E-BAM USER 7500 SPECIFICATION

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1. Overview

This document describes the implementation of the 7500 protocol commands used in the second-generation E-BAM firmware R2.0.0 and greater.

2. Instrument Communication Modes

2.1. Overview

There are three modes of communication:

1. *User communication* – This is a user interactive mode using simple letter commands for ease of use.
2. *Computer communication* – This mode is used for computer-to-device communication. It requires a level of data integrity.
3. *Network communication* – This mode is used for computer-to-device communication with more than one device on a network.

2.2. User Communication

In the user communication mode (terminal mode), the user simply presses the Enter key, <cr>, three times to enter the mode. In this mode simple character commands can be issued with no <Esc> character required.

An asterisk character appears during wake-up, and also after a command has completed. The asterisk indicates that the instrument is ready for a new command. Commands are echoed back from the instrument in this mode. The characters must be echoed as received in the instrument.

A help menu can be viewed by sending H, h, or ?; giving all the commands available to the user. Factory commands are not shown.

Pressing <Esc> or Q<cr> will exit terminal mode.

2.3. Computer Communication

In the computer communication mode the command format requires a level of data integrity – checksum.

This mode is entered whenever an <Esc> character is sent to the instrument.

Character echo is suppressed in this mode.

2.3.1. **Computer Command Format**

The computer command has the following format:

```
<Esc>Cmd p1 p2*cs<cr>
```

Computer commands are prefaced with an `<Esc>` (0x1B) character followed directly by a command, `Cmd`, which is variable in length depending on the command. After the command characters there can be zero or more parameter fields, `p1 p2`. Each parameter field is delimited by one or more Space characters (0x20). The end of the message is signaled by the Checksum Delimiter character `*` (0x2A) followed by the checksum, `cs`, and finally terminated with a carriage return `<cr>` (0x0D) character.

A computer command example follows:

```
<Esc>RV*1234<cr>
```

All command responses are terminated with a checksum

```
RV E-BAM, 83231, R2.0.0*1234<cr><lf>
```

2.3.2. **Checksum Computation**

Checksum is calculated as the 16 bit unsigned integer sum of all of the characters after the `<Esc>` character up to but not Including the Checksum Delimiter Character `*` (0x2A). It is printed out as an ASCII decimal number.

The result is always 5 characters in length with leading zeros.

The checksum may be bypassed in the following manner: `*//<cr>`.

3. Command Summary

3.1. Command List

$ – User level password commands. Refer to the PW command for more information.

Command	Description
#	Request MetRecord Revision
1	Request settings report
2	Request All User data report
3	Request New User data report
4	Request Last User data report
7	Request Alarm event report
C	$ Clear data log file
D	$ Get/Set date part of the real time clock
H	Help menu
Q	Quit out of terminal mode
T	$ Get/Set time part of the real time clock
CA	$ Clear alarm log file
CU	Get/Set concentration units
DS	Report data log channel descriptors
DT	$ Get/Set the date and time of the real time clock
ID	$ Get/Set location ID or address
LG	$ Get/Set display language
MA	$ Get/Set Modbus address
MP	$ Get/Set Modbus port
NW	Get/Set <Esc>A network mode
OP	$ Get/Set operation command
PR	Print report
PW	Unlock protected commands (User or Factory)
QH	Report current readings header
RQ	Report current readings without header
RV	Report Model/Part/Revision
SB	$ Get/Set baud rate
SS	Get Met One serial number

ST	$ Get/Set sample time (data log period)
TS	$ Get/Set timestamp mode
UN	$ Get/Set data log channel units
GTC	$ Start touch screen calibration
SPW	$ Get/Set user password
XRD	Get record descriptor report
XRF	XMODEM read file
BKGD	$ Get/Set background offset
SPAN	$ Get/Set Span Mass Audit
TPER	$ Get/Set tape advance period
DSCRC	Get the data log channel descriptors CRC
FRHSP	$ Get/Set filter RH set point
RTPER	$ Get/Set real-time average period
TPRES	$ Get/Set tape advanced pressure
XRDCRC	Get file descriptors CRC

4. E-BAM Commands

The command and responses shown below are for computer mode unless otherwise noted. User mode responses are more verbose and similar in nature.

4.1. # – Request MetRecord Revision

Command	Description
#	Request the MetRecord Revision.

Response	Description
# 7500 r	7500 – This document number r – The revision of this document implemented in firmware

Example
#<cr> # 7500 C<cr><lf>

4.2. 1 – Report Settings

Command	Description
1	Report the settings. There is never a checksum after each line.

Response

```
E-BAM Settings Report
2019-06-26 13:05:06

     Station ID, 1
  Serial Number, X25505
       Firmware, 83231, R2.0.0
        Display, 82451, R1.1
      Digital 1, 597, 10503-01, R01.0.4
      Digital 2, MSO, 10463-03, R1.1.0

    MET Average, 1 HR
     Time Stamp, ENDING
     Conc Units, ug/m3

    Tape Period, 1 HR
  Tape Pressure, 250
RealTime Period, 15
              K, 1.000
     Background, 0.0000
            Usw, 0.285
  Span Membrane, 0.780
   Factory Mode, OFF

  FRH Set Point, 45.0
     FRH P-Gain, 0.500
     FRH I-Gain, 0.300

         RS-232, 115200
         RS-485, 115200
    Modbus Port, RS-232
 Modbus Address, 1
     Byte Order, 512

  Name, Offset,  Slope
  Flow,  0.000,  1.000
    AT,  0.000
    BP,  0.000
    FT,  0.000
 UPPER,  0.000
```

```
LOWER,  0.000
  FRH,  0.000

RealTime Alpha, 0.2316
RealTime Gamma, 0.1500

  Sound Volume, 10
      Language, English
```

4.3. 2 – Report All Data

Command	Description
2	Report all the data. The 2 command always sends the data in CSV format.

Header Response: A report header is present for the CSV format when execute from terminal mode. It is suppressed in computer mode.

```
Data Report
2019-06-26 13:06:32
Station, 1, X25505

Time,ConcRT(ug/m3),ConcHR(ug/m3),Flow(lpm),WS(m/s),WD(Deg),AT(C),RH(%),BP(mmHg),FT(C),FRH(%),Status
```

An <Esc> or <cr> character will cancel a report.

```
2019-04-16 09:00:00,+99999.0,+99999.0,+00.00,00.3,149,+022.4,035,730.7,+024.6,029,00128
2019-04-16 10:00:00,+99999.0,+99999.0,+00.00,00.3,167,+023.0,035,731.0,+024.9,029,00640
2019-04-16 11:00:00,+99999.0,+99999.0,+00.00,00.3,141,+023.3,034,731.4,+025.5,028,00768
```

4.4. 3 – Report New Data

Command	Description
`3`	Report the new data since the last request.

Response:
The response is the same as the 2-command.

4.5. 4 – Report Last Data

Command	Description
`4`	Report the last data record.
`4 0`	Report all the data.
`4 -1`	Report the new data since the last request.
`4 n`	Report the last `n` -records where `n` is less than or equal to the maximum amount of records stored in the device.
`4 d`	Report the data back to date `d` (yyyy-MM-dd HH:mm:ss).

Response:
The response is the same as the 2-command.

4.6. 7 – Report Alarm Events

Command	Description
7	Report all alarm events

Response:

```
Alarm Report
2019-06-26 13:13:50
Station, 1, X25505

Time,Alarm
2019-06-26 13:13:50,TAPE BREAK,14
2019-06-26 13:13:50,BETA DETECTOR,500
2019-06-26 13:13:50,SENSOR RANGE,AT,-60.0
2019-06-26 13:13:50,TAPE ADVANCE,250.0
2019-06-26 13:13:50,FLOW FAILURE,0.0
2019-06-26 13:13:50,NOZZLE FAILURE,UP
2019-06-26 13:13:50,NOZZLE FAILURE,DOWN
2019-06-26 13:13:50,NOZZLE FAILURE,FOIL INSERT
2019-06-26 13:13:50,DIGITAL LINK DOWN
2019-06-26 13:13:50,POWER OUTAGE
2019-06-26 13:13:50,MAINTENANCE
```

4.7. C – Clear Data Log

Command	Description
C Y	Clear the data log.

Response
C Y

Example
C Y<cr> C Y<cr><lf>

4.8. D – Request or Set the Date Only

Command	Description
D	Request the date part of the real time clock.
D yyyy-MM-dd	Set the date part of the real time clock.

Response
D yyyy-MM-dd

Parameter	Description
yyyy	Years 2000 – 2037
MM	Months 1 – 12
dd	Days 1 – 31

Example
D<cr> D 2013-01-08<cr><lf> D 2013-01-08<cr> D 2013-01-08<cr><lf>

4.9. H – Help Menu

Command	Description
H or ?	Report the help menu.

Response
E-BAM Help Menu 1 - Report Settings 2 - Report All Data 3 - Report New Data 4 - Report Last Data 7 - Report Alarm Log C - Clear Data Log D - Set Date T - Set Time CA - Clear Alarm Log CU - Set Conc Units DT - Set Date/Time ID - Set Location ID MA - Modbus Address MP - Modbus Port OP - Get Operational State PR - Print Report QH - Report Data Record Header RV - Report Model/Part/Revision RQ - Report current readings SB - Set Baud Rate SS - Get Serial Number ST - Set Sample Time TS - Set Time Stamp SPW - Set User Password BKGD - Set Background Offset FTSP - Set FT Set Point RTPER - Set Real-Time Period TPRES - Set Tape Pressure

4.10. Q – Exit User Mode

Command	Description
Q	Exit User mode and enter Computer mode.

Response	Description
Q Exit User Mode	The command was successful.

Example
Q<cr> Q Exit User Mode<cr><lf>

4.11. T – Request or Set the Time Only

Command	Description
T	Request the time part of the real time clock.
T HH:mm:ss	Set the time part of the real time clock.

Response	Description
T HH:mm:ss	HH – Hours 0 – 23. mm – Minutes 0 – 59. ss – Seconds 0 – 59, this parameter is optional. When omitted the value will be 0.

Example
T<cr> T 13:18:38<cr><lf> T 14:13:12<cr> T 14:13:12<cr><lf>

4.12. CA – Clear Alarm Log

Command	Description
CA Y	Clear the alarm log.

Response
CA Y

Example
CA Y<cr> CA Y<cr><lf>

4.13. CU – Request or Set the Count Units

Command	Description
CU	Request count unit setting.
CU e	Set the count unit setting, where e is 0-ug/m3, 1-mg/m3.

Response	Description
CU e-unit	e – The enumerator setting. unit – The unit sort name.

Example
CU<cr> CU 0-ug/m3<cr><lf> CU 1<cr> CU 1-mg/m3<cr><lf> CU ?<cr> CU 0-ug/m3,1-mg/m3

4.14. Field Descriptors

Retrieval commands are used to query the instrument for Descriptor Information Table. These commands can be accessed by any serial device such as a data logger or software.

Information can be retrieved in either in single line responses or in bulk. Single line responses are needed for devices with limited serial input buffer sizes.

4.14.1. DS 0 – Query Abbreviated Descriptor Information

Command	Description
`DS 0`	This command returns the general header information.

Response	Description
`DS n,id,r`	The response will indicate the general descriptor information. `n` – Number of field descriptor lines available. `id` – Location ID `r` – Reserved for future use. 0 is the default.

Example
`DS 0<cr>` `DS 12,1,0<cr><lf>`

4.14.2. **DS c – Specific Descriptor Information**

Command	Description
`DS c`	This command returns the specific channel header information in the Descriptor Information Table. `c` – Channel number.

Response
`DS c,FieldName,MeasureType,units,prec,math,max,min`

Parameter	Description
`c`	Field number – 1 based.
`FieldName`	Field name string in printable ASCII. This is the user selected name for the measurement. Example: AT1 for air temp, FT1 for flow temp, etc.
`MeasureType`	Measurement type string in printable ASCII
`units`	Engineering units string in printable ASCII.
`prec`	Display value precision.
`math`	Math type field. Vector (V), Scalar (S), Total (T), Minimum (MIN), Maximum (MAX), Standard Deviation (STD), Bitwise OR (OR), No Math (NO).
`max`	Maximum measurement value.
`min`	Minimum measurement value.

Example
`DS 3<cr>` `DS 3,ConcHR,CONC,ug/m3,0,S,10000,-15<cr><lf>`

4.14.3. **DS – Request All Descriptor Information**

Command	Description
DS	This command returns all of the general and header information. The command can be used for devices that have a large serial input buffer size.

Example
DS<cr> DS 1,Time,TIME,,0,NO,0,0<cr><lf> DS 2,ConcRT,CONC,ug/m3,0,S,10000,-15<cr><lf> DS 3,ConcHR,CONC,ug/m3,0,S,10000,-15<cr><lf> DS 4,Flow,FLOW,lpm,1,S,20.0,0.0<cr><lf> DS 5,WS,WS,m/s,1,S,60.0,0.0<cr><lf> DS 6,WD,WD,Deg,0,V,360,0<cr><lf> DS 7,AT,AT,C,1,S,70.0,-50.0<cr><lf> DS 8,RH,RH,%,0,S,100,0<cr><lf> DS 9,BP,BP,mmHg,0,S,825,200<cr><lf> DS 10,FT,AT,C,1,S,70.0,-50.0<cr><lf> DS 11,FRH,RH,%,0,S,100,0<cr><lf> DS 12,Status,INFO,,0,OR,0,0<cr><lf>

4.14.4. **DSCRC – Descriptor table CRC**

Command	Description
DSCRC	This command returns the instrument descriptor table CRC. The intent is for the system or software to query and save this CRC. The value is then compared on subsequent reads to check for any instrument configuration changes. If the CRC does not match the previous CRC then check for a change in the field configuration parameters.

Response	Description
DSCRC hhhh	hhhh – The CRC value in hexadecimal.

Example
DSCRC<cr> DSCRC 864A<cr><lf>

4.15. DT – Request or Set the Date and Time

Command	Description
`DT`	Request the date and time part of the real time clock.
`DT yyyyMMddHHmmss` `DT yyyy-MM-dd HH:mm:ss`	Set the date and time part of the real time clock.

Response
`DT yyyy-MM-dd HH:mm:ss`

Parameter	Description
`yyyy`	Years 2000 – 2037
`MM`	Months 1 – 12
`dd`	Days 1 – 31
`HH`	Hours 0 – 23
`mm`	Minutes 0 – 59
`ss`	Seconds 0 – 59

Example

```
DT<cr>
DT 2013-01-08 11:39:23<cr><lf>

DT 2013<cr>
DT 2013-01-01 00:00:00<cr><lf>

DT 20130108<cr>
DT 2013-08-08 00:00:00<cr><lf>

DT 2013-01-081141<cr>
DT 2013-01-08 11:41:00<cr><lf>
```

4.17. ID – Request or Set the Location ID

Command	Description
`ID`	Request the Location ID.
`ID id`	Set the Location ID. The range is 1 to 999.

Response	Description
`ID id`	`id` – The location ID. The ID value is three characters with leading zero's.

Example

`ID<cr>`
`ID 001<cr><lf>`
 	
`ID 2<cr>`
`ID 002<cr><lf>`

4.18. LG – Request or Set the Display Language

Command	Description
`LG`	Request the Display Language setting.
`LG e`	Set the Display Language setting, where `e` is `0-ug/m3`, `1-mg/m3`.

Response	Description
`LG e-lang`	`e` – The enumerator setting. `lang` – The Display Language name.

Example

`LG<cr>`
`LG 0-English<cr><lf>`
`LG 1<cr>`
`LG 1-Chinese<cr><lf>`
`LG ?<cr>`
`LG 0-English,1-Chinese<cr><lf>`

4.19. MA – Request or Set the Modbus Address

Command	Description
MA	Request the Modbus address.
MA a	Set the Modbus address. The range is 1 to 247.

Response	Description
MA a	a – The Modbus address.

Example
MA<cr> MA 1<cr><lf> MA 2<cr> MA 2<cr><lf>

4.20. MP – Request or Set the Modbus Port

Command	Description
MP	Request the Modbus port.
MP e	Set the Modbus port, where e is 0-RS-232, 1- RS-485

Response	Description
MP e-n	e – The enumerator setting. n – The port name

Example
MP<cr> MP 0-RS-232<cr><lf> MP 1<cr> MP 1- RS-485<cr><lf> MP ? <cr><lf> MP 0-RS-232,1-RS-485<cr><lf>

4.21. NW – Set Network Mode

Command	Description
NW	Request the measurement concentration setting.
NW m	Set the network mode where m is 0-Off, 1-On.

Response	Description
NW 0	Network mode is off
NW 1	Network mode is on

Example
NW<cr> NW 0 <cr><lf> NW 1<cr> NW 1<cr><lf> <Esc>A 1 NW 0*cs<cr> NW 0<cr><lf>

4.22. OP – Request or Set the Operation State

Command	Description
`OP`	Request the current operation state.
`OP n`	Set the operation state where `n` is `0=stop operation, 1=start operation`

Response	Description
`OP n-state`	`n` – the current state enumerator `state` – the name of the current state

Example

`OP<cr>`
`OP 1-UNIT OFF<cr><lf>`
 	
`OP 1<cr>`
`OP 3-STARTING...<cr><lf>`

4.23. PR – Print Report

Command	Description
`PR 0`	Report the settings.
`PR 1`	Report all data.
`PR 2`	Report all alarm events.

Response:
`PR 0` – The response is the same as the `1`-command.
`PR 1` – The response is the same as the `2`-command.
`PR 2` – The response is the same as the `7`-command.

4.24. PW – Unlock User Commands

Command	Description
`PW n`	This command `Unlocked` the user protected commands ($).

Response	Description
`PW Unlocked`	If the user password is correct, you will see this response.

Example
`PW 1234<cr>` `PW Unlocked<cr><lf>`

4.25. QH – Report Data Record Header

Command	Description
QH	Report data record header.

Response
Time,ConcRT(ug/m3),ConcHR(ug/m3),Flow(lpm),AT(C),RH(%),BP(mmHg),FT(C),FRH(%),Status

Example
QH<cr> Time,ConcRT(ug/m3),ConcHR(ug/m3),Flow(lpm),WS(m/s),WD(Deg)AT(C),RH(%),BP(mmHg),FT(C),FRH(%),Status

4.26. RQ – Request Last Record

Command	Description
RQ	Request the instantaneous measurement record.

Response:
2019-06-26 14:50:45,+99999.0,+99999.0,+00.00,00.3,258,+023.8,034,728.5,+026.0,025,00640,*04355

Example:
RQ<cr> 2019-06-26 14:50:45,+99999.0,+99999.0,+00.00,00.3,258,+023.8,034,728.5,+026.0,025,00640,*04355

4.27. RV – Report Model, Firmware, Revision

Command	Description
`RV`	Request the model number, firmware part number, and revision string. Instruments with more than one processor or programmable devices will include more than one part number and revision on the next subsequent lines.

Response	Description
`RV m, p, r`	`m` – Device model name. `p` – Firmware part number. `r` – Firmware revision.

Example

`RV<cr>`
`E-BAM, 83231, R2.0.2<cr><lf>`
`Display, 82451, R1.1<cr><lf>`

4.27.1. RV 0 – Request the number of processor/devices supported

Command	Description
`RV 0`	Request the number of processor or programmable devices.

Response	Description
`RV n`	`n` – Number processor or programmable devices.

Example
`RV 0<cr>` `RV 2<cr><lf>`

4.27.2. **RV n – Request individual processor/device information**

Command	Description
`RV n`	Request the model number, firmware part number, and revision for a specified processor or programmable device `n`.

Response	Description
`RV e m, p, r`	`e` – Device enumerator. `m` – Device model name. `p` – Firmware part number. `r` – Firmware revision.

Example

`RV 1<cr>`
`RV 1 E-BAM, 83231, R2.0.2<cr><lf>`
 	
`RV 2<cr>`
`RV 2 Display, 82451, R1.1<cr><lf>`

4.28. SB – Request or Set the Serial Baud Rate

Command	Description
SB	Request the serial baud rate setting.
SB e	Set the serial baud rate where e is 2-1200,3-2400,4-4800,5-9600,6-19200,7-38400,8-57600,9-115200.

Response	Description
SB e-name	e – Serial baud rate enumerator. name – baud rate name.

Example
SB<cr> SB 5-9600<cr><lf> SB 6<cr> SB 6-19200<cr><lf>

4.29. SB – Request or Set the Baud Rate

Command	Description
SB	Request the Baud Rate.
SB e	Set the Sample Time. e – the Sample Time, where e is 3-2400,4-4800,5-9600, 6-19200,7-38400,8-57600,9-115200

Response	Description
SB e-n	e – The enumerator value. n – The Buad Rate value.

Example
SB<cr> SB 9-115200<cr><lf> SB 5<cr> SB 5-9600<cr><lf> SB ?<cr> SB 3-2400,4-4800,5-9600,6-19200,7-38400,8-57600,9-115200<cr><lf>

4.30. SS – Request or Set the Serial Number

Command	Description
SS	Request the serial number.

Response	Description
SS A99999	

Example
SS<cr> SS X25505<cr><lf>

4.31. ST – Request or Set the Sample Time

Command	Description
ST	Request the Sample Time.
ST e	Set the Sample Time. e – the Sample Time, where e is 0-1 MIN,1-5 MIN,2-10 MIN,3-15 MIN,4-30 MIN, 5-1 HR

Response	Description
ST e-v	e – The enumerator value. v – The current sample time value.

Example
ST<cr> ST 5-1 HR<cr><lf> ST 1<cr> ST 1-5 Min<cr><lf> ST ?<cr> ST 0-1 MIN,1-5 MIN,2-10 MIN,3-15 MIN,4-30 MIN,5-1 HR<cr><lf>

4.32. TS – Request or Set the Timestamp Mode

Command	Description
TS	Request the Timestamp Mode setting.
TS e	Set the Timestamp Mode setting, where e is 0-ENDING,1-BEGINNING.

Response	Description
TS e-name	e – The enumerator setting. name – The enumerator name.

Example
TS<cr> TS 1-BEGINNING<cr><lf> TS 0<cr> TS 0-ENDING<cr><lf> TS ?<cr> TS 0-ENDING,1-BEGINNING<cr><lf>

4.33. UN c – Request Specific Channel Available Field Units

Command	Description
`UN c`	Request the list of available channel/field units. `c` – Desired channel/field

Response	Description
`UN 1-a,...`	Returns the available units for the channel/field units. `1-a` – The enumerator and name `...` – More enumerators and names If a field has no units associated with it, a single response with an enumerator of 0 is returned with a unit name of N/A

Example

`UN 3<cr>`
`UN 3 1-ug/m3,2-mg/m3<cr><lf>`
 	
`UN 1<cr>`
`UN 1 0-N/A<cr><lf>`

4.34. UN c u – Set Specific Channel Field Units

Command	Description
`UN c u`	Set the channel/field units. `c` – Desired channel/field `u` – Enumerated unit (1, 2, 3 etc.) Enumerators are 1 based. Sending a 0 enumerator to this command will echo back the current setting with no changes.

Response	Description
`UN c 1-a`	Returns the enumerator and unit name after the change. `c` – channel/field `1-a` – The enumerator and unit name

Example

`UN 3 1<cr>`
`UN 3 1-ug/m3<cr><lf>`
 	
`UN 3 0<cr>`
`UN 3 1-ug/m3<cr><lf>`

4.35. GTC – Start the Touch Screen Calibration

Command	Description
GTC	Start the touch screen calibration.

Response
Begin touch calibrate...

Example
GTC<cr> Begin touch calibrate...<cr><lf>

4.36. SPW – Request or Set the User Password

Command	Description
SPW	Request the user password.
SPW wxyz	Set the user password, where w,y,x,z are digits from 1 – 9.

Response	Description
SPW ----	---- - The user password has not been entered and therefore cannot be shown.
SPW wxyz	wxyz – The current user password.

Example
SPW<cr> SPW ----<cr><lf> PW 1234<cr> PW Unlocked<cr><lf> SPW<cr> SPW 1234<cr><lf> SPW 1122<cr> SPW 1122<cr><lf>

4.37. XRD – Request the X-Modem Record Descriptors

Command	Description
XRD e	Request the X-modem record descriptors, where e is 1=data file record.

Response	Description
	See below.

Example

```
XRD 1<cr>
XRD 1,3,12,1,LE<cr><lf>
1,Time,,0,NO,DATETIME,1.0E+00,0.0E+00,2.5E+00<cr><lf>
2,Status,,0,OR,UINT32,1.0E+00,0.0E+00,2.5E+00<cr><lf>
3,ConcRT,mg/m3,3,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
4,ConcHR,mg/m3,3,TOH,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
5,Flow,lpm,2,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
6,WS,m/s,1,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
7,WD,Deg,0,V,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
8,AT,C,1,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
9,RH,%,0,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
10,BP,mmHg,1,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
11,FT,C,1,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
12,FRH,%,0,S,FLOAT,1.0E+00,0.0E+00,2.5E+00<cr><lf>
```

4.38. XRF – X-modem Read File

Command	Description
XRF f	Start a X-Modem Read where f is 1-User Data, 2-Alarms

Response	Description

Example
XRF 1<cr>

4.39. BKGD – Request or Set the Background Offset

Command	Description
BKGD	Request the background offset setting.
BKGD n	Set the background offset setting, where n is from -0.0500 to 0.0500.

Response	Description
BKGD n	n – the background offset setting value

Example
BKGD<cr> BKGD 0.0000<cr><lf> BKGD 0.035<cr> BKGD 0.0350<cr><lf>

4.40. SPAN – Request or Set the Span Mass Audit

Command	Description
SPAN	Request the Span Mass Audit value.
SPAN n	Set the Span Mass Audit, where n is from 0.4 to 2.0.

Response	Description
SPAN n	n – the Span Mass Audit value.

Example
SPAN<cr> SPAN 0.780<cr><lf> SPAN 0.775<cr> SPAN 0.775<cr><lf>

4.41. TPER – Request or Set the Tape Advance Period

Command	Description
TPER	Request tape advance period setting.
TPER e	Set the tape advance period setting. The e range is 0-AUTO, 1-1 HR, 2-2 HR, 3-3 HR, 4-4 HR, 5-6 HR, 6-8 HR, 7-12 HR, 8-24 HR.

Response	Description
TPER 0-AUTO	

Example
TPER<cr> TPER 8-24 HR<cr><lf> TPER 0<cr> TPER 0-AUTO<cr><lf> TPER 0<cr> TPER 0-AUTO,1-1 HR,2-2 HR,3-3 HR,4-4 HR,5-6 HR,6-8 HR,7-12 HR,8-24 HR<cr><lf>

4.42. FRHSP – Request or Set the Filter RH Set Point

Command	Description
FRHSP	Request the filter RH set point.
FRHSP n	Set the filter RH set point, where n is from 0.0 to 100.0.

Response	Description
FRHSP n	n – the filter RH set point value

Example
FRHSP <cr> FRHSP 45.0<cr><lf> FRHSP 35<cr> FRHSP 35.0<cr><lf>

4.43. RTPER – Request or Set the Real-time Average Period

Command	Description
RTPER	Request the real-time average period.
RTPER n	Set the real-time average period, where n is from 15 to 60.

Response	Description
RTPER n	n – the real-time average period value.

Example
RTPER <cr> RTPER 60<cr><lf> RTPER 30<cr> RTPER 30<cr><lf>

4.44. TPRES – Request or Set the Tape Advanced Pressure

Command	Description
`TPRES`	Request the tape advanced pressure setting.
`TPRES n`	Set the tape advanced pressure setting, where `n` is from `50` to `350`.

Response	Description
`TPRES n`	`n` – the tape advanced pressure setting.

Example

`TPRES <cr>`
`TPRES 250<cr><lf>`
 	
`TPRES 150<cr>`
`TPRES 150<cr><lf>`

4.45. XRDCRC – Request the File Descriptor CRC

Command	Description
`XRDCRC 1`	Request the file descriptor CRC.

Response	Description
`XRDCRC f hhhh`	`f` – the file number. `hhhh` – the file record descriptor CRC value in hexadecimal.

Example
`XRDCRC 1<cr>` `XRDCRC 1 ECFC<cr><lf>`

5. Modbus Map

1.1. 3x Modbus Map

Name	Address	Type	Points	Description
Word	0	Uint16	1	Fixed value of 1
Dword	1	Uint32	2	Fixed value of 123456789
Float	3	Float32	2	Fixed value of 123456.0
String	5	String	3	Fixed value of “ABCDE”
Year	100	Uint16	1	Current time Year
Month	101	Uint16	1	Current time Month
Day	102	Uint16	1	Current time Day
Hour	103	Uint16	1	Current time Hour
Minute	104	Uint16	1	Current time Minute
Second	105	Uint16	1	Current time Second
Date/Time	106	Uint32	2	Current Unix time (Seconds since Jan 1 1970)
N Channel	200	Uint16	1	Number of channels in last data record
Serial Number	201	String	4	MOI serial number (10 Bytes including 0 terminator)
Revision	205	String	20	Product Model, part number, and revision
Digital Revision	225	String	20	Digital sensor Model, part number, and revision

Instantaneous real time readings

Name	Address	Type	Points	Description
Date/Time	1000	Uint32	2	Current Unix time (Seconds since Jan 1 1970)
Status	1002	Uint32	2	Current alarm status
Conc RT	1004	Float	2	Real time concentration (ug/m3 or mg/m3)
Conc HR	1006	Float	2	Previous hour concentration (ug/m3 or mg/m3)
Flow	1008	Float	2	(LPM) Sample flow rate
NA	1010	Float	2	Not used
WS	1012	Float	2	(m/s) Wind Speed
WD	1014	Float	2	(Deg) Wind Direction
AT	1016	Float	2	(C) Ambient temperature
RH	1018	Float	2	(%) External relative humidity
BP	1020	Float	2	(mmHg) Barometric pressure
Upper	1022	Float	2	(mmHg) Upper tape pressure
Lower	1024	Float	2	(mmHg) Lower tape pressure
FT	1026	Float	2	(C) Filter temperature
FRH	1028	Float	2	(%) Filter relative humidity
NA	1030	Float	2	Not used
BT	1032	Float	2	(C) Box temperature
BV	1034	Float	2	(V) Battery voltage
Beta	1036	Float	2	(Hz) Beta counts

Last data record readings

Name	Address	Type	Points	Description
Date/Time	2000	Uint32	2	Unix timestamp (Seconds since Jan 1 1970)
Status	2002	Uint32	2	Alarm status
Conc RT	2004	Float	2	Real time concentration (ug/m3 or mg/m3)
Conc HR	2006	Float	2	Previous hour concentration (ug/m3 or mg/m3)
Flow	2008	Float	2	(LPM) Flow rate
WS	2010	Float	2	(m/s) Wind Speed
WD	2012	Float	2	(Deg) Wind Direction
AT	2014	Float	2	(C) Ambient temperature
RH	2016	Float	2	(%) External relative humidity
BP	2018	Float	2	(mmHg) Barometric pressure
FT	2020	Float	2	(C) Filter temperature
FRH	2022	Float	2	(%) Filter relative humidity

1.2. 4x Modbus Map

Name	Address	Type	Points	Description
Modbus Address	0	Int16	1	Modbus address
Byte Order	1	Int16	1	Value 1 to 4
Year	100	Uint16	1	Set time Year
Month	101	Uint16	1	Set time Month
Day	102	Uint16	1	Set time Day
Hour	103	Uint16	1	Set time Hour
Minute	104	Uint16	1	Set time Minute
Second	105	Uint16	1	Set time Second
Date/Time	106	Uint32	2	Set Unix time (Seconds since Jan 1 1970)

6. Multi-Drop Network Communication Services

The following is an extension to the serial commands to allow operation in a multi-drop network. This network mode must be enabled. When enabled, the unit will no longer echo characters as they are entered and the automatic print at the end of the sample will be disabled.

The networking protocol uses the existing serial commands by adding an Identification Command Prefix in front of the command to address the desired unit.

6.1. Identification Command Prefix

When network mode is enabled, the standard commands must be prefixed with an Identification command to specify which unit in the network is to respond.

The format of the identification command is <Esc>A<sp>999<sp>cmd*cs<cr>.

Receipt of an Identification command will cause the unit to recognize that it is in a network and disable command echo and real time output. The unit will also automatically change to Network Mode.

Command Component	Description
<Esc>	ASCII escape character (0x1B hex, 27 decimal)
A	ASCII character 'A' (0x41 hex, 65 decimal)
<sp>	ASCII space character (0x20 hex, 32 decimal)
999	1 to 3 numeric ASCII characters 0 – 9 (0x30 – 0x39 hex, 48 – 57 decimal). This is the Location ID (1 – 999) set in the unit. An address of 0 will function as a "Global Address"
<sp>	ASCII space character (0x20 hex, 32 decimal)
cmd	Normal serial command. This may include 0 or more additional parameters separated by <sp>.
*	ASCII '*' character (0x2A hex, 42 decimal). Checksum Delimiter
cs	Checksum.
<cr>	ASCII carriage return character (0x0D hex, 13 decimal)

6.2. Data Integrity

There will be a Data Integrity checksum on all commands and all responses when in Network Mode. The Checksum will be appended to the end of the command and response strings and delimited with the "*" (ASCII 0x2A) character. The checksum will be a 16 bit sum of all the characters After the <Esc> Character, up to but Not Including the "*" delimiter character. The number will be printed in Decimal format. This is not fixed width.

Command strings with a missing or improper checksum will be ignored.

There is a special checksum of two forward slash characters "//" which will resolve as a good checksum. This will allow for easier human interaction without the need to manually calculate checksums.

6.3. NW Command

The NW command is used to enable the network mode. The format for enabling is as follows:

<Esc>A<sp>0<sp>NW<sp>1*//<cr>.

The format to disable is as follows:

<Esc>A<sp>0<sp>NW<sp>0*//<cr>.

6.4. Command Example

For example to set the Sample Time to 60 seconds on a unit with the location ID of 25, the command string would look like this:

<Esc>A<sp>25<sp>ST<sp>60*//<cr>

6.5. Global Addressing

Device addresses range from 1 to 999. The address of 0 will be used for a Global Address. All units will process commands addressed to unit 0. There is an added requirement that the unit Must Not respond with serial output when globally addressed even for commands which normally do so.

6.6. Serial Timing

When in half duplex mode (either Network Mode or RS-485 Mode), the unit will have a minimum pause of 10mS between the time a command is received and a response is sent to allow for the correct turnaround of typical RS-485 interface hardware.

The networked device will produce a response to all commands (except Globally Addressed messages) within 50mS.

6.7. Unavailable Command

Some commands are not available in Network Mode.

The multi-drop network support must be disabled for those commands to operate. Disable the network with this command: <Esc>A<sp>0<sp>NW<sp>0*//<cr>.

6.8. Firmware Update

Firmware updates can only be performed with only one unit connected to the computer and network mode is disabled.