HORIBA Medical

# OUTPUT FORMATS

Pentra 400

ABX Pentra 400

**RAA025GEN**

## Table of contents



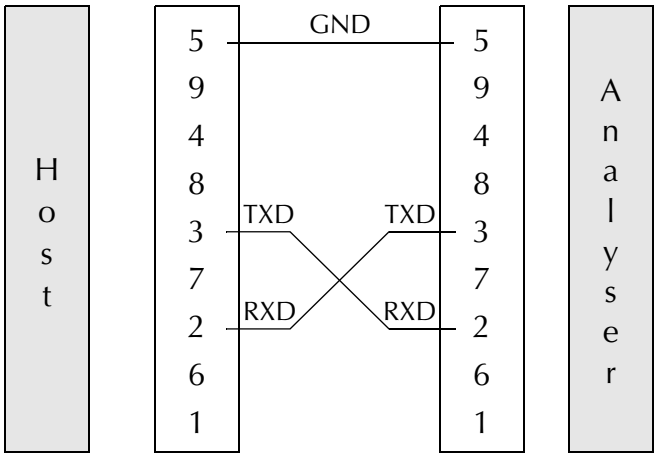
## Revisions

| Part number | Software version | | Chapters | Date |
|---|---|---|---|---|
| | Pentra 400 | Pentra C400 | | |
| RAA025GEN | 5.0.7 | 1.1.X | All | 08/07/13 |

# Physical connection

## RS232 connection

The RS port connector of the instrument is a standard DB-9 male connector.



# ASTM format

HORIBA Medical analyzer format complies with the ASTM specifications E-1381 & E-1394:

- E-1381: Standard specification for Low Level protocol to transfer messages between clinical or laboratory instruments and computer systems.
- E-1394: Standard specification for transferring Information between clinical or laboratory instruments and computer systems.

## 1. Connection specifications (ASTM E-1381)

### 1.1. Hardware and software characteristics

You can setup Baud rate, Parity, Stop bit,...

Hardware setting of the interface: Connect the Host and the instrument with the DB-9 serial port.

### 1.2. Output data characteristics

Characters: ASCII

Maximum message length: 247 characters including the control characters

Analyzer manages Xon/Xoff protocol.

### 1.3. Communication protocol

Table 1: Standard control characters

| Control String | Hexadecimal value |
|---|---|
| <ENQ> | $05 |
| <ACK> | $06 |
| <NAK> | $15 |
| <STX> | $02 |
| <ETX> | $03 |
| <ETB> | $17 |
| <CR> | $0D |
| <LF> | $0A |
| <EOT> | $04 |

#### 1.3.1. Instrument/Host connection

Table 2: Typical discussion between Instrument and Host

| Instrument | < > | Host |
|---|---|---|
| <ENQ> | > | |
| | < | <ACK> |
| <STX>1...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <STX>2...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <EOT> | > | |

Table 3: Typical discussion between Host and Instrument

| Instrument | < > | Host |
|---|---|---|
| | < | <ENQ> |
| <ACK> | > | |
| | < | <STX>1...Data...<CR><ETX>xx<CR><LF> |
| <ACK> | > | |
| | < | <STX>2...Data...<CR><ETX>xx<CR><LF> |
| <ACK> | > | |
| | < | <EOT> |

### 1.3.2. Discussion with conflict between Instrument and Host

Number of transmissions if negative answer: 6

Timeout: 15s

Special timing: None

Description of other specific treatments: None

In case of ENQ/ENQ conflict, analyzer waits for 2s and tries emitting again, in case of 6 successive tries, analyzer will wait for 10s (default is 10s) before another downloading request.

Analyzer prevails in case of conflict.

Table 4: Discussion with conflict between Instrument and Host

| Instrument | < > | Host |
|---|---|---|
| <ENQ> | > | |
| | < | <ENQ> |
| Waits for 2 seconds... | | |
| <ENQ> | > | |
| | < | <ACK> |

Table 4: Discussion with conflict between Instrument and Host

| Instrument | < > | Host |
|---|---|---|
| <STX>1...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <STX>2...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <EOT> | > | |

### 1.3.3. Defect packet during discussion between Instrument and Host

Table 5: Defect packet during discussion between Instrument and Host

| Instrument | < > | Host |
|---|---|---|
| <ENQ> | > | |
| | < | <ACK> |
| <STX>1...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <NAK> |
| <STX>1...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <STX>2...Data...<CR><ETX>xx<CR><LF> | > | |
| | < | <ACK> |
| <EOT> | > | |

### 1.3.4. Message length > 240 characters

If the data is longer than 240 characters, it must be split into two parts and sent in two communications packets. The intermediate packet uses the <ETB> character, and the ending packet uses the <ETX> character.

### 1.4. Flow control

Xon/Xoff protocol may be used on HORIBA Medical instruments.

### 1.5. Interruptions

If the emission of results is started, the EOT interruption character will not be taken into consideration.
On the other hand, if the EOT interruption character is received during the frame preceding the results, the analyzer will close its message by the terminal phase, then will wait for 20s before taking the line again.

### 1.6. ASTM Data frame format

A sequential number located after the <STX> character is inserted into each Data frame. Frame number is set to 1 when transfer phase is initialized and is incremented by 1 for each frame up to 7 and then returns to 0.

Frame number allows receiver to distinguish between new and retransmitted frame. In case of retransmitted frame (after a <NAK> response from Host), frame number is not incremented: <STX>1...Data...<CR><ETX>xx<CR><LF>.

Table 6: Frame format

| ASTM field | Definition | Transmitted data | # of bytes | Comments |
|---|---|---|---|---|
| 0 | STX | $02 | 1 | |
| 1 | Frame number | 1 to 7, 0,... | 1 | Frame number is set to 1 and incremented by 1 for each frame up to 7 and then returns to 0 |
| 2 | Data message | | 240 max. | Header, Patient, Order, Result & Comment messages |
| 3 | End of data message<br>ETB if data message contains 240 characters<br>ETX if end frame | | 1 | |
| 4 | Checksum | | 2 | |
| 5 | CRLF | $0D $0A | 2 | |

#### 1.6.1. Frame cheksum

According to ASTM E-1381, frame checksum (<STX>1...Data...<CR><ETX>xx<CR><LF>) is defined as modulo 256 of ASCII values sum between <STX> not included and <ETX> included characters: 1...Data...<CR><ETX>.

# 2. Record general format specifications (ASTM E-1394)

## 2.1. Codes of characters

HORIBA Medical analyzers use Standard ASCII characters set with codes between 32 and 127 (codes from 0 to 31 are for protocol only).

The Escape delimiter is not used in the data sent by analyzers.

Data frames encapsulate Records defined by ASTM E-1394 norm, Records themselves encapsulate ASTM fields.

The record is inside Data frame: <STX>1...Data...<CR><ETX>xx<CR><LF>

Table 7: ASTM Records

| Record ID | ASTM Definition |
|---|---|
| H | Header |
| P | Patient |
| O | Order |
| R | Result |
| C | Comment |
| Q | Query (Request information order) |
| S | Scientific record |
| M | Manufacturer information |
| L | Terminator record |

## 2.2. Structure of Records

### 2.2.1. Structure of records for Order transmission

The transmission of an Order without Patient record is not allowed, but Patient record can be empty. Example: <STX>2P|1<CR><ETX>BB<CR><LF>.

The modification of a Patient is allowed only if the corresponding "Patient file" is not in process.

#### 2.2.1.1. Unique Order record

- H (Header)
- .. P (Patient)
- .. C (Patient Comments) Optional
- ... .....O (Order)
- ... .....C (Order Comments) Optional
- L (Terminator)

#### 2.2.1.2. Multi Order record

- H (Header)
- .. P (Patient)
- .. C (Patient Comments) Optional
- ... .....O (Order)
- ... .....O (Order)
- ... .....O (Order)
- ... .....C (Order Comments) Optional
- L (Terminator)

### 2.2.2. Structure of records for Result transmission

- H (Header)
- ..P (Patient)
- ..C (Patient Comments) Optional
- ... .....O (Order)
- ... .....C (Order Comments) Optional
- ... .....C (Run Alarms) Optional
- ..... .... R (Result)
- ..... .... C (Flag Result) Optional
- ..... .... R (Result)
- ..... .... C (Flag Result) Optional
- .....
- .....
- ..... .... R (Result)
- ..... .... C (Flag Result) Optional
- L (Terminator)

## 2.3. Description of Records

- Delimiter must be used even if field is free.
- Delimiters inside records are separated by "|" (ASCII $7C).
- Delimiters inside fields are separated by "^" (ASCII $5E).

### 2.3.1. Header record

R = Received by the instrument from the Host
S = Sent by the instrument to the Host

Table 8: Header record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 7.1.1 | Record Type | H | ✓ | ✓ | 1 |
| 7.1.2 | Delimiters definition | idem standard | ✓ | ✓ | 4 |
| 7.1.3 | Message Control ID | | | | |
| 7.1.4 | Access Password | | | | |
| 7.1.5 | Sender Name | Text | | ✓ | 15 |
| 7.1.6 | Sender Address | | | | |
| 7.1.7 | Reserved | | | | |
| 7.1.8 | Sender Telephone Nb | | | | |
| 7.1.9 | Characteristics of Sender | | | | |
| 7.1.10 | Receiver ID | | | | |
| 7.1.11 | Comments or Special Instructions | | | | |
| 7.1.12 | Processing ID | P (=patient), Q (=control) | | ✓ | 1 |
| 7.1.13 | Version Nb | E1394-97 | | ✓ | 8 |
| 7.1.14 | Date and Time of message | YYYYMMDDHHMMSS | | ✓ | 14 |

### 2.3.2. Patient record

Table 9: Patient record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 8.1.1 | Record Type | P | ✓ | ✓ | 1 |
| 8.1.2 | Sequence Nb | 1, 2, 3... | ✓ | ✓ | 1 |
| 8.1.3 | Practice Assigned Patient ID | | | | |
| 8.1.4 | Laboratory Assigned Patient ID | Patient ID (Advised for Workflow management) The Space character is banned on the left and on the right of the text. | ✓ | ✓ | 25 |
| 8.1.5 | Patient ID No 3 | | | | |
| 8.1.6 | Patient Name | LASTNAME^FIRSTNAME | ✓ | ✓ | 20^20 |
| 8.1.7 | Mother's Maiden Name | | | | |
| 8.1.8 | Birthdate | YYYYMMDD | ✓ | ✓ | 8 |
| 8.1.9 | Patient Sex | M (male), F (female) or U (unspecified) | ✓ | ✓ | 1 |
| 8.1.10 | Patient Race-Ethnic Origin | | | | |
| 8.1.11 | Patient Address | | | | |
| 8.1.12 | Reserved | | | | |
| 8.1.13 | Patient Telephone Nb | | | | |
| 8.1.14 | Attending Physician ID | Text | ✓ | | 20 |
| 8.1.15 | Special Field 1 | | | | |
| 8.1.16 | Special Field 2 | | | | |
| 8.1.17 | Patient Height | | | | |
| 8.1.18 | Patient Weight | | | | |

Table 9: Patient record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 8.1.19 | Patient's Known or Suspected Diagnosis | | | | |
| 8.1.20 | Patient Active Medication | | | | |
| 8.1.21 | Patient's Diet | | | | |
| 8.1.22 | Practice Field 1 | | | | |
| 8.1.23 | Practice Field 2 | | | | |
| 8.1.24 | Admission and Discharge Dates | | | | |
| 8.1.25 | Admission Status | | | | |
| 8.1.26 | Location | Text | ✓ | | 20 |
| 8.1.27 | Nature of Alternative Diagnostic Code and Classifiers | | | | |
| 8.1.28 | Nature of Alternative Diagnostic Code and Classifiers | | | | |
| 8.1.29 | Patient Religion | | | | |
| 8.1.30 | Martial Status | | | | |
| 8.1.31 | Isolation Status | | | | |
| 8.1.32 | Language | | | | |
| 8.1.33 | Hospital Service | | | | |
| 8.1.34 | Hospital Institution | | | | |
| 8.1.35 | Dosage Category | | | | |

The fields above are filled in following the demographic level of information present on the analyzer.

### 2.3.3. Order record

Table 10: Order record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 9.4.1 | Record Type | O | ✓ | ✓ | 1 |
| 9.4.2 | Sequence Nb | 1, 2, 3... | ✓ | ✓ | 1 |
| 9.4.3 | Specimen ID | Sample ID | ✓ | | 16 |
| | | Sample ID^rack^pos^replicate | | ✓ | 16+2+2+2 |
| | | "CONTROL"^rack^pos^replicate^Control Name^Lot N°<br><br>The Space character is banned on the left and on the right of the text. | | ✓ | 7+2+2+2+20+16 |
| 9.4.4 | Instrument Specimen ID | | | | |
| 9.4.5 | Universal Test ID | ^^^Test code\^^^Test code... (from the Host)<br>or empty from Pentra | ✓ | | see Table 12, "Test codes", page 12 |
| 9.4.6 | Priority | S (Stat) or R (Routine) | ✓ | | 1 |
| 9.4.7 | Requested/Ordered Date and Time | | | ✓ | 14 |
| 9.4.8 | Specimen Collection Date and Time | YYYYMMDDHHMMSS | ✓ | ✓ | 14 |
| 9.4.9 | Collection End Time | | | | |
| 9.4.10 | Collection Volume | | | | |
| 9.4.11 | Collector ID | | | | |

Table 10: Order record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 9.4.12 | Action Code (see nota) | C: Cancel request<br>N: New request<br>A: Add request<br>Q: Send a control | ✓ | ✓ | 1 mandatory for reception (C/A/N) |
| 9.4.13 | Danger Code | | | | |
| 9.4.14 | Relevant Clinical Information | | | | |
| 9.4.15 | Date/Time Specimen Received | | | | |
| 9.4.16 | Specimen Descriptor | 1: Serum/Plasma<br>2: Urine<br>3: Other (see Table 12, "Test codes", page 12)<br><br>Empty if control | ✓ | ✓ | 1 (mandatory) |
| 9.4.17 | Ordering Physician | | | ✓ | 20 |
| 9.4.18 | Physician Tel Nb | | | | |
| 9.4.19 | User Field 1 | | | | |
| 9.4.20 | User Field 2 | | | | |
| 9.4.21 | Laboratory Field 1 | | | | |
| 9.4.22 | Laboratory Field 2 | | | | |
| 9.4.23 | Date and Time Results reported or last modified | | | | |
| 9.4.24 | Instrument Charge to Computer System | | | | |
| 9.4.25 | Instrument Section ID | | | | |
| 9.4.26 | Report Types | F: Final | | ✓ | 1 |
| 9.4.27 | Reserved | | | | |

Table 10: Order record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 9.4.28 | Location or Ward of Specimen Collection | | | | |
| 9.4.29 | Nosocomial Infection Flag | | | | |
| 9.4.30 | Specimen Service | | | ✓ | 20 |
| 9.4.31 | Specimen Institution | | | | |

If the Action Code (field 9.4.12) is "A" for the first download, the order is created on the instrument.
In case of a Multi Order record, "N" must be used for the first Order and "A" for the next Orders. Otherwise, only the first Order will be taken into account.

### 2.3.4. Result record

Table 11: Result record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 10.1.1 | Record Type | R | | ✓ | 1 |
| 10.1.2 | Sequence Nb | 1, 2, 3... | | ✓ | 1 |
| 10.1.3 | Universal Test ID* | ^^^Test code ^ Test Name | | ✓ | see Table 12, "Test codes", page 12 |
| 10.1.4 | Data or Measurement Value | Text xxx.xxx | | ✓ | Max 11 |
| 10.1.5 | Units | see Table 17, "Units", page 15 | | ✓ | 2 |
| 10.1.6 | Reference Range | Normal L to Normal H<br>Panic L to Panic H | | | |
| 10.1.7 | Result Abnormal Flag | L, H, A | | ✓ | 2 |

Table 11: Result record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 10.1.8 | Nature of Abnormality Testing | | | | |
| 10.1.9 | Result Status | M: Operator Modified<br>F: Final result | | ✓ | 1 |
| 10.1.10 | Date of Change in Normative Values or Units | | | | |
| 10.1.11 | Operator Identification | | | | |
| 10.1.12 | Date/Time Test Starting | YYYYMMDDHHMMSS | | ✓ | 14 |
| 10.1.13 | Date/Time Test Completed | | | | |
| 10.1.14 | Instrument Identification | | | | |

The transmitted numerical values correspond to the rounded values displayed on the analyzers, therefore they never exceed 6 characters.

The transmitted units are the ones configured by the user.

*: The Test codes table should be updated on the Host according to the test definition, for the Open Channels, freely definable by the user. The Test codes available on the instrument are between 000 and 999. The calculated parameters available on the instrument are from 1000.

Example of calculated parameter: if Test Name "Ratio" = APO A1 / APO B (Test code 1001), the LIS only have to send the test code 1001 in the field 9.4.5 of the Order record to receive results for "Ratio" with APO A1 and APO B parameters.

The relation beetween "Test Name" and "Specimen" should be in accordance with the table below (only the orders created with the right relation will be accepted in the worklist).

Table 12: Test codes

| Test Code | Test Name | Specimen | Test Code | Test Name | Specimen | Test Code | Test Name | Specimen |
|---|---|---|---|---|---|---|---|---|
| 1 | | | 26 | GluP-U | 2 | 51 | | |
| 2 | | | 27 | GluK | 1 | 52 | HAPT | 1 |
| 3 | ALP_R | 1 | 28 | | | 53 | A1c-WB | 3 |
| 4 | ALT | 1 | 29 | Iron | 1 | 54 | A1c-H | 3 |
| 5 | AST | 1 | 30 | Lact | 1 | 55 | THb-WB | 3 |
| 6 | Amy | 1 | 31 | Magn | 1 | 56 | THb-H | 3 |
| 7 | Amy-U | 2 | 32 | Phos | 1 | 57 | | |
| 8 | CK | 1 | 33 | Phos-U | 2 | 58 | | |
| 9 | CKMB | 1 | 34 | TP | 1 | 59 | | |
| 10 | GGT | 1 | 35 | TPU | 2 | 60 | Kappa | 1 |
| 11 | | | 36 | Trigly | 1 | 61 | Lambda | 1 |
| 12 | Lipase | 1 | 37 | UA | 1 | 62 | | |
| 13 | Alb | 1 | 38 | UA-U | 2 | 63 | | |
| 14 | Bili-T | 1 | 39 | Urea | 1 | 64 | Oroso | 1 |
| 15 | Bili-D | 1 | 40 | Urea-U | 2 | 65 | Prealb | 1 |
| 16 | Calcium | 1 | 41 | | | 66 | RF | 1 |
| 17 | Calc-U | 2 | 42 | Alb-T | 1 | 67 | | |
| 18 | C_Chol | 1 | 43 | µALB-U | 2 | 68 | | |
| 19 | C_HDL | 1 | 44 | Apo A1 | 1 | 69 | | |
| 20 | C_LDL | 1 | 45 | Apo B | 1 | 70 | | |
| 21 | CO2 | 1 | 46 | ASO | 1 | 71 | | |
| 22 | | | 47 | | | 72 | | |
| 23 | | | 48 | | | 73 | | |
| 24 | Fructo | 1 | 49 | | | 74 | BUN-U | 2 |
| 25 | GluP | 1 | 50 | CRP | 1 | 75 | | |

Table 12: Test codes

| Test Code | Test Name | Specimen | Test Code | Test Name | Specimen | Test Code | Test Name | Specimen |
|---|---|---|---|---|---|---|---|---|
| 76 | | | 101 | NA_S | 1 | 217 | CREA_RB | 1 |
| 77 | BUN | 1 | 102 | K_S | 1 | 218 | Chol_AK | 1 |
| 78 | ALPM_R | 1 | 103 | CL_U | 2 | 219 | AlbT | 1 |
| 79 | TP_R | 1 | 104 | NA_U | 2 | 220 | AlbT-U | 2 |
| 80 | CA_R | 1 | 105 | K_U | 2 | .../... | | |
| 81 | CA_R U | 2 | 106 | | | | | |
| 82 | LDH | 1 | 107 | | | | | |
| 83 | FERR2 | 1 | .../... | | | | | |
| 84 | | | 152 | GluHK-U | 2 | | | |
| 85 | | | .../... | | | | | |
| 86 | | | 202 | | | | | |
| 87 | MYO2 | 1 | 203 | | | | | |
| 88 | | | 204 | TP2 | 1 | | | |
| 89 | | | 205 | LDHifcc | 1 | | | |
| 90 | | | 206 | | | | | |
| 91 | | | 207 | | | | | |
| 92 | IgA_CP | 1 | 208 | | | | | |
| 93 | IgG_CP | 1 | 209 | Crenz | 1 | | | |
| 94 | IgM_CP | 1 | 210 | Crenz-U | 2 | | | |
| 95 | TRSF_CP | 1 | 211 | CREA3 | 1 | | | |
| 96 | | | 212 | CREA_U3 | 2 | | | |
| 97 | | | 213 | TP3 | 1 | | | |
| 98 | | | 214 | HDL100 | 1 | | | |
| 99 | | | 215 | CaAS | 1 | .../... | | |
| 100 | CL_S | 1 | 216 | CaU_AS | 2 | 600 | T1 | 1 |

The table above is given as an example and should be updated on the Host with the Application Version installed on the instrument. Please refer to the Application Version Release Note.
ISE Test codes (from 100 to 105) are never affected by an Application Version update.

### 2.3.5. Terminator record

Table 13: Terminator record

| ASTM field | Definition | Transmitted data | Field length |
|---|---|---|---|
| 13.1.1 | Record type | L | 1 |
| 13.1.2 | Sequence number | 1 | 1 |
| 13.1.3 | Termination code | N: Normal<br>I: No information available for last query | 1 |

### 2.3.6. Flags and alarms

Please refer to the instrument user manual for a complete description of analytical and quality flags.

#### 2.3.6.1. Analytical alarms

All the results with an analytical flag are identified and transmitted the following way:

- "A" for Abnormal in the field 10.1.7 of the result.

- The result record is followed by a comment record. All the flags, separated by a delimiter (^), are in this comment record.

Table 14: Analytical flags

| Flags |
|---|
| HIGH_ABS |
| SAMPLE_LIMIT |
| (1)REAG_RANGEHIGH<br>(2)REAG_RANGELOW |
| NON_LINEAR_A<br>NON_LINEAR_B<br>NON_LINEAR_C<br>NON_LINEAR_D |
| HIGH_ACTIV |
| REAC_LIMIT_A<br>REAC_LIMIT_B<br>REAC_LIMIT_C<br>REAC_LIMIT_D |
| NOISE_A<br>NOISE_B<br>NOISE_C<br>NOISE_D |
| AG_EXCESS |
| BLANK_RANGE |
| SIGN |
| DIV_ABS_A<br>DIV_ABS_B<br>DIV_ABS_C<br>DIV_ABS_D |
| DIV_ABSf_A<br>DIV_ABSf_B<br>DIV_ABSf_C<br>DIV_ABSf_D |

Table 14: Analytical flags

| Flags |
|---|
| DIV_ABSi_A<br>DIV_ABSi_B<br>DIV_ABSi_C<br>DIV_ABSi_D |
| (1)TEST_RANGE_LOW<br>(2)TEST_RANGE_HIGH |
| CALC_CONCENTRATION |
| DEVIATION |
| (1)LINEARITY_LOW<br>(2)LINEARITY_HIGH |
| (1)CONF_RANGELOW<br>(2)CONF_RANGEHIGH |
| (1)CONF_RANGELOW_W<br>(2)CONF_RANGEHIGH_W |
| (1)CONF_RANGELOW_W1<br>(2)CONF_RANGEHIGH_W1 |
| (1)CONF_RANGELOW_W2<br>(2)CONF_RANGEHIGH_W2 |
| (1)CONF_RANGELOW_W3<br>(2)CONF_RANGEHIGH_W3 |
| (1)CONF_RANGELOW_W4<br>(2)CONF_RANGEHIGH_W4 |
| (1)CONF_RANGELOW_W5<br>(2)CONF_RANGEHIGH_W5 |
| (1)CONF_RANGELOW_W6<br>(2)CONF_RANGEHIGH_W6 |
| WESTGARD_RULE_4 |
| WESTGARD_RULE_5 |
| WESTGARD_RULE_6 |

Table 14: Analytical flags

| Flags |
|---|
| (1)CRITICAL_RANGEL<br>(2)CRITICAL_RANGEH |
| (1)NORM_RANGEL<br>(2)NORM_RANGEH |
| (1)CALC_RANGELOW<br>(2)CALC_RANGEHIGH |
| ISE_ERROR |

Table 15: Quality flags

| Message | Flags |
|---|---|
| R | CALC_CONV |
| C | CALC_ERROR |
| Q | CTRL_ERROR |
| KE | CALIBRATION_EXPIRED |
| CE | CAL_EXPIRED |
| QE | CTRL_EXPIRED |
| SE | SOL_EXPIRED |
| I | INCOMPATIBILITY |

### 2.3.6.2. Biological flags

All the results with a biological flag are identified and transmitted the following way:

The field 10.1.7 of the result record is filled in with one of those identifiers: "L / H".

### 2.3.7. Comment record

Table 16: Comment record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 11.1.1 | Record Type | C | ✓ | ✓ | 1 |
| 11.1.2 | Sequence Nb | 1, 2, 3... | ✓ | ✓ | 1 |
| 11.1.3 | Comment Source | I: Clinical instrument system | | ✓ | 1 |
| 11.1.4 | Comment Text | Text | ✓ | ✓ | Comment Text dependent |
| 11.1.5 | Comment Type | G: Free text<br>I: Instrument flag comment | | ✓ | 1 |

### 2.3.8. Units

Units are transmitted in the field 10.1.5 of the result record.

Table 17: Units

| | Units | | Units | | Units |
|---|---|---|---|---|---|
| 1 | Ref | 17 | µg/dL | 33 | IU/dL |
| 2 | mol/L | 18 | ng/L | 34 | mIU/L |
| 3 | mol/dL | 19 | ng/dL | 35 | mIU/dL |
| 4 | mmol/L | 20 | mg/mL | 36 | mIU/mL |
| 5 | mmol/dL | 21 | µg/mL | 37 | mval/L |
| 6 | µmol/L | 22 | ng/mL | 38 | mEq/L |
| 7 | µmol/dL | 23 | pg/mL | 39 | % |
| 8 | nmol/L | 24 | µkat/L | 40 | s |
| 9 | nmol/dL | 25 | nkat/L | 41 | KU/L |

Table 17: Units

| | Units | | Units | | Units |
|---|---|---|---|---|---|
| 10 | pmol/L | 26 | U/L | 42 | kIU/L |
| 11 | pmol/dL | 27 | U/dL | 43 | g/mol |
| 12 | g/L | 28 | mU/L | 44 | mg/g |
| 13 | g/dL | 29 | mU/dL | 45 | Δ A |
| 14 | mg/L | 30 | U/mL | 46 | Δ A/min |
| 15 | mg/dL | 31 | mU/mL | 47 | Δ % |
| 16 | µg/L | 32 | IU/L | 48 | IU/mL |

### 2.3.9. QUERY mode

The E-1394 protocol imposes a specific treatment for the request to the LIS. The characteristics of this treatment are as follows.

#### 2.3.9.1. Emission of a request to the LIS

Table 18: Request information record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 12.1.1 | Record Type | Q | ✓ | ✓ | 1 |
| 12.1.2 | Sequence Nb | 1 | ✓ | ✓ | 1 |
| 12.1.3 | Starting Range ID Number | ^SID | ✓ | ✓ | 1+16 |
| 12.1.4 | Ending Range ID Number | | | | |
| 12.1.5 | Universal Test ID | All | | ✓ | |
| 12.1.6 | Nature of Request Time Limits | | | | |
| 12.1.7 | Beginning Request Result Date & Time | | | | |

Table 18: Request information record fields

| ASTM field | Definition | Transmitted data | Used for | | Field length |
|---|---|---|---|---|---|
| | | | R | S | |
| 12.1.8 | Ending Request Result Date & Time | | | | |
| 12.1.9 | Requesting Physician Name | | | | |
| 12.1.10 | Requesting Physician Tel N° | | | | |
| 12.1.11 | User Field 1 | | | | |
| 12.1.12 | User Field 2 | | | | |
| 12.1.13 | Request Information Status code | O: Test information and demographic request (no results)<br>X: Request cancelled | ✓ | ✓ | |

### 2.3.9.2. Test order on request reception

- Query messages are generated by the instrument at each Barcode reading cycle for tubes unknown in the worklist.

- A Query message consists of the sequence H, Q, L. The Q record contains 1 SID.

- For each Query message, a response from the Host is expected. If the response is not received after a delay of 10 seconds, the instrument will not try to send another Query message.

- There are 3 cases of response returned by the Host (see Table 19, "Example: tube 2312019", page 16 which is a description of case 1 and case 2):

1. An order is matched for the SID: The response message consists of the following sequence of records H, P, O, L.

2. There is no order matched for the SID: The response message consists of the sequence of records: H, Q, L with "X" for the field 12.1.13 (Request Information Status code).

3. There is no order matched for the SID: The response message consists of the sequence of records: H, L with "I" for the field 13.1.3 (Termination code). In this case, the instrument will not try to send another Query message.

The color of the line defines the transmission way:

| |
|---|
| From HOST to PENTRA |
| From PENTRA to HOST |

Table 19: Example: tube 2312019

| Query for the tube 2312019 |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|\|\|\|\|\|\|P\|E1394-97\|20050111111131<CR><ETX>6A<CR><LF> |
| <ACK> |
| <STX>2Q\|1\|^2312019\|\|ALL\|\|\|\|\|\|\|0<CR><ETX>7C<CR><LF> |
| <ACK> |
| <STX>3L\|1\|N<CR><ETX>06<CR><LF |
| <ACK> |
| <EOT> |
| **Answer for the tube 2312019 (with programmation) - Routine Mode** |
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111502<CR><ETX>47<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION |
| <CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|PATIENT COMMENT\|<CR><ETX>38<CR><LF> |
| <ACK> |

Table 19: Example: tube 2312019

| |
|---|
| <STX>40\|1\|2312019\|\|^^^13\^^^12\^^^14\^^^32\^^^34\^^^37\^^^39\|**R**\|19900522105500\|\|\|\|A\|\|\|1<CR><ETX>4F<CR><LF> |
| <ACK> |
| <STX>5C\|1\|I\|ORDER COMMENT<CR><ETX>A1<CR><LF> |
| <ACK> |
| <STX>6L\|1\|N<CR><ETX>09<CR><LF> |
| <ACK> |
| <EOT> |
| Answer for the tube 2312019 (with programmation) - STAT Mode |
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111502<CR><ETX>47<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION |
| <CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|PATIENT COMMENT\|<CR><ETX>38<CR><LF> |
| <ACK> |
| <STX>40\|1\|2312019\|\|^^^13\^^^12\^^^14\^^^32\^^^34\^^^37\^^^39\|**S**\|19900522105500\|\|\|\|A\|\|\|1<CR><ETX>4F<CR><LF> |
| <ACK> |
| <STX>5C\|1\|I\|ORDER COMMENT<CR><ETX>A1<CR><LF> |
| <ACK> |
| <STX>6L\|1\|N<CR><ETX>09<CR><LF> |
| <ACK> |
| <EOT> |

Table 19: Example: tube 2312019

| Answer for the tube 2312019 (with programmation) - Multi Order record |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111131<CR><ETX>45<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION<CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|PATIENT COMMENT\|<CR><ETX>38<CR><LF> |
| <ACK> |
| <STX>4O\|1\|2312019\|\|^^^36\|R\|19900522105500\|\|\|\|N\|\|\|\|1<CR><ETX>85<CR><LF> |
| <ACK> |
| <STX>5O\|2\|2312019\|\|^^^20\|R\|19900522105500\|\|\|\|A\|\|\|1<CR><ETX>73<CR><LF> |
| <ACK> |
| <STX>6O\|3\|2312019\|\|^^^19\|R\|19900522105500\|\|\|\|A\|\|\|1<CR><ETX>7D<CR><LF> |
| <ACK> |
| <STX>7O\|4\|2312019\|\|^^^18\|R\|19900522105500\|\|\|\|A\|\|\|1<CR><ETX>7E<CR><LF> |
| <ACK> |
| <STX>0C\|1\|I\|ORDER COMMENT<CR><ETX>20<CR><LF> |
| <ACK> |
| <STX>1L\|1\|N<CR><ETX>04<CR><LF> |
| <ACK> |
| <EOT> |

Table 19: Example: tube 2312019

| Answer for the tube 2312019 (with programmation) - Message length > 240 characters |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20121003082008<CR><ETX>4E<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION<CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3O\|1\|2312019\|\|^^^36\^^^37\^^^38\^^^39\^^^40\^^^41\^^^42\^^^43\^^^44\^^^45\^^^46\^^^47\^^^48\^^^49\^^^50\^^^51\^^^52\^^^53\^^^54\^^^55\^^^56\^^^57\^^^58\^^^59\^^^60\^^^61\^^^62\^^^63\^^^64\^^^65\^^^66\^^^67\^^^68\^^^69\^^^70\^^^71\^^^72\^^^73<ETB>ED<CR><LF> |
| <ACK> |
| <STX>4\^^^74\|R\|19900522105500\|\|\|\|\|N\|\|\|\|1<CR><ETX>11<CR><LF> |
| <ACK> |
| <STX>5L\|1\|N<CR><ETX>08<CR><LF> |
| <ACK> |
| <EOT> |
| **Answer for the tube 2312019 (without programmation)** |
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111502<CR><ETX>47<CR><LF> |
| <ACK> |
| <STX>2Q\|1\|^2312019\|\|\|\|\|\|\|\|\|X<CR><ETX>AC<CR><LF> |
| <ACK> |
| <STX>3L\|1\|N<CR><ETX>06<CR><LF> |
| <ACK> |
| <EOT> |

# 3. Management of errors

## 3.1. Field acceptation

- Only the fields described with their specified length, in previous tables, are used by HORIBA Medical instruments.
- Length of field can be inferior to maximum value but must not be superior.
- Only "Sample ID", "Action Code", "Specimen Descriptor" and "Test" fields from Order record must be filled in, all other fields are optional.
- If the lengh of the "Sample ID" is longer than the one defined in the order (see Table 10, "Order record fields", page 10, 9.4.3 field), the request is rejected.
- Concerning the "Sample ID", if there is space character on the left and on the right of the text or if the field is too long, the request is rejected.
- Concerning the "Patient ID", if there is space character on the left and on the right of the text or if the field is too long, the request is accepted but the "Patient Demographics" will be rejected.
- Concerning the "First Name", "Last Name", "Department" and "Physician" fields, the space characters on the left, on the right and all the characters beyond the defined value (20 characters) are deleted.

## 3.2. During Instrument transmission

During a single result transmission by the instrument, if the Host loses the transmission (Time-Out or EOT) the full message will be transmitted again after a configurable delay (10s by default).

In case of long files with several results the re-transmission will be done from the lost result until the end.

After 6 consecutive NAKs detected, the sent file is postponed until later transmission.

### 3.3. During Host transmission

According to E-1381 protocol, error management of Time-out, Checksum and frame number, in case of failure to comply with these norms, will return NAK (or communication will be halted). In case of transmission of long files (Worklist upload for example), files previously transmitted before transmission error will be interpreted and managed by the instrument, others will not be used.

According to E-1394 protocol, all Orders without "Sample ID" or with "Sample ID" superior to 16 characters, will not be interpreted by the instrument.

## 4. Example of data frame

### 4.1. Example of Test Order sent by Host

The color of the line defines the transmission way:

| |
|---|
| From HOST to PENTRA |
| From PENTRA to HOST |

Table 20: Example of Test Order sent by Host

| Routine Mode |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20031118154840<CR><ETX>59<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID12345\|\|LASTNAME^FIRSTNAME\|\|19641223\|M\|\|\|\|Prescriptor\|\|\|\|\|\|\|\|\|\|Location<CR><ETX>D6<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|Patient Comment\|<CR><ETX>B8<CR><LF> |
| <ACK> |
| <STX>4O\|1\|2312015\|\|\^\^\^13\\^\^\^29\|R\|20031117\|\|\|\|N\|\|\|\|1<CR><ETX>25<CR><LF> |
| <ACK> |
| <STX>5C\|1\|I\|Order Comment\|<CR><ETX>E1<CR><LF> |
| <ACK> |
| <STX>6L\|1\|N<CR><ETX>09<CR><LF> |
| <ACK> |
| <EOT> |

Table 20: Example of Test Order sent by Host

| STAT Mode |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111502<CR><ETX>47<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION |
| <CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|PATIENT COMMENT\|<CR><ETX>38<CR><LF> |
| <ACK> |
| <STX>40\|1\|2312019\|\|\^\^\^13\\^\^\^12\\^\^\^14\\^\^\^32\\^\^\^34\\^\^\^37\\^\^\^39\|S\|19900522105500\|\|\|A\|\|\|\|1<CR><ETX>4F<CR><LF> |
| <ACK> |
| <STX>5C\|1\|I\|ORDER COMMENT<CR><ETX>A1<CR><LF> |
| <ACK> |
| <STX>6L\|1\|N<CR><ETX>09<CR><LF> |
| <ACK> |
| <EOT> |
| **Multi Order record** |
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20050111111131<CR><ETX>45<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION<CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|PATIENT COMMENT\|<CR><ETX>38<CR><LF> |
| <ACK> |

Table 20: Example of Test Order sent by Host

| |
|---|
| <STX>4O\|1\|2312019\|\|\^\^\^36\|R\|19900522105500\|\|\|\|N\|\|\|\|1<CR><ETX>85<CR><LF> |
| <ACK> |
| <STX>5O\|2\|2312019\|\|\^\^\^20\|R\|19900522105500\|\|\|\|A\|\|\|\|1<CR><ETX>73<CR><LF> |
| <ACK> |
| <STX>6O\|3\|2312019\|\|\^\^\^19\|R\|19900522105500\|\|\|\|A\|\|\|\|1<CR><ETX>7D<CR><LF> |
| <ACK> |
| <STX>7O\|4\|2312019\|\|\^\^\^18\|R\|19900522105500\|\|\|\|A\|\|\|\|1<CR><ETX>7E<CR><LF> |
| <ACK> |
| <STX>0C\|1\|I\|ORDER COMMENT<CR><ETX>20<CR><LF> |
| <ACK> |
| <STX>1L\|1\|N<CR><ETX>04<CR><LF> |
| <ACK> |
| <EOT> |
| **Message length > 240 characters** |
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|ABX\|\|\|\|\|\|P\|E1394-97\|20121003082008<CR><ETX>4E<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID001\|\|NAME^FIRSTNAME\|\|19641223\|M\|\|\|\|\|PRESCRIPTOR\|\|\|\|\|\|\|\|\|\|LOCATION<CR><ETX>14<CR><LF> |
| <ACK> |
| <STX>3O\|1\|2312019\|\|\^\^\^36\\^\^\^37\\^\^\^38\\^\^\^39\\^\^\^40\\^\^\^41\\^\^\^42\\^\^\^43\\^\^\^44\\^\^\^45\\^\^\^46\\^\^\^47\\^\^\^48\\^\^\^49\\^\^\^50\\^\^\^51\\^\^\^52\\^\^\^53\\^\^\^54\\^\^\^55\\^\^\^56\\^\^\^57\\^\^\^58\\^\^\^59\\^\^\^60\\^\^\^61\\^\^\^62\\^\^\^63\\^\^\^64\\^\^\^65\\^\^\^66\\^\^\^67\\^\^\^68\\^\^\^69\\^\^\^70\\^\^\^71\\^\^\^72\\^\^\^73<ETB>ED<CR><LF> |
| <ACK> |
| <STX>4\\^\^\^74\|R\|19900522105500\|\|\|\|N\|\|\|\|1<CR><ETX>11<CR><LF> |
| <ACK> |

Table 20: Example of Test Order sent by Host

| |
|---|
| <STX>5L\|1\|N<CR><ETX>08<CR><LF> |
| <ACK> |
| <EOT> |

A test requested by the Host is created only if the corresponding test application is activated (whatever the reagent status is).

### 4.2. Example of Test Result sent by instrument

The color of the line defines the transmission way:

| |
|---|
| From HOST to PENTRA |
| From PENTRA to HOST |

Table 21: Example of Test Result sent by instrument

| |
|---|
| <ENQ> |
| <ACK> |
| <STX>1H\|\^&\|\|\|01\|\|\|\|\|\|P\|E1394-97\|20031118162410<CR><ETX>D7<CR><LF> |
| <ACK> |
| <STX>2P\|1\|\|PID12345\|\|LASTNAME^FIRSTNAME\|\|19641223\|M<CR><ETX>C4<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|Patient Comment\|G<CR><ETX>FF<CR><LF> |
| <ACK> |
| <STX>4O\|1\|2312015\|\|\|\|20031118154703\|20031117000000\|\|\|\|\|\|\|1\|Prescriptor\|\|\|\|\|\|\|\|F\|\|\|\|Location<CR><ETX>EE<CR><LF> |
| <ACK> |
| <STX>5C\|1\|I\|Order Comment\|G<CR><ETX>28<CR><LF> |

Table 21: Example of Test Result sent by instrument

| |
|---|
| <ACK> |
| <STX>6R\|1\|^\^\^1002^RATIO\|5.54\|2\|\|A\|\|F\|\|\|18991230000000<CR><ETX>1D<CR><LF> |
| <ACK> |
| <STX>7C\|1\|I\|Flag^NORM_RANGEL\|I<CR><ETX>69<CR><LF> |
| <ACK> |
| <STX>0R\|2\|^\^\^13^ALB\|5.5494\|6\|\|H\|\|F\|\|\|20031118162203<CR><ETX>7E<CR><LF> |
| <ACK> |
| <STX>1C\|1\|I\|Flag^NORM_RANGEH\|I<CR><ETX>5F<CR><LF> |
| <ACK> |
| <STX>2R\|3\|^\^\^29^IRON1\|-0.01262\|6\|\|L\|\|F\|\|\|20031118162215<CR><ETX>76<CR><LF> |
| <ACK> |
| <STX>3C\|1\|I\|Flag^NORM_RANGEL\|I<CR><ETX>65<CR><LF> |
| <ACK> |
| <STX>4L\|1\|N<CR><ETX>07<CR><LF> |
| <ACK> |
| <EOT> |

### 4.3. Example of Control Header sent by instrument

HI \^&IIIP400-162IIIIIIIQIE1394-97I20061013171336

### 4.4. Example of Control Order sent by Host

OI1ICONTROL^^^^N ctr^501500IIII20061010094849IIIIIQIIIIIIIIIIIIIF

### 4.5. Example of Control Result sent by instrument

The color of the line defines the transmission way:

| |
|---|
| From HOST to PENTRA |
| From PENTRA to HOST |

Table 22: Example of Control Result sent by instrument

| |
|---|
| <STX>1HI \^&IIIP400-162IIIIIIIQIE1394-97I20061013154745<CR><ETX>2A<CR><LF> |
| <ACK> |
| <STX>2PI1<CR><ETX>3F<CR><LF> |
| <ACK> |
| <STX>3OI1ICONTROL^^^^Nctr^501500IIII20061010094849IIIIIQIIIIIIIIIIIIIIF<CR><ETX>1B<CR><LF> |
| <ACK> |
| <STX>4RI1I^^^18^C_CholI2.47I4IIIIFIII20061013154049<CR><ETX>2D<CR><LF> |
| <ACK> |
| <STX>5LI1IN<CR><ETX>08<CR><LF> |

## Contact

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