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DAS-TEMP







User Guide

for the

Keithley MetraByte

DAS-TEMP

32-Channel

Temperature Measuring Board

Revision B - September 1991
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Part Number: 24415

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

The DAS-TEMP is a 32-channel temperature-measuring board configured as a plug-in accessory for the IBM PC/XT/AT and compatibles. Temperature measuring covers the range of -55 to 150°C (standard sensors, available from the manufacturer, cover a range of -25 to 105°C) and is software-controlled.

Temperature measuring uses probes based on current-output temperature transducers. Current-output operation makes the interface immune to wiring-resistance variations and to most noise sources. This operation can also be programmed to reject unwanted frequencies under software control (50, 60, or 400Hz rejection).

Temperature transducers are AD592 sensors (from Analog Devices). These sensorss are two-terminal current sources whose output current is directly proportional to absolute temperature; sensor output is 1 microamp/°Kelvin.

To make up a DAS-TEMP probe, a single sensor attached to 3 ft of #24 stranded Teflon-coated wire is encapsulated in the tip of a 1/4 in. steel tube. Standard probe lengths are 1.5 and 6 inches. A 1/4 in. compression fitting is also available for mounting the probe to a bracket or fixture.

The temperature range of a probe is -25 to 105°C with a maximum un-calibrated accuracy of ±1.0°C. Non-linearity is 0.35°C over the probe's full temperature range (0.15°C over the 0 to 70°C range). Long-term stability is an excellent 0.1°C/month non-cumulative.

Software control may be either continuous or background. Continuous control requires the constant support of the DAS-TEMP and its host PC. Background operation runs under on-board timer-driven interrupts. With either type of control, the board can scan at 200 conversions/second.

1.2 SPECIFICATIONS

Board Only

Probe Support: Any linear 1uA/°K current-out probe whose range is -55 to 150°C.

Scan Rates:

RATE	RESOLUTION	ACCURACY	NORMAL MODE REJ. FREQ.	DRIFT
200 Conv/second	0.1°C	±0.1°C	400Hz	±0.0375°C reading per °C board temperature range.
30 Conv/second	0.015°C	"	60Hz	"
25 Conv/second	0.012°C	"	50Hz	"

Standard Probe

Temperature:

RANGE	ACCURACY	OVERALL ACCURACY (INCLUDING BOARD ERRORS)	NON-LINEARITY
0 to 70°C	±0.8°C	±0.9°C	±0.15°C
-25 to 105°C	±1.0°C	±1.1°C	±0.35°C

Absolute Maximum Temperature Range: -45 to 125°C.

Long-Term Drift: ±0.1°C/month non-cumulative.

Repeatability: ±0.1°C.

■ ■ ■

CHAPTER 2

SETUP & INSTALLATION

2.1 GENERAL

This chapter provides instructions for the installing the DAS-TEMP in an IBM PC/XT/AT or compatible. The chapter begins with procedures for making working copies of your DAS-TEMP Distribution Software. Next are instructions for unpacking and inspection, followed by descriptions of the options and methods for setting all configurable parameters.

2.2 BACKING UP DISTRIBUTION SOFTWARE

Distribution software is furnished on 5.25", 360K floppy diskette(s). To accommodate users with 3.5" floppy drives, the Software is also available on 720K diskette(s).

As soon as possible, make a working copy of your DAS-TEMP software using the procedures that follow. Store your original software copy in a safe place as a backup.

The following back-up procedures cover the more common computer configurations: a single-floppy drive (with hard disk), dual-floppy drives, and a hard drive.

Single-Floppy-Drive Machines

To copy your Distribution Software to your computer's hard disk, refer to the subsection below entitled *Hard-Drive Machines* . To copy to another diskette in a single-floppy-drive machine (with hard disk),

1. Turn on power to your computer and display.
2. After system boot-up, the DOS prompt should be **C >**
3. Be sure the DOS file *DISKCOPY.EXE* is in the C:\ directory. Then, type **DISKCOPY A: A:**
4. Insert the *source* diskette (your DAS-TEMP Distribution Software diskette) into Drive A. The system will prompt you through the disk copying process. When the source diskette has been copied into memory, the System will ask you to insert the *target* diskette into Drive A. The *target* diskette is a formatted, blank disk that is to be your back-up disk.
5. When a copy is complete, the computer will ask COPY ANOTHER (Y/N)?. Respond by typing **Y** for another diskette or **N** if you are finished copying. If you typed **Y** , repeat Steps 3 and 4.
6. Put the original DAS-TEMP diskette(s) in a safe place. Label the back-up diskette(s) *DAS-TEMP Working Disk* and use for running your DAS-TEMP programs.

Dual-Floppy-Drive Machines

To copy your Distribution Software to the computer's hard disk, refer to the next subsection, *Hard-Drive Machines* . To copy to another diskette(s) in a dual-floppy-drive machine,

1. Turn on power to your computer and display, and place your DOS diskette in Drive A.
2. The DOS prompt should be **A >** If not, type **A:** followed by **< Enter >** . Be sure the diskette in Drive A contains the DISKCOPY.EXE file.
3. Then, type **DISKCOPY A: B:**
4. Insert the *source* diskette (your DAS-TEMP diskette) into Drive A. The system will prompt you through the disk copying process. It will ask you to insert the *target* diskette into Drive B. The *target* diskette is a blank disk that is to be your back-up disk.
5. When a copy is complete, the computer will ask COPY ANOTHER (Y/N)?. Respond by typing **Y** for another diskette or **N** if you are finished copying. If you typed **Y** , repeat Steps 3 and 4.
6. When copying is complete, put the original DAS-TEMP diskette(s) in a safe place. Label the back-up diskette(s) *DAS-TEMP Working Disk* . Use this disk to run the software.

Hard-Drive Machines

To copy your DAS-TEMP files to a hard disk:

1. Start your computer. You should see a prompt, which indicates you are at the DOS level (for example, if your hard drive is designated as *C* , you should see the prompt **C >**).
2. The following instructions create a special directory for the DAS-TEMP Distribution Software files. At the DOS prompt, type: **mkdir DASTEMP** followed by **< Enter >** . Change to the DAS-TEMP directory by typing: **CD DASTEMP** followed by **< Enter >** .
3. Place the Distribution diskette into Floppy Drive A and type **A:** . When the prompt changes from **C >** to **A >** , type **copy *.* C:** followed by **< Enter >**.
4. When a copy is complete, the computer will ask COPY ANOTHER (Y/N)?. Respond by typing **Y** for another diskette or **N** if you are finished copying. If you typed **Y** , repeat Steps 3 and 4.
5. You have now copied the contents of the Distribution Software diskette to your hard disk. Store the original diskette in a safe place.

2.3 UNPACKING AND INSPECTING

After you remove the wrapped board from its outer shipping carton, proceed as follows:

1. Place one hand firmly on a metal portion of the computer chassis (the computer must be turned Off and grounded). You place your hand on the chassis to drain off static electricity from the package and your body, thereby preventing damage to board components.
2. Allow a moment for static electricity discharge; carefully unwrap the board from its anti-static wrapping material.
3. Inspect the board for signs of damage. If any damage is apparent, return the board to the factory.
4. Check the contents of your package against its packing list to be sure the order is complete. Report any missing items to the manufacturer immediately.

You may find it advisable to retain the packing material in case the board must be returned to the factory.

2.4 CONFIGURATION OPTIONS

The subsections that follow describe DAS-TEMP configuration options you may adjust prior to board installation. These options are switch-jumper-selectable and include the following:

- Setting the Base Address.
- Setting the CAL/NORM switch.

Figure 2-1 shows switch and jumper locations for these settings.

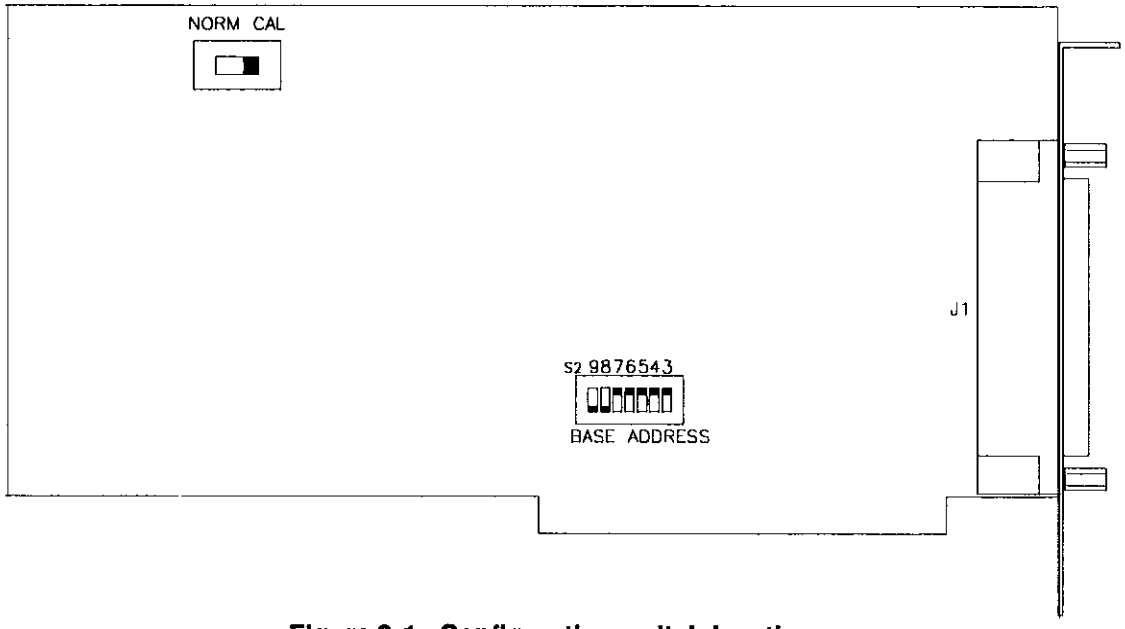


Figure 2-1. Configuration switch locations.

The CAL/NORM Switch

CAL/NORM is a 2-position slide switch that determines whether the Board is configured for calibration or normal operation. The switch should be set to NORM for temperature measurement.

The Base Address Switch

Check the setting of the board's Base Address switch, which is an 8-position DIP switch labelled *S2*. This switch is preset at the factory for an address of 300 Hex.

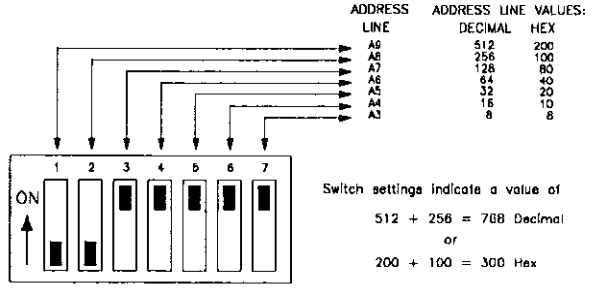


Figure 2-2. Diagram of the Base Address switch (S2).

The factory-preset Base Address of 300 Hex is within the address range shown in the following table as *Reserved*. This default value will function in most computers without conflict, thereby eliminating any need for address selection and configuration. However, if you have a need to change the Base

Address from its preset value, you must select an address within a range of 200 to 3F8 Hex (512 to 1016 Decimal). In addition, the address must be on an 8-byte boundary and must not conflict with addresses already in use for other devices. As an aid to selecting a usable 3-digit Hex number, the following table is an industry-standard I/O address map for the full 000 to 3FF range.

HEX RANGE	USAGE	HEX RANGE	USAGE
000 to 1FF	Internal System	387 to 37F	LPT1:
200 to 20F	Game	380 to 38C	SDLC comm.
210 to 217	Expansion unit	380 to 389	Binary comm. 2
220 to 24F	Reserved	3A0 to 3A9	Binary comm. 1
278 to 27F	Reserved	3B0 to 3BF	Mono dsp/LPT1:
2F0 to 2F7	LPT2:	3C0 to 3CF	Reserved
2F8 to 2FF	COM2:	3D0 to 3DF	Color graphics
300 to 31F	Prototype card	3E0 to 3E7	Reserved
320 to 32F	Hard disk	3F0 to 3F7	Floppy disk
		3F8 to 3FF	COM1:

2.5 HARDWARE INSTALLATION

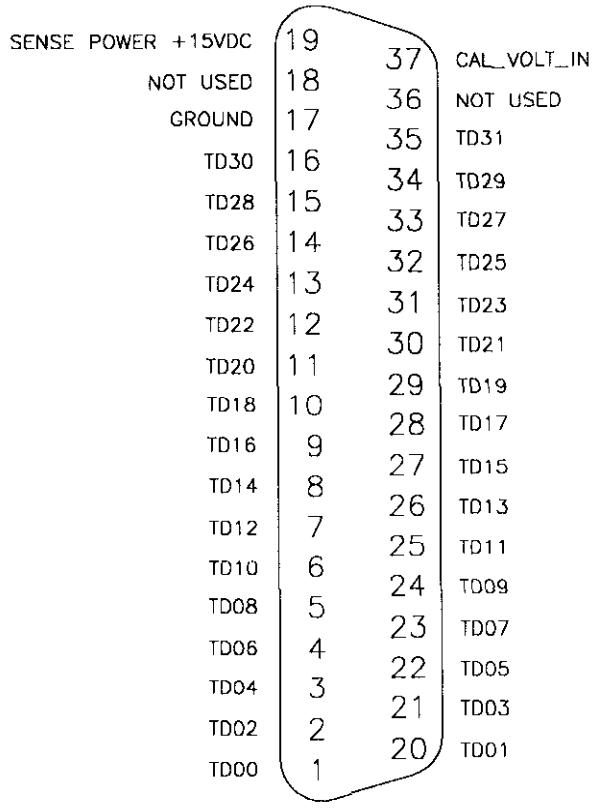
WARNING: ANY ATTEMPT TO INSERT OR REMOVE A BOARD WITH THE COMPUTER POWER ON COULD DAMAGE YOUR COMPUTER!

1. Turn Off power to the PC and all attached equipment.
2. Remove the cover of the PC as follows: First remove the cover-mounting screws from the rear panel of the computer. Then, slide the cover of the computer about 3/4 of the way forward. Finally, tilt the cover upwards and remove.
3. Choose an available option slot. Loosen and remove the screw at the top of the blank adapter plate. Then slide the plate up and out to remove.
4. Hold the DAS-TEMP board in one hand placing your other hand on any metallic part of the PC/AT chassis (but not on any components). This will safely discharge any static electricity from your body.
5. Make sure the board switches have been properly set (refer to the preceding section).
6. Align the board connector with the desired accessory slot and with the corresponding rear-panel slot. Gently press the board downward into the socket. Secure the board in place by inserting the rear-panel adapter-plate screw.
7. Replace the computer's cover. Tilt the cover up and slide it onto the system's base, making sure the front of the cover is under the rail along the front of the frame. Replace the mounting screws.
8. Plug in all cords and cables. Turn the power to the computer back on.

You are now ready to make any necessary system connections, install the DAS-TEMP software, and perform calibration and perform checks on calibration and adjustment, as described in the chapter on calibration.

The manufacturer recommends that you retain the static-shield packaging for possible future removal and handling of the DAS-TEMP board.

2.6 DAS-TEMP I/O CONNECTIONS



■ ■ ■

CHAPTER 3

DRIVER SOFTWARE LOAD/UNLOAD

3.1 GENERAL

Before your DAS-TEMP can be operational, you must load its driver files into computer memory, where they can be active. The driver files, which are included in the Distribution Software, are as follows:

VI.EXE	Virtual Instrument support DOS device driver for parsing and for use with Pop Up screen instruments.
VITASK.EXE	Virtual Instrument support DOS device driver. This driver is for tasking only; it provides no Pop Up support. Use this driver instead of VI.EXE when you do not need Pop Up support and wish to conserve memory space.
MDASTEMP.EXE	DOS callable device driver. This driver, which must be loaded after VI.EXE or VITASK.EXE, enables the ILI (Independent Language Interface), allowing you to use Calls to control DAS-TEMP operation. The ILI supports these Calls in any of several popular programming languages.
PDASTEMP.EXE	DOS Pop Up device driver. This driver supports a visual pop-up interface that allows mouse or keyboard control of the 32 DAS-TEMP channels; it also supports a parsing command interface that allows you to program control of the Pop Up Menu using English-like commands. Use this driver with VI.EXE for Pop-Up Men and Parser support or with VITASK.EXE for Parser support only; either way, you must load VI.EXE or VITASK.EXE first.

In the loading process, you must enter a separate loading instruction for each driver file to be used. The loading instruction must include the following information:

- The file loading command.
- A path to the driver file (if it is not in the computer's normal scan path).
- Any switches for changing default parameters ("hot" keys, Base Address, etc.).

Sections 3.3, 3.4, and 3.5 contain instruction models and information for proper use of the three driver files.

You may use any one of the following interfaces for entering your driver-file loading instructions:

1. Via the AUTOEXEC.BAT file.
2. Via the DOS command line.
3. Via a batch file.

Section 3.6 discusses each of these loading interfaces.

If you wish to clear your DAS-TEMP drivers from computer memory, you may unload them using any one of the following interfaces.

1. Unload by re-booting the computer (only if you do not load via AUTOEXEC.BAT).
2. Unload via the DOS command line.
3. Unload via a batch file.

Section 3.6 discusses each of these unloading interfaces.

To be able to use the DOS **CLS** command, your computer must have an active ANSI.SYS file. Refer to Section 3.8 for information on loading ANSI.SYS.

3.2 SYNTAX CONVENTIONS FOR THIS MANUAL

Syntax for all instruction models in this manual uses the following conventions (*exception:* syntax conventions for Pop-Up-Menu Help Screens are explained in Chapter 4):

path **POGO**.exe */AB = c*

Rules for these conventions are

1. Anything in *Italics* is optional.

2. Anything in **BOLD UPPER CASE** is *mandatory* (plain lower case need not be included in the actual command).

3. Anything in *lower-case italics* is an *optional variable* .

Generally, the available entries for a variable will be listed in the ***Remarks:*** category, immediately below the ***Syntax:*** model.

In the above example, **POGO** is mandatory. *path* is an optional variable; if used, you enter the correct path to POGO.EXE. The instruction could not be executed without these entries. */AB = c* is optional but if used, a value for *c* must be entered.

NOTE that the actual instruction does not require upper case; it may be upper-case, lower-case, or mixed.

As mentioned earlier, the syntax conventions given here do not apply to syntax used in the help screens of the Pop-Up Menu. Help screen syntax conventions are explained in Chapter 4.

3.3 LOAD/UNLOAD INSTRUCTIONS FOR VI.EXE OR VITASK.EXE

Use VI.EXE to support all DAS-TEMP software and pop-up functions; use VITASK.EXE only when Pop Up Menu functions are not needed. Syntax for loading/unloading the VI.EXE or VITASK.EXE driver file is as follows:

path **VI**.exe *MONO /HK = x /MK = m /SK = s /U*

or

path **VITASK**.exe *MONO /HK = x /SK = s /U*

where

path — DOS path to VI.EXE or VITASK.EXE. Example: **C:\DASTEMP**

MONO — Optional command (for VI.EXE only) for computers with monochromatic displays. If *MONO* is not specified, *COLOR* is assumed.

/HK = x — Help Key switch (for VI.EXE only): to specify your choice of key(s) for bringing up the Help Screen (while the Pop-Up Menu is active. The default Help Keys are **< Alt > + < H >**.

x is one, two, or three keys, as follows:

(1) One key: any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**;

(2) Two or three keys: it can be a combination of the **< Ctrl >** and/or **< Alt >** key(s) plus any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**.

Note that your entry must be spelled out. For example, entering **/HK = F1** assigns the function key **< F1 >** to be the Help Key. Or entering **/HK = Ctrl D** specifies that the **< Ctrl >** and **< D >** keys must be pressed at the same time to bring up the Help screen.

/MK = m — Mode Select Key switch (for VI.EXE only): to specify whether the Pop-Up Menu is to be Keyboard or a Mouse operated. The default Mode Select keys are **< Alt > + < M >**. Using the Mode Select key combination switches the Pop-Up Menu into Keyboard mode; from there, you press **< Esc >** to enter Mouse mode.

m is one, two, or three keys, as follows:

(1) One key: any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**;

(2) Two or three keys: it can be a combination of the **< Ctrl >** and/or **< Alt >** key(s) plus any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**.

Note that your entry must be spelled out. For example, entering **/MK = F8** assigns the function key **< F8 >** for Mode Select. Or entering **/MK = Ctrl T** specifies that the **< Ctrl >** and **< T >** keys must be pressed at the same time to bring up the Help screen.

/SK = s Instrument Select Key switch (for VI.EXE only): if you have other DAS-TEMP boards installed in your computer, this switch enables you to toggle between Pop-Up Menus of each instrument for the HELP function or for Mode selection of Keyboard input. The default Instrument Select key is **< Alt > + < Tab >**.

s is one, two, or three keys, as follows:

(1) One key: any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**;

(2) Two or three keys: it can be a combination of the **< Ctrl >** and/or **< Alt >** key(s) plus any choice of **< A >** through **< Z >**, **< F1 >** through **< F10 >**, **< 0 >** through **< 9 >**, or **< Tab >**, **< Esc >**, or **< ? >**.

Note that your entry must be spelled out. For example, entering **/SK = F3** assigns the function key **< F3 >** as the Mode Select key. Or entering **/SK = Ctrl S** specifies that the **< Ctrl >** and **< S >** keys must be pressed at the same time to bring up the Help screen.

/U Unload switch: when VI.EXE or VITASK.EXE is already active and you wish to de-activate it (unload it from memory), you use only this switch in your instruction. For example, using the example path given above your unload instruction will be

C:\DASTEMP\VI /U or **C:\DASTEMP\VITASK /U**

NOTE, however, that before you can unload VI.EXE or VITASK.EXE, you must first unload MDASTEMP.EXE or PDASTEMP.EXE or both (in any order).

An example instruction for VI.EXE is as follows:

```
C:\VI.EXE /HK = Alt X  /MK = Alt Y  /SK = Alt Z
```

You would enter this instruction at the DOS command line or into the AUTOEXEC.BAT file. This instruction specifies the following:

- VI.EXE is in the root directory of the C Drive
- Color monitor
- Help keys are **< Alt > + < X >**
- Mode Select keys are **< Alt > + < Y >**
- Instrument Select keys are **< Alt > + < Z >**.

When this instruction for loading VI.EXE is executed, the computer will respond with the following display:

```
******     VI.EXE  Rev 3.02
                o HELP KEY is ALT X
                o INSTRUMENT SELECT KEY is ALT Z
                o MODE SELECT KEY is ALT Y
```

An example instruction for VITASK.EXE is as follows:

```
C:\vitask
```

You would enter this instruction at the DOS command line or into the AUTOEXEC.BAT file. This instruction specifies that VITASK.EXE is in the root directory of the C Drive. When this instruction for loading VITASK.EXE is executed, the computer will respond with the following display:

```
******      VITASK.EXE  Rev 3.02
```

3.4 LOAD/UNLOAD INSTRUCTIONS FOR MDASTEMP.EXE

Use the following syntax to enter a loading instruction for MDASTEMP.EXE:

NOTE: Before you can load MDASTEMP.EXE, you must load VI.EXE or VITASK.EXE (with MDASTEMP.EXE, using VITASK.EXE is the recommended choice because it uses less memory).

path **MDASTEMP**.exe */BA = **b** /U*

The elements of this model are explained as follows (note that if you do not use the switch */BA* , its default value is assumed):

path — DOS path to MDASTEMP.EXE. Example: C:\DASTEMP\

*/BA = **b*** — Base Address: The Base Address setting for the instrument being loaded (refer to base-address selection, in Chapter 2). The default Base Address is &H300 (768 decimal).

b is the Base Address value. Either hex or decimal values are acceptable; however, if they are given in hex they must be preceded by an ampersand (&) and an H (for example, **&H300**). Make certain that the Base Address you enter has not been already assigned to another device.

/U — Unload switch: when MDASTEMP.EXE is already active and you wish to de-activate it (unload it from memory), you use only this switch in your instruction. For example, using the example path given above your unload instruction will be

```
C:\DASTEMP\MDASTEMP /U
```

NOTE that you must unload MDASTEMP.EXE (and PDASTEMP.EXE, if used) before VI.EXE or VITASK.EXE.

An example instruction for MDASTEMP.EXE is as follows:

```
C:\dastemp\MDASTEMP  /ba = &h300
```

You would enter this instruction at the DOS command line or into the AUTOEXEC.BAT file. This instruction specifies the following:

- MDASTEMP.EXE is in the DASTEMP directory of the C Drive
- Base Address is 300 Hex

When this instruction for loading MDASTEMP.EXE is executed, the computer responds with the following display.

```
****** MDASTEMP.EXE  Rev 1.00
               o Base Address is 0300 Hex

Number Of Bytes Used By Device : 11056
At Memory Segment  [215B]
```

3.5 LOAD/UNLOAD INSTRUCTIONS FOR PDASTEMP.EXE

Use the following syntax to enter a loading instruction for PDASTEMP.EXE:

NOTE: Before you can load PDASTEMP.EXE, you must first load VI.EXE or VITASK.EXE (load VI.EXE only if you require pop-up support, as VITASK.EXE uses less memory).

path **PDASTEMP**.exe */PK = p /BA = b /NAME = n /U*

The elements of this model are explained as follows (note that if you do not use the switches */PK* , */BA* , or */NAME* , their default values are assumed):

path — DOS path to PDASTEMP.EXE. Example: **C:\DASTEMP**

/PK = p — Pop-Up Menu Hot Key switch: when the number of installed PCIP boards is greater than one, each instrument should be assigned its own Pop-Up key. The default Pop-Up Menu hot key is **< Ctrl > < F8 >** .

p is one, two, or three keys, as follows:

(1) One key: any choice of **< A >** through **< Z >** , **< F1 >** through **< F10 >** , **< 0 >** through **< 9 >** , or **< Tab >** , **< Esc >** , or **< ? >** . Note that in working with a single key, the key you choose will be unusable for any other function while CALL.EXE is loaded; you might therefore want to confine your single-key choice to one of the function keys (**< F1 >** through **< F10 >**).

(2) Two or three keys: it can be a combination of the **< Ctrl >** and/or **< Alt >** key(s) plus any choice of **< A >** through **< Z >** , **< F1 >** through **< F10 >** , **< 0 >** through **< 9 >** , or **< Tab >** , **< Esc >** , or **< ? >** .

Note that your entry must be spelled out. For example, entering /PK = F3 assigns the function key **< F3 >** for Mode Select. Or entering /PK = Ctrl P specifies that the **< Ctrl >** and **< P >** keys must be pressed at the same time to bring up the Help screen.

/BA = b Base Address: the Base Address setting for the instrument being loaded (refer to base-address selection, in Chapter 2). The default Base Address is &H300 (768 decimal).

b is the Base Address value. Either hex or decimal values are acceptable; however, if they are given in hex they must be preceded by an ampersand (&) and an H (for example, **&H300**). Make certain that the Base Address you enter has not been already assigned to another device.

/NAME = n Used when the number of installed DAS-TEMP boards is greater than one and you wish to display the pop-up screens for any two of the boards. **You must enter a PDASTEMP.EXE command for both boards--to give each board a unique Pop-Up Key, Base Address, and Name.**

n is the name you enter for one board; it must be 1-8 characters. Any of the following characters are acceptable: < **A** > through < **Z** >, < **0** > through < **9** >, < **$** >, < **&** >, < **#** >, < **@** >, < **!** >, < **%** >, < **(** >, < **)** >, < **-** >, < **{** >, < **}** >, < **_** >. Note that /, \, and * are illegal.

The name you enter will appear in the upper-left corner of the Pop-Up Menu. The device opened when programming will be the same name.

/U Unload switch: when PDASTEMP.EXE is already active and you wish to de-activate it (unload it from memory), you use only this switch in your instruction. For example, using the example path given above your unload instruction will be

```
C:\DASTEMP\PDASTEMP /U
```

An example instruction for CALL.EXE is as follows:

```
C:\DasTemp\Pdastemp /pk = Alt x
```

You would enter this instruction at the DOS command line or into the AUTOEXEC.BAT file. This instruction specifies the following:

- PDASTEMP.EXE is in the DASTEMP directory of the C Drive
- Pop-Up Menu keys are < **Alt** > + < **X** >

When your instruction for loading PDASTEMP.EXE is executed, the computer responds by returning the following display.

```
****** PDASTEMP.EXE  Rev 1.00
                o POP UP KEY is ALT X
                o Base address is 0300 Hex

Number Of Bytes Used By Device: 39488
At Memory Segment  [215B]
```

3.6 DRIVER-FILE LOADING/UNLOADING INTERFACE OPTIONS

General

As explained in Section 3.1, loading and unloading interface options for your driver-file instructions are

- Via the AUTOEXEC.BAT file (for loading only).
- Via the command line.
- Via a batch file.

When you load via the AUTOEXEC.BAT file, your driver files become active at each computer boot-up. The files remain active until you unload them or shut down the computer. If you unload the files and then wish to re-activate them, you must reload via the command line or a batch file. To load via the AUTOEXEC.BAT file, you must first modify AUTOEXEC.BAT to include the full loading instruction for each driver file. You may use a text editor or word processor to modify AUTOEXEC.BAT (refer to *Text Editing*); or you may use the TMPSETUP.EXE program from your Distribution Software (refer to Section 3.6). Be sure to insert your instructions in the correct order (refer to *Loading/Unloading Order*).

Loading/unloading via the DOS command line allows you to activate and de-activate the driver files on an as-needed basis. This option also allows you to change your switch parameters with each loading. The drawback to this option is that it can be tedious, especially when your entry contains an error. Drivers loaded from the DOS command line may be unloaded from the command line, or they may be unloaded by rebooting the PC.

Loading and unloading via batch files also allows you to activate and de-activate your driver files on an as-needed basis. However, you are confined to a single set of switch parameters unless you modify your start-up file or you have additional batch files. You require a batch file for loading and another for unloading. Use a text editor or word processor to make your batch files and be sure you insert your instructions in the correct order (refer to *Loading/Unloading Order*).

Loading/Unloading Order

Proper loading order for the Callable Driver:

First, load **VI.EXE** or **VITASK.EXE**
Then, load **MDASTEMP.EXE**

Proper loading order for the Pop-Up Driver:

First, load **VI.EXE** or **VITASK.EXE**
Then, load **PDASTEMP.EXE**

Proper unloading order for the Callable Driver:

First, unload **MDASTEMP.EXE**
Then, unload **VI.EXE** or **VITASK.EXE**

Proper unloading order for the Callable Driver:

First, unload **PDASTEMP.EXE**
Then, unload **VI.EXE** or **VITASK.EXE**

Text Editing

Your AUTOEXEC.BAT, CONFIG.SYS, and batch files should contain only unformatted, ASCII characters. Thus, to make or modify these files, you must use a simple text editor or a word processor that can save unformatted files.

To make one of these files, start it as a new document. Enter your instructions (complete with path and any switches) one-per-line in proper order (from top to bottom). When your entries are complete, perform a *save*. You will be prompted to enter a document name. Enter **AUTOEXEC.BAT** or **CONFIG.SYS**, as required; or if your document is to be a batch file, enter your choice of name such as **DTLOAD.BAT** or **DTUNLOAD.BAT**.

3.7 MODIFYING AUTOEXEC.BAT WITH TMPSETUP.EXE

If you prefer not to modify the AUTOEXEC.BAT file directly, you may use the DAS-TEMP Setup program. This is a self-explanatory program contained in the DAS-TEMP software package.

Before you begin any DAS-TEMP programs, make certain that both the software and hardware are correctly installed. Note the Base Address switch setting (set according to instructions in Chapter 2) for later reference. Then, change to the directory containing your DAS-TEMP software. At the DOS prompt, type **TMPSETUP <Enter>**

3.8 LOADING ANSI.SYS

ANSI.SYS is generally included with the files in your computer's DOS software package. To activate ANSI.SYS, you must modify your computer's CONFIG.SYS file to include an instruction that will load it into system memory. Your instruction must use the syntax of the following model:

DEVICE = *path* **ANSI.SYS**

For example, if ANSI.SYS is in a directory called *DOS* on the D Drive, your instruction would be

```
DEVICE=D:\DOS\ANSI.SYS
```

Remember that when you alter a CONFIG.SYS file, you must re-boot before the new changes can take effect. ■

CHAPTER 4

MENU OPERATION

4.1 GENERAL

With the DAS-TEMP Pop Up drivers loaded and the Pop Up "hot keys" entered, the Main Menu appears on the screen. From the Main Menu, you can switch to the Logging Menu or the All Channels Menu using either the keyboard or a mouse. This chapter describes each of the three menus and their control parameters.

4.2 ACCESS TO POP-UP MAIN MENU

As soon as your DAS-TEMP driver files (VI.EXE and PDASTEMP.EXE) are loaded (Chapter 3), you may toggle the Pop-Up Menu on and off the screen using the Pop-Up Menu hot key(s). The default hot keys are < **Alt** > < **F2** > ; to select your own hot key(s), refer to the driver-file loading procedures in Chapter 3. The Main Menu appears as shown in Figure 4-1.

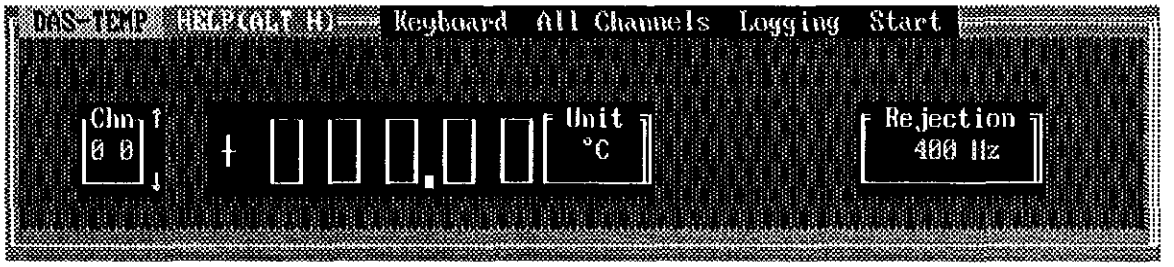


Figure 4-1. Main Pop-Up Menu for DAS-TEMP.

To access the Help Screens, press < **Alt** > < **H** >. To exit the Pop-Up Menu at any time, press < **Esc** > once (or more, if needed to clear any Menu highlights); then press the Pop-Up Menu hot key(s) (default is < **Alt** > < **F2** >) to pop-down the Menu.

4.3 THE POP-UP HELP SCREEN

Access

While the Pop-Up Menu is onscreen, you can summon the Help Screen by pressing the Help Screen hot key(s). The default hot keys are < **Alt** > < **H** > ; to select your own hot key(s), refer to the driver-file loading procedures in Chapter 3. Use the Help Screen to look up hot keys and programming instructions. Press < **Esc** > to exit the Help screen.

Syntax Conventions Used In The Help Screens

Commands listed in the Help Screen use syntax conventions that differ from those used elsewhere in this manual. Conventions for Help Screen commands are as follows:

- Upper case signifies *mandatory*. All upper-case characters must be entered for execution of the command. Lower-case characters are shown for clarity but need not be entered.
- Curly brackets { } signify *optional*. Anything inside curly brackets is not essential to execution of the command.
- Square brackets [ ] signify *selection*. You must select one of the choices inside the brackets. Each choice is separated by a comma.

An example of these conventions is as follows:

{ SEt } DEgrees [C, F]

To execute this command, you entry must include **de c** or **de f**. Note that your actual entry may use upper-, lower-, or mixed-case lettering.

4.4 MAIN MENU MOUSE/KEYBOARD CONTROL

DAS-TEMP responds to mouse or keyboard, or it can be switched between both. If DAS-TEMP detects a mouse, it defaults to mouse control with each call of the Pop-Up Menu.

Select keyboard control by pressing the Mode Select hot key(s) (default hot keys are **< Alt > < M >**). To select your own hot key(s), refer to the driver-file loading procedures in Chapter 3. The highlight on *Keyboard* signifies that keyboard control is active. Press **< Enter >** to complete the selection, and then follow the instructions at the bottom of the Main Menu for further choices.

Return to mouse control by pressing **< Esc >**.

4.5 MAIN MENU CONTROL FUNCTIONS

Control-Bar Functions

The Main Menu Control Bar contains the following functions, as shown in Figure 4-1:



Window-Box Functions

The Main Menu contains three window boxes containing controllable functions. These boxes are identified by the labels **Chn**, **Unit**, and **Rejection**, as shown in the following diagram.



Access To The Control Functions

To select a Control Bar function by mouse, move the cursor onto the Function and click (right or left). Similarly, to select a window box function, move the cursor into the desired window box and click (right or left).

To select a Control Bar function by keyboard, select Keyboard control (per Section 4.4) and step the cursor through the Control Bar Function List using the < ← > and < → > cursor keys. Press < **Enter** > to complete your selection. To enter the Main Menu window boxes, place the cursor on **Keyboard** and press < **Enter** > ; then follow directions at the bottom of the Main Menu for further choices.

4.6 DESCRIPTIONS OF THE FUNCTIONS & SUBMENUS

Control-Bar Functions & Submenus

Keyboard

...activates keyboard control of all DAS-TEMP functions. To exit from this mode, press < **Esc** > .

All Channels

...switches to the **All Channels** Menu, as shown in Figure 4-2.

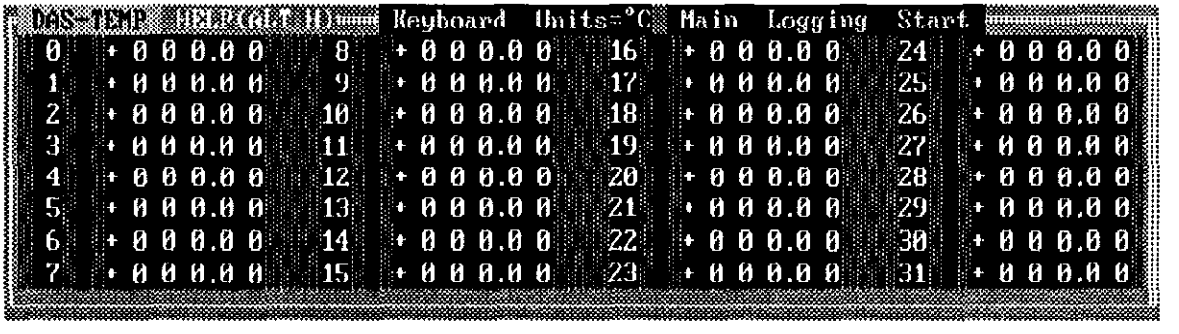


Figure 4-2. *All Channels* menu.

This Menu displays readouts for all 32 channels simultaneously, while its Control Bar offers

Keyboard Units=°C Main Logging Start

If you are in the mouse control mode,

...Clicking on **Keyboard** switches you to keyboard control.

...Clicking on **Units°C** switches your temperature measurements from Celsius to Fahrenheit, which will be indicated by **Units=°F** .

...Clicking on **Main** switches you back to the Main Menu.

...Clicking on **Logging** switches you to the Logging Menu, described below under *Logging* .

...Clicking on **Start** commences measurements, as described below under *Start* .

An additional feature of the **All Channels** Menu is the Channel Log On/Off capability. Using mouse or keyboard, you can move the cursor to the blank area between each channel number and adjacent temperature readout box to click the channel On or Off the logging list. A √ symbol signifies that a channel is on the logging list.

Logging

...switches to the Logging Menu, shown in Figure 4-3.

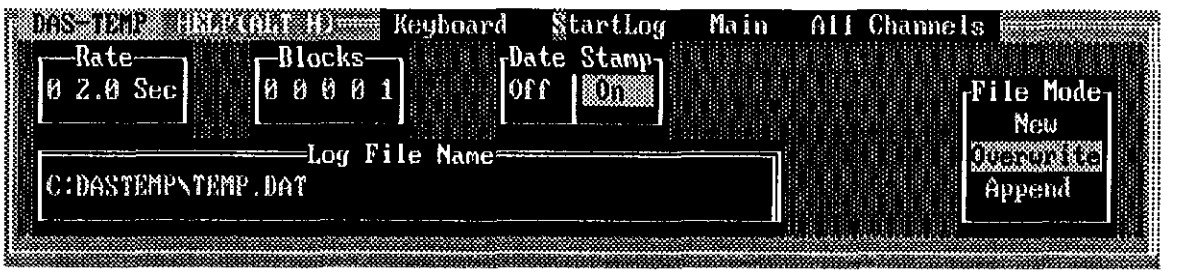


Figure 4-3. *Logging* Menu.

This menu gives you control of the logging functions. Its Control Bar offers

Keyboard StartLog Main All Channels

If you are in the mouse control mode,

...Clicking on **Keyboard** switches you to keyboard control.

...Clicking on **StartLog** toggles between **StartLog** and **StopLog** , switching On the DAS-TEMP logging function for all channels indicated in the All Channels Menu. While the logging function is On, **StopLog** appears in the control bar of the Logging Menu.

...Clicking on **Main** switches you back to the Main Menu.

...Clicking on **All Channels** switches you to the All Channels Menu.

Within the Logging Menu, you can specify **Rate** , **Blocks** , **Date Stamp** , **File Mode** , and **Log File Name** . **Rate** allows you to set the scanning rate, in seconds. **Blocks** lets you specify the number of blocks to be scanned. **Date Stamp** gives you the choice of dating your scanning

samples. **File Mode** allows you to specify whether the new scanning data is to be a new Log File, an overwrite of an existing Log File, or an addition to an existing Log File. **Log File Name** provides a space for entering the path and name of the Log File to be used for recording your data.

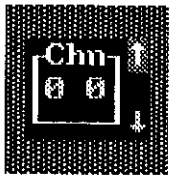
Start

...starts measurements for the selected channel (the channel listed in the Chn Box; see *Chn* , below). While measurements are underway, **Stop** is displayed in the control bar.

Window-Box Functions

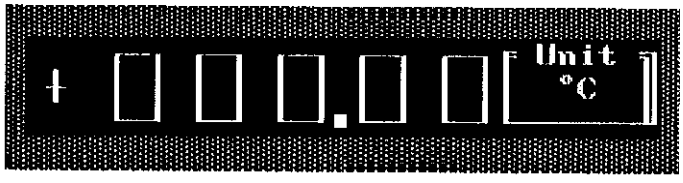
Three separate windows across the center of the Main Menu allow you to monitor any one of the 32 input channels. The use of these windows is discussed below under the headings of *Chn* , *Unit* , and *Rejection* .

Chn



This window (shown at right) contains a display showing the number of the selected channel (0 - 31). To select a channel number in keyboard mode, you enter the desired channel number via the keyboard. To select a channel number in mouse mode, you click on the *up* or *down* arrow to step the display one channel number at a time through the full range of channel numbers (in the adjacent illustration, mouse cursor is on the *up* arrow).

Unit



This window contains a 6-place readout of the polarity and temperature value of the selected channel. The **Unit** box indicates whether the temperature value is in °C or °F. Clicking on **Unit** toggles the readout between °F or °C.

Rejection



This window displays the value for NMR (Normal Mode Rejection). Clicking on **Rejection** steps you through frequencies of 400, 60, and 50Hz. ■

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CHAPTER 5

CALL MODES

5.1 GENERAL

In each of the following CALL MODE discussions, usage explanations include the following subheadings:

- *Parameters:*
- *Error Codes:*

DAS-TEMP callable functions are Language Independent Functions that can be called from BASIC, C, PASCAL, or FORTRAN. Each of nine callable functions (MODE 0 through MODE 8) passes a pointer to its parameter (PARAMS) list, which you initialize with your choice of parameter values before each call. Once you initialize your parameter lists, you may write a CALL statement such as the following:

```
Params(1)=0;
CALL MODE5(PARAMS)
```

This statement calls MODE 5 and passes a pointer to PARAMS. For more detailed program examples, refer to your Distribution Software.

5.2 MODE 0: INITIALIZE THE DAS-TEMP

This mode initializes the board's hardware registers and subsystems to the values established by your parameter list

MODE 0 Parameters:

Params(0) =	0 (returns Error Code, if any).
Params(1) =	Enter a value for Base Address in Dec or Hex.
Params(2) =	Enter a value for Interrupt Level (enter 0 for None, or enter 2 - 7).
Params(3) =	Enter a value for temperature scale (0 for °C; 1 for °F).
Params(4) =	Enter a value for Rejection Code (0 = 400; 1 = 60; 2 = 50).

MODE 0 also sets the following defaults: Channels = 0 to 31; Trigger Source is Software Strobe.

MODE 0 Error Codes:

0 = No Error

1 = Board NOT at selected Address

2 = Board is in CALIBRATE mode

3 = Interrupt Level <> 0 or < 2 or > 7

4 = Base Address out of range

5 = Invalid Rejection Code

6 = Invalid Unit

5.3 MODE 1: SET CHANNEL SCAN LIST

This call sets up a scan list to be used by modes 3 and 6. If MODE 1 is not called, MODEs 3 and 6 assume the scan of Channels 0-31.

MODE 1 Parameters:

PARAMS(0) = 0 (returns Error Code, if any).

PARAMS(1) = Enter a value for segment of Scan List, or enter -1 to signify a BASICA segment (to be used only with BASICA).

PARAMS(2) = Enter a value for Offset of Scan List.

MODE 1 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

5.4 MODE 2: READ CURRENT CHANNEL & INTERRUPT STATUS

Use this mode in conjunction with MODEs 4 and 6 to monitor interrupt status.

MODE 2 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Return a value (2 - 7) for Interrupt Level.

Params(2) = Return a value (0 - 65535) for Scan or Word Count.

Params(3) = Return a value (0 - 31) for Current Channel.

Params(4) = Return a value (0 = Complete; 1 = Active) for Interrupt Status.

Params(5) = Return a value for temperature scale (0 = °C; 1 = °F).

MODE 2 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

11 = Interrupts NOT enabled.

5.5 MODE 3: PERFORM A MULTI-CHANNEL SCAN

This Call performs a multi-channel scan using the default Channel List (0 - 31). If MODE 1 was called, the user-selected Scan List is used.

MODE 3 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Enter a value for segment of Data Array, or enter -1 to signify a BASICA segment (to be used only with BASICA).

Params(2) = Enter a value for Data Array Offset.

Params(3) = Enter a value for temperature scale (0 = Celsius; 1 = Fahrenheit).

NOTE: To determine the actual temperature, divide the saved value by 10.

MODE 3 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

5.6 MODE 4: PERFORM SINGLE-CHANNEL ON-BOARD TIMER SCAN

In addition to performing a single-channel Timer Scan, this mode then follows with a transfer of the data to an array, on Interrupt.

MODE 4 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Enter a value for the Channel Number (0 - 31).

Params(2) = Enter a value for segment of Data Array, or enter -1 to signify a BASICA segment (to be used only with BASICA).

Params(3) = Enter a value for Data Array Offset.

Params(2) = Enter a value for the number of scans.

NOTE: To determine the actual temperature, divide the saved value by 10.

MODE 4 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

11 = Interrupts NOT enabled.

13 = Invalid number of scans (must be > 0).

5.7 MODE 5: PERFORM A SINGLE-CHANNEL SCAN

This call performs a single scan of the selected channel and returns data in Params(2).

MODE 5 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Enter a value (0 - 31) for the Channel Number to be scanned.

Params(2) = This parameter calls for data to be returned.

Params(3) = Enter a value for temperature scale (0 = Celsius; 1 =Fahrenheit).

NOTE: To determine the actual temperature, divide the value returned for Params(2) by 10.

MODE 5 Returns:

0 = No Error.

7 = Driver NOT initialized.

10 = Illegal Channel (< 0 or > 31).

5.8 MODE 6: PERFORM A MULTIPLE-CHANNEL SCAN

This mode performs a multiple-channel scan using the on-board timer. If MODE 1 was not called, use the default Scan List. If MODE 1 was called, use the user-selected Scan List. Transfer data to an array on Interrupt.

MODE 6 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Entering a 0 = Don't Cycle; entering a value > 0 specifies the Number of Cycles.

Params(2) = Enter a value for Segment of Data Array.

Params(3) = Enter a value for Offset of Data Array.

NOTE: To determine the actual temperature, divide the saved value by 10.

MODE 6 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

11 = Interrupts NOT enabled.

5.9 MODE 7: SET PRESCALER FREQUENCY & COUNTER TIMER 2

NOTE: Run this mode before any of the Interrupt-driven modes.

This mode sets up the Prescaler, which generates the input Frequency for the on-board Timer Counter 2. Counter 2 divides this input frequency down, allowing Interrupts to be generated every 4us to 17.9s.

The following list contains the Prescaler Frequency Codes:

0 = Prescaler Inactive
1 = Prescaler Inactive
2 = 500 KHz
3 = 250 KHz
4 = 125 KHz
5 = 62.50 KHz
6 = 31.25 KHz
7 = 15.625 KHz
8 = 7.812 KHz
9 = 3.906 KHz
10 = 1.953 KHz
11 = 976.56 Hz
12 = 488.28 Hz
13 = 244.14 Hz
14 = 122.07 Hz
15 = 61.01 Hz

MODE 7 Parameters:

Params(0) = 0 (returns Error Code, if any).

Params(1) = Enter a value (0 - 15 from above list) for the Prescaler Frequency Code.

Params(2) = Enter a value (0 - 65535) for the Counter 2 divide-down.

MODE 7 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

11 = Interrupts not enabled.

12 = Counter 2 Value (< 2).

5.10 MODE 8: DISABLE INTERRUPTS & RESET INTERRUPT VECTORS

MODE 8 Parameters:

PARAMS(0) = 0 (returns Error Code, if any).

MODE 8 Error Codes:

0 = No Error.

7 = Driver NOT initialized.

11 = Interrupts NOT enabled.

5.11 CALLABLE EXAMPLE PROGRAMS

Your Distribution Software contains callable example programs with information on using the calls from C, PASCAL, BASIC, and FORTRAN. ■

CHAPTER 6

PARSER COMMAND SET

6.1 GENERAL

If you prefer to write your control programs with parsable commands, the Distribution Software facilitates your task by incorporating an Independent Language Interface (ILI) in the DAS-TEMP driver files. ILI enables you to write your DAS-TEMP commands as simple ASCII statements and to work these commands into a program in any of several popular languages.

This chapter describes the ASCII commands you can use with the ILI feature. The description of each command covers function, syntax, and options for the command variables. There are also examples of use. In addition, the Distribution Software contains the program TEMPCMD.BAS to enable you to test your commands. To run TEMPCMD.BAS, load and run TEMPCMD.BAS from BASIC (with your BASIC interpreter in the same directory, type **BASIC TEMPCMD.BAS**).

The chapter also contains a procedure for incorporating ASCII commands into a program, and it gives sample programs written in C and BASIC. Additional programming examples and a few helpful hints for users writing in Pascal, C, Turbo Pascal, Turbo C, or other languages can be found in the Appendix.

The latter portion of this chapter covers programming considerations. This portion includes useful reference information.

If you require more specific control over DAS-TEMP, you can find low-level programming information in Chapter 7 and register descriptions in Chapter 8. Note, however, that the descriptions are only outlines of register functions.

While user programming is a means for customizing and automating DAS-TEMP control, you are urged to make the best use of the DAS-TEMP device driver before exploring customization.

6.2 OPENING THE DEVICE DRIVER FILE

While writing your program, your instruction for opening the ILI Parser Driver requires the appropriate file-open command and the filename. If you are working with a single board, your filename will be *$TMPPOP*. If you are working with two or more boards and the */NAME = n* switch was used for each board, you must use your assigned name preceded by a dollar sign to open the driver for each board. For example, if you loaded **PDASTEMP /Name = CARD-X** for one of the boards, your file-open command to open the driver for that board will use the filename *$CARD-X*. After being opened, the ILI Driver will respond to your language's Print or Write instructions to pass your ASCII commands to the DAS-TEMP board. For example: if your language is BASIC, you write your ASCII commands to the board using **PRINT**, and you read from the board using **INPUT**.

If errors occur, the DAS-TEMP device driver returns an error code, an error description, and the command line where the error occurred. Refer to Section 6.4 for error messages.

The following subsection contains an example of opening the ILI Driver file and performing reads and writes in BASIC. Section 6.2.2 conatins a similar example in C. (Appendix C also includes helpful hints on how to open, write to, read from, trap errors, and close the instrument drivers from Pascal, C, Turbo-Pascal and Turbo-C.)

Opening the Driver File--in BASIC

The following program is an example of opening the DAS-TEMP driver file using BASIC.

```
010   CLS
020   ON ERROR GOTO 330
030   OPEN "$TMPPOP" FOR OUTPUT AS #1
040   PRINT #1, "CLEAR"
050   OPEN "$TMPPOP" FOR INPUT AS #2
060   '
100   'SAMPLE SET COMMAND
110   PRINT #1, "SET CHANNEL 5"
120   PRINT #1, "SET DEGREES C"
.
.
.
200   'SAMPLE READ COMMAND
210   PRINT #1, "READ TEMP 5"
220   INPUT #2, T
230   CLS
240   LOCATE 10,10
250   PRINT "CHANNEL 5 TEMP = ";T
260   'NORMAL EXIT
270   SYSTEM
.
.
.
300   '
310   'Error Handler
320   '
330   BEEP
340   PRINT #1, "HIDE"
350   INPUT #2,EN : LINE INPUT #2, A$ : LINE INPUT #2, B$
360   PRINT "DAS-TEMP Error number ";EN
370   PRINT "ERROR - "A$
380   PRINT "On command line of ...";B$
390   PRINT "Strike any key to continue"
400   IF INKEY$=" " GOTO 400
410   CLS
420   RESUME 90
```

Opening the Driver File--in C

The following program is an example of opening the TEMP driver file using C.

```
FILE *DASTEMP;
char ErrMess1[200], ErrMess2[200]
int ErrNum;

main();
   {
     if ((DASTEMP = fopen("$TMPPOP","r+"))==NULL)
     printf("Could not find device DAS-TEMP");
     if (!(fputs("Set Channel 5",DASTEMP)GetError();
     if (fflush(DASTEMP == EOF) Get Error();
...
...
...
}
void  GetError()                    /* retrieve error number and
                                       error message from device*/
   {
     rewind(DASTEMP);
     fscanf(DASTEMP,"%d",ErrNum):    /* get error number */
     fgets(ErrMess1,80,DASTEMP);     /* get error message 1 */
     fgets(ErrMess2,80,DASTEMP);     /* get error message 2 */
     rewind(DASTEMP);
     printf("ERROR Number %d", ErrNum);
     printf("ERROR - %s", ErrMess2);
     printf("On command line of ...%s", ErrMess1);
   }
```

6.3 COMMAND TYPES

With the ILI Driver file open, you can use three types of ASCII commands for reading and writing to DAS-TEMP, as follows:

1. **SET** commands set the measurement type, such as trigger level and slope, coupling, input attenuation etc. For example, the command **SEt LOG ALl** selects all 32 channels for logging.
2. **READ** commands call for reading data from DAS-TEMP. For example, the command **REad TEmp 5** requests a return of the temperature for Channel 5.

   After the **REad** command is sent, the value or data to be read is retrieved via an **INPUT** command (in BASIC), or a standard File-Read command in other languages.
3. **Single Word** commands; several single-word commands are available for additional set-up and control applications. Examples of these include the Show command (which summons the Pop-Up Menu) and the Hide command (which removes the Pop-Up Menu from view).

6.4 COMMAND USAGE

Rules for command usage are as follows:

1. Multiple commands may appear on one command line.
2. The ILI is not case-sensitive: commands may be in uppercase, lowercase, or mixed.
3. Incorrect spellings are unacceptable and can lead to no action or wrong action.

The following are examples of legal input lines:

Set Channel 31 **Set Degrees C** **Read Chan 31**	Commands can be combined.
ReAd cHannEL **hiDE**	Note that case does not matter.
SE ch 31 **re Ch 31**	Commands can be abbreviated.

Examples of illegal commands are as follows:

Set Dfg On	Words must be correctly spelled.
Set chan 43	43 is not a valid variable.

6.5 COMMAND DESCRIPTIONS

Commands presented in this chapter are described in terms of Syntax, Action, Remarks, and Example. Explanations for each of these categories is as follows:

Syntax: Syntax for all command models use the conventions illustrated by the example

SEt **CH**annel **n**

Rules for these conventions are

1. Anything in *Italics* is optional.

2. Anything in **BOLD UPPER CASE** is *mandatory* (plain lower case need not be included in the actual command).

3. Anything in **bold lower case** is a *mandatory variable*; it requires a value or statement. Generally, the available entries for a variable will be listed in the Remarks category, immediately below the command model.

In the above example, **CH** and a value or statement for **n** are mandatory. The instruction could not be executed without these entries. *SEt* is optional; and if used, only SE is required.

NOTE that the actual instruction does not require upper case; it may be upper case, lower case, or mixed.

Remarks: Furnishes values for variables, and\or gives any other pertinent information.

Action: Summarizes what the command achieves.

Example: Sample of typical use of the command.

6.6 LIST OF COMMANDS

SET Commands

SET CHANNEL n

Syntax: *SEt* CHannel **n**

Remarks: Where **n** = 0 to 31.

Action: Selects the channel to be displayed.

Example: **CH 8**

SET DEGREES s

Syntax: *SEt* DEgrees **s**

Remarks: Where **s** is **C** for Celsius or **F** for Fahrenheit.

Action: Sets the temperature scale to Celsius or Fahrenheit.

Example: **se de f**

SET REJECTION n

Syntax: *SEt* REJection **n**

Remarks: Where **n** = 400, 60, or 50.

Action: Sets the NMR (Normal Mode Rejection) frequency.

Example: **Set Rej 400**

SET LOGFILE filename

Syntax: *SEt* LOGFILE **filename**

Remarks: Where **filename** specifies the path and name for the file that is to contain saved data.

Example: **Logfile TempData.Dat**

SET MODE s

Syntax: *SEt* MOde **s**

Remarks: Where **s** is **NEw**, **OVerwrite**, or **APpend**.

Action: Selects the Save mode where a NEW file can not already exist; OVERWRITE will destroy existing data, if named file exists; APPEND will add new data to end of existing data.

Example: **Se Mo ov**

SET LOG x y 0

Syntax: *SEt* **LOG x y o**

Remarks: Where **x y = 0** to **31**, each separated by a space. And where **o = ON** (enables selected channels for logging), **OFf** (disables selected channels), **ALl** (enables ALL channels for logging), or **OFf** (disables ALL channels).

Action: Selects channels to be logged.

Example: **se log 1 3 8 11 On**

SET LOGRATE r

Syntax: *SEt* **LOGRATE r**

Remarks: Where **r = 2.0** to **99.9**, **102** to **5994** by 6.

Action: Sets the time in seconds between each sample.

Example: **lograte 23**

SET BLOCKS s

Syntax: *SEt* **BLock s**

Remarks: Where **s = 1** to **99999**.

Action: Sets the number of data blocks to be saved.

Example: **se bl 40**

SET DATE o

Syntax: *SEt* **DAte o**

Remarks: Where **o** is either **ON** or **OFf**.

Action: Sets the logging data stamp On or Off.

Example: **DATE OF**

READ Commands

READ CHANNEL

Syntax: **REad CHannel**

Action: Returns the selected channel.

Example: **Re Channel**

READ DEGREES

Syntax: **RE**ad **DE**grees

Action: Returns temperature scale setting, where a return of 0 = Celsius, or 1 = Fahrenheit.

Example: **read degrees**

READ TEMP n

Syntax: **RE**ad **TE**mp **n**

Remarks: Where **n** is **0** to **31**

Action: Reads the temperature for Channel n.

Example: **Re TE 25**

READ REJECTION

Syntax: **RE**ad **REJ**ection

Action: Returns the current Rejection rate as 0 = 400Hz, 1 = 60Hz, or 2 = 50Hz.

Example: **read rej**

READ LOGFILE

Syntax: **RE**ad **LOGFILE**

Action: Returns the name of the current file being used to log data.

Example: **Re Logfile**

READ MODE

Syntax: **RE**ad **MO**de

Action: Returns the current File Mode setting, where 0 = New, 1 = Overwrite, 2 = Append.

Example: **re mo**

READ LOGSTAT

Syntax: **RE**ad **LOGSTAT**

Action: Returns the current logging status, where 0 = Logging Off and 1 = Logging On.

Example: **re Logstat**

READ DATE

Syntax: **RE**ad **DA**te

Action: Returns the Log Date status.

Example: **re date**

READ LOGRATE

Syntax: **RE**ad **LOGRATE**

Action: Returns the current Logging Rate.

Example: **re LOGRATE**

READ BLOCKS

Syntax: **RE**ad **BL**ocks

Action: Returns the number of blocks being saved.

Example: **re bl**

READ STATUS

Syntax: **RE**ad **STAT**us

Action: Returns the DAS-TEMP measurement status.

Example: **Re Status**

SINGLE WORD Commands

SHOW 1,2,3

Syntax: **SH**ow *s*

Remarks: Where, when used, *s* = **1** for Main Menu, **2** for All Channel Menu, **3** for Logging Menu.

Action: Shows specified Pop Up Menu (default is 1).

Example: **sho 2**

HIDE

Syntax: **HI**de

Action: Hides DAS-TEMP popup display.

CLEAR

Syntax: **CL**ear

Action: Clears input string buffer of driver.

LOCK

Syntax: **LO**ck

Action: Disable mouse and keyboard input.

UNLOCK

Syntax: UNLock

Action: Enable mouse and keyboard input.

START

Syntax: STart

Action: Enables DAS-TEMP channel measurement.

Example: `St`

STOP

Syntax: STOP

Action: Disables DAS-TEMP channel measurement.

Example: `Stop`

STARTLOG

Syntax: STARTLOG

Action: Enables channel logging.

Example: `startlog`

STOPLOG

Syntax: STOPLOG

Action: Disables channel logging.

Example: `StopLog`

6.7 ERROR CODES

ERROR NUMBER	DESCRIPTION
651	Illegal character encountered
652	Too Many Commands in Input Line
653	Incorrect Usage of Command `SET` or `READ`
654	Incorrect Usage of the SHOW Command
655	Illegal CHANNEL Must Be 0-31
656	Illegal UNIT MUST be C for °C or F for °F
657	Illegal Command MUST be ON or OFF

658 - Illegal MODE Must be New, Overwrite, or Append

659 - Illegal File Name

660 - Illegal RATE Must Be 200, 30, or 25

661 - Illegal Log CHANNEL Must Be 0-31

662 - Illegal LOG Command Error

663 - Start DAS-TEMP before attempting to log

664 - Log channels not enabled

665 - Illegal block value; must be 1-99999

666 - Unknown ERROR

■ ■ ■

CHAPTER 7

OPERATION BY LOW - LEVEL PROGRAMMING

7.1 OVERVIEW

Control of conversions on the DAS-TEMP involves selecting a channel and performing a conversion. After selecting a channel, it will be necessary to wait the equivalent of one conversion period (to allow the V-F to settle to its final value) before triggering a conversion that will yield a valid result.

Implement the delay for channel settling in one of two ways. The first way calls for issuing a "dummy" conversion immediately after channel selection to facilitate measuring the channel settling time. This "dummy" conversion method is used in the Software Trigger Mode Of Conversion, described later in this chapter. The second way is used in the Interrupt Mode Of Conversion, also described in this chapter; it involves setting the on-board timer to 1/2 the maximum conversion rate of the V- F and handling channel sequencing in the Interrupt Service Routine.

There are two ways of triggering conversions for the DAS-TEMP: software strobe and on-board timer strobe. The software strobe is used in non-interrupt modes, and the timer strobe is used in interrupt modes. Note that if interrupts are enabled, either mode will generate an interrupt.

In either interrupt-driven or non-interrupt-driven modes, the board must be initialized. Initialization consists of setting up the Counter/Timer (8254), channel selection, and IRQ level control. The Counter/Timer controls the conversion period, counts the output of the V-F, and sets the rate for interrupt driven modes.

7.2 COUNTER/TIMER (8254) SETUP PROCEDURE

1. Set up Counter 1 (V-F Gating Timer) first.

   Write a Hexadecimal 72 to Base Address +3. This is a command that sets the Counter to a hardware-triggered one-shot mode.

   Then, write the least-significant byte of count followed by the most-significant byte to Base Address +1 (see the register map in Chapter 7 for actual values and required codes).

2. Setup and load Counter 0 (V-F Output Counter).

   Write a Hexadecimal 30 to Base Address +3. This entry is a command that sets up the timer in event counting mode.

   Write Hexadecimal FF twice to Base Address +0. This will load the input registers of Counter 0 with Hexadecimal FFFF but does not load the counters.

   Write to Base Address +6 (load Counter 0).

   The counter is now ready to read the V-F output.

3. If using the on-board timer-driven trigger, set up Counter 2. This counter is generally used in interrupt-driven modes. There is no need to do any setup of this counter, unless interrupts are

enabled.

Write a Hexadecimal B4 to Base Address +3. This command sets the Timer to Rate Generator mode.

Write the least-significant byte of count followed by the most-significant byte to Base Address +2. Each count represents one period of the prescaler output clock.

The counter will not actually run unless the TMRE bit at Base Address +4 is set to a logic one. Do not set TMRE bit active yet.

7.3 CHANNEL SETUP

The first channel to be converted should be selected and enabled, and a conversion trigger should be issued to assure channel settling. This setup must be done regardless of which mode of conversion is used.

1. Write the first channel to be converted to Base Address +4 making sure the CHEN bit is high.

2. Read from Base Address +3 to trigger a conversion. This will provide a means of knowing when the channel has settled.

7.4 SOFTWARE TRIGGER CONVERSION MODE

Once the Counter Timer and channel setup is complete, conversions may begin. The steps below accomplish the following:

Checking to see if the "dummy" settling time conversion is complete (Step 1, below). This "dummy" conversion could have been generated during board initialization or as the last step in the last conversion.

Trigger a measurement, and read the V-F output (Steps 2-7, below).

Select the next channel, and generate a "dummy" settling trigger (Steps 8-9).

1. Read the level of Bit 5 (CONV) from Base Address +4 and wait till it goes low. This is to determine whether the settling time conversion is complete. Note that Bit 5 may be low by the time you read it, indicating the conversion is complete.
2. Write a Hexadecimal 30 to Base Address +3. This command sets the timer to event counting mode.
3. Write Hexadecimal FF twice to Base Address +0. This will load the input registers of the Counter 0 with Hexadecimal FFFF but does not load the counters.
4. Write to Base Address +6 (Counter 0 load) to load the counter.
5. Read from Base Address +3 to trigger a conversion.
6. Read the level of Bit 5 (CONV) from Base Address +4 and wait till it goes low. This is to determine whether the conversion is complete.
7. Read the contents of Counter 0 by issuing a Counter Latch command (write 0 to Base Address +3) and reading the least-significant byte and then the most-significant byte from Base Address +0. Save this data for conversion to temperature later.
8. Write the next channel to be converted to Base Address +4, making sure the CHEN bit is high.

9. Read from Base Address +3 to trigger a conversion. This will provide a means of knowing when the channel has settled.

7.5 INTERRUPT MODE OF CONVERSION

Once the Counter/Timer and channel setup is complete, interrupt-driven conversions may begin.

Interrupt Setup:

1. Once the counter/timers and the channel setup have been initialized, set up the interrupt logic. The Board should be in a mode where no trigger activity is occurring (at power-up the interrupts and timer driven triggers are disabled).
2. Clear the interrupt bit by reading from Base Address +5 (IRQ register). This bit will be set because of the initial "dummy" settling time conversion.
3. Select the proper interrupt, and enable interrupts by writing to Base Address +5 with bits at 0-2 set at the level needed to select IRQ2-7. Make sure Bit 4 is high (TMRE) so that timer driven interrupts will occur. This will drive the appropriate IRQ line and leave the others in tri-state.
4. Setup the Counter/Timer and Prescaler for the desired channel sequence rate. Note that the rate must not exceed 1/2 the conversion speed.

CONVERSION RATE	MAXIMUM TIMER RATE
400	200
60	30
50	25

Interrupt service:

Upon receiving an interrupt, do the following:

1. Write the next channel to Base Address +4, making sure the CHEN bit is high. This must be done first.
2. Read the contents of Counter 0 by issuing a Counter Latch command (write 0 to Base Address +3) and reading the least-significant byte then the most-significant byte from Base Address +0. Save this data for conversion to temperature later.
3. Write a Hexadecimal 30 to Base Address +3. This is a command that sets the timer to event counting mode.
4. Write Hexadecimal FF twice to Base Address +0. This loads the input registers of the Counters with a count of Hexadecimal FFFF but does not load the counters.
5. Write to Base Address +6 (Counter 0 load) to load the counter.
6. The card is now ready for the next timer trigger.

■ ■ ■

CHAPTER 8

REGISTER STRUCTURE & FORMAT

8.1 GENERAL

DAS-TEMP registers use seven consecutive base addresses in the I/O space as follows (R = Read, W = Write):

LOCATION (HEX)		FUNCTION	TYPE
Base Address	+0	Counter Timer Zero; for V to F output counting	R/W
"	+1	Counter Timer One; for V to F period and resolution selection.	R/W
"	+2	Counter Timer Two; for on-board scan-timer generation.	R/W
"	+3	Counter Timer control. Measurement conversion trigger.	R/W
"	+4	Channel Select and Status.	R/W
"	+5	Interrupt & prescaler control. Interrupt bit clear.	R/W
"	+6	Load counter zero strobe.	W

The I/O-area address for Base Address +0 is switch-selectable over a range of 200 to 3E0 (Hex) in increments of 8 (Hex). All other register addresses are offsets of this address. All registers are 8-bits wide. The following sections describe each of these registers.

8.2 BASE ADDRESS +0: COUNTER TIMER COUNTER ZERO (8254)

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	CTR0-7	CTR0-6	CTR0-5	CTR0-4	CTR0-3	CTR0-2	CTR0-1	CTR0-0

Write initial count of 65535 (FFFF Hex) after setting up in Event counting mode via register at Base Address +0.

Read

BIT:	7	6	5	4	3	2	1	0
READ:	CTR0-7	CTR0-6	CTR0-5	CTR0-4	CTR0-3	CTR0-2	CTR0-1	CTR0-0

Reads value after V to F output has counted down from initial count. A valid count will be present only if the time period generated by Counter 1 has elapsed since a trigger was generated. To check for valid data (for Non-Interrupt operation), read Bit 5 of the Channel Readback/Status Register. To calculate number of counts, subtract value read from 65535.

8.3 BASE ADDRESS +1: COUNTER TIMER COUNTER ONE (8254)

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	CTR1-7	CTR1-6	CTR1-5	CTR1-4	CTR1-3	CTR1-2	CTR1-1	CTR1-0

Load counter with number of counts to yield the duration the V to F will be counted. Different count values will lead to different output values in Counter 0. The table below reflects those differences. Output is in °Kelvin. The initial count is also full-scale count that will be calculated from the value read from Counter 0. When Counter One has counted down to 0, it generates an interrupt (if enabled) indicating that Counter 0 contains the V/F reading. Upon receiving an interrupt, the Interrupt Service Routine should read the contents for Counter 0, select the next channel, and clear the interrupt before the next trigger occurs. NMRR stands for *Normal Mode Rejection Ratio* and indicates the frequency rejected (also all integer multiples).

Celsius: **°C = °K - 273.15**

Fahrenheit: **°F = 9/5 °C + 32**

Celsius: **°C = °5/9 [°F - 32]**

Rankine: **°R = °F - 459.7**

INITIAL COUNT	°KELVIN/COUNT	MAX SAMPLE RATE	NMRR FREQUENCY
5000 (1388 Hex)	0.1	400/s	400 Hz
33,333 (8235 Hex)	0.015	60/s	60 Hz
40,000 (9C40 Hex)	0.0125	50/s	50Hz

Read

BIT:	7	6	5	4	3	2	1	0
READ:	CTR1-7	CTR1-6	CTR1-5	CTR1-4	CTR1-3	CTR1-2	CTR1-1	CTR1-0

Reading Counter 1 will return current count.

8.4 BASE ADDRESS +2: COUNTER TIMER COUNTER TWO (8254)

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	CTR2-7	CTR2-6	CTR2-5	CTR2-4	CTR2-3	CTR2-2	CTR2-1	CTR2-0

Counter 2 is set up in the Rate Generator Mode to serve as a timer for channel sequencing. Load the Counter with the number of input clock periods between channel readings. Note that the 8254 does not allow an initial count of 1 in this mode. The range of rates is from 4.0 microseconds to 17.9 minutes. The register at Base Address +5 sets the prescaler frequency

RATE = (Prescaler Output Frequency) / (Counter 2 Value)

Read

BIT:	7	6	5	4	3	2	1	0
READ:	CTR2-7	CTR2-6	CTR2-5	CTR2-4	CTR2-3	CTR2-2	CTR2-1	CTR2-0

Reading Counter 2 will return current count.

8.5 BASE ADDRESS +3: COUNTER TIMER CONTROL (8254) & READING TRIGGER

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	SC1	SC0	RW1	RW0	M2	M1	M0	BCD

SC1	SC0	SELECT COUNTER BITS
0	0	Select Counter 0
0	1	Select Counter 1
1	0	Select Counter 2
1	1	Read Back Command (Not used)

RW1	RW0	READ/WRITE CONTROL
0	0	Counter Latch Command
0	1	Read/Write least-significant byte of selected counter only.
1	0	Read/Write most-significant byte of selected counter only
1	1	Read/Write least significant byte, then most significant byte

M2	M1	M0	READ/WRITE CONTROL
0	0	0	MODE 0, Event Counting mode (used for Counter 0.) Counter counts down from initial count while GATE is high.
0	0	1	MODE 1, Hardware Triggered One Shot (used for Counter 1). Generates an output that has a duration of the number of clock pulses in initial count. (The DAS-TEMP clock is at 2MHz. One clock = 250ns.)
0	1	0	MODE 2, Rate Generator (used for sequence timing).
0	1	1	MODE 3, Square Wave (not used).
1	0	0	MODE 4, Software Triggered Strobe (not used).
1	0	1	MODE 5, Hardware Triggered Strobe (not used).

BCD	
0	Binary 16-bit count mode.
1	4-decade Binary Coded Decimal Count (BCD).

Read

Read triggers a conversion (counters must be set up). No data is returned.

8.6 BASE ADDRESS +4: CHANNEL SELECT & STATUS

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	CHEN	X	X	CHAN4	CHAN3	CHAN2	CHAN1	CHAN0

Bits 0 - 4 select Channels 0 - 32. Bits 5 and 6 do nothing. Bit 7 enables the MUX so that probes are connected. The CHEN bit and Channel Select bits are low at power-up.

Read

BIT:	7	6	5	4	3	2	1	0
READ:	INT	CAL	CONV	CHAN4	CHAN3	CHAN2	CHAN1	CHAN0

Bits 0 - 4 read back selected channel. Bit 5 indicates the status of conversion; when at logic one, a conversion is in progress. Check Bit 5 after triggering a conversion, and wait until it goes low (for non-interrupt mode). Note that Bit 5 will be low if the conversion time (since the trigger) has elapsed. Bit 6 is the Calibration Mode bit; when at logic one, it indicates that the calibration slide switch is in the calibrate position. Bit 7 is the readback of the Interrupt Flip-Flop. Note that the Interrupt bit will be set when conversion is complete, whether or not interrupts are enabled; but it will drive only the appropriate IRQ line if interrupts are enabled. The INT bit is cleared when Base Address +5 is read.

8.7 BASE ADDRESS +5: INTERRUPT SELECT / TRIGGER MODE SELECT

Write

BIT:	7	6	5	4	3	2	1	0
WRITE:	P3	P2	P1	P0	TMRE	ISEL2	ISEL1	ISEL0

Interrupts are generated when the V to F output is ready. As soon as an interrupt is received, the next channel should be written and the count read from Counter 0. This register is at all zeros at power-up. The state of the Interrupt Bit can be read from the Status Register (Base Address +4).

ISEL2	ISEL1	ISEL0	INTERRUPT SELECTED
0	0	0	None (Disables Interrupts)
0	0	1	None (Disables Interrupts)
0	1	0	Interrupt 2
0	1	1	Interrupt 3
1	0	0	Interrupt 4
1	0	1	Interrupt 5
1	1	0	Interrupt 6
1	1	1	Interrupt 7

TMRE	
0	On-board timer (8254 Counter 2) and Prescaler disbled.
1	On-board timer (8254 Counter 2) and Prescaler enabled.

The Prescaler divides a 2MHz clock by values from 4 to 32768, as shown below. This is the input clock for the on-board counter timer (8254 Counter 2).

P3	P2	P1	P0	PRESCALER OUTPUT FREQUENCY	P3	P2	P1	P0	PRESCALER OUTPUT FREQUENCY
0	0	0	0	Inactive	1	0	0	0	7,812.50
0	0	0	1	Inactive	1	0	0	1	3,906.25
0	0	1	0	500,000.00	1	0	1	0	1,953.13
0	0	1	1	250,000.00	1	0	1	1	976.56
0	1	0	0	125,000.00	1	1	0	0	488.28
0	1	0	1	62,500.00	1	1	0	1	244.14
0	1	1	0	31,250.00	1	1	1	0	122.07
0	1	1	1	15,625.00	1	1	1	1	61.01

Read

A read clears interrupt. All bits are read back.

8.8 BASE ADDRESS +6: LOAD COUNTER 0

Write

A write to this address will load Counter 0 of the 8254. This should be done when setting up the counter for the next channel.

Read

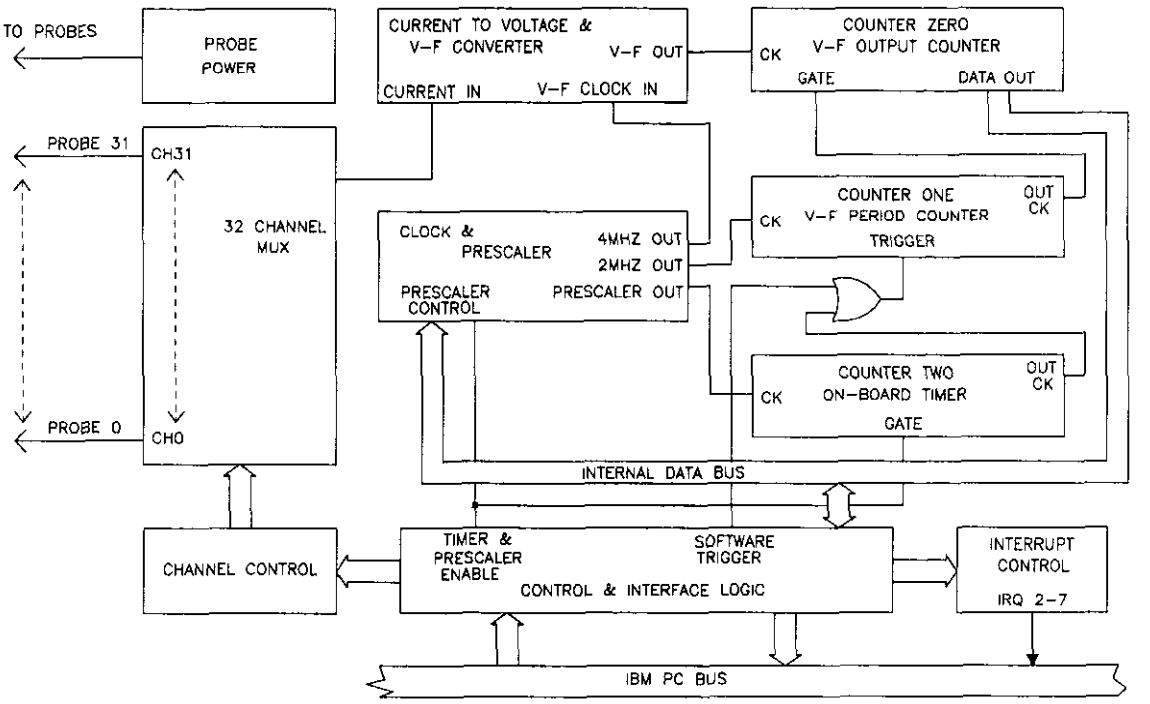
A read to this address does nothing.

■ ■ ■

CHAPTER 9

OPERATING PRINCIPLES

9.1 BASIC CIRCUITRY



Block diagram of DAS-TEMP circuits.

Referring to the block diagram, DAS-TEMP hardware includes a signal-switching-and-conversion front end, associated control logic, and interface circuitry for the PC bus. Signals from the 32 temperature sensors connect to measurement circuitry via a 32-channel multiplexer, which is controlled by a register. Measurement circuitry includes a current-to-voltage converter and a synchronous voltage-to-frequency (V-F) converter. An 8254 counter timer is used in Counter 1 to provide V-F period-of-observation control and in Counter 0 to count V-F output clocks. Counter 2 works with the Prescaler to provide timer-driven conversions at rates from 200-per-second to one-per-17.9 minutes. The Interrupt Selection logic is under software control.

9.2 TEMPERATURE CONVERSION

A current-to-voltage converter transforms the temperature-sensor output current into a voltage ranging from 0 to -10 Volts. The V-F converts that voltage into a frequency proportional to the magnitude of the voltage input. The frequency output for 0V is 0Hz, while for full scale it is 2Mhz.

Full-scale V-F frequency is one-half the V-F input clock frequency (full-scale V-F frequency = 2MHz). Standard DAS-TEMP sensors (AD592) span a range of 992KHz (-25 °C) to 1.512MHz (+105 °C).

However, the DAS-TEMP board can support wider-range sensors such as the AD590 (-55 to 150 °C) with no modifications. The equations below show how to calculate frequency.

$$F_{out} = ((\text{Current Out})\ (20{,}000\ \text{Ohms})) / ((10\ \text{Volts})\ (2{,}000{,}000\text{Hz}))$$

Where

$$\text{Current Out} = 1\ \text{MicroAmp} / {}^{\circ}\text{Kelvin}$$

Solving for °Kelvin

$$\text{Temp } {}^{\circ}\text{K} = ((10\ \text{Volts})\ (F_{out})) / ((20{,}000\text{Hz})\ (20{,}000\ \text{Ohms})\ (1 \times 10^{-6}\ \text{Amps}))$$

$$= F_{out} / 4000$$

Counters 0 and 1 of the 8254 perform V-F counting and duration-of-observation, respectively. That is, Counter 0 counts the number of clock pulses from the the V-F converter, and Counter 1 sets the amount of time that Counter 0 totals the pulses. The input clock to Counter 1 is a 2MHz clock that is synchronous with the V-F clock. The input to Counter 0 is the output of the V-F. Counter 1 is set up in a mode that generates a pulse N clock cycles long when triggered, where N is the initial count. Counter 0 is enabled to count only during the N-cycle pulse generated by Counter 1. Since the Counter 1 input clock is exactly the full scale frequency of the V-F (2MHz), the N-cycle count loaded into it is also the full-scale count yielded by Counter 0 (V-F out counter). For example, if Counter 1 was loaded with a count of 5,000, it would yield a Counter-0-Enable pulse 2.5ms long. If the V-F output was 1MHz when the Counter 0 was enabled, Counter 0 would contain a count of 2,500 when finished. Note that speed of conversion may be traded off for resolution using the V-F technique. For the purpose of the DAS-TEMP measurements, a count of 5,000 is generally the best choice.

V-F converters will reject true pure AC signals of frequencies that are integer sub-multiples of the period of observation. This happens because V-F converter outputs average the value of the incoming input signal. If a pure AC signal is present in the input signal and the period of observation is exactly one or more integral multiples of the signal period, then the output count produced by that signal will be zero. A further assumption is that the AC signal is riding on a DC level and that the resulting combined signal is within the range of converter measurement. This would be the case in the usual situation where an input signal contains a small level of line-frequency interference. DAS-TEMP sensors provide excellent AC rejection, but some AC noise could be picked up between the sensor and the DAS-TEMP board. In general, the 5,000-count full scale is the best choice unless line noise becomes a problem. See register desriptions for details on 50- and 60-cycle rejection. The General relationship for calcluating the initial count to reject a given frequency is as follows (note that FULL SCALE COUNT = INITIAL COUNT):

$$\text{Initial Count} = 1 / ((F_{Reject})\ (500 \times 10^{-9}))$$

The relationships for number of °Kelvin/Count is

$$^{\circ}\text{Kelvin / Count} = 500 / (\text{FULL SCALE COUNT})$$

For example the °K/Count for a full-scale count of 5000 is 0.1°F/Count. ■

CHAPTER 10

FACTORY RETURNS

Before returning any equipment for repair, please call 508/880-3000 to notify MetraByte's technical service personnel. If possible, a technical representative will diagnose and resolve your problem by telephone. If a telephone resolution is not possible, the technical representative will issue you a Return Material Authorization (RMA) number and ask you to return the equipment. Please reference the RMA number in any documentation regarding the equipment and on the outside of the shipping container.

Note that if you are submitting your equipment for repair under warranty, you must furnish the invoice number and date of purchase.

When returning equipment for repair, please include the following information:

1. Your name, address, and telephone number.
2. The invoice number and date of equipment purchase.
3. A description of the problem or its symptoms.

Repackage the equipment. Handle it with ground protection; use its original anti-static wrapping, if possible.

Ship the equipment to

Repair Department
Keithley MetraByte Corporation
440 Myles Standish Boulevard
Taunton, Massachusetts 02780

Telephone 508/880-3000
Telex 503989
FAX 508/880-0179

Be sure to reference the RMA number on the outside of the package! ■

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