Built-in Data Acquisition System Manual

23-Mar-98 (02837-A)

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Introduction

This manual describes the built-in data acquisition system (DAS) present in all AMX-based analyzers. The terms *analyzer* and *instrument* are used interchangeably throughout this manual.

Design Objectives

The DAS is designed to implement "predictive diagnostics" that captures historical trending data so users can anticipate when an instrument will require service. The captured data is in a form that makes it easy to process with another computer application and plot graphically.

The DAS is designed to be flexible. It has a consistent user interface across all instruments, but each instrument's differences are accommodated. New data parameters and triggering events can be added to the instrument software as needed. Users have full control over which data is captured and when it's captured.

The DAS is designed to store a large amount of data. By adjusting the sampling frequency and the number of data parameters the DAS can store more than a year's worth of data. The data is stored in a special area of the battery-backed RAM where it's retained even when the instrument is powered off or a new software version is installed.

The DAS permits users to access the captured data via the instrument's front panel or the RS-232 interface. The latter is designed for a remote computer to automatically download the captured data for further processing.

Instruments Containing DAS

Currently the DAS is present only in air pollution analyzers, though it could be installed in calibrators. It's also available only in AMX-based instruments because of the large memory requirements.

Instruments Containing DAS
M100A-AMX
M101A-AMX
M200A-AMX
M300-AMX
M400-AMX
M400A-AMX

Table 1: Instruments Containing DAS

Examples Used in this Manual

All of the examples used in this manual refer to the M400. Keep in mind that the names of things will be different in other instruments.

Typographic Conventions Used in this Manual

In this manual, front panel push buttons are indicated using bold capital characters, for example, **SETUP**. Push-button sequences are denoted by a series of button names, separated by dashes, such as **SETUP-MORE-COMM-BAUD**.

Names of things such as properties, events, and setup variables are indicated using italicized capital characters, as in *PARAMETERS*, or *ATIMER*, or *RS232_MODE*.

RS-232 printouts are enclosed in a shaded box, with user input in lower case, and instrument output in upper case, like so:

```
d report "pnumtc" records = 1 compact<CR>
D   79:12:00  0400  PNUMTC:   1   719.6     29.8<CRLF>
```

In RS-232 printouts, non-printable characters are denoted by special symbols consisting of several characters enclosed in angle brackets, as shown in the table below. All commands must be terminated by a carriage return, so if a <CR> symbol is not shown in an RS-232 command, it is implied. Similarly, all messages transmitted by the instrument are terminated by a carriage return-line feed pair; so if a <CRLF> symbol is not shown in an RS-232 output, it is implied.

Special RS-232 Symbols	
Symbol	**Character Represented**
<ESC>	Escape
<SP>	Space
<BS>	Backspace
<CR>	Carriage return
<LF>	Line feed
<CRLF>	Carriage return, line feed pair

Table 2: Special RS-232 Symbols

Configuring the DAS

This section explains how to configure the DAS to collect the data you want. Configuration mainly consists of creating *data channels* and setting their various *properties* as desired. These topics are described in detail below.

Data Parameters, Triggering Events, and Data Channels

The DAS is comprised of three principal objects: *data parameters*, *triggering events*, and *data channels*. While reading the following descriptions of these objects refer to the diagram below for an understanding of how these objects work together.
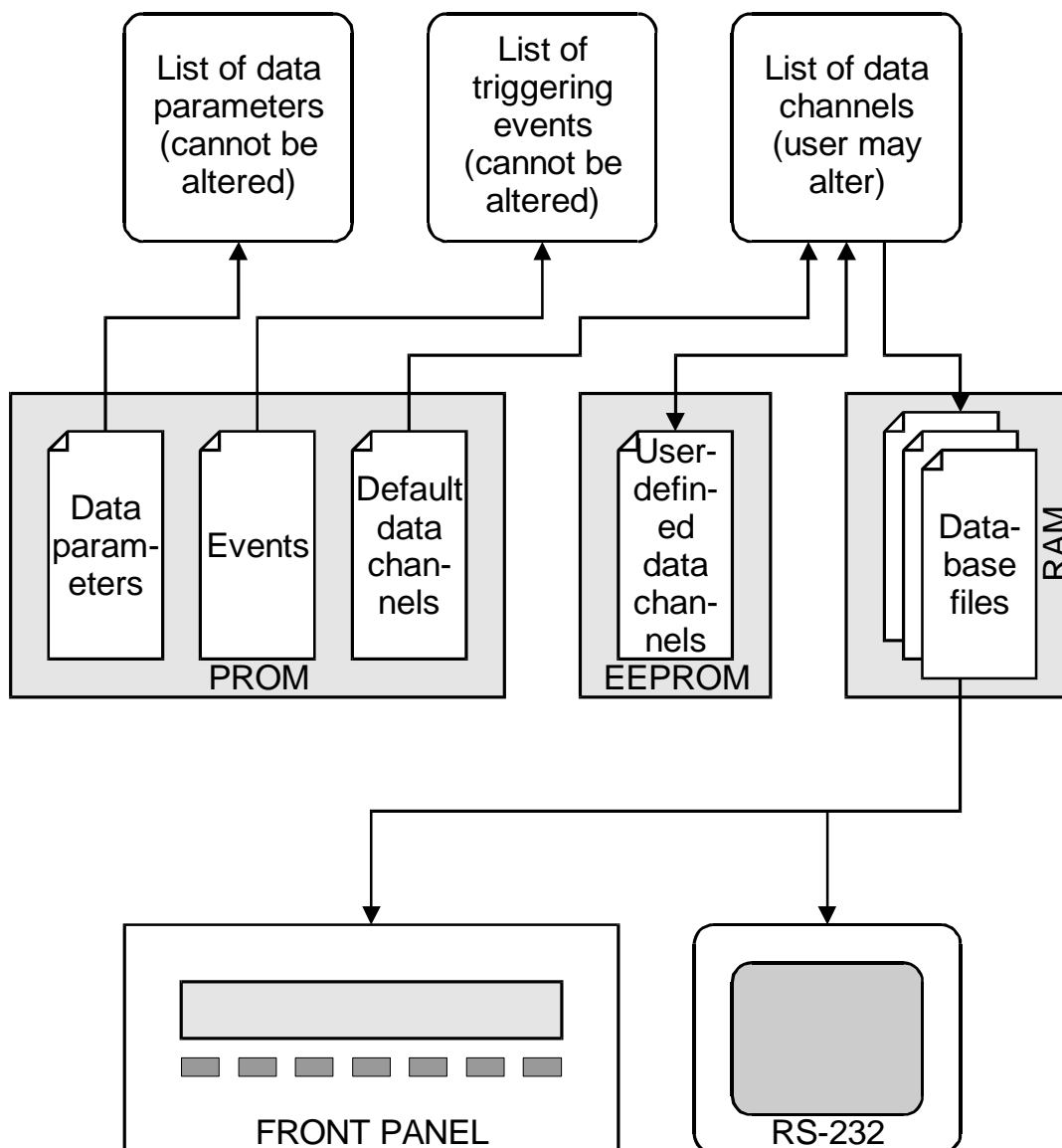
Figure 1: DAS Overview

Data Parameters

Data parameters are the data points that may be captured. The list of data parameters is arbitrary, but it essentially consists of anything that appears in a test measurement on the display, as well as some internal parameters, such as the concentration just prior to calibrating the instrument.

The list of data parameters is specific to each instrument, although some data parameters are present in all instruments. (Refer to *Appendix B* for the list of data parameters for each instrument.) The data parameter names are limited to six characters because of display size constraints. **The list of data parameters is not customizable in any way by the user.**

Like data channels, data parameters have a few user-configurable properties, which are summarized in the table below.

Data Parameter Properties	
Property	**Description**
PARAMETER	Instrument-specific data point name.
SAMPLE MODE	INST: Records instantaneous reading. AVG: Records average reading during reporting interval. MIN: Records minimum reading during reporting interval. MAX: Records maximum reading during reporting interval.
PRECISION	Decimal point precision for display purposes (0–4).

Table 3: Data Parameter Properties

Triggering Events

Triggering events trigger data channels to capture data parameters. Triggering events are things such as expired timers, exiting from calibration, or the occurrence of a warning condition.

The list of triggering events is specific to each instrument, although some triggering events are present in all instruments. (Refer to *Appendix B* for the list of triggering events for each instrument.) The triggering event names are limited to six characters because of display size constraints. **The list of triggering events is not customizable in any way by the user.**

Data Channels

Data channels connect the triggering events to the data parameters. For each data channel the user selects one triggering event and one or more data parameters to capture. This means that there are many possible combinations of triggering events and data parameters, which is the key to the system's flexibility. Users may create up to 20 data channels, each with up to 10 data parameters.

Each instrument has some default data channels defined in the PROM. The user is free to modify or delete the default data channels. (Refer to *Appendix B* for the list of default data channels for each instrument.)

The diagram below shows how data channels link triggering events and data parameters together. It also shows the menu button sequences required to edit the lists of data channels and data parameters.

| LIST OF DATA CHANNELS | LIST OF PARAMETERS |

Menu button sequence:
SETUP-DAS-EDIT-PASSWORD-ENTR

Menu button sequence:
-**EDIT-PARAMETERS-EDIT-YES**

NAME: CONC
EVENT: ATIMER
REPORT PERIOD: 000:01:00
NUMBER OF RECORDS: 800
RS-232 REPORT: OFF
CHANNEL ENABLED: ON
CAL. HOLD OFF: ON

PARAMETER: O3CNC1
MODE: AVG
PRECISION: 1

NAME: PNUMTC
EVENT: ATIMER
REPORT PERIOD: 000:01:00
NUMBER OF RECORDS: 360
RS-232 REPORT: OFF
CHANNEL ENABLED: ON
CAL. HOLD OFF: OFF

PARAMETER: SMPFLW
MODE: AVG
PRECISION: 1

PARAMETER: SMPPRS
MODE: AVG
PRECISION: 1

NAME: CALDAT
EVENT: SLPCHG
REPORT PERIOD: don't care
NUMBER OF RECORDS: 200
RS-232 REPORT: OFF
CHANNEL ENABLED: ON
CAL. HOLD OFF: OFF

PARAMETER: SLOPE1
MODE: INST
PRECISION: 3

PARAMETER: OFSET1
MODE: INST
PRECISION: 1

PARAMETER: ZSCNC1
MODE: INST
PRECISION: 1

Figure 2: Internal DAS Structure

Data channels have a few user-configurable properties, which are summarized in the table below.

Data Channel Properties			
Property	**Description**	**Initial Setting**	**Setting Range**
"Easy" Properties			
NAME	The data channel's name (primarily used for RS-232 access	"NONE"	Up to 6 letters and digits.

	and reports).		
EVENT	The event that triggers this data channel to sample its data parameters or issue a report.	ATIMER	Any of the events listed in the table of triggering events shown above.
PARAMETERS	The number of data parameters sampled by this data channel.	1	1 to 10
REPORT PERIOD	The amount of time between each report.	000:01:00	000:00:01 to 366:23:59 (Days:Hours:Min.)
NUMBER OF RECORDS	The number of reports that will be stored in the data file.	100	1 to 10000 (limited by available storage space)
RS-232 REPORT	Indicates whether or not a report will be printed on the RS-232 channel.	OFF	OFF or ON
CHANNEL ENABLED	Provides a convenient means to temporarily disable a data channel.	ON	OFF or ON
CAL. HOLD OFF	Disables sampling of data parameters while instrument is in calibration mode.	OFF	OFF or ON
"Hard" Properties			
STARTING DATE	The date when the first sample will be taken (midnight of this date).	01-JAN-1996	01-JAN-1970 to 31-DEC-2037
SAMPLE PERIOD	The amount of time between each sample.	000:00:01	000:00:01 to 366:23:59 (Days:Hours:Min.)
COMPACT REPORT	Indicates whether the report printed on the RS-232 channel will be compact or verbose.	OFF	OFF or ON

Table 4: Data Channel Properties

Menu Tree for Configuring DAS

This section describes the menu tree used to configure the DAS; it assumes that the user is familiar with the instrument's menu-driven user interface. The entire menu tree is quite large — too large to comfortably fit in a single diagram — so it's broken up into four separate diagrams.

Editing the List of Data Channels

The diagram below shows the menu tree for editing the list of data channels, starting from the instrument's main menu.
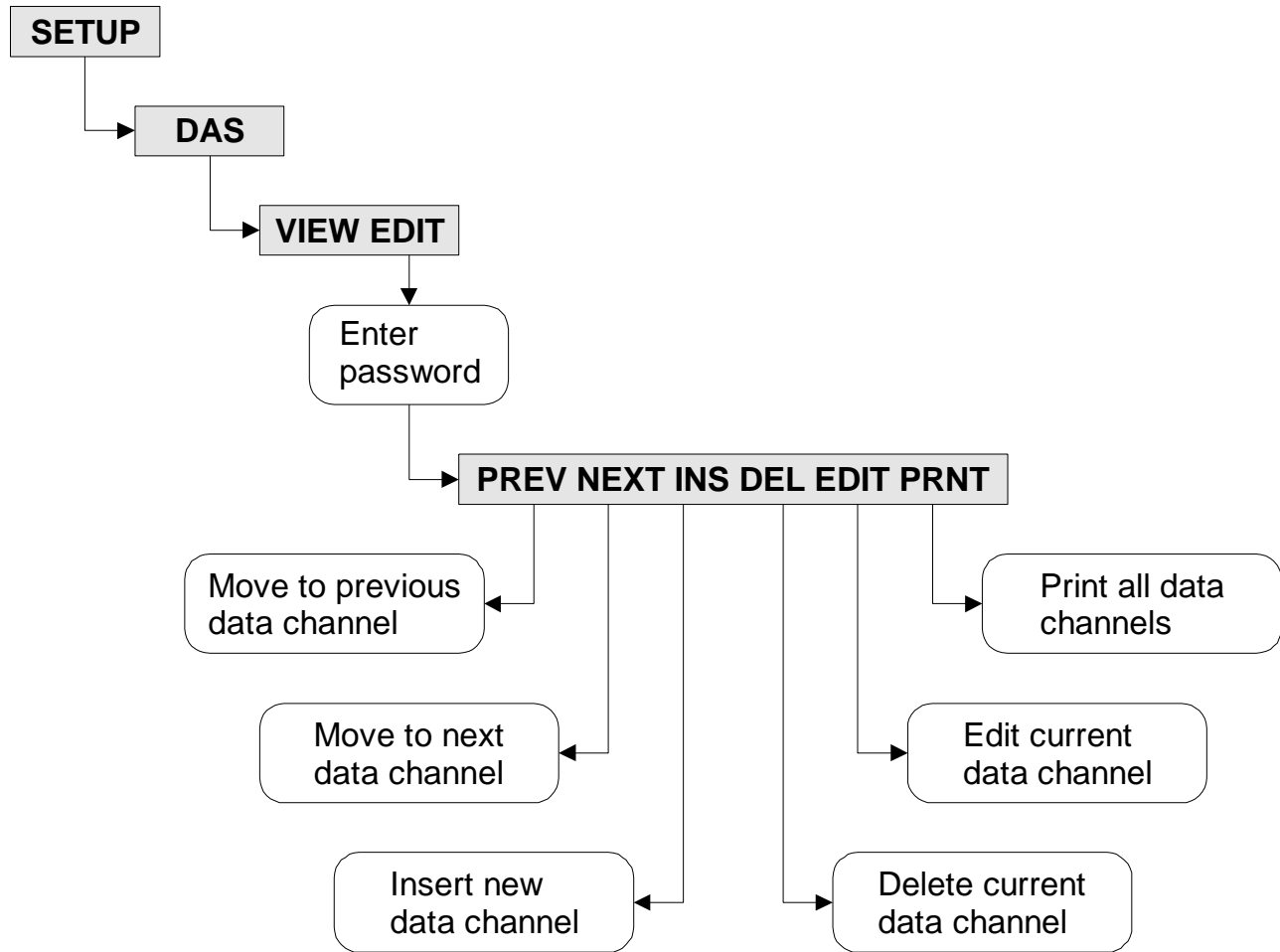
Figure 3: Editing the List of Data Channels

If you press **EDIT** you will go to the data channel property menu described in the next section.

Editing the Data Channel's Properties

The diagram below shows the menu tree for editing the data channel's properties, starting from the previous menu.
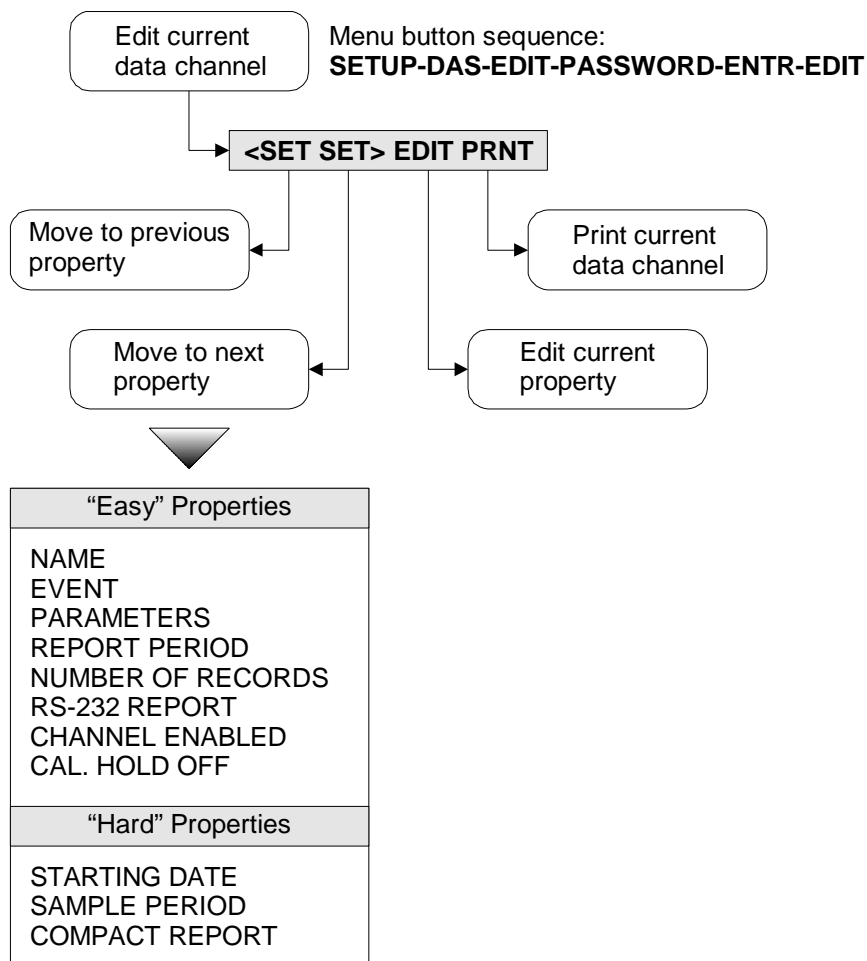
Figure 4: Editing the Data Channel's Properties

If you press **EDIT** while viewing the *PARAMETERS* property you go to the menu described in the next section.

Editing the List of Data Parameters

The diagram below shows the menu tree for editing the list of data parameters, starting from the previous menu.
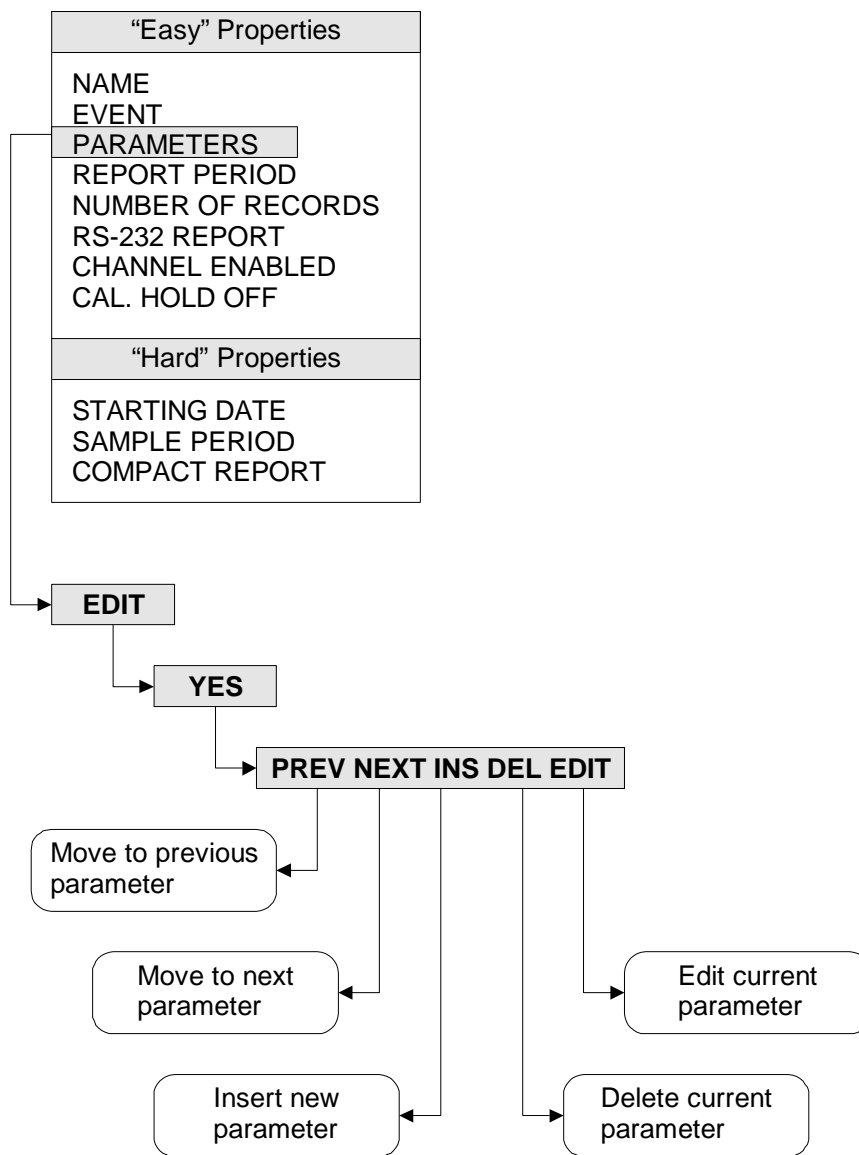
Figure 5: Editing the List of Data Parameters

If you press **EDIT** you will go to the data parameter property menu described in the next section.

Editing the Data Parameter's Properties

The diagram below shows the menu tree for editing the data parameter's properties, starting from the previous menu.

Menu button sequence:
SETUP-DAS-EDIT-PASSWORD-ENTR-EDIT-PARAMETERS-EDIT-YES

```
        Edit current
         parameter

              │
              ▼
        <SET SET> EDIT
         │      │     │
    ┌────┘      │     └──────────┐
    ▼           │                ▼
Move to previous│            Edit current
property        │            property
                ▼
           Move to next
             property
                ▼
```

Data Parameter Properties
PARAMETER
SAMPLE MODE
PRECISION
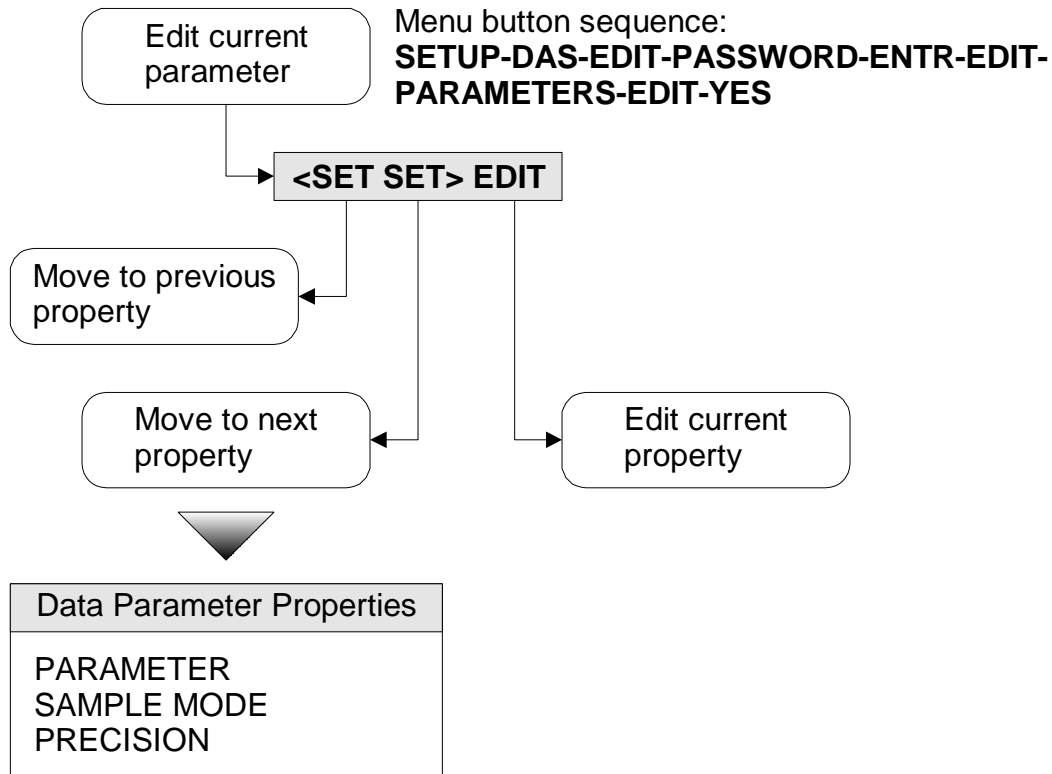
Figure 6: Editing the Data Parameter's Properties

Modifying the DAS Configuration

The previous sections gave an overview of the DAS organization and the menu tree. This section describes the configuration in more detail.

> **While modifying the DAS configuration data collection is suspended and remote access is inhibited.**

Configuring Data Channels

You configure the data channels by editing the list of data channels and changing the properties for data channels. Refer to *Figure 3: Editing the List of Data Channels* to see how to get to this menu. Once you get into this menu the instrument displays a summary of the first data channel that looks like the following. The underlined portion constitutes the data channel summary.

SETUP C.7 0) CONC :ATIMER, 1, 800
PREV NEXT   INS   DEL   EDIT PRNT EXIT

"0" in this example is simply the data channel's index in the list. The first data channel in the list is at index 0, the second is at index 1, and so on.

"CONC" in this example is the name of the data channel. It may be any six-character, user-defined name.

"ATIMER" is the triggering event. In this example the data channel is triggered by an automatic timer.

"1" in this example is the number of data parameters that the data channel will sample. In this case there is only one parameter.

And finally, **"800"** is the number of records that will be stored in the data channel's data file. In this example the file stores only the most recent 800 records.

You can move to the next data channel by pressing **NEXT** until you get to the end of the list, when you will see the following.

```
SETUP C.7   END OF DATA CHANNELS
PREV               INS              PRNT EXIT
```

The menu buttons are described in the table below.

| Menu Buttons for Editing List of Data Channels ||
Button	Description
PREV	Move to previous data channel.
NEXT	Move to next data channel.
INS	Insert a new data channel before current one.
DEL	Delete current data channel. When you delete a data channel the memory consumed by its data file is recovered. So you should delete any unneeded data channels before inserting new ones.
EDIT	Edit properties for current data channel. See sections below for details.
PRNT	Print configuration of all data channels to RS-232 interface.

Table 5: Menu Buttons for Editing List of Data Channels

"Easy" Data Channel Properties in Detail

This section describes each of the data channel properties in detail. Refer to *Table 3: Data Channel Properties* for a summary of the properties. Once you get into this menu the instrument displays the value of the first data channel property similar to the following.

```
SETUP C.7   NAME:CONC
<SET SET> EDIT  PRNT                    EXIT
```

The menu buttons are described in the table below.

Menu Buttons for Editing Data Channel Properties	
Button	**Description**
<SET	Move to previous property.
SET>	Move to next property.
EDIT	Edit current property. See property descriptions below for details.
PRNT	Print configuration of current data channel to RS-232 interface.

Table 6: Menu Buttons for Editing Data Channel Properties

NAME

Each data channel must have a unique name. This name appears in the menus and on the RS-232 interface. This name is also used to request DAS reports via the RS-232 interface. The name may consist of up to six letters and digits.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   NAME:CONC – –
C     O     N     C     –     –     ENTR EXIT
```

You may change the data channel's name and then press **ENTR** to accept the changes or **EXIT** to abort the changes. The first (left-most) dash in the name denotes the end of the name.

EVENT

Each data channel has one triggering event that triggers data collection. All triggering events except *ATIMER* also generate a report that's stored in the data channel's data file. *ATIMER* events generate a report only after the report period has elapsed.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   EVENT:ATIMER
PREV NEXT                          ENTR EXIT
```

Use the **PREV** and **NEXT** buttons to scroll through the list of events and then press **ENTR** to select the new event or **EXIT** to keep the old one.

PARAMETERS

When viewing the property summary in the configuration menu this property shows only the number of data parameters that the data channel samples, as shown below.

```
SETUP C.7   PARAMETERS:1
<SET SET> EDIT  PRNT                EXIT
```

If you press **EDIT** while viewing this property you go to another menu that edits the list of data parameters. Refer to *Figure 5: Editing the List of Data Parameters* and *Configuring Data Parameters* for detailed information.

> **If you modify the list of data parameters, the data file and all of the data it contains is deleted and a new data file is created. Be sure you have saved the old data before you modify the list of data parameters.**

REPORT PERIOD

This property controls when reports are generated for *ATIMER* events only. For all other events reports are issued immediately when the event occurs. The report period is specified in units of days, hours, and minutes, measured from midnight of the *STARTING DATE* property.

For example, if the data channel was created on 23-Mar-1998 and *REPORT PERIOD* is 000:01:00 (one hour), then the first report will be generated at 1:00 AM, 23-Mar-1998, the second report will be at 2:00 AM, and so on.

If *REPORT PERIOD* is 001:00:00 (one day), then the first report will be generated at 12:00 AM, 24-Mar-1998, the second at 12:00 AM, 25-Mar-1998, and so on.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   REPORT PERIOD DAYS:0
0      0      0                    ENTR EXIT
```

You should enter the number of days between each report and press **ENTR** to accept the changes or **EXIT** to abort the changes. If you press **ENTR** you will go to the next display.

```
SETUP C.7   REPORT PERIOD TIME:01:00
0      1:     0      0             ENTR EXIT
```

You should enter the number of hours and minutes between each report and press **ENTR** to accept the changes or **EXIT** to abort the changes. Note that the hours and minutes are *added* to the days to form the total report period. So if the number of days is one and the number of hours is one, then the total report period is 25 hours.

NUMBER OF RECORDS

This property specifies how many records (reports) are stored in the data file. Each record consists of a time stamp and one or more data parameters. Once the data file has reached its capacity the DAS begins replacing the oldest records in the file with new ones. Thus, the data file contains only the most recent records.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   NUMBER OF RECORDS:800
0      8      0      0              ENTR EXIT
```

You should enter the number of records to store and press **ENTR** to accept the changes or **EXIT** to abort the changes.

> **If you modify the number of records, the data file and all of the data it contains is deleted and a new data file is created. Be sure you have saved the old data before you modify the number of records.**

RS-232 REPORT

If this property is enabled, then every time a new report is generated it's printed to the RS-232 interface. Regardless of the setting of this property, reports are always stored in the data file and may be retrieved later, even via the RS-232 interface.

Usually you would enable this property only if you have a printer connected to the instrument for maintaining an audit trail. If you have a computer connected to the instrument, it's better to have the computer explicitly request the reports using commands.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   RS-232 REPORT:OFF
OFF                            ENTR EXIT
```

Select **ON** to have reports printed to the RS-232 or **OFF** to disable printing and press **ENTR** to accept the changes or **EXIT** to abort the changes.

CHANNEL ENABLED

This property enables sampling of a channel's data parameters. This property provides a convenient means to temporarily disable a channel while retaining its configuration and data. Later, you can re-enable the channel and resume data collection.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   CHANNEL ENABLED:ON
ON                             ENTR EXIT
```

Select **ON** to enable data sampling or **OFF** to disable sampling and press **ENTR** to accept the changes or **EXIT** to abort the changes.

CAL. HOLD OFF

When enabled, this property inhibits data sampling while the instrument is in any calibration mode. Some parameters, such as concentration, should not be sampled while in calibration. This property should really be used only with data channels that are triggered by an *ATIMER* event.

Data sampling is also inhibited for a few minutes after the instrument exits calibration and returns to sample mode. The duration of this post-calibration hold off is controlled by the *DAS_HOLD_OFF* setup variable. The post-calibration hold off is the same for all data channels that have this property enabled.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   CAL. HOLD OFF:ON
ON                              ENTR EXIT
```

Select **ON** to enable calibration hold off or **OFF** to disable it and press **ENTR** to accept the changes or **EXIT** to abort the changes.

"Hard" Data Channel Properties in Detail

These properties are seldom used so they are normally hidden from view. Contact the factory for instructions on modifying these properties.

STARTING DATE

This property specifies the first date to begin sampling data. Reports are generated at *REPORT PERIOD* intervals measured from midnight of the starting date. Normally *STARTING DATE* is the date that the data channel was created. But if you want to begin collecting data some time in the future you can change this property.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   STARTING DATE:23-MAR-98
2      3      MAR  9      8         ENTR EXIT
```

Enter the starting date and press **ENTR** to accept the changes or **EXIT** to abort the changes. Notice that you may enter only two digits for the year. The century portion of the year is determined according to the following table.

Converting 2-Digit Year to 4-Digit Year	
2-Digit Year	**4-Digit Year**
00–37	2000–2037
38–99	1938–1999

Table 7: Converting 2-Digit Year to 4-Digit Year

SAMPLE PERIOD

This property controls how frequently data parameters are sampled for *ATIMER* events only. For all other events the data parameters are sampled immediately when the event occurs. As for the *REPORT PERIOD* property, the sample period is specified in units of days, hours, and minutes, measured from midnight of the *STARTING DATE* property. The sample period should be less

than the report period. Otherwise, the reports may not contain any samples. Refer to the *REPORT PERIOD* property for examples of how these periods are measured.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   SAMPLE PERIOD DAYS:0
0       0       0                       ENTR EXIT
```

You should enter the number of days between each sample and press **ENTR** to accept the changes or **EXIT** to abort the changes. If you press **ENTR** you will go to the next display.

```
SETUP C.7   SAMPLE PERIOD TIME:00:01
0       0:      0       1               ENTR EXIT
```

You should enter the number of hours and minutes between each sample and press **ENTR** to accept the changes or **EXIT** to abort the changes.

COMPACT REPORT

This property controls the default format of reports printed to the RS-232, including those printed automatically and those explicitly requested by RS-232 commands. When compact reports are enabled the reports are printed as shown below.

```
D    79:12:00   0400   CONC   :    1    19.1
D    79:13:00   0400   CONC   :    1    19.1
D    79:14:00   0400   CONC   :    1    19.1
```

Notice that except for the data channel's name, the report above contains only numeric data. The simpler format makes this report easier for a computer to parse.

Furthermore, the compact report can print up to five parameters on a single line, whereas the verbose format prints each parameter on a separate line. So the compact report format uses far fewer characters to report the same information, which is important when downloading DAS data from remote instruments.

When compact reports are disabled the reports are printed as shown below.

```
D    79:12:00   0400   CONC   : AVG   O3CNC1=   19.1 PPB
D    79:13:00   0400   CONC   : AVG   O3CNC1=   19.1 PPB
D    79:14:00   0400   CONC   : AVG   O3CNC1=   19.1 PPB
```

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   COMPACT REPORT:OFF
OFF                                     ENTR EXIT
```

Select **ON** to print compact reports or **OFF** to print verbose reports and press **ENTR** to accept the changes or **EXIT** to abort the changes.

Configuring Data Parameters

You configure the data parameters by editing the list of data parameters and changing the properties for data parameters. Refer to *Figure 5: Editing the List of Data Parameters* to see how to get to this menu.

> **If you modify the list of data parameters in any way, the data file and all of the data it contains is deleted and a new data file is created. Be sure you have saved the old data before you modify the list of data parameters.**

Once you get into this menu the instrument displays a summary of the first data parameter that looks like the following. The underlined portion constitutes the data parameter summary.

SETUP C.7	0) PARAM=O3CNC1, MODE=AVG				
PREV NEXT		INS	DEL	EDIT	EXIT

"0" in this example is simply the data parameter's index in the list. The first data parameter in the list is at index 0, the second is at index 1, and so on.

"O3CNC1" is the specific data parameter that will be sampled. In this example it's "ozone concentration for range 1." Refer to *Appendix B* for a complete list of data parameters for each instrument.

"AVG" is the sampling mode. In this case the mode is "average." Refer to *Table 2: Data Parameter Properties* for a complete list of sampling modes.

You can move to the next data parameter by pressing **NEXT** until you get to the end of the list, when you will see the following.

SETUP C.7	END OF PARAMETERS	
PREV	INS	EXIT

The menu buttons are described in the table below.

Menu Buttons for Editing List of Data Parameters	
Button	**Description**
PREV	Move to previous data parameter.
NEXT	Move to next data parameter.
INS	Insert a new data parameter before current one.
DEL	Delete current data parameter.
EDIT	Edit properties for current data parameter. See section below for details.

Table 8: Menu Buttons for Editing List of Data Parameters

Data Parameter Properties in Detail

This section describes each of the data parameter properties in detail. Refer to *Table 2: Data Parameter Properties* for a summary of the properties. Once you get into this menu the instrument displays the value of the first data parameter property similar to the following.

```
SETUP C.7   PARAMETER:O3CNC1
<SET  SET>  EDIT                              EXIT
```

The menu buttons are described in the table below.

Menu Buttons for Editing Data Parameter Properties	
Button	**Description**
<SET	Move to previous property.
SET>	Move to next property.
EDIT	Edit current property. See property descriptions below for details.

Table 9: Menu Buttons for Editing Data Parameter Properties

PARAMETER

This property selects the instrument-specific data point to sample. If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   PARAMETER:O3CNC1
PREV NEXT                           ENTR EXIT
```

Use the **PREV** and **NEXT** buttons to scroll through the list of parameters and then press **ENTR** to select the new parameter or **EXIT** to keep the old one.

SAMPLE MODE

This property selects the sampling mode for the parameter. The *AVG*, *MIN*, and *MAX* modes are really only useful in data channels that are triggered by *ATIMER* events. In data channels that are triggered by other events, use the *INST* sampling mode.

If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   SAMPLE MODE:AVG
INST  AVG  MIN   MAX                ENTR EXIT
```

Select the desired sampling mode and then press **ENTR** to accept the changes or **EXIT** to abort the changes.

PRECISION

This property specifies the number of digits to display to the right of the decimal point. If you press **EDIT** while viewing this property you will see a display similar to the following.

```
SETUP C.7   PRECISION:1
1                                    ENTR EXIT
```

Enter a number from 0 to 4 and then press **ENTR** to accept the changes or **EXIT** to abort the changes.

Configuration Examples

This section describes some typical DAS data channel configurations.

Sampling at Regular Intervals

Most trending information can be captured at regular intervals by triggering a data channel with an automatic timer. One possible configuration for collecting ozone concentration readings is summarized in the table below.

Data Channel Configuration for Monitoring Ozone Concentration		
Property	**Setting**	**Description**
NAME	CONC	User-defined name for the data channel. This name is only significant to the user.
EVENT	ATIMER	Data channel will be triggered by a timer. The default sample period is one minute so the concentration will be sampled once per minute.
REPORT PERIOD	000:01:00	A concentration report will be stored in the data file every hour. This could be every few minutes or every few days instead.
NUMBER OF RECORDS	800	A total of 800 reports will be stored in the data file. The number of records is limited only by the available memory.
RS-232 REPORT	OFF	The hourly reports will not be printed on the RS-232 interface. The reports can be printed to the RS-232 interface later.
CHANNEL ENABLED	ON	The data channel is enabled. This property is useful for temporarily disabling a data channel.
CAL. HOLD OFF	ON	The concentration will not be sampled while the instrument is in calibration mode. Not all data parameters are affected by calibration so this setting is not pertinent to some parameters.
PARAMETER	O3CNC1	The data channel will sample the ozone concentration for range #1.
MODE	AVG	The data channel will average the concentration samples during the hour.

		Since the sample period is one minute, this average will consist of 60 one-minute samples.
PRECISION	1	The concentration average will be displayed with one digit to the right of the decimal point.

Table 10: Data Channel Configuration for Monitoring Ozone Concentration

Sampling during Calibration

It might be desirable to monitor the instrument's slope to look for drift. Since the slope changes only following a calibration, it's easiest to trigger the data channel with an event such as *SLPCHG*. The table below shows one possible configuration.

Data Channel Configuration for Monitoring Slope		
Setup Property	**Setting**	**Description**
NAME	CALDAT	User-defined name for the data channel.
EVENT	SLPCHG	Data channel will be triggered whenever the slope is recalculated.
REPORT PERIOD	—	This property is used only when the event is *ATIMER*.
NUMBER OF RECORDS	200	A total of 200 reports will be stored in the data file.
RS-232 REPORT	OFF	The reports will not be printed on the RS-232 interface.
CHANNEL ENABLED	ON	The data channel is enabled.
CAL. HOLD OFF	OFF	Don't enable this or else the slope won't be sampled since it's sampled while in calibration mode.
PARAMETER	SLOPE1	The data channel will sample the slope for range #1.
MODE	INST	The data channel will take a single slope sample.
PRECISION	3	The concentration average will be displayed with three digits to the right of the decimal point.

Table 11: Data Channel Configuration for Monitoring Slope

Sampling after Exceptional Events

The previous two examples are ordinary ones. The following example would probably be used only to diagnose a problem with an instrument. Suppose you had an instrument that periodically generated photometer lamp temperature warnings. The following configuration would record the photometer lamp temperature at the time the warning was issued.

Data Channel Configuration for Capturing Photometer Lamp Temperature Warnings		
Setup Property	**Setting**	**Description**
NAME	LMPWRN	User-defined name for the data channel.
EVENT	PHTMPW	Data channel will be triggered whenever a photometer lamp warning occurs.
REPORT PERIOD	—	This property is used only when the event is *ATIMER*.
NUMBER OF RECORDS	10	A total of 10 reports will be stored in the data file.
RS-232 REPORT	ON	The reports will be printed on the RS-232 interface. So on the audit trail you'll see the warning message and the temperature that triggered it.
CHANNEL ENABLED	ON	The data channel is enabled.
CAL. HOLD OFF	OFF	Don't enable this or else the warning won't be captured if the instrument is in calibration mode.
PARAMETER	PHTEMP	The data channel will sample the photometer lamp temperature.
MODE	INST	The data channel will take a single temperature sample.
PRECISION	1	The concentration average will be displayed with one digit to the right of the decimal point.

Table 12: Data Channel Configuration for Capturing Photometer Lamp Temperature Warnings

Maximum Number of Channels, Parameters, and Records

Due to the finite memory capacity of the instrument there are some limits placed on the number of DAS objects you can create, as summarized in the table below.

DAS Configuration Limits	
Feature	**Maximum Number[1]**
Data channels	20
Data parameters per data channel	10
Total data parameters that may be monitored	200
Records stored per data channel	10,000
[1] Actual number is limited by available storage space and will be less than the maximum.	

Table 13: DAS Configuration Limits

The actual number of *data parameters* that may be stored depends on the available storage space and the number of parameters being sampled at once.

The battery-backed RAM file system used in all the AMX instruments for storing the DAS data is 72 K-bytes (73,728 bytes) in size. About 2 K-bytes is used by the file system, and about 4 K-bytes is reserved for future use. That leaves about 66 K-bytes (67,584 bytes) available for storing data.

Each record in a data channel's data file consists of a 32-bit time stamp followed by one 32-bit floating-point value for each data parameter being sampled. So the size of each record in bytes is $4 * (1 + N)$, where N is the number of data parameters. Thus, the total number of *records* that may be stored, assuming that they are all stored in one file, is $67,584 / (4 * (1 + N))$; the total number of *data parameters* is simply the total number of records times the number of parameters in each record.

The RAM file system size was deliberately selected to accommodate the M200A, which needs to store up to two weeks' worth of 5-minute averages for three gases. That amounts to 12,096 data parameters, which can be accommodated, as shown in the table below.

DAS Storage Capacity	
Number of Parameters Sampled at Once	Total Number of Data Parameters that May Be Stored
1	8,400
2	11,200
3	12,600
4	13,500
5	14,000
6	14,400
7	14,700
8	15,000
9	15,200
10	15,300

Table 14: DAS Storage Capacity

Operating the DAS

When the DAS Is Operating

The DAS operates automatically whenever any data channels are enabled and while the DAS configuration is not being modified. While the DAS configuration is being modified the DAS is suspended.

Disabling the DAS

You can disable the DAS only by setting the *CHANNEL ENABLED* property of each data channel to *OFF*.

DAS Status Indicators

The green *SAMPLE* LED on the instrument front panel provides a general indication of the DAS status, as summarized in the table below.

SAMPLE LED Indicator Meaning	
LED State	**DAS Status**
Off	Not sampling (e.g. in zero or span calibration).
Blinking	Not sampling. In hold off mode.
On	Sampling normally.

Table 15: SAMPLE LED Indicator Meaning

Averages in Progress when Instrument Is Powered Off

The DAS is capable of averaging data parameter samples over very long time intervals. For example, each concentration report typically consists of the average of 60 one-minute samples. If the instrument is powered off in the middle of the averaging interval, the samples accumulated so far are saved in the battery-backed RAM. If the instrument is powered back on during the same averaging interval, the DAS resumes adding samples to the same average.

For example, suppose a data channel is set up to average the concentration for a one-hour interval. If the instrument is powered off 20 minutes into the averaging interval the average will contain 20 samples, which will be stored in the battery-backed RAM. If the instrument remains off for 10 minutes before being powered back on, the data channel will accumulate another 30 samples into the same average. So the average will contain a total of 50 samples for that one-hour averaging interval.

The number of samples in each average is not stored in the data file. This is because storing this number would significantly reduce the storage capacity of the DAS. And because the vast majority of the time each average contains all the samples.

Viewing the Captured Data

Once you've captured some data you'll probably want to view it. This section describes how to view the captured data. Whereas data sampling is suspended while configuring the DAS, data sampling continues normally while viewing the data.

Menu for Viewing the Data Channel Status

The diagram below shows the menu tree for viewing the capture status of data channels, starting from the instrument's main menu.

```
┌─────────┐
│  SETUP  │
└─────────┘
     │
     └──▶ ┌───────┐
          │  DAS  │
          └───────┘
              │
              └──▶ ┌───────────┐
                   │ VIEW EDIT │
                   └───────────┘
                        │
                        └──▶ ┌────────────────┐
                             │ PREV NEXT VIEW │
                             └────────────────┘
```

Move to previous data channel	View data for current channel

Move to next data channel
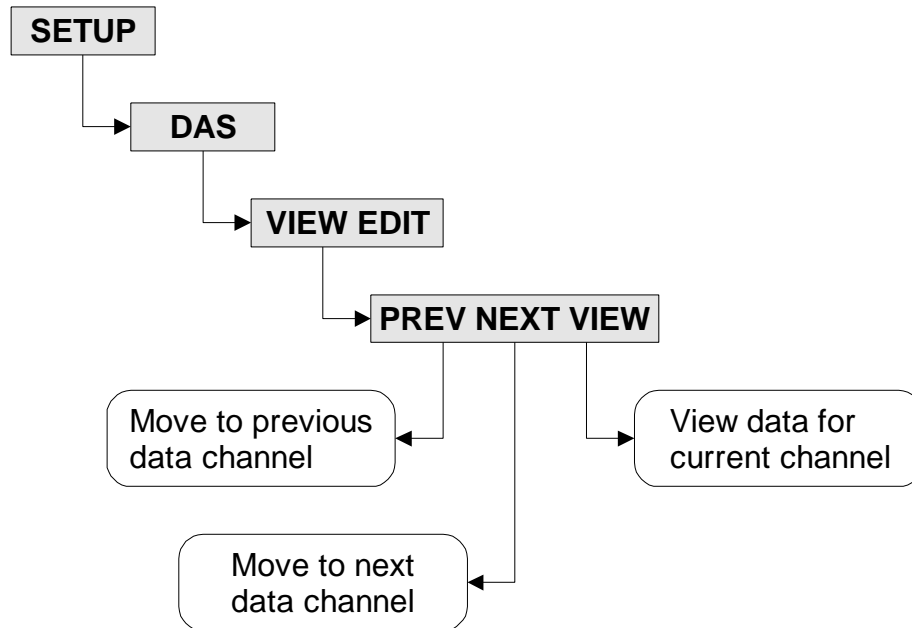
Figure 7: Viewing the Data Channel Status

When you enter this menu the instrument shows the capture status of the first data channel, similar to the following display.

```
SETUP C.7   PNUMTC: DATA AVAILABLE
PREV NEXT VIEW                        EXIT
```

The example above indicates that data has been captured for the data channel named "PNUMTC." If no data had been captured for the channel the display would look like this.

```
SETUP C.7   PNUMTC: NO DATA AVAILABLE
PREV NEXT                             EXIT
```

You can press the **PREV** and **NEXT** buttons to view the status of other channels. If you press **VIEW** you will go to the captured data view menu described in the next section.

Menu for Viewing the Captured Data for a Channel

The diagram below shows the menu tree for viewing the captured data for a single channel, starting from the previous menu.
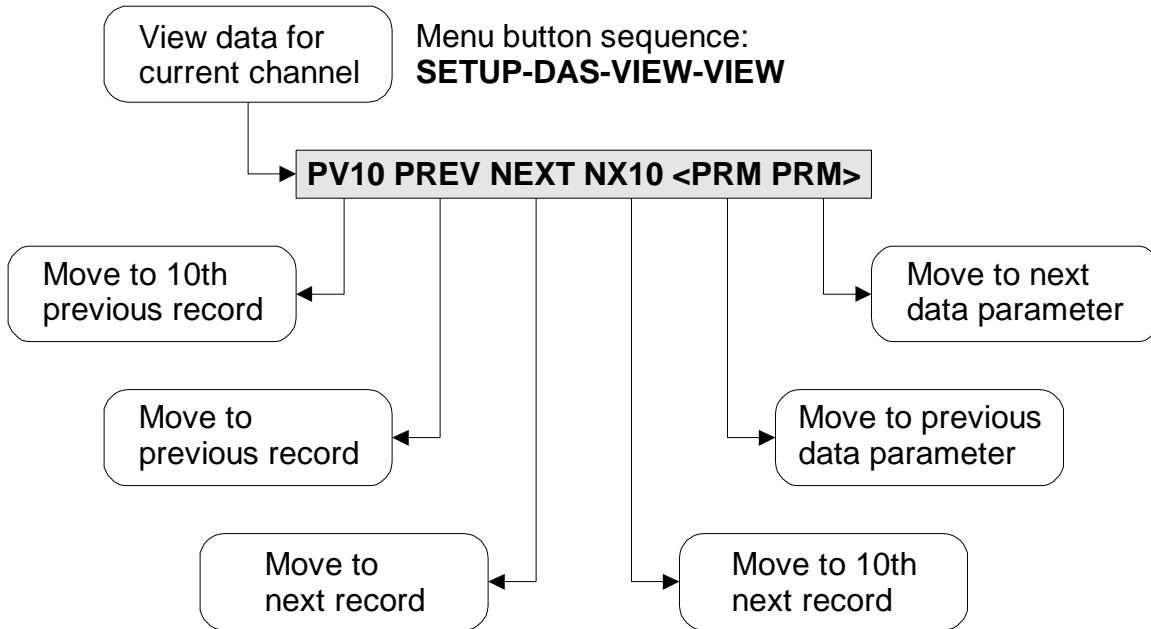
Figure 8: Viewing the Captured Data for a Channel

When you enter this menu the instrument shows the first captured data record for the data channel, similar to the following display. This example is for the data channel named "PNUMTC."

```
SETUP C.7   79:12:00 SMPFLW=719.6 cc/m
PV10  PREV NEXT NX10  <PRM PRM>        EXIT
```

The format of the display above is described in the table below.

DAS Record View Format	
Display Field	**Description**
79:12:00	This is the record's time stamp in the format of *day-of-year:hours:minutes*. This record was recorded on the 79th day of the year at 12:00.
SMPFLW	This is the data parameter being sampled.
719.6	This is the value that was sampled for the data parameter.
cc/m	This is the unit of measurement that the sampled value is in.

Table 16: DAS Record View Format

If the data channel has more than one data parameter the **<PRM** and **PRM>** buttons will appear. Since the data channel in this example has two parameters the **<PRM** and **PRM>** buttons are shown. If you press the **PRM>** button the instrument will show the captured data for the next parameter in the record, *SMPPRS* in this example, as shown below.

```
SETUP C.7   79:12:00 SMPPRS=29.8 InHg
PV10  PREV NEXT NX10  <PRM PRM>        EXIT
```

Notice that the time stamps in the above two displays are the same. This is because both parameters are part of the same record. Use the **PREV** and **NEXT** buttons to move between records, and the **<PRM** and **PRM>** buttons to move between data parameters in the same record.

Captured Data is Stored as Two Dimensional Table

The data captured for each data channel is stored in the data file as a two dimensional table, with each row storing one record, and each column storing one data parameter. The diagram below shows how the data is stored in the data file.

RECORD NUMBER	TIME STAMP	PARAM 1 (SMPFLW)	PARAM 2 (SMPPRS)
1	79:12:00	719.6	29.8
2	79:13:00	719.6	29.8
3	79:14:00	719.6	29.8
4			
...			
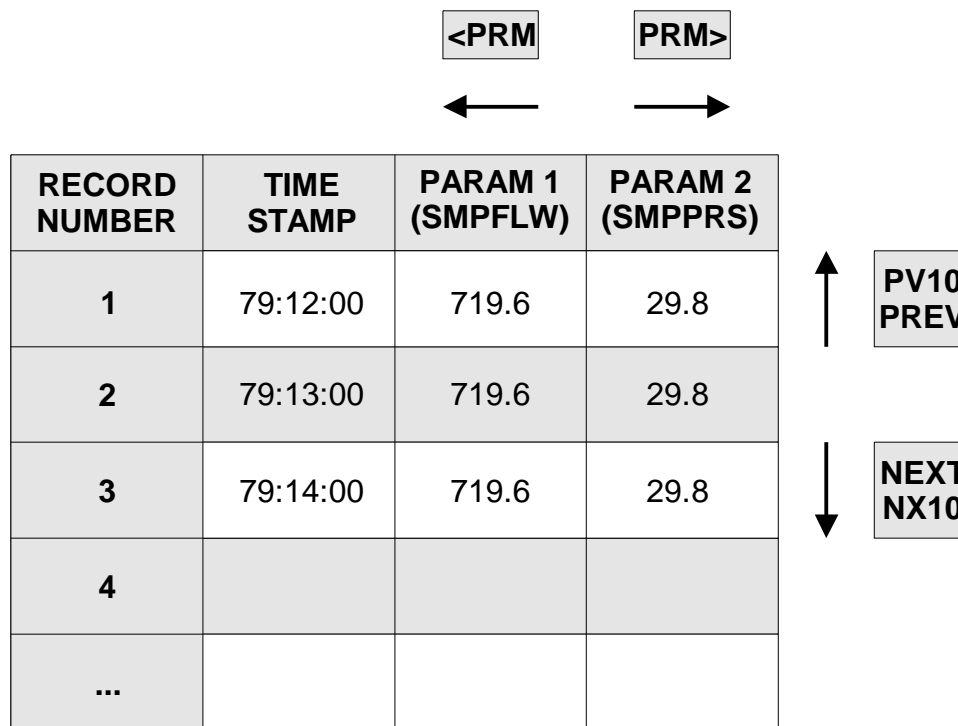
Figure 9: Captured Data File Format

Deleting the Captured Data for a Data Channel

Since the DAS is designed to ensure the integrity of the data it captures, there is no easy way to delete the captured data. If you must delete the data, however, you can edit the data channel configuration and edit the *NUMBER OF RECORDS* property. You don't have to actually change the number of records; simply press **ENTR** without changing the number. That will delete the existing data file and create a new one.

RS-232 Interface to the DAS

This section describes the RS-232 interface to the DAS. It doesn't discuss the general-purpose features of the RS-232 interface built into the instrument. Refer to the separate RS-232 interface documentation for general information on commands and configuring the RS-232 interface.

Configuring the RS-232 Interface

As a minimum, you may need to select the desired baud rate and operating mode of the RS-232 interface.

Setting the Baud Rate

To set the baud rate in most instruments, press **SETUP-MORE-COMM-BAUD** and select one of the choices. Then press **ENTR** to accept the changes or **EXIT** to abort the changes.

Setting the Interface Mode

To set the interface mode, edit the instrument's list of setup variables, go to the one called *RS232_MODE*, and enter a value based on the following table. To enable several features simply add the decimal values shown in the table.

RS232_MODE Settings	
Decimal Value	**Feature Description**
1	Turns on quiet mode (messages suppressed).
2	Places instrument in computer mode (no echo).
4	Enables security feature (log on required).
8	Enables native protocol and setup menus.
16	Enables alternate protocol and setup menus.
32	Enables multi-drop support.
64	Enables modem support.
4096	Display command prompt. Useful when using a terminal.

Table 17: RS232_MODE Settings

Recommended Mode Settings

If you are planning to connect to the instrument with a terminal or a terminal program, you should set *RS232_MODE* to a value of 0 (zero). If you are planning to connect to the instrument with a computer, you should set *RS232_MODE* to a value of 3. For other settings refer to the RS-232 interface documentation or contact the factory.

Command Line Interface

The RS-232 interface is command line oriented. You issue commands to the instrument and it returns response messages.

All commands sent to the instrument must be terminated by a carriage return and/or line feed character. You may enter commands in upper or lower case.

All messages sent from the instrument are terminated with a carriage return-line feed pair.

General Commands

You can obtain a list of the general-purpose RS-232 commands using the *?* (question mark) command. Refer to the RS-232 interface documentation for detailed information on these commands.

DAS Commands

This section briefly describes the RS-232 commands that pertain to the DAS. The commands are summarized in the table below.

RS-232 Commands for DAS	
Command	**Description**
D [id[1]] PRINT ["name"] [!]	Prints the configuration of all data channels if "name" is omitted. Prints the configuration of a single data channel if "name" is provided. If provided, the name must be in double quotes.
D [id[1]] REPORT "name" [RECORDS = number] [COMPACT|VERBOSE]	Prints the captured data for a single data channel. The *RECORDS* option specifies the number of records (from most recent backwards in time). The *COMPACT* and *VERBOSE* options control the print format. The name must be in double quotes.
[1] Refers to the instrument ID number. This field in the command is optional and is used when multiple instruments are connected to the same RS-232 channel in a multi-drop fashion.	

Table 18: RS-232 Commands for DAS

Printing the DAS Configuration

You can obtain a printout of the entire DAS configuration or the configuration of a single data channel using the *PRINT* command. For example, the command *D PRINT* will print the configuration of all the data channels in a format similar to the following. The command is shown in lower case.

```
d print<CR>
SETUP PROPERTIES FOR CONC:
  NAME:              CONC
  EVENT:             ATIMER
  REPORT PERIOD:     000:01:00
  NUMBER OF RECORDS: 800
```

```
    RS-232 REPORT:      OFF
    CHANNEL ENABLED:    OFF
    CAL. HOLD OFF:      ON
    PARAMETERS:         1
       PARAMETER=O3CNC1, MODE=AVG, PRECISION=1

 SETUP PROPERTIES FOR O3REF:
    NAME:               O3REF
    EVENT:              ATIMER
    REPORT PERIOD:      000:01:00
    NUMBER OF RECORDS:  730
    RS-232 REPORT:      OFF
    CHANNEL ENABLED:    ON
    CAL. HOLD OFF:      OFF
    PARAMETERS:         1
       PARAMETER=PHREF, MODE=AVG, PRECISION=1

 SETUP PROPERTIES FOR PNUMTC:
    NAME:               PNUMTC
    EVENT:              ATIMER
    REPORT PERIOD:      000:01:00
    NUMBER OF RECORDS:  360
    RS-232 REPORT:      OFF
    CHANNEL ENABLED:    ON
    CAL. HOLD OFF:      OFF
    PARAMETERS:         2
       PARAMETER=SMPFLW, MODE=AVG, PRECISION=1
       PARAMETER=SMPPRS, MODE=AVG, PRECISION=1

 SETUP PROPERTIES FOR O3GEN:
    NAME:               O3GEN
    EVENT:              ATIMER
    REPORT PERIOD:      000:01:00
    NUMBER OF RECORDS:  360
    RS-232 REPORT:      OFF
    CHANNEL ENABLED:    ON
    CAL. HOLD OFF:      ON
    PARAMETERS:         1
       PARAMETER=O3DRIV, MODE=AVG, PRECISION=1

 SETUP PROPERTIES FOR CALDAT:
    NAME:               CALDAT
    EVENT:              SLPCHG
    REPORT PERIOD:      000:01:00
    NUMBER OF RECORDS:  200
    RS-232 REPORT:      OFF
    CHANNEL ENABLED:    ON
```

```
  CAL. HOLD OFF:     OFF
  PARAMETERS:        3
    PARAMETER=SLOPE1, MODE=INST, PRECISION=3
    PARAMETER=OFSET1, MODE=INST, PRECISION=1
    PARAMETER=ZSCNC1, MODE=INST, PRECISION=1
```

The command *D PRINT "CONC"* will print the configuration of just the data channel named "CONC" in a format similar to the following. Note that the double quotes around the data channel name are required.

```
d print "conc"<CR>
SETUP PROPERTIES FOR CONC:
  NAME:              CONC
  EVENT:             ATIMER
  REPORT PERIOD:     000:01:00
  NUMBER OF RECORDS: 800
  RS-232 REPORT:     OFF
  CHANNEL ENABLED:   OFF
  CAL. HOLD OFF:     ON
  PARAMETERS:        1
    PARAMETER=O3CNC1, MODE=AVG, PRECISION=1
```

The command *D PRINT "CONC"!* (with an exclamation point) will print the configuration of the data channel, including its "hard" properties, in a format similar to the following.

```
d print "conc" !<CR>
SETUP PROPERTIES FOR CONC:
  NAME:              CONC
  EVENT:             ATIMER
  STARTING DATE:     01-JAN-96
  SAMPLE PERIOD:     000:00:01
  REPORT PERIOD:     000:01:00
  NUMBER OF RECORDS: 800
  RS-232 REPORT:     OFF
  COMPACT REPORT:    OFF
  CHANNEL ENABLED:   OFF
  CAL. HOLD OFF:     ON
  PARAMETERS:        1
    PARAMETER=O3CNC1, MODE=AVG, PRECISION=1
```

Modifying the DAS Configuration

Modifying the DAS configuration through the RS-232 interface is not currently supported.

Printing the Captured Data Records

You can obtain a printout of the captured data records for a single data channel using the *REPORT* command. For example, the command *D REPORT "PNUMTC" RECORDS = 3* will

---

print the most recent three records stored for the data channel named "PNUMTC" in a format similar to the following. Note that the double quotes around the data channel name are required.

```
d report "pnumtc" records = 3<CR>
D   79:12:00  0400   PNUMTC: AVG   SMPFLW= 719.6 cc/m
D   79:12:00  0400   PNUMTC: AVG   SMPPRS=  29.8 InHg
D   79:13:00  0400   PNUMTC: AVG   SMPFLW= 719.6 cc/m
D   79:13:00  0400   PNUMTC: AVG   SMPPRS=  29.8 InHg
D   79:14:00  0400   PNUMTC: AVG   SMPFLW= 719.6 cc/m
D   79:14:00  0400   PNUMTC: AVG   SMPPRS=  29.8 InHg
```

Notice that although *RECORDS = 3* was specified, the printout above contains six lines. That's because each record in this example contains two data parameters, and each parameter is printed on a separate line in verbose mode. Notice that every pair of lines has the same time stamp.

The command *D REPORT "PNUMTC" RECORDS = 3 COMPACT* will print the most recent three records stored for the data channel in a format similar to the following.

```
d report "pnumtc" records = 3 compact<CR>
D   79:12:00  0400   PNUMTC:  1   719.6     29.8
D   79:13:00  0400   PNUMTC:  1   719.6     29.8
D   79:14:00  0400   PNUMTC:  1   719.6     29.8
```

Notice that except for the data channel's name, the compact printout above contains only numeric data. The simpler format makes this report easier for a computer to parse.

Furthermore, the compact report can print up to five parameters on a single line, whereas the verbose format prints each parameter on a separate line. So the compact report format uses far fewer characters to report the same information, which is important when downloading DAS data from remote instruments.

Verbose DAS Report Format

The table below describes the format of verbose reports, field by field. This description uses the verbose reports for the "PNUMTC" data channel shown above as examples. Verbose reports print one line for each data parameter in the record.

Verbose DAS Report Format	
Message Field	**Description**
Fields common to verbose and compact reports	
D	All messages that may be generated automatically start with a single character denoting the message category. The letter *D* stands for *diagnostics*, as in *predictive diagnostics*, which is an alternate name for the DAS.
79:12:00	This is the record's time stamp in the format of *day-of-year:hours:minutes*. This record was recorded on the 79th day of the year at 12:00.

0400	This is the instrument's ID number. You may change the ID number by pressing **SETUP-MORE-COMM-ID**.
PNUMTC	This is the name of the data channel.
Fields unique to verbose reports	
AVG	This is the sampling mode for this data parameter.
SMPFLW	This is the data parameter being sampled.
719.6	This is the value that was sampled for the data parameter.
cc/m	This is the unit of measurement that the sampled value is in.

Table 19: Verbose DAS Report Format

Compact DAS Report Format

The table below describes the format of compact reports, field by field. This description uses the compact reports for the "PNUMTC" data channel shown above as examples. Compact reports print up to five data parameters in the record on a line.

Compact DAS Report Format	
Message Field	**Description**
Fields common to verbose and compact reports	
D	All messages that may be generated automatically start with a single character denoting the message category. The letter *D* stands for *diagnostics*, as in *predictive diagnostics*, which is an alternate name for the DAS.
79:12:00	This is the record's time stamp in the format of *day-of-year:hours:minutes*. This record was recorded on the 79th day of the year at 12:00.
0400	This is the instrument's ID number. You may change the ID number by pressing **SETUP-MORE-COMM-ID**.
PNUMTC	This is the name of the data channel.
Fields unique to compact reports	
1	This is the line number for this record. Since only five data parameters may be printed per line, a single record may span multiple lines. If so, each line has a different line number so that a computer parsing the data can distinguish the lines.
719.6	This is the value that was sampled for the SMPFLW data parameter.
29.8	This is the value that was sampled for the SMPPRS data parameter.

Table 20: Compact DAS Report Format

Modifying the Captured Data Records

You cannot modify the captured data records through the RS-232 interface or the front panel.

Appendix A — Glossary

AMX — the real-time operating system inside the instruments.

Battery-backed RAM — non-volatile memory device used to store captured data that changes frequently.

Captured data —refers to the general data captured by the DAS, as opposed to specific records or data parameters.

Carriage return — ASCII character code 13 (decimal).

Channel — see *data channel*.

Data channel — specifies which data parameters to capture and the event that triggers the data capture.

Data channel property — user-configurable attributes of data channels such as the name, the number of records to store, etc.

Data file — each data channel stores its captured records in a separate data file in the battery-backed RAM.

Data parameter — a single data point in an instrument such as a concentration or a flow. These are instrument-specific, although some, such as the DC power supply, are common to all instruments.

Data parameter property — user-configurable attributes of data parameters such as the instrument-specific data point, the sampling mode, and the displayed precision.

EEPROM— non-volatile memory device used to store configuration settings that change infrequently.

Event — see *triggering event*.

Front panel — refers to the display and keyboard on the front of the instrument.

Line feed — ASCII character code 10 (decimal).

Menu — refers to the instrument's menu that's accessible from the front panel.

Parameter — see *data parameter*.

Predictive diagnostics — the process of monitoring an instrument in order to observe trends and predict instrument service.

PROM— read-only memory device used to store the instrument's firmware and default DAS configuration.

Record — a single DAS record captured by a data channel and stored in a data file. A record consists of a time stamp and one or more data parameters.

RS-232 interface — refers to the RS-232 port on the rear of the instrument and/or the software command set used to control the instrument and access captured data.

Setup variable — a variable for configuring an instrument's operation. Setup variables may be accessed by pressing **SETUP-MORE-VARS** on the instrument's front panel.

Triggering event — an instrument-specific event such as calibration, an automatic timer, or a warning condition that triggers the capture of one or more data parameters.

Appendix B — Instrument Specifics

This appendix lists the data parameters, triggering events, and default data channels for all instruments containing the DAS.

Model 100A-AMX

Model 100A-AMX Data Parameters		
Name	**Description**	**Units**
PMTDET	PMT detector reading	mV
UVDET	UV lamp detector reading	mV
LAMPR	UV lamp intensity ratio since last lamp calibration	—
DRKPMT	PMT detector dark offset.	mV
DARKUV	UV lamp detector dark offset.	mV
SLOPE1	Slope for range #1	PPB/mV
SLOPE2	Slope for range #2	PPB/mV
OFSET1	Offset for range #1	mV
OFSET2	Offset for range #2	mV
ZSCNC1	Concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
ZSCNC2	Concentration during calibration for range #2	PPB
CONC1	SO_2 concentration for range #1	PPB
CONC2	SO_2 concentration for range #2	PPB
STABIL	Concentration stability	PPB
STRLGT	Stray light	PPB
RCTEMP	Reaction cell temperature	Degrees C
IZSTMP	IZS temperature	Degrees C
PMTTMP	PMT temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
VACUUM	Vacuum pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
HVPS	High voltage power supply output	Volts
DCPS	DC power supply output	mV

Table 21: Model 100A-AMX Data Parameters

Model 100A-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired
EXITZR	Exit zero calibration

EXITLS	Exit low span calibration
EXITHS	Exit high span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
PMTDTW	PMT detector warning
UVLMPW	UV lamp intensity warning
SHUTRW	Shutter warning
RCTMPW	Reaction cell temperature warning
IZTMPW	IZS temperature warning
PTEMPW	PMT temperature warning
SFLOWW	Sample flow warning
SPRESW	Sample pressure warning
VPRESW	Vacuum pressure warning
BTEMPW	Internal box temperature warning
HVPSW	High voltage power supply warning
DCPSW	DC power supply warning

Table 22: Model 100A-AMX Triggering Events

Model 100A-AMX Default Data Channels	
Property	**Setting**
NAME	CONC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	CONC1, AVG, 1
NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE,	SMPFLW, AVG, 1

PRECISION	SMPPRS, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	SLOPE1, INST, 3 OFSET1, INST, 1 ZSCNC1, INST, 1

Table 23: Model 100A-AMX Default Data Channels

Model 101A-AMX

Model 101A-AMX Data Parameters		
Name	**Description**	**Units**
PMTDET	PMT detector reading	mV
UVDET	UV lamp detector reading	mV
LAMPR	UV lamp intensity ratio since last lamp calibration	—
STRLGT	Stray light	PPB
DRKPMT	PMT detector dark offset.	mV
DARKUV	UV lamp detector dark offset.	mV
S2SLP1	SO_2 slope for range #1	PPB/mV
S2SLP2	SO_2 slope for range #2	PPB/mV
H2SLP1	H_2S slope for range #1	PPB/mV
H2SLP2	H_2S slope for range #2	PPB/mV
S2OFS1	SO_2 offset for range #1	mV
S2OFS2	SO_2 offset for range #2	mV
H2OFS1	H_2S offset for range #1	mV
H2OFS2	H_2S offset for range #2	mV
S2ZSC1	SO_2 concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
S2ZSC2	SO_2 concentration during calibration for range #2	PPB
H2ZSC1	H_2S concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
H2ZSC2	H_2S concentration during calibration for range #2	PPB

S2CNC1	SO$_2$ concentration for range #1	PPB
S2CNC2	SO$_2$ concentration for range #2	PPB
H2CNC1	H$_2$S concentration for range #1	PPB
H2CNC2	H$_2$S concentration for range #2	PPB
STABIL	Concentration stability	PPB
RCTEMP	Reaction cell temperature	Degrees C
IZSTMP	IZS temperature	Degrees C
PMTTMP	PMT temperature	Degrees C
CNVTMP	Converter temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
HVPS	High voltage power supply output	Volts
DCPS	DC power supply output	mV

Table 24: Model 101A-AMX Data Parameters

Model 101A-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired
EXITZR	Exit zero calibration
EXITLS	Exit low span calibration
EXITHS	Exit high span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
UVLMPW	UV lamp intensity warning
SHUTRW	Shutter warning
RCTMPW	Reaction cell temperature warning
IZTMPW	IZS temperature warning
PTEMPW	PMT temperature warning
CTEMPW	Converter temperature warning
SFLOWW	Sample flow warning
SPRESW	Sample pressure warning
BTEMPW	Internal box temperature warning
HVPSW	High voltage power supply warning
DCPSW	DC power supply warning

Table 25: Model 101A-AMX Triggering Events

Model 101A-AMX Default Data Channels	
Property	**Setting**
NAME	CONC

EVENT	ATIMER
STARTING DATE	01-JAN-97
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE,	S2CNC1, AVG, 1
PRECISION	H2CNC1, AVG, 1
NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-97
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE,	SMPFLW, AVG, 1
PRECISION	SMPPRS, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-97
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE,	S2SLP1, INST, 3
PRECISION	S2OFS1, INST, 1
	S2ZSC1, INST, 1

Table 26: Model 101A-AMX Default Data Channels

Model 200A-AMX

Model 200A-AMX Data Parameters		
Name	**Description**	**Units**
PMTDET	PMT detector reading	mV
NXSLP1	NO_X slope for range #1	PPB/mV
NXSLP2	NO_X slope for range #2	PPB/mV
NOSLP1	NO slope for range #1	PPB/mV

NOSLP2	NO slope for range #2	PPB/mV
NXOFS1	NO_X offset for range #1	mV
NXOFS2	NO_X offset for range #2	mV
NOOFS1	NO offset for range #1	mV
NOOFS2	NO offset for range #2	mV
NXZSC1	NO_X concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
NXZSC2	NO_X concentration during calibration for range #2	PPB
NOZSC1	NO concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
NOZSC2	NO concentration during calibration for range #2	PPB
N2ZSC1	NO_2 concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
N2ZSC2	NO_2 concentration during calibration for range #2	PPB
NXCNC1	NO_X concentration for range #1	PPB
NXCNC2	NO_X concentration for range #2	PPB
NOCNC1	NO concentration for range #1	PPB
NOCNC2	NO concentration for range #2	PPB
N2CNC1	NO_2 concentration for range #1	PPB
N2CNC2	NO_2 concentration for range #2	PPB
STABIL	Concentration stability	PPB
AZERO	Auto-zero reading	mV
O3FLOW	Ozone flow rate	cc/m
RCPRES	Reaction cell pressure	Inches Hg
RCTEMP	Reaction cell temperature	Degrees C
BLTEMP	Orifice block temperature	Degrees C
IZSTMP	IZS temperature	Degrees C
CNVTMP	Converter temperature	Degrees C
PMTTMP	PMT temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
HVPS	High voltage power supply output	Volts
DCPS	DC power supply output	mV

Table 27: Model 200A-AMX Data Parameters

Model 200A-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired
EXITZR	Exit zero calibration
EXITLS	Exit low span calibration
EXITHS	Exit high span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
CONCW	Concentration limit warning
AZEROW	Auto-zero limit warning
OFLOWW	Ozone flow warning
RPRESW	Reaction cell pressure warning
RTEMPW	Reaction cell temperature warning
BLTMPW	Orifice block temperature warning
IZTMPW	IZS temperature warning
CTEMPW	Converter temperature warning
PTEMPW	PMT temperature warning
SFLOWW	Sample flow warning
BTEMPW	Internal box temperature warning
HVPSW	High voltage power supply warning
DCPSW	DC power supply warning

Table 28: Model 200A-AMX Triggering Events

Model 200A-AMX Default Data Channels	
Property	**Setting**
NAME	CONC
EVENT	ATIMER
STARTING DATE	01-JAN-97
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	NXCNC1, AVG, 1 NOCNC1, AVG, 1 N2CNC1, AVG, 1
NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-97

SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	O3FLOW, AVG, 1 SMPFLW, AVG, 1 SMPPRS, AVG, 1 RCPRES, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-97
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	NXSLP1, INST, 3 NXOFS1, INST, 1 NXZSC1, INST, 1 NOSLP1, INST, 3 NOOFS1, INST, 1 NOZSC1, INST, 1

Table 29: Model 200A-AMX Default Data Channels

Model 300-AMX

Model 300-AMX Data Parameters		
Name	**Description**	**Units**
DETMES	Detector measure reading	mV
DETREF	Detector reference reading	mV
SLOPE1	Slope for range #1	—
SLOPE2	Slope for range #2	—
OFSET1	Offset for range #1	—
OFSET2	Offset for range #2	—
ZSCNC1	Concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPM
ZSCNC2	Concentration during calibration for range #2	PPM
CONC1	CO concentration for range #1	PPM
CONC2	CO concentration for range #2	PPM

STABIL	Concentration stability	PPM
BNTEMP	Optical bench lamp temperature	Degrees C
WTEMP	Wheel temperature	Degrees C
SMPTMP	Sample temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
DCPS	DC power supply output	mV

Table 30: Model 300-AMX Data Parameters

Model 300-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired
EXITZR	Exit zero calibration
EXITSP	Exit span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
SOURCW	Source warning
SYNCW	Sync warning
BNTMPW	Optical bench temperature warning
WTEMPW	Wheel temperature warning
STEMPW	Sample temperature warning
SFLOWW	Sample flow warning
SPRESW	Sample pressure warning
BTEMPW	Internal box temperature warning
DCPSW	DC power supply warning

Table 31: Model 300-AMX Triggering Events

Model 300-AMX Default Data Channels	
Property	**Setting**
NAME	CONC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE,	CONC1, AVG, 1

PRECISION	
NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE,	SMPFLW, AVG, 1
PRECISION	SMPPRS, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE,	SLOPE1, INST, 3
PRECISION	OFSET1, INST, 1
	ZSCNC1, INST, 1

Table 32: Model 300-AMX Default Data Channels

Model 400-AMX

Model 400-AMX Data Parameters		
Name	**Description**	**Units**
PHMEAS	Last photometer measure reading	mV
PHREF	Last photometer reference reading	mV
SLOPE1	Slope for range #1	—
SLOPE2	Slope for range #2	—
OFSET1	Offset for range #1	PPB
OFSET2	Offset for range #2	PPB
ZSCNC1	Concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
ZSCNC2	Concentration during calibration for range #2	PPB
PHTEMP	Photometer lamp temperature	Degrees C
O3CNC1	Ozone concentration for range #1	PPB

O3CNC2	Ozone concentration for range #2	PPB
STABIL	Concentration stability	PPB
O3REF	Ozone generator reference reading	mV
O3DRIV	Ozone generator drive	mV
O3TEMP	Ozone generator lamp temperature	Degrees C
SMPTMP	Sample temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
DCPS	DC power supply output	mV

Table 33: Model 400-AMX Data Parameters

Model 400-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired
EXITZR	Exit zero calibration
EXITLS	Exit low span calibration
EXITHS	Exit high span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
PHREFW	Photometer reference warning
PHTMPW	Photometer lamp temperature warning
O3REFW	Ozone generator reference warning
O3LMPW	Ozone generator lamp intensity warning
O3TMPW	Ozone generator lamp temperature warning
STEMPW	Sample temperature warning
SFLOWW	Sample flow warning
SPRESW	Sample pressure warning
BTEMPW	Internal box temperature warning
DCPSW	DC power supply warning

Table 34: Model 400-AMX Triggering Events

Model 400-AMX Default Data Channels	
Property	**Setting**
NAME	CONC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF

COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	O3CNC1, AVG, 1
NAME	O3REF
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	730
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	PHREF, AVG, 1
NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	SMPFLW, AVG, 1 SMPPRS, AVG, 1
NAME	O3GEN
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	O3DRIV, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00

NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	SLOPE1, INST, 3 OFSET1, INST, 1 ZSCNC1, INST, 1

Table 35: Model 400-AMX Default Data Channels

Model 400A-AMX

Model 400A-AMX Data Parameters		
Name	**Description**	**Units**
PHMEAS	Last photometer measure reading	mV
PHREF	Last photometer reference reading	mV
SLOPE1	Slope for range #1	—
SLOPE2	Slope for range #2	—
OFSET1	Offset for range #1	PPB
OFSET2	Offset for range #2	PPB
ZSCNC1	Concentration during calibration for range #1 (i.e. concentration used to compute slope and offset)	PPB
ZSCNC2	Concentration during calibration for range #2	PPB
PHTEMP	Photometer lamp temperature	Degrees C
O3CNC1	Ozone concentration for range #1	PPB
O3CNC2	Ozone concentration for range #2	PPB
STABIL	Concentration stability	PPB
O3REF	Ozone generator reference reading	mV
O3DRIV	Ozone generator drive	mV
O3TEMP	Ozone generator lamp temperature	Degrees C
SMPTMP	Sample temperature	Degrees C
SMPFLW	Sample flow rate	cc/m
SMPPRS	Sample pressure	Inches Hg
VACUUM	Vacuum pressure	Inches Hg
BOXTMP	Internal box temperature	Degrees C
DCPS	DC power supply output	mV

Table 36: Model 400A-AMX Data Parameters

Model 400A-AMX Triggering Events	
Name	**Description**
"Easy" Events	
ATIMER	Automatic timer expired

EXITZR	Exit zero calibration
EXITLS	Exit low span calibration
EXITHS	Exit high span calibration
EXITMP	Exit multi-point calibration
SLPCHG	Slope and offset were recalculated
"Hard" Events	
EXITDG	Exit diagnostic mode
PHREFW	Photometer reference warning
PHTMPW	Photometer lamp temperature warning
O3REFW	Ozone generator reference warning
O3LMPW	Ozone generator lamp intensity warning
O3TMPW	Ozone generator lamp temperature warning
STEMPW	Sample temperature warning
SFLOWW	Sample flow warning
SPRESW	Sample pressure warning
BTEMPW	Internal box temperature warning
DCPSW	DC power supply warning

Table 37: Model 400A-AMX Triggering Events

Model 400A-AMX Default Data Channels	
Property	**Setting**
NAME	CONC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:01
REPORT PERIOD	000:01:00
NUMBER OF RECORDS	800
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	O3CNC1, AVG, 1
NAME	O3REF
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	730
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	PHREF, AVG, 1

NAME	PNUMTC
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	SMPFLW, AVG, 1
	SMPPRS, AVG, 1
NAME	O3GEN
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	360
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	ON
PARAMETER, MODE, PRECISION	O3DRIV, AVG, 1
NAME	CALDAT
EVENT	ATIMER
STARTING DATE	01-JAN-96
SAMPLE PERIOD	000:00:05
REPORT PERIOD	001:00:00
NUMBER OF RECORDS	200
RS-232 REPORT	OFF
COMPACT REPORT	OFF
CHANNEL ENABLED	ON
CAL. HOLD OFF	OFF
PARAMETER, MODE, PRECISION	SLOPE1, INST, 3
	OFSET1, INST, 1
	ZSCNC1, INST, 1

Table 38: Model 400A-AMX Default Data Channels