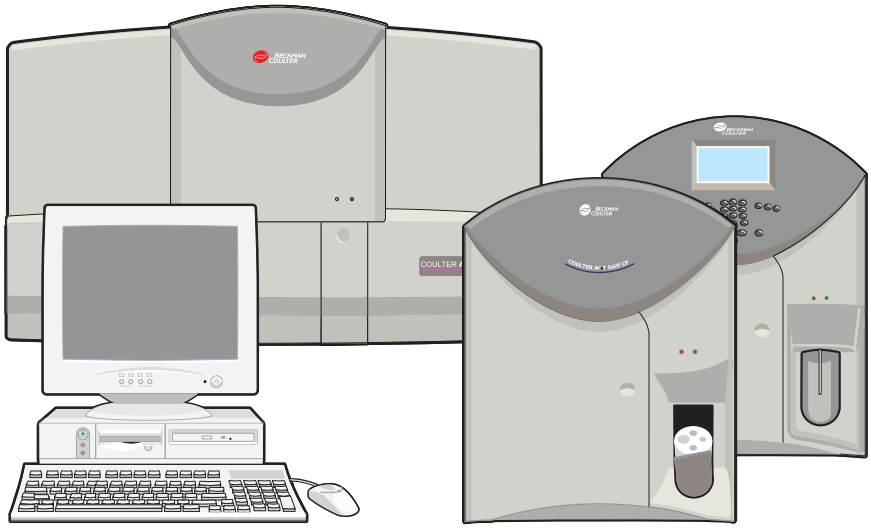
BECKMAN COULTER™ A^{C}•T™ 5diff Hematology Analyzer
COULTER® A^{C}•T™ 5diff CP Hematology Analyzer
COULTER® A^{C}•T™ 5diff AL Hematology Analyzer

Host Transmission Specification



PN 4277065C (November 2002)

Beckman Coulter, Inc.
Fullerton, CA 92835

BECKMAN COULTER™

WARNINGS AND PRECAUTIONS

READ ALL PRODUCT MANUALS AND CONSULT WITH BECKMAN COULTER-TRAINED PERSONNEL BEFORE ATTEMPTING TO OPERATE INSTRUMENT. DO NOT ATTEMPT TO PERFORM ANY PROCEDURE BEFORE CAREFULLY READING ALL INSTRUCTIONS. ALWAYS FOLLOW PRODUCT LABELING AND MANUFACTURER'S RECOMMENDATIONS. IF IN DOUBT AS TO HOW TO PROCEED IN ANY SITUATION, CONTACT YOUR BECKMAN COULTER REPRESENTATIVE.

HAZARDS AND OPERATIONAL PRECAUTIONS AND LIMITATIONS

WARNINGS, CAUTIONS, and IMPORTANTS alert you as follows:

WARNING - Can cause injury.
CAUTION - Can cause damage to the instrument.
IMPORTANT - Can cause misleading results.

BECKMAN COULTER, INC. URGES ITS CUSTOMERS TO COMPLY WITH ALL NATIONAL HEALTH AND SAFETY STANDARDS SUCH AS THE USE OF BARRIER PROTECTION. THIS MAY INCLUDE, BUT IT IS NOT LIMITED TO, PROTECTIVE EYEWEAR, GLOVES, AND SUITABLE LABORATORY ATTIRE WHEN OPERATING OR MAINTAINING THIS OR ANY OTHER AUTOMATED LABORATORY ANALYZER.

WARNING Risk of operator injury if:

- All doors, covers and panels are not closed and secured in place prior to and during instrument operation.
- The integrity of safety interlocks and sensors is compromised.
- Instrument alarms and error messages are not acknowledged and acted upon.
- You contact moving parts.
- You mishandle broken parts.
- Doors, covers and panels are not opened, closed, removed and/or replaced with care.
- Improper tools are used for troubleshooting.

To avoid injury:

- Keep doors, covers and panels closed and secured in place while the instrument is in use.
- Take full advantage of the safety features of the instrument. Do not defeat safety interlocks and sensors.
- Acknowledge and act upon instrument alarms and error messages.
- Keep away from moving parts.
- Report any broken parts to your Beckman Coulter Representative.
- Open/remove and close/replace doors, covers and panels with care.
- Use the proper tools when troubleshooting.

CAUTION System integrity might be compromised and operational failures might occur if:

- This equipment is used in a manner other than specified. Operate the instrument as instructed in the Product Manuals.
- You introduce software that is not authorized by Beckman Coulter into your computer. Only operate your system's computer with software authorized by Beckman Coulter.
- You install software that is not an original copyrighted version. Only use software that is an original copyrighted version to prevent virus contamination.

IMPORTANT If you purchased this product from anyone other than Beckman Coulter or an authorized Beckman Coulter distributor, and, if it is not presently under a Beckman Coulter service maintenance agreement, Beckman Coulter cannot guarantee that the product is fitted with the most current mandatory engineering revisions or that you will receive the most current information bulletins concerning the product. If you purchased this product from a third party and would like further information concerning this topic, call your Beckman Coulter Representative.

REVISION STATUS

Initial Issue, 7/00
A^{C}•T 5diff (OV),
Software version 1.01

Issue B, 5/01
A^{C}•T 5diff OV
Software version 1.01
A^{C}•T 5diff CP
Software version 1.03

Note: Revision B included the CP instrument.

Issue C, 11/02
A^{C}•T 5diff OV
Software version 1.01
A^{C}•T 5diff CP
Software version 1.03
A^{C}•T 5diff AL
Software version 1.00

Note: Revision C includes the AL instrument.

This document applies to the latest software listed and higher versions. When a subsequent software version changes the information in this document, a new issue will be released.

REVISION STATUS

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ILLUSTRATIONS

TABLES

1.1 INTRODUCTION

This document provides information on the host transmission for the:

- A^{C}•T 5diff hematology analyzer (referred to as OV),
- A^{C}•T 5diff Cap Pierce (CP) hematology analyzer, and
- A^{C}•T 5diff Autoloader (AL) hematology analyzer.
- Unless otherwise stated, all information in this document pertains to the A^{C}•T 5diff hematology analyzer (referred to as Open Vial or OV), the A^{C}•T 5diff Cap Pierce hematology analyzer (referred to as Cap Pierce or CP), and the A^{C}•T 5diff Autoloader (AL) hematology analyzer.

The connection between the host computer and the CP, OV, or AL system can be achieved when all settings and format options, such as protocol, format description, and communication mode, have been properly set up.

1.2 GENERAL

ATTENTION: Any modification of the instrument's transmission setup may impact the instrument's ability to communicate with the host computer and, therefore, should not be done without consulting with the host vendor or developer.

Note: A user password is required to access:

- the Host Setup menu for the OV instrument,
- the Communications tab for the CP system, and
- the Setup screen for the AL system.

Use this document in conjunction with each system's customer documentation:

- For the OV system, refer to the Operator's Guide (part number 4237615).
- For the CP system, refer to the Operator's Guide (part number 4237650). You can print a copy of the Operator's Guide from the system's software by clicking **Help ▸▸ Print Manual**. If you have difficulty accessing the information, contact a Beckman Coulter representative.
- For the AL system, refer to the Instructions for Use (part number 4277367). You can also view the information from the system's software by clicking **Help**. If you have difficulty accessing the information, contact a Beckman Coulter representative.

1.3 DESCRIPTION

Transmission Formats

The format is the description of the data content that is output by the instrument.

OV and CP Formats

Both the OV and CP offer three formats: Fixed, Variable, and XLS.

- **Fixed** allows only a numeric result transmission of a constant number of characters for each transmission. For additional information on the Fixed format, see:

  - ***Heading 5.3, FIXED FORMAT: OV SYSTEM***, or
  - ***Heading 5.4, FIXED FORMAT: CP SYSTEM***.
- **Variable** allows the transmission of parameter values, diffplot information, and histogram information. For information on the Variable format for both the OV and the CP, see ***Heading 5.5, VARIABLE FORMAT: OV, CP, AND AL SYSTEMS***.
- **XLS** allows the output in a spreadsheet format. **Note**: This option does not send any flagging information and is not recommended for routine use.

Although the OV and CP instruments transmit data in the same formats, the content of each of the formats differs for each system and are not interchangeable.

AL Format

There is one transmission format for the AL: Variable.

- For information on the **Variable** format, see ***Heading 5.5, VARIABLE FORMAT: AL SYSTEM***.

Communication (Comm) Mode

The communication mode enables the software to control the transmission process. Two communication modes are available: unidirectional and birdirectional.

- Unidirectional allows results to be transmitted to the host.
- Bidirectional allows the Worklist to be downloaded from the host and the results to be transmitted to the host.

The CP and AL systems allow you to choose between **Unidirectional** or **Bidirectional** communication modes.

Unidirectional Communication Mode

On the CP and AL systems, the unidirectional communication mode automatically disables the Software Handshake.

On the OV, the unidirectional communication mode allows the selection/deselection of a software handshake:

- Software Handshake Off: each result is transmitted without any software handshaking between the instrument and host.
- Software Handshake On: software controls the transmission process through three steps:
  - communication initialization,
  - results transmission and verification, and
  - communication end.

Bidirectional Communication Mode

On the CP and AL systems, the bidirectional communication mode automatically enables the Software Handshake.

Bidirectional communication mode requires the handshake to be ON. Results transmission occurs in three steps:

1. Communication initialization.
2. Results transmission and verification.
3. Communication end.

Protocol

Serial Transmission Flow Control

Through the XON/XOFF protocol, the OV, CP, and AL systems allow the host that is receiving serial communication data to control the flow of the serial data. This flow control is available at all times and is independent from the Software Handshake selected for the OV or the Unidirectional or Bidirectional protocol selected for the CP. and AL

The host can transmit XOFF (ASCII DC3, hex $13) to stop transmission from the instrument, such as when a pending data overflow may occur at the host. The transmission will be stopped a few moments after the XOFF command is issued; during the delay, the host must be able to receive a few more pending characters while XOFF is processed. To resume transmission from the instrument, the host transmits XON (ASCII DC1, hex $11); the host then receives the remaining serial data.

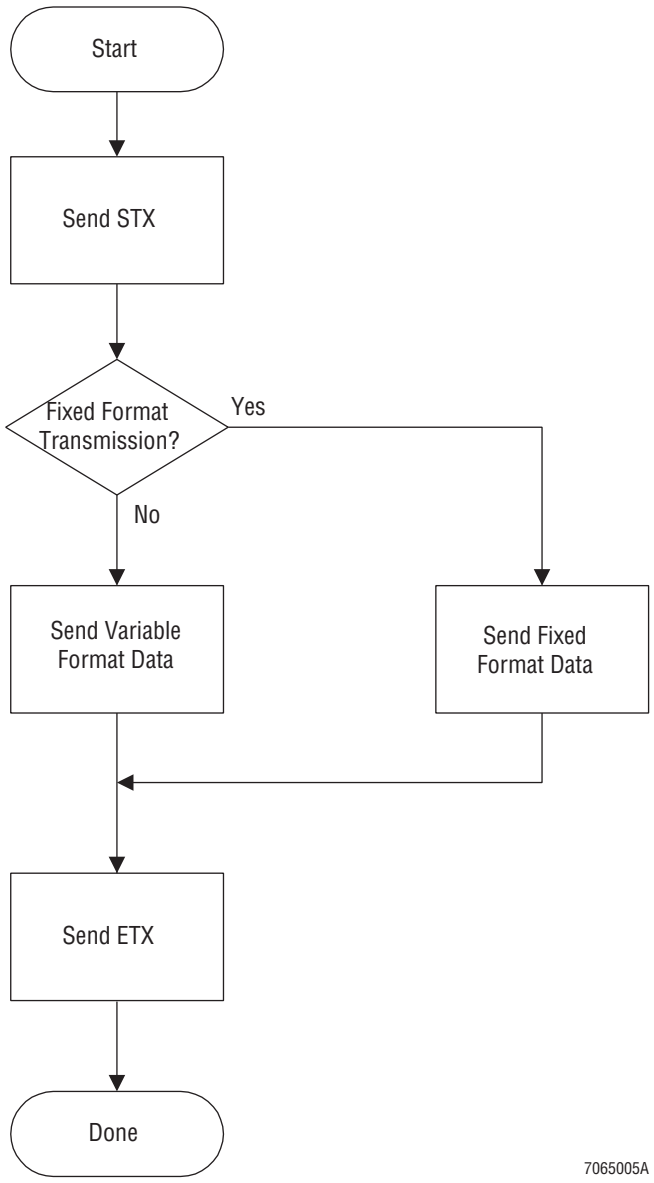
1.4 OV COMMUNICATION MODE

Unidirectional is the only communication mode supported by the OV system.

Software Handshake OFF

The Software Handshake OFF mode allows the instrument to transmit serial data to the host without requiring the host to respond to any of the data sent by the instrument. This mode of serial communications is open-loop since there is no way for the instrument to respond or retry possible bad transmission received at the host. In this case, the host's receiving software must discard any data received in error, such as if a bad CRC or Checksum is received. The data to the host must be manually retransmitted prior to cycling the next sample. See Figure 1.1.

Figure 1.1 Software Handshake OFF: Instrument to Host (OV)



Software Handshake ON

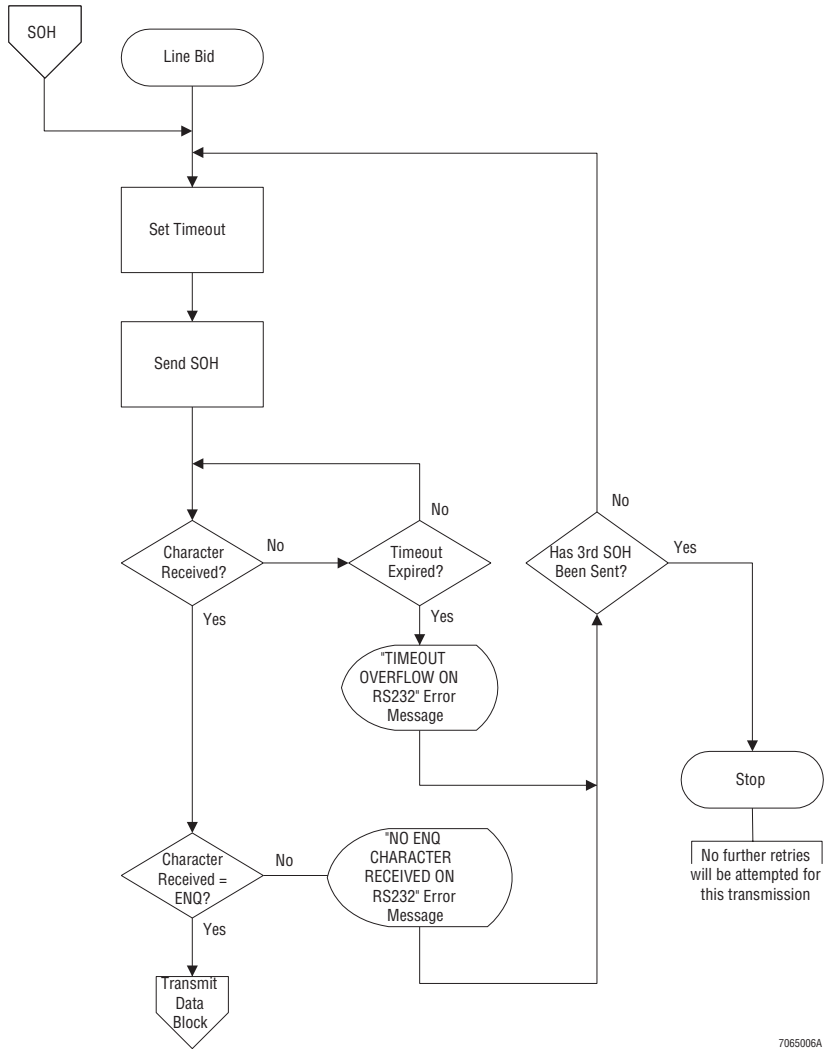
The Software Handshake ON mode enables the instrument to retransmit information received in error at the host. The protocol uses ACK/NAK and Timeouts between the instrument and the host for transmission retries. **Note**: The Timeout value used is that set in the Sending Configuration screen under Time Out.

The serial handshake protocol is divided into three distinct phases: Line Bid, Data Block Transmission, and End String Transmission (Variable or Fixed).

Line Bid

Line Bid (Figure 1.2) establishes initial communication between the instrument and the host before the data block is transmitted. The system can retry up to three times before the system ends the results transmission. In this phase of the process, the instrument sends an SOH (hex $01) and waits for an ENQ (hex $05) from the host. If proper responses are not received in the expected time, the instrument retries the Line Bid sequence again. The Line Bid may recur if there are errors in the Data Block or End String processes.

Figure 1.2 Line Bid: OV



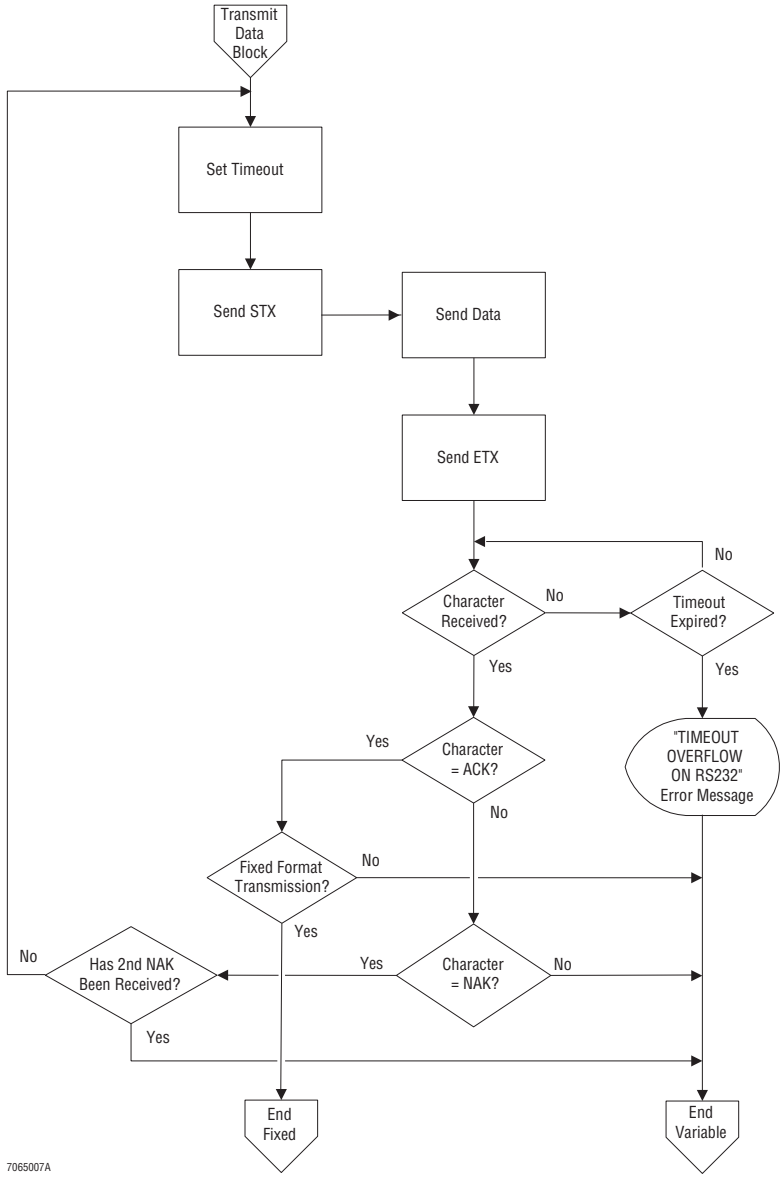
Data Block Transmission

Data Block Transmission (Figure 1.3) occurs after Line Bid is properly processed. Retry of Data Block can be initiated by the host, which can transmit NAK (hex $15) up to two times for each data block transmission.

If the host receives the Data Block correctly, the host responds with ACK (hex $06) to continue with the next phase of the process, End String Transmission. If there are more than two retries within the Data Block transmission or if the Timeout expires, the instrument unconditionally transmits the End String in the End Variable Format.

If the system exits in error during the Data Block Transmission, the instrument transmits the End Variable String regardless of the system's format – Fixed or Variable.

Figure 1.3 Data Block Transmission: OV



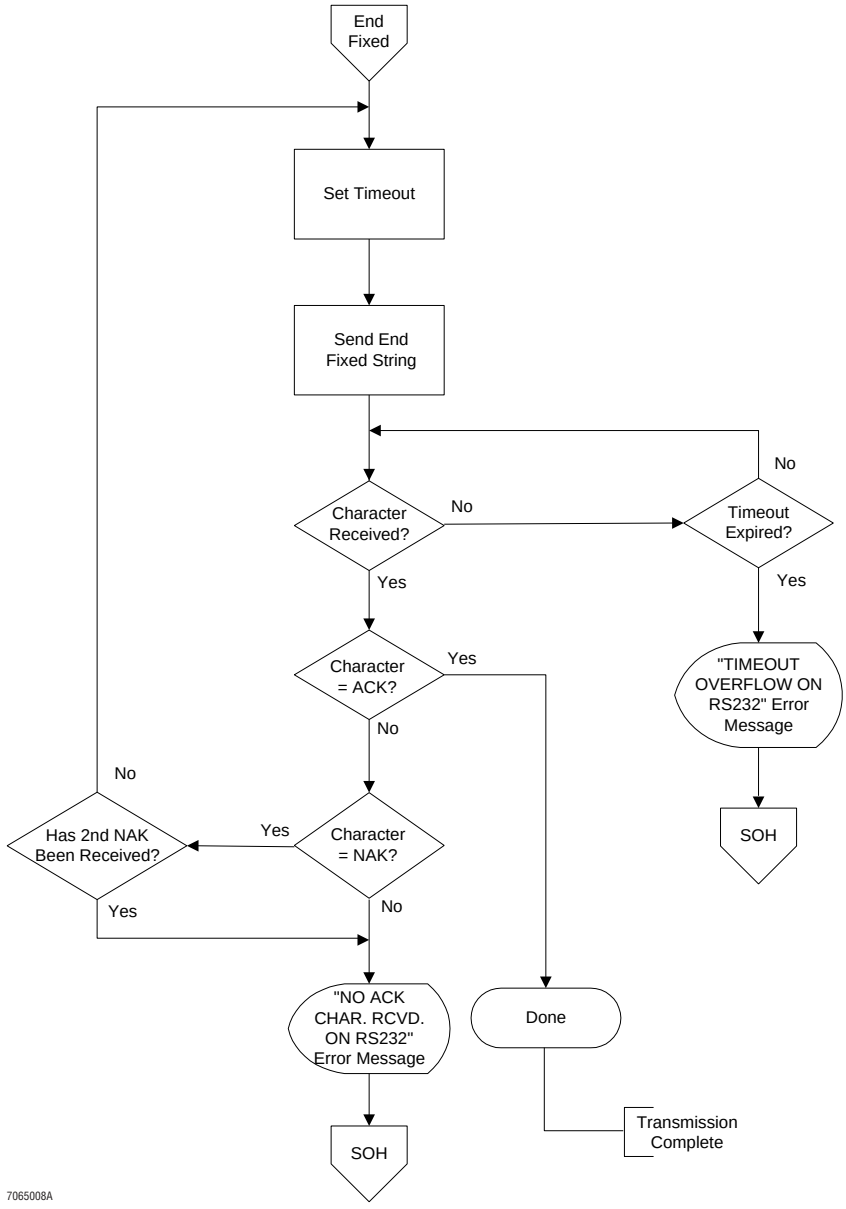
End String Transmission

Once the Data Block Transmission process is complete, the End String Transmission (End Variable or End Fixed) phase begins. During this phase, the instrument sends an End String to indicate the end of the transmission process for the specific sample being transmitted to the host.

The End String can be sent in either the Fixed or Variable format:

- If the system is set to Fixed format, End Fixed String (Table 1.1) is sent. See Figure 1.4.
- If the system is set to the Variable format, End Variable String (Table 1.2) is sent. See Figure 1.5.

Figure 1.4 End Fixed String: OV



When the host successfully receives the End String, the host sends an ACK (hex $06). When the instrument receives the ACK, the transmission sequence for that particular sample is completed. If the host does not successfully receive the End String, the host sends a NAK (hex $15). If more that two NAKs are received or if the system incurs a timeout, error conditions are displayed and the Line Bid process beings again and will repeat up to two more times.

Figure 1.5 End Variable String: OV

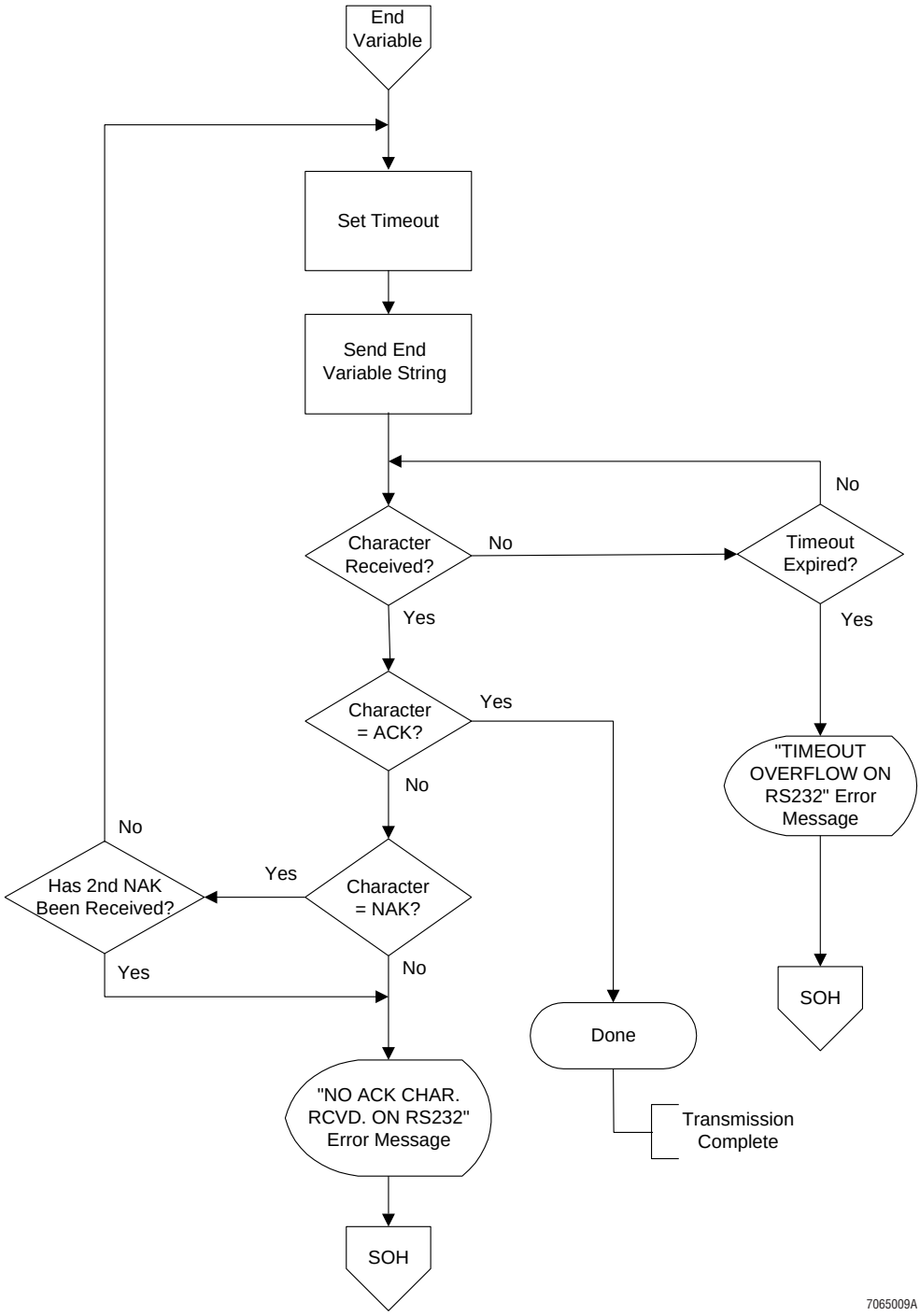


Table 1.1 shows the format for the OV End Fixed String. Table 1.2 shows the format for the OV End Variable String.

Character formats include:

–: Space ($20)

] : Carriage return ($0D)

z: numeric field.

Table 1.1 End Fix String: OV

Information	Description	Number of Characters
STX ($02)	Start of Text	1
E ($45)	Character E	1
zz]	Analyzer Number ($30 to $39) + CR ($0D)	2 + 1
CRC	CRC of bytes starting at byte 2 and ending at byte 5. CRC is computed by XORing bytes 2 through 5 and ORing the results with ($40)	1
ETX ($03)	End of Text	1

Table 1.2 End Variable String: OV

Information	Description	Number of Characters
STX ($02)	Start of Text	1
zzzzz]	Number of bytes (in decimal format $30-$39) between STX and ETX in End Variable String followed by CR ($0D)	5 + 1
($FF)-END-----]	Results Type. $FF, Space ($20) followed by word END with 5 spaces, followed by CR ($0D)	2 + 8 + 1
($FC)-zzzzzzzz]	$FC, Space, 8 decimal bytes ($30-$39), CR ($0D)	2 + 8 + 1
($FB)-AcT5diff]	Analyzer Name. ($FB)($20)AcT5diff, CR ($0D)	2 + 8 + 1
($FE)-Vz.z-]	Version Number. ($FE)($20), Vz.z ($20) CR ($0D)	2 + 5 + 1
($FD)-zzzz]	Hex-ASCII (lower case) sum, modulo $FFFF, of preceding bytes (starting with second byte) in End Variable String	2 + 4 + 1
ETX ($03)	End of Text	1

1.5 CP COMMUNICATION MODES

There are two CP communication modes – unidirectional and bidirectional. **Note**: After a Startup is done, the Startup results are unconditionally transmitted to the host.

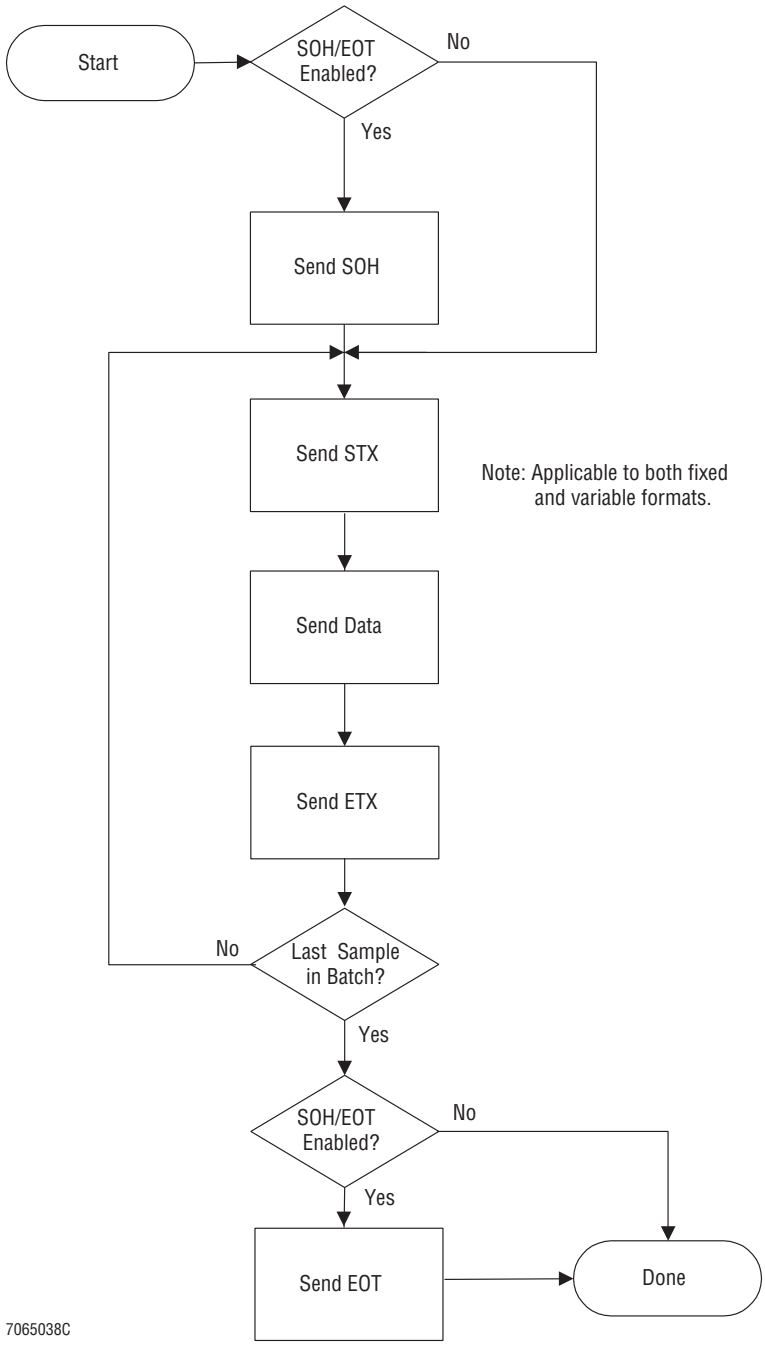
Unidirectional (Software Handshake OFF)

The unidirectional communication mode (Figure 1.6) allows the instrument to transmit serial data to the host without requiring the host to respond to any of the data sent by the instrument.

This mode of serial communications is open-loop since there is no way for the instrument to respond or retry possible bad transmission received at the host. In this case, the host's receiving software must discard any data received in error, such as if a bad CRC or Checksum is received. The data to the host must be manually retransmitted if the first transmission failed.

When the Unidirectional option is selected, the systems offer an option to add a preamble (SOH, hex $01) and postamble (EOT, hex $04) characters to further identify the serial transmission block.

Figure 1.6 Unidirectional Mode: CP



Bidirectional (Software Handshake ON)

The bidirectional communication mode enables the instrument to retry transmissions received in error at the host and download the patient worklist. The protocol uses ACK/NAK and Timeouts between the instrument and the host for transmission retries.

The LIS/HIS Configuration screen shows the following times (in seconds):

- Time Out: The amount of time the instrument will wait for an expected host response.
- Waiting Time: The amount of time the instrument will wait to re-request a Line Bid when there is a request from the host for a Line Bid and when there is an existing pending Line Bid from the instrument to the host.

  This situation could occur when there is a pending transmission from the instrument to the host and the host is requesting a patient file download.
- Time: Active only when the Automatic Disconnect checkbox is selected, this is the time the instrument will wait for a host response during patient file downloads. This prevents the instrument from waiting indefinitely for a host response once a Line Bid has been given to the host.

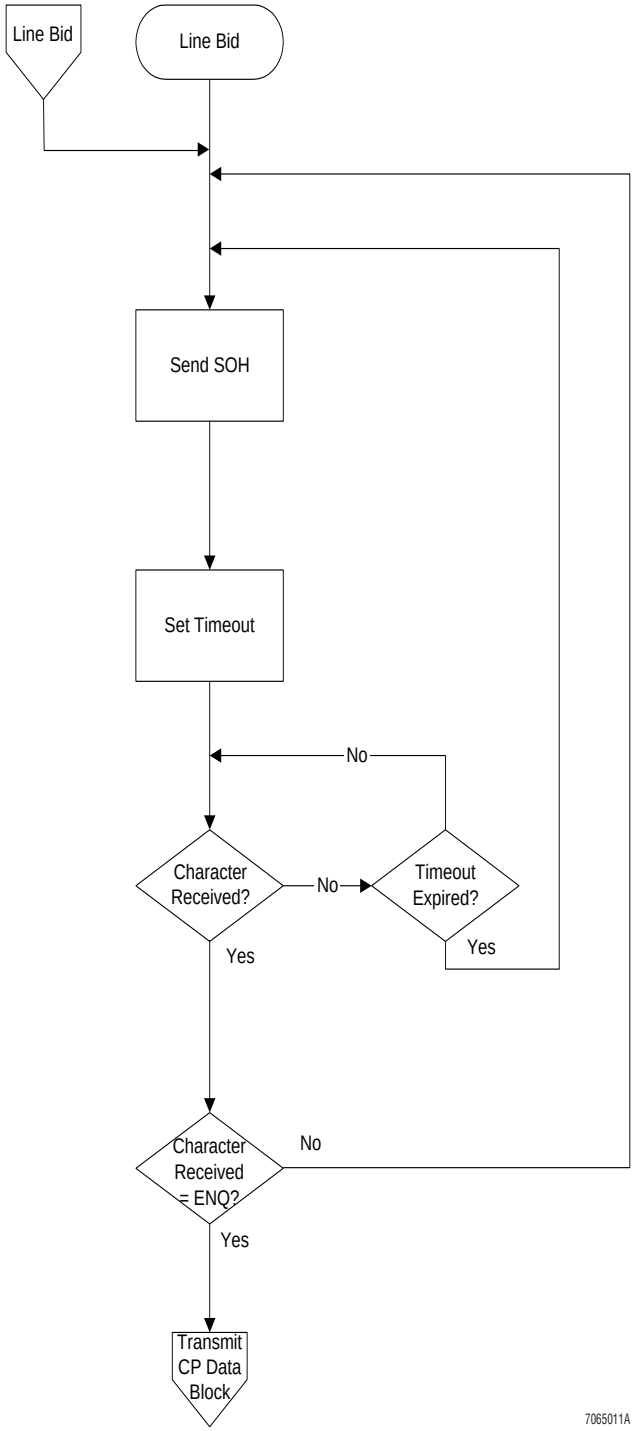
The serial bidirectional protocol is divided into three distinct phases:

- Line Bid, using S0H ($01) to request the serial line and ENQ ($05) to acknowledge. See ***Line Bid*** for details.
- Data block transmission, using ACK ($06) to accept or NAK ($15) to reject the data block transmission. See ***Data Block Transmission*** for details.
- End string transmission.See ***CP End*** for details.

Line Bid

Line Bid (Figure 1.7) establishes initial communication between the instrument and the host before the data block is transmitted. In this phase of the process, the instrument sends an SOH (hex $01) and waits for an ENQ (hex $05) from the host. If proper responses are not received in the expected time, the instrument retries the Line Bid sequence.

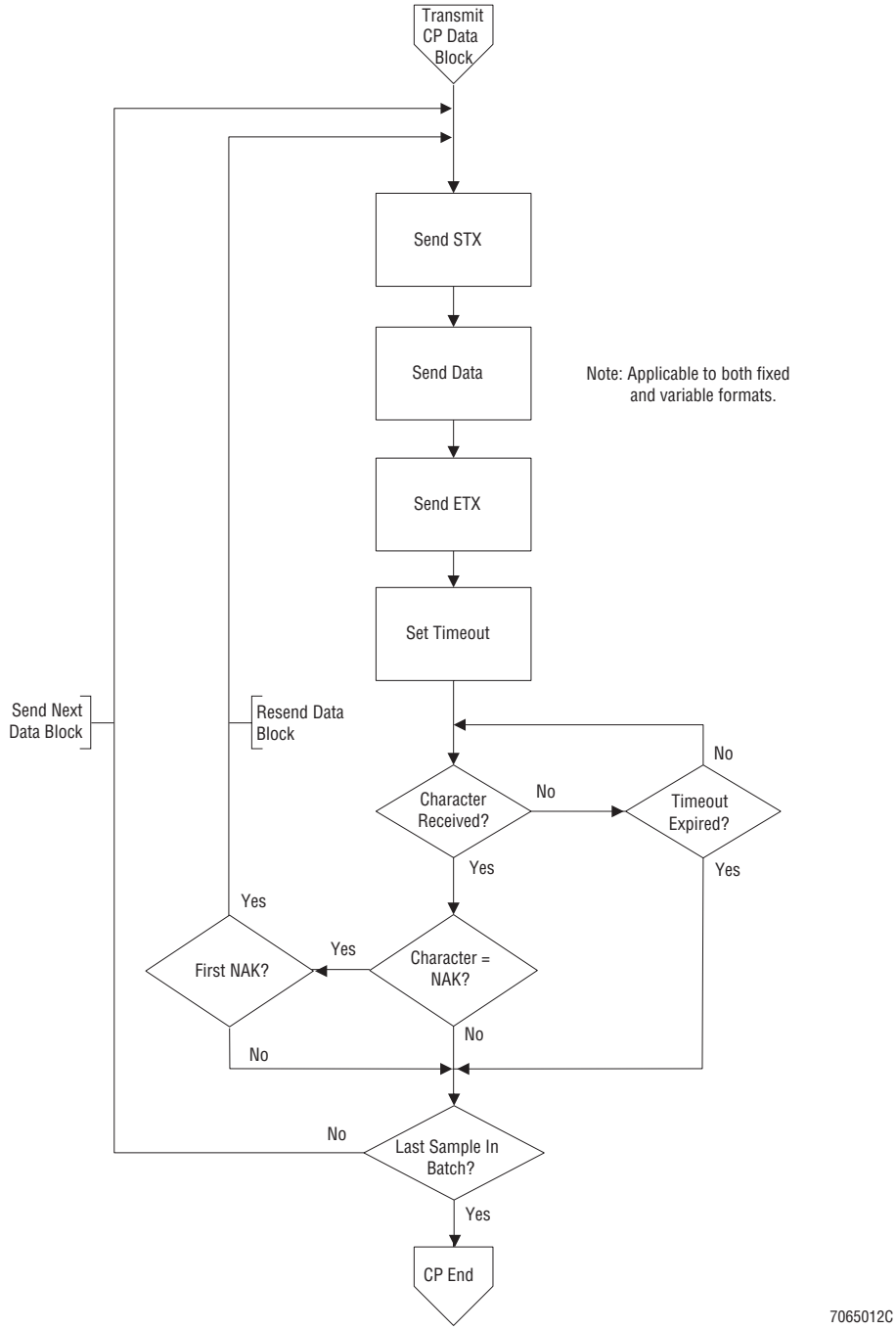
Figure 1.7 Line Bid: CP



Data Block Transmission

Data Block Transmission (Figure 1.8) occurs after Line Bid is properly processed. Retransmission of each Data Block can be initiated by the host by transmitting NAK (hex $15).

Figure 1.8 Data Block Transmission: CP



CP End

Once the Data Block Transmission process is complete, the CP End (Figure 1.9) phase begins. During this phase, the instrument sends an End String to indicate the end of the transmission process for the specific sample or batch of samples being transmitted to the host. Retransmission of the End String is done when the host sends a NAK (hex $15). When running samples and the system is set to autotransmit, samples will be spooled. If transmission was in error, the transmission logic loops to Line Bid until the sample results are correctly transmitted to the host.

The End String can be sent in either the Fixed or Variable format:

- If the system is set to Fixed format, End Fixed String (Table 1.3) is sent.
- If the system is set to the Variable format, End Variable String (Table 1.4) is sent.

Figure 1.9 CP End: CP

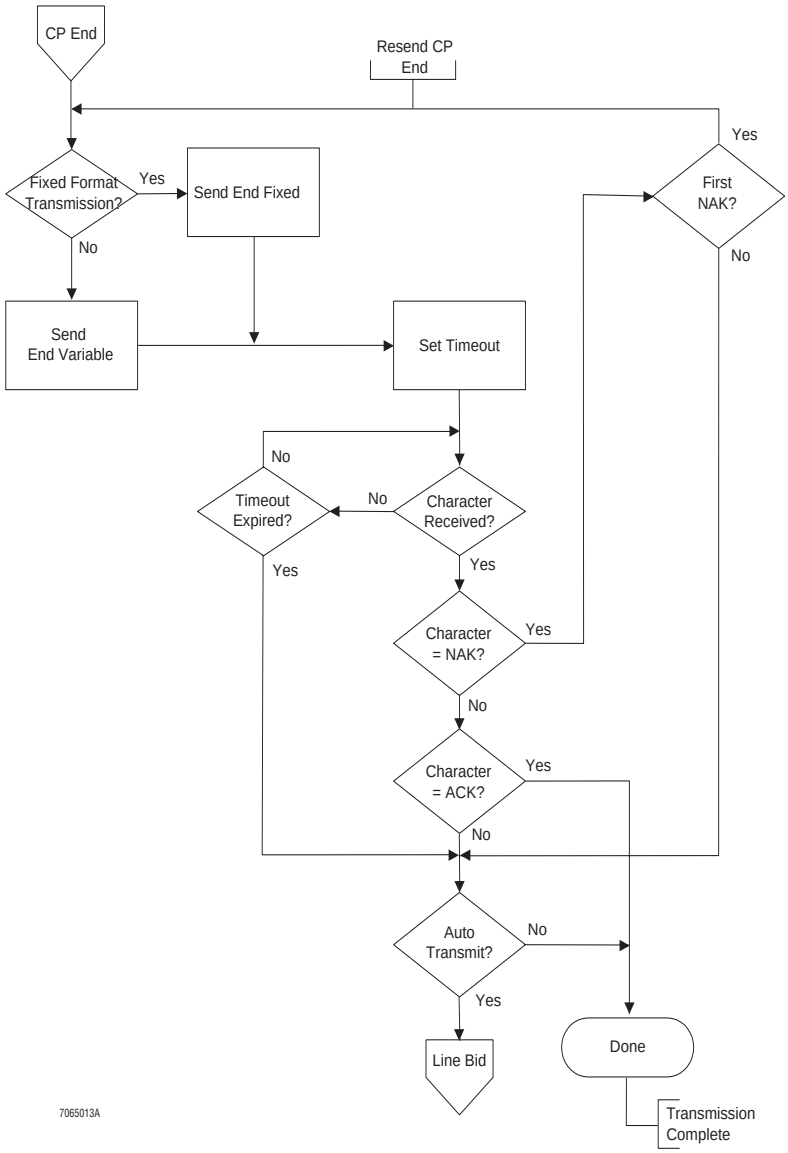


Table 1.3 shows the format for the CP End Fixed String. Table 1.4 shows the format for the CP End Variable String.

Character formats include:

–: Space ($20)

] : Carriage return ($0D)

z: numeric field.

Table 1.3 End Fixed String: CP

Information	Description	Number of Characters
STX ($02)	Start of Text	1
E ($45)	Character E	1
zz]	Analyzer Number ($30 to $39) + CR ($0D)	2 + 1
CRC	CRC of bytes starting at byte 2 and ending at byte 5. CRC is computed by XORing bytes 2 through 5 and ORing the results with ($40).	1
ETX ($03)	End of Text	1

Table 1.4 End Variable String: CP

Information	Description	Number of Characters
STX ($02)	Start of Text	1
zzzzz]	Number of bytes (in decimal format $30-$39) between STX and ETX in End Variable String followed by CR ($0D)	5 + 1
($FF)-END-----]	Results Type. $FF, Space ($20) followed by word END with 5 spaces, followed by CR ($0D)	2 + 8 + 1
($FD)-zzzz]	Hex-ASCII (lower case) sum, modulo $FFFF, of preceding bytes (starting with second byte) in End Variable String	2 + 4 + 1
ETX ($03)	End of Text	1

Host Download

The CP system's Worklist can receive (download) patient information from the host. The file reception is performed in the background in a three-step process:

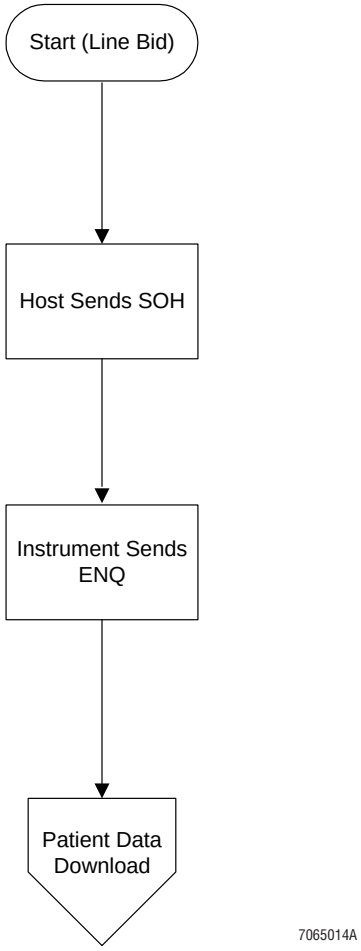
1. Communication initialization using SOH ($01) from the host and ENQ ($05) from the instrument,
2. File transmission and verification using ACK ($06) – to acknowledge reception of good serial data – and NAK ($15) for file re-transmission, and
3. Communication end.

The Patient Data download protocol is divided into three distinct phases: Line Bid, Patient Data Transmission, and End Patient Download Transmission.

CP Line Bid

CP Line Bid (Figure 1.10) establishes initial communication between the host and the instrument before the patient data is transmitted. In this phase of the process, the host sends an SOH (hex $01) and waits for an ENQ (hex $05) from the instrument.

Figure 1.10 CP Line Bid During Patient Download: CP

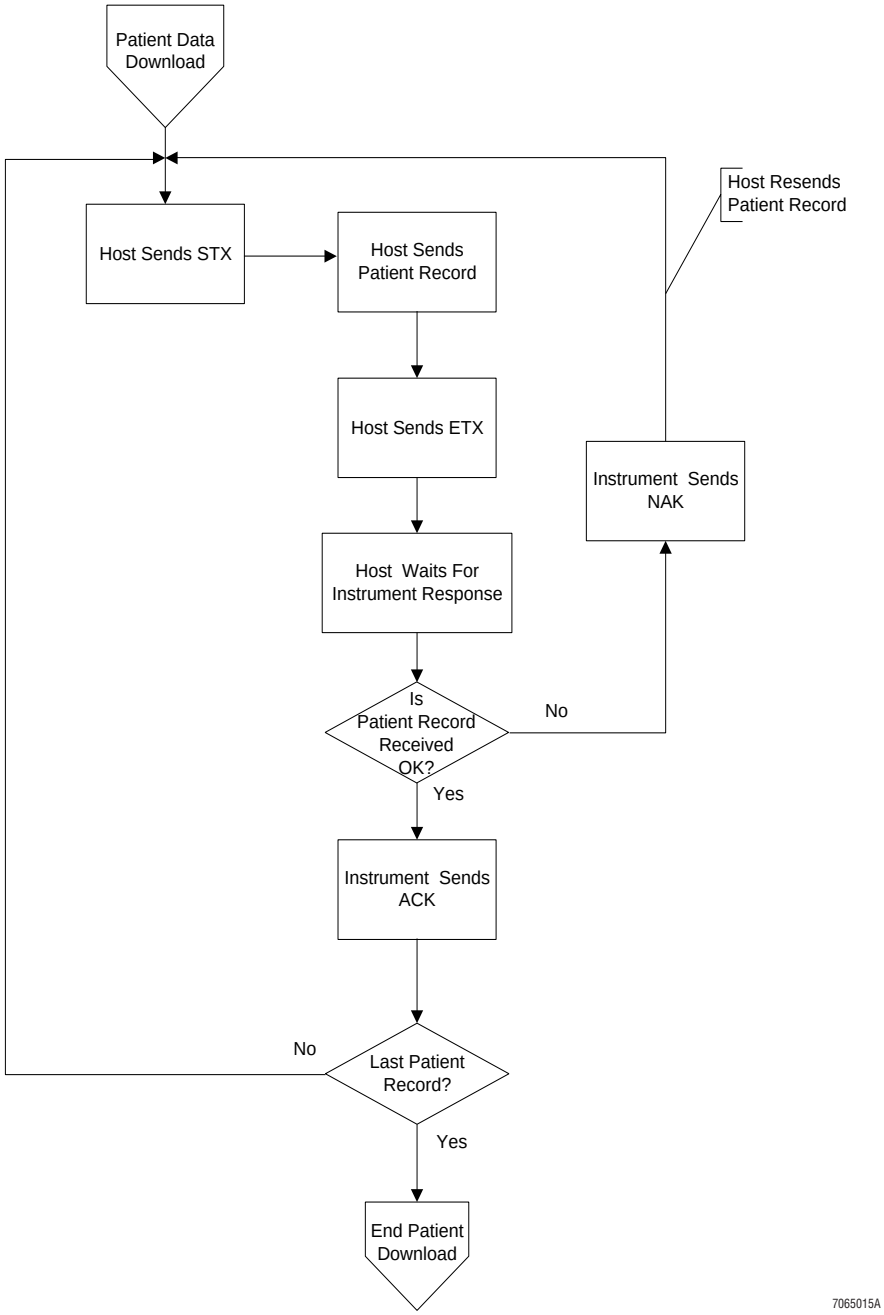


Patient Data Transmission

Once Line bid is established, the host can transmit the patient files in Fixed or Variable formats as defined in this document. The instrument can accept either format automatically, independent of the setting selected in the LIS/HIS Screen. The host must wait for an ACK (hex ($06) from the instrument for every patient record sent by the host. If the instrument sends a NAK (hex ($15) for any patient record, the host retransmits the patient record.

For a detailed description of the patient data download process, see Figure 1.11.

Figure 1.11 Patient Data Download Process: CP



End Patient Download Transmission

The End Patient Download follows at the end of the patient data download. The host transmits the End Patient Download string in the same format used to transmit the patient data.

- If Fixed patient data was downloaded, see Table 1.5 for the expected patient End String.
- If Variable patient data was downloaded, see Table 1.6 for the expected patient End String.

For a detailed description of the End Patient Data Download process, see Figure 1.12.

Character formats include:

–: Space ($20)

] : Carriage return ($0D)

z: numeric field.

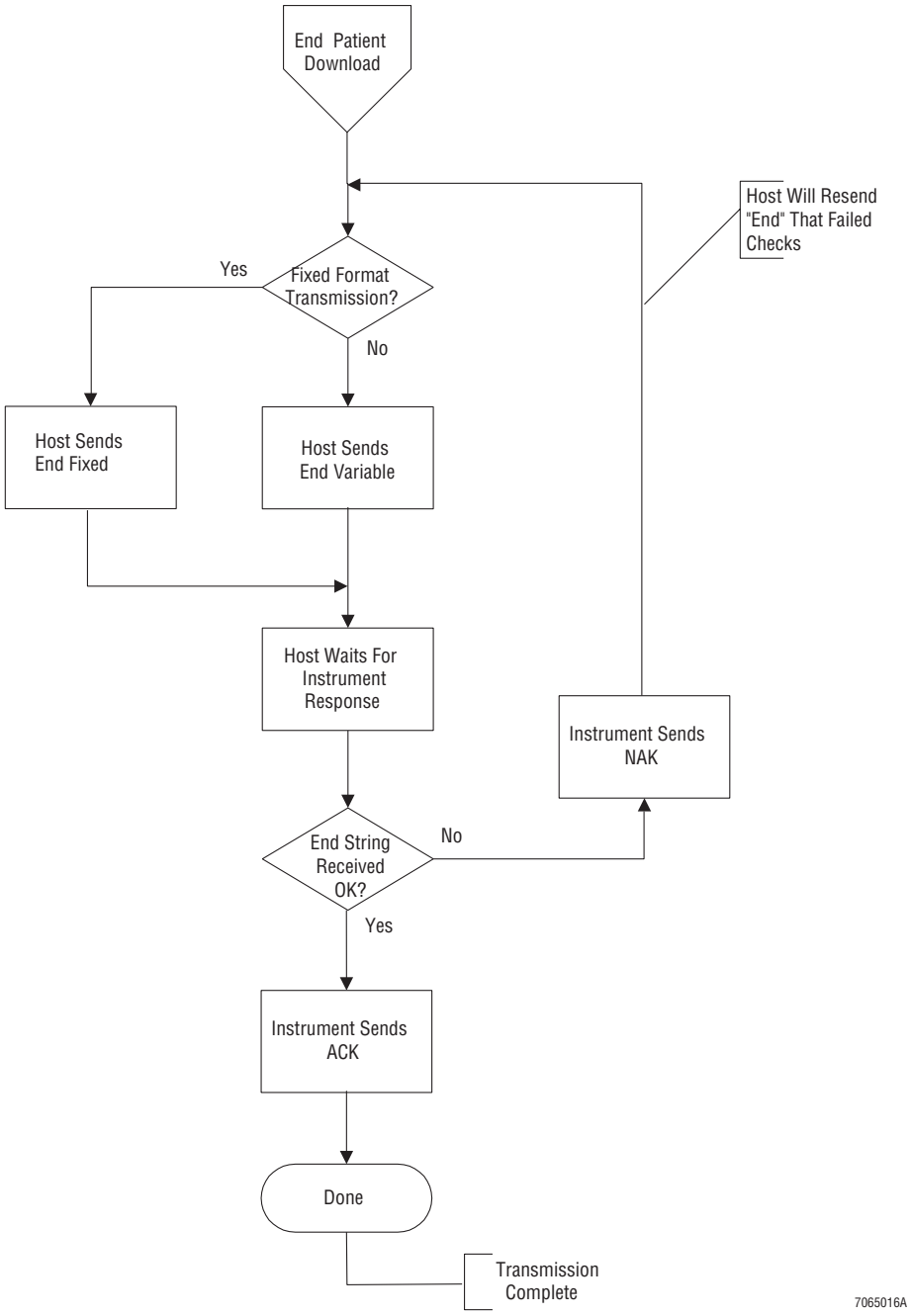
Table 1.5 End Fix String: CP

Information	Description	Number of Characters
STX ($02)	Start of Text	1
E ($45)	Character E	1
zz]	Analyzer Number ($30 to $39) + CR ($0D)	2 + 1
CRC	CRC of bytes starting at byte 2 and ending at byte 5. CRC is computed by XORing bytes 2 through 5 and ORing the results with ($40).	1
ETX ($03)	End of Text	1

Table 1.6 End Variable String: CP

Information	Description	Number of Characters
STX ($02)	Start of Text	1
zzzzz]	Number of bytes (in decimal format $30-$39) between STX and ETX in End Variable String followed by CR ($0D)	5 + 1
($FF)-END-----]	Results Type. $FF, Space ($20) followed by word END with 5 spaces, followed by CR ($0D)	2 + 8 + 1
($FD)-zzzz]	Hex-ASCII (lower case) sum, modulo $FFFF, of preceding bytes (starting with second byte) in End Variable String	2 + 4 + 1
ETX ($03)	End of Text	1

Figure 1.12 End Patient Data Download Process: CP



1.6 AL COMMUNICATION MODES

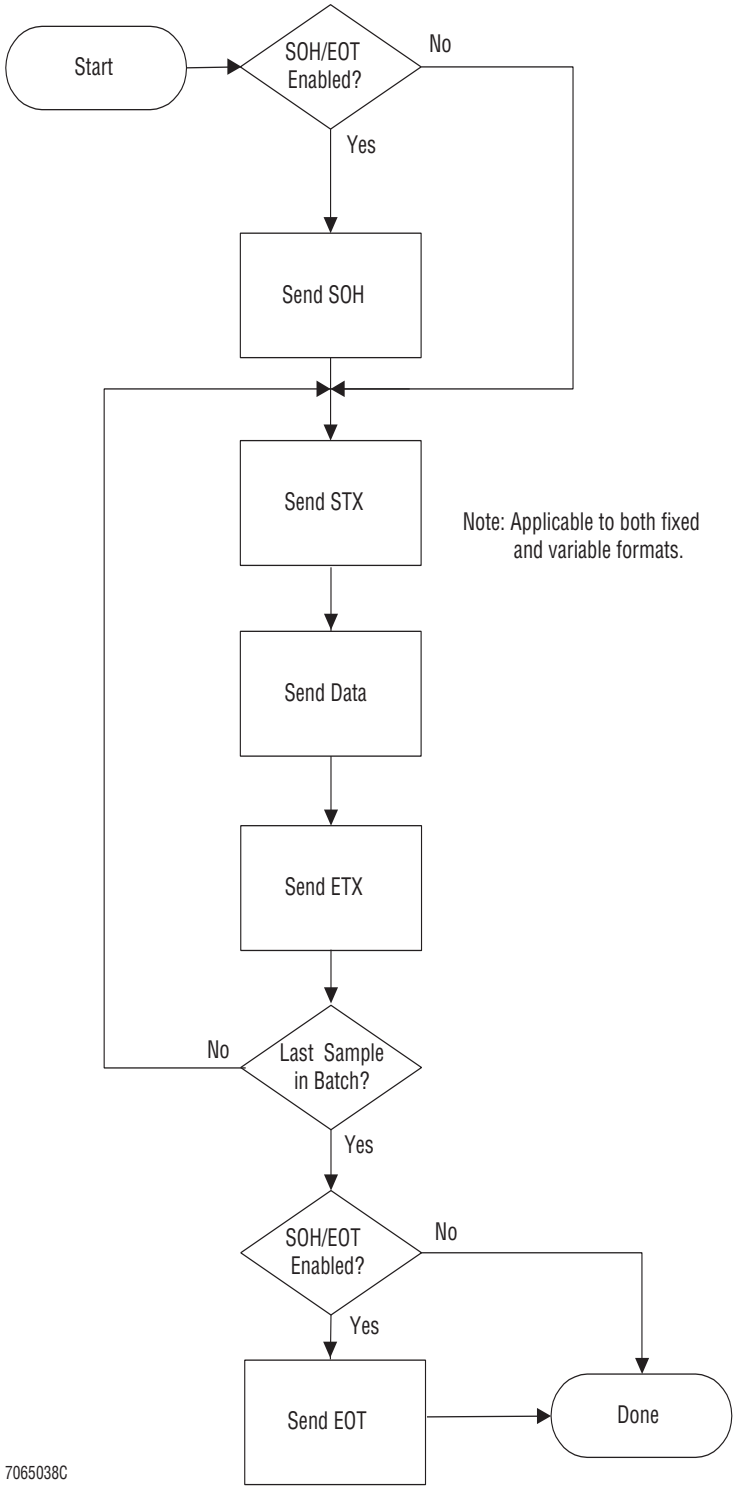
There are two AL communication modes – unidirectional and bidirectional.

Unidirectional (Software Handshake OFF)

The unidirectional communication mode (Figure 1.13) allows the instrument to transmit serial data to the host without requiring the host to respond to any of the data sent by the instrument. This mode of serial communications is open-loop since there is no way for the instrument to respond or retry possible bad transmission received at the host. In this case, the host's receiving software must discard any data received in error, such as if a bad CRC or Checksum is received. The data to the host must be manually retransmitted if the first transmission failed.

When the Unidirectional option is selected, the systems offer an option to add a preamble (SOH, hex $01) and postamble (EOT, hex $04) characters to further identify the serial transmission block.

Figure 1.13 Unidirectional Mode: AL



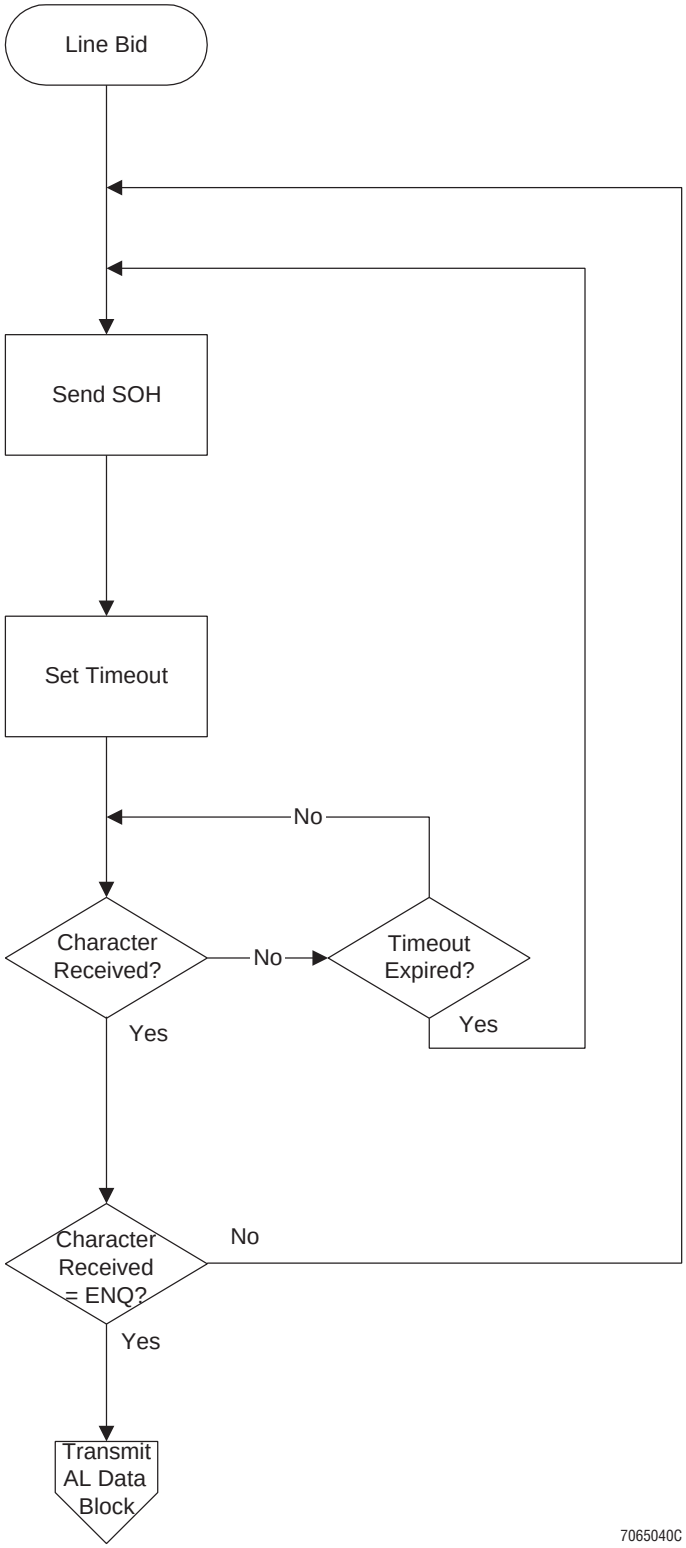
Bidirectional (Software Handshake ON)

The bidirectional communication mode enables the instrument to retry transmissions received in error at the host and download the patient worklist. The protocol uses ACK/NAK and Timeouts between the instrument and the host for transmission retries.

Line Bid

Line Bid (Figure 1.14) establishes initial communication between the instrument and the host before the data block is transmitted. In this phase of the process, the instrument sends an SOH (hex $01) and waits for an ENQ (hex $05) from the host. If proper responses are not received in the expected time, the instrument retries the Line Bid sequence.

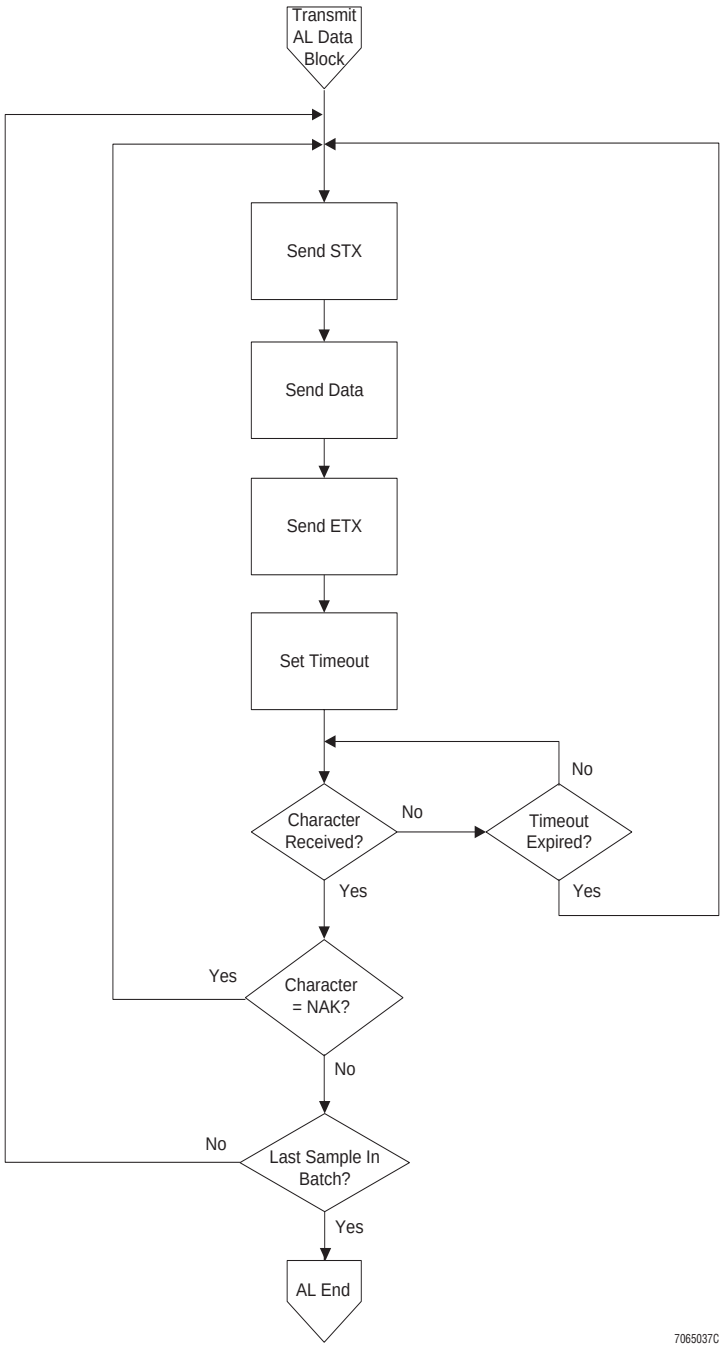
Figure 1.14 Line Bid: AL



Data Block Transmission

Data Block Transmission (Figure 1.15) occurs after Line Bid is properly processed. Retransmission of each Data Block can be initiated by the host by transmitting NAK (hex $15).

Figure 1.15 Data Block Transmission: AL



AL End

Once the Data Block Transmission process is complete, the AL End (Figure 1.16) phase begins. During this phase, the instrument sends an End String to indicate the end of the transmission process for the specific sample or batch of samples being transmitted to the host. Retransmission of the End String is done when the host sends a NAK (hex $15). When running samples and the system is set to autotransmit, samples will be spooled. If transmission was in error, the transmission logic loops to Line Bid until the sample results are correctly transmitted to the host.

Figure 1.16 AL End

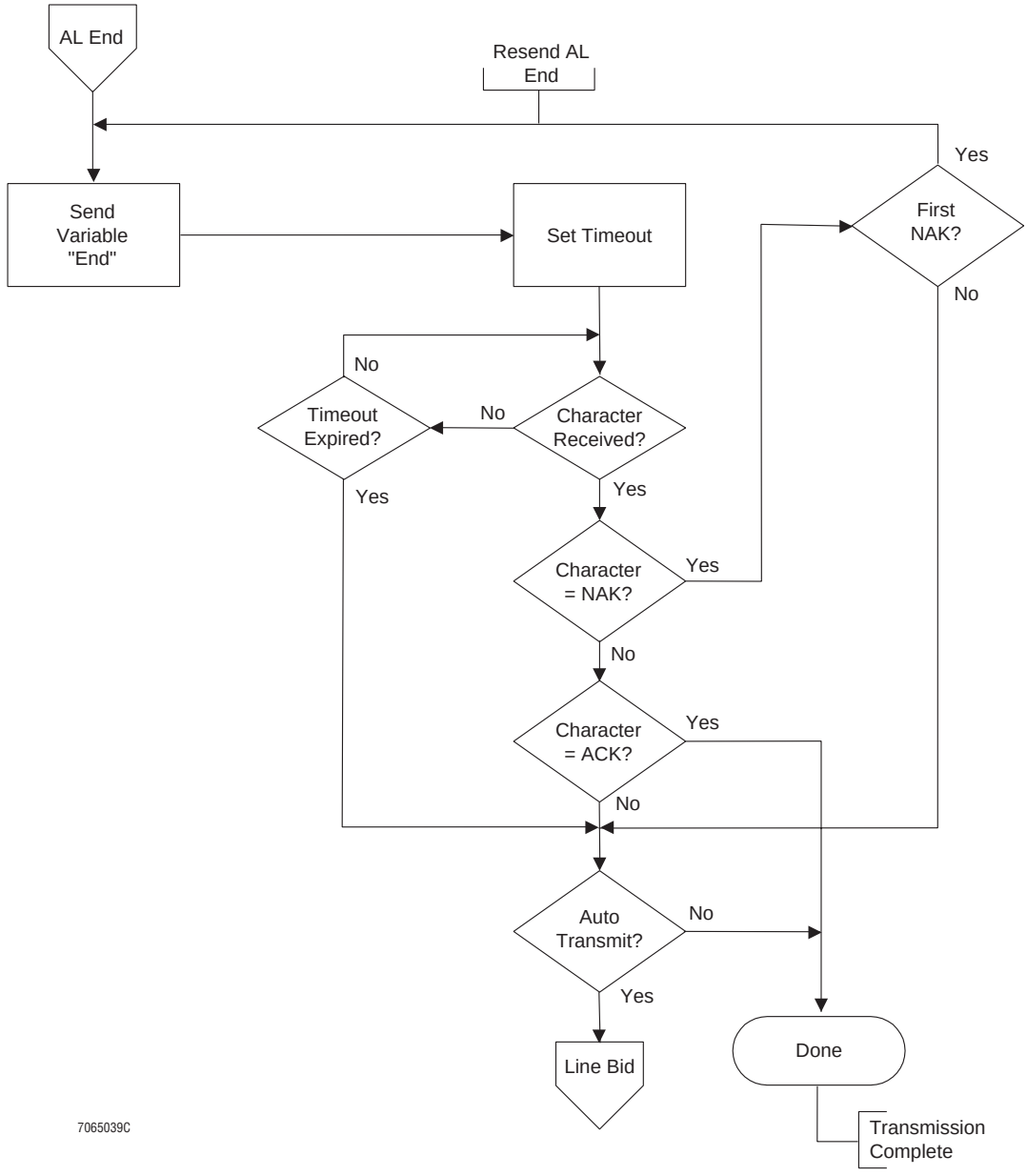


Table 1.7 shows the format for the AL End Variable String.

Character formats include:

–: Space ($20)

] : Carriage return ($0D)

z: numeric field.

Table 1.7 End Variable String: AL

Information	Description	Number of Characters
STX ($02)	Start of Text	1
zzzzz]	Number of bytes (in decimal format $30-$39) between STX and ETX in End Variable String followed by CR ($0D)	5 + 1
($FF)-END-----]	Results Type. $FF, Space ($20) followed by word END with 5 spaces, followed by CR ($0D)	2 + 8 + 1
($FD)-zzzz]	Hex-ASCII (lower case) sum, modulo $FFFF, of preceding bytes (starting with second byte) in End Variable String	2 + 4 + 1
ETX ($03)	End of Text	1

Host Download

The AL system's Worklist can receive (download) patient information from the host. The file reception is performed in the background in a three-step process:

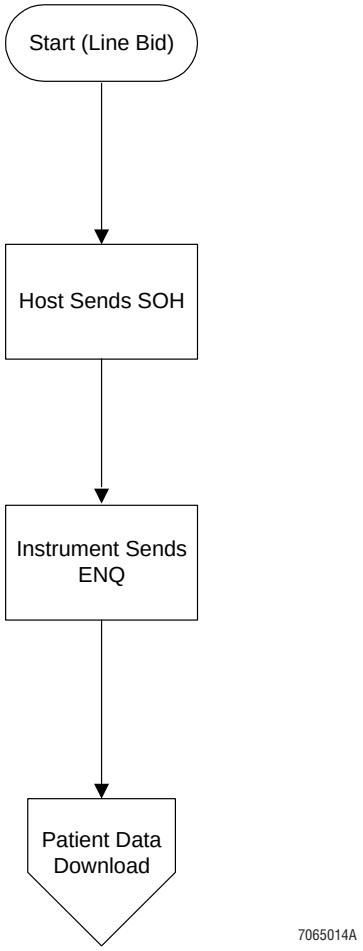
1. Communication initialization using SOH ($01) from the host and ENQ ($05) from the instrument,
2. File transmission and verification using ACK ($06) – to acknowledge reception of good serial data – and NAK ($15) for file re-transmission, and
3. Communication end.

The Patient Data download protocol is divided into three distinct phases: Line Bid, Patient Data Transmission, and End Patient Download Transmission.

AL Line Bid

AL Line Bid (Figure 1.17) establishes initial communication between the host and the instrument before the patient data is transmitted. In this phase of the process, the host sends an SOH (hex $01) and waits for an ENQ (hex $05) from the instrument.

Figure 1.17 AL Line Bid During Patient Download: AL

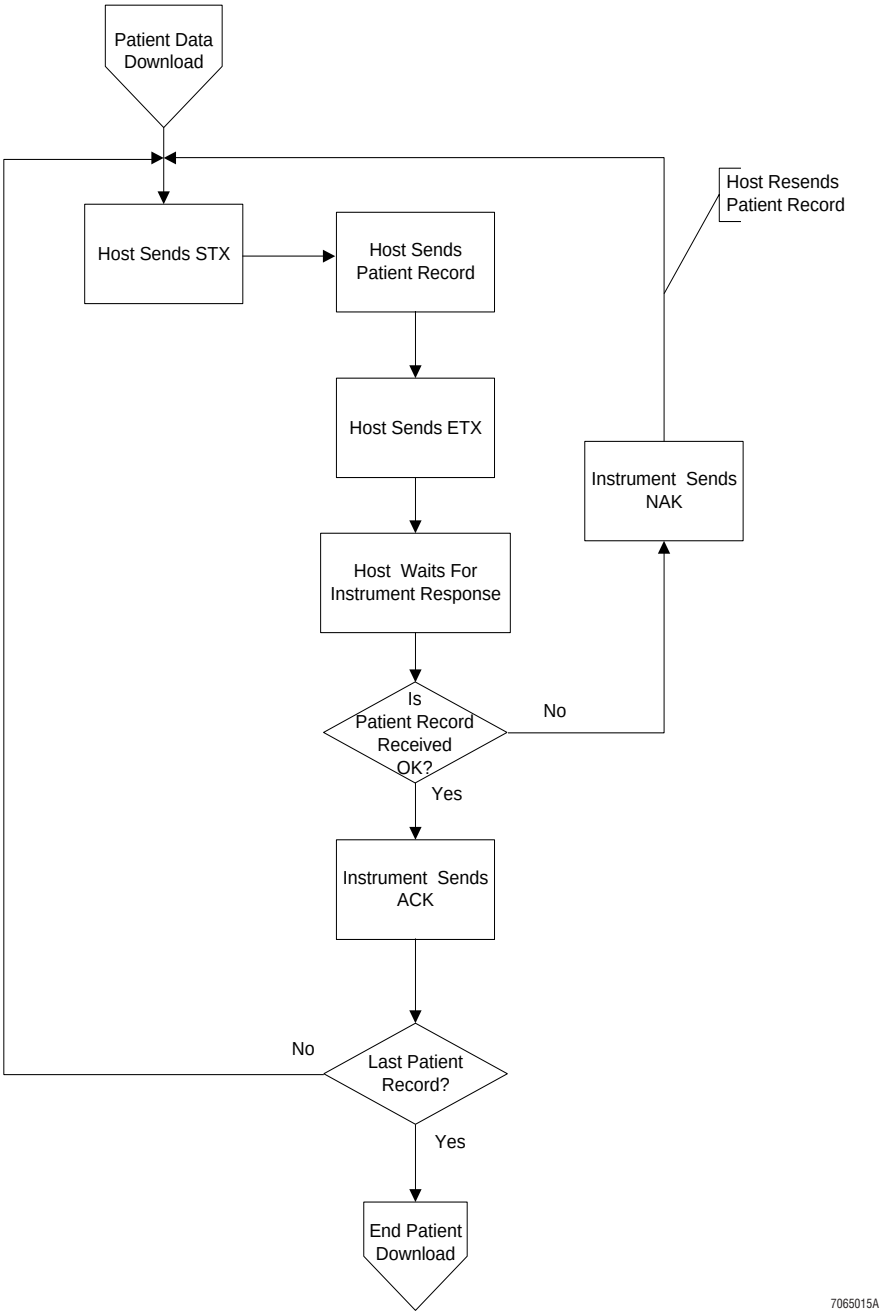


Patient Data Transmission

Once Line bid is established, the host can transmit the patient files in Fixed or Variable formats as defined in this document. The instrument can accept either format automatically, independent of the setting selected in the LIS/HIS Screen. The host must wait for an ACK (hex ($06) from the instrument for every patient record sent by the host. If the instrument sends a NAK (hex ($15) for any patient record, the host retransmits the patient record.

For a detailed description of the patient data download process, see Figure 1.18.

Figure 1.18 Patient Data Download Process: AL



End Patient Download Transmission

The End Patient Download follows at the end of the patient data download. The host transmits the End Patient Download string in the same format used to transmit the patient data.

See Table 1.8 for the expected patient End String.

For a detailed description of the End Patient Data Download process, see Figure 1.19.

Character formats include:

–: Space ($20)

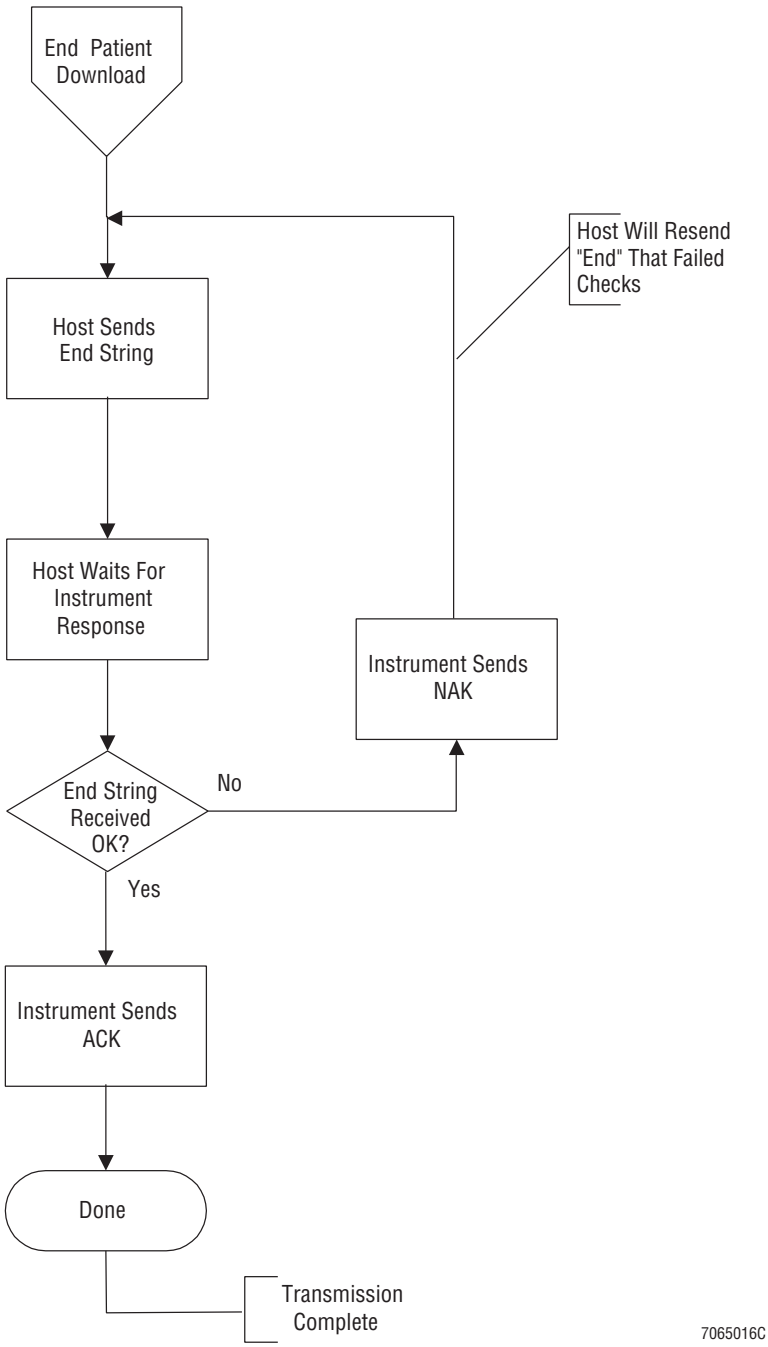
] : Carriage return ($0D)

z: numeric field.

Table 1.8 End Variable String: AL

Information	Description	Number of Characters
STX ($02)	Start of Text	1
zzzzz]	Number of bytes (in decimal format $30-$39) between STX and ETX in End Variable String followed by CR ($0D)	5 + 1
($FF)-END-----]	Results Type. $FF, Space ($20) followed by word END with 5 spaces, followed by CR ($0D)	2 + 8 + 1
($FD)-zzzz]	Hex-ASCII (lower case) sum, modulo $FFFF, of preceding bytes (starting with second byte) in End Variable String	2 + 4 + 1
ETX ($03)	End of Text	1

Figure 1.19 End Patient Data Download Process: AL



Output Characteristics

- ASCII characters
- Analyzer manages XON/XOFF protocol.

Communication Protocol

- When transmission is correct, the Host sends ACK ($06).
- When transmission is incorrect, the Host sends NAK ($15).
- Number of transmission attempts: 6
- Timeout: 15 seconds

If there is an ENQ\ENQ conflict, the Analyzer waits two seconds and attempts re-transmission. If there are 6 consecutive attempts, the Analyzer waits from 500 milliseconds to 10 seconds before transmitting another download request.

In the event of conflict, the Analyzer takes priority.

A transmission can contain several results.

2.1 INTRODUCTION

Do the setup procedures in this section only if you have the OV System.

- For setup information for the CP System, see Chapter ***3, HOST COMMUNICATIONS SETUP: CAP PIERCE SYSTEM***.
- For setup information for the AL System, see Chapter ***4, HOST COMMUNICATIONS SETUP: AUTOLOADER SYSTEM***.

2.2 SETTING UP THE OPEN VIAL INSTRUMENT FOR HOST COMMUNICATION

Only authorized technicians should perform this procedure.

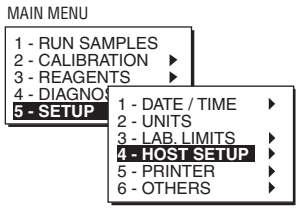
Use these procedures to configure your instrument to communicate with your laboratory's host computer.

Host Setup Configuration

Do this procedure to choose the baud rate, parity, stopbit, character length, protocol, and analyzer number for any transmission format.

---

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.

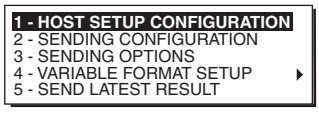


---

2 Enter the user password and press  .

---

3 Select **HOST SETUP CONFIGURATION**.

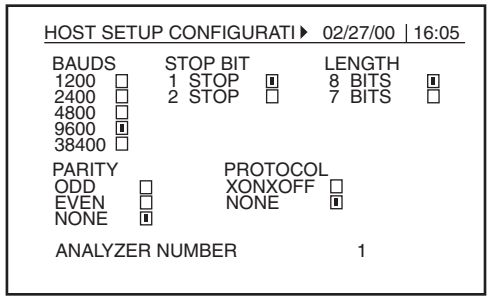


4 Move the cursor to the parameter you want to select and press • to select or de-select the selection

Note:

▮ = selected.

☐ = not selected.



5 Repeat step 4 as needed.

Note: The Analyzer Number is a numeric field. Enter the numbers at the numeric keypad.

6 Press ↵ to accept the changes.

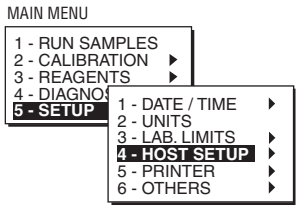
7 Press ESC to exit and save the changes.

2.3 SENDING CONFIGURATION

Do this procedure to configure the transmission format, software handshake, time out, waiting time, and automatic disconnect parameters.

---

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.

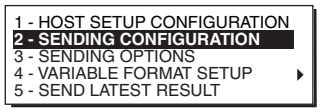


---

2 Enter the user password and press  .

---

3 Select **SENDING CONFIGURATION**.



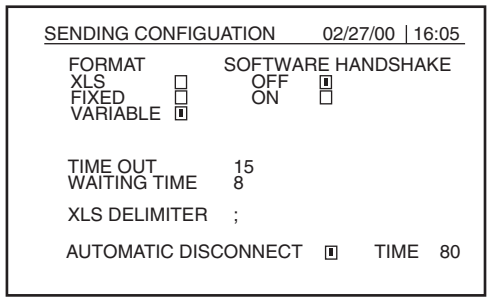
4 Move the cursor to the parameter you want to select and press •.

The Time Out value represents the number of seconds the instrument will wait for a host response with Software Handshake ON. Waiting Time and Automatic Disconnect are not for customer use at this time. However, ensure that the Automatic Disconnect checkbox is selected.

Note:

☒ = selected.

☐ = not selected.



5 Repeat step 4 as needed.

Note: For numeric fields, enter the numbers at the numeric keypad and press ↵.

6 Press ESC to exit and save the changes.

2.4 SENDING OPTIONS

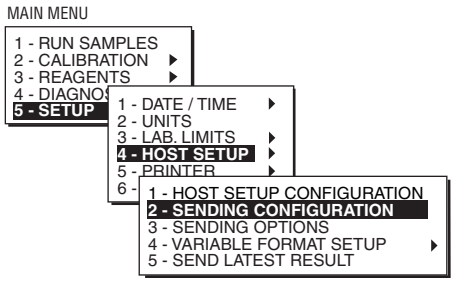
There are five sending options from which you can choose:

- *Step-by-step Transmission*: transmits all patient samples (auto xmit).
- *Send Calibration Results*: transmits individual results from calibration run.
- *Send Flowcell WBC Calibration Results*: transmits individual results from flowcell WBC calibration process.
- *Send Reproducibility Results*: transmits individual results from reproducibility procedure.
- *Send Startup Results*: transmits background results at the end of Startup.

Do this procedure to select the results to be transmitted.

---

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP ▸▸ SENDING OPTIONS**.



---

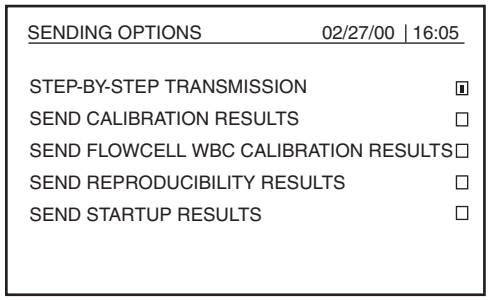
2 Move the cursor to the desired option and press  to select or de-select the option.

Note:

☑ = selected.

☐ = not selected.

Note: If selected, Step-by-Step transmission sets the instrument to automatically transmit the result to the host when the cycle is completed.



---

3 Repeat step 2 as needed.

4 Press ESC to exit and save the changes.

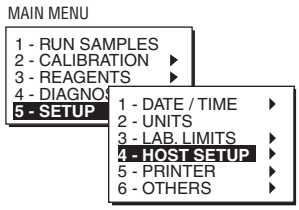
Variable Format Setup

The Variable format allows you to select the information to be transmitted, such as numeric values, flags and messages, histograms and thresholds, and patient files.

Numeric Values

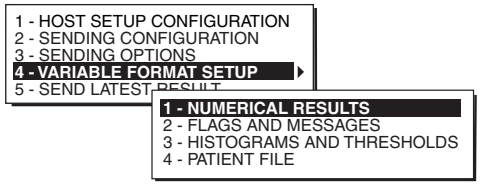
Do this procedure to select the hematology parameters to be transmitted.

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.



2 Enter the user password and press ↵.

3 Select **VARIABLE FORMAT SETUP ▸▸ NUMERICAL RESULTS**.

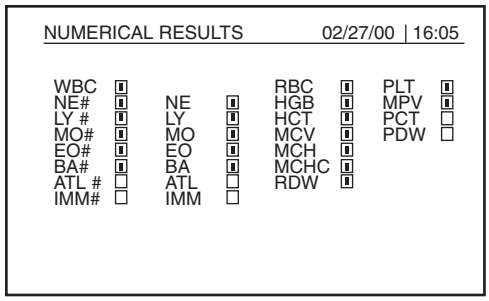


4 Move the cursor to the parameter you want to select and press ● to select or de-select the option.

Note:

▣ = selected.

☐ = not selected.



ATTENTION: On the language selection screen, if Pct, PDW, ATL, or IMM is selected and if the USA field is selected, the message "IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY" will transmit. Refer to heading A.4, LANGUAGE AND USA FIELD SELECTION, in the Operator's Guide for additional information.

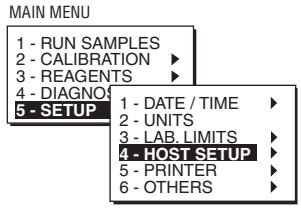
5 Repeat step 4 as needed.

6 Press ESC to exit and save the changes.

Flags and Messages

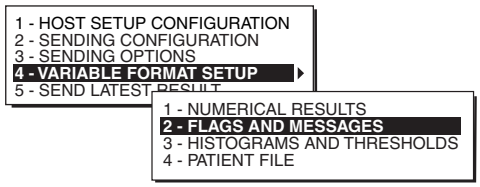
Do this procedure to select the flags and interpretive messages to be transmitted.

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.



2 Enter the user password and press  .

3 Select **VARIABLE FORMAT SETUP ▸▸ FLAGS AND MESSAGES**.

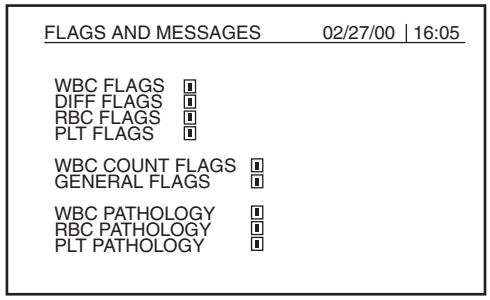


4 Move the cursor to the parameter you want to select and press  to select or de-select the selection

Note:

 = selected.

 = not selected.

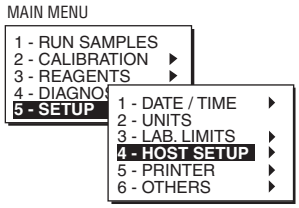


5 Repeat step 4 as needed.

6 Press  to exit and save the changes.

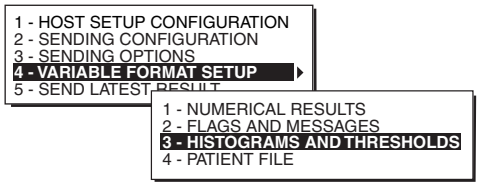
Histograms and Thresholds

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.



2 Enter the user password and press  .

3 Select **VARIABLE FORMAT SETUP ▸▸ HISTOGRAMS AND THRESHOLDS**.

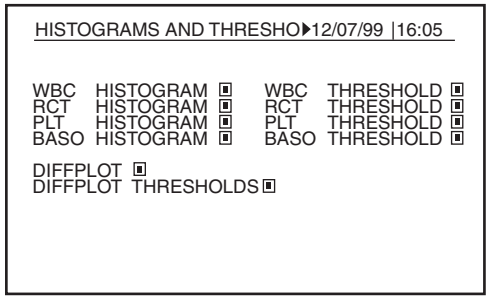


4 Move the cursor to the parameter you want to select and press  to select or de-select the selection

Note:

☑ = selected.

☐ = not selected.



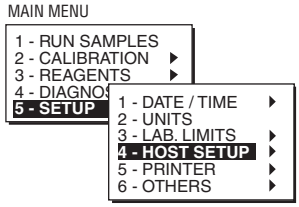
5 Repeat step 4 as needed.

6 Press ESC to exit and save the changes.

Patient File

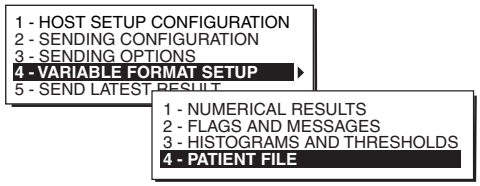
Do this procedure to select the patient file data to be transmitted.

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.



2 Enter the user password and press ↵.

3 Select **VARIABLE FORMAT SETUP ▸▸ PATIENT FILE**.

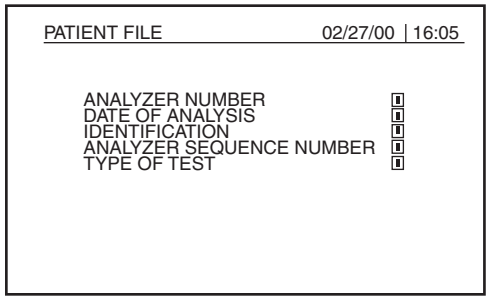


4 Move the cursor to the parameter you want to select and press • to select or de-select the selection

Note:

☒ = selected.

☐ = not selected..



5 Repeat step 4 as needed.

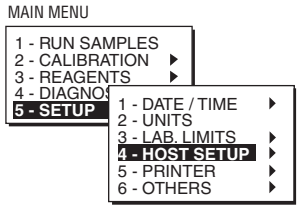
6 Press ESC to exit and save the changes.

Send Latest Result

Do this procedure to transmit the latest result to the host computer via the RS 232 output port on the instrument.

---

1 Beginning at the Main menu, select **SETUP ▸▸ HOST SETUP**.



---

2 Enter the user password and press  .

---

3 Select **SEND LATEST RESULTS**.

2.5 PIN ASSIGNMENTS

Determine if the host has a 9-pin or a 25-pin port and ensure that the pin assignments are properly configured. See:

- Figure 2.1, 9-Pin Configuration (OV), or
- Figure 2.2, 25-Pin DTE Configuration (OV).

Figure 2.1 9-Pin Configuration (OV)

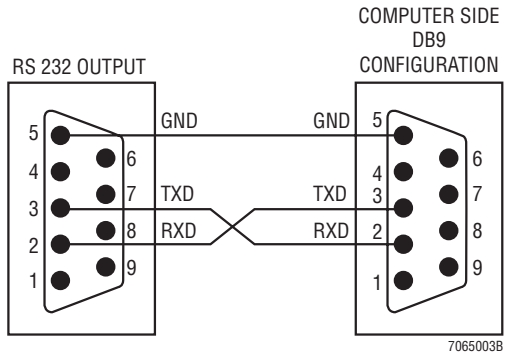
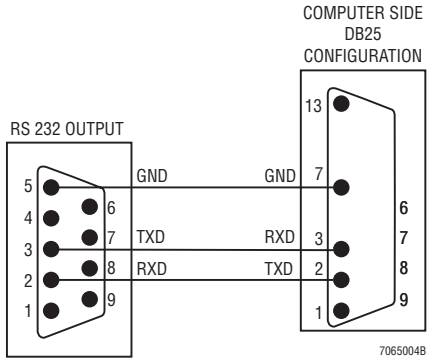


Figure 2.2 25-Pin DTE Configuration (OV)



3.1 INTRODUCTION

Do the setup procedures in this section only if you have the CP System.

- For setup information for the OV System, see Chapter ***2, HOST COMMUNICATIONS SETUP: OPEN VIAL SYSTEM***.
- For setup information for the AL System, see Chapter ***4, HOST COMMUNICATIONS SETUP: AUTOLOADER SYSTEM***.

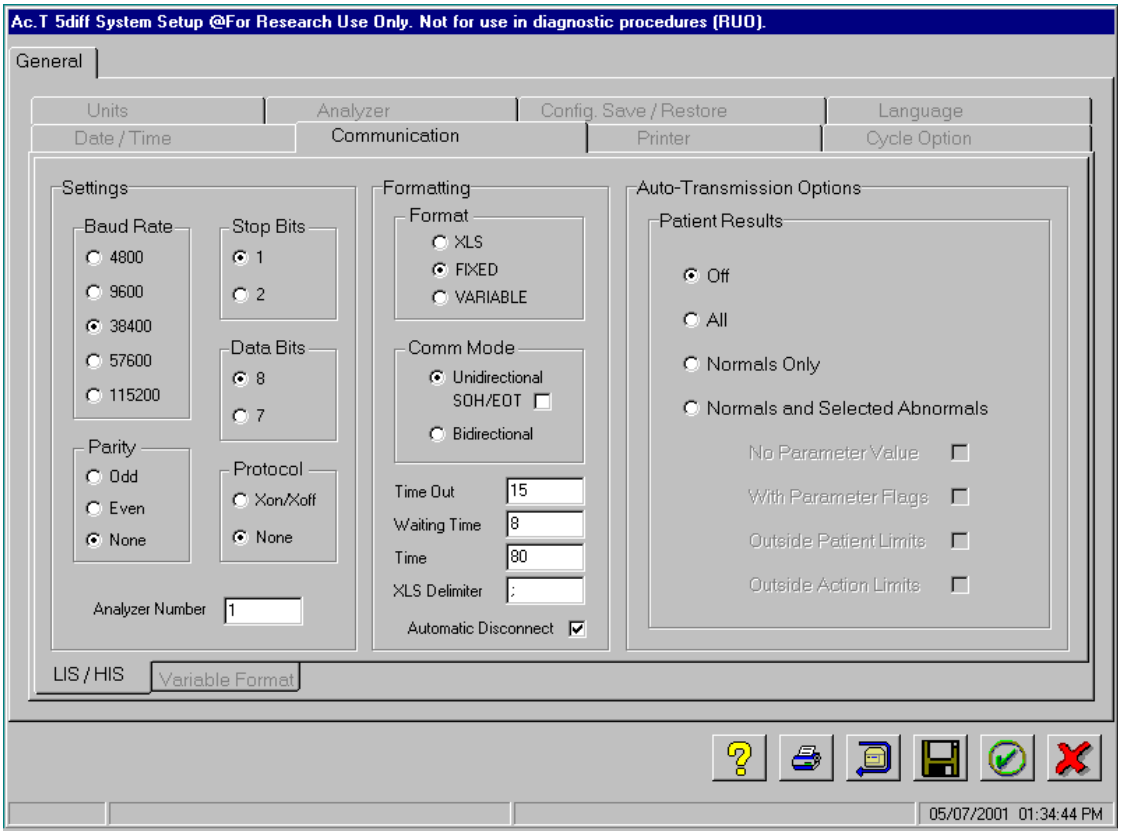
3.2 SETTING UP THE INSTRUMENT FOR HOST COMMUNICATION

Only authorized technicians should perform this procedure.

Use these procedures to configure your instrument to communicate with your laboratory's host computer.

Figure 3.1 shows the setup screen.

Figure 3.1 Host Communication Setup Window: CP



Communication Configuration

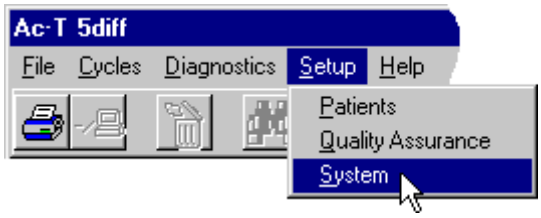
Do this procedure to define the communication configuration, including the settings, formatting, and autotransmission options. These settings apply to all formats.

There are 4 autotransmission options for results from which you can choose:

- *Off*: no patient results will be transmitted.
- *All*: transmits all patient results.
- *Normals only*: transmits all normal patient results.
- *Normals and Selected Abnormals*: transmits all normal patient results and selected abnormal patient results.

---

1 **Setup** ▸▸ **System**.

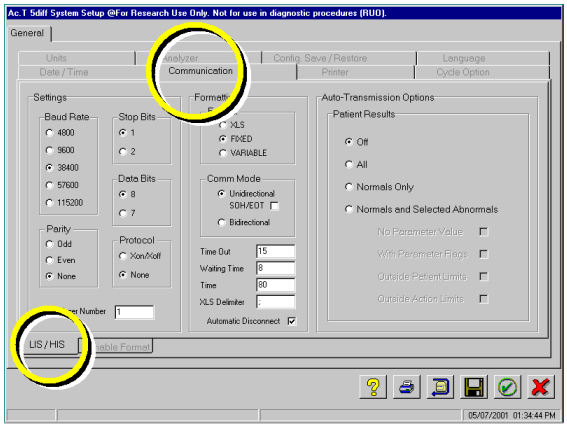


---

2 Enter the password and .

---

3 :the **Communication** tab then the **LIS/HIS** tab.



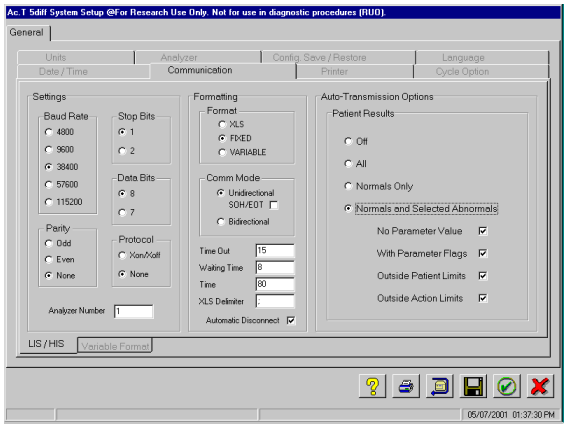
4  to print the existing settings for reference, if needed.

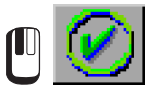
5 the button next to the desired setting. Repeat for each setting.

Note: If you select **Normals and Selected Abnormals** as the autotransmission option, then you can further select from:

No Parameter Value
With Parameter Flags
Outside Patient Limits
Outside Action Limits

For numeric fields, enter the number and press tab to go the next field.



6  to save the settings.

It is recommended that you log out and log in again to ensure that the change to the communications settings are applied correctly.

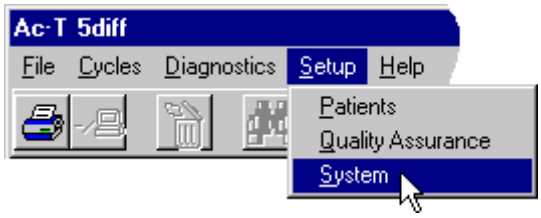
Variable Format Setup

The Variable format allows you to select the information to be transmitted, such as numeric values, flags and messages, histograms and thresholds, and patient information.

Do this procedure to select the transmission for the desired numerical results, flags and messages, patient information, and histograms and thresholds.

---

1 **Setup** ▸▸ **System**.

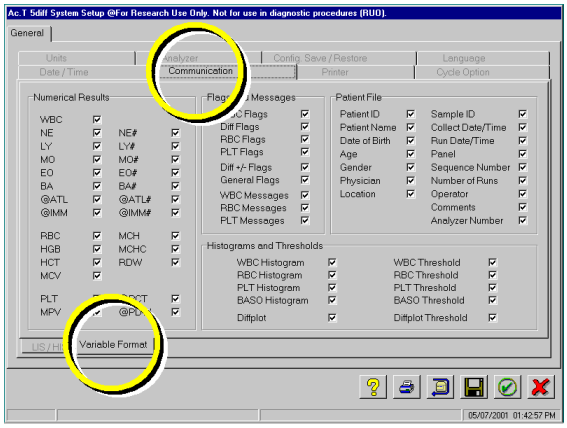


---

2 Enter the password and .

---

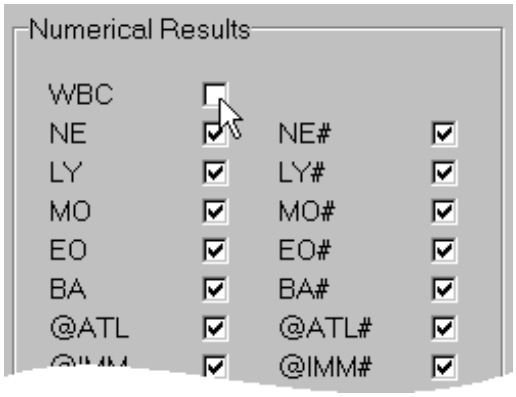
3 the **Communication** tab then the **Variable Format** tab.



---

4 to print the existing settings for reference, if needed.

5 the button next to the desired setting. Repeat for each desired setting.



6 to save the settings.

3.3 PIN ASSIGNMENTS

Determine if the host has a 9-pin or a 25-pin port and ensure that the pin assignments are properly configured. See:

- Figure 3.2, 9-Pin Configuration (CP), or
- Figure 3.3, 25-Pin DTE Configuration (CP).

Figure 3.2 9-Pin Configuration (CP)

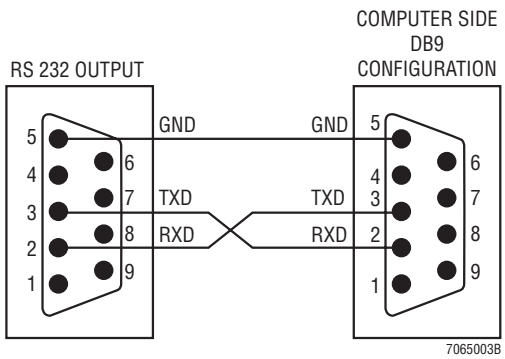
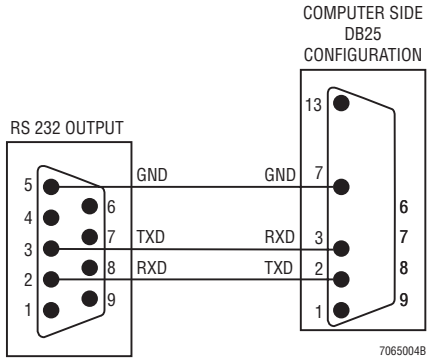


Figure 3.3 25-Pin DTE Configuration (CP)



4.1 INTRODUCTION

Do the setup procedures in this section only if you have the AL System.

- For setup information for the OV system, see ***Heading 2, HOST COMMUNICATIONS SETUP: OPEN VIAL SYSTEM***.
- For setup information on the CP system, see ***Heading 3, HOST COMMUNICATIONS SETUP: CAP PIERCE SYSTEM***.

4.2 SETTING UP THE AL INSTRUMENT FOR HOST COMMUNICATION

Only authorized technicians should perform this procedure.

Use these procedures to configure your instrument to communicate with your laboratory's host computer.

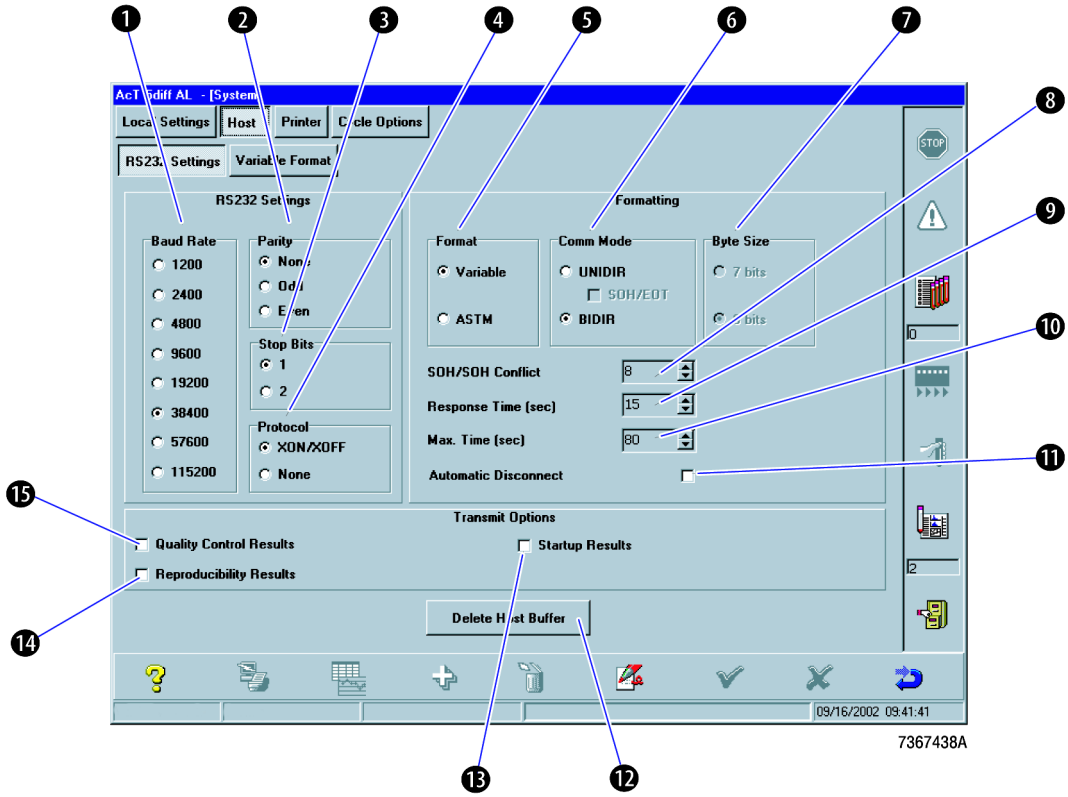
Two tabs are available under the Host tab: **RS232 Settings** and **Variable Format**.

RS232 Settings

Understanding the RS232 Settings Screen

See Figure 4.1.

Figure 4.1 RS232 Settings Screen: AL



1. Allows you to select the baud rate.
2. Allows you to select the parity.
3. Allows you to select the stop bits.
4. Allows you to select the protocol.

❺ Allows you to select the format.

❻ Allows you to select the communication mode.

❼ Allows you to select the byte size.

❽ Allows you to define the SOH/SOH Conflict parameters.

❾ Allows you to define the response time in seconds. When the Automatic Disconnect checkbox is selected, this is the time the instrument will wait for a host response during patient file downloads.

❿ Allows you to define the maximum time (in seconds) that the Host will attempt transmitting data.

⓫ Allows you to select Automatic Disconnect, which will cause the Host to disconnect when the maximum time is reached.

⓬ Allows you to delete the Host buffer.

⓭ Allows you to select to have Startup results automatically uploaded from the Analyzer.

⓮ Allows you to select to have Reproducibility results automatically uploaded from the Analyzer.

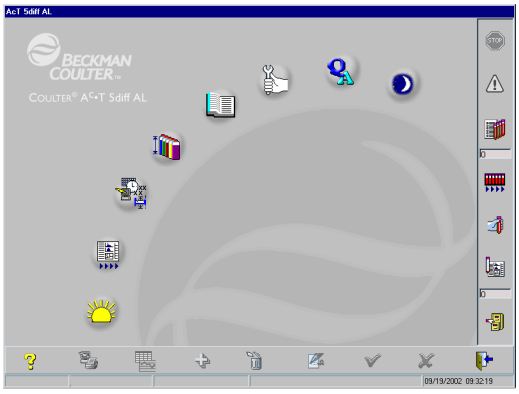
⓯ Allows you to select to have Quality Control results automatically uploaded from the Analyzer.

Procedure for Defining RS232 Settings

Do this procedure to define the RS232 settings.

---

1 At the Main Menu screen,  .

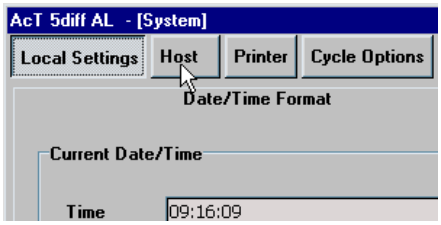


---

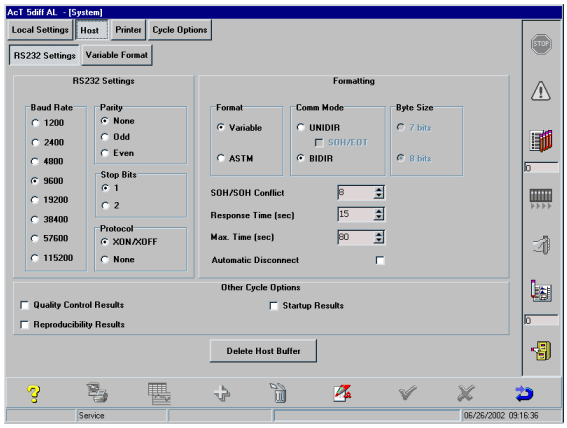
2  .

---

3  the **Host** tab.



4 the **RS232 Settings** tab.



5 .

6 Select the desired option(s).

7 to save the change.

Variable Format

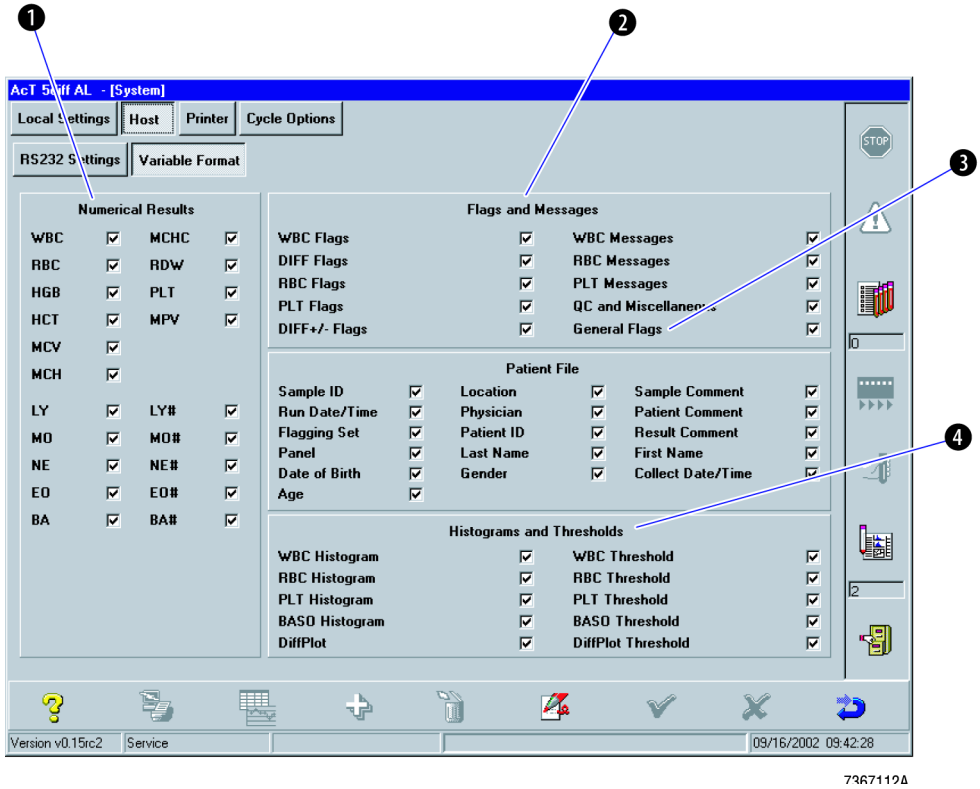
Under the Variable Format tab (Figure 4.2), you can define/edit these settings:

- Numerical Results
- Flags and Messages
- Patient File
- Histograms and Thresholds

Understanding the Variable Format Screen

See Figure 4.2.

Figure 4.2 Variable Format Settings Screen (AL)



❶ Allows you to select the parameters for which you want numerical results to be sent to the Host computer

❷ Allows you to select the flags and messages to be sent to the Host computer

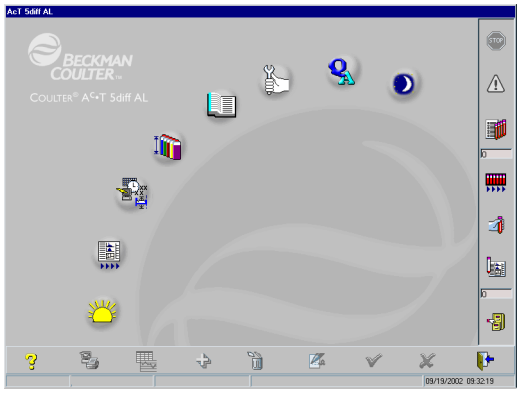
❸ Allows you to select specific information from the patient file to be sent to the Host computer

❹ Allows you to select histograms and thresholds to be sent to the Host computer

Do this procedure to define the Variable Format settings.

---

1 At the Main Menu screen,  .

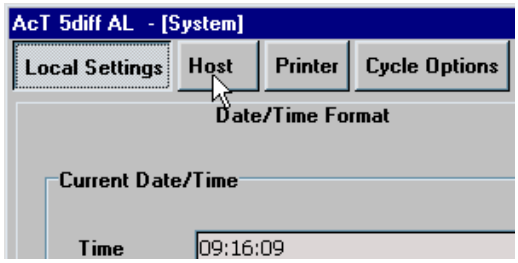


---

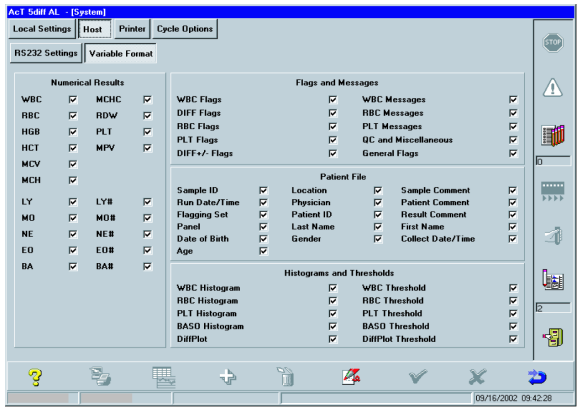
2  .

---

3  the **Host** tab.



4 the **Variable Format** tab.



5 .

6 Select the desired option(s).

7 to save the change.

4.3 VERIFYING PIN ASSIGNMENTS

Determine if the Host computer has a 9-pin or a 25-pin port and ensure that the pin assignments are properly configured. See:

- Figure 4.3, 9-Pin Configuration (AL), or
- Figure 4.4, 25-Pin DTE Configuration (AL).

Figure 4.3 9-Pin Configuration (AL)

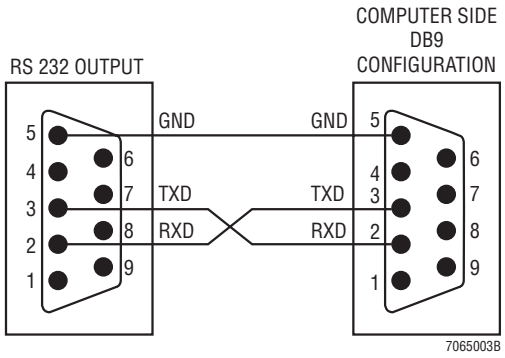
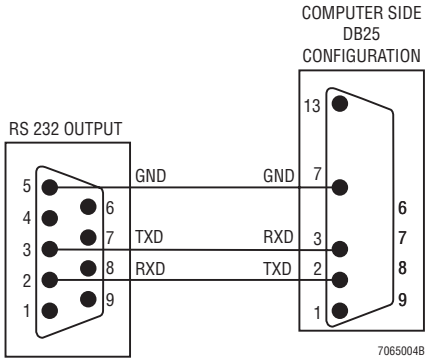


Figure 4.4 25-Pin DTE Configuration (AL)



5.1 FORMATS

ATTENTION: Each format is unique to the instrument type (OV, CP, or AL) and must not be interchanged.

Available Formats: OV and CP Systems

There are three formats available for the OV and CP systems: Fixed, Variable, and XLS. However, the two recommended formats on the OV and CP systems are Fixed and Variable. The XLS format is for factory use only and is not recommended for customer use.

Available Formats: AL System

There is one format available for the AL system: Variable. For additional information:

- See Heading 5.5, VARIABLE FORMAT: AL SYSTEM.

5.2 ALPHANUMERIC CHARACTERS

Alphanumeric characters consist of letters from the alphabet and numbers. Special characters, such as a comma ($2C), are NOT included and, therefore, should not be used as an alphanumeric characters.

5.3 FIXED FORMAT: OV SYSTEM

Description

For the OV system, the Fixed format host output provides a fixed output of 434 ASCII characters per sample result as shown in the format layout below. Each transmission includes an STX and ETX.

Character Format

Space and carriage return are represented as:

- : Space ($20)

] : Carriage return ($0D)

z: numeric field,

zz/zz/zz – Date, in format selected in Setup/Date Format
zzHzzmnzzs –Time, in 24hr format Hours(h) Minutes(mn) seconds(s)
zzzzz – Parameter result in US format with extra decimal place, right justified with leading zeros e.g. 04.52

When a parameter is not transmitted the field (zzzzz) is replaced by . . . . ..

Note: In CBC mode, all Differential parameters are transmitted as . . . . .. Pct, PDW, ATL % and #, and IMM % and # are transmitted as . . . . . unless enabled in Setup. If RUO parameters are enabled and USA is selected in language selection, then the RUO (Research Use Only) message will transmit; otherwise, “spaces” are sent.

Y: Sequence number

4 digits or spaces $30 to $39 or $20 (right-justified with leading spaces).

A: Sample ID

Autonumbering ID mode: 5 numeric characters or spaces $30 to $39 or $20 (left-justified with 11 trailing spaces).

Manual ID mode: 16 alphanumeric characters, $20 to $7F (left justified with trailing spaces).

R: Parameter review flag identifier

Space " " ($20) indicates no parameter flag (normal)
* ($2A) indicates parameter flag and result should be reviewed

N: Patient Flagging Limits identifier

Space " " ($20) indicates within Patient limits
H ($48) indicates result greater than Patient limits
L ($4C) indicates result lower than Patient Limits
D ($44) indicates exceeds instrument capacity

ABC… : DiffPlot, WBC/BASO and Plt flag identifiers

Zero "0" indicates no flag or flag not used
One "1" indicates flag present

CRC is calculated using EXCLUSIVE OR (XOR) of all transmitted bytes except STX and ETX, then an inclusive "or" (OR) with ($40).

EXCLUSIVE OR (XOR) follows the rule:	1 XOR 1 = 0	1 XOR 0 =1	0 XOR 0 = 0
INCLUSIVE OR (OR) follows the rule:	1 OR 1 = 1	1 OR 0 = 1	0 OR 0 = 0

Example:

STX ($02)
Value 1
Value 2
…..
Value X
CRC
ETX ($03)

Result Format for OV System

See Table 5.1.

Table 5.1 Result Format for OV System

Line Number	Description
1	STX, header and analyzer number
2	Sequence number
3	Sample ID
4	Date, time, and sampling mode
5 to 37	Parameter result, Review flag and Patient Limit flag information
38	DiffPlot flagging information. See Table 5.3 for flag interpretation
39	WBC/BASO flagging information. See Table 5.4 for flag interpretation
40	Plt flagging information. See Table 5.5 for flag interpretation

Table 5.1 Result Format for OV System *(Continued)*

Line Number	Description
41	RUO message (when USA and RUO parameters are selected)
42	CRC, ETX

Layout Format for OV System

See Table 5.2.

Table 5.2 Layout Format for OV System

Line Number	Information Sent	Description	Number of Characters
1	STXRzz]	Start of text, character “R”, analyzer number	1+1+2+1
2	YYYY]	Sequence number	4+1
3	AAAAAAAAAAAAAAA]	ID field	16+1
4	zz/zz/zz-zzHzzmnzzs*]	Date and time	20 + 1
5	zzzzz-RN]	WBC count and Flags	8 + 1
6	zzzzz-RN]	LY# and Flags	8 + 1
7	zzzzz-RN]	LY% and Flags	8 + 1
8	zzzzz-RN]	MO# and Flags	8 + 1
9	zzzzz-RN]	MO% and Flags	8 + 1
10	. . . . .-RN]	Not Used	8 + 1
11	. . . . .-RN]	Not Used	8 + 1
12	zzzzz-RN]	NE# and Flags	8 + 1
13	zzzzz-RN]	NE% and Flags	8 + 1
14	zzzzz-RN]	EO# and Flags	8 + 1
15	zzzzz-RN]	EO% and Flags	8 + 1
16	zzzzz-RN]	BA# and Flags	8 + 1
17	zzzzz-RN]	BA% and Flags	8 + 1
18	zzzzz-RN]	ATL# and Flags	8 + 1
19	zzzzz-RN]	ATL% and Flags	8 + 1
20	zzzzz-RN]	IMM# and Flags	8 + 1
21	zzzzz-RN]	IMM% and Flags	8 + 1
22	. . . . .-RN]	Not Used	8 + 1
23	. . . . .-RN]	Not Used	8 + 1
24	. . . . .-RN]	Not Used	8 + 1
25	. . . . .-RN]	Not Used	8 + 1
26	zzzzz-RN]	RBC and Flags	8 + 1

Table 5.2 Layout Format for OV System *(Continued)*

Line Number	Information Sent	Description	Number of Characters
27	zzzzz-RN]	HGB and Flags	8 + 1
28	zzzzz-RN]	HCT and Flags	8 + 1
29	zzzzz-RN]	MCV and Flags	8 + 1
30	zzzzz-RN]	MCH and Flags	8 + 1
31	zzzzz-RN]	MCHC and Flags	8 + 1
32	zzzzz-RN]	RDW and Flags	8 + 1
33	. . . . .-RN]	Not Used	8 + 1
34	zzzzz-RN]	PLT and Flags	8 + 1
35	zzzzz-RN]	MPV and Flags	8 + 1
36	zzzzz-RN]	PCT and Flags	8 + 1
37	zzzzz-RN]	PDW and Flags	8 + 1
38	ABCDEFGHIJKLMNOPQRSTU]	DIFFPLOT Flags	21 +1
39	ABCDEF]	WBC/BASO Flags	6 + 1
40	ABC]	PLT Flags	3 + 1
41	IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY	RUO messages when parameters selected in USA mode	53 +1
42	CRC, ETX	Cyclic Redundancy Check	1+1
			Total characters: 434

Flag Format: OV System

Line 38 – DiffPlot Flags for OV System

See Table 5.3.

Table 5.3 Line 38 – DiffPlot Flags for OV System

Character	Flag
A	SL
B	NL
C	MN
D	LN
E	UM
F	UN
G	DB
H	Diff Reject
I	NE

Table 5.3 Line 38 – DiffPlot Flags for OV System *(Continued)*

J	Not used
K	Not used
L	Not used
M	Not used
N	Not used
O	Not used
P	MB
Q	Not used
R	Not used
S	Not used
T	Not used
U	Not used
Flags "Not used" are always sent as 0.	

Line 39 – WBC/BASO Flags for OV System

See Table 5.4.

Table 5.4 Line 39 – WBC/BASO Flags for OV System

Character	Flag
A	*WBC
B	Not used
C	Not used
D	Not used
E	Not used
F	Not used
Flags "Not used" are always sent as 0.	

Line 40 – Plt Flags for OV System

See Table 5.5.

Table 5.5 Line 40 – Plt Flags for OV System

Character	Flag
A	SCL
B	SCH
C	MIC

5.4 FIXED FORMAT: CP SYSTEM

Description

For the CP system, the Fixed Format provides a constant input or output of characters per sample to and/or from the host. See Table 5.6.

Table 5.6 Fixed Format for CP System: Characters Per Sample by Communication Mode

Communication Mode	Direction	Total Characters
Unidirectional	Workstation to Host	491, or 493 if SOH/EOT are enabled
Bidirectional	Workstation to Host	499 (SOH, 491 data, 7 end string)
Bidirectional	Host to Workstation	225 (SOH, 217 data, 7 end string)

Character Format

Space and carriage return are represented as:

–: Space ($20)

] : Carriage return ($0D)

z: numeric field,

dd/mm/yyyy – Date, 8 numeric characters ($30 to $39) representing the date, where dd is the day of month, mm is the month, and yyyy is the year.
zzhzzmnzzs –Time, in 24hr format Hours(h) Minutes(mn) seconds(s)
zzzzz – Parameter result in US format with extra decimal place, right justified with leading zeros e.g. 04.52

When a parameter is not transmitted the field (zzzzz) is replaced by . . . . ..

Note: In CBC mode, all Differential parameters are transmitted as . . . . .. Pct, PDW, ATL % and #, and IMM % and # are transmitted as . . . . . unless enabled in Setup. If enabled and USA is selected in language selection, then the RUO (Research Use Only) message will transmit; otherwise, “spaces” are sent.

A: Sample ID

Autonumbering ID mode: 6 numeric characters or spaces $30 to $39 or $20 (left-justified with 10 trailing spaces).

Manual ID mode: 16 alphanumeric characters, $20 to $7F (left justified with trailing spaces).

B: Alphanumeric characters

Example: ($20), $30 to $39), ($41 to $5A), and ($61 to $7A)

Y: Sequence number

4 digits or spaces $30 to $39 or $20 (right-justified with leading spaces).

P: Panel (test type)

A ($41) – CBC
B ($42) – CBC/DIFF

CDEF: Age. CDE represents age, and F represents the age designator (days [d] = $64, weeks [w] = $77, months [m] = $6D, years [y] = $79). For example, 017d, 003w, 010 m, or 017 y.

G: Gender (female [F] = $46, male [M] = $4D, or Unknown [U} = $55).

ddmmyyyy: Date of birth or collection date. (dd = day, mm = month, yyyy = year)

zzhzzmnzzs: Time. (z = numeric value, h= hours, mn = minutes, s = seconds).

R: Parameter review flag identifier

Space " " ($20) indicates no parameter flag (normal)
* ($2A) indicates parameter flag and result should be reviewed

N: Patient Flagging Limits identifier

Space " " ($20) indicates within Patient limits
H ($48) indicates result greater than Patient limits
L ($4C) indicates result lower than Patient Limits
D ($44) indicates exceeds instrument capacity

ABC… : DiffPlot, WBC/BASO and Plt flag identifiers

Zero "0" indicates no flag or flag not used
One "1" indicates flag present

CRC is calculated using EXCLUSIVE OR (XOR) of all transmitted bytes except STX and ETX, then an inclusive "or" (OR) with ($40).

EXCLUSIVE OR (XOR) follows the rule:	1 XOR 1 = 0	1 XOR 0 =1	0 XOR 0 = 0
INCLUSIVE OR (OR) follows the rule:	1 OR 1 = 1	1 OR 0 = 1	0 OR 0 = 0

Example:

STX ($02)
Value 1
Value 2
…..
Value X
CRC
ETX ($03)

Result Format for CP System

The result format defines the format of the results to be transmitted from the CP system to the host (upload). See Table 5.7.

Table 5.7 Result Format for CP System

Line Number	Description
1	STX, header and analyzer number
2	Sequence number
3	Sample ID
4	Patient name
5	Patient ID
6	Date and time
7 to 39	Parameter result, Review flag, and Patient Limit flag information
40	DiffPlot flagging information. See Table 5.9 for flag interpretation.
41	WBC/BASO flagging information. See Table 5.10 for flag interpretation
42	Plt flagging information. See Table 5.11 for flag interpretation
43	RUO message (when USA and RUO parameters are selected)
44	CRC, ETX

Layout Format for CP System

See Table 5.8.

Table 5.8 Layout Format for CP System

Line Number	Information Sent	Description	Number of Characters
1	STXRzz]	Start of text, character “R”, analyzer number	1+1+2+1
2	YYYY]	Sequence number	4+1
3	AAAAAAAAAAAAAAA]	Sample ID	16+1
4	BBBBBBBBBBBBBBBBBBBBBBBBBBBBBB]	Patient Name	30 + 1
5	BBBBBBBBBBBBBBBBBBBBBBBBBBB]	Patient ID	25 + 1
6	ddmmyyyy-zzhzzmnzzs–]	Date, time, and sampling mode	20 + 1
7	zzzzz-RN]	WBC count and Flags	8 + 1
8	zzzzz-RN]	LY# and Flags	8 + 1
9	zzzzz-RN]	LY% and Flags	8 + 1
10	zzzzz-RN]	MO# and Flags	8 + 1
11	zzzzz-RN]	MO% and Flags	8 + 1
12	. . . . .-RN]	Not Used	8 + 1

Table 5.8 Layout Format for CP System *(Continued)*

Line Number	Information Sent	Description	Number of Characters
13	. . . . .-RN]	Not Used	8 + 1
14	zzzzz-RN]	NE# and Flags	8 + 1
15	zzzzz-RN]	NE% and Flags	8 + 1
16	zzzzz-RN]	EO# and Flags	8 + 1
17	zzzzz-RN]	EO% and Flags	8 + 1
18	zzzzz-RN]	BA# and Flags	8 + 1
19	zzzzz-RN]	BA% and Flags	8 + 1
20	zzzzz-RN]	ATL# and Flags	8 + 1
21	zzzzz-RN]	ATL% and Flags	8 + 1
22	zzzzz-RN]	IMM# and Flags	8 + 1
23	zzzzz-RN]	IMM% and Flags	8 + 1
24	. . . . .-RN]	Not Used	8 + 1
25	. . . . .-RN]	Not Used	8 + 1
26	. . . . .-RN]	Not Used	8 + 1
27	. . . . .-RN]	Not Used	8 + 1
28	zzzzz-RN]	RBC and Flags	8 + 1
29	zzzzz-RN]	HGB and Flags	8 + 1
30	zzzzz-RN]	HCT and Flags	8 + 1
31	zzzzz-RN]	MCV and Flags	8 + 1
32	zzzzz-RN]	MCH and Flags	8 + 1
33	zzzzz-RN]	MCHC and Flags	8 + 1
34	zzzzz-RN]	RDW and Flags	8 + 1
35	. . . . .-RN]	Not Used	8 + 1
36	zzzzz-RN]	PLT and Flags	8 + 1
37	zzzzz-RN]	MPV and Flags	8 + 1
38	zzzzz-RN]	PCT and Flags	8 + 1
39	zzzzz-RN]	PDW and Flags	8 + 1
40	ABCDEFGHIJKLMNOPQRSTU]	DIFFPLOT Flags	21 +1
41	ABCDEF]	WBC/BASO Flags	6 + 1
42	ABC]	PLT Flags	3 + 1
43	IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY	RUO messages when parameters selected in USA mode	53 +1
44	CRC, ETX	Cyclic Redundancy Check	1+1
			Total characters: 491

Flag Format: CP System

Line 40 – DiffPlot Flags for CP System

See Table 5.9.

Table 5.9 Line 40 – DiffPlot Flags for CP System

Character	Flag
A	SL
B	NL
C	MN
D	LN
E	UM
F	UN
G	DB
H	Diff Reject
I	NE
J	Not used
K	Not used
L	Not used
M	Not used
N	Not used
O	Not used
P	MB
Q	Not used
R	Not used
S	Not used
T	Not used
U	Not used

Flags "Not used" are always sent as 0.

Line 41 – WBC/BASO Flags for CP System

See Table 5.10.

Table 5.10 Line 41 – WBC/BASO Flags for CP System

Character	Flag
A	*WBC
B	Not used
C	Not used
D	Not used
E	Not used
F	Not used

Flags "Not used" are always sent as 0.

Line 42 – Plt Flags for CP System

See Table 5.11.

Table 5.11 Line 42 – Plt Flags for CP System

Character	Flag
A	SCL
B	SCH
C	MIC

Fixed Patient File Layout Format for the CP System (Download)

The Patient File format defines the format of the patient file that is to be transmitted from a host computer to the CP Worklist.

Patient File Format

A total of 217 characters must be transmitted for each patient file as shown in the following format.

See Table 5.12.

Table 5.12 Patient File Layout Format for CP System

Line Number	Information Sent	Description	Number of Characters
1	STXDzz]	Start of text, character "D", analyzer number	1 + 1+ 2 + 1
2	AAAAAAAAAAAAAAA]	Sample ID	16 + 1
3	BBBBBBBBBBBBBBBBBBBBBBBBBBBB]	Patient Name	30 + 1
4	BBBBBBBBBBBBBBBBBBBBBBBBB]	Patient ID	25 + 1

Table 5.12 Patient File Layout Format for CP System *(Continued)*

Line Number	Information Sent	Description	Number of Characters
5	P]	Panel (test type [CBC A $41 or CBC/DIFF B $42])	1 + 1
6	ddmmyyyy]	Date of birth	8 + 1
7	CDEF]	Age	4 + 1
8	G]	Gender (F = $46, M=$4D, U = $55)	1 + 1
9	BBBBBBBBBBBBBBBBBBBBBBBBBBBB]	Physician	30 + 1
10	BBBBBBBBBB]	Location	15 + 1
11	ddmmyyyy-zzhzzmnzzs]	Collection date and time.	19 + 1
12	BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB]	Comments	50 + 1
13	CRC, ETX	Cycle Redundancy Check, End of text	1 + 1
			Total characters: 217

5.5 VARIABLE FORMAT: OV, CP, AND AL SYSTEMS

The Variable format can transmit a variable number of fields depending on the defined setup.

Transmission Format

Table 5.13 defines the structure and content of the information that can be transmitted using the Variable format. Since the information transmitted is defined by the setup of the system, the order in which the information is sent will vary with the setup configuration. This means that the order in which the information is presented below does not represent the order in which the data is transmitted. The information is transmitted as 8-bit, therefore, the data bits must be set to 8-bit.

Typical Transmission Structure (Upload): OV, CP, and AL Systems

See Table 5.13.

Table 5.13 Typical Transmission Structure and Content: Variable Format for OV, CP, and AL Systems

Information	Description	Size
STX XXXXX]	Packet Length (excluding STX & ETX	5 bytes
$FF - RESULT- -]	Information Type	Space + 8 characters
ID - XX • • • • • • • • X]	Identifier and Field 1	ID - 1 byte ($21 to $FF) defining the information in field that follows.
ID - XX • • • • • • • • • • • • • • • X]	Identifier and Field 2	
ID - XX • • • • • • • • X]	Identifier and Field n	
$FE - V3.0 -]	Format version	
$FD - CHECKSUM-]	Checksum	Sum modulo $FFFF of all characters from position two of the data and up to the last character prior to the checksum identifier character. Value is a 4-byte hexadecimal number preceded by space. Hex number is represented as a lowercase ASCII hex. (identifier – space – Checksum – carriage return)
ETX		

$ = A hexadecimal #
] = Carriage return ($OD)
- = Space ($20)

The fields that are transmitted are controlled via the selection made on the Variable Format Settings screen. In addition to those fields, the instrument will always send additional fields, regardless of the selection made.

Minimum Transmission

This section details the fields that are always sent regardless of the options selected.

Each information field is transmitted in the transmission format: ID, Space, Data, Carriage Return. Data that has a character string of less than the defined data field length will have trailing characters padded with spaces. The fields sent are different between the OV, CP, and AL; therefore, each is described separately.

Table 5.14 Minimum Transmitted Information: Variable Format (OV)

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$FF	ÿ	Results type	8 Character string **RESULT** : Sample results **END** : End string identifier **RES-BLK** : Startup background results	2 + 8 + 1 ID, Space, String, CR
$FD	ý	Check sum	4 Character Number 16 bit checksum values as 4 hexadecimal bytes (ASCII-Hex)	2 + 4 + 1 ID, Space, Number, CR
$FE	þ	Version number	5 Character string Vx.xx	2 + 5 + 1 ID, Space, String, CR
$74	t	Sampling Mode	1 Character string **M** : Open vial mode	2 + 1 + 1 ID, Space, Character, CR
$FA	ú	RUO message	53 character string IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY If country is not USA = spaces	2 + 53 + 1 ID, Space, String, CR
$FB	û	Analyzer Name	8 Character string **AcT5diff** : Open Vial system	2 + 8 + 1 ID, Space, String, CR

Table 5.15 Minimum Transmitted Information: Variable Format (CP)

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$FF	ÿ	Results type	8 Character string **RESULT** : Sample results **RES-RR** : Sample results that have been rerun **END** : End string identifier **RES-BLK** : Startup background results	2 + 8 + 1 ID, Space, String, CR
$FD	ý	Check sum	4 Character Number 16 bit checksum values as 4 hexadecimal bytes (ASCII-Hex)	2 + 4 + 1 ID, Space, Number, CR

Table 5.15 Minimum Transmitted Information: Variable Format (CP) *(Continued)*

Identifier		Description	Information Sent	Field Length and Format
Hex	**ANSI**			
$FE	þ	Version number	5 Character string Vx.xx	2 + 5 + 1 ID, Space, String, CR
$74	t	Sampling Mode	1 Character string **R** : Cap Piercing mode	2 + 1 + 1 ID, Space, Character, CR
$FA	ú	RUO message	53 character string IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY	2 + 53 + 1 ID, Space, String, CR
$FB	û	Analyzer Name	8 Character string **AcT5dfCP** : Used for the Cap Piercing unit	2 + 8 + 1 ID, Space, String, CR

Table 5.16 Minimum Transmitted Information: Variable Format (AL)

Identifier		Description	Information Sent	Field Length and Format
Hex	**ANSI**			
$FF	ÿ	Results type	8 Character string **RESULT** : Sample results **RES-RR** : Sample results that have been rerun **END** : End string identifier **RES-BLK** : Startup background results **QC-RES-M** : QC sample results	2 + 8 + 1 ID, Space, String, CR
$FD	ý	Check sum	4 Character Number 16 bit checksum values as 4 hexadecimal bytes (ASCII-Hex)	2 + 4 + 1 ID, Space, Number, CR
$FE	þ	Version number	5 Character string Vx.xx	2 + 5 + 1 ID, Space, String, CR
$74	t	Sampling Mode	1 Character string **M** : Manual/Stat Mode **R** : Autoloader mode	2 + 1 + 1 ID, Space, Character, CR
$FA	ú	RUO message	53 character string IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY	2 + 53 + 1 ID, Space, String, CR
$FB	û	Analyzer Name	8 Character string **AcT5dfAL**: Autoloader	2 + 8 + 1 ID, Space, String, CR
$70	p	Analyzer number	2 Character string	2 + 2 + 1 ID, Space, String, CR
$73	s	Analyzer sequence number	Not used. Sent as blanks.	2 + 4 + 1 ID, Space, String, CR
$82	,	Number of runs	**Number of runs:** ‘0’ for first run, ‘1’ for second run, and so forth	2 + 1 + 1 ID, Space, String, CR

Table 5.16 Minimum Transmitted Information: Variable Format (AL) *(Continued)*

Identifier		Description	Information Sent	Field Length and Format
Hex	**ANSI**			
$83	ƒ	Operator Code	**Operator code**: up to 15 characters, left justified, with trailing spaces	2 + 15 + 1 ID, Space, String, CR
$B0	°	Cassette/Position	Numeric • If a sample was run in the Autoloader mode: First two digits: Cassette (range: 01 to 99) Second two digits: Position (range: 01 to 10) Example: Cassette 2, Position 5: 0205 • If a sample was run in the Manual (Stat) mode: 0000. Note: For Control and Reproducibility samples, the Cassette and Position is sent as blanks.	2 + 4 + 1 ID, Space, String, CR

For example, Field Type RESULT: $FF $20 $52 $45 $53 $55 $4C $54 $20 $20 $0D equates to ÿ RESULTcr.

5.6 VARIABLE FORMAT SETTINGS

The following sections describe the output controlled by the variable output setup screens. Setup is divided into the following sections:

- Numerical Results
- Flags and Messages
- Patient File
- Histogram and Threshold Options (OV, CP, and AL)

Numerical Results

This section provides details of the fields that are controlled by the numerical results options.

The Hematology parameter numerical results are transmitted in a fixed length format, consisting of 10 bytes (2 + 7 + 1), in the order of ID, Space, Result, Flags, Carriage Return.

All parameters are identified by identifiers $21 to $43. The transmitted numeric field consists of five digits preceded by space. If the number of bytes in the result is less than five, the leading bytes are filled with zeros.

Note: All results are transmitted in US format with an extra decimal place compared to the displayed and printed results.

When the analyzer cannot calculate a parameter, the result is replaced by . . . . .. If the value is greater than the reportable range, the result is replaced by + + + + +.

Note: If the Country setup is USA and if the RUO parameters (PCT, PDW, ATL, or IMM) are selected, the message ($FA) "IN USA, PCT, PDW, ATL, IMM ARE FOR RESEARCH USE ONLY" is transmitted; otherwise, the field is sent as spaces.

Parameter Status

Following the numerical field, a two-character field indicates the flagging status of the result.

- The first character indicates parameter reject or review flag status.
- The second character indicates the parameter value status as compared to Patient and Action limits.

First Character

R	Review flag
*	Balance flag
V	Voteout flag
Space	No abnormality
S	Ba% and Ba# control file flag

Second Character

L	Result lower than Action limit
l	Result lower than Patient limit
H	Result higher than Action limit
h	Result higher than Patient limit
Space	Result within Patient Range
+	Result exceeds linear range but is within the reportable range
O	Parameter exceeds instrument capacity

List of Parameter Identifiers (Format - ID, Space, Result, Flags, Carriage Return)

See Table 5.17.

Table 5.17 Parameter Identifiers (OV, CP, and AL)

Identifier		
Hex	**ANSI**	**Parameter**
$21	!	WBC
$22	"	Lymphocyte #
$23	#	Lymphocyte %
$24	$	Monocyte #
$25	%	Monocyte %
$28	(	Neutrophil #
$29	)	Neutrophil %
$2A	*	Eosinophil #

Table 5.17 Parameter Identifiers (OV, CP, and AL) *(Continued)*

Identifier		
Hex	**ANSI**	**Parameter**
$2B	+	Eosinophil %
$2C	,	Basophil #
$2D	-	Basophil %
$2E	.	Atypical Lymphocyte #
$2F	/	Atypical Lymphocyte %
$30	0	Large Immature Cell #
$31	1	Large Immature Cell %
$32	2	RBC
$33	3	Hgb
$34	4	Hct
$35	5	MCV
$36	6	MCH
$37	7	MCHC
$38	8	RDW
$40	@	Plt
$41	A	MPV
$42	B	Pct
$43	C	PDW

Example: Each parameter result is a fixed length of 10 characters, consisting of 1 character parameter ID field, space, 5 character result, 2 character flag field, carriage return (1 + 1 + 5 + 2 + 1).

An RBC count of 5.50 in US units with counting voteout and exceeding patient limits would transmit as: $32 $20 $30 $35 $2E $35 $30 $56 $68 $OD, which equates to “2 05.50Vhcr”.

Flags and Messages

This section describes the Flags and Messages that can be selected for transmission.

Flags

The flags associated with a parameter are transmitted as codes in fixed length strings.

- If the flag is present, the appropriate code is transmitted.
- If the flag is not present, the code is replaced by spaces.

List of Flag Code Options (Format – ID, Space, Codes, Carriage Return)

See Table 5.18.

Table 5.18 Flag Code Identifiers: Variable Format (OV, CP, and AL)

Identifier		Description	Information Sent	Field Length and Format
Hex	ANSI			
$50	P	WBC/BASO Flags	*WBC	2 + 4 + 1 ID, Space, String, CR
$51	Q	DIFFPLOT Flags	COMBSLNLMNLNUMUNDBNESL1	2 + 23 + 1 ID, Space, String, CR
$52	R	RBC Flags	MIMA	2 + 4 + 1 ID, Space, String, CR
$53	S	PLATELET Flags	PCSCMC	2 + 6 + 1 ID, Space, String, CR
$66	f	WBC/BASO COUNT Flags	DIFF±BASO+	2 + 10 + 1 ID, Space, String, CR
$67	g	GENERAL Flags	Not used (sent as spaces)	2 + 6 + 1 ID, Space, String, CR

In addition to the flags described above, the AL also transmits the fields in Table 5.19.

Table 5.19 Flag Identifiers: Variable Format for AL

Identifier		Description	Information Sent	Field Length and Format
Hex	ANSI			
$A0	<SP>	QC and Miscellaneous	QCFPCMMNMPFMRGEUNMRCP If the flag is present, the appropriate flag is transmitted. If the flag is not present, the flag is replaced by spaces.	2 + 21 + 1

Description of Flag Codes (OV, CP, and AL)

The flag code options described in Table 5.18 are detailed in Table 5.20.

Table 5.20 List of Flags: Variable Format (OV, CP, and AL)

Flag Group	Code	Interpretation
WBC/BASO	*WBC	WBC count interference flag

Table 5.20 List of Flags: Variable Format (OV, CP, and AL) *(Continued)*

Flag Group	Code	Interpretation
DiffPlot	CO	Diff Reject flag
	MB	Mono/Baso region flag
	SL	Small Lymphocyte region flag
	NL	Neut/Lymph region flag
	MN	Mono/Neut region flag
	LN	Lower Neut region flag
	UM	Upper Mono region flag
	UN	Upper Neut region flag
	DB	Debris region flag
	NE	Neut/Eos region flag
	SL1	Small Lymphocyte 1 region flag
RBC	MI	MICRO flag
	MA	MACRO flag
Plt	PC	SCL flag
	SC	SCH flag
	MC	MIC flag
WBC Balance	DIFF±	Balance flag
	BASO+	BASO% > 50%
General	Not used	Sent as spaces

In addition to the flags described above, the AL also transmits the codes in Table 5.21.

Table 5.21 List of Flags: Variable Format (AL)

Flag Group	Code	Interpretation
QA and Miscellaneous	QCF	QC Failed
	PCM	Platelet Concentrate Mode
	MNM	Manual Match
	PFM	Patient File Modified
	RGE	Reagent Expired
	UNM	Unmatched
	RCP	Recalculated

Messages

Messages associated with a sample are transmitted in variable length strings. Only the messages that occur on the sample are transmitted. The field is truncated to the length of the messages sent; it is not padded with spaces. Each message is transmitted as a 4-byte code preceded by a space.

List of Message Options (Format – ID, Space, Chain of messages, Carriage Return)

See Table 5.22.

Table 5.22 Message Identifiers: Variable Format (OV, CP, and AL)

Identifier				
Hex	**ANSI**	**Description**	**Number of Messages (Maximum)**	**Field Length and Format (N = Number Messages Sent)**
$54	T	WBC Messages	12	1 + (nx5) + 1 ID, Space, String, CR
$55	U	RBC Messages	7	1 + (nx5) + 1 ID, Space, String, CR
$56	V	PLT Messages	4	1 + (nx5) + 1 ID, Space, String, CR

List of Message Codes

See Table 5.23.

Table 5.23 Message Codes: Variable Format (OV, CP, and AL)

Population	Code	Message Interpretation
WBC	LEU+	Leucocytosis
	LEU-	Leucopenia
	LYM+	Lymphocytosis
	LYM-	Lymphopenia
	NEU+	Neutrophilia
	NEU-	Neutropenia
	EOS+	Eosinophilia
	MYEL	Myelemia
	LIMC	Large Immature Cells
	ALYM	Atypical Lymphocytes
	LSHT	Left Shift
	NRBC	Nucleated Red Blood Cells
	MON+	Monocytosis
	BAS+	Basophilia
	BLST	Blasts

Table 5.23 Message Codes: Variable Format (OV, CP, and AL)

Population	Code	Message Interpretation
RBC	ANEM	Anemia
	ANI1	Anisocytosis
	MIC1	Microcytes
	MAC1	Macrocytes
	MICR	Microcytosis
	MACR	Macrocytosis
	HCR1	Hypochromia
	CAGG	Cold Agglutinin
	ERYT	Erythrocytosis
Plt	THR+	Thrombocytosis
	THR-	Thrombocytopenia
	PLAG	Platelet Aggregates
	SCEL	Small cells
	MICC	Microcytes
	SCHI	Schistocytes
	MAPL	Macro Platelets
ALL (applicable to WBC, RBC, and PLT)	????	No Interpretation
	PANC	Pancytopenia

Variable Format Example

The following is a transmission example for a sample with DIFFPLOT SL and SL1 flags, DIFF+, Leucopenia, Nucleated Red Blood cells, and Platelet aggregate messages.

```
$50$20$20$20$20$20$20$20$20$20$20$20$OD
$51$20$20$20$20$53$4C$20$20$20$20$20$20$20$20$20$20$20$20$
20$53$4C$31$OD
$52$20$20$20$20$20$OD
$53$20$20$20$20$20$20$OD
$54$20$4C$45$55$2D$20$4E$52$42$43$OD
$55$OD
$56$20$50$4C$41$47$OD
$66$20$20$20$20$20$44$49$46$46$2B$20$20$20$20$20$OD
$67$20$20$20$20$20$20$20$OD
```

This equates to:

P
Q SL SL1
R
S
T LEU- NRBC
U

V PLAG
f DIFF+
g

Patient File

This section provides details of the fields that are controlled by the Patient File option. The number of fields and the filed contents are different between the OV, CP, and AL; therefore, the fields for each instrument are described separately.

Patient File Options for the OV System

Patient File selection allows the transmission of additional sample information. The fields have fixed character string lengths. Data that has a character string of less than the defined data field length will have trailing characters padded with spaces.

List of Patient File Identifiers (Format – ID, Space, String, Carriage Return) for the OV System

See Table 5.24.

Table 5.24 Patient File Identifiers for the OV System

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$70	p	Analyzer number	2 Character string	2 + 2 + 1 ID, Space, String, CR
$71	q	Analysis date and time	**Date** in format as per setup & time in 24 hr format 10/25/00 13h15mn31s	2 + 19 + 1 ID, Space, String, CR
$73	s	Analyzer sequence number	**Sequence number** (with leading zeros)	2 + 4 + 1 ID, Space, String, CR
$76	v	Identification	**Autonumbered Sample ID**: up to 5 numbers, left justified, with trailing spaces **Manually entered Sample ID**: up to 16 characters with trailing spaces	2 + 16 + 1 ID, Space, String, CR
$80	€	Panel	Single Character: A : CBC B : CBC/DIFF	2 + 1 + 1 ID, Space, String, CR

Patient File Options for the CP System

List of Patient File Identifiers (Format – ID, Space, String, Carriage Return) for the CP System

See Table 5.25.

Table 5.25 Patient File Identifiers for the CP System

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**

Table 5.25 Patient File Identifiers for the CP System *(Continued)*

$70	p	Analyzer number	2 Character string	2 + 2 + 1 ID, Space, String, CR
$71	q	Analysis date and time	**Date**: In European format ddmmyyyy and time in 24 hour format. For example: 27032001 10h05mn04s	2 + 19 + 1 ID, Space, String, CR
$73	s	Analyzer sequence number	**Sequence number** (with leading zeros)	2 + 4 + 1 ID, Space, String, CR
$75	u	Sample ID	**Autonumber Sample ID**: up to 6 numbers, left justified, with trailing spaces **Manually entered Sample ID**: up to 16 characters	2 + 16 + 1 ID, Space, String, CR
$76	v	Patient Name	**Patient Name**: up to 30 characters, left justified, with trailing spaces	2 + 30 + 1 ID, Space, String, CR
$77	w	Date of Birth	**Date of birth**: ddmmyyyy, in European format	2 + 8 + 1 ID, Space, String, CR
$78	x	Age	**Age**: Uses one of the following formats, 7d, 4w, 10m, 54y, where “d” represents days, ‘w’ represents weeks, ‘m’ represents months, and ‘y’ represents years.	2 + 4 + 1 ID, Space, String, CR
$79	y	Gender	**Gender**: ‘M’ for male, ‘F’ for female, or ‘U’ for unknown.	2 + 1 +1 ID, Space, String, CR
$7B	{	Physician	**Physician**: up to 30 characters, left justified, with trailing spaces	2 + 30+ 1 ID, Space, String, CR
$7C	|	Location	**Location**: up to 15 characters, left justified, with trailing spaces	2 + 15 + 1 ID, Space, String, CR
$7D	}	Collection date and time	**Collection date and time**: Date in European format (ddmmyyyy). Time in 24 hour format. 31012001 13h05	2 + 14 + 1 ID, Space, String, CR
$7E	~	Comments	**Comments**: up to 50 characters, left justified, with trailing spaces	2 + 50 + 1 ID, Space, String, CR
$80	€	Panel	**Panel**: represents the test to be run. Appears as one character: ‘A’ is CBC and ‘B’ is CBC/DIFF.	2 + 1 + 1 ID, Space, String, CR
$82	,	Number of runs	**Number of runs**: ‘0’ for first run, ‘1’ for second run, and so forth	2 + 1 + 1 ID, Space, String, CR
$83	*f*	Operator Code	**Operator code**: up to 15 characters, left justified, with trailing spaces	2 + 15 + 1 ID, Space, String, CR
$8B	<	Patient ID	**Patient ID**: up to 25 characters, left justified, with trailing spaces	2 + 25 + 1 ID, Space, String, CR

Patient File Options for the AL System

List of Patient File Identifiers (Format – ID, Space, String, Carriage Return) for the AL System

See Table 5.26.

Table 5.26 Patient File Identifiers for the AL System

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$71	q	Analysis date and time	**Date**: In European format ddmmyyyy and time in 24 hour format. For example: 27032001 10h05mn04s	2 + 19 + 1 ID, Space, String, CR
$75	u	Sample ID	**Sample ID**: up to 16 characters, left justified, with trailing spaces	2 + 16 + 1 ID, Space, String, CR
$76	v	Patient Last Name	**Patient Last Name**: up to 20 characters, left justified, with trailing spaces	2 + 20 + 1 ID, Space, String, CR
$77	w	Date of Birth	**Date of birth**: ddmmyyyy, in European format	2 + 8 + 1 ID, Space, String, CR
$78	x	Age	**Age**: Uses one of the following formats, 7d, 4w, 10m, 54y, where “d” represents days, ‘w’ represents weeks, ‘m’ represents months, and ‘y’ represents years.	2 + 4 + 1 ID, Space, String, CR
$79	y	Gender	**Gender**: ‘M’ for male, ‘F’ for female, or ‘U’ for unknown.	2 + 1 +1 ID, Space, String, CR
$7B	{	Physician	**Physician**: up to 20 characters, left justified, with trailing spaces	2 + 20+ 1 ID, Space, String, CR
$7C	|	Location	**Location**: up to 20 characters, left justified, with trailing spaces	2 + 20 + 1 ID, Space, String, CR
$7D	}	Collection date and time	**Collection date and time**: Date in European format (ddmmyyyy). Time in 24 hour format. 31012001 13h05	2 + 14 + 1 ID, Space, String, CR
$7E	~	Sample Comments or Control Comments	**Sample Comments or Control Comments**: up to 50 characters, left justified, with trailing spaces	2 + 50 + 1 ID, Space, String, CR
$7F	No ANSI	Flagging Set	Flagging set	2 + 20 + 1
$80	€	Panel	**Panel**: represents the test to be run. Appears as one character: ‘A’ is CBC and ‘B’ is CBC/DIFF.	2 + 1 + 1 ID, Space, String, CR
$8B	<	Patient ID	**Patient ID**: up to 25 characters, left justified, with trailing spaces	2 + 25 + 1 ID, Space, String, CR
$B1	±	First Name	**Patient First Name**: Up to 20 characters, left justified, with trailing spaces	2 + 20 + 1
$B2	²	Patient Comment	**Patient Comment**: Up to 50 characters, left justified, with trailing spaces	2 + 50 + 1
$B3	³	Result Comment	**Result Comment**: Up to 50 characters, left justified, with trailing spaces	2 + 50 + 1

Histogram and Threshold Options (OV, CP, and AL)

This section describes the field that are controlled by the Histogram and Threshold options.

List of Histogram and Threshold Identifiers (Format – ID, Space, String, Carriage Return)

See Table 5.27.

Table 5.27 Histogram and Threshold Identifiers: Variable Format (OV, CP, and AL)

Identifier		Description	Information Sent	Field Length and Format
Hex	ANSI			
$57	W	WBC Histogram	Amplitude of each Channel (See Note 1)	2 + 128 + 1 ID, Space, String, CR
$58	X	RBC Histogram	Amplitude of each Channel (See Note 1)	2 + 128 + 1 ID, Space, String, CR
$59	Y	PLT Histogram	Amplitude of each Channel (See Note 1)	2 + 128 + 1 ID, Space, String, CR
$5A	Z	BASO Histogram	Amplitude of each Channel (See Note 1)	2 + 128 + 1 ID, Space, String, CR
$5B	[	DIFFPLOT	Screen bitmap (See Note 2)	2 + 4096 + 1 ID, Space, String, CR
$5D	]	WBC Thresholds	5 Thresholds (See Note 3)	2 + 19 + 1 ID, Space, String, CR
$5E	^	RBC Thresholds	2 Thresholds (See Note 3)	2 + 7 + 1 ID, Space, String, CR
$5F	_	PLT Thresholds	1 Threshold (See Note 3)	2 + 3 + 1 ID, Space, String, CR
$60	`	BASO Thresholds	3 Thresholds (See Note 3)	2 + 11 + 1 ID, Space, String, CR
$61	a	DIFFPLOT Thresholds	12 Volume Thresholds, 6 Absorbance Thresholds (See Note 3)	2 + 71 + 1 ID, Space, String, CR

Note 1: For Control and Reproducibility samples, data is sent as blanks.
Note 2: For Control and Reproducibility samples, data is sent as zeros.
Note 3: For Control and Reproducibility samples, data is sent as zeros.

Histograms

WBC, RBC, and Plt histograms are transmitted as 128 characters preceded by a space. Each character represents the amplitude of the channel. Zero amplitude (0) is represented by $20 and maximum amplitude (223) ([223 = 255 ($FF) - 32 ($20)]) is represented by $FF.

The BASO histogram is transmitted as 128 characters preceded by a space. Each character represents the amplitude of the channel. Zero amplitude (0) is represented by $20 and maximum amplitude (32) ([32 = 64 ($40) - 32 ($20)]) is represented by $40.

DiffPlot

The 2048 graphic bytes of the DiffPlot are transmitted as 4096 ASCII bytes preceded by a space. Each group of two ASCII bytes represents the value of one graphic byte starting from the top left and going to the bottom right of the DiffPlot.

The DiffPlot is reconstructed based on data bits (not bytes). One byte represents 8 points (each bit is a point). The binary value of the point (0 or 1) indicates if the pixel is ON or OFF. The 2048 bytes transmitted represent 16384 bits; 16384 gives you the 128x128 DiffPlot Region.

Figure 5.1 shows the DiffPlot Regions. Figure 5.2 shows the decoded DiffPlot information.

Figure 5.1 DiffPlot Regions (OV, CP, and AL)

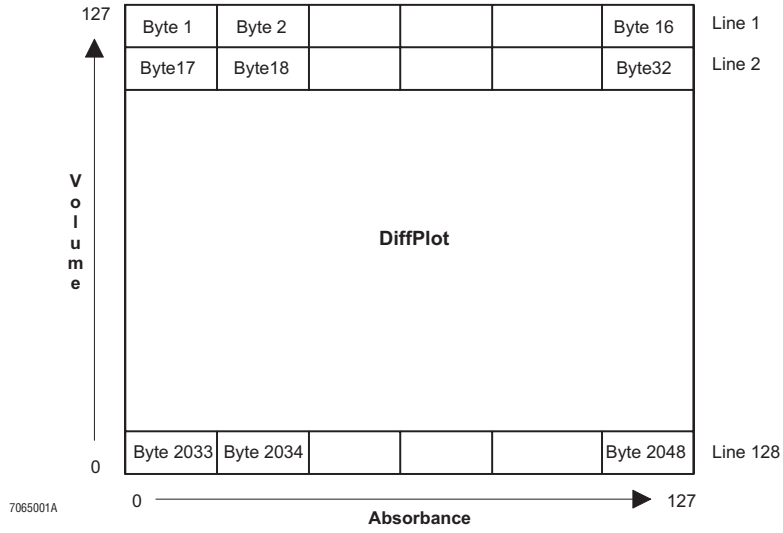
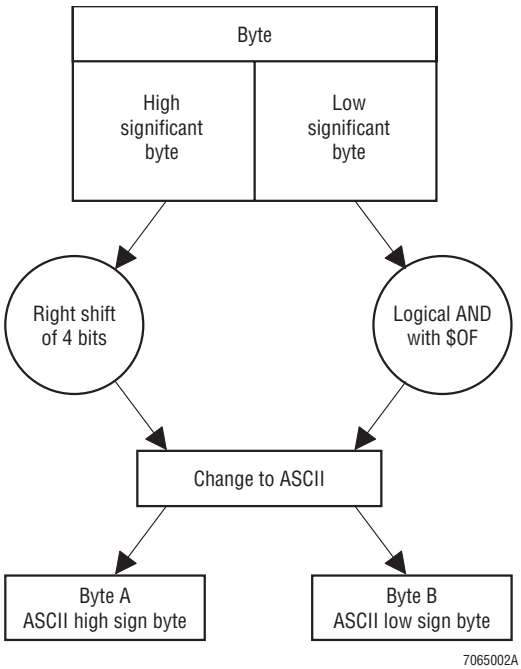


Figure 5.2 DiffPlot Bytes (OV, CP, and AL)



Thresholds

Thresholds used in the population separation and flagging on the Histograms and DiffPlot are transmitted as the channel number where they are located. Each threshold is transmitted as a 3-byte character preceded by a space.

5.7 HOST DOWNLOAD (VARIABLE FORMAT)

The CP and AL are capable of receiving broadcast downloads from a host computer onto the Worklist. To receive a download the variable format configuration must be set to **Bidirectional**. The data to be downloaded from the host must be sent in the following formats:

- Table 5.28, Variable File Format for Patient Data Worklist Download: CP
- Table 5.29, Variable File Format for Patient Data Worklist Download: AL

Table 5.28 Variable File Format for Patient Data Worklist Download: CP

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$02	STX	Preamble and packet length	**Start of Data Block and Packet Length**: Start of text with packet length (sum of all bytes in records, excluding STX and ETX, in decimal number representation $30 to $39).	1 + 5 + 1 ID, String, CR
$75	u	Sample ID	**Sample ID**: up to 16 characters, left justified, with trailing spaces	2 + 16 + 1 ID, Space, String, CR
$76	v	Patient Name	**Patient Name**: up to 30 characters, left justified, with trailing spaces	2 + 30 + 1 ID, Space, String, CR
$77	w	Date of Birth	**Date of birth**: ddmmyyyy, in European format	2 + 8 + 1 ID, Space, String, CR
$78	x	Age	**Age**: Uses one of the following formats: 7d, 4w, 10m, 54y, where “d” represents days, ‘w’ represents weeks, ‘m’ represents months, and ‘y’ represents years.	2 + 4 + 1 ID, Space, String, CR
$79	y	Gender	**Gender**: ‘M’ for male, ‘F’ for female, or ‘U’ for unknown.	2 + 1 + 1 ID, Space, String, CR
$7B	{	Physician	**Physician**: up to 30 characters, left justified, with trailing spaces.	2 + 30 + 1 ID, Space, String, CR
$7C	|	Location	**Location**: up to 15 characters, left justified, with trailing spaces.	2 + 15 +1 ID, Space, String, CR
$7D	}	Collection date and time	**Collection Date and Time**: Date in European format (day, 2 characters; month, 2 characters; year, 4 characters) and time in 24 hr. format. 31012000 13h15	2 + 14 + 1 ID, Space, String, CR

Table 5.28 Variable File Format for Patient Data Worklist Download: CP *(Continued)*

$7E	~	Comments	**Comments**: up to 50 characters, left justified, with trailing spaces	2 + 50 + 1 ID, Space, String, CR
$80	€	Panel	**Panel**: represents the test to be cycled. Appears as one character: 'A' is for CBC and 'B' is for CBC/DIFF.	2 + 1 + 1 ID, Space, String, CR
$8B	<	Patient ID	**Patient ID**: up to 25 characters, left justified, with trailing spaces.	2 + 25 + 1 ID, Space, String, CR
$FD	ý	Checksum	**Checksum**: sum modulo $FFFF of all characters from position two up to the last character prior to the checksum identifier. Value is a 4-byte hexadecimal preceded by a space. Hex number is represented as a lowercase ASCII hex.	2 + 4 + 1 ID, Space, String, CR
$03	ETX	End of Text	**End of data block identifier**	1

Table 5.29 Variable File Format for Patient Data Worklist Download: AL

Identifier				
Hex	**ANSI**	**Description**	**Information Sent**	**Field Length and Format**
$02	STX	Preamble and packet length	**Start of Data Block and Packet Length**: Start of text with packet length (sum of all bytes in records, excluding STX and ETX, in decimal number representation $30 to $39).	1 + 5 + 1 ID, String, CR
$75	u	Sample ID	**Sample ID**: up to 16 characters, left justified, with trailing spaces	2 + 16 + 1 ID, Space, String, CR
$76	v	Last Name	**Patient Last Name**: up to 20 characters, left justified, with trailing spaces	2 + 20+ 1 ID, Space, String, CR
$77	w	Date of Birth	**Date of birth**: ddmmyyyy, in European format	2 + 8 + 1 ID, Space, String, CR
$78	x	Age	**Age**: Uses one of the following formats: 7d, 4w, 10m, 54y, where "d" represents days, 'w' represents weeks, 'm' represents months, and 'y' represents years.	2 + 4 + 1 ID, Space, String, CR
$79	y	Gender	**Gender**: 'M' for male, 'F' for female, or 'U' for unknown.	2 + 1 + 1 ID, Space, String, CR
$7B	{	Physician	**Physician**: up to 20 characters, left justified, with trailing spaces.	2 + 20 + 1 ID, Space, String, CR
$7C	|	Location	**Location**: up to 15 characters, left justified, with trailing spaces.	2 + 15 +1 ID, Space, String, CR

Table 5.29 Variable File Format for Patient Data Worklist Download: AL *(Continued)*

$7D	}	Collection date and time	**Collection Date and Time**: Date in European format (day, 2 characters; month, 2 characters; year, 4 characters) and time in 24 hr. format. 31012000 13h15	2 + 14 + 1 ID, Space, String, CR
$7E	~	Sample Comments	Up to 50 characters, left justified, with trailing spaces	2 + 50 + 1 ID, Space, String, CR
$7F	No ANSI	Flagging Set	Up to 20 characters, left justified, with trailing spaces.	2 + 20 + 1
$80	€	Panel	**Panel**: represents the test to be cycled. Appears as one character: 'A' is for CBC and 'B' is for CBC/DIFF.	2 + 1 + 1 ID, Space, String, CR
$8B	<	Patient ID	**Patient ID**: up to 25 characters, left justified, with trailing spaces.	2 + 25 + 1 ID, Space, String, CR
$B1	±	Patient First Name	Up to 20 characters, left justified, with trailing spaces	2 + 20 + 1 ID, Space, String, CR
$B2	2	Patient Comment	Up to 50 characters, left justified, with trailing spaces	2 + 50 + 1 ID, Space, String, CR
$FD	ý	Checksum	**Checksum**: sum modulo $FFFF of all characters from position two up to the last character prior to the checksum identifier. Value is a 4-byte hexadecimal preceded by a space. Hex number is represented as a lowercase ASCII hex.	2 + 4 + 1 ID, Space, String, CR
$03	ETX	End of Text	**End of data block identifier**	1

Notes Regarding Worklist Download (CP and AL)

Sample ID field is tested for:

- Correct length
- Not a reserved code
- Not AUTO_SID (AL only)

If the Sample ID data is not acceptable:

- the order is not added to the Worklist, and
- an entry is placed in the Host Log to read *Worklist order for Sample ID (X) has been rejected.* (AL only)

Patient ID field is tested for:

- Correct length
- Not AUTO_PID (AL only)

If the Patient ID data is not acceptable for the transmission of an order:

- the order is not added to the Worklist, and
- an entry is placed in the Host Log to read *Patient record for Patient ID (X) has been rejected.* (AL only)

If the Patient ID data is not acceptable for the transmission of a patient record;

- the patient record is not created/modified, and
- an entry is placed in the Host Log to read *Worklist order for Patient ID (X) has been rejected.* (AL only)

For the remaining data, if the value transmitted is incorrect, the order or patient records is not rejected. However, the following criteria are applied (and the operator is not notified of the changes being made):

- If the Date of Birth and Age do not match, the Date of Birth takes priority, and Age is recomputed to agree with the Date of Birth.
- If the Gender is incorrect, it defaults to 0: Unknown.
- If the Panel is incorrect, the default panel is used.
- If the Flagging Set is incorrect, the default flagging set is used.

TRADEMARKS

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Documentation

▪ **Operator's Guide** PN 4237615 (Open Vial) PN 4237650 (Cap Pierce)	Use and Function • Operation Principles • Specifications/Characteristics • Precautions/Hazards • Running Samples • Reviewing Results • Calibration • Diagnostics • Instrument Setup • Log Sheets • Manual Calibration • Troubleshooting Flowchart • Training Checklist • References • Glossary • Abbreviations • Index
▪ **Instructions for Use** PN 4277367 (Autoloader)	Use and Function • Operation Principles • Specifications/Characteristics • Precautions/Hazards • Running Samples • Reviewing Results • Calibration • Diagnostics • Instrument Setup • Log Sheets • Manual Calibration • References • Glossary • Abbreviations • Index
▪ **Host Transmission Specification** PN 4277065 (Open Vial, Cap Pierce, and Autoloader Systems)	Defines requirements for interfacing the instrument to a host computer.

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