal<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|1|^^^pH|7.426|||||OK||||20050531132354 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|2|^^^PCO2|
39.8|||||OK||||20050531132354<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|3|^^^PO2| 92.2|||||OK||||20050531132354<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|4|^^^Na|148.3|||||OK||||20050531132354 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|5|^^^K| 4.97|||||OK||||20050531132354<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|6|^^^iCa| 1.23|||||OK||||20050531132354<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|7|^^^ctHb|31-May-05||||||||20050531132354
<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|8|^^^SO2|31-May-05|||||||20050531132354
<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4L|1|N<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<EOT>

NOTE: Version 2..03 and greater of OPTI R supports the DOB field.

Example:

OPTI:

<STX>5R|41|^^^DOB^S^^|20-May-1959|||||||20070731103322|OPTI
Medical OPTI R^2.01.0001^1003 <ETX><CS><CR><LF>

Receiver:

<ACK>

3.2.6.2 Auto QC Sample

OPTI:

<ENQ>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337||||||Meas|P|2.2|↵

20050531133824<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1

Receiver:

<ACK>

OPTI:

<STX>3O|1||AQC^9632||||||||||||Other^3|||219400|PASS|||↵
20050531133824<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|1|^^^pH^M^^|7.178||7.12 to 7.22|||||||20050531133813|↵
OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|2|^^^PCO2^M^^|70.4|mmHg|64.0 to 78.0|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|3|^^^PO2^M^^|70.6|mmHg|58.0 to 82.0|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|4|^^^Na^M^^|124.6|mmol/L|120.0 to 130.0|||||||↵
0050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|5|^^^K^M^^|2.84|mmol/L|2.50 to 3.30|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|6|^^^iCa^M^^|1.61|mmol/L|1.44 to 1.74|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|7|^^^ctHb^M^^|20.4|g/dL|18.2 to 22.2|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|8|^^^SO2^M^^|79.1|%|76.0 to 82.0|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4L|1|N<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337|||||Cal|P|2.2|↵
20050531133825<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3O|1||CALIBRATION^System Cal<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|1|^^^pH|7.427|||||OK||||20050531133512 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|2|^^^PCO2| 39.7|||||OK||||20050531133512↵
<ETX><CS><CR><LF>

Receiver:
<ACK>
OPTI:
<STX>6R|3|^^^PO2| 92.2|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>7R|4|^^^Na|148.3|||||OK||||20050531133512 <ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>0R|5|^^^K| 4.97|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>1R|6|^^^iCa| 1.23|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>2R|7|^^^ctHb|31-May-05||||||||20050531133512↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>3R|8|^^^SO2|31-May-05||||||||20050531133512↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>4L|1|N<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<EOT>

3.2.6.3 Quality Control OPTI-check Sample

OPTI:

<ENQ>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337||||||Meas|P|2.2|↵

20050531133824<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1

Receiver:

<ACK>

OPTI:

<STX>3O|1||QC^9632|||||||||||OPTI-check^2|||219400|PASS|||↵

20050531133824<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|1|^^^pH^M^^|7.178||7.12 to 7.22|||||||20050531133813|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|2|^^^PCO2^M^^|70.4|mmHg|64.0 to 78.0|||||||↵

20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|3|^^^PO2^M^^|70.6|mmHg|58.0 to 82.0|||||||↵

20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|4|^^^Na^M^^|124.6|mmol/L|120.0 to 130.0|||||||↵
0050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|5|^^^K^M^^|2.84|mmol/L|2.50 to 3.30|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|6|^^^iCa^M^^|1.61|mmol/L|1.44 to 1.74|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|7|^^^ctHb^M^^|20.4|g/dL|18.2 to 22.2|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|8|^^^SO2^M^^|79.1|%|76.0 to 82.0|||||||↵
20050531133813|OPTI Medical OPTI
R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4L|1|N<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337|||||Cal|P|2.2|↵
20050531133825<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:
<STX>2P|1<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>3O|1||CALIBRATION^System Cal<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>4R|1|^^^pH|7.427|||||OK||||20050531133512 <ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>5R|2|^^^PCO2| 39.7|||||OK||||20050531133512↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>6R|3|^^^PO2| 92.2|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>7R|4|^^^Na|148.3|||||OK||||20050531133512 <ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>0R|5|^^^K| 4.97|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>1R|6|^^^iCa| 1.23|||||OK||||20050531133512<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>2R|7|^^^ctHb|31-May-05||||||||20050531133512↵
<ETX><CS><CR><LF>
Receiver:
<ACK>

OPTI:
<STX>3R|8|^^^SO2|31-May-05||||||||20050531133512↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>4L|1|N<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<EOT>

3.2.6.4 Quality Control OPTI-check Sample (Failed)

OPTI:
<ENQ>
Receiver:
<ACK>
OPTI:
<STX>1H|\^&|||OPTI Medical OPTI R^1.01.0001^4337|||||Meas↵
|P|2.2|20050613113935<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>2P|1<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>3O|1||QC^9876|||||||||||OPTI-check PLUS^3|||218600|FAIL↵
|||20050613113936<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>4R|1|^^^pH^M^^|7.592||6.600 to
7.800||||||20050613113913|↵
OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>
Receiver:
<ACK>

OPTI:

<STX>5R|2|^^^PCO2^M^^|22.6|mmHg|10.0 to 200.0|||||||↵

20050613113913|OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|3|^^^PO2^M^^|134.6|mmHg|10.0 to 700.0|||||||↵

20050613113913| OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>7R|4|^^^Na^M^^|156.3|mmol/L|100.0 to 180.0|||||||↵

20050613113913|OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>0R|5|^^^K^M^^|5.90|mmol/L|0.80 to 9.99|||||||↵

20050613113913|OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1R|6|^^^iCa^M^^|348.8|mg/dL|30.0 to 400.0|||||||↵

20050613113913| OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2R|7|^^^ctHb^M^^|–|g/dL|5.0 to
25.0|<||||||20050613113913|↵

OPTI Medical OPTI R^1.01.0001^4337<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3R|8|^^^SO2^M^^|100.0|%|60.0 to 100.0|||||||↵

20050613113913|OPTI Medical OPTI R^1.01.0001^4337↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4L|1|N<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>1H|\^&|||OPTI Medical OPTI
R^1.01.0001^4337||||||Cal|P|2.2|↵

20050613113937<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>2P|1<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>3O|1||CALIBRATION^System Cal<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>4R|1|^^^pH|7.416|||||OK||||20050613113603 <ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>5R|2|^^^PCO2| 39.7|||||OK||||20050613113603↵

<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:

<STX>6R|3|^^^PO2| 93.2|||||OK||||20050613113603<ETX><CS><CR><LF>

Receiver:

<ACK>

OPTI:
<STX>7R|4|^^^Na|148.4|||||OK||||20050613113603 <ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>0R|5|^^^K| 4.97|||||OK||||20050613113603<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>1R|6|^^^iCa| 0.0|||||OK||||20050613113603<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>2R|7|^^^ctHb|13-Jun-05|||||||||20050613113603↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>3R|8|^^^SO2|13-Jun-05|||||||||20050613113603↵
<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<STX>4L|1|N<ETX><CS><CR><LF>
Receiver:
<ACK>
OPTI:
<EOT>

4 APPENDIX

4.1 Measured Parameters

The table below lists all possible measured results that are available on the OPTI Medical OPTI Critical Care Analyzer and could be transmitted to the host system. The OPTI R is a single-use cassette based analyzer and can send various combinations of these parameters depending on the cassette type run.

pH	pH
Partial pressure of carbon dioxide	PCO_2
Partial pressure of oxygen	PO_2
Total hemoglobin concentration	ctHb
Hemoglobin oxygen saturation	SO_2
Sodium	Na
Potassium	K
Calcium	Ca
Barometric pressure	Baro

4.2 Input Parameters

The table below lists all input parameters that are available on the OPTI Medical OPTI Critical Care Analyzer and could be transmitted to the host system. These parameters are selectable by the user and any combination of these parameters can be sent to the host.

Operator ID	<10 character entry field>
Patient ID	<15 character entry field>
Accession Number	<12 character entry field>
Patient Temperature	14 – 44 °C
Patient Sex	Male, Female, or "?"
Hb Type	"Adult" or "Fetal"
Puncture Site	"LR","RR","LB","RB","LF", "RF","CORD","SCALP"
Bypass	"On Pump" or "Off Pump"
Patient Sample Type	"Art", "Ven", "MixVen" , "Cap", Cord", "CPB"
tHb	1 – 26 g/dL
Mean corpuscular hemoglobin concentration	29.0 – 37.0 %
O2 Mode	"Room air", "Mask", "T-Piece", "Nasal Canula", "Ventilator", "Bag", "Hood", "Other"
FIO_2	0.21 – 1.0
RQ	0.70 – 2.00
P_{50}	15 – 40
Vent Mode	"N/A", "SIMV", "PSV", "PCV", "CMV/AC", "CPAP", "PCIVR", "BIPAP"
Tidal Volume VT (TVol)	0 – 4000
Minute Volume MVol (VE)	0 – 120
Peak Inspiratory Pressure (PIP)	0 – 140
Plateau Pressure (Pplat)	0 – 100
Pressure Support (PS)	0 – 99.9
Positive End Expiratory Pressure (PEEP)	0 – 50
Continuous Positive Airway Pressure (CPAP)	0 – 50
Frequency Rate (f)	0 – 155

Flow Rate Liter Flow (FR)	0(CPAP) 300.00
I/E Ratio Inspiratory Time / Expiratory Time	0.2 – 9.9 / 0.2 – 9.9
Bi Level Pressure Inspiratory / Expiratory Pressure	0 – 9.9 / 0 – 9.9
User Field 1	<9 character entry field>
User Field 2	<9 character entry field>
User Field 3	<9 character entry field>
DOB (OPTI R 2.1 up)	“DD-MMM-YYYY”

NOTE: DOB fields DD and YYYY are numeriic MMM is a text field for month.

English	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Japanese	01M	02M	03M	04M	05M	06M	07M	08M	09M	10M	11M	12M
German	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
French	Jan	Fev	Mar	Avr	Mai	Jun	Jul	Aou	Sep	Oct	Nov	Dec
Spanish	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic
Italian	Gen	Feb	Mar	Apr	Mag	Giu	Lug	Ago	Set	Ott	Nov	Dic
Chinese	01M	02M	03M	04M	05M	06M	07M	08M	09M	10M	11M	12M

4.3 Calculated Parameters

The table below lists all possible calculated results that are available on the OPTI Medical OPTI Critical Care Analyzer and could be transmitted to the host system. These parameters are completely selectable by the facility.

***Note**: Please refer to the Operator's Manual*

Actual bicarbonate,	HCO_3^-
Base excess,	BE
Base excess ecf,	BE_{ecf}
Base excess actual,	BE_{act}
Buffer base,	BB
Total CO_2,	tCO_2
Standard bicarbonate,	st. HCO_3^-
Standard pH,	st.pH
Hydrogen ion concentration,	cH^+
Oxygen saturation,	SO_2 (c)
Oxygen content,	O_2ct
Alveolar-arterial oxygen difference	$AaDO_2$
P_{50}	P_{50}
Hematocrit,	Hct(c)
Normalized Calcium	nCa++

4.4 Sample Types

Arterial, Venous, Mixed Venous, Capillary, Cord, CPB (Cardio-Pulminary Bypass)

4.5 Blood Types

Whole Blood, Serum, Plasma, Dialysate and aqueous for QC