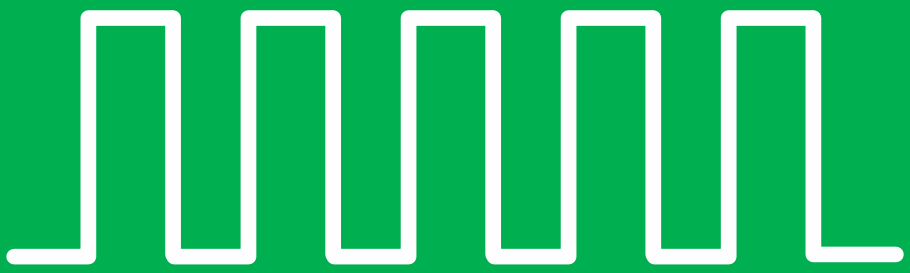
ANALYTICAL TECHNOLOGY, INC.

O & M Manual



D12Ex & F12D

Ascii Protocol Manual

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D12EX AND F12D ASCII PROTOCOL

Introduction

The D12 Series (D12 and F12) gas transmitters feature an ASCII protocol that can be used to obtain real time readings, read and write configuration settings, and download reports over asynchronous UART connection (PC COM port or other). It is a human readable, plain text, master/slave protocol that can be accessed *interactively* using a terminal emulation program, and also *programmatically* via a simple host or PLC program. The protocol also supports a configurable auto-trigger mode, where readings are output on a timed or event driven basis, and a "squawk" mode for locating a single transmitter in the field.

The protocol is designed for a simple RS232 connection (point-to-point), but also supports two addressing modes for an RS485 (multi-point) UART (COM) connection. Only one master is ever permitted.

Applicability

This document applies to D12Ex-T, D12Ex-IR, and F12/D (versions 1.08 or higher) gas transmitters with the embedded ASCII protocol. Refer to the transmitter's operating manual for details on connecting power and communications, and enabling and configuring the protocol through the front panel.

Table of Contents

Protocol

Data Transfer

Data transfer is "master-slave". The host initiates a transfer by sending a query message, after which, the transmitter sends back a reply message. The period of time required for the transmitter to process the query is 10ms or less for read queries, and 200ms or less for write queries. There is no timing requirement between characters sent to the transmitter. The transmitter also features an "Auto-trigger" mode for sending data based on a time interval or event.

Messages

Message are plain text characters (ASCII 0-127), terminated with a carriage return (ASCII 13, represented by <CR>). Intervening and trailing whitespace characters are ignored (unless required), as are line feed characters (ASCII 10) sent immediately after the carriage return. The backspace character (ASCII 8) is implemented and will reposition the input buffer pointer to permit correcting mistakes entered through a terminal program. Sending <CR> alone (null command) has the effect of resetting the input buffer to its starting position in preparation for a new query.

Unless noted otherwise, the following rules apply to the descriptions and examples used throughout this manual.

1) Optional fields are shown in square braces, "[ ]".
2) Fields are typically separated by commas.
3) The ellipse symbol "..." indicates more fields may be present.
4) Text appearing between angle brackets < > describes the contents of a field, such as <CR> to represent the carriage return character (ASCII 13), or <value> to represent data later described in detail.
5) Examples assume a line feed character <LF> inserted after each carriage return <CR>, and neither are shown to improve readability.
6) Comments are contained within parenthesis.
7) Numeric values read from and written to the transmitter are assumed to be ASCII decimal values (base 10, like, "123.4"). ASCII decimal values with decimal points will be rounded up when integer values are expected.
8) ASCII hexadecimal values (or ASCII hex) are defined as plain text representing a base-16 numeric value, like "3F501A2C". Leading zeros are suppressed. The Command Reference will indicate numbers transferred as ASCII hex.
9) The following table summarizes the symbols used.

Symbol	***Description***
<CR>	Carriage return character, ASCII 13
<SP>	Space character, ASCII 32
(text)	Comments

Query Messages and Commands

Query messages are sent by the host and are composed of commands for reading and writing data and settings, and executing services in the transmitter. At a minimum, a query message consists of a command followed by an ASCII carriage return character, CR (ASCII 13). However, many queries require one or more arguments following the command.

```
Example 1 Simple read query

   RDG?                              (request gas reading)

   0.0                               (reply)

Example 2 Read query with arguments

   RDG? 1,5,7          (request read gas reading, units, temperature)
```

Notice that when *arguments* appear in a query, they must be separated from the command by at least one ASCII space character (ASCII 32), with the fields separated by commas, and terminated with <CR>.

```
   Format: command <space> arg1[,arg2,…]<CR>

Example 3 Write query with argument

   RANGE= 10.0         (request to set range)
```

Commands

Commands to read data end with a question mark character (?). Commands to write data end with an equal sign (=). Service queries may have either, or none, depending on the type of service requested. This presents a more natural interface and reduces the number of the command tree nodes, which improves the performance of the transmitter's command interpreter.

Unless specified, commands may be entered in any combination of upper or lower case. A command must be the first character received following the <CR> of the previous reply, or the previous query if no reply was returned. If a command requires arguments, a space character (ASCII 32) must separate the command from the arguments.

Command arguments are separated by commas (ASCII 44). Optional arguments may be omitted, but must be followed by a comma if not last in the list.

Not all commands are implemented by every transmitter and sensor combination. These exceptions are noted in the command description. The transmitter will return "!Invalid command", "!Cannot perform this action", etc. Commands are listed alphabetically in the Command Reference section.

Reply Messages

The transmitter replies with the data requested, or a simple "Ok" when no data is returned. Requested data is separated by commas, if necessary, and the reply is terminated with <CR>. Some queries, such as reading the data log, return multiple lines in comma delimited format.

```
Format: value1[,value2,…]<CR>
```

```
Example 4  Read data with multiple fields
RTC?                              (request date, time, day)
06/15/16,15:35:42,Wednesday       (reply)
```

```
Example 5  Write data with multiple fields
RTC= 06/15/16,15:36:00,Wed        (request to set clock)
Ok                                (reply)
```

Requesting the contents of the data log returns multiple lines.

```
Example 6 Reply with multiple lines (report)
LOG?                              (request report of data log)
06/15/16,13:36,0.0,0.1,0.0,0.1    (reply - abbreviated)
06/15/16,13:40,0.1,0.0,0.0,0.0
```

Exceptions

When the transmitter cannot reply to a query, it responds with an exception message. The message is preceded by an exclamation character '!' to help identify it as an exception reply message. For example, requesting sensor data or settings when the sensor is removed results in a reply of "!Sensor trouble." At this point, the host can present and/or store the text.

Exceptions fall into two categories: command exceptions and reply exceptions. Command exceptions, such as "!Invalid command.", are returned by the protocol driver when it cannot properly decode a command (see Command Exceptions on page 12). Reply exceptions, like "!Sensor power on delay.", are returned by the transmitter in response to a valid command that cannot be executed. A full list of exception messages are detailed in *Table 3 Reply Exceptions*.

Addressing

If the master is connected to only one transmitter, no address field is required. If the master is connected to more than one transmitter on the same connection, an address field is required to direct commands to the intended transmitter. For this purpose, the transmitter supports two types of addresses, ***COM Address***, and ***User Defined Address.***

COM Address

COM addressing uses a numeric value (the transmitter's COM address) to distinguish transmitters on the same connection. A COM address is specified by the '@' symbol (ASCII 64) followed by the transmitter's address, a period (ASCII 46), and then the command. The numeric address is represented as one or two ASCII hex (hexadecimal) characters, which allows up to 255 unique addresses, however, the physical characteristics of RS485 usually limit the number of devices to 32.

```
Query Format: @<addr>.command[<SP>arg1,arg2,…]<CR>
```

The transmitter echoes the address in the reply, after replacing the period with a comma (ASCII 44).

```
Reply Format: @<addr>,<reply><CR>
```

Example 7 Use COM addressing to read data

(Read transmitter 1 gas concentration)

```
@1.RDG?                                    (request)
@1,0.01                                    (reply)
```

(Read transmitter 31 real time clock)

```
@1F.RTC?                                   (request)
@1F,06/15/16,15:35:42,Wednesday            (reply)
```

Example 8 Use COM addressing to write data

```
@1.rtc= 06/15/16,15:30:24,Wednesday        (request)
@1,Ok                                      (reply)
```

By default, the transmitter's COM address is 1 and must be changed prior to installation on a shared connection. On D12 and F12 transmitters, this can be done through the user interface, or by using the command, "**ADR=**". Note that this command expects the address to be passed as an ASCII decimal value, 0-255.

@1.ADR= 31 (set address to 31 decimal)

@1,Ok

@1F,ADR= 1 (restore address to 1 decimal)

@1F,Ok

Global COM Address, @0

The global COM address is an address that all transmitters *silently* respond to (send no reply), regardless of their own COM or user defined address. Because of the potential problems that could arise, this addressing mode is restricted to only a few commands.

Example 9

```
(Request date and time from transmitter 31)
@1F.RTC?                                (request)
@1F,06/15/16,15:35:42,Wednesday         (reply)


(Update date and time of all transmitters)
@0.rtc= 06/15/16,16:36:00,Wed           (request)
                                        (no reply)


@1F.rtc?                                (request)
@1F,06/15/16,16:36:04,Wednesday         (reply)
```

User Defined Address, UDA

The User Defined Address, or UDA, allows the use of meaningful name to distinquish transmitters on the same connection. The name may be up to 8 characters long, and consist of the following characters.

```
A-Z, a-z, 0-9, and _ (underscore)
```

The user defined address is set using the "UDA= ", command. By default, the UDA is null, so the transmitter will respond to commands without an address field. Once set, the transmitter will not respond to commands unless preceded by the UDA or the transmitter's COM address (not the global address).

Example 10 Setting the UDA

Notice: Once the UDA is set, the transmitter will only respond to queries with the proper user defined address (record this value prior to setting).

```
UDA= gx1     (request to set the UDA to gx1)
Ok           (reply)
```

The transmitter will now only respond to commands prefixed by the UDA or the transmitter's COM address.

Queries to the transmitter must now be prefixed by the user defined address, followed by a period (ASCII 46), then the command (no intervening whitespace).


```
Query Format: <uda>.command[<SP>arg1,arg2,…]<CR>
```

Replies from the transmitter are prefixed by the UDA, followed by a comma (ASCII 44).

```
Reply Format: <uda>,<reply><CR>
```

Example 11 Using the UDA

```
gx1.tmp?
gx1,22.2C
```

Auto-trigger Mode

Normally, the host issues a RDG? command to obtain readings and status. However, the TRIG command configures the transmitter to automatically output the reply on a timed interval, change in reading, alarm event, or all three. This feature allows a simple terminal program like Hyperterminal to capture data to a file in real time, and may eliminate the need to write a custom application. For more information, see Auto-trigger Mode in

Command Reference starting on page 12.

Example - collect readings once every second, composed of the date, time, gas reading, temperature reading, and status.

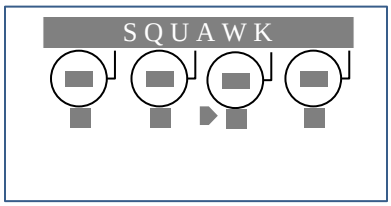
07/04/16,09:29:57,-0.0,74,10070040

07/04/16,09:29:58,-0.0,74,10070040

07/04/16,09:29:59,-0.0,74,10070040

Squawk

To assist with network management, the transmitter may be commanded to present a special "Squawk" display, as shown below. This can be used by technicians to help identify transmitters in the field.



Squawk mode is activated by setting Status bit 26 (Squawking). Pressing the transmitter's ESC button returns the display to normal.

Command Reference

Programmatic Access

The primary command for programmatically requesting measured readings, status, date and time, etc., is, RDG? [args]. Nearly all other commands are used for reading and writing configuration settings, downloading reports, and modifying network behavior.

Auto-trigger Mode

The TRIG command can be used to configure automatic, timed and event driven replies to a RDG? command. Output may be triggered based on a timed interval, change in reading, alarm event, or all three.

Other commands may still be entered while in Auto-trigger mode, however, output is suspended for 10 seconds afterwards.

Command Exceptions

Invalid commands, syntax, or arguments return one of the following exception messages.

!Message too long.	Command received exceeded 80 characters
!Syntax error.	Invalid character received, usually after <CR>
!Invalid command.	Command unrecognized or not allowed
!Invalid, missing, or extra argument(s).	Problem detected with argument list following command
!Invalid register(s).	Invalid register specified
!Invalid service request.	Unable to decode service request (or not supported)

Reply Exceptions

After a command is decoded and processed, the transmitter may not be able to comply with the query and returns a Reply Exception. These exceptions are listed in *Table 3 Reply Exceptions* starting on page 82.

Adr?

Descripton

Gets the transmitter numeric (COM) address. This is the address used for ASCII (COM), HART, and Modbus protocols.

Args

None

Reply

Numeric address, 1-255

Examples

Adr?
1

Adr= <value>

Descripton

Sets the transmitter numeric (COM) address.

Args

Value is an ASCII decimal numeric address, 1-255.

Reply

Ok

Examples

Adr= 12
1

Alarms?

Descripton

Gets the current active alarm status as a text string.

Args

None

Reply

<alarm status>
Alarm status text is one or more of the following.

- Alarm
- Warning
- Caution
- Inhibited
- Normal
- Trouble

If two or more alarms are active, they are separated by the '+' character (ASCII 43).

Examples

Alarms?
Normal

Alarms?
Alarm+Warning

AlmSP? <index>

Descripton

Gets the level at which the specified alarm becomes active. Inactive high alarms, like warning and alarm, become active at and above this value. Inactive low alarms, like caution, become active at and below this value. Alarms become active only after the set delay period has expired (see AlmSD?).

Args

Index must be supplied and is one of the following.

0	(Caution)
1	(Warning)
2	(Alarm)

Reply

Alarm level in gas sensor units of measure.

Examples

AlmSP? 0
-4.0

AlmSP? 1
0.5

AlmSP? 2
1.0

AlmSP= <index>,<level>

Descripton

Sets the level at which the specified alarm becomes active. Inactive high alarms, like warning and alarm, become active at and above this value. Inactive low alarms, like caution, become active at and below this value. Alarms become active only after the set delay period has expired (see AlmSD?).

Note: changing this level forces the reset level to the same value (see AlmRP?).

Take extreme care when adjusting this setting.
Do not set alarms above the long term exposure level of the target gas!

Args

Both arguments are required.
Index is a numeric value from 0 to 2.

0	(Caution)
1	(Warning)
2	(Alarm)

Level is assumed to be in the gas sensor units of measure (ie, PPB,PPM,%). The lower limit is typically -20% of the sensor's range value (ie, Range? * -0.2). The upper limit is typically 120% of the sensor's maximum upper range value (see Sensor?).

Reply

Ok

Examples

AlmSP= 0,-3
Ok

AlmSP= 1,0.4
Ok

AlmSP= 2,0.8
Ok

AlmSP= 2
!Invalid, missing or extra arguments(s).

AlmRP? <index>

Descripton

Gets the level at which the specified alarm becomes inactive and can be programmed to provide alarm hysteresis (deadband). Active high alarms, like warning and alarm, become inactive at and below this value. Active low alarms, like caution, become inactive at and above this value. Alarms become inactive only after the reset delay period has expired (see AlmRD?).

Note: changing AlmSP forces this level to the same value.

Args

Index is a numeric value from 0 to 2 and must be supplied.

0	(Caution)
1	(Warning)
2	(Alarm)

Reply

Alarm reset level in gas sensor units of measure.

Examples

AlmRP? 0
-4.0

AlmRP? 1
0.5

AlmRP? 2
1.0

AlmRP= <index>,<level>

Descripton

Sets the level at which the specified alarm becomes inactive and can be programmed to provide alarm hysteresis (deadband). Active high alarms, like warning and alarm, become inactive at and below this value. Active low alarms, like caution, become inactive at and above this value. Alarms become inactive only after the reset delay period has expired (see AlmRD?).

Note: changing AlmSP forces this level to the same value.

Args

Both arguments are required.
Index is a numeric value from 0 to 2.

0	(Caution)
1	(Warning)
2	(Alarm)

Level is assumed to be in the gas sensor units of measure (ie, PPB,PPM,%). For high alarms, the lower limit is typically -20% of the sensor's range value (ie, Range? * -0.2), and the upper limit is the alarm set level (see AlmSP?). For low alarms, the lower limit is the alarm set level (see AlmSP?), and the upper limit is typically 120% of the sensor's maximum upper range value (see Sensor?).

Reply

Ok

Examples

```
AlmRP= 0,-3
Ok

AlmRP= 1,0.4
Ok

AlmRP= 2,0.8
Ok

AlmRP= 2
!Invalid, missing or extra arguments(s).
```


AlmSD? <index>

Descripton

Gets the set delay time period of the specified alarm. This is the amount of time that the alarm *condition* must exist uninterrupted before activating the alarm. This is designed to help prevent false alarms caused by a momentary exposure to the analyte gas for up to 10 seconds.

Args

Index must be supplied and is one of the following.

0	(Caution)
1	(Warning)
2	(Alarm)

Reply

Set delay period in seconds.

Examples

(Get set delay of warning)
AlmSD? 1
10

(Get set delay of alarm)
AlmSD? 2
5

AlmSD= <index>,<period>

Descripton

Sets the set delay time period of the specified alarm. This is the amount of time that the alarm condition must exist uninterrupted before activating the alarm. This is designed to help prevent false alarms caused by a momentary exposure to the analyte gas for up to 10 seconds.

Args

Both arguments are required.
Index is a numeric value from 0 to 2.

0	(Caution)
1	(Warning)
2	(Alarm)

Period is 0 to 10 seconds.

Reply

Ok

Examples

AlmSD= 0,2
Ok

AlmSD= 1,5
Ok

AlmRD? <index>

Descripton

Gets the reset delay time period of the specified alarm. This is the amount of time that c*onditions* must be normal before deactivating the alarm. This is designed to allow a minimum amount of time for fans to clear the area for up to two hours after a gas leak. Note that this setting has no effect for alarms programmed for manual reset (see AlmOpt?).

Args

Index must be supplied and is one of the following.

0 (Caution)
1 (Warning)
2 (Alarm)

Reply

<reset delay period in seconds, 0-7200>

Examples

(get reset delay of warning)
AlmRD? 1
30

(get reset delay of alarm)
AlmRD? 2
600

AlmRD= <index>,<period>

Descripton

Sets the reset delay time period of the specified alarm. This is the amount of time that c*onditions* must be normal before deactivating the alarm. This is designed to allow a minimum amount of time for fans to clear the area for up to two hours after a gas leak. Note that this setting has no effect for alarms programmed for manual reset (see AlmOpt?).

Args

Both arguments are required.
Index is a numeric value from 0 to 2.

0	(Caution)
1	(Warning)
2	(Alarm)

Period is 0 to 7200 seconds.

Reply

Ok

Examples

AlmRD= 1,30
Ok

AlmRD= 2,600
Ok

AlmOpt? <index>

Descripton

Gets the alarm options for the specified alarm. The command returns both a numeric value and a text description.

Args

Index must be supplied and is one of the following.

0 (Caution)
1 (Warning)
2 (Alarm)

Reply

<Value>,<Description>

Value is an ASCII decimal value representing the bit settings below.
Bits

4 3210
R FFTT

Where,

TT …Alarm type (00=Disabled, 01=High, 10=Low)
FF …Fault override (00=Hold, 01=Set, 10=Clear
R …Reset (0=Manual, 1=Auto)

Description is a text description in the form, <Type>/<FOvr>/<Reset>

Examples

(Get alarm options for Caution)
AlmOpt? 0
18,Low/Hold/Auto
(Value = 18d = 12h = 10010b; R=1, FF=00,TT=10)

(Get alarm options for Warning)
AlmOpt? 1
17,High/Hold/Auto
(Value = 17d = 11h = 10001b; R=1, FF=00, TT=01)

(Get alarm options for Alarm)
AlmOpt? 2
1,High/Hold/Manu
(Value = 1d = 01h = 000001b; R=0, FF=00, TT=01)

AlmOpt= <index>,<value>

Descripton

Sets the alarm options for the specified alarm.

Args

Index must be supplied and is one of the following.

0 (Caution)
1 (Warning)
2 (Alarm)

Value is an ASCII decimal value representing the bit settings below.
Bits

4 3210
R FFTT

Where,

TT …Alarm type (00=Disabled, 01=High, 10=Low)
FF …Fault override (00=Hold, 01=Set, 10=Clear
R …Reset (0=Manual, 1=Auto)

Reply

Ok

Examples

(Set alarm options for Caution to Low/Hold/Auto, R=1, FF=00, TT=10;
Value = 10010b = 12h = 18d)
AlmOpt= 0,18
Ok

(Set alarm options for Warning to High/Hold/Auto, R=1, FF=00, TT=01;
Value = 10001b = 11h = 17d)
AlmOpt= 1,17
Ok

(Set alarm options for Alarm to High/Hold/Manual, R=0, FF=00, TT=01;
Value = 00001b = 01h = 1d)
AlmOpt= 2,1
Ok

AlmIhb?

Descripton

Gets the alarm inhibit state. The command actually returns the time remaining on the running, countdown timer, in seconds. Alarms are inhibited when the value is greater than 0.

Args

None

Reply

>0 when alarms are inhibited (disabled)
0 when alarms are not inhibited (enabled)

Examples

AlmIhb?
54
(Alarms inhibited, 54 seconds remaining)

AlmIhb?
0
(Alarm inhibit ended)

AlmIhb= <state>

Descripton

Sets the alarm inhibit state.

Args

State is a Boolean value, where 0 ends alarm inhibit, and any positive value restarts the alarm inhibit timer from the full period (see AlmIhbPd?).

Reply

Ok

Examples

(Inhibit alarms for a defined period, see AlmIhbPd?)
AlmIhb= 1
Ok

(End alarm inhibit)
AlmIhb= 0
Ok

AlmIhbPd?

Descripton

Gets the user alarm inhibit time period setting.

Args

None

Reply

Period in seconds.

Examples

AlmIhbPd?
900
(900 seconds = 15 minutes, the default value)

AlmIhbPd= <value>

Descripton

Sets the alarm inhibit time period setting.

Args

Value is time in seconds (default=900, 15 minutes).

Reply

Ok

Examples

(Change alarm inhibit period to 10 minutes, 600 seconds)
AlmIhbPd= 600
Ok

AlmRst

Descripton

Resets all active, manual reset alarms if conditions permit. This service has the same effect as selecting Reset All from the front panel, or activating the Remote Reset input.

Args

None

Reply

Ok

Examples

AlmRst
Ok

AlmTst?

Descripton

Gets the alarms currently under test.

Args

None

Reply

The returned value is an ASCII decimal value representing the alarms currently under test.
Bits

3210
TAWC

Where,

T is Trouble
A is Alarm
W is Warning
C is Caution

Examples

AlmTst?
0
(No alarms under test)

AlmTst?
2
(Warning currently under test)

AlmTst= <value>

Descripton

Tests the specified alarms and associated relays for 5 minutes, or until cancelled by sending AlmTst= 0. No alarms may be active or already under test. You must send AlmTst= 0 to cancel any test in progress before sending a new query.

Args

Value is an ASCII decimal value representing the alarms currently under test.
Bits

3210
TAWC

Where,

T is Trouble
A is Alarm
W is Warning
C is Caution

Reply

Ok

Examples

(Test Warning)
AlmTst= 2
Ok

(Stop alarm test in progress)
AlmTst= 0
Ok

(Test both Alarm and Warning)
AlmTst= 6
Ok

(Stop alarm test in progress)
AlmTst= 0
Ok

AoVal?

Descripton

Gets the analog output value (4-20mA). This is the value normally computed from the gas sensor reading and may not match the physical measured value, especially for values above 22mA. The value does not normally go below 4mA, unless overridden by one of the following.

Alarm Inhibit
Auto-test
Trouble alarm
Forced by user or remote interface
Calibration by user or remote interface

The *Status?* command reports "Loop Fixed" when the analog output is being overridden, as well as the source of the override (alarm inhibit, auto-test, or trouble alarm). *Status?* does not report overrides by the user or remote interface.

Args

None

Reply

Analog output value in mA in the form, d.dd.

Examples

AoVal?
4.00

AoVal= <value>

Descripton

Enables or disables a remote override of the analog output. The override is enabled when <value> is greater than 0 and disabled when <value> equals 0. *Status*? indicates the output is fixed (Loop Fixed), and *AoVal*? reports the fixed value.

Args

Value must be in the range 3.6 to 22 mA, or 0 to end the override.

Reply

Ok

Examples

AoVal= 12
Ok

AoVal= 0
Ok

AoVal= 0
!Not in fixed current output mode

AoAlmIhb?

Descripton

Gets the analog output value temporarily forced during alarm inhibit.

Args

None

Reply

Analog output value in mA (3.6 to 22 mA, default=4 for Toxic and LEL gas sensors, 17.38 for Oxygen sensors).

Examples

(Toxic or LEL gas sensor)
AoAlmIhb?
4.00

(Oxygen sensor)
AoAlmIhb?
17.38

AoAlmIhb= <value>

Descripton

Sets the analog output value temporarily forced during alarm inhibit.

Args

Value must be in the range 3.6 to 22 mA.

Reply

Ok

Examples

(Toxic or LEL gas sensor)
AOAlmIhb= 3.8
Ok

(Oxygen sensor)
AOAlmIhb= 17.38
Ok

AoATst?

Descripton

Gets the analog output value temporarily forced during gas sensor test (Auto-test). This value is output when the test is started manually or automatically and is held for up to 10 minutes afterwards to allow time for the gas to dissipate and for the sensor to fully recover. Oxygen sensors do not require auto-test.

Args

None

Reply

Analog output value in mA (3.6 to 22 mA, default=4).

Examples

AoATst?
4.00

AoATst= <value>

Descripton

Sets the analog output value temporarily forced during automatic gas sensor test (Auto-test). This value is output when the test is started manually or automatically and is held for up to 10 minutes afterwards to allow time for the gas to dissipate and for the sensor to fully recover. Oxygen sensors do not require auto-test.

Args

Value must be in the range 3.6 to 22 mA(default=4).

Reply

Ok

Examples

AoATst= 4.2
Ok

AoTrbl?

Descripton

Gets the analog output value used to indicate a trouble alarm.

Args

None

Reply

Analog output value in mA (3.6 to 22 mA, default=3.6).

Examples

AoTrbl?
3.6

AoTrbl= <value>

Descripton

Sets the analog output value used to indicate a trouble alarm.

Args

Value must be in the range 3.6 to 22 mA (default=3.6).

Reply

Ok

Examples

AoTrbl= 3.6
Ok

AoCal4mA= <value>

Descripton

Calibrates the analog output at 4mA using the measured feedback value. The analog output must have previously been overridden to 4mA using “AoVal= 4”.

Args

Value is the measured value of the analog output.

Reply

Ok

Examples

AoVal= 4
Ok

AoCal4mA= 4.019
Ok

AoCal20mA= <value>

Descripton

Calibrates the analog output at 20mA using the measured feedback value. The analog output must have previously been overridden to 20mA using “AoVal= 20”.

Args

Value is the measured value of the analog output.

Reply

Ok

Examples

AoVal= 20
Ok

AoCal20mA= 19.96
Ok

ATCtrl?

Descripton

Gets the state of the gas sensor auto-test control.

Args

None

Reply

<state>,<description>

Where,

State	Description
0	Off
1	Ready
2	Start
3	Stop
4	Generate
5	Waiting
6	Fail 1/3
7	Fail 2/3
8	Fail 3/3
9	Trouble
10	Pass

Examples

ATCtrl?
0,Off

ATCtrl?
10,Pass

ATCtrl= <value>

Descripton

Sets the state of the gas sensor auto-test control. To set the control to Ready or Start, a gas sensor must be installed with a compatible* gas generator. The sensor's upper range value (see Range?) must be at or below the gas generator's maximum range value (see Gen? command).

Args

State Description

0	Off – stop and disable automatic start.
1	Ready - test can start automatically.
2	Start - start test now.
3	Stop - stop test now (ATCtrl must be > 3)

Reply

Ok

Examples

ATCtrl= 0
Ok

ATCtrl= 1
Ok

ATCtrl= 1
!Gas generator not installed.

ATDate?

Descripton

Gets the date of the next automatic gas sensor test.

Args

None

Reply

<date>,<time>
Date format is defined by the transmitter date format setting (mm/dd/yy or ddmmmyy).

Examples

ATDate?
06/22/16,09:00:00 (date format=mm/dd/yy)

ATDate?
22Jun16,09:00:00 (date format=ddmmmyy)

ATDate= [<date>][,<time>]

Descripton

Gets the date of the next automatic gas sensor test.

Args

[<date>],[<time>]
Date format is defined by transmitter date format setting (mm/dd/yy or ddmmmyy). Otherwise, an exception will occur. Time format is 24-hour format only. Date or time may be omitted and remain unchanged. If date is omitted, a comma must appear before time.

Reply

Ok

Examples

ATDate= 06/24/16,23:30:00 (date format = mm/dd/yy)
Ok

ATDate= 24Jun16,23:30:00 (date format = ddmmmyy)
Ok

ATDate= ATDate= 06/24/16,23:30:00 (date format != ddmmmyy)
!Invalid or missing argument(s).

ATDate= ,23:30:00 (date omitted)

Ok

ATCnts?

Descripton

Gets the number of gas sensor test passes, failures, and retries.

Args

None

Reply

<pass count>,<fail count>,<retry count>

Examples

ATCnts?
139,1,5

ATCnts?
!Sensor trouble.

Blank?

Description

Gets the sensor blanking (suppression) value. The transmitter reports 0 when the gas reading is at or below this value.

Args

None

Reply

Blanking value in units of PPM, PPB, or % (determined by the installed gas sensor).

Examples

Blank?
0.04

Blank= <value>

Description

Sets the sensor blanking (suppression) value. The transmitter reports 0 when the gas reading is at or below this value.

Args

Value is 0 to 5% of the sensor range setting (FS).

Reply

Ok

Examples

Blank= 0.04
Ok

Damp?

Description

Gets the sensor damping value used to increase stability of the gas reading.

Args

None

Reply

Integer from 1 to 100 (typical is 5-10).

Examples

Damp?
5

Damp= <value>

Description

Sets the sensor damping value used to increase stability of the gas reading.

Args

Value is an integer from 1 to 100 (decimal values are rounded up).

Reply

Ok or exception message (see *Table 3 Reply Exceptions*).

Examples

Damp= 9.5
Ok

Damp?
10

Damp= -10
!Input data low.

Gas?

Description

Gets the chemical name of the target gas to which the sensor responds.

Args

None

Reply

Gas name as a text string

Examples

Gas?
Cl2

Gas= <text>

Description

Sets the chemical name of the target gas to which the sensor responds.
Note: multi-gas sensors only; not available on H10 sensors.

Args

Text must be one of the valid gas names listed in the appropriate section of the transmitter operating manual.

Reply

Ok or exception message (see *Table 3 Reply Exceptions*) .

Examples

Gas= CO2
Ok

Gas= H2O2
!Invalid Command

GasNo?

Description

Gets the (ATi) index of the target gas to which the sensor responds. The value is unique to the installed sensor.

Args

None

Reply

Integer value from 1 to 255 (decimal)

Examples

GasNo?
14

GasNo= <value>

Description

Sets the (ATi) index of the target gas to which the sensor responds. The value is unique to the installed sensor.
Note: multi-gas sensors only; not available on H10 sensors.

Args

Integer value from 1 to 255.

Reply

Ok

Examples

GasNo= 2
Ok

GasNo= 2
!Invalid command

Gen?

Description

Gets information about the installed gas generator.

Args

None

Reply

<ID>,<Revision>,<Gas info>,<mAH Used>,<Settings>
Where,
ID: model-part no-serial No
Revision: hardware/software revision levels
Gas info: maximum allowable sensor range and name of gas
mAH Used: accumulated total of gas generation
Settings: gas pass level (in sensor units) and mA required by generator, or exception message (see below).

Examples

(Normal reply)
Gen?
C18-11-151,Hw=A/Sw=0,Cl2 20.0 PPM,0.24mA Used, 1.0 PPM/1.00 mA

(Generator not installed)
Gen?
Not Installed

(Gas type not compatible with sensor)
Gen?
C18-11-151,Hw=A/Sw=0,Cl2 20.0 PPM,0.24mA Used, Wrong Gas Type

(Insufficient output for programmed sensor range)
Gen?
C18-11-151,Hw=A/Sw=0,Cl2 20.0 PPM,0.24mA Used, Under-range

(Sensor not installed, memory error, or configuration error)
Gen?
C18-11-151,Hw=A/Sw=0,Cl2 20.0 PPM,0.24mA Used, Sensor Trouble

Log?

Descripton

Prints the data log report.

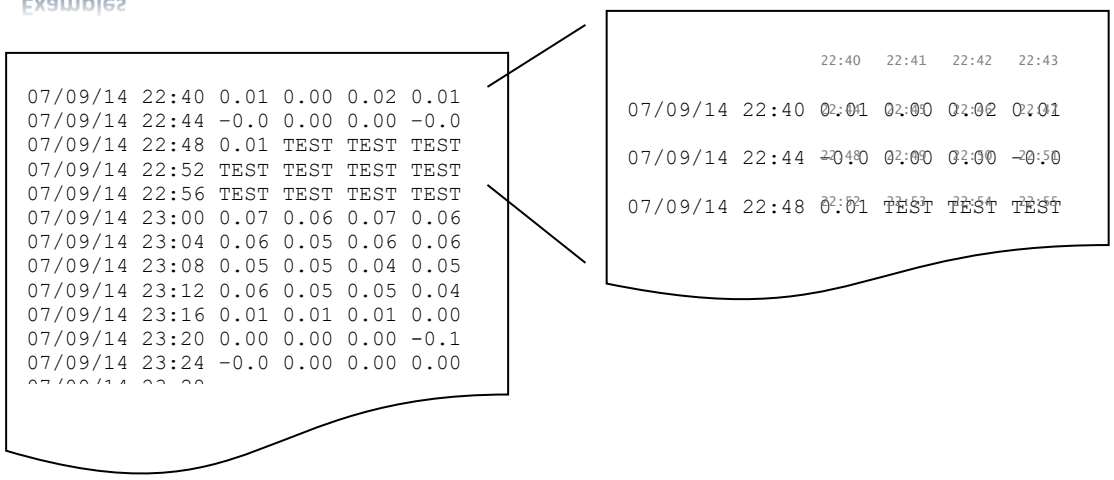
Args

None

Reply

Each line of the report begins with the date and time, followed by up to 30 gas readings. All fields on the line are separated by a TAB character (ASCII 9), which serves to keep the fields aligned in columns. This format is suitable for most Epson protocol printers and for import into most spreadsheet programs after capture. The date and time apply to the first gas reading on the line following the time. Readings appearing in subsequent columns to the right were recorded at the programmed sampling interval after the first reading.

Examples



In the example above, the first sample occurred at 22:40. The next sample to the right occurred at 22:41, followed by the next at 22:42, and so on. This pattern is repeated to the end of the line, and then repeats on the line below, and so on.

LogCtrl?

Descripton

Gets data log control state.

Args

None

Reply

<index>,<description>

Examples

LogCtrl?
0,Off

LogCtrl?
1,On

LogCtrl= <value>

Descripton

Sets the data log control state.

Args

Value is 0 (Off), 1 (On), or 2 (Clear)

Reply

Ok

Examples

(Turn off the data log)
LogCtrl= 0
Ok

(Turn on the data log)
LogCtrl= 1
Ok

(Clear the data log)
LogCtrl= 2
Ok

LogRate?

Descripton

Gets data log sampling period.

Args

None

Reply

Number of minutes between samples.

Examples

LogRate?
1
(1 minute between samples)

LogRate= <value>

Descripton

Selects the data log sampling period, which also controls the number of samples per day, and the number of days of continuous logging before new samples overwrite the oldest samples.

Args

Value is an index into a table of sampling periods, not the actual sampling period. The table below associates the index to the sampling period, samples-per-day, and number of days of storage.

Index	*Sampling Period (Minutes)*	*Samples/Day*	*Total Days*
0	1	1440	11
1	2	720	22
2	3	480	32
3	4	360	43
4	5	288	54
5	6	240	64
6	10	144	104
7	12	120	124
8	15	96	152
9	20	72	196
10	30	48	278
11	60	24	474

Reply

Ok

Examples

(Select 1 sample per minute)
LogRate= 0
Ok

Range?

Description

Gets the full scale range of the sensor (upper range value). This value is used to select input gain, determine the number of displayed decimal digits, and establish the analog output full scale (ie, 20mA on 4-20mA output).

Args

None

Reply

Current value of the sensor full scale range.

Examples

Range?
2.00

Range?
20.0

Range?
200

Range= <value>

Description

Sets the full scale range of the sensor (upper range value). This value is used to select input gain, determine the number of displayed decimal digits, and establish the analog output full scale (ie, 20mA on 4-20mA output). The transmitter reading is not guaranteed to be accurate above this value, which could lead to a dangerous condition. Changing the range changes the blanking (suppression) value proportionally.

Note

The data log stores samples in a %FS format to maximize storage. Changing the Range value using the ASCII,HART, or Modbus protocol automatically clears the data log without notice.

Args

Value must be within the upper range limits of the sensor. The upper range limits are displayed using the Sensor? command.

Reply

Ok

Examples

Range=5
Ok

Range= 10
Input data high.

Rdg? [args]

Descripton

Gets the gas concentration reading and other data specified by args. This single, efficient command is recommended for obtaining periodic readings and status programmatically.

Args

Args is a comma separated list of numerical values that specify which readings to return. If arguments are omitted, the transmitter returns the displayed gas concentration, which is blanked (suppressed) around zero to avoid noisy readings. Otherwise, the specified readings are returned as a comma separated list.

0	None - prints a comma with no data, use to control column alignment.
1	Blanked (suppressed) gas reading (value shown on the main display).
2	Unblanked (unsuppressed) gas reading (value shown in the zero and span displays).
3	Blanked gas reading as a fraction of range (=gas reading/full scale range). The full scale range is defined in the sensor range menu (determines analog input gain) and is automatically used to represent the 20mA output level.
4	Unblanked (unsuppressed) gas reading as a fraction of range (same as 3, otherwise).
5	Gas reading units as a text string (PPB, PPM,%, %LEL)
6	Gas temperature in °C.
7	Gas temperature in °F.
8	Alarm status as a single string, or an ordered list separated commas, as shown below, like Inhibited, Normal, Trouble, Alarm, Warning, Caution.
9	32 transmitter status bits as an ASCII hex value (see Table 1)
10	32 transmitter trouble bits as an ASCII hex value (see Table 2)
11	Transmitter date like 06/17/16 or 17Jun16, according to the transmitter date format setting.
12	Transmitter time like 12:30:08
13	Analog output (4-20mA)
14	32-bit transmitter ID as an ASCII hex value
15	32-bit sensor ID as an ASCII hex value
	16-25 (reserved for factory use)

Reply

By default, the transmitter returns the displayed gas concentration, which is blanked (suppressed) around zero to avoid noisy readings. Otherwise, the specified readings are returned as a comma separated list.

Examples

Terminating CR converted to CR/LF (hidden to improve readability).

(Request blanked gas reading)
RDG?
0.00

(Request blanked gas reading, units, temperature in °F)
RDG? 1,5,7
0.00,PPM,76

(Request unblanked gas reading, units, temperature in °C)
RDG? 2,5,6
-0.01,PPM,24.7

(Request status and fault registers as 32-bit hexadecimal values)
RDG? 9,10
10000040,0

(Request transmitter date, time, un-blanked gas reading, temperature in °F, and status)
RDG? 11,12,2,7,9
06/16/16,18:38:38,-0.01,76,10000040

(Request same as previous, but with leading and trailing empty column)
RDG? 0,11,12,2,7,9,0
,06/16/16,18:38:38,-0.01,76,10000040,

RlyCfg? <index>

Descripton

Gets the assigned alarm and normal coil state of the specified relay.

Args

Index is the index of the relay:

0 RL1
1 RL2
2 RL3

Reply

The returned value is an ASCII decimal value representing the relay configuration bit settings.

Bits

4 3210
C 00AA

Where,

C is the normal state of the coil

0=deenergized
1= energized

AA is the assigned alarm:

00=Caution
01=Warning
10=Alarm
11=Trouble

Examples

RlyCfg? 0
1,WARNING/NORM_OFF
(C=0, AA=01)

RlyCfg? 1
2,ALARM/NORMOFF
(C=0,AA=10)

RlyCfg? 2
19,TROUBLE/NORM_ON
(C=1,AA=3)

RlyCfg= <index>,<value>

Descripton

Gets the assigned alarm and normal coil state of the specified relay.

Args

Index is the index of the relay:

0 RL1
1 RL2
2 RL3

Value is an ASCII decimal value representing the relay configuration bit settings.

Bits

4 3210
C 00AA

Where,

C is the normal state of the coil

0=normally de-energized
1= normally energized

AA is the assigned alarm

00=Caution
01=Warning
10=Alarm
11=Trouble

Reply

Ok

Examples

(Assign relay 1 to Warning and make coil normally de-energized; C=0,AA=01, Value=1)
RlyCfg= 0,1
Ok

(Assign relay 2 to Alarm and make coil normally de-energized, C=0, AA=10, Value=2)
RlyCfg= 1,2
2,ALARM/NORMOFF

(Assign relay 3 to Trouble and make coil normally energized, C=1, AA=11, Value=19)
RlyCfg= 2,19

Rtc?

Descripton

Gets the real-time-clock date, time, and day of week. The date will be in the currently selected date format (mm/dd/yy[yy] or dd/mm/yy[yy], see RtcFmt?).

Args

None

Reply

<date>,<time>,<day of week>

Examples

Rtc?
07/14/2016,10:36:26,Thursday

Rtc= [<date>][,<time>][,<day of week>]

Descripton

Sets the real-time-clock date, time, and day of week.

Args

Date must be in the currently selected date format (mm/dd[/xx[yy]] or dd/mm[/xx[yy]], see RtcFmt?). It is permissible to use a 2 or 4 digit year, or omit the year entirely. If the year is omitted, the current year is assumed.
Time must be in the form of hh:mm[:ss] (seconds are optional)
Day of week is one of:

- Mon
- Tue
- Wed
- Thu
- Fri
- Sat
- Sun

Characters trailing the first three characters are ignored.

Reply

Ok

Examples

(Set the full date only)
Rtc= 7/14/2016
Ok

(Set the date in the current year)
Rtc= 7/14,13:30:10,Thu
Ok

(Set the time only)
Rtc= ,2:00:00

(Set the day of the week only)
Rtc= ,,Thu
Ok

RtcFmt?

Descripton

Gets the transmitter's date format.

Args

None

Reply

<date format index>,<text description>
Where,
Date format index is 0 for MM/DD/YYYY(US), or 1 for DD/MM/YYYY(UK)

Examples

RtcFmt?
0,MM/DD/YY
(US standard)

RtcFmt?
1,DD/MM/YYYY
(UK standard)

RtcFmt= <value>

Descripton

Sets the date format.

Args

Value is either 0 for MM/DD/YYYY, or 1 for DD/MM/YYYY

Reply

Ok

Examples

(Set to MM/DD/YYYY)
RtcFmt= 0
Ok

(Set to DD/MM/YYYY)
RtcFmt= 1
Ok

SecCode?

Descripton

Gets the code used to lock and unlock the user panel. This command is enabled by hardware jumper. Contact factory for further details.

Args

None

Reply

Integer value, 0-9999

Examples

SecCode?
0

SecCode?
!Cannot perform this action.

SecCode= <value>

Descripton

Sets the code used to access the user interface panel. This command is enabled by hardware jumper. Contact factory for further details.

Args

Integer value, 0-9999

Reply

Ok

Examples

SecCode= 1
Ok

SecCode= 1
!Cannot perform this action.

SecMfg?

Descripton

Gets the time remaining on the factory access timer (seconds). Factory access is always a timed, temporary state.

Args

None

Reply

0-7200

Examples

SecMfg?
660
(11 minutes)

SecMfg= <value>

Descripton

Sets the factory access timer (seconds). Factory access is always a timed, temporary state.

Args

0-7200

Reply

Ok

Examples

(Set the factory access timer for 1 hour)
SecMfg= 3600
Ok

SecPnl?

Descripton

Gets the state of the user panel lock. This setting is stored in non-volatile memory.

Args

None

Reply

The reply is numeric value of 0 or 1, followed by a comma and text description.
<0,1>,<Inactive,Active>

Examples

SecPnl?
0,Inactive

SecPnl?
1,Active

SecPnl= <value>

Descripton

Sets the state of the user panel lock. This setting is stored in non-volatile memory.

Args

Value is 0 (Inactive) or 1 (Active).

Reply

Ok

Examples

(Activate panel security lock)
SecPnl= 1
Ok

(Deactivate panel security lock)
SecPnl= 0
Ok

Sensor?

Description

Gets information about the installed sensor.

Args

None

Reply

<ID>,<Revision>,<Upper range value and gas name>,<Upper range limits>
Where,
ID: model-part no-serial No
Revision: hardware/software revision levels
Upper range and gas name: full scale range and chemical name of the target gas. This value should be set to the highest expected gas level to be accurately reported (see Range=). Instrument readings above this level may not be accurate, due to analog input gain selection. The value also sets the 20mA level on the analog output, and determines the precision of the displayed value, according to the table below.

Upper Range
1.00-4.99
5.0-49.9
50-2000

Upper range limits: the minimum and maximum settings of the upper range value.

Examples

Sensor?
H10-1003-2449,Hw=D2C/Sw=2.00,100 PPM Cl2,5-200 PPM

Span= <value>

Description

Calibrates the gas sensor sensitivity and updates the calibration history. A supply of target or surrogate gas must be applied for a minimum of 5 minutes prior to calling this function. Inhibit alarms before applying gas to the sensor.

Args

Value: concentration of gas applied to the sensor.

Reply

Ok or exception message (see Table 3 Reply Exceptions).

Examples

Span= 1.01
Ok

Span= 4.96
!Sensor power on delay.

Spans?

Description

Reports the gas sensor span calibrations.

Args

None

Reply

Span, Date,<Units> (column headers)
<N.>,<Date>,<Value> (data columns)
Where,
Units: units of measure for the recorded value
N: calibration number (1-63)
Date: date of calibration
Value: for H10 sensors, this is a percentage of the original sensitivity computed during the original factory span. For other sensors, it is the concentration of the applied gas during the calibration.

Examples

Span, Date, %Sens
1,06/28/12,100

Status?

Description

Gets the transmitter status register as a 32-bit hexadecimal value, followed by a textual description of each active bit. The value may be decoded programmatically using Table 1 Transmitter Status Bit.

Args

None

Reply

<ASCII hex 32-bit unsigned integer>,<names of active bits separated by '/'>

Examples

Status?
100000D0,Cfg Change/Alarm Inhibit/Data Log On/Loop Fixed

StatusSet= <bits> and StatusClr= <bits>

Description

Sets or clears writable bits in the transmitter status register. At present, there are only three writable bits (see Table 1 Transmitter Status Bit).

Args

Bits is the OR sum of the status bits required to be set and is expressed as an ASCII Hex value of up to 8 digits.

Reply

Ok

Examples

(Activate squawk mode)
StatusSet= 04000000
Ok
Status?
4000040, Squawking/Data Log On

(Clear squawk mode)
StatusClr= 04000000
Ok
Status?
40,Data Log On

Tmp?

Descripton

Gets the gas sensor temperature in °C.

Args

None

Reply

<gas sensor temperature>

Examples

Terminating CR converted to CR/LF (hidden to improve readability).

Tmp?
22.2

Tmp?
!Sensor trouble.

Tmp=

Descripton

Sets the gas sensor temperature in °C. This function computes and stores the temperature offset to correct the reading during normal operation.

Args

None

Reply

Ok

Examples

Tmp= 22.7
Ok

Tmp= 22.7
!Sensor trouble.

TmpUnits?

Descripton

Gets the gas sensor temperature units of measure. The H10 sensor reports temperature in °C only. Use RDG? command to obtain temperature in units of °F.

Args

None

Reply

<gas sensor temperature units of measure>

Examples

TmpUnits?
C

TmpUnits?
!Sensor trouble.

Trig?

Description

Gets the current auto-trigger settings.

Args

None

Reply

The transmitter returns a line of comma separated fields composing the non-volatile auto-trigger settings (see the Trig= command below).

Examples

Trig?
0,1,1,RDG? 1,5,6
(Auto-trigger is OFF, interval is 1 second, delta is 1%FS, command is RDG? 1,5,6 – see RDG? command)

Trig= [args]

Description

Sets the auto-trigger settings.

Args

Args is a comma separated list in the following format.

[Source], [Interval], [Delta], [Command]

Where,

Source is one of the following
0=NONE (auto-triggering is off)
1=TIMED (output at a rate determined by the Interval field)
2=DELTA (output on a %FS gas reading change)
3=TIMED or DELTA
4=ALARM (output on a change of alarm state, see below)
5=TIMED or ALARM
6=DELTA or ALARM
7=TIMED, DELTA, or ALARM

When TIMED is specified as a source, output is sent at a rate determined by the Interval field (see below). When combined with an event source, the interval can be comparatively long to minimize the number of redundant output lines (see examples below).

When DELTA is specified as a source, output is sent immediately upon detecting a %FS (percentage of full scale) change in the gas reading, as specified by the Delta field (see below). The change is measured from the last auto-triggered gas reading.

When ALARM is specified as a source, output is sent when the state of any alarm changes (including the Trouble alarm). After that, replies are output at shorter intervals (more often) while any alarm is active:

DANGER …1s
WARNING …2s
CAUTION …5s
TROUBLE …1s

The Source field is optional, see note 1 below.

Interval is the number of seconds (1 to 3600) between output lines when the trigger source specifies TIMED. The field is optional, see note 1 below.

Delta is an integer value representing the %FS of gas reading change required to trigger a reply when the source specifies DELTA. The field is optional, see note 1 below.

Command is the command the transmitter is replying to. Currently, the only selection is the RDG? command. The field is optional, see note 1 below.

Note 1 The field is optional, but the comma separator must be present. If the field is omitted, the current value is unchanged.

Reply

Ok

Examples

(Output the unblanked gas reading and alarm status once every 5 seconds)
Trig= 1,5,,Rdg? 2,8
Ok
-0.0,Normal
-0.0,Normal
-0.0,Normal
…

(Turn off auto-trigger mode and leave all other settings alone)
Trig= 0
Ok

(Resume TIMED auto-trigger mode – settings the same as above)
Trig= 1
Ok
-0.0,Normal
-0.0,Normal
-0.0,Normal
(Output the date, time, unblanked gas reading, temperature in °C, and transmitter status once every 5 seconds)
Trig= 1,5,,RDG? 11,12,2,6,9
Ok
07/04/16,10:56:02,-0.0,23.6,10070040
07/04/16,10:56:07,-0.0,23.7,10070040
07/04/16,10:56:12,-0.0,23.6,10070040

(Output the date, time, unblanked gas reading, temperature in °C, and transmitter status once every 30 seconds, or when the gas reading changes by more than 2%)
Trig= 3,30,2,RDG? 11,12,2,6,9
Ok
07/04/16,13:18:25,0.1,24.8,10070040 (t=0, normal timed trigger)
07/04/16,13:18:55,0.1,24.8,10070040 (t+30,normal timed trigger)
07/04/16,13:19:25,0.1,24.8,10070040 (t+60,normal timed trigger)
07/04/16,13:19:36,1.7,24.8,10070046 (t+71,delta gas change trigger,+8% spike)
07/04/16,13:19:45,1.2,24.8,10070046 (t+80,delta gas change trigger,-2.5%)
07/04/16,13:19:47,0.7,24.8,10070046 (t+82,delta gas change trigger, -2.5%)
07/04/16,13:19:50,0.3,24.8,10070044 (t+85, delta gas change trigger, -2.0%)
07/04/16,13:20:20,0.2,24.8,10070044 (t+115,normal timed trigger)
07/04/16,13:20:50,0.1,24.8,10070044 (t+145,normal timed trigger)

(Output the date, time, unblanked gas reading, units, temp in °C, alarm and transmitter status once every 30 seconds, or when the alarm status changes)

Trig= 5,30,1,RDG? 11,12,2,5,6,8,9
Ok
07/21/16,16:49:36,0.1,PPM,24.9,Normal,10070040 (no alarm, output every 30s)
07/21/16,16:50:06,0.1,PPM,25.0,Normal,10070040
07/21/16,16:50:36,0.1,PPM,24.9,Normal,10070040
07/21/16,16:50:43,1.8,PPM,24.9,Alarm+Warning,10070046 (alarm active, output ever 1s)
07/21/16,16:50:44,4.9,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:45,5.4,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:46,4.1,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:47,2.4,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:48,1.7,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:49,1.1,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:50,0.8,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:51,0.5,PPM,24.9,Alarm+Warning,10070046
07/21/16,16:50:52,0.4,PPM,24.9,Alarm,10070044 (warning inactive, alarm latched on)
07/21/16,16:50:53,0.3,PPM,25.0,Alarm,10070044
07/21/16,16:50:54,0.3,PPM,24.9,Alarm,10070044
07/21/16,16:50:55,0.2,PPM,24.9,Alarm,10070044
07/21/16,16:50:56,0.2,PPM,24.9,Alarm,10070044
07/21/16,16:50:57,0.2,PPM,24.9,Alarm,10070044
Almrst (command to reset alarm)
Ok
07/21/16,16:51:10,0.1,PPM,24.9,Normal,10070040 (alarm state change to normal)
07/21/16,16:51:18,0.1,PPM,24.9,Normal,10070040 (resume output every 30s)
07/21/16,16:51:48,0.1,PPM,24.9,Normal,10070040
07/21/16,16:52:18,0.1,PPM,24.9,Normal,10070040

Trouble?

Description

Gets the transmitter fault register as a 32-bit hexadecimal value, followed by a textual description of each active bit. The value may be decoded programmatically using *Table 2 Transmitter Fault Bits*

Args

None

Reply

<ASCII hex 32-bit unsigned integer>,<names of active bits separated by '/'>

Examples

Trouble?
0,None

Uda?

Description

Gets the user defined address. This is a user defined text string that uniquely identifies the transmitter on a multi-drop network. It can be used to address a transmitter much like a serial number.

Notice

Once the UDA has been set, the transmitter will only respond to commands preceded by it (see User Defined Address, UDA on page 9), or the transmitter's COM address (see

COM Address on page 8).

Args

None

Reply

<user defined text string>

Examples

Uda?
Bldg1.R6

Uda= <text>

Description

Sets the user defined address. This is a user defined text string that uniquely identifies the transmitter on a multi-drop network. It can be used to address a transmitter much like a serial number.

Notice

Once the UDA has been set, the transmitter will only respond to commands preceded by it (see User Defined Address, UDA on page 9), or the transmitter's COM address (see

COM Address on page 8).

Args

Text is a string of up to 8 alpha-numeric characters (A-Z, a-z, 0-9), and includes '_' (underscore).

Reply

Ok

Examples

Uda= 1East_6
Ok

1East_6.Rdg?
1East_6, 0.0

@1.uda?
@1,1East_6

Units?

Description

Gets the units of measure for the gas reading as a text string (always in upper case).

Args

None

Reply

PPB, PPM, %, or %LEL

Examples

Units?
PPM

Units= <value>

Description

Sets the (ATi) index of the target gas to which the sensor responds.
Note: multi-gas sensors only; not available on H10 sensors.

Args

Value is one of the following integer values.

0	PPB
1	PPM
2	%
3	%LEL

Reply

Ok

Examples

GasNo= 2
Ok

GasNo= 2
!Invalid command

Zero=

Description

Calibrates the gas sensor offset and updates the calibration history. A supply of air or nitrogen free of target or surrogate gas must be applied for a minimum of 5 minutes prior to calling this function. Inhibit alarms before applying gas to the sensor.

Args

None

Reply

Ok or exception message (see *Table 3 Reply Exceptions*).

Examples

Zero=
Ok

Zero=
!Sensor power on delay.

Zeros?

Description

Reports the gas sensor zero calibrations.

Args

None

Reply

Zero, Date, <Units> (column headers)
<N.>,<Date>,<Value> (data columns)
Where,
Units: units of measure for the value recorded.
N: calibration number (1-63)
Date: date of calibration
Value: value recorded in calibration history. This is the reading just prior to calibration (sometimes referred to as, “drift”).

Examples

Zero, Date, PPM
1,06/28/12,0.00

Tables

Table 1 Transmitter Status Bits (Read Only)

BIT	Description	Hex Value
0	Caution alarm active	00000001
1	Warning alarm active	00000002
2	Alarm alarm active	00000004
3	Trouble alarm active	00000008
4	Alarm inhibit active	00000010
5	Panel locked	00000020
6	Data log active	00000040
7	Analog output fixed	00000080
8	Temperature sensor over range	00000100
9	Temperature sensor under range	00000200
10	Gas sensor over range	00000400
11	Gas sensor under range	00000800
12	Data log setup NVM error	00001000
13	Calibration history not initialized	00002000
14	Gas sensor power on delay (warmup)	00004000
15	Real time clock/calendar reset	00008000
16	Gas generator installed	00010000
17	Gas generator type valid	00020000
18	Gas generator range valid	00040000
19	Alarm test active	00080000
20	Gas sensor auto-test active	00100000
21	Gas sensor auto-test pass	00200000
22	Gas sensor auto-test cannot begin	00400000
23	Gas sensor auto-test failed	00800000
24	Reserved	01000000
25	Reserved	02000000
26	Squawk mode active[2,3]	04000000
27	Find-me mode active[2,3]	08000000
28	Configuration changed[3]	10000000
29	Reserved	20000000
30	Reserved	40000000
31	Reserved	80000000

[2] These bits may be set using the StatusSet= command.
[3] These bits may be cleared using the StatusClr= command.

Table 2 Transmitter Fault Bits (Read Only)

BIT	Description
0	Gas sensor ADC read fault
1	LCD bus fault
2	SPI bus fault
3	Temperature ADC read fault
4	Gas sensor under-range
5	Gas sensor removed
6	Gas sensor memory error
7	Gas sensor configuration error
8	Gas generator removed (or memory error)
9	Gas generator configuration error (gas type/gas range)
10	User memory error in xmtr or SIB
11	Factory memory error in xmtr or SIB
12	User memory error on FIB
13	Factory memory error on FIB
14	Gas sensor auto-test failed
15	Relays enabled, but power not available
16	Transmitter not calibrated (factory only)
17	CPU error (stack, fuses, etc.)
18	Trouble alarm test active
19	Gas sensor not calibrated
20	Transmitter setting not verified by user
21	Generic h/w failure detected
22	Reserved
23	Reserved
24	SIB or sensor timeout (not communicating)
25	SIB or sensor data receive error (framing, parity, etc.)
26	SIB or sensor protocol error (bad crc, wrong address, etc)
27	SIB or sensor response error (wrong data context)
28	SIB or sensor CPU error (see bit 17 above)
29	SIB or sensor h/w error (see bit 21 above)
30	SIB or sensor NVM1 error
31	SIB or sensor NVM2 error

Table 3 Reply Exceptions

Code	Description
0	None
1	Sensor removed.
2	No data in data log
3	Data log busy.
4	Cannot update sensor calibration memory
5	n/a
6	Cannot perform this action
7	Sensor output too low
8	Sensor output too high
9	Power up timeout active
10	Sensor/transmitter fault present
11	Autotest in progress
12	Input parameter too small
13	Input parameter too large
14	Cannot verify CPU memory
15	Alarm disabled, cannot change reset point
16	Not in fixed current output mode
17	Gas generator not installed.
18	Gas generator incompatible with sensor.
19	Gas generator incompatible on sensor's range.
20	Concentration too high, cannot autotest.
21	Sensor failed autotest.
22	Testing alarms.
23	Device online, panel access denied. Set device offline and retry.
24	Panel locked by HART master. Must unlock at host.
25	Alarm active.
26	Factory NVM reset, return to factory for calibration.
27	Alarms inhibited.

28	<reserved>
29	<reserved>
30	DANGER: High levels of gas detected, cannot reset alarm.
31	Override not enabled (see Autotest Options).
32	COM protocol must be ASCII.
33	Factory settings memory error.
34	Gas generator memory error.
35	Device error.
36	3-wire power required.
37	Device busy.
38	Unknown exception.
39	Panel locked.
40	Sensor COM timeout.
41	Sensor COM error.
42	Sensor protocol error.
43	Sensor service request failed.
44	Sensor reporting trouble, request failed.
45	Message too long.
46	Syntax error.
47	Invalid command.
48	Invalid or missing argument(s).
49	Invalid register(s).
50	Invalid service request.
51	Clock reset - restore correct date and time.

Appendix A
Example: Capturing and Charting a Data Log Report

This example uses Hyperterminal® to capture a data log report from the transmitter into a PC file, and then opens the file in Microsoft Excel® for charting.

Serial Connection

A data log report may be sent to a serial printer or a computer over an RS232 or RS485 connection.

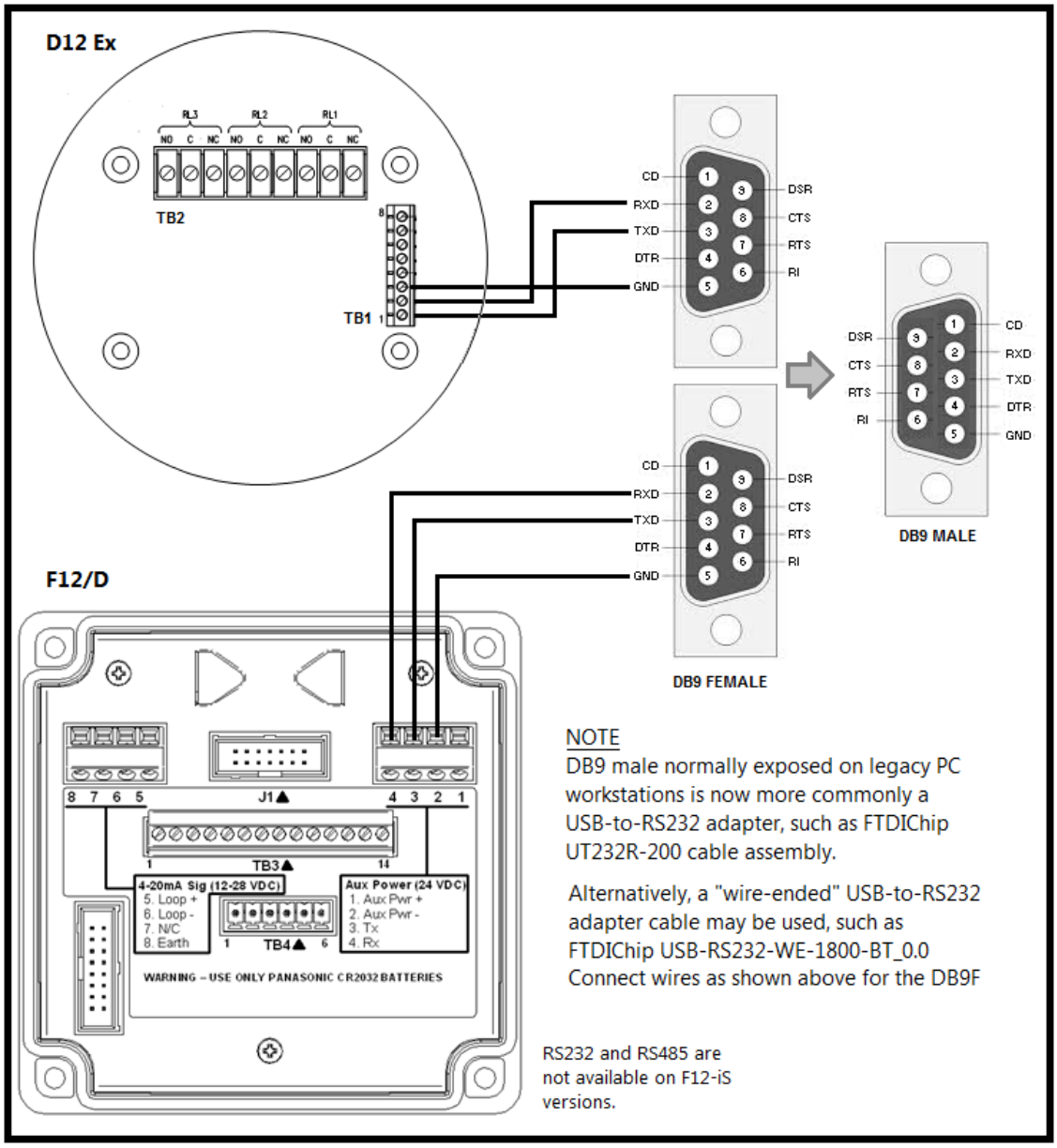


Figure 1 RS232 Connections

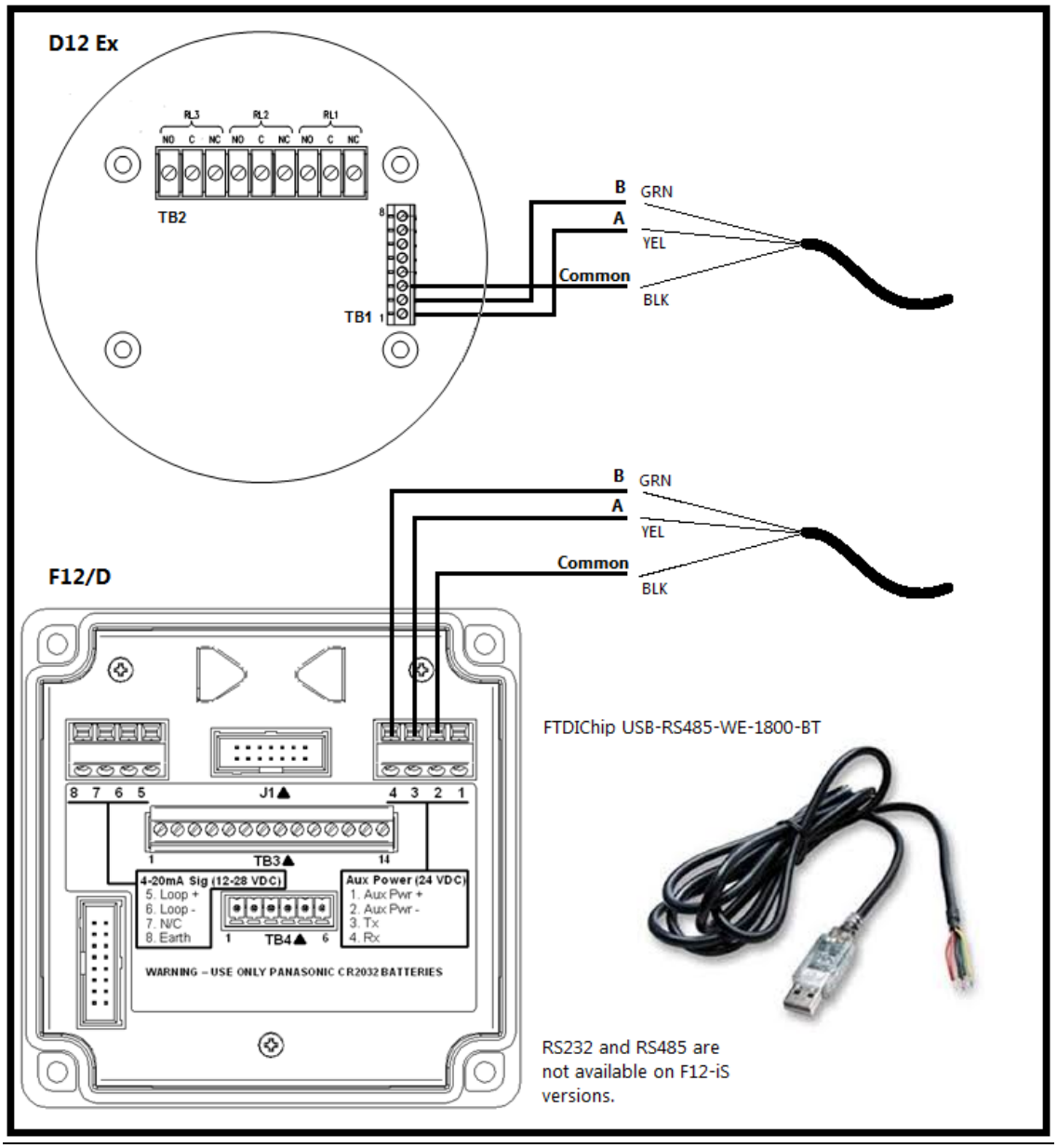
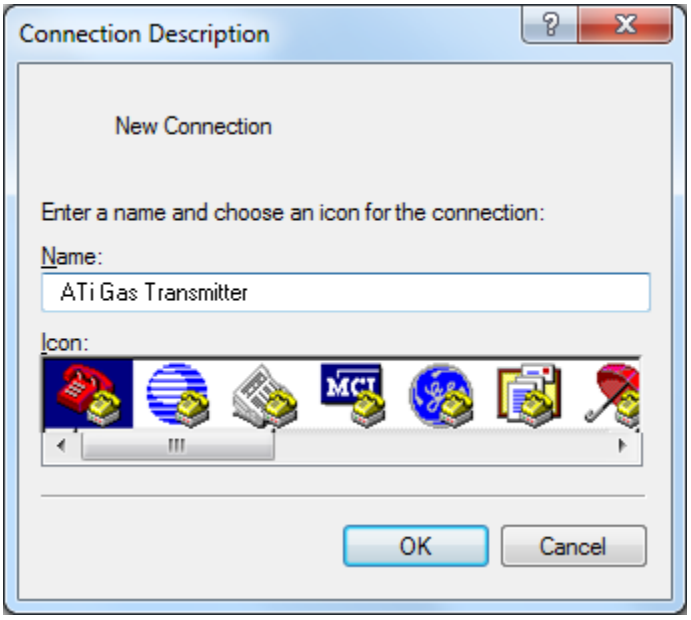


Figure 2 RS485 Connections

Capturing Output with Hyperterminal®

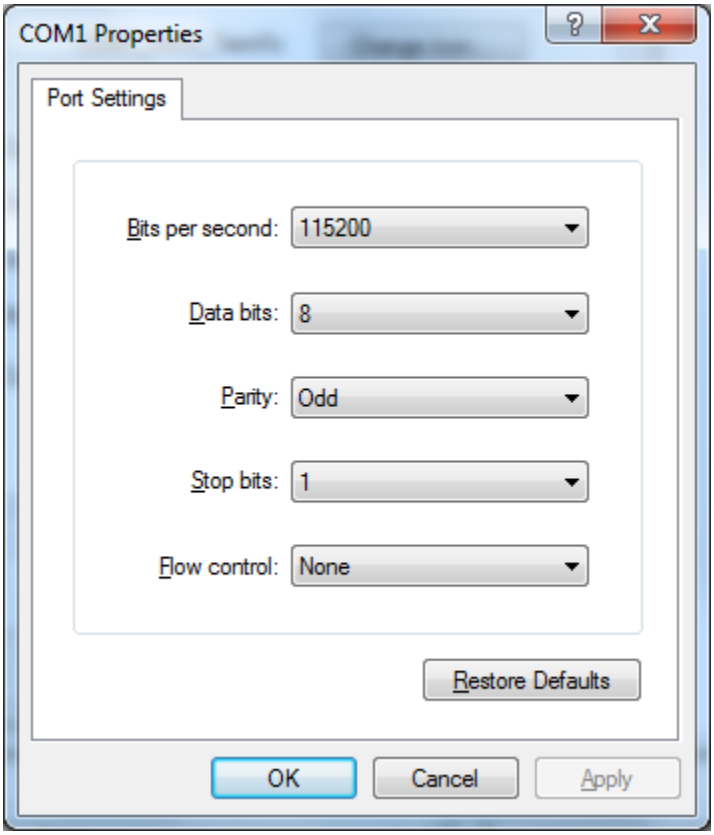
Start HyperTerminal by clicking on **Start**, **Programs, Accessories, Communications**, and **HyperTerminal,** and then double-clicking **Hypertrm.exe**.

When the **Connection Description** dialog box appears, enter a name of your choosing in the box labeled, "Name". If you wish, choose an icon by sliding the horizontal scroll bar over and clicking one of the selections. Click **OK** when ready.

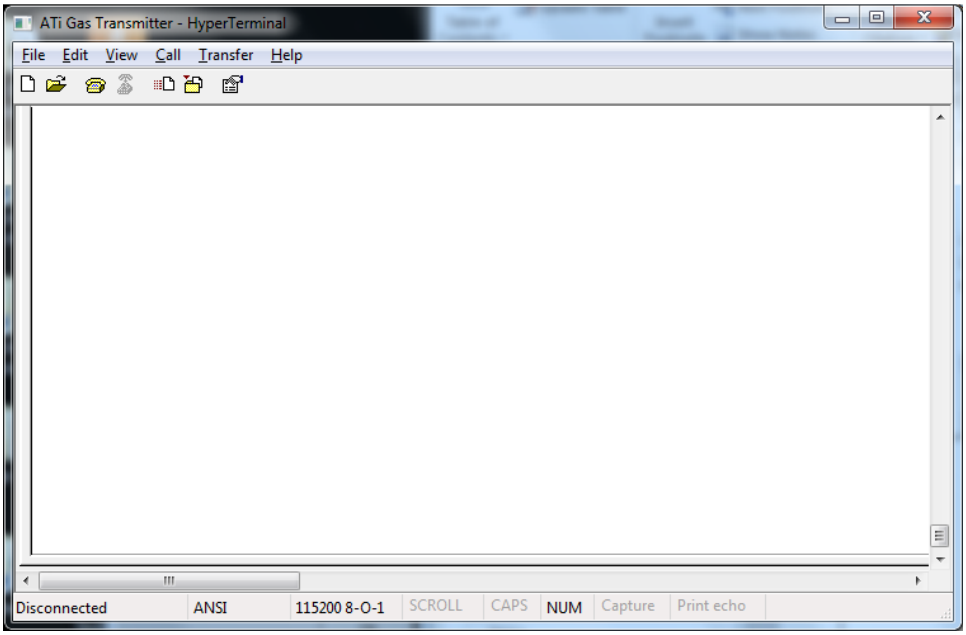


When the **Connect To** dialog appears, set **Connect using** to the name of the port used for the transmitter (ie, **COM1** below), and click **OK**.

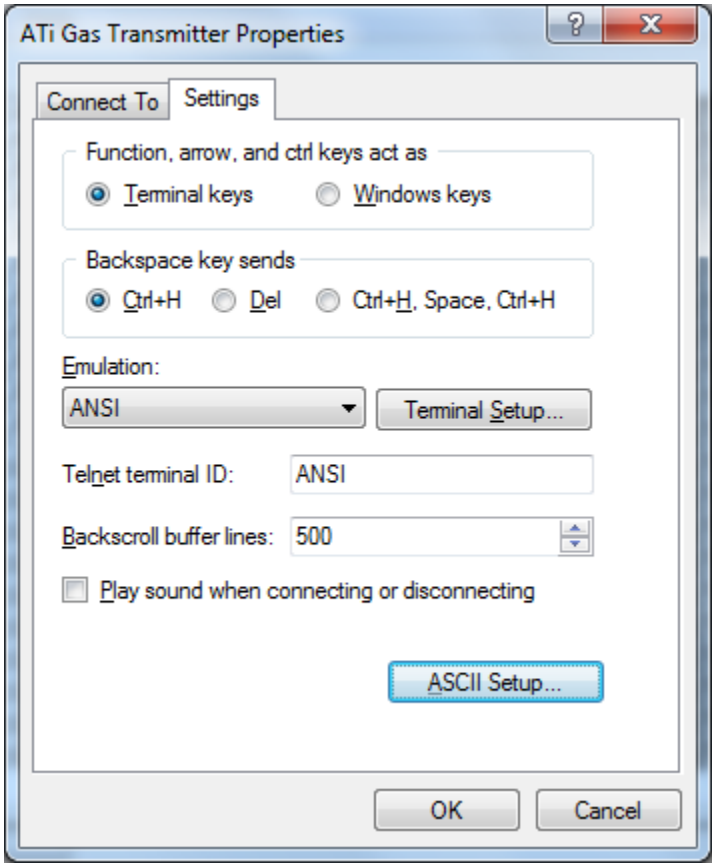
When the **COM Properties** dialog box appears, configure the Port Settings as shown below. Note that the settings shown below must match the transmitter settings, and may not be achievable on all connections. Since the protocol does not implement a checksum or CRC, it is advisable to implement a parity check to help ensure data integrity. Refer to the transmitter's operation manual for instructions on how to change the COM settings. Click **OK** when finished.



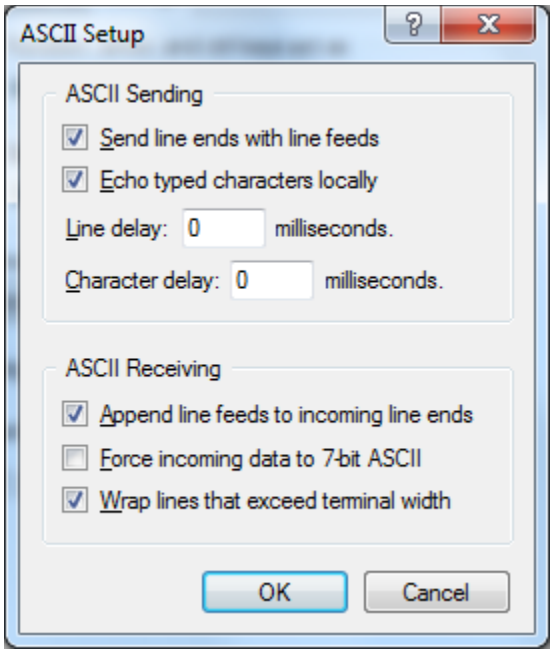
The main form reappears. Data may also start to appear in the terminal window, depending on if the transmitter was left in Auto-trigger mode.



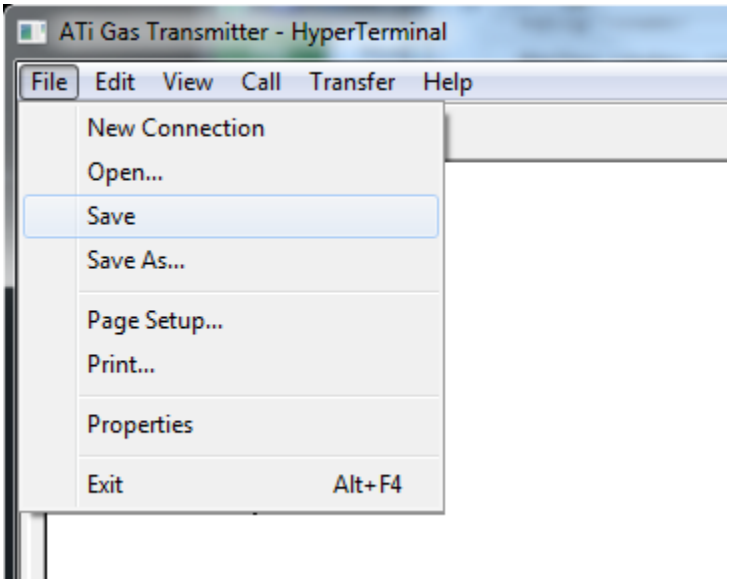
Click the properties icon  on the main form. When the **Properties** form appears, click the **Settings** tab and configure the settings as shown below (do not click OK).



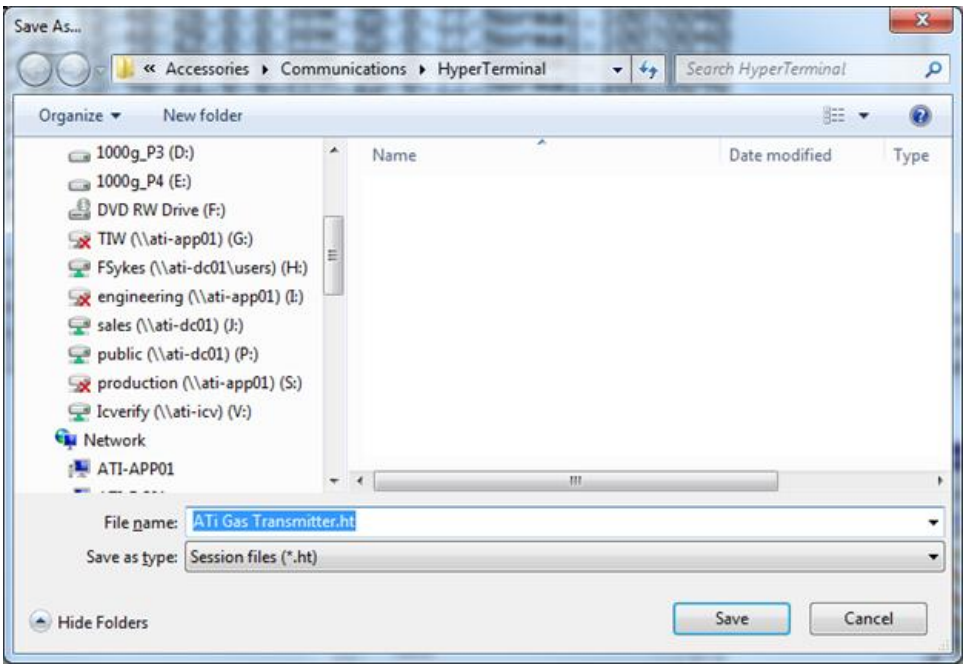
Click the **ASCII Setup** button and configure the settings as shown below.



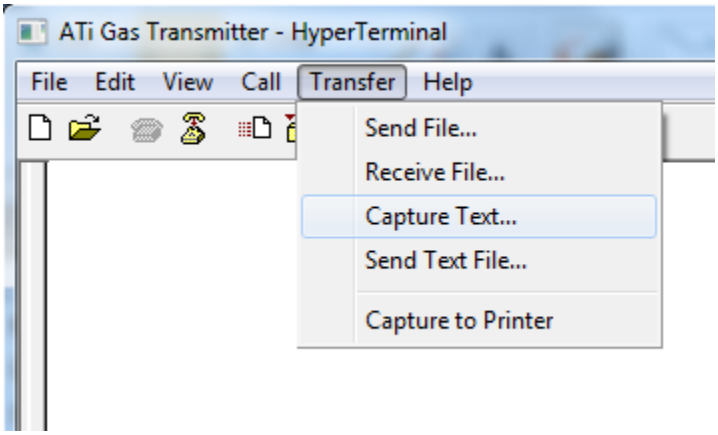
Click **OK** twice to return to the main form. When the main form reappears, click **File**, **Save**.



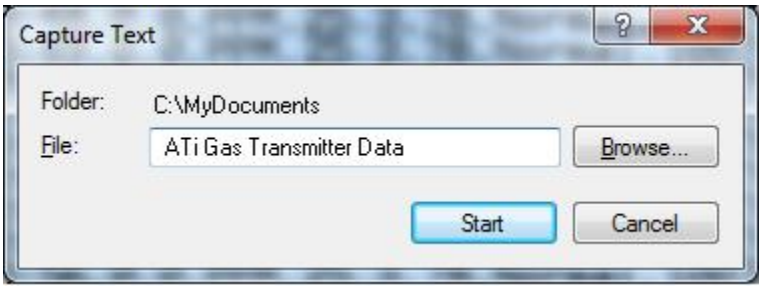
Save the settings as a HyperTerminal session file of your choosing.ht (the session name should automatically appear as the default filename). You may later place this file on your desktop and simply click it to get this point automatically in the future.



In order to chart the data, it must be "captured" into a file. Click **Transfer** on the menu bar, and then click **Capture Text.**



When the Capture Text form appears**,** then click the **Browse** button and navigate to an appropriate folder location. Type the name of a file to store the report in (or choose an existing file to append a new report), then click **Start.**

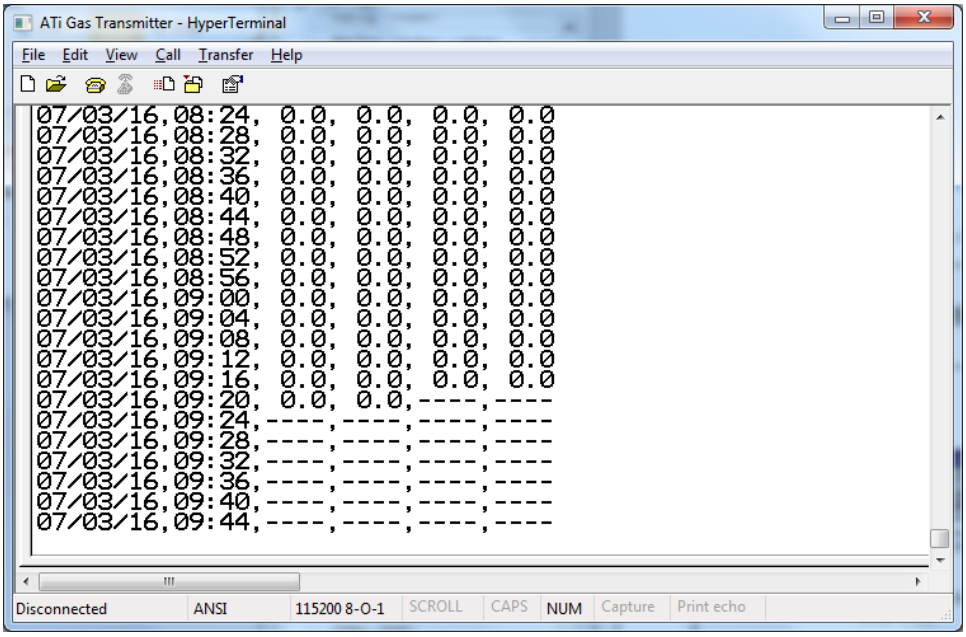


When the main form reappears, HyperTerminal is ready to accept a report from the transmitter and save it in the specified file. Data already appearing in the main form's terminal window will not appear in the file.

In the main form's terminal window, type:

Log?

The transmitter will begin printing the lines of the report, as shown below.



When the transmitter stops printing, click **Transfer**, then **Capture Text,** and then **Stop**. This will close the report file so that it may be opened by another program.

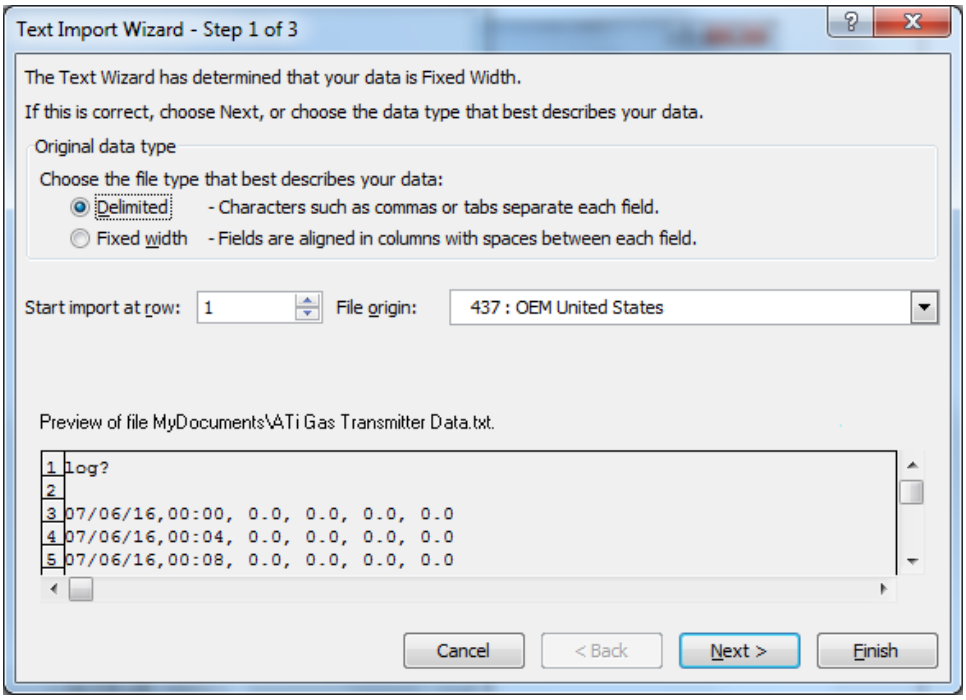
Charting with Microsoft Excel®

Microsoft Excel can be used to import data log reports and create useful and informative charts.

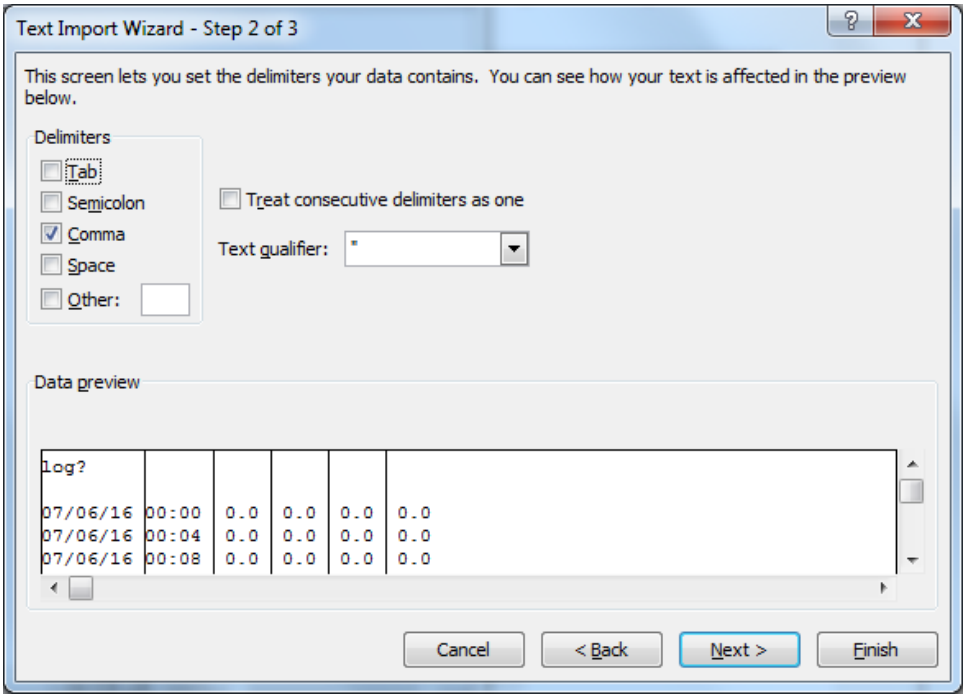
Start Excel by clicking **Start**, **Programs**, and then **Microsoft Excel.**

When Excel opens, click **File** and then **Open.** Navigate to the data log report file you wish to chart and click **Open**. Excel will recognize the report as a text file and offer some configuration options.

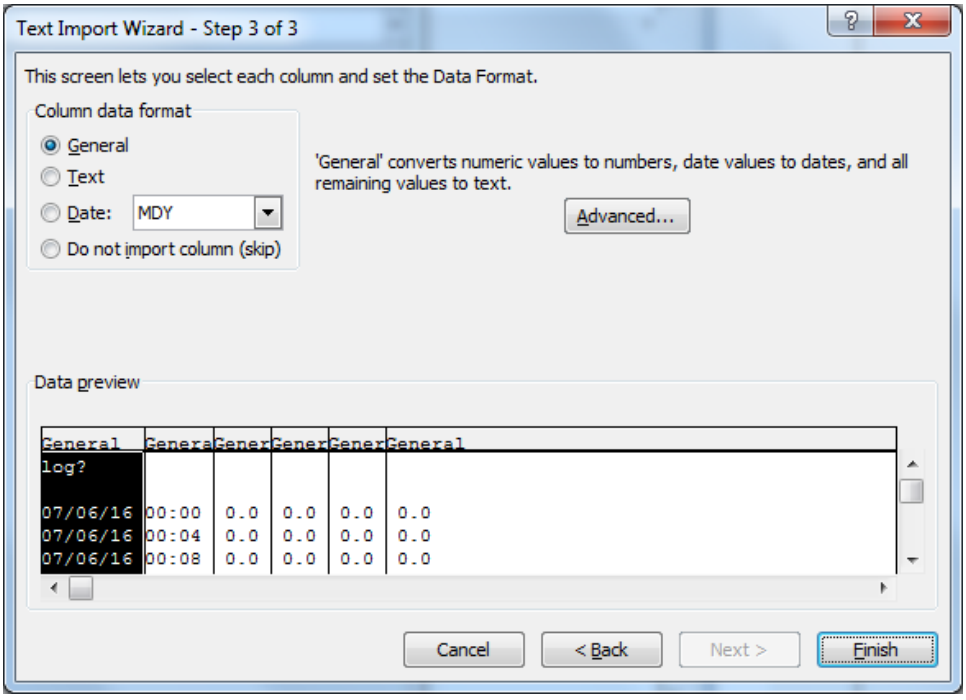
When the **Text Import Wizard – Step 1 of 3** appears, configure the settings as shown below and click **Next**. (Note that the values in your report file will be different than those shown below.)



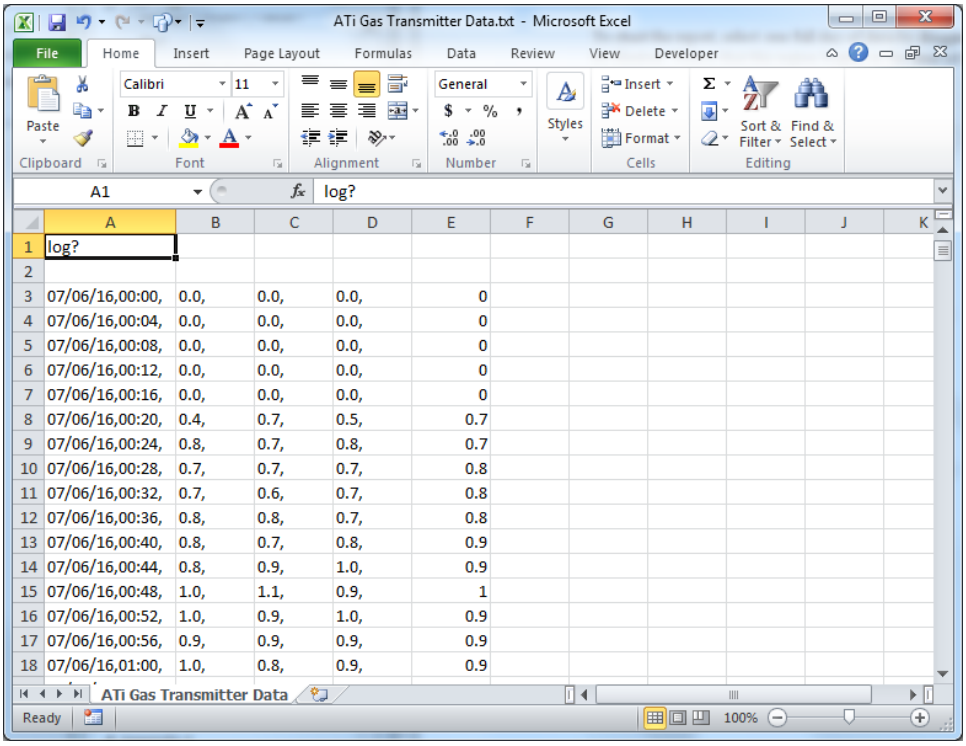
When the **Text Import Wizard – Step 2 of 3** appears, configure the settings as shown below and click **Next**.



When the Text Import Wizard – Step 3 of 3 appears, click **Finish**.

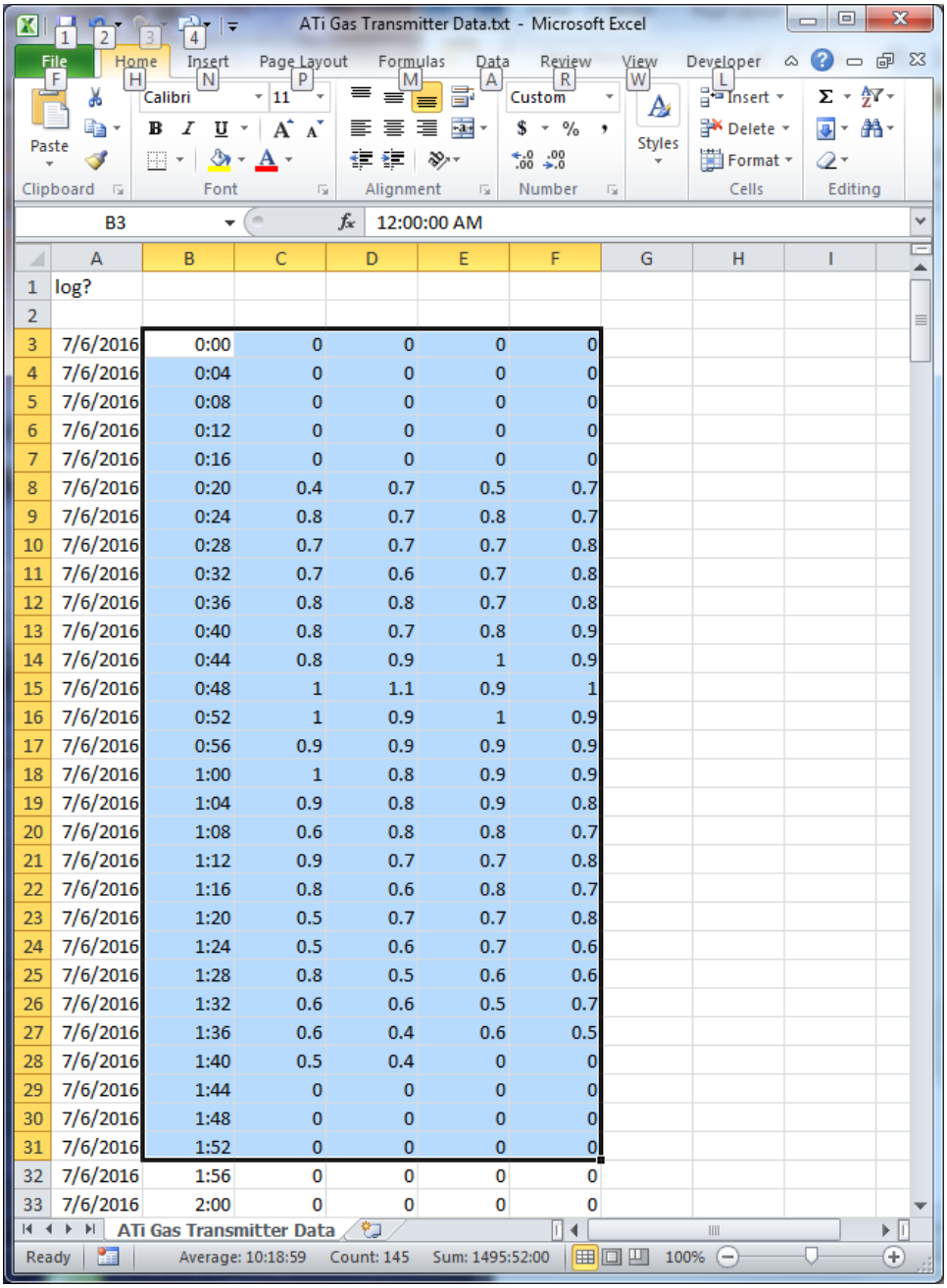


The data should resemble the format below. The Log? command will appear in the first row and may be deleted. Of course the dates, times, and values will be different.



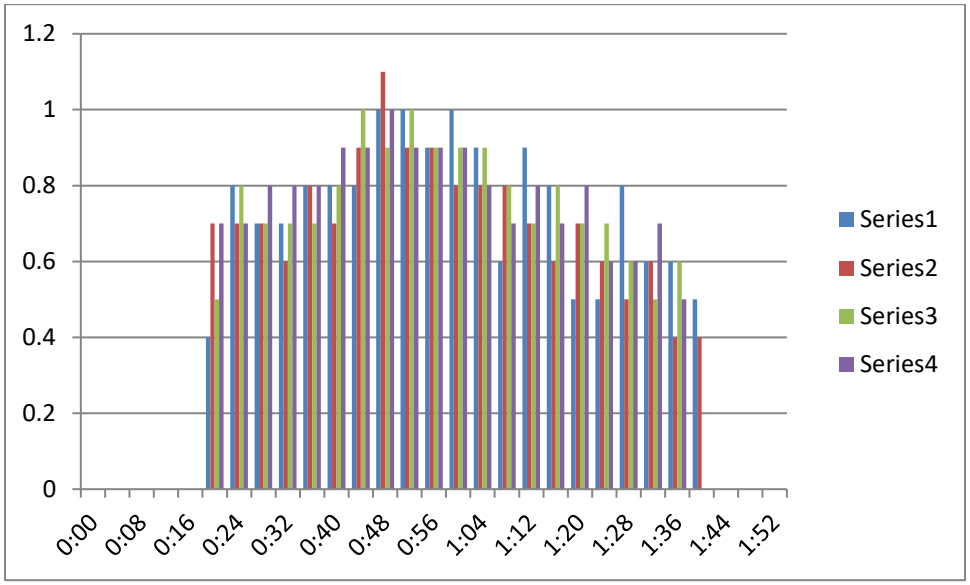
	A	B	C	D	E	F	G	H	I	J	K
1	log?										
2											
3	07/06/16,00:00,	0.0,	0.0,	0.0,	0						
4	07/06/16,00:04,	0.0,	0.0,	0.0,	0						
5	07/06/16,00:08,	0.0,	0.0,	0.0,	0						
6	07/06/16,00:12,	0.0,	0.0,	0.0,	0						
7	07/06/16,00:16,	0.0,	0.0,	0.0,	0						
8	07/06/16,00:20,	0.4,	0.7,	0.5,	0.7						
9	07/06/16,00:24,	0.8,	0.7,	0.8,	0.7						
10	07/06/16,00:28,	0.7,	0.7,	0.7,	0.8						
11	07/06/16,00:32,	0.7,	0.6,	0.7,	0.8						
12	07/06/16,00:36,	0.8,	0.8,	0.7,	0.8						
13	07/06/16,00:40,	0.8,	0.7,	0.8,	0.9						
14	07/06/16,00:44,	0.8,	0.9,	1.0,	0.9						
15	07/06/16,00:48,	1.0,	1.1,	0.9,	1						
16	07/06/16,00:52,	1.0,	0.9,	1.0,	0.9						
17	07/06/16,00:56,	0.9,	0.9,	0.9,	0.9						
18	07/06/16,01:00,	1.0,	0.8,	0.9,	0.9						

To chart data, select a region of interest. Start in column B (time of day) and make certain to include all columns of data.



	A	B	C	D	E	F	G	H	I
1	log?								
2									
3	7/6/2016	0:00	0	0	0	0			
4	7/6/2016	0:04	0	0	0	0			
5	7/6/2016	0:08	0	0	0	0			
6	7/6/2016	0:12	0	0	0	0			
7	7/6/2016	0:16	0	0	0	0			
8	7/6/2016	0:20	0.4	0.7	0.5	0.7			
9	7/6/2016	0:24	0.8	0.7	0.8	0.7			
10	7/6/2016	0:28	0.7	0.7	0.7	0.8			
11	7/6/2016	0:32	0.7	0.6	0.7	0.8			
12	7/6/2016	0:36	0.8	0.8	0.7	0.8			
13	7/6/2016	0:40	0.8	0.7	0.8	0.9			
14	7/6/2016	0:44	0.8	0.9	1	0.9			
15	7/6/2016	0:48	1	1.1	0.9	1			
16	7/6/2016	0:52	1	0.9	1	0.9			
17	7/6/2016	0:56	0.9	0.9	0.9	0.9			
18	7/6/2016	1:00	1	0.8	0.9	0.9			
19	7/6/2016	1:04	0.9	0.8	0.9	0.8			
20	7/6/2016	1:08	0.6	0.8	0.8	0.7			
21	7/6/2016	1:12	0.9	0.7	0.7	0.8			
22	7/6/2016	1:16	0.8	0.6	0.8	0.7			
23	7/6/2016	1:20	0.5	0.7	0.7	0.8			
24	7/6/2016	1:24	0.5	0.6	0.7	0.6			
25	7/6/2016	1:28	0.8	0.5	0.6	0.6			
26	7/6/2016	1:32	0.6	0.6	0.5	0.7			
27	7/6/2016	1:36	0.6	0.4	0.6	0.5			
28	7/6/2016	1:40	0.5	0.4	0	0			
29	7/6/2016	1:44	0	0	0	0			
30	7/6/2016	1:48	0	0	0	0			
31	7/6/2016	1:52	0	0	0	0			
32	7/6/2016	1:56	0	0	0	0			
33	7/6/2016	2:00	0	0	0	0			

Click **Insert,** then **Charts**, then **select 2D Clustered Column**. When the chart appears, it should resemble the one shown below.



Each bar represents one data sample. The samples are ordered correctly in time, and the label on the x-axis is the time of the first sample in each cluster. To keep track of the date, select only data from a single day. The series names are not meaningful and can be deleted. Converting the data to a linear series, and further analysis are beyond the scope of this example.

WATER QUALITY MONITORS

Dissolved Oxygen
Free Chlorine
Combined Chlorine
Total Chlorine
Residual Chlorine Dioxide
Potassium Permanganate
Dissolved Ozone
pH/ORP
Conductivity
Hydrogen Peroxide
Peracetic Acid
Dissolved Sulfide
Residual Sulfite
Fluoride
Dissolved Ammonia
Turbidity
Suspended Solids
Sludge Blanket Level
MetriNet Distribution Monitor

GAS DETECTION PRODUCTS

NH_3	Ammonia
CO	Carbon Monoxide
H_2	Hydrogen
NO	Nitric Oxide
O_2	Oxygen
CO	Cl2 Phosgene
Br_2	Bromine
Cl_2	Chlorine
ClO_2	Chlorine Dioxide
F_2	Fluorine
I_2	Iodine
H_X	Acid Gases
C_2H_4O	Ethylene Oxide
C_2H_6O	Alcohol
O_3	Ozone
CH_4	Methane (Combustible Gas)
H_2O_2	Hydrogen Peroxide
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
HF	Hydrogen Fluoride
H_2S	Hydrogen Sulfide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
SO_2	Sulfur Dioxide
H_2Se	Hydrogen Selenide
B_2H_6	Diborane
GeH_4	Germane
AsH_3	Arsine
PH_3	Phosphine
SiH_4	Silane
HCHO	Formaldehyde
$C_2H_4O_3$	Peracetic Acid
DMA	Dimethylamine