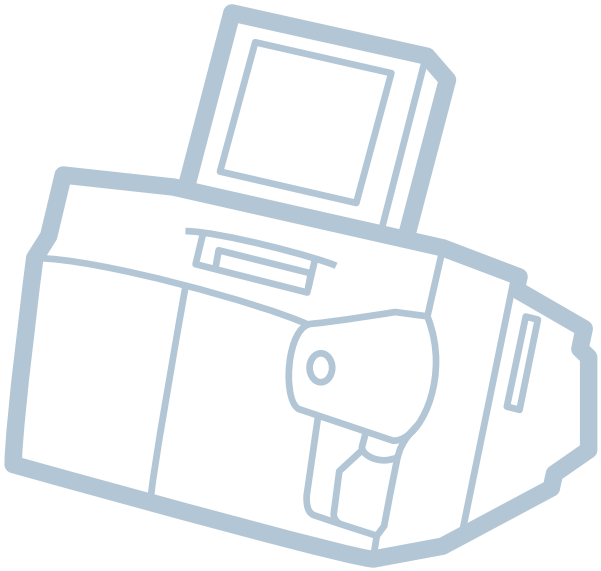
RAPIDLab® 1200
Systems



Interface Specifications Manual

06621307 Rev. Z

CE

SIEMENS

Made in UK

Siemens Healthcare Diagnostics Inc.
511 Benedict Avenue
Tarrytown, NY 10591-5097 USA

EC REP Siemens Healthcare Diagnostics Ltd.
Sir William Siemens Sq.
Frimley, Camberley, UK GU16 8QD

www.siemens.com/poc

The information in this manual was correct at the time of printing. However, Siemens continues to improve products and reserves the right to change specifications, equipment, and maintenance procedures at any time without notice.

Implementing an LIS software interface to a RAPIDLab 1200 system is solely the responsibility of the customer. Siemens recommends that a professional software programmer develop and implement the LIS software interface. Siemens is not responsible for any communications problems or for any damage to a RAPIDLab 1200 system or an LIS that might result from implementing an LIS communication protocol.

Contents

A Variables

B Data Records

C HIBC Protocol for Barcode Implementation

Index

Using this Manual

The *RAPIDLab® 1200 Interface Specifications Manual* describes the specifications for interfacing a RAPIDLab 1200 system to a laboratory information system (LIS) or a hospital information system (HIS). This manual is descriptive rather than procedural and provides the following information:

- message formats
- physical interface specifications

Who Should Use this Manual

Software engineers and programmers should use this manual as a reference document when programming the LIS to use data generated by a RAPIDLab 1200 system. The laboratory information system manager can refer to this manual to identify the appropriate communication protocol.

Finding Information in this Manual

The following table helps you locate the manual sections that contain the information you need to complete interface tasks.

If you want to . . .	*Then refer to . . .*
find general information about the LIS 3 communication protocol	Section 1, *Overview.*
identify the specifications for the physical interface between a RAPIDLab 1200 system and a laboratory information system	Section 5, *Physical Interface*.
find information about message transactions	Section 2, *Message Transactions*.
find information about the message format	Section 3, *Message Format*.
find information about message transfer	Section 4, *Message Transfer.*
review variables and data records for LIS 3 protocol	Appendix A, *Variables*, and Appendix B, *Data Records*.
review HIBC barcode messaging protocol	Appendix C, *HIBC Protocol for Barcode Implementation.*

RAPIDLab 1200 System Information

Refer to the *RAPIDLab 1200 Operator's Guide*, Section 8, System Configuration, for the procedures to connect a RAPIDLab 1200 system to an LIS.

Conventions Used in this Manual

The following table explains the text and symbol conventions used in this manual.

Convention	*Description*
{...}	Braces delimit records. For example, {identifier} indicates an identifier record.
<...>	Angle brackets indicate ASCII control characters. For example, <STX> indicates Start of Text (02 decimal).
NOTE:	The note symbol identifies information that requires your attention.

1 Overview

The RAPIDLab 1200 system is designed to transmit patient sample data, quality control (QC) sample data, and system calibration data to a laboratory information system (LIS) or to a hospital information system (HIS). Transmission of patient sample, QC sample, and calibration data can be automatic or only upon the request of the LIS or operator.

About the RAPIDLab 1200 System

The RAPIDLab 1200 system is used for the determination of pH, pCO_2, pO_2, sodium (Na^+), potassium (K^+), ionized calcium (Ca^{++}), chloride (Cl^-), glucose (Glu), lactate (Lac), total hemoglobin (tHb), hemoglobin derivatives, and neonatal bilirubin (nBili) in arterial, venous, mixed venous, and capillary whole blood samples. The system can report the following parameters:

Parameter	*Description*
pH or H^+	hydrogen ion concentration
pCO_2	partial pressure of carbon dioxide
pO_2	partial pressure of oxygen
Na^+	sodium
K^+	potassium
Ca^{++}	calcium ion concentration
Cl^-	chloride
Glu	glucose
Lac	lactate
HCO_3-act	actual bicarbonate
HCO_3-std	standard bicarbonate
BE(B)	base excess of blood
BE(ecf)	base excess of extracellular fluid
$ctCO_2$	total carbon dioxide
pH(T), H^+(T)	temperature corrected pH
pCO_2(T)	temperature corrected pCO_2

Parameter	*Description*
pO_2(T)	temperature corrected pO_2
RI(T)	temperature corrected respiratory index
pO_2(A-a)(T)	alveolar-arterial oxygen tension difference
pO_2(a/A)(T)	alveolar-arterial oxygen tension ratio
Qsp/Qt(T)	physiologic shunt
Qsp/Qt(T)(est)	estimated physiologic shunt
O_2SAT(est)	oxygen saturation (estimated)
O_2CT(est)	oxygen content (estimated)
Hct	hematocrit (calculated)
pO_2/F_IO_2	arterial pO_2 to fraction of inspired O_2 ratio
Ca^{++} (7.4)	calcium adjusted for pH
AnGap	anion gap
ctO_2(a)	arterial oxygen content
ctO_2(v)	venous oxygen content
$ctO_2(\bar{v})$	mixed venous oxygen content
ctO_2(Hb)	oxygen content of hemoglobin
$\dot{V}O_2$	oxygen consumption rate
$\dot{D}O_2$	oxygen delivery
$ctO_2([a-\bar{v}]/a)$	a-v extraction index
$ctO_2(a-\bar{v})$	arterial-mixed venous oxygen content difference
tHb	total hemoglobin
FO_2Hb	oxyhemoglobin
*F*COHb	carboxyhemoglobin
*F*MetHb	methemoglobin
*F*HHb	deoxyhemoglobin
sO_2	hemoglobin oxygen saturation

Parameter	Description
BO_2	oxygen binding capacity
p50	oxygen tension at 50% saturation
nBili	neonatal bilirubin

About the Communication Protocol

The RAPIDLab 1200 system uses the LIS 3 and LIS 4 protocols to transmit patient, QC, and calibration data from the system to the LIS or HIS upon the request of the LIS. The system uses the LIS 4 protocol to receive control commands and transmit host queries.

If you have two LIS connections, you can configure one as the primary port. The system then automatically sets the other to secondary. The primary port supports both LIS 3 and LIS 4 transmissions. The secondary port does not support control commands and host queries, so the protocol cannot be switched from LIS 3 to LIS 4 for that port.

If you have only one LIS connection, it is the primary port by default.

Messages are enclosed within control characters so that the LIS can detect the start and end of transmission. Each message also includes a checksum to enable the detection of bad transmissions. Messages are automatically retransmitted one time if the LIS does not acknowledge a transmission.

2 Message Transactions

The protocol supports the following transactions:

- Device Identify

  The RAPIDLab 1200 system informs the LIS to identify itself; the LIS transmits its model and device ID to the system. If the LIS makes the request, then the RAPIDLab 1200 system transmits its model and device ID to the LIS.

- Patient Sample Assay

  The RAPIDLab 1200 system informs the LIS that patient data is available, the LIS requests the data, and the system transmits the requested data.

- QC Assay

  The RAPIDLab 1200 system informs the LIS that QC or High G/L data is available, the LIS requests the data, and the system transmits the requested data.

- Calibration

  The RAPIDLab 1200 system informs the LIS that calibration data is available, the LIS requests the data, and the system transmits the requested data.

- System Status

  The RAPIDLab 1200 system informs the LIS of its status (for example, the system is ready for analysis).

- System Control

  The LIS sends commands to the RAPIDLab 1200 system that affect system operation (for example, turning on and turning off parameters).

- Date / Time

  The LIS requests the RAPIDLab 1200 system date and time, and the system transmits the requested data.

Most of these transactions require multiple messages to complete the transaction. The following sections detail the transactions. Refer to Section 3, *Message Format*, for a description of the message format, and to Appendix B, *Data Records*, for a list of the fields present in the larger data records.

Data Availability and Identification

The RAPIDLab 1200 system informs the LIS that the system has data available to transmit under the following circumstances:

- at the completion of sample analysis, quality control (QC) analysis, High G/L analysis, or calibration when Auto is selected for the port for sending patient, QC, or calibration data

- when Auto is selected for the port for sending patient, QC, or calibration dataand the system operator recalls, edits, and saves patient demographic data by touching the Continue button, and when an a-v study report is created

  NOTE: For a-v studies, if Auto is not selected, the system does not send a-v study results to the LIS until the Print button is pressed when the combined results are displayed.
- when the operator prints a report
- when the operator sends data

The protocol includes a mechanism for requesting a retransmission of data upon detection of a transmission error. This mechanism uses a relatively simple message acknowledgment protocol that allows one retry. Refer to *Message Acknowledgement* in Section 4.

The protocol does not detect when the same, error-free message is transmitted twice. This situation can occur when the LIS acknowledges an error-free message but the acknowledgment is corrupted, causing the RAPIDLab 1200 system to resend the message. If the receipt of duplicate data is a problem for the LIS application, the LIS can check each data message to ensure it is not a duplicate of the preceding message.

The transmission of duplicate data messages can also occur in an error-free environment when the operator recalls data and makes multiple requests for results to be sent to the LIS. For example, if the operator prints the same patient report more than once, the RAPIDLab 1200 system sends data available message to the LIS each time the report is printed.

The messages are enclosed within control characters to allow for the detection of start and end of transmission. The messages also include a checksum to enable the detection of bad transmissions. To aid in the parsing of messages, delimiters are used to identify variable boundaries. For more information, refer to Section 4, *Message Transfer.*

Sequence Numbers

Upon completion of analysis or calibration, the RAPIDLab 1200 system assigns a sequence number to each new patient analysis, QC analysis, High G/L analysis, or calibration. The sequence starts at 1, increments to 2^{32}, and then, if necessary, begins again at 1.

NOTE: Not all sequence numbers will be used. For example, sequence number 10 may be followed by sequence number 14.

When the RAPIDLab 1200 system saves new patient, QC, High G/L, or calibration data, it also notifies the LIS that the data, identified by its sequence number, is available. To obtain the data, the LIS must request the data by specifying the sequence number in the data request message the LIS sends to the RAPIDLab 1200 system. For example, the system notifies the LIS that patient data with sequence number 123 is available and the LIS requests the patient data for sequence number 123.

The LIS does not have to request the data immediately after notification. The LIS can wait until it is informed that additional data is available and then request data for specific sequence numbers, with the assurance that the data is still available. This feature allows the LIS time to act and avoids delaying the system before being allowed to make the next transaction available.

If the LIS requests data that is not in the system database, the system informs the LIS that the data is not available.

Buffering and Queue Clearing

Data is stored and queued by the RAPIDLab 1200 system until the database capacity is exceeded. When the database is full, the oldest sample sequences are removed to create space to store new sample data. Refer to the *RAPIDLab 1200 Operator's Guide*, Section 7, File Management, for the current storage capacity of the database.

If the RAPIDLab 1200 system and LIS connection is interrupted, the system queues all unsent patient, QC, and High G/L sample results and calibration data. When the connection is re-established, the system sends the queued data to the LIS. The most recent results are sent first. This process takes place below current transactions and does not interrupt or affect use of the RAPIDLab 1200 system.

The RAPIDLab 1200 system sends queued data, with a minimum 10 second delay between transmissions, in the following order:

- all patient sample results
- all QC and High G/L data
- all calibration data

Each data set is sent in chronological order, starting with the data most recently generated.

Device Identify Transaction

The device sending data (either the RAPIDLab 1200 system or the LIS) requests the device receiving data (the LIS or the RAPIDLab 1200 system, respectively) to identify itself. The device receiving data responds by sending its model and device ID.

Both the RAPIDLab 1200 system and the LIS can initiate a device identify transaction at any time by sending the following message:

Request device identity: {ID_REQ}

The receiving device responds by sending a data record containing the name and value of the variables aMOD (the model number) and iIID (the device identifier). The device uses the following message:

Device identifier: {ID_DATA}{aMOD, iIID}

The device identify transaction must be implemented in the LIS for the system to recognize the LIS connection.

The contents of the aMOD and iIID fields must be as follows:

Field	*RAPIDLab 1200 System*	*LIS*
aMOD	12nn where nn is the type of system configuration	LIS
iIID	up to 5 alphanumeric characters	up to 6 alphanumeric characters

The aMOD value appears in the system ID on printed reports and on the System Information screen.

Instrument Identifier Field

The instrument identifier field (iIID) enables the LIS and the RAPIDLab 1200 system to identify systems with the same aMOD to which a message is directed. All system transactions require the iIID field.

The iIID value is taken from the Serial Number field. The system serial number (for example, 12345) is entered during system setup by the service engineer.

The iIID value appears in the System ID on printed reports and on the System Information screen.

Patient Sample Assay Transaction

The RAPIDLab 1200 system informs the LIS that patient data is available, the LIS requests the data, and the system transmits the requested data. The RAPIDLab 1200 system initiates this transaction.

If the RAPIDLab 1200 system . . .	*Then the LIS . . .*
notifies the LIS that a patient sample analysis has begun or been canceled	acknowledges the message.
notifies the LIS that new or edited patient data is available	acknowledges the message; the LIS at anytime requests the data and identifies the sequence number of the requested data.
sends the requested data or notifies the LIS that the data is no longer available	acknowledges the message.

Measurement Status

When a patient sample analysis has begun, the system informs the LIS by sending the following message (iOID appears if the operator logged in):

> Patient sample analysis initiated: {SMP_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the analysis sequence or the operation fails due to a system error, the system informs the LIS (iOID appears if the operator logged in):

> Patient sample analysis canceled: {SMP_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Rapid Sample Identification Transaction

Rapid Sample Identification is a setup option that allows the RAPIDLab 1200 system to query the LIS system for patient demographic information based on the patient ID entered at the system. This feature is used to confirm that the patient ID, entered by the operator, matches the patient.

NOTE: The RAPIDLab 1200 system supports sending and receiving transmissions of ASCII and UTF-8 Unicode encoded characters in the Patient First Name (iFNAME) and Patient Last Name (iLNAME) demographic fields to and from an LIS. It also supports displaying and printing these characters in these fields. A serial port connection, if used, must be configured to send 8 data bits.

With Rapid Sample Identification turned on, when a patient ID is entered, the system informs the LIS by sending the following message:

> Rapid Sample Identification Requested: {PAT_DEMOG_REQ} {aMOD, illD, iPID}

The LIS responds in one of the following three ways:

- the patient demographic data was found for the requested patient ID so the LIS sends the following message:

  > Rapid Sample Identification Data: {PAT_DEMOG_DATA} {aMOD, illD, iPID, iLNAME, iFNAME, iSEX, iDOB}

- the patient demographic data was not found for the requested patient ID so the LIS sends the following message:

  > Rapid Sample Identification Data Not Found: {PAT_DEMOG_NOT_AV} {aMOD, illD, iPID}

- the LIS does not respond. After 60 seconds, the system assumes that the data could not be found and informs the operator.

Data Available

The RAPIDLab 1200 system notifies the LIS that the system has data to transmit:

- at the completion of sample analysis when Auto is selected for the port for sending patient, QC, or calibration data
- when Auto is selected for the port for sending patient, QC, or calibration data and the system operator recalls, edits, and saves patient demographic data by touching the Continue button
- when the operator prints a report or resends data
- when clearing a queue

When patient sample data is available, the system sends the following message to the LIS:

Sample data available: {SMP_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The sample sequence number does not increment with retransmissions.

Request Sample Data

When informed that data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the requested sample data:

Request patient sample data: {SMP_REQ}{aMOD, iIID, rSEQ}

Sample Assay Data

If the requested data is available, the system sends the following message:

Sample data: {SMP_NEW_DATA}{sample assay data}

The sample type and the parameters configured on the system can affect the parameters transmitted in the sample assay data record. Refer to Appendix B, *Data Records*, for the sample assay data record.

Sample Assay Data Not Available

If the requested data is no longer available, the system sends the following message:

Patient sample data not available: {SMP_NOT_AV}{aMOD, iIID, rSEQ**}**

The data may not be available if the database is full. When the database is full, the oldest sample sequences are removed to create space to store new sample data.

Edited Sample Data

When the system operator recalls patient sample data, edits the data, and then sends the results to the LIS, the system sends the following message:

Sample data available: {SMP_NEW_AV}{aMOD, iIID, rSEQ}

When the LIS responds with the SMP_REQ message, the system sends the following message:

Edited patient sample data: {SMP_EDIT_DATA}{sample assay data}

NOTE: An a-v study can be performed on a RAPIDLab 1245 or 1265 system when the operator combines an arterial and a mixed-venous sample. After combining samples, only the arterial sample is available for printing and sending to the LIS. For a-v studies, if Auto is not selected, the system does not send a-v study results to the LIS until the Print button is pressed when the combined results are displayed.

QC or High G/L Assay Transaction

The RAPIDLab 1200 system informs the LIS that QC or High G/L data is available, the LIS requests the data, and the system transmits the requested data. The RAPIDLab 1200 system initiates the transaction.

If the RAPIDLab 1200 system . . .	*Then the LIS . . .*
notifies the LIS that a QC or High G/L sample analysis has begun or been canceled	acknowledges the message.
notifies the LIS that new QC or High G/L data is available	acknowledges the message; the LIS at anytime requests the QC or High G/L data and identifies the sequence number of the requested data.
sends the requested QC or High G/L data or notifies the LIS that the data is no longer available	acknowledges the message.

Measurement Status

When QC or High G/L sample analysis begins, the system informs the LIS (iOID appears if the operator logged in):

> QC or High G/L sample analysis initiated: {QC_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the QC or High G/L analysis sequence or the operation fails due to a system error, the system informs the LIS with the following message (iOID appears if the operator logged in):

> QC or High G/L sample analysis canceled: {QC_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Data Available

The RAPIDLab 1200 system informs the LIS that the system has QC or High G/L data to transmit:

- at the completion of QC or High G/L analysis when Auto is selected for the port for sending patient, QC, or calibration data.
- when the operator prints a report or resends the data
- when clearing a queue

The system sends the following message to the LIS when QC or High G/L data is available:

> QC or High G/L sample data available: {QC_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The sequence number does not increment with retransmissions.

Request QC or High G/L Data

When informed that QC or High G/L data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the required QC or High G/L data:

Request QC or High G/L data: {QC_REQ}{aMOD, iIID, rSEQ}

QC or High G/L Assay Data

If the requested QC or High G/L data is available, the system sends the following message:

QC or High G/L data: {QC_NEW_DATA}{assay data}

Refer to Appendix B, *Data Records,* for the QC or High G/L assay data record.

QC or High G/L Assay Data Not Available

If the requested QC or High G/L data is no longer available, the system sends the following message:

QC or High G/L data not available: {QC_NOT_AV}{aMOD, iIID, rSEQ}

The data may not be available if the database is full. When the database is full, the oldest sample sequences are removed to create space to store new sample data.

Calibration Transactions

The RAPIDLab 1200 system informs the LIS that new calibration data is available, the LIS requests the data, and the system transmits the requested data. The transaction is initiated by the RAPIDLab 1200 system.

If the RAPIDLab 1200 system . . .	*Then the LIS . . .*
notifies the LIS that a calibration sequence has begun or been canceled	acknowledges the message.
notifies the LIS that calibration data is available	acknowledges the message; the LIS at anytime requests the calibration data and identifies the sequence number of the requested data.
sends the requested calibration data or notifies the LIS that the data is no longer available	acknowledges the message.

Calibration Initiated

When a calibration sequence has begun, the system informs the LIS (iOID appears if the operator logged in):

Calibration initiated: {CAL_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the calibration sequence, or if the calibration fails due to a system error, the system informs the LIS with the following message (iOID appears if the operator logged in):

Calibration canceled: {CAL_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Data Available

The RAPIDLab 1200 system informs the LIS that the system has calibration data to transmit:

- at the completion of calibration when Auto is selected for the port for sending calibration data
- when the operator prints a report or resends the data
- when clearing a queue

The system sends the following message to the LIS when calibration data is available:

Calibration: {CAL_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The calibration sequence number does not increment with retransmissions.

Request Calibration Data

When informed that calibration data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the requested calibration data:

Request calibration data: {CAL_REQ}{aMOD, iIID, rSEQ}

Calibration Data

If the requested calibration data is available, the system sends the following message:

Cal data: {CAL_NEW_DATA}{calibration data}

The calibration data records sent by the RAPIDLab 1200 system depend on the type of calibration performed. The calibration data record contains either a cal data set, a slope data set, or both.

Calibration Sequences	*Data Set*
1-point	cal
2-point	cal and slope
2-point	cal, slope, and tHb slope

Within each cal and slope data set, each parameter is represented by two entries. In the variable name, *name* is replaced by the name of a particular parameter, such as aCmNa$^+$ or aSdNa$^+$.

CAL		*SLOPE*	
Format	*Function*	*Format*	*Function*
aCmname	(MEASURED)	aSmname	(MEASURED)
aCdname	(DRIFT)	aSdname	(DRIFT)

The first entry (MEASURED) is the measured calibrant or slope value. The second entry (DRIFT) is the drift in calibration or slope for that parameter.

NOTE: The RAPIDLab 1200 system deviates from the 200 and 800 systems in the representation of calibration data because the RAPIDLab 1200 system does not include an ADJUSTED number.

Refer to Appendix B, *Data Records*, for the calibration data records.

Calibration Data Not Available

If the requested data is no longer available, the system sends the following message:

Cal data not available: {CAL_NOT_AV}{aMOD, iIID, rSEQ}

The data may not be available if the database is full. When the database is full, the oldest calibration sequences are removed to create space to store the new calibration data.

System Status Transactions

Several system status messages inform the LIS about the status of the RAPIDLab 1200 system.

System Ready

The system ready message informs the LIS when the system is ready to accept a sample. The system sends the following message when analysis is complete and the system is ready to accept a new sample (iOID appears if the operator logged in):

System ready: {SYS_READY}{aMOD, iIID, aDATE, aTIME, iOID}

System Not Ready

The system not ready message informs the LIS when the system is not ready to accept a new sample, such as when the operator is replacing a cartridge. If the system is not ready, it sends the following message (iOID appears if the operator logged in):

System not ready: {SYS_NOT READY}{aMOD, iIID, aDATE, aTIME, iOID}

System Waiting Operator Action

The system sends the waiting operator action message during analysis if the system is delayed during analysis and is waiting for the operator to take action (for example, if the system is waiting for the operator to remove the sample device). The system sends the following message (iOID appears if the operator logged in):

System waiting: {SYS_WOPR}{aMOD, iIID, aDATE, aTIME, iOID}

System Measuring

When the system resumes analysis upon recovery from a SYS_WOPR condition, the system sends the following message (iOID appears if the operator logged in):

System measuring: {SYS_MEASURING}{aMOD, iIID, aDATE, aTIME, iOID}

Calibration Pending

When the system is about to perform a calibration, the system sends the following message (iOID appears if the operator logged in):

Calibration pending: {SYS_CAL_PEND} {aMOD, iIID, aDATE, aTIME, iOID}

NOTE: The system sends the SYS_CAL_PEND message before the expected start of a calibration.

If the calibration fails, the system repeats the calibration and sends the following message (iOID appears if the operator logged in):

Calibration repeating: {SYS_CAL_REP}{aMOD, iIID, aDATE, aTIME, iOID}

NOTE: The data from the repeated calibration replaces the data from the calibration that failed.

Reagent Errors

If an error occurs when the system is delivering reagents from the reagent, wash, or automatic QC cartridges, the system sends the following messages (iOID appears if the operator logged in):

Reagent cartridge error: {RGT_ERROR_RCART} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

Wash cartridge error: {RGT_ERROR_WCART} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

AutomaticQC cartridge error: {RGT_ERROR_AQC} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

When the reagent error has been cleared in the reagent, wash, or automatic QC cartridge, the system sends the following messages (iOID appears if the operator logged in):

Reagent cartridge error has been cleared: {RGT_OK_RCART} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

Wash cartridge error has been cleared: {RGT_OK_WCART} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

AutomaticQC cartridge error has been cleared: {RGT_OK_AQC} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

If an error occurs in the tubing delivering reagents to the measurement module, the system sends the following messages when the error occurs and when it is cleared (iOID appears if the operator logged in):

Reagent error in the tubing: {RGT_ERROR_TUBING} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

Reagent error in the tubing has been cleared: {RGT_OK_TUBING} {aMOD, iIID, aDATE, aTIME, aREAGENT, iOID}

Fluid Detector Error

If analysis cannot be performed because the system cannot detect reagents required to perform an analysis, the system sends the following message (iOID appears if the operator logged in):

Fluid detector error: {FD_ERROR} {aMOD, iIID, aDATE, aTIME, iOID}

Probe Error

If analysis cannot be performed because of a reagent or automatic QC valve error, the system sends the following message (iOID appears if the operator logged in):

Probe error: {PROBE_ERROR} {aMOD, iIID, aDATE, aTIME, iOID}

Electronics Error

If analysis cannot be performed because of an electronics error, the system sends the following message (iOID appears if the operator logged in):

Electronics error: {ELECTRONICS_ERROR} {aMOD, iIID, aDATE, aTIME, iOID}

Processing Error

If analysis cannot be performed because of a communication error between the components of the system, the system sends the following message (iOID appears if the operator logged in):

Processing error: {PROCESSING_ERROR} {aMOD, iIID, aDATE, aTIME, iOID}

System Control Transactions

The LIS can configure the RAPIDLab 1200 system to perform the following operations:

- prevent the operator from analyzing samples
- include and exclude parameters from analysis
- perform 1-point and 2-point calibrations
- invoke a wash
- synchronize the time at local systems with the time at the LIS

NOTE: If the system has two LIS connections, the secondary port does not support control commands and host queries.

Sample Analysis Disabled

The LIS informs the system to disable sample analysis by sending the following message:

Sample analysis disabled: {CTL_LOCK}{aMOD, iIID}

When the system receives a request to disable analysis from the LIS, it sets a flag that prevents sample analysis at the Analysis screen. The system displays a message, on the screen where an operator enters their password, indicating that analysis is disabled. Analysis can be enabled by the LIS.

Sample Analysis Enabled

The LIS informs the system to enable sample analysis by sending the following message:

Sample analysis enabled: {CTL_FREE}{aMOD, iIID}

Parameter Enabled or Disabled

The LIS informs the system to enable or disable a parameter by sending the following message:

Parameter enabled or disabled: {CTL_CHAN}{parameter selection data}

When the system receives a request to enable or disable parameters {CTL_CHAN} from the LIS, the system sets flags to enable or disable the selected parameters during analysis. The parameters are disabled or enabled as defined by the status of the flags. The enable/disable selection is in effect until the system receives another {CTL_CHAN} message for the parameters or until the operator selects parameters in Setup at the RAPIDLab 1200 system.

The LIS may enable a parameter that has been disabled by the system because the parameter failed or missed QC by sending the following message:

Parameter enabled: {CTL_OVERRIDE_QC}{parameter selection data}

When the system receives the override request, the system enables the parameter.

The request to enable or disable a parameter includes a setup variable and the request to override a parameter includes a system variable. Refer to Appendix B, *Data Records*, for the fields sent in the parameter selection data record.

Calibration Requests

The LIS informs the system to perform a 1-point calibration by sending the following message:

1-pt Calibration Request: {CTL_1PT} {aMOD, illD}

If the system can accommodate the request, it responds with the CAL_START message. Otherwise, no response is sent to the LIS. The system may not be able to perform a 1-point calibration because of the following conditions:

- the system is busy and cannot perform a calibration at the time of the request
- the next calibration due is a 2-point or 2-point full calibration

The LIS may request a 2-point full calibration by sending the follow message:

2-pt Calibration Request: {CTL_2PT} {aMOD, illD}

If the system can accommodate the request, it responds with the CAL_START message. Otherwise, no response is sent to the LIS. The system may not be able to perform a calibration because the system is busy at the time of the request.

Wash Request

The LIS informs the system to perform a wash by sending the following message:

Wash request: {CTL_WASH} {aMOD, iIID}

No response is sent to the LIS. To ensure a wash requested remotely does not conflict with a local request, a wash is performed only if one of the following conditions applies:

- the system is in an idle state
- the system is in an AQC troubleshooting state

Time Synchronization Request

The time synchronization request is initiated by the LIS when it wants to synchronize the time setting of local systems with the time setting of the LIS. The following message is sent:

Time synchronization request: {CTL_TIME_SET} {aMOD, iIID, aDATE, aTIME}

The aDATE value is in ddMmmYYYY format. The aTIME value is in hh:mm:ss format.

No response is sent to the LIS. If the local user is currently on the Date and Time Setup screen, the LIS command is ignored, and the command is not implemented.

Date/Time Transaction

The date/time transaction is initiated by the LIS when it wants to determine the system's date and time:

Request time: {TIME_REQ}{aMOD, iIID}

The system responds by sending a data record containing the name and value of the variables aDATE and aTIME:

System time: {TIME_DATA}{aMOD, iIID, aDATE, aTIME}

3 Message Format

This section explains the rules for building messages and the rules for decoding the messages received. In this protocol, messages are enclosed within ASCII control characters so that the LIS can detect the start and end of transmission. The control characters and their meanings are listed alphabetically in the following table.

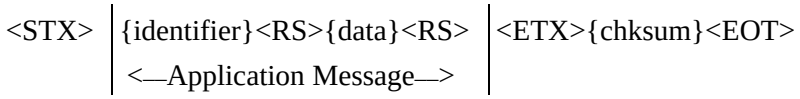
Control Character	*Meaning*
<ACK>	acknowledge
<EOT>	end of transmission
<ETB>	end of transmission block
<ETX>	end of text
<FS>	field separator
<GS>	group separator
<RS>	record separator
<STX>	start of text

NOTE: A shorthand notation is used to describe the transmitted messages with the format {identifier}{data}. The braces {. . .} are not actually transmitted, but are used in this document to delimit records.

Each message consists of an application message contained in a datalink frame. The frame consists of the following elements:

- a start-of-message character before the application message
- an end-of-message character at the end of the application message
- two checksum characters
- an end-of-transmission character

The format of the frame is as follows:



where:

<STX> is the ASCII control character Start of Text (02 decimal)

<RS> is the record separator (30 decimal)

<ETX> is the ASCII control character End of Text (03 decimal)

checksum is a variable, two-digit, hexadecimal number included to support error checking by the receiver

<EOT> is the ASCII control character End of Transmission (04 decimal)

Each application message consists of one or two records, each terminated by a record separator character. The first record, {identifier}, identifies the message type. If present, the second record, {data}, contains information that gives further identity to the message or provides data.

The identifier record is always transmitted first, and the characters given within the braces are transmitted exactly as shown in Section 2, *Message Transactions*.

The data record is transmitted second. The contents of the braces indicate the data fields to be sent, not the exact content of the record.

Application Message Format

The application message format uses delimiters to mark the beginning and end of a record. The identifier record and the data record are each terminated by the ASCII control character Record Separator (30 decimal), <RS>.

For example: {identifier}<RS>{data}<RS>

Identifier Record Format

The identifier record is a string of ASCII characters that describe the type of record being sent and is terminated by the ASCII control character Field Separator (28 decimal), <FS>.

For example: SMP_NEW_DATA<FS>

Data Record Format

The format of a data record is as follows:

{name}<GS>{value}<GS>{units}<GS>{exception group}<GS><FS>
{name}<GS>{value}<GS>{units}<GS>{exception group}<GS><FS>
{name}<GS>{value}<GS>{units}<GS>{exception group}<ETB><GS><FS> etc.

where:

<GS> is the ASCII control character Group Separator (29 decimal)

<FS> is the ASCII control character Field Separator (28 decimal)

<ETB>is the ASCII control character End of Transmission Block (23 decimal)

The allowable set of characters for each of the groups (name, value, units, and exceptions) is normally the set of all printable ASCII characters (codes 20 through 126, decimal). However, the value for the Patient First Name (iFNAME) and Patient Last Name (iLNAME) fields can use any ASCII or UTF-8 encoded Unicode characters.

The <GS> character terminates each group, including null groups. That is, every field in the record contains exactly 4 <GS> characters.

The <FS> character terminates every field of the record.

The <ETB> character terminates an exception group.

The number and ordering of the fields within the record is generally unconstrained.

The following example shows the complete structure of a sample data message from a RAPIDLab 1200 system. The parameters listed in the example are a subset of the actual parameters that can be transmitted. Refer to Appendix A, *Variables,* for a complete list of parameters.

In the sample data message that follows, the identifier record, SMP_EDIT_DATA, indicates that the data record contains patient sample data that was recalled and edited at the RAPIDLab 1200 system. Within the data record, the RAPIDLab 1200 system identifies itself by the model number (aMOD), 1265, and the device ID (iIID), 12345. The patient identifier (iPID) is entered as 25.

<STX>SMP_EDIT_DATA<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>11Apr2012<GS><GS><GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>16:20:36
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS>
rRCartID<GS>970506816<GS><GS><GS><FS>rWCartID<GS>970506918
<GS><GS><GS><FS>mpH<GS><GS><GS>QUES<ETB><GS><FS>mPCO2<
GS><GS>mmHg<GS><<ETB><GS><FS>mPO2<GS>183.3<GS>mmHg<GS>
<GS><FS>mNa+<GS>118.5<GS>mmol/L<GS><GS><FS>mK+<GS>5.25<GS>
mmol/L<GS><GS><FS>mCa++<GS>0.76<GS>mmol/L<GS><GS><FS>mCl
<GS>91<GS>mmol/L<GS><GS><FS>mGlucose<GS>60<GS>mg/dL<GS>
<GS><FS>iPID<GS>25<GS><GS><GS><FS>iLNAME<GS>ARTERY<GS>
<GS><GS><FS>iSEX<GS>M<GS><GS><GS><FS>iDOB<GS>12Dec1932
<GS><GS><GS><FS>iROOM<GS>2525<GS><GS><GS><FS>iDID<GS>25
<GS><GS><GS><FS>iDATE<GS>11Apr2012<GS><GS><GS><FS>
iTIME<GS>16:20<GS><GS><GS><FS>iACC<GS>47<GS><GS><GS><FS>
iOID<GS>42<GS><GS><GS><FS>iTEMP<GS>37.0<GS>C<GS><GS><FS>
itHb<GS>14.0<GS>g/dL<GS><GS><FS>iFIO2<GS>23.0<GS>%<GS><GS>
<FS>iFlow<GS>27.00 <GS>L/min<GS><GS><FS>iRR<GS>17.0<GS>bpm
<GS><GS><FS>cPO2/FIO2<GS><GS>mmHg/%<GS>><ETB><GS><FS>
cPO2<GS>183.3<GS>mmHg <GS><GS><FS><RS><ETX>{chksum}<EOT>

In the sample data message that follows: the identifier, QC_NEW_DATA, indicates that the data record contains Quality Control information from the RAPIDLab 1200 system. The record status (iSTATUS) for this QC result is "ACCEPTED". The level (iQLEV) is "1", and the material type (iQID) is "AQC1" indicating that the sample was from Automatic QC.

<STX>QC_NEW_DATA<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>11038<GS><GS><GS><FS>rDATE<GS>25Mar2012<GS><GS><GS><FS>
rDEVICE<GS>AQC<GS><GS><GS><FS>rTIME<GS>02:02:26<GS><GS><GS><FS>
rTYPE<GS>QC<GS><GS><GS><FS>rSEQ<GS>138921<GS><GS><GS><FS>
rRCartID<GS>2611502003<GS><GS><GS><FS>rWCartID<GS>608005401<GS><GS>
<GS><FS>iQLEV<GS>1<GS><GS><GS><FS>iQID<GS>AQC1<GS><GS><GS><FS>
rAQCID<GS>1144148855<GS><GS><GS><FS>iSTATUS<GS>ACCEPTED<GS>
<GS><GS><FS>sLQmpH<GS>7.130<GS> <GS><GS><FS>mpH<GS>7.151<GS>
<GS><GS><FS>sHQmpH<GS>7.170<GS> <GS><GS><FS>sLQmPCO2<GS>63.6
<GS>mmHg<GS><GS><FS>mPCO2<GS>68.1<GS>mmHg<GS><GS><FS>
sHQmPCO2<GS>76.4<GS>mmHg<GS><GS><FS>sLQmPO2<GS>139.0<GS>mmHg
<GS><GS><FS>mPO2<GS>149.2<GS>mmHg<GS><GS><FS>sHQmPO2<GS>161.0
<GS>mmHg<GS><GS><FS>sLQmNa+<GS>110.0<GS>mmol/L<GS><GS><FS>
mNa+<GS>115.4<GS>mmol/L<GS><GS><FS>sHQmNa+<GS>120.0<GS>mmol/L
<GS><GS><FS>sLQmK+<GS>2.70<GS>mmol/L<GS><GS><FS>mK+<GS>3.00
<GS>mmol/L<GS><GS><FS>sHQmK+<GS>3.30<GS>mmol/L<GS><GS><FS>
sLQmCa++<GS>1.48<GS>mmol/L<GS><GS><FS>mCa++<GS>1.60<GS>mmol/L
<GS><GS><FS>sHQmCa++<GS>1.72<GS>mmol/L<GS><GS><FS>sLQmCl-
<GS>74<GS>mmol/L<GS><GS><FS>mCl-<GS>80<GS>mmol/L<GS><GS><FS>
sHQmCl-<GS>86<GS>mmol/L<GS><GS><FS>sLQmGlucose<GS>186<GS>mg/dL
<GS><GS><FS>mGlucose<GS>198<GS>mg/dL<GS><GS><FS>sHQmGlucose
<GS>214<GS>mg/dL<GS><GS><FS>sLQmLactate<GS>10.00<GS>mmol/L<GS>
<GS><FS>mLactate<GS>11.88<GS>mmol/L<GS><GS><FS>sHQmLactate
<GS>14.00<GS>mmol/L<GS><GS><FS>sLQmtHb<GS>16.4<GS>g/dL<GS><GS>
<FS>mtHb<GS>17.9<GS>g/dL<GS><GS><FS>sHQmtHb<GS>19.6<GS>g/dL
<GS><GS><FS>sLQmO2Hb<GS>75.0<GS>%<GS><GS><FS>mO2Hb<GS>78.3
<GS>%<GS><GS><FS>sHQmO2Hb<GS>81.0<GS>%<GS><GS><FS>sLQmCOHb
<GS>-1.5<GS>%<GS><GS><FS>mCOHb<GS>2.8<GS>%<GS><GS><FS>
sHQmCOHb<GS>8.5<GS>%<GS><GS><FS>sLQmMetHb<GS>12.4<GS>%<GS>
<GS><FS>mMetHb<GS>16.2<GS>%<GS><GS><FS>sHQmMetHb<GS>19.6<GS>
%<GS><GS><FS>sLQmHHb<GS>-1.5<GS>%<GS><GS><FS>mHHb<GS>2.7
<GS>%<GS><GS><FS>sHQmHHb<GS>6.5<GS>%<GS><GS><FS>mBP<GS>755
<GS>mmHg<GS><GS><FS><RS><ETX>(checksum)<EOT>

Data Record Field Contents

A data record generally consists of multiple fields, each field containing the results of a particular parameter or the data for an assay (run) variable or a demographic variable.

Each field within a data record must contain the following four parts or groups in this fixed sequence: name, value, units, and exceptions. The ASCII control character <GS> terminates each group in the field. All four group separators must be sent, even if one or more of the groups is null.

Often the exceptions group, which conveys an abnormal condition for a parameter, is null. In some cases, the value group is null when the exceptions group contains an exception. The value group and the exceptions group cannot both be null. The name group cannot be null. The units group can be null. Two examples from data records are described in the table below.

This field . . .	*Means that . . .*
mNa+<GS>140.3<GS>mmol/L <GS><GS><FS>	the parameter measured Na^+ (sodium-ion concentration) has a value of 140.3, the units of measure are millimoles per liter, and there are no exceptions.
mPCO2<GS><GS>mmHg<GS>< <ETB><GS><FS>	the parameter measured pCO_2 (carbon dioxide [partial pressure]) has no reported value, the units of measure are millimeters of mercury, and a sample below reporting range (<) exception is reported.

The sections that follow describe the content and format of each of the four groups.

Name Group

Each name group is a string of ASCII characters of arbitrary length corresponding to a variable name. A name group is the first group of every field in the record. Refer to Appendix A, *Variables*, for a list of variable names.

The case of each character (upper case or lower case) is significant. The first character of the name is always lower case and provides the following information:

This character . . .	*Indicates that the variable is . . .*
m	measured by the system.
c	calculated by the system.
i	entered by an operator.
a, r, s	assigned by the system.

Any field can be omitted from a data record if no value or exception is being reported. The LIS must be able to receive fields in any order.

NOTE: The manufacturer reserves the right at any time without notice to change the fields and the order of fields that the RAPIDLab 1200 system transmits.

Value Group

Each value group is typically a string of ASCII characters of arbitrary length, corresponding to the value of the variable in that field. The value group is the second group of every field in the record and immediately follows the name group. Refer to Appendix A, *Variables*, for the format of variable values.

All parameter variables have numeric values. Other variables have alphanumeric values. nBili has the potential to send a qualitative result of <2, indicating that the result is below the 2 mg/dL reporting threshold.

Dates are sent in the format nnAaannnn, consisting of two digits for day of the month, a three-character abbreviation of the month, and all four digits of the year.

Month abbreviations are: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec.

Times are sent in the format nn:nn:nn in standard 24-hour time. The exception to this is iTIME, which is sent in the format nn:nn.

Units Group

Each units group is a string of ASCII characters of arbitrary length, corresponding to the unit of measure for a parameter value. The units group is the third group of every field in the record. The units group is always null for any variables, such as patient last name, that are not parameters. Refer to Appendix B, *Data Records*, for a list of units of measure.

The units transmitted in the units group are those selected at the RAPIDLab 1200 system for reporting results for each parameter. Some parameters have fixed units, in which case the data in the units group for each of these parameters is always the same. For example, the units for Na^+ are always mmol/L. Certain parameters do not report units, in which case the units group is null. For example, the units group is null for any parameters for which the results are reported as decimal fractions.

Exception Group

Each exception group is a string of ASCII characters of arbitrary length, corresponding to the mnemonics for abnormal conditions. If exceptions are transmitted, they are delimited by a trailing <ETB> (23 decimal). The exception group is the last group in the field.

The format of the exception group depends on the number of exceptions:

This format is sent . . .	*When there are . . .*
<GS>	no exceptions.
exception<ETB><GS>	one exception.
exception<ETB> exception<ETB><GS>	two exceptions.

An exception group in the field of a data record can provide additional encoded information about the parameter value reported. An exception group identifies data that is outside the reporting or established range for patient or QC samples, respectively, and other conditions that affect interpretation of the results for the parameter. It is, of course, the operator's responsibility to accept or reject any parameter result received with an associated exception.

Any exception code supported by the RAPIDLab 1200 system can be reported for measured parameters. Only the exception code for out of reporting range flags can be reported for calculated parameters.

The following exception codes can be transmitted with patient and QC sample results:

Code	*Meaning*
<	below reporting range
>	above reporting range
H	above established range for patient or QC
L	below established range for patient or QC
QUES	questionable result for this parameter
SULF	CO-ox results corrected for sulfHb interference
CTEMP	CO-ox results are unavailable because of a CO-ox temperature problem
COOXERR	CO-ox error occurred
INTERF	interfering substance on Glucose or Lactate (patient samples only)
NEP	result did not endpoint within timeout period
NOISE	Sensor noise
SENSOR	Glucose or Lactate sensor connection error
BUB	bubbles detected in the sample
MIC	user-initiated microsample
MQV	system-initiated microsample

NOTE: If an nBili value falls below the 2.0 mg/dL (34 µmol/L) reporting range, a value of "<2" (or "<34") is transmitted to the LIS without an exception code.

The following codes can be transmitted with calibration data:

Code	*Meaning*
<	below reporting range
>	above reporting range
OFFO	electrode offset out of range
SLPO	electrode slope out of range
DRIFT	electrode drift or interfering substance on glucose sensor or electrode noise
CALREP	repeating calibration because it failed
COOXERR	CO-ox error occurred
NEP	result did not endpoint within timeout period
NOISE	Sensor noise
SENSOR	Glucose or Lactate sensor connection error

NOTE: For CO-ox, the variable name is aZmtHb if the CO-ox zero failed.

Example of Analytical Range Limit Exception

NOTE: The example below does not show all transactions and messages are not shown in their entirety.

In the example below, measured parameters that exceed the configured Analytical Range limit value include the > or < symbol next to the limit value that was exceeded, and the limit values are bolded. This data is included within the Group Separators for the given measured parameter. For example, <GS>>**7.2**<GS>.

<STX>SMP_NEW_DATA<FS>

<RS>aMOD<GS>1265<GS><GS><GS><FS>iIID<GS>12279<GS><GS><GS>
<FS>rDATE<GS>02Feb2012<GS><GS><GS><FS>rDEVICE<GS>SYRINGE
<GS><GS><GS><FS>rTIME<GS>09:15:57<GS><GS><GS><FS>rTYPE<GS>
SAMPLE<GS><GS><GS><FS>iSOURCE<GS>ARTERIAL<GS><GS><GS>
<FS>rSEQ<GS>980020<GS><GS><GS><FS>rRCartID<GS>2931501702<GS>
<GS><GS><FS>rWCartID<GS>922401401<GS><GS><GS><FS>mpH
<GS>**<7.2**<GS><GS><GS><FS>mPCO2<GS><GS>mmHg<GS>QUES<ETB>
<GS><FS>mPO2<GS>140.1<GS>mmHg<GS><GS><FS>mNa+<GS>122.3
<GS>mmol/L<GS><GS><FS> mK+<GS>**<6**<GS>mmol/L<GS><GS>
<FS> mCa++<GS>**<2**<GS>mmol/L<GS><GS><FS> mCl-<GS><GS>
mmol/L<GS>QUES<ETB><GS><FS> mGlucose<GS>**<200**<GS>mg/dL
<GS><GS><FS> mLactate<GS>**>1.6**<GS>mmol/L<GS> <GS><FS>mtHb
<GS>**>13**<GS> g/dL<GS><GS><FS> mnBili<GS>20.4<GS>mg/dL
<GS>H<ETB><GS><FS> mBP<GS>765<GS>mmHg<GS><GS>
<FS> iPID<GS>666<GS><GS><GS><FS> iSEX<GS>M<GS><GS>
<GS><FS>iDOB<GS>08Aug1988<GS><GS><GS><FS>iDATE<GS>
02Feb2012<GS><GS><GS><FS>iOID<GS>123<GS><GS><GS><FS>iTEMP
<GS>42.0<GS>C<GS><GS><FS> iFIO2<GS>45.0<GS>%<GS><GS>
<FS> cPO2/FIO2<GS>3.11<GS>mmHg/%<GS><GS><FS>cPO2<GS>
174.2<GS> mmHg<GS><GS><FS>
<RS><ETX>82<EOT>

4 Message Transfer

The protocol uses message acknowledgments and message retry on no acknowledgment. The system's communication protocol builds the message to be transmitted into a frame that includes a checksum for error detection.

Acknowledgment Format

The format of an acknowledgment is as follows:

<STX><ACK><ETX>{chksum}<EOT>

where:

<STX> is the ASCII control character Start of Text (02 decimal)

<ACK> is the ASCII control character Acknowledge (06 decimal)

<ETX> is the ASCII control character End of Text (03 decimal)

<EOT> is the ASCII control character End of Transmission (04 decimal)

This transmission format is identical to the format used for message transmissions and therefore allows the interrupt mechanism to easily detect start and end of transmissions.

Message Acknowledgment

The LIS and the RAPIDLab 1200 system perform the following functions to implement the acknowledgment protocol.

If . . .	*Then . . .*
the system has a message to transmit to the LIS	the system transmits the message and starts a timer. The system then waits to receive an acknowledgment from the receiver, and sets the variable RETRY = FALSE (transaction started).
the LIS receives a good message (no parity/framing errors or checksum error)	the LIS transmits an acknowledgment to the system, and passes the message onto higher levels of the application code.
the system timer expires and RETRY = FALSE	the system retransmits the message and restarts the timer. The system also sets the variable RETRY = TRUE.
the system timer expires and RETRY = TRUE	the system logs an error (transaction complete).

(Continued)

If . . .	*Then . . .*
the system receives a bad message	the system ignores the message.
the system receives an acknowledgment message from the LIS	the system stops the timer (transaction complete).

The retry timer that the system (or LIS) implements does not start until the last character in the message has been transmitted. The timer duration depends upon baud rate, as follows:

Baud	19200	9600	4800	2400	1200
Timer (secs)	5	6	8	11	17

The checksum for this fixed content acknowledgment is 0B, making the acknowledgment message:

<STX><ACK><ETX>{chksum}<EOT>

Error Detection

The protocol includes a checksum that consists of two ASCII characters that represent a two-character hexadecimal number in the range 00 through FF.

The hexadecimal number is generated by performing a modulo-256_{10} summation of all the previous characters in the frame (that is., over the range <STX>. . .<ETX>, inclusive) and then expressing the resulting 8-bit unsigned integer in hexadecimal format.

For example, consider the following ID_DATA message:

<STX>ID_DATA<FS><RS>aMOD<GS>LIS<GS><GS><GS>
<FS>iIID<GS>333<GS><GS><GS><FS><RS><ETX>84<EOT>

The aMOD field must be LIS as shown, but the iIID field can be any alphanumeric characters (up to 6).

The summation of the value of each character in the string and the resulting hexadecimal number are described following table:

	Decimal	*Hexadecimal*
Summation	1924	784
Modulo 256_{10}	132	84

The checksum is transmitted as the two ASCII characters 8 and 4 (8 is 56 decimal, hex 38, and 4 is 52 decimal, hex 34).

Maximum Transmission Size

The RAPIDLab 1200 system transmits messages of up to 2500 characters, including all control characters and the checksum.

Examples Using the Protocol

This section provides three examples that describe some of the messages transmitted using the communication protocol.

Example A: Device Identify Transaction

Example A describes the messages transmitted during system port configuration. The content of the messages is explained in the message key following the transaction table. The LIS must respond with the correct ID_DATA message for the system to recognize the LIS connection and allow transmission of further messages.

The ID_REQ/ ID_DATA transaction described in the following table is initiated on system or port start-up by the RAPIDLab 1200 system and is required for the LIS to conform to the protocol.

RAPIDLab 1200 System		*LIS*
ID Request (Message 1)	→	
	←	Acknowledge (Message 2)
	←	ID data (Message 3)
Acknowledge (Message 2)	→	

NOTE: The acknowledge message must be issued within the retry time for the specified baud rate.

Message Key:

Message 1

<STX>ID_REQ<FS><RS><ETX>13<EOT>

Message 2

<STX><ACK><ETX>{chksum}<EOT>

Message 3

<STX>ID_DATA<FS><RS>aMOD<GS>LIS<GS><GS><GS><FS>iIID
<GS>333<GS><GS><GS><FS><RS><ETX>84<EOT>

Example B: Patient Sample Analysis

Example B describes the messages transmitted during a typical patient sample analysis for a RAPIDLab 1200 system. The content of the messages is explained in the message key following the transaction table.

RAPIDLab 1200 System		*LIS*
System Not Ready (Message 1)	→	
	←	Acknowledge (Message 2)
Sample Start (Message 3)	→	
	←	Acknowledge (Message 2)
System Waiting (Message 4)	→	
	←	Acknowledge (Message 2)
System Measuring (Message 5)	→	
	←	Acknowledge (Message 2)
New Sample Available (Message 6)	→	
	←	Acknowledge (Message 2)
	←	Sample Request (Message 7)
Acknowledge (Message 2)	→	
Sample New Data (Message 8)	→	
	←	Acknowledge (Message 2)
System Ready (Message 9)	→	
	←	Acknowledge (Message 2)

Message Key:

Message 1

<STX>SYS_NOT_READY<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan2012<GS><GS><GS>
<FS>aTIME<GS>13:33:17<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 2

<STX><ACK><ETX>{chksum}<EOT>

Message 3

<STX>SMP_START<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan2012<GS><GS><GS>
<FS>aTIME<GS>13:33:19<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 4

<STX>SYS_WOPR<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan2012<GS><GS><GS>
<FS>aTIME<GS>13:33:41<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 5

<STX>SYS_MEASURING<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan2012<GS><GS><GS>
<FS>aTIME<GS>13:33:44<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 6

<STX>SMP_NEW_AV<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS><RS>
<ETX>{chksum}<EOT>

Message 7

<STX>SMP_REQ<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID<GS>
12345<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS><RS><ETX>
{chksum}<EOT>

Message 8

<STX>SMP_NEW_DATA<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>20Jan2012<GS><GS><GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>13:33:15
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS>
rRCartID<GS>834437404<GS><GS><GS><FS>rWCartID<GS>834437505
<GS><GS><GS><FS>mpH<GS>7.391<GS><GS><GS><FS>mPCO2<GS>25.3<GS
>mmHg<GS>L<ETB><GS><FS>mPO2<GS>181.1<GS>mmHg<GS>H
<ETB><GS><FS>mNa+<GS>155.6<GS>mmol/L<GS>H<ETB><GS><FS>mK+
<GS>3.11<GS>mmol/L<GS>L<ETB><GS><FS>mCa++<GS>1.63<GS>mmol/L
<GS>L<ETB><GS><FS>mCl-<GS>121<GS>mmol/L<GS>H<ETB><GS><FS>
mGlucose<GS>41<GS>mg/dL<GS>L<ETB><GS><FS>mLactate<GS>55<GS>
mg/dL<GS><ETB><GS><FS>iPID<GS>123<GS><GS><GS><FS>iLNAME
<GS>AV-A<GS><GS><GS><FS>iSEX<GS>F<GS><GS><GS><FS>iDOB
<GS>12Dec1932<GS><GS><GS><FS>iROOM<GS>556325884<GS><GS>
<GS><FS>iDID<GS>321456<GS><GS><GS><FS>iDATE<GS>20Jan2012
<GS><GS><GS><FS>iTIME<GS>14:30<GS><GS><GS><FS>iACC<GS>
9876543210<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS><FS>iTEMP
<GS>35.9<GS>C<GS><GS><FS>iFIO2<GS>50.0<GS>%<GS><GS><FS>
iFlow<GS>12.00<GS>Lmin<GS><GS><FS>iRR<GS>16.0<GS>bpm<GS>
<GS><FS>cHCO3act<GS>15.0<GS>mmol/L<GS><GS><FS>cBE(vv)<GS>
-9.9<GS>mmol/L<GS><GS><FS>ctCO2<GS>15.8<GS>mmol/L<GS><GS>
<FS>cCa++<GS>1.62<GS>mmol/L<GS><GS><FS>cAnGap<GS>22.7<GS>
mmol/L<GS><GS><FS>cPO2/FIO2<GS>3.62<GS>mmHg/%<GS><GS><FS>
cpH<GS>7.407<GS><GS><GS><FS>cPO2<GS>175.2<GS>mmHg<GS><GS>
<FS>cPCO2<GS>24.1<GS>mmHg<GS><GS><FS><RS><ETX>{chksum}
<EOT>

Message 9

<STX>SYS_READY<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan2012<GS><GS><GS>
<FS>aTIME<GS>13:35:32<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS><FS>
<ETX>{chksum}<EOT>

Example C: Edited Patient Sample Data

Example C describes the messages transmitted during the transmission of edited patient sample data (in this case an arterial sample) for a RAPIDLab 1200 system. The content of the messages is explained in the message key following the transaction table.

RAPIDLab 1200 System		*LIS*
System Not Ready (Message 1)	→	
	←	Acknowledge (Message 2)
New Sample Available (Message 3)	→	
	←	Acknowledge (Message 2)
	←	Sample Request (Message 4)
Acknowledge (Message 2)	→	
Edit Sample Data (Message 5)	→	
	←	Acknowledge (Message 2)
System Ready (Message 6)	→	
	←	Acknowledge (Message 2)

Message Key:

Message 1

<STX>SYS_NOT_READY<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>11Apr2012<GS><GS>
<GS>
<FS>aTIME<GS>16:23:30<GS><GS><GS><FS><RS><ETX>{chksum}<EOT>

Message 2

<STX><ACK><ETX>{chksum}<EOT>

Message 3

<STX>SMP_NEW_AV<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS><RS>
<ETX>{chksum}<EOT>

Message 4

<STX>SMP_REQ<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID<GS>
12345<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS><RS><ETX>
{chksum}<EOT>

Message 5

<STX>SMP_EDIT_DATA<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>11Apr2012<GS><GS>
<GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>16:20:36
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS>
rRCartID<GS>970506816<GS><GS><GS><FS>rWCartID<GS>970506918
<GS><GS><GS><FS>mpH<GS><GS><GS>QUES<ETB><GS><FS>mPCO2
<GS><GS>mmHg<GS><<ETB><GS><FS>mPO2<GS>183.3<GS>mmHg<GS>
<GS><FS>mNa+<GS>118.5<GS>mmol/L<GS><GS><FS>mK+<GS>5.25<GS>
mmol/L<GS><GS><FS>mCa++<GS>0.76<GS>mmol/L<GS><GS><FS>mCl
<GS>91<GS>mmol/L<GS><GS><FS>mGlucose<GS>60<GS>mg/dL<GS>
<GS><FS>iPID<GS>25<GS><GS><GS><FS>iLNAME<GS>
ARTERY<GS><GS><GS><FS>iSEX<GS>M<GS><GS><GS><FS>iDOB<GS>
12Dec1912<GS><GS><GS><FS>iROOM<GS>2525<GS><GS><GS><FS>iDID
<GS>25<GS><GS><GS><FS>iDATE<GS>11Apr2012<GS><GS><GS>
<FS>
iTIME<GS>16:20<GS><GS><GS><FS>iACC<GS>47<GS><GS><GS><FS>
iOID<GS>42<GS><GS><GS><FS>iTEMP<GS>37.0<GS>C<GS><GS><FS>
itHb<GS>14.0<GS>g/dL<GS><GS><FS>iFIO2<GS>23.0<GS>%<GS><GS>
<FS>iFlow<GS>27.00<GS>L/min<GS><GS><FS>iRR<GS>17.0<GS>bpm
<GS><GS><FS>cPO2/FIO2<GS><GS>mmHg/%<GS>><ETB><GS><FS>cPO2
<GS>183.3<GS>mmHg <GS><GS><FS><RS><ETX>{chksum}<EOT>

Message 6

<STX>SYS_READY<FS><RS>aMOD<GS>1265<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>11Apr2012<GS><GS><GS>
<FS>aTIME<GS>16:24:11<GS><GS><GS><FS><RS><ETX>{chksum}<EOT>

5 Physical Interface

Architecture

The basic architecture is point-to-point communications between the LIS and the RAPIDLab 1200 system.

Hardware Link

The hardware link consists of a serial asynchronous (RS-232) interface.
Communication is normally full duplex at one of the following user-selected baud rates:

- 19200
- 9600
- 4800
- 2400
- 1200

The system interface port is equipped with a 9-pin, D-type, male connector.

The systems are considered to be Data Terminal Equipment (DTE). The DTE lines that are supported are listed below.

DTE Line	*Pin Number*
Data Carrier Detect (not used)	Pin 1
Received Data	Pin 2
Transmitted Data	Pin 3
Data Terminal Ready (not used)	Pin 4
Signal Ground	Pin 5
Data Set Ready (not used)	Pin 6
Request to Send (not used)	Pin 7
Clear to Send (not used)	Pin 8
Ring Indicator (not used)	Pin 9

Character Format

You can select two character format options when you select the LIS communication parameters in setup at the RAPIDLab 1200 system.

Option	*Selection*
data bits	7 bits, 8 bits
parity	odd, even, none

The stop bits are set to 1.

NOTE: If using an RS-232 connection and transmitting Unicode characters for patient names, the connection must be configured to use 8 data bits (the default) and not be changed to use 7 data bits.

TCP/IP Connection

The following criteria must be met to establish a connection between the RAPIDLab 1200 system and a Laboratory Information System (LIS):

- LIS sends the TCP/IP connection request on port #3001 to the IP address or DHCP name of the RAPIDLab 1200 system.
- There is a double acknowledgement. The LIS acknowledgement is needed in addition to the low level TCP/IP packet acknowledgement.
- This protocol only supports 802.3 (Ethernet) networking.
- The physical interface is 10BaseT, RJ45 connector.

Appendix A: Variables

The tables in this appendix list the fields that can appear in messages sent by either the RAPIDLab 1200 system or the LIS.

Parameter Variables

The variable names listed in the table below are the parameters for the RAPIDLab 1200 system. The lowercase prefix at the beginning of each variable name to indicate that the parameter is measured (m) or calculated (c). For example, AnGap becomes cAnGap.

Variable Name	*Parameter*	*Unit of Measure*
mpH	pH	pH units
mH+	H^+	mmol/L
mPCO2	pCO_2	mmHg or kPa
mPO2	pO_2	mmHg or kPa
mNa+	Na^+	mmol/L
mK+	K^+	mmol/L
mCa++	Ca^{++}	mmol/L or mg/dL
mCl–	Cl^-	mmol/L
mGlucose	Glu	mg/dL or nmol/L
mLactate	Lac	mmol/L or mg/dL
mtHb	tHb	g/dL, g/L, mmol/L
mO2Hb	FO_2Hb	% or decimal
mCOHb	*F*COHb	% or decimal
mMetHb	*F*MetHb	% or decimal
mHHb	*F*HHb	% or decimal
mPO2(v)	pO_2(v)	mmHg or kPa
mtHb(v)	tHb(v)	g/dL, g/L, mmol/L
mO2Hb(v)	O_2Hb(v)	% or decimal
mBP	*p*Atm	mmHg or kPa
mnBili	nBili	mg/dL or µmol/L
cHCO3act	HCO_3–act	mmol/L

(Continued)

Variable Name	*Parameter*	*Unit of Measure*
cHCO3std	HCO_3–std	mmol/L
cBE(vt)	BE(B)	mmol/L
cBE(vv)	BE(ecf)	mmol/L
ctCO2	*c*tCO_2	mmol/L
cCa++	Ca^{++}(7.4)	mmol/L or mg/dL
cAnGap	AnGap	mmol/L
cO2SAT	O_2SAT(est)	% or decimal
cO2(CT)	O_2CT	mL/dL, mL/L, or mmol/L
cPO2/FIO2	*p*O_2/F_IO_2	mmHg% or kPa%
cpH	pH(T)	pH units
cH+	H^+(T)	nmol/L
cPCO2	pCO_2(T)	mmHg or kPa
cPO2	pO_2(T)	mmHg or kPa
cRI	RI(T)	% or decimal
cSO2*	*s*O_2	% or decimal
msO2*	*s*O_2	% or decimal
cHct	Hct	% or decimal
cO2CAP	BO_2	mL/dL, mL/L, mmol/L
cA-aDO2	*p*O_2(A-a)(T)	mmHg, kPa
ca/A	*p*O_2(a/A)(T)	% or decimal
cP50	*p*50	mmHg, kPa
cQsp/Qt	$\dot{Q}$sp/$\dot{Q}$t(T)	% or decimal
cQsp/Qt(est)	$\dot{Q}$sp/$\dot{Q}$t(T)(est)	% or decimal
cctO2(Hb)	*c*tO_2(Hb)	mL/dL, mL/L, mmol/L
cctO2(a)	*c*tO_2(a)	mL/dL, mL/L, mmol/L
cctO2(v)	*c*tO_2($\bar{v}$)	mL/dL, mL/L, mmol/L
cctO2(v)	*c*tO_2(v)	mL/dL, mL/L, mmol/L
cctO2(a-v)	*c*tO_2(a-$\bar{v}$)	mL/dL, mL/L, mmol/L
cctO2[(a-v)/a]	*c*tO_2([a-$\bar{v}$]/a)	% or decimal

Variable Name	Parameter	Unit of Measure
cDO2	$\dot{D}O_2$	mL/min, L/min, mmol/min
cVO2	$\dot{V}O_2$	mL/min, L/min, mmol/min

* The user can choose to report the s02 parameter as cS02 or ms02. cS02 is the default.

Entered Variables

Entered variables are indicated by the prefix i (input). These variables can be patient or sample demographic values, such as iPID (patient ID) and iSOURCE (sample source). They can also be values that relate to the configuration of QC files, such as iQLEV (an identifier of QC). The units for the variables listed below are all null fields, unless otherwise noted.

NOTE: RAPIDLab 1200 system supports sending and receiving transmissions of ASCII and UTF-8 encoded Unicode characters in the Patient First Name (iFNAME) and Patient Last Name (iLNAME) demographic fields to and from an LIS.

Variable Name	Variable Description
iPID	patient ID
iFNAME	patient first name
iLNAME	patient last name (surname)
iSEX	patient sex (M, F, or U)
iDOB	patient birth date
iROOM	patient location
iDID	physician ID
iDATE	patient sample collection date
iTIME	patient sample collection time
iACC	accession number
iOID	operator ID
iTEMP	temperature C or F
itHb	concentration of total hemoglobin g/dL, g/L, or mmol/L
iFIO2	fraction of inspired oxygen % or decimal

Variable Name	*Variable Description*
iFlow	oxygen flow L/min
iRR	Resp. Rate b/min
iOBF	O_2 binding factor decimal
ictO2(a-v)	arterial-mixed venous oxygen content difference mL/dL, mL/L, mmol/L
iQt	cardiac output L/min
iQDATE	QC expiration date
iQID	QC material identifier
iQLEV	level identifier of QC material
iQLOT	lot identifier of QC material
iSOURCE	sample source (ARTERIAL, VENOUS, CAPILLARY, ARTERIAL-VENOUS, OR MIXEDV)
iSTATUS	whether QC sample results should be ACCEPTED or REJECTED **NOTE**: Recalled QC samples can be rejected and re-sent to the LIS in a QC_NEW_DATA message with an updated iSTATUS field of REJECTED (previously sent as ACCEPTED following analysis).

Assay (Run) Variables

Assay variables are included in patient sample data, QC data, and calibration data records to distinguish one analysis (run) from another, and also to identify the type of analysis performed. Assay variables are prefixed by the letter r. The rSEQ variable appears in messages that indicate the availability of data and is required in messages requesting data. The assay variables are listed in the following table:

Variable Name	*Variable Description*
rDATE	analysis data
rDEVICE	sample device (CAPILLARY, SYRINGE, AMPULE, or AQC)
rSEQ	sequence number for this analysis
rTIME	time of analysis
rRCartID	serial number of reagent cartridge
rWCartID	serial number or wash cartridge
rAQCID	serial number of AutomaticQC cartridge

Variable Name	Variable Description
rTYPE	analysis type (SAMPLE, OPMICRO, or SYSMICRO) if *Microsample Flagging* is enabled on the RAPIDLab 1200 system, rTYPE is sent as OPMICRO if the operator initiated the sample as a microsample, or SYSMICRO if the system detected a sampling issue and converted the sample to a microsample
rAVSEQ	sequence number for an a-v study report where the sequence number is the combination of the sequence number of the arterial sample and the mixed-venous sample with a slash (/) separating the two numbers

System Variables

The system variables aMOD and iIID are included in all data records except the Device Identity request (ID_REQ). The LIS must provide the aMOD field as LIS in the ID_DATA message.

NOTE: The calibration data fields aCmname, aCdname, aSmname, and aSdname also represent system variables.

System variables are prefixed by the letter a, except IID, which is prefixed by the letter i. In the system variable, *name* is replaced by the name of a particular parameter. For example, aCmname becomes aCmPO2 when the calibration point of pO_2 is measured.

System Variable	Variable Description
aMOD	model number (system identifier)
iIID	instrument identifier
aCmname	cal point measured of parameter named
aCdname	cal point drift of parameter named
aSmname	slope point measured of parameter named
aSdname	slope drift of parameter named
aZmtHb	CO-ox zero calibration failed

Setup Variables

The setup variable sDISname appears in the data record that the system sends in the Parameter Enabled/Disabled transaction. Setup variable sHQname and sLQname may be included in QC data records to indicate high and low limits entered into the system for the target range. Setup variables are prefixed by the letter *s*.

In the setup variable, *name* is replaced by the name of a particular parameter. For instance, sDISname becomes sDISGlucose when the Glucose parameter has been disabled.

Setup Variable	*Variable Description*
sDISname	disable channel for parameter named
sHQname	high QC warning limit of parameter named
sLQname	low QC warning limit of parameter named

Refer to *Parameter Selection Data Record* in Appendix B for the variable names.

Appendix B: Data Records

Appendix B contains the following data records:

- patient sample assay
- QC
- calibration
- parameter selection

The following table is a key to interpreting all value formats described in Appendix B. Use of the letter n in parentheses in the value field indicates variance in parameter resolution based on the units of measure in which the RAPIDLab 1200 system reports the results.

Value	*Description*
n	integer (0 through 9)
.	decimal point
A	upper case alphabetic character (A through Z)
a	lower case alphabetic character (a through z)

Patient Sample Assay Data Record

The following table lists the variables included in the patient sample assay data record.

Variable Name	*Value*	*Unit of Measure*
aMOD	12nn	null field
iIID	up to 6 alphanumeric characters	null field
rRCartID	up to 10 alphanumeric characters	null field
rWCartID	up to 10 alphanumeric characters	null field
rTYPE	SAMPLE, COMBINED, OPMICRO, SYSMICRO	null field
rSEQ	nnnnn...(2^{32})	null field
rAVSEQ	nnnnn...(2^{32})/nnnnn...(2^{32})	null field
iACC	up to 13 alphanumeric characters	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
iPID	up to 13 alphanumeric characters	null field
iFNAME	up to 15 characters	null field
iLNAME	up to 15 characters	null field
iDATE	nnAaannnn	null field
iTIME	nn:nn	null field
iOID	up to 13 alphanumeric characters	null field
iROOM	up to 11 alphanumeric characters	null field
iDOB	nnAaannnn	null field
iSEX	M, F, or U	null field
iDID	up to 13 alphanumeric characters	null field
iSOURCE	ARTERIAL VENOUS CAPILLARY ARTERIAL-VENOUS MIXEDV	null field
rDEVICE	SYRINGE CAPILLARY	null field
mpH	n.nnn	null field
or		

Variable Name	*Value*	*Unit of Measure*
mH+	nnnn.n	nmol/L
mPCO2	nnn.n nn.nn	mmHg kPa
mPO2	nnn.n nn.nn	mmHg kPa
mNa+	nnn.n	mmol/L
mK+	nn.nn	mmol/L
mCa++	n.nn nn.n	mmol/L mg/dL
mCl-	nnn	mmol/L
mGlucose	nnn nn.n	mg/dL mmol/L
mLactate	nn.nn nnn.n	mmol/L mg/dL
mtHb	nn.n nnn nn.n	g/dL g/L mmol/L
mO2Hb	nnn.n n.nnn	% null field
mCOHb	nnn.n n.nnn	% null field
mMetHb	nnn.n n.nnn	% null field
mHHb	nnn.n n.nnn	% null field
mBP	nnn nnn.n	mmHg/% kPa/%
mnBili	nn.n nnnn	mg/dL umol/L
cHCO3act	nn.n	mmol/L
cHCO3std	nn.n	mmol/L
cBE(vt)	nn.n	mmol/L
cBE(vv)	nn.n	mmol/L
ctCO2	nn.n	mmol/L
cCa++	n.nn nn.n	mmol/L mg/dL

Variable Name	*Value*	*Unit of Measure*
cAnGap	nn.n	mmol/L
cO2SAT	nnn.n	%
	n.nnn	null field
cO2(CT)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cPO2/FIO2	n.nn	mmHg/%
	n.nnn	kPa/%
cpH	n.nnn	null field
or		
cH+	nnnn.n	nmol/L
cPO2	nnn.n	mmHg
	nn.nn	kPa
cPCO2	nnn.n	mmHg
	nn.nn	kPa
cRI	nn.nn	null field
	nnnn	%
cSO2*	nnn.n	%
	n.nnn	null field
msO2*	nnn.n	%
	n.nnn	null field
cHct	nn	%
	n.nn	null field
cO2CAP	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cA-aDO2	nnn.n	mmHg
	nnn.nn	kPa
ca/A	n.nn	null field
	nnn	%
cP50	nn.n	mmHg
	nn.nn	kPa
cQsp/Qt	nnn	%
	n.nn	null field
cQsp/Qt(est)	nnn	%
	n.nn	null field

Variable Name	*Value*	*Unit of Measure*
cctO2(Hb)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(a)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(v)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(v)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(a-v)	nn.n	mL/dL
	nnn	mL/L
	n.n	mmol/L
cctO2[(a-v)/a]	nnn	%
	n.nn	null field
cDO2	nnnn	mL/min
	n.nn	L/min
	nnn.n	mmol/min
cVO2	nnnn	mL/min
	n.nn	L/min
	nnn.n	mmol/min
mtHb(v)	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
mPO2(v)	nnn.n	mmHg
	nn.nn	kPa
mO2Hb(v)	nnn.n	%
	n.nnn	null field
ictO2(a-v)	nn.n	mL/dL
	nnn	mL/L
	n.n	mmol/L
iOBF	n.nn	null field
iTEMP	nn.n	C
	nnn.n	F
itHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L

Variable Name	*Value*	*Unit of Measure*
iFIO2	nnn.n n.nnn	% null field
iFlow	nn.nn	L/min
iRR	nnn.n	bpm
iQt	nn.nn	L/min

* The user can choose to report the s02 parameter as cS02 or ms02. cS02 is the default.

NOTE: Parameters that are arterial-venous only are entered in Setup and used only in a-v study reports. These parameters are transmitted with data for a-v study reports. OBF and ctO_2(a-v) can also appear in arterial samples that report estimated shunt.

QC Sample Data Record

The following table lists the variables included in the QC data record for gases and analytes.

Variable Name	*Value*	*Unit of Measure*
aMOD	12nn	null field
iIID	up to 6 alphanumeric characters	null field
rRCartID	up to 10 alphanumeric characters	null field
rWCartID	up to 10 alphanumeric characters	null field
rTYPE	QC	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rDEVICE	AQC, SYRINGE, AMPULE	null field
rAQCID	up to 10 alphanumeric characters	null field (only for AutomaticQC)
rTIME	nn:nn:nn	null field
iQID	up to 16 alphanumeric characters	null field
iQLEV	1 alphanumeric character	null field
iQLOT	up to 10 alphanumeric characters	null field (not for AutomaticQC)
iQDATE	nnAaannnn	null field (only for Required QC)

Variable Name	*Value*	*Unit of Measure*
iSTATUS	ACCEPTED or REJECTED	null field
iOID	up to 13 alphanumeric characters	null field
sLQmpH	n.nnn	null field
or		
sLQmH+	nnnn.n	nmol/L
mpH	n.nnn	null field
or		
mH+	nnnn.n	nmol/L
sHQmpH	n.nnn	null field
or		
sHQmH+	nnnn.n	nmol/L
sLQmPCO2	nnn.n nn.nn	mmHg kPa
mPCO2	nnn.n nn.nn	mmHg kPa
sHQmPCO2	nnn.n nn.nn	mmHg kPa
sLQmPO2	nnn.n nn.nn	mmHg kPa
mPO2	nnn.n nn.nn	mmHg kPa
sHQmPO2	nnn.n nn.nn	mmHg kPa
sLQmNa+	nnn.n	mmol/L
mNa+	nnn.n	mmol/L
sHQmNa+	nnn.n	mmol/L
sLQmK+	nn.nn	mmol/L
mK+	nn.nn	mmol/L
sHQmK+	nn.nn	mmol/L
sLQmCl-	nnn	mmol/L
mCl-	nnn	mmol/L

Variable Name	*Value*	*Unit of Measure*
sHQmCl-	nnn	mmol/L
sLQmCa++	n.nn	mmol/L
	nn.n	mg/dL
mCa++	n.nn	mmol/L
	nn.n	mg/dL
sHQmCa++	n.nn	mmol/L
	nn.n	mg/dL
sLQmGlucose	nnn	mg/dL
	nn.n	mmol/L
mGlucose	nnn	mg/dL
	nn.n	mmol/L
sHQmGlucose	nnn	mg/dL
	nn.n	mmol/L
sLQmLactate	nn.nn	mmol/L
	nnn.n	mg/dL
mLactate	nn.nn	mmol/L
	nnn.n	mg/dL
sHQmLactate	nn.nn	mmol/L
	nnn.n	mg/dL
sLQmtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
mtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
sHQmtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
sLQmO2Hb	nnn.n	%
	n.nnn	null field
mO2Hb	nnn.n	%
	n.nnn	null field
sHQmO2Hb	nnn.n	%
	n.nnn	null field
sLQmCO2Hb	nnn.n	%
	n.nnn	null field
mCO2Hb	nnn.n	%
	n.nnn	null field
sHQmCO2Hb	nnn.n	%
	n.nnn	null field

Variable Name	*Value*	*Unit of Measure*
sLQmMetHb	nnn.n n.nnn	% null field
mMetHb	nnn.n n.nnn	% null field
sHQmMetHb	nnn.n n.nnn	% null field
sLQmHHb	nnn.n n.nnn	% null field
mHHb	nnn.n n.nnn	% null field
sHQmHHb	nnn.n n.nnn	% null field
mBP	nnn nnn.n	mmHg kPa
sLQmnBili	nn.n nnn	mg/dL umol/L
mnBili	nn.n nnn	mg/dL umol/L
sHQmnBili	nn.n nnn	mg/dL umol/L

Calibration Data Record

The calibration records sent by a RAPIDLab 1200 system depend upon the type of calibration performed. There are three different calibration sequences:

- 1-point (cal only)
- 2-point (cal and slope)
- 2-point/full (cal, slope, and tHb slope)

Variables reported for a 1-point calibration are shown in the following table:

Variable Name	*Value*	*Unit of Measure*
aMOD	12nn	null field
iIID	up to 6 alphanumeric characters	null field
rRCartID	up to 10 alphanumeric characters	null field

Variable Name	*Value*	*Unit of Measure*
rWCartID	up to 10 alphanumeric characters	null field
rTYPE	1-POINT	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
mBP	nnn nnn.n	mmHg kPa
aCmpH	n.nnn	null field
or		
aCmH+	nnnn.n	nmol/L
aCdpH	n.nnn	null field
or		
aCdH+	nnnn.n	nmol/L
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.nn nn.nnn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.n nn.nn	mmHg kPa
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.n	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCdCa++	n.nn nn.n	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnn	mmol/L

Variable Name	*Value*	*Unit of Measure*
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnn nn.n	mg/dL mmol/L
aCmLactate	nn.nn nnn.n	mmol/L mg/dL
aCdLactate	nn.nn nnn.n	mmol/L mg/dL
aZmtHb (appears only if CO-ox zero failed)	nn.n nnn nn.n	g/dL g/L mmol/L

The 2-point calibration includes all calibration and slope data except tHb. Variables reported for a 2-point calibration are shown in the following table:

Variable Name	*Value*	*Unit of Measure*
aMOD	12nn	null field
iIID	up to 6 alphanumeric characters	null field
rRCartID	up to 10 alphanumeric characters	null field
rWCartID	up to 10 alphanumeric characters	null field
rTYPE	2-POINT	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
mBP	nnn nnn.n	mmHg kPa
aCmpH	n.nnn	null field
or		
aCmH+	nnn.n	nmol/L
aCdpH	n.nnn	null field
or		
aCdH+	nnn.n	nmol/L

Variable Name	*Value*	*Unit of Measure*
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.n nn.nn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.n nn.nn	mmHg kPa
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.n	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCaCa++	n.nn nn.n	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnn	mmol/L
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnn nn.n	mg/dL mmol/L
aCmLactate	nn.nn nnn.n	mmol/L mg/dL
aCdLactate	nn.nn nnn.n	mmol/L mg/dL
aSmpH	n.nnn	null field
or		
aSmH+	nnn.n	nmol/L
aSdpH	n.nnn	null field
or		
aSdH+	nnn.n	nmol/L
aSmPCO2	nnn.n nn.nn	mmHg kPa

Variable Name	*Value*	*Unit of Measure*
aSdPCO2	nnn.n nn.nn	mmHg kPa
aSmPO2	nnn.n nn.nn	mmHg kPa
aSdPO2	nnn.n nn.nn	mmHg kPa
aSmNa+	nnn.n	mmol/L
aSdNa+	nnn.n	mmol/L
aSmK+	nn.nn	mmol/L
aSdK+	nn.nn	mmol/L
aSmCl-	nnn	mmol/L
aSdCl-	nnn	mmol/L
aSmCa++	n.nn n.nn	mmol/L mg/dL
aSdCa++	n.nn n.nn	mmol/L mg/dL
aSmGlucose	nnn nn.n	mg/dL mmol/L
aSdGlucose	nnn nn.n	mg/dL mmol/L
aSmLactate	nn.nn nnn.n	mmol/L mg/dL
aSdLactate	nn.nn nnn.n	mmol/L mg/dL
aZmtHb (appears only if CO-ox zero failed)	nn.n nnn nn.n	g/dL g/L mmol/L

The data record for a 2-point/full calibration shown in the following table includes calibration and slope data including tHb:

Variable Name	*Value*	*Unit of Measure*
aMOD	12nn	null field
iID	up to 6 alphanumeric characters	null field
rRCartID	up to 10 alphanumeric characters	null field

Variable Name	*Value*	*Unit of Measure*
rWCartID	up to 10 alphanumeric characters	null field
rTYPE	2-POINT	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
mBP	nnn nnn.n	mmHg kPa
aCmpH+	n.nnn	null field
or		
aCmmH+	nnn.n	nmol/L
aCdpH+	n.nnn	null field
or		
aCdH+	nnn.n	nmol/L
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.n nn.nn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.n nn.nn	mmHg kPa
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.n	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCdCa++	n.nn nn.n	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnn	mmol/L

Variable Name	*Value*	*Unit of Measure*
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnn nn.n	mg/dL mmol/L
aCmLactate	nn.nn nnn.n	mmol/L mg/dL
aCdLactate	nn.nn nnn.n	mmol/L mg/dL
aSmpH+	n.nnn	null field
or		
aSmH+	nnn.n	nmol/L
aSdpH+	n.nnn	null field
or		
aSdH+	nnn.n	nmol/L
aSmPCO2	nnn.n nn.nn	mmHg kPa
aSdPCO2	nnn.n nn.nn	mmHg kPa
aSmPO2	nnn.n nn.nn	mmHg kPa
aSdPO2	nnn.n nn.nn	mmHg kPa
aSmNa+	nnn.n	mmol/L
aSdNa+	nnn.n	mmol/L
aSmK+	nn.nn	mmol/L
aSdK+	nn.nn	mmol/L
aSmCa++	n.nn n.nn	mmol/L mg/dL
aSdCa++	n.nn n.nn	mmol/L mg/dL
aSmCl-	nnn	mmol/L
aSdCl-	nnn	mmol/L
aSmGlucose	nnn nn.n	mg/dL mmol/L

Variable Name	*Value*	*Unit of Measure*
aSdGlucose	nnn nn.n	mg/dL mmol/L
aSmLactate	nn.nn nnn.n	mmol/L mg/dL
aSdLactate	nn.nn nnn.n	mmol/L mg/dL
aSmtHb	nn.n nnn nn.n	g/dL g/L mmol/L
aSdtHb	nn.n nnn nn.n	g/dL g/L mmol/L
aZmtHb (appears only if CO-ox zero failed)	nn.n nnn nn.n	g/dL g/L mmol/L

Parameter Selection Data Record

This data record is appended to a {CTL_CHAN} identifier record to enable or disable one or more parameters during sample analysis. The enable/disable selection is in effect until it is changed by another {CTL_CHAN} message or by selecting the parameters in Setup at the RAPIDLab 1200 system.

The sDISname variable indicates whether the parameter identified by the variable name should be enabled or disabled. For example, sDISPO2 refers to the parameter PO_2. A 1 (one) in the value group will disable the channel, while a 0 (zero) will enable the channel. sDISpH$^+$ will disable pH or H^+.

Variable Name	*Value*
aMOD	12nn
iIID	up to 6 alphanumeric characters
sDISpH+	0 or 1
sDISPCO2	0 or 1
sDISPO2	0 or 1
sDISNa+	0 or 1
sDISK+	0 or 1
sDISCa++	0 or 1
sDISCl-	0 or 1

Variable Name	Value
sDISGlucose	0 or 1
sDISLactate	0 or 1
sDIStHb	0 or 1

Restore QC Data Record

Variable	Name Value
aMOD	12nn
iIID	up to 6 alphanumeric characters
apH+	0 or 1
aPCO2	0 or 1
aPO2	0 or 1
aNa+	0 or 1
aK+	0 or 1
aCa++	0 or 1
aCl-	0 or 1
aGlucose	0 or 1
aLactate	0 or 1
atHb	0 or 1

Appendix C: HIBC Protocol for Barcode Implementation

Appendix C explains how to use Health Industry Bar Code (HIBC) protocol to enable barcode scanning. The following topics are covered:

- HIBC Protocol
- HIBC Demographics Data Entry Restrictions
- HIBC Message Format
- HIBC Hardware Considerations
- RAPIDLab 1200 System Behavior When HIBC Protocol is Used

HIBC Protocol

The Health Industry Business Communications Council (HIBCC) specification ANSI/HIBC 3.0-2008, *Positive Identification for Patient Safety: Part 1: Medication Delivery,* describes encoding procedures used to implement HIBC patient data messaging for patient wrist band data. This specification is also applicable to RAPIDLab 1200 barcode messaging. This appendix describes HIBC protocol applied to RAPIDLab 1200 messaging.

The following points apply to the use of HBIC protocol with the RAPIDLab 1200 system:

- HIBC supports 2D and RFID serial data entry.
- All QC data entry requires 1D barcode entry.
- Only data entry fields enabled in Setup at the time of sample analysis are displayed at the data entry screen.
- The order of fields on the Patient Data Entry screen is variable, depending on which options are enabled in Setup, and which enabled options are required or not required.
- All the RAPIDLab 1200 demographics data entry fields listed in the table on the following page are supported by HIBC protocol.

HIBC Demographics Data Entry Restrictions

The following table lists data entry fields available at the RAPIDLab 1200 system, field length, and data entry type. HIBC supports data entry for all fields.

Data Entry Field Name	*Width (In Characters)*	*Data Allowed via Onscreen Keyboard*
Patient ID	20	Alphanumeric
Last Name	15	Alphanumeric
First Name	15	Alphanumeric
Sex/Gender	N/A	Pop-up
Date of Birth	10	Numeric
Location	11	Alphanumeric
Physician ID	13	Alphanumeric
Draw Date	10	Numeric
Draw Time	5	Numeric
Accession #	13	Alphanumeric
Operator ID		Alphanumeric
Temperature	xx.x C	Numeric
	xxx.x F	
Entered tHb	xx.x g/dL	Numeric
	xxx g/L	
	xx.x mmol/L	
F_1O_2	xxx.x %	Numeric
	x.xxx	
Flow	xx.xx L/min	Numeric
Respiratory Rate	xxx.x bpm	Numeric
Barometric Pressure	xxx mmHg	Numeric
	xxx.x kPa	

HIBC Message Format

The sections below, which derive from the ANSI/HIBC protocol specifications 3.0 - 2008, describe the following message formats:

- SEID messages provide supplemental employee information
- EII messages provide employee identification information
- SPID messages provide patient information
- PHY messages provide physician information
- Zpx messages enable user definition of messages within a SPID tag. Siemens has defined 10 Zpx messages to define customized fields used by the RAPIDLab 1200 system, such as the Barometer and Flow fields.

For more information about the ANSI/HIBC specification, see the following link:

http://www.hibcc.org/AUTOIDUPN/docs/PosID_PatientSafety_MedDelivery FinalANSIs.pdf

SEID Message Structure

A SEID message uses a combination of tags and records. Tags identify the SEID message and SEID sections, such as EID.

The structure of a SEID message follows the format:

<SEID> RS VER|1.0RS<EID> RS EII<Employee ID Information> RS EI2<Employee Supplemental Information>RS<\EID>RS<\SEID>

Sections are used for separating record groups for specific purposes. The following tags are defined for SEID version 1.0, and are reserved tag words.

TAG	*Description*
<SEID>	Employee Identification Badge Message Start
<EID>	Employee Identification Data Section Start
<\EID>	Employee Identification Data Section End
<\SEID>	Employee Identification Badge Message End

Versioning is handled by new record identifiers or the addition of fields to the end of an existing record as authorized by HIBCC. Once a record identifier is issued, it cannot change.

To reduce symbol size, the <EID> and <\EID> section tags may be omitted if not needed.

Employee Identification Information (EII)

This record contains the employee ID and other optional information. The structure of the EII follows the format:

EII|IssuingEntityId|{EmployeeID}|{BadgeNumber}|

Field Name	*Field Description/Definition*	*Field Entered at RAPIDLab 1200*
IssuingEntityID	A unique identifier for the entity issuing the badge. Ideally, the provider's Health Industry Number (HIN) is used	N/A
Employee ID	Employee Identification code or number	Operator ID
BadgeNumber	A serialized number uniquely identifying the badge	Password (if supplied, will be used to look up and match to an Operator ID configured at the instrument)

Example: EII|9C8341600|0654321|33345A12Q|

Employee 0654321 issued by entity with HIN 9C8341600, badge serial number 33345A12Q

SPID Message Structure

A compact symbol is important when printed on patient wristbands. The structure of the SPID message follows the format:

<SPID> RS VER|1.0 RS <PID> RS PII<Patient ID Information> RS PHY<Physician Information> RS SID<Security Information> RS <\PID> RS <\SPID>

The SPID message may be embedded within a larger set of data conveyed in a symbol but it must be the primary source of patient identification data from the entire set of data contained in the symbol.

Sections are used for separating record groups for specific purposes.

The following tags are defined for SPID version 1.0 and are reserved tag words:

TAG	*Description*
<SPID>	Patient Identification Message Start
<PID>	Patient Identification Information Section Start
<\PID>	Patient Identification Information Section End
<\SPID>	Patient Identification Message End

To reduce symbol size, the <PID> and <\PID> section tags may be omitted if no other tags exist within the <SPID><\SPID> message.

Patient Identification Information (PII)

This record contains the patient ID or MRN, date of birth and other optional information. The structure of the PII message follows the format:

PII|PatientID|DateOfBirth|{Source}|{Gender}|{IssuingEntityID}|
{VisitNumber}|{AdmitVisitDate}|{LastName}|{FirstName}|{MiddleIntial}|
{Age}|{AgeUnits}|{IssuingEntityCode}|

Field Name	*Field Description/Definition*	*Field entered at RAPIDLab 1200*
PatientID	Patient ID or Medical Record Number.	Patient ID
DateOfBirth	Date of Birth in YYYYMMDD format. This is mandatory on patient wristbands. This may be extended to include time as YYYYMMDDHHMM as needed.	Date of Birth
Source	Source of the information – from where the data was read - such as a patient wristband, patient medical file label, etc. Please refer to the codes list in Section 7.10.of the HIBCC specification ANSI/HIBC 3.0-2008.	N/A
Gender	Patient Gender or Sex, “M”, “F”, “U” (Unknown).	Sex
IssuingEntityID	A number or code indicating the provider in a network that issued the wristband, or place of issue within a single provider. Ideally this will be the HIN.	N/A

Field Name	*Field Description/Definition*	*Field entered at RAPIDLab 1200*
VisitNumber	A number indicating the visit number or encounter number for the patient.	N/A
AdmitVisitDate	The date the patient was admitted or the outpatient visit date.	N/A
LastName	Patient Last Name (see notes)	Last Name
FirstName	Patient First Name	First Name
MiddleIntial	Patient Middle Initial	N/A
Age	Age of the patient in terms of AgeUnits.	N/A
AgeUnits	Code indicating units for Age such as days, hours, etc.	N/A
IssuingEntityCode	Code indicating the IssuingEntityID source. “U” indicates the IssuingEntityID is a HIN number.	N/A

Example: PII|445414|19561214|A|F|MGH|01234572|20041212|

Female patient MRN 445414 born on 12/14/1956 from a patient wristband issued by MGH for visit number 01234572 and was admitted on December 12th, 2004. The patient name is Ima N. Otwell.

Example with HIN:

PII|445414|19561214|A|F|9C8341600|2|20041212|Ima|Otwell|N|||U|

Physician Information (PHY)

This record contains information about the physician. The structure of the PII follows this format:

PHY|PhysicianID|LastName|{FirstName}|{MiddleIntial}|

Field Name	*Field Description/Definition*	*Field entered at RAPIDLab 1200*
PhysicianID	Physician Identifier (see notes)	Physician ID (Doctor ID)
LastName	Physician Last Name (see notes)	N/A
FirstName	Physician First Name	N/A
MiddleIntial	Physician Middle Initial	N/A

Example: PHY|12306|Iswell|Dr. Al|L|

Patient ID Prototype Record (ZPx)

This record provides a means to prototype new or enter modifications to existing records within the <SPID> message. The letter x is replaced by a letter or number to create a temporary record identifier. These records may be implemented in a closed system for testing until the HIBCC AITC issues a formal revision to the specification. Siemens has defined ZP0 - ZP9 as described in the table below.

The structure of the ZPx follows this format:

ZPx|Field Value| Field Units|…

Example: ZPC|1|The patient needs eyeglasses to read.|

Record ID	*FieldName*	*FieldValueFormat (max length)*	*FieldUnits*
ZP0	Location	Alphanumeric (11)	(null)
ZP1	DrawDate	YYYYMMDD	(null)
ZP2	DrawTime	HHMM	(null)
ZP3	AccessionNum	Alphanumeric (13)	(null)
ZP4	Temperature	##.#	1. C
		###.#	2. F
ZP5	tHb	##.#	1. g/dL
		###	2. g/L
		##.#	3. mmol/L
ZP6	FIO2	###.#	1. %
		#.###	2. (null)
ZP7	Flow	##.##	1. L/min
ZP8	RespRate	###.#	1. bpm
ZP9	Barometer*	###	1. mmHg
		###.#	2. kPa

NOTE: RS is an ASCII Record Separator character (Decimal 30, Hexidecimal 0x1E). The string sent to Siemens interface should start with <STX> (0x02) and end with <ETX> (0x03).

Example of an HIBC Message String

An example of an HIBC message string is:

<SPID>RSVER|1.0RS<PID>RSPII|XC1234567|19370730|A|M||5674321||Chan|
Tai Man Christopher|||||RSPHY|9876|Jackson|Bartholemew||RS<\PID>RS<\SPID>

The following information can be extracted from this message and entered in the appropriate fields in the data entry form:

- Patient ID = XC1234567
- Date of Birth = 30 July 1937
- Sex/Gender = Male
- Accession Number = 5674321 (using the “visit number” field as the “accession number”)
- Last Name = Chan
- First Name = Tai Man Christopher (this is truncated to “Tai Man Christo”)
- Physician ID = 9876

Start Character Requirements

Each scanned string must begin with a start character.

Code 128 is required for QC barcode scan purposes.

Acceptable Code 128 start characters are as follow:

- “f” Siemens proprietary symbology char
- “D” Symbol standard symbology char

The acceptable Code 39 start character is as follows:

- “a” Siemens proprietary symbology char

NOTE: The string sent to Siemens interface should start with <STX> (0x02) and end with <ETX> (0x03).

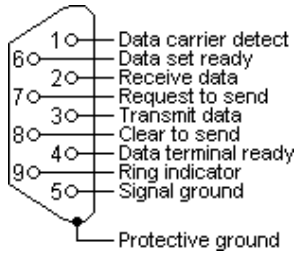
HIBC Hardware Considerations

The standard 9 pin DB9 connector uses pin 5 as Signal ground. However, the RAPIDLab 1200 system uses a DB9 connector that uses pin 7 as Signal ground. To accommodate the irregularity of using pin 7 as Signal ground, the following wiring connections should be made between the DB9 connector on the RAPIDLab 1200 system and the connector on the barcode scanner:

- Pin 2 on the RAPIDLab 1200 system to Pin 2 on the barcode scanner
- Pin 3 on the RAPIDLab 1200 system to Pin 3 on the barcode scanner
- Pin 7 on the RAPIDLab 1200 system to Pin 5 on the barcode scanner

See Standard RS232 DB9 Pinout diagram below to identify pin location.

Standard RS232 DB9 Pinout



RAPIDLab 1200 System Behavior When HIBC Protocol is Used

General Behaviors

- The RAPIDLab 1200 system automatically identifies the scanned string as a 1D or HIBC barcode by looking for the key words “SEID” or “SPID” in the scanned string.
- All fields in the scanned string are validated, even if the field is not enabled in Setup, or the field is not available on the system.
- Fields that are supported by HIBC but are not available in the RAPIDLab 1200 system are ignored. However, all fields are validated to ensure entered characters are legal.
- The system allows repeat HIBC barcode scans of any HIBC barcode field. All fields are cleared at the beginning of each scan.
- At the patient demographics screen, all fields in the scanned string are optional. The required fields are defined by the system Setup configuration.
- If duplicate records exist, the system processes the first record in the string and additional records are ignored. For example, if two EII records are present in a scanned string, only the first record is processed.
- For ZP4,5,6,7,8,9, the entire field is interpreted as empty if either the unit or the value filed is empty.
- The maximum length for a scanned string is 2500 characters, including control characters.
- When HIBC is enabled, and barcode only mode is selected, the barcode string for each field that is required in Setup must be present in the scanned string. If you are at the Analysis screen, and the scanned string does not contain data for the required field, an error message displays. This message indicates that a required field is not found in the scanned string. You cannot continue until all required fields are entered in the string, or you enter a different barcode that is valid.
- The Patient ID data string automatically converts to upper case characters.

How Data is Read at Different Screens

- Upon signing in at Setup screens, only the EII record is read from the scanned string. The rest of the message is discarded.

  NOTE: The user access level check is only performed at the Sign in screen.
- At the Patient Search screens, only the patient ID field of the PII record is read from the scanned string. The rest of the message is discarded.
- At the Patient Demographics screen, all available records are read from the scanned string.

- At the Patient Demographics screen, the user can not change operator ID if the system is in restricted mode.
- At the Patient Demographics screen, the scanned password must exist in the database, but the user can enter a non-existing operator using the keypad, if the system is in non-restricted mode.

Error Messages

- If any of the following validation rules fails, an “Invalid data format” alert message displays in a pop-up box, and error message detail information is logged in the UI.log file.
    - The number of fields must be consistent with the number of fields defined for the record.
    - No illegal characters are allowed in the field.
    - Character entry cannot exceed the length restriction of the field.
    - The data type must be consistent with the data type defined for the field.
    - The data must be valid, e.g. a valid date.The unit must match the current unit in the setup.
- If the operator ID cannot be found in the database, an “Invalid password” message displays in a pop-up box.
- If the entered operator ID does not match data found in the database, a pop-up box with the following message displays: “Operator ID not found or operator password does not match the operator ID scanned.”
- If the data scanned is out of range, a pop-up box with display the following message: “Data out of range.”
- A new scan is ignored if an error message box is not cleared.

Effects of HIBC Barcode Scan on User Interface

- When barcode only mode is active, the keypad for required fields is disabled at the Patient Demographics screen. You can only change required demographics fields by scanning the barcode. You can change demographics fields that are optional using either the barcode scanner or the keypad.
- When barcode only mode is active, the keypad is disabled for required fields at the Patient Demographics screen. Required fields must be scanned. Optional fields can still be entered using the keypad or scanner.
- When barcode only mode is active, and an HIBC barcode is scanned, the Analyze button is disabled until an HIBC barcode label is successfully scanned. If a barcode scan fails, a beep is emitted indicating the scan is unsuccessful, and the Analyze button remains disabled. All scanned data is entered in the Patient Demographics screen when the Analyze button is pressed after a successful scan.
- An HIBC barcode scan is not allowed if the system is busy at the Analysis screen.

- An HIBC scan is ignored if the system is performing a local database query or a host query.

Index

G

H

I

L

M

N

P

Q

R

S

T

U

V

W