

# **DADS USER GUIDE**

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## INTRODUCTION

The DADS is a compact “black box” recorder designed to continuously monitor and store vehicle dynamics. When a critical event has occurred, (like a vehicle roll-over) the DADS will contain the last minutes of data leading up to the event. The device can hold approximately 15 minutes of data contained in a circular buffer configuration. When it reaches the end of memory it returns to the beginning of memory and starts overwriting previously saved data. Proper operation of the device requires a minimum of three valid accelerometer inputs corresponding to the lateral (sideways), axial (forward/backward) and vertical (up/down) directions. These signals are used to determine if the vehicle has over turned.

Data collection begins automatically after power is applied and is halted when a critical roll over event is experienced. Once the DADS unit has been tripped the data file must be “offloaded” before it can be re-activated for data collection activities.



Recording is halted by disconnecting power to the DADS. The device receives a power on reset pulse with a 140 ms delay each time it is powered.

The “STOP RECORDING” event is triggered by any accelerometer signal exceeding a pre-set limit. Weighted averages are used allowing a brief timeout period before the device trips. This is typically 30 seconds to allow the

recorder to capture data past the end of the event.

After the device has been tripped it will remain tripped until manually re-enabled using a computer. At this time data can be offloaded and inspected. The device can later be restarted from the setup utility for subsequent deployments.

Valid sensor signals must be connected to the analog input channels 0, 1 and 2 of the DADS. These correspond to lateral, axial and vertical acceleration signals and can be found on the rear panel of the LG-Alert. These channels are the primary focus of the data acquisition process. Without suitable signals on all three channels the device will detect the error and trip. Additional signals can be connected to A/D channels 3 and 4 (0-5 VDC) and Digital Input Channels 0, 1, 2 and 4 (switch closure or relay dry contacts). Digital channel 3 is reserved for sounding audio signals.



## FEATURES

User Friendly :	Designed to work with the LG-Alert™ Tri –Axis accelerometer. No configuration is needed and it begins operation automatically.
Processors :	Motorola 68HC11F1 and PIC16C62
Compact Size :	1.3 x 3.3 x 5.2 inches.
Power Consumption :	100 mA typical, 40uA during hibernation
Memory :	472k Non-volatile data and program storage 128k battery backed RAM for data file and program
Interface :	RS-232 serial Port (DB9 to 3.5mm stereo jack) High speed parallel data interface downloads 512k Serial Flash (SFLASH) in less than 30 seconds. DB25 to 9 Pin Mini Din Connector.
Analog Inputs :	5 accessible on back panel quick connect socket (6 internally accessible)
Digital Input / Outputs :	5 TTL Digital I/O channels (3 used internally to operate status LED's)
Expandable :	8 bit bus interface with chip selects for expansion
Software :	Programs in TFBASIC and Assembler inside a full-featured DOS/Windows based Programming IDE (Integrated Development Environment)

## SPECIFICATIONS

Host Computer	Minimum system requirements for communicating with the DADS 486 IBM compatible or greater, 640K RAM, 1 MB free disk space, 3.5" floppy drive, CD ROM, serial port and parallel port.
Electrical Input :	9-18 VDC at 0.5 W Max. Dissipation, 150 mA Max.
Power Consumption :	100 mA Typical, 40 uA Hibernate
Environmental :	Operating Temperature Range –25 to 70 degrees C Relative Humidity 0 to 95%, non-condensing
Serial Communications :	Serial Baud Rates 300, 600, 1200, 2400, 4800, 9600, 19200, 38400
Sampling Rate :	DADS base software default 10 samples per second or 5 analog + 5 digital
12 bit A/D Accuracy :	+/- 1.5 LSB
8 bit A/D Accuracy :	+/- 1.5 LSB
Dimensions :	1.3 x 3.3 x 5.2 inches (3.3 x 8.4 x 13.2 cm)
Weight :	0.6 lbs (300 grams)
Backup Battery :	3 Volt Coin Cell Sony CR2032 (220 mA hours) DADS Un-powered typically 6 months shelf life DADS Powered typically > 3 years

## **GETTING STARTED:**

The following items should have been received in your DADS kit.

- ✓ User Guide
- ✓ 1.44MB 3.5" DADS floppy Disk or CD ROM
- ✓ DADS CPU module
- ✓ Mounting bracket and hardware
- ✓ Power cable splitter 2.1mm female to two 2.1mm male jacks
- ✓ Sensor Wire Harness
- ✓ Parallel cable, DB25 to 9-pin mini-DIN
- ✓ Serial Cable, DB9 to 3.5mm Stereo Phone Jack

If anything appears to be missing contact Stability Dynamics Ltd. immediately.

Additional items that are useful for installation and trouble shooting include:

- ✓ A voltmeter
- ✓ Small Philips Screwdriver
- ✓ Wire cutters
- ✓ 12VDC AC Wall Adaptor
- ✓ Two 1.5 V AA batteries (to create 1.5 and 3 Volt signals)

## **Host PC Requirements**

The DADS was designed to be programmed and off-loaded using an IBM compatible PC. The minimum system requirements are:

- ✓ 25 MHz 486SX or greater with a minimum of MSDOS 6.xx
- ✓ 640K RAM with 580K available for program
- ✓ Hard Drive with 1MB available for program and related files
- ✓ 3.5" 1.4MB floppy drive
- ✓ Parallel port
- ✓ Serial port RS-232
- ✓ Microsoft or compatible mouse
- ✓ Data storage on the host will be user managed

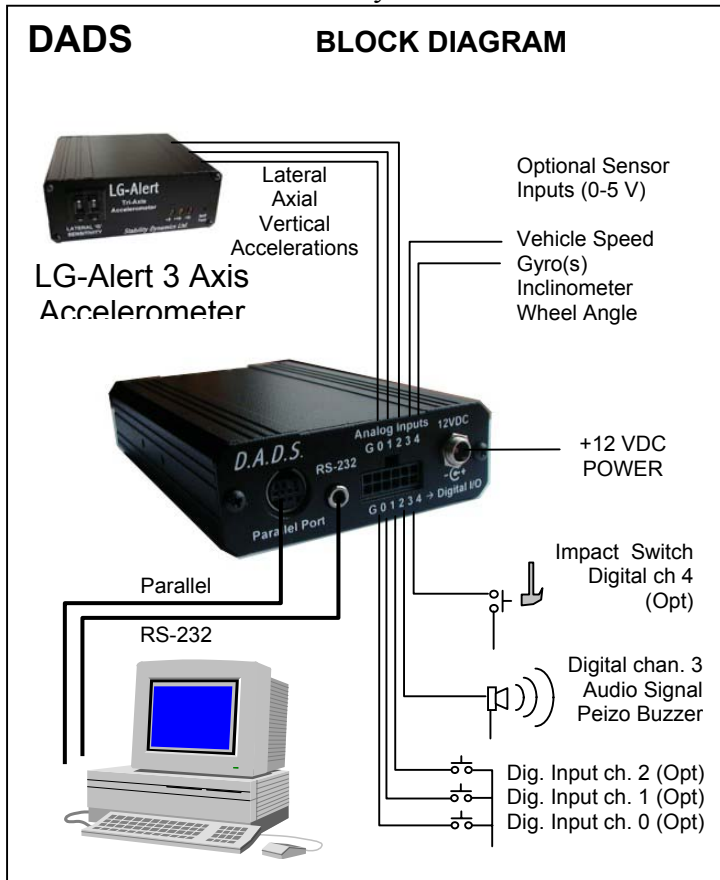
Acknowledging that it is a rare person that wants to read the entire manual before starting, this section provides some simple steps to get you up and running.

To use the DADS system as configured out of the box little or no experience is require with electronics and programming.

If custom modifications are required to the original source code and hardware configuration you will have to contact Stability Dynamics Ltd.

Remember the measurement system is all CMOS and thus static sensitive. Normal care in handling is all

that is required to prevent damage to the sensitive electronics. You must take extra precautions if you are in a very dry climate prone to static electricity. If you are wearing a wool sweater or are walking on wool rugs it is always a good practice to touch ground (negative of the battery) when handling the DADS. Be warned that static damage is easily identified and is not covered under the warranty!



Load the DADS software from the disk provided onto the host PC's hard drive. Inside a DOS window run A:SETUP to initiate installation.

The installation software should create a directory on the host hard drive called C:\DADS. All files on the floppy will then be copied to this directory. All associated files will reside in this directory including any data files that are created by the DADS and offloaded to the host. TFTOOLS.EXE and CONVERT.BAT are the primary programs associated with the system.

If the host is running Windows 95 or 98 the explore button can be used to provide access into this directory. Shortcuts for these programs can be created by right mouse clicking and dragging them from C:\DADS out to the desktop. Under the option dialog box be sure to choose "create shortcut" so the program files are not "moved" to the desktop.

Alternatively the files from the DADS disk can be manually copied by first making a directory under C:\ then coping all files to that directory. Make sure to keep a backup copy of the SETUP disk and always backup any data you feel is useful.

Open a DOS window if you are running Windows 95/98

```
At the prompt C:\> type :   md DADS <enter>           To make the DADS sub-directory
                           copy A:*. * C:\DADS <enter>   To copy files from A: to C:\DADS
                           cd DADS <enter>              To change to the DADS directory
                           dir <enter>                 To list directory of files
                           TFTools <enter>             To run the DADS software
                           Convert <enter>            To convert a raw data file to text
```

The first time you run TFTools you may need to set some of the configuration parameters to allow communications. Connect the serial cable between the DADS and a COM port on the host computer. Run TFTools.exe from a DOS window and power the DADS (12VDC). Don't be alarmed if nothing appears in the TFTOOLS terminal window the first time you start. If the serial communications parameters are correct, the data stream from the DADS should be scrolling by on the host PC screen. If the serial

configuration is incorrect, the TFTTools window will be inactive or displaying junk characters. You may have to refer to the section on communications for details about port configuration. Typical default settings are COM2,19200 Baud and once established are loaded from the configuration file automatically on start up.

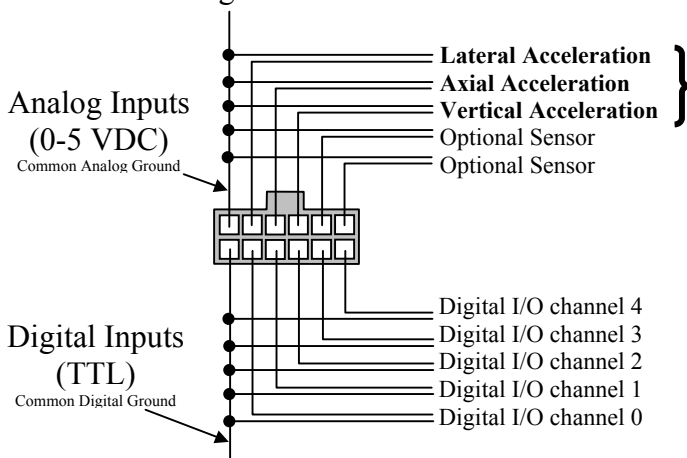
**DADS Status Lights**

There are three status lights on the front panel of the device. These lights will flash back and forth upon powering to indicate the device is booting. After the device has booted the green light will blink slowly to indicate sensors are being scanned. The yellow light will blink whenever the device is storing data to SFLASH memory. The red light flashes to indicate that the next block of memory is being prepared for overwriting in the circular buffer. All lights will flash together if the DADS has been “tripped”. The device will remain in “tripped” mode until re-activated using a computer.

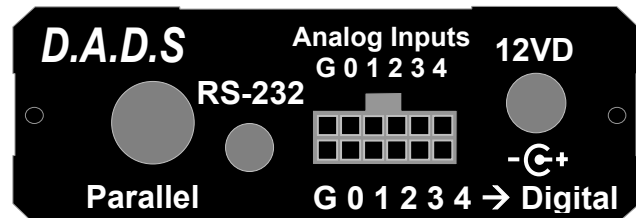


**Sensor Inputs (Available on the quick disconnect socket on the rear of the DADS)**

The quick disconnect socket on the back of the DADS provides access to five of the (12 bit) A/D channels and five of the digital I/O channels. These 10 channels are the focus of the base software package. The

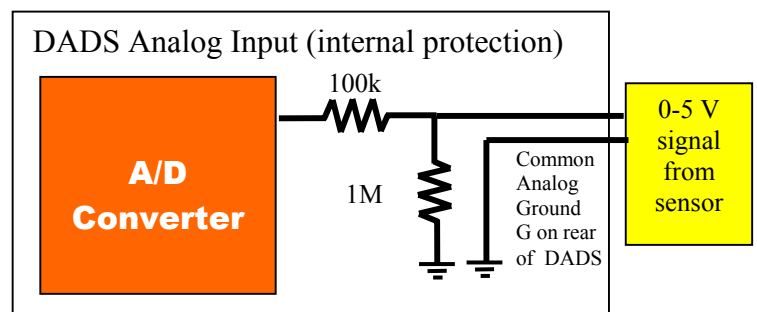


To LG-Alert Base Module  
A/D channels 0,1 and 2 are lateral, axial and vertical acceleration signals respectively



device must have acceleration signals on analog input 0,1 and 2 to function correctly since these channels are used to detect “vehicle roll over”. All other inputs are optional. Analog signals must be conditioned and scaled between 0 and 5 VDC. Digital signals are TTL high (1) by default and must be pulled to digital ground (0) through a switch or relay dry contact. These appear as a 1 “switch open”, and 0 for “switch closed” in the data file.

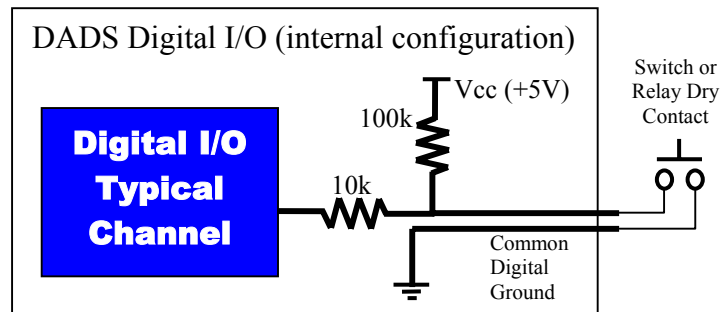
The analog inputs are designed to handle signals that range from 0 to the converter’s Vcc, typically +5V. Slope and offset values can be assigned to any sensor who’s output is in the range of 0 – 5 VDC. Signals outside this range will produce an error.



The LG-Alert’s accelerometer signals are biased about +2.5 V with a sensitivity of approximately 2.4 volts per ‘g’. When 1 ‘g’ of acceleration acts on the

sensitive axis, the signal from the sensor will increase or decrease +2.4 V depending on the direction. For one direction the voltage increases, for the opposite direction the voltage decreases. The response of the sensor is linear up to the maximum input of +/- 1 'g'. Data stored in the file will be converted to engineering units using the slope and offset calibration values. Default analog signal storage formats data to 2 decimals places, (for example 0.35 'g's).

Digital sensor inputs incorporate a pull up resistor to force a default TTL high condition. Without a sensor connected to the channel, it will read "1" or TTL high (5V). This value will be stored in the data file. If a sensor is connected to the digital channel it must act as a simple switch closure to the common digital ground. When the switch is open the channel floats to Vcc. When closed, the channel is grounded. Note that digital channel 3 is internally configured for audio output signals (tones). This feature can be disabled if the channel is needed for recording activities.



**SOFTWARE :**

TFTOOLS.EXE and CONVERT.BAT are DOS applications. There is currently no Windows version, but it does run from Windows as a DOS application. The user interface to the DADS is based on Borland International's DOS based Turbo Vision, which looks a little like windows but runs in text mode only. The conversion utility was written as a general purpose binary to text program in QBASIC.

The methods of using a mouse, clicking on an object to select it and dragging to move an object, are similar to the techniques used in Microsoft Windows. At this time, only the left mouse button is recognized. Middle and right mouse buttons are ignored. This may change in future versions. If you don't have a mouse you can use special keys and key combinations to manipulate objects on the screen. See the section on keyboard equivalents for mouse actions.

The base software has been configured to record only the ten channels accessible on the rear panel of the DADS (5 analog + 5 digital). Analog channel 0, 1 and 2 must be supplied with the lateral, Axial and vertical accelerometer signals respectively. These sensors are typically set to a zero bias point of +2.5 Volts. A/D channels 3 and 4 are optionally configured as additional 0-5 VDC sensors. Channels A/D 5, 6, 7, 8, 9 and 10 are not used in the DADS system. Digital channels 0,1,2 and 4 are optional TTL I/O lines saved to the data file. Digital channel 3 is configured as an output and is used to activate the internal buzzer. This buzzer signal is also available on the rear panel of the DADS.

When the DADS starts, it initializes variables, prints the start up header, and begins program execution. If the DADS has been freshly launched, the date and time are copied from the host, and the file pointer starts from zero. Operation of the device is not dependant on the back up battery. When the backup battery is not present the date, time and file pointer start from scratch each time the DADS starts (Jan. 1,1980, 00:00:00 am, file pointer = 0). Data collection will continue as long as power is supplied to the device and the critical "roll over" event has not been experienced.

If the device is functioning properly the green light should be blinking slowly and the yellow light flickering quickly. The green light indicates sensors being scanned and the yellow light indicates data is being saved to the non-volatile memory area. If little or no vehicle movement is detected by the device, recording activities will be suspended. The yellow light will then cease to flicker until sufficient movement is again detected.

If the device has been tripped, (the "STOP RECORDING" flag has been set) it enters a safe mode and flashes all three lights continuously. The device will contain readings up to the time the "STOP RECORDING" event was observed.

The data storage area is continuously written over holding approximately 15 minutes of data. Since data is contained in a circular buffer arrangement, the start of data may not necessarily be at the beginning of the storage area. The start of the file can be determined by inspecting the date or time columns. The beginning and end of the data file is also separated by up to 8K of erased memory denoted by Hex FF or 255 decimal.

For critical data collection applications and maintenance free operation the backup battery should not be inserted in the DADS. A low or faulty backup battery can cause the device to freeze. Leaving the backup battery out will provide more reliability and allow the DADS to begin operation each time it is powered.

Data will be recorded at the start of the memory area each time it is powered and monitoring will continue as long as the device is provided with suitable power.

When the DADS detects that stable (12VDC) power has been applied it boots and prints the main header. Pressing the “pause” key will allow you to read the screen if required. This header contains some details on basic DADS operation. Press any key to again allow the data to be printed to the host monitor.

```

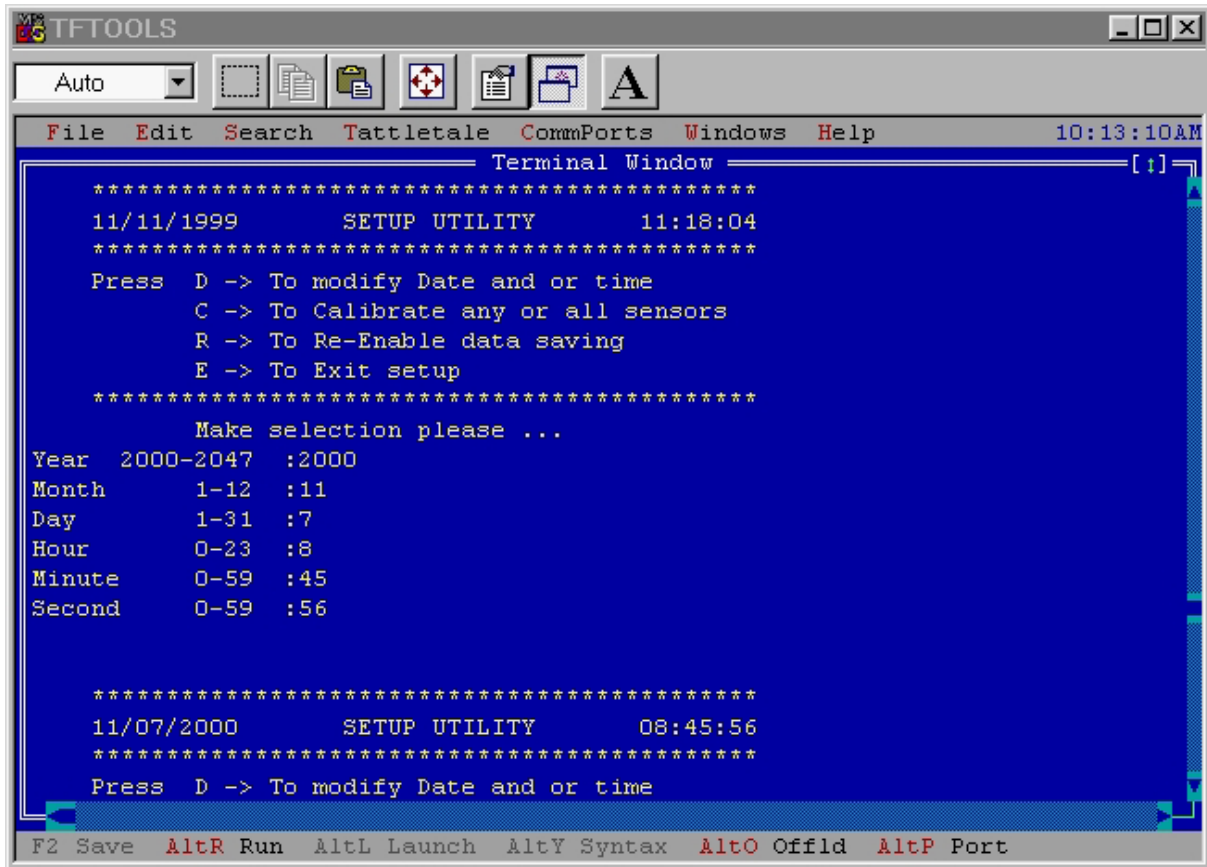
TFTOOLS
Auto
File Edit Search Tattletale CommPorts Windows Help 10:07:29AM
Terminal Window [t]
*****
Stability Dynamics Ltd                      Crash Data Recorder
Ver 1.06 July 2000                          Written : J. Sheaff
Copyright                                    All Rights Reserved
*****
NOTES:   Press PAUSE now to pause this screen for reading
- Exit program by pressing Ctrl-C           Pause/Break to Pause Scrolling
- Scan Rate 10 per second  Date,Time, A/D ch0,1,2,3,4, DigIn ch0,1,2,3,4
- Data Stored in binary format      (11x4 + 5 bytes = 49 bytes per record)
- Stop Recording halted by lat, axl or vert acc running avg > 0.6 g's
- OFFLOAD Data, ERASE Data File and then  RE-START or RE-LAUNCH Logger
- *** Remember ***** to Disable header in OFFLOAD pop-up menu ***
- Convert Binary data file to text use  CONVERT1.BAS  utility program
TROUBLE SHOOTING                          (Logger Not Responding on power up)
1. Select RUN or RELAUNCH from TATTLETALE drop down menu (Be patient)
2. Remove parallel cable if connected, and interupt supply power briefly
3. Remove coin cell backup battery (under front cover) and interupt power
Still No Response from Logger ? Press Reset button on the front panel
*** Remember *** to restore DATE and TIME *** if a reset is performed
Still No Response?  A Fresh LAUNCH of Logger source code  CDR*.TFB
DFMAX=487423  DFPNT=67669  DFERASED=1  Date : 10/11/2000  Time : 10:02:02
F2 Save  AltR Run  AltL Launch  AltY Syntax  AltO Offld  AltP Port

```

Immediately after the header is printed there will be a brief pause to allow operator to make changes to the configuration. Pressing S when the main header is printed will enter the SETUP mode.

- D or d → Change date and time in the DADS
- C or c → Calibrate Sensors connected to the DADS
- R or r → Reset the DADS if it has been tripped (enable data overwriting)
- E or e → Exit the setup routine

To change the date and time, simply press D from the SETUP menu. Follow the prompts to enter the correct date and time elements. Use the time shown in the top right corner of the TFTools terminal window to synchronize the DADS with the host computer.



To check calibration constants press C. Again follow the prompts to calibrate or skip these steps. Selecting N at each prompt will skip that step. Answering N for every prompt will leave calibration constants unchanged. If you choose Y for any of the prompts, make sure to follow instructions very carefully. See the section on sensor calibration for more details about sensor calibration. Following the sensor calibration input prompts the DADS will continuously scan and print sensor readings until the operator exits calibration. If the calibration was unsuccessful, the operator can press C to jump back to the calibration input prompts and try again.

The device can be re-activated by pressing R from the setup menu. This step clears the “Stop Recording Flag” that is checked each time the DADS starts. Re-activating the DADS should only be done if the data resident in the DADS has already been safely offloaded or it is of no use. Clearing of the “Stop Recording Flag” allows the DADS to write over previously written data. Note that the DADS can only be re-activated if the file pointer is set to zero. The data file pointer (DFPNT) can be set to zero by erasing the data file. From the TFTools terminal window:

```

Press CTRL-C to halt the DADS
Select Tattletale - Erase data file
Select Tattletale - Run

```

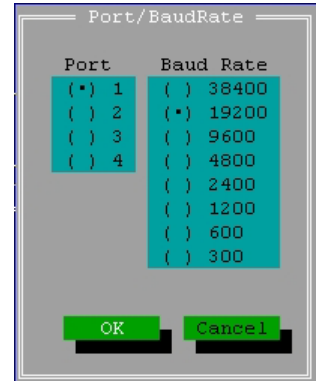
Press "S" during warm-up sequence (when the header is printed) to enter setup  
Press "R" to re-activate the DADS for saving (remove "Stop Recording Flag")  
Press "E" to exit setup sequence and begin data monitoring

The system can be deployed as a dedicated "crash data recorder" or it can be used for simple research oriented data collection activities.

Stability Dynamics Ltd. provides support for its software only and does not provide instruction on how to program or process data. It custom changes are required in the underlying firmware contact Stability Dynamics Ltd. We provide the data system to function in a pre-configured manner scanning, saving and looking for the critical stop condition. The device records at approximately 10 Hz (10 samples per second) for each of the 10 channels located on the rear of the recorder. Data collected by the DADS can be converted using the utility program provided which simply takes a DADS binary file and converts it to ASCII text characters. Data analysis and processing can be accomplished using third party programs like MS Excel.

**COMMUNICATIONS:**

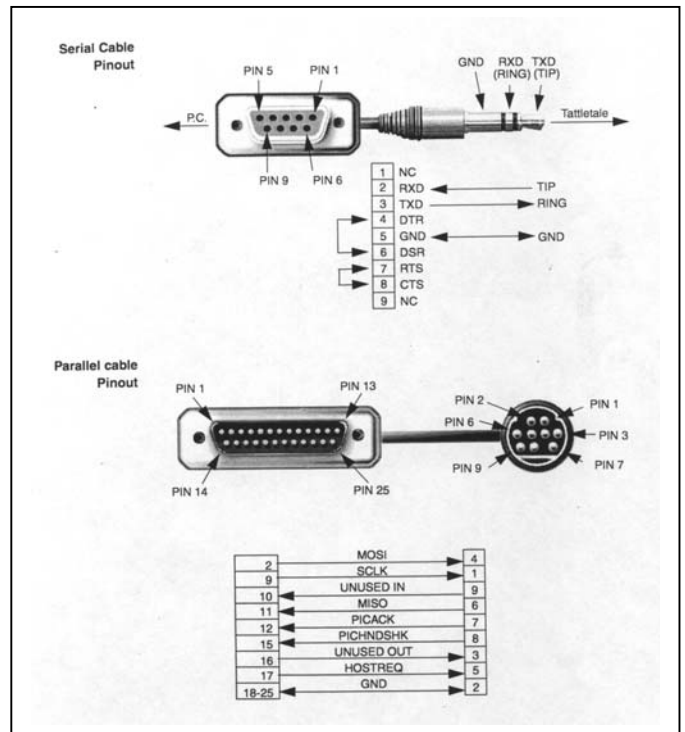
The DADS device comes complete and ready to run using only a single serial port on the host computer. For access to all the DADS features, the host computer also requires a standard parallel printer port connection (typically LPT1). The DADS was designed to be compatible with all PC parallel ports including ECP and EEP, when configured to run in standard mode. Two communications cables are provided with the device for both serial and parallel interfaces to the host computer.



The DADS supports COM1 thru COM4 but must be correctly specified along with the correct baud rate in the **COMMPORTS** drop down menu in TFTOOLS.EXE main menu. If communication ports are being used by another device or are not available, an error message will be printed. If the ports are configured correctly, the host PC will be able to communicate to the DADS. Typically device settings are Com2 set to 19600 baud rate, data bits = 8, parity none, stop bits = 1 and flow control set to none. The parallel port should be configured to LPT1.

NOTE: It is recommended that the DADS be powered before the parallel cable is connected.

Data offloads can be done with either the serial cable using **XMODEM OFFLOAD** or the parallel cable using **PARALLEL OFFLOAD**. Parallel off loads are much faster than serial offloads.



Source code updates require both cables to be connected between the host computer and the DADS. With a new source file a "LAUNCH" will update the DADS firmware.

If communication between the DADS and host does not begin automatically upon running TFTOOLS.EXE you may need to adjust the port settings. If a line of junk characters appears on the host computer the baud rate likely needs to be matched with the host. The host configuration can be found under the Windows Control Panel.

From the Windows 95 / 98 START menu :

- choose        *SETTINGS*
- CONTROL PANEL*

*SYSTEM  
DEVICE MANAGER  
COM1 or 2  
PORT SETTINGS*

Make note of the baud rate, parity, stop bits, and flow control of the host configuration. Ensure that both the host and the DADS are set the same. Exit from TFTOOLS.EXE and restart to see if the changes allow communication. Make sure the COM port you are trying to use is not connected to something else. PC's share interrupts on the COM ports. Typically COM1 and COM3 share one and COM2 and COM4 share one. Only one device using interrupts can be active on either pair at one time. Therefore if your mouse is on COM1, don't use COM3. If you have a mouse on COM1 and a modem on COM2, then you may be able to use COM4 but you must make sure not to use the modem or load it's drivers.

If the host is a laptop and has an alternate pointing device besides a mouse on COM1, it should be used and the mouse driver for COM1 should be disabled. This may require removal of the mouse directives in AUTOEXEC.BAT file. Simply edit the file AUTOEXEC.BAT and force any mouse directives to be comment lines by typing REM in front of them. The computer will need to be restarted after these changes are made to allow the COM port to be used by the DADS.

Some of the earlier SVGA video cards had a conflict with the COM4 port in IBM 8514 mode. This appears as incorrect colors on the display and periodic system freeze up. If you are using IBM 8514 display mode, you should not use COM4.

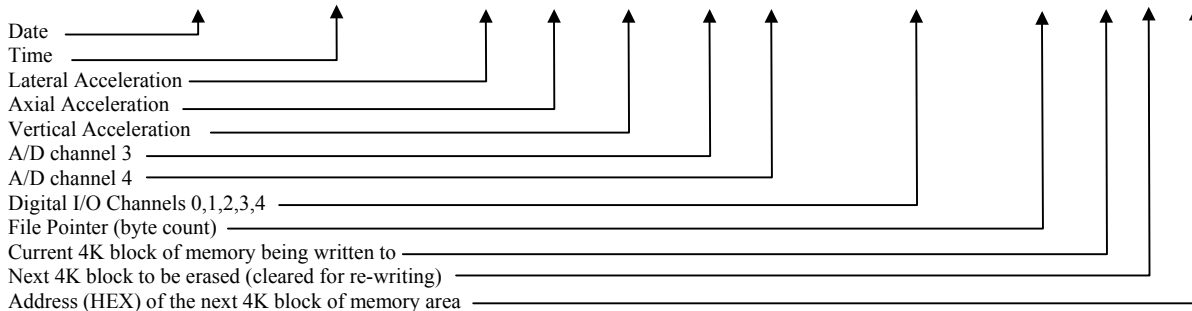
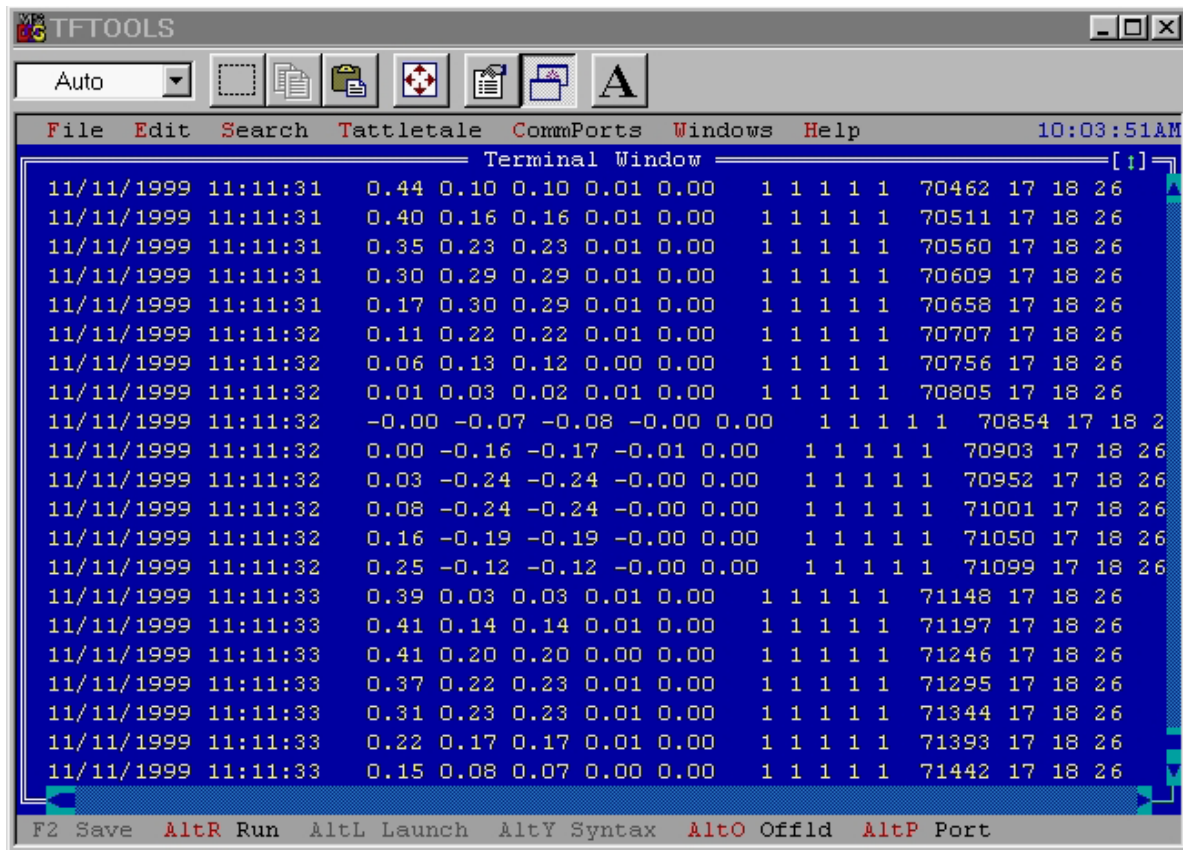
Communication settings are saved to the file TFTOOLS.CFG when you exit from TFTools. This file will be used to set configuration settings the next time TFTOOLS runs.

See the section on Trouble Shooting for additional help if the DADS fails to sign on.

### RUN TIME DIAGNOSTICS

When the DADS is operational, diagnostics can be viewed on the host PC by running TFTools.EXE and connecting the serial cable. From a DOS prompt, go to the directory that has the file TFTools.EXE and enter the command *TFTools* <enter>. The program will launch and display the main window and within that the terminal window. Alternatively, double clicking on the TFTools.exe file in the C:\DADS sub directory can be done if the host is using Windows 95 or 98. If short cuts to TFTools.EXE and Convert.BAT have been placed on the desktop, simply double click to run.

When active, the DADS will be continuously printing a stream of data to the terminal window as shown below.



The green light on the DADS will be blinking slowly indicating the measurement process is active. The yellow light will flicker if the readings are being saved. Sensor readings can be inspected and general

troubleshooting performed using the TFTools terminal window. Proper operation of the device will require normal signal levels on A/D channels 0,1 and 2. These signals are provided by the LG-Alert 3 axis accelerometer and have a zero bias of +2.5 VDC. If the LG-Alert is level and stationary, these three channels should be reading close to zero.

Information contained in each line entry includes the date and time, followed by sensor readings and data storage details. If the readings are being stored successfully, the data file pointer should be increasing and the yellow “SAVE” light on the front panel will be flickering. If little or no motion is detected by the DADS, saving will be paused and the file pointer will stop incrementing. The device should typically be in this state when the vehicle is stationary and on level ground. If the yellow light continuously flickers when the vehicle is motionless and level the sensor calibration may need to be checked. This data save threshold check is used to filter out near zero values and extend the life of the non-volatile EEPROM data storage area.

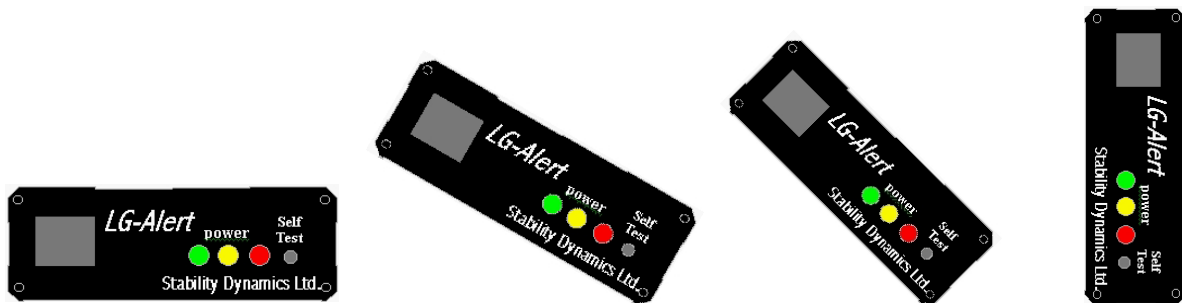
Default DADS save thresholds:

- Lateral Save threshold      0.09 ‘g’
- Axial Save threshold        0.25 ‘g’
- Vertical Save threshold      0.25 ‘g’

If any acceleration reading exceeds it’s thresh hold an internal timer is reset. If readings are below the thresh holds the timer counts down. After the time out period has elapsed data saving is suspended until motion is again detected. These variables are found in the source code near the top of the file.

Overall functionality of the DADS can be determined using this screen and performing a few steps.

1. With the system sitting stationary (LG-Alert level and motionless)
2. Wait for data saving to be suspended (Vehicle motionless on level ground)  
The green light should blink slowly and the yellow light should stop flickering
3. Press the LG-Alert self test button  
Saving should be initiated and the yellow light will start to flicker again  
Lateral acceleration measurements should deflect ~ 1 ‘g’
4. To make sure all A/D channels are functioning properly each sensor will have to be examined individually. Provide a known physical input to the sensing element and watch the measurement printed on the diagnostic screen.
5. For full evaluation of acceleration signals (Lateral, axial and vertical) the LG-Alert must be removed from



Lateral ‘g’s	+/- 0.01	0.50	0.71	1.00
Axial ‘g’s	+/- 0.01	0.00	0.00	0.00
Vertical ‘g’s	+/- 0.01	0.13	0.29	1.00

its mounting bracket and rotated to various orientations. Test orientations in the axial direction as well and note the relationship between lateral, axial, and vertical. The DADS should start recording each time it is rotated and suspend recording after it has been brought back to the level stationary position and the time out period has elapsed.

6. If additional analog sensors are connected they can be examined for accuracy as well. Again apply a known input to the device and watch the response on the diagnostic screen.
7. After the full scale of each sensor has been verified all analog sensors can be examined for the zero condition. If values are not close enough to zero all sensors can be zeroed using the calibration routine under the setup section of the DADS. The user can press S during the DADS warm up sequence to gain access to the setup menu. Press C to enter the calibration routine, choose Y to calibrate sensors, choose Y to zero all analog sensors, (this sets the Offset), and then enter N to all remaining prompts to skip the slope portion of code.
8. If digital inputs are connected to the DADS they can be inspected as well to verify that they are responding properly. Digital channels will read "1" for switch open condition and "0" for switch closed condition. Simply shorting the wire for each digital channel to the digital ground pin should produce a "0" in that column and releasing the wire will produce a "1" in that column.
9. The data file can be offloaded from the DADS, converted from binary to text and inspected to verify that all manually applied inputs were recorded properly. Note that if the LG-Alert is level and stationary while the optional channels are being tested the readings will not be recorded in the file. Tilt the LG-Alert enough to force saving when these optional channels are being tested to ensure there data is saved to the file if it is required for inspection.

## CALIBRATING SENSORS

Connect the serial cable to the DADS and run TFTOOLS.EXE from a DOS window. Make sure you have the three accelerometer signals attached to the appropriate channels. The device should be printing run time diagnostics to the PC screen. Press CTRL-C to halt program execution. The DADS should respond by printing the “#” prompt. Click on the menu item TATTLETALE and choose RUN to start the DADS and initiate the warm-up sequence. Press S during the warm up sequence to force the program into set-up mode. Press C to enter the calibration subroutine. Press Y to calibrate any or all of the A/D channels or N to skip calibration. Immediately following the calibration input sequence the DADS will continuously measure and print current sensor readings to allow calibration to be verified. Once verified, pressing any key will return operator to the setup menu. Press E to exit from the setup sequence and begin normal program operation.

```

TFTOOLS
Auto
File Edit Search Tattletale CommPorts Windows Help 02:17:22PM
Terminal Window [1]
To calibrate sensors Press Y. Press any other key to skip

Set all sensors to zero then press Y or N y
AD offsets Ch0 = 32897 Ch1 = 33348 Ch2 = 33342 Ch3 = 33369 Ch4 = 33360

Calibrate Lateral accel ? (rotate 90) press Y or N y
Input a known value for A/D ch 0 eg.[1] 1

Calibrate Axial Accel ? (rotate 90) press Y or N y
Input a known value for A/D ch 1 eg.[1] 1

Calibrate Vertical Accel ? (rotate 90) press Y or N y
Input a known value for A/D ch 2 eg.[1] 1

Cal A/D channel 3 ? Press Y or N y
Input a known value for A/D channel 3 [1] 100

Calibrate A/D channel 4 ? Press Y or N y
Input a known value for A/D ch 4 [1] 50

ANALOG INPUT CHANNELS DIGITAL
F2 Save AltR Run AltL Launch AltY Syntax AltO Offld AltP Port

```

The first option given allows new zero offsets for all channels to be measured and saved to EEPROM. **Note that all channels must be zeroed together so all sensors connected to the DADS must be in the zero condition before you press Y.** The LG-Alert should be in a level stationary position. After the DADS measures the offsets, it prints them to the display. Offsets for the accelerometers channels 0, 1 and 2 are typically 32768 representing approximately 2.5 VDC (mid way in the 0-5VDC scale). This is the zero bias voltage of the accelerometers and is half of the 65536 A/D range. 0 corresponds to 0 VDC and 65536 corresponds to the full scale of the A/D converter (5 VDC or Vcc). From 2.5 VDC the signal can increase

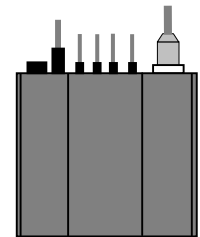
or decrease representing positive or negative accelerations (left/right, forward/backward, up/down) directions for each of the lateral, axial and vertical accelerometers respectively. To skip the zeroing of the sensors press N.

The slope value for each channel can now be assigned. These are done individually starting with channel 0 and proceeding to channel 4. This step can be skipped pressing N at the prompt.



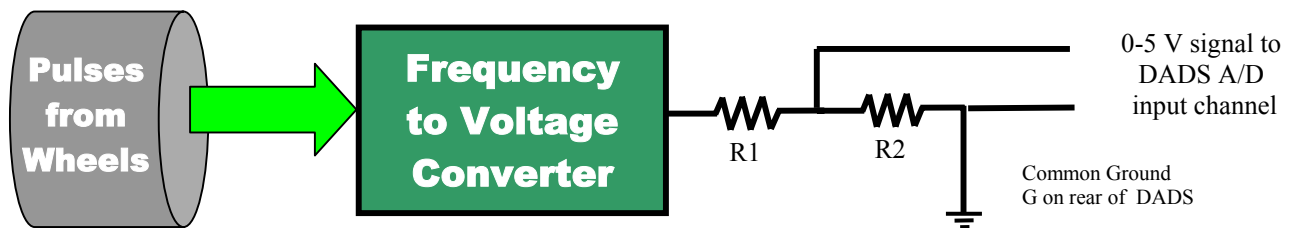
To calibrate the lateral acceleration (A/D Channel 0) simply rotate the LG-Alert 90 degrees to introduce earths gravity (1 'g') and press Y. The LG-Alert must be free from its mounting bracket to accomplish this rotation. Make sure to rotate the LG-Alert in the lateral direction as shown here.

To calibrate the axial acceleration sensor, (A/D Channel 1), rotate the LG-Alert 90 degrees to introduce 1 'g' to this axis. The front panel of the LG-Alert must be facing directly up or down. Press Y to calculate a new value for the slope for this channel or press N to skip.



For the vertical acceleration (A/D Channel 2) the LG-Alert can be rotated 90 degrees in either lateral or axial directions. The vertical accelerometer has by default 1 'g' acting on it when the LG-Alert is level, rotating the device 90 degrees in either lateral or axial directions removes earths gravity from the sensing element (a shift of 1 'g'). The calibration routine defaults to a 1 'g' input for calibration of the accelerometers. **Note : Rotating the LG-Alert 180 degrees onto its top would represent a 2 'g' input, which is out of range of the LG-Alert.**

If sensor channels 3 and 4 are used, they must have signals in the range of 0 to 5 VDC. Signal conditioning may be needed to scale the sensors output to fit within this range. The full scale of the sensor will need to be created and corresponding values inputted during the calibration sequence.

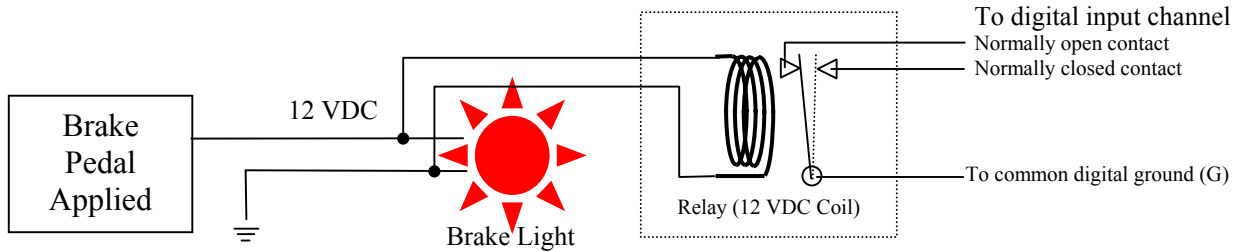


For example, suppose channel 3 is being used for vehicle speed monitoring. The signal may be available as a frequency output. A frequency to voltage converter will be needed with the voltage output scaled between 0 and 5 volts. Channel 3 will need to be supplied with a voltage and corresponding speed value during calibration steps. The signal can be simulated or taken directly from the speed sensor being monitored while the vehicle is moving.

Similar configuration would be needed for A/D channel 4 if used.

Digital channels require no calibration. They are configured according to the users requirements. For example, if the channel is being used to monitor the ON/OFF status of a piece of equipment a relay could be used to signal this state. When the equipment is powered, the supply voltage could be used to activate a relay. The normally open or normally closed contacts can provide either state to the DADS input channel.

The measurements on the host display can be examined to determine if the configuration is working. The associated digital channel should change state between “0” and “1” based on the state of the equipment.



All sensors can be zeroed at any time using the calibration routine. Make sure all analog sensor signals are in the zero condition before pressing Y. This is recommended after the LG-Alert is remounted to remove any small error the bracket orientation may introduce. All of the subsequent calibration steps can be skipped by pressing N at each prompt. Once this is done all analog sensors should read close to zero.

Once all of the signals have been verified and the calibration routine is exited, all subsequent starts of the DADS will reflect these changes. Data stored in the file will be calculated using the new calibration constants.

## TROUBLE SHOOTING

### PROPER OPERATION OF THE DADS

Connect the serial cable from the host to the DADS.

A cold start of the device usually takes 10 to 20 seconds

A back and forth flashing of the lights indicates the system is booting

There will then be a 5 second pause to allow operator interaction

Press "S" to enter the setup menu to allow you to :

Change date and time

Calibrate sensors

Re-enable saving (Allow data to be overwritten)

After this, the device will enter a continuous scanning loop until

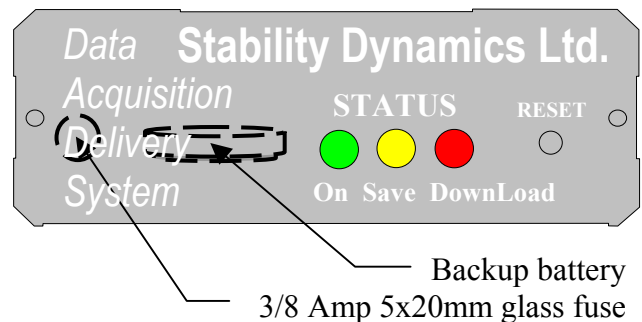
1. Power is disconnected or
2. CTRL-C from the host computer (Operator halt of program)
3. It is tripped by a vehicle rollover (Tilt orientation exceeds maximum limit for longer than the timeout period typically 30 seconds)

If the device remains inactive for more than 20 seconds after power is applied it may indicate a low backup battery or an unreliable power connection. If the device fails to begin operation after connecting the power cable try the following steps.

- 1) Press the "Reset" button and wait approximately 10 – 15 seconds for the device to restart. Remember that a reset forces date time and file pointer to zero (the initial state).
- 2) Remove Parallel (LPT) cable if connected. This may cause the device to suspend operation.
- 3) Check the power cable to the DADS. It should have 12 VDC.
- 4) Remove the 3 volt back-up battery located just behind the front panel. (Sony CR2032 3VDC coin cell). **Be sure to disconnect power to the DADS when checking the back up battery.** Try pressing the reset button on the DADS with the backup battery removed and power cable connected.

Test operation of system without the backup battery. If no replacement backup battery is available the DADS can be operated without the backup battery. The backup battery is only used to retain date and time during power outs. The non-volatile SFLASH data storage area does not require the backup battery.

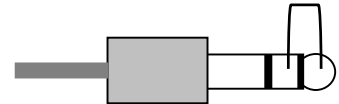
- 5) Check the 3/8 amp fuse located just behind the front panel of the DADS. **Be sure to disconnect power while the device is being serviced. Access to the glass fuse may require removal of the rear panel and printed circuit board from the DADS enclosure. Be careful of static discharge when removing the circuit boards from the DADS enclosure.**



- 6) Select RUN or RELAUNCH from the TATTLETALE drop down menu. NOTE : Make sure to reset the date and time if required. The prompt for this occurs during the warm up sequence and header printing. Press S on the keyboard of the host to enter DADS setup. Press D to set the date and time, then E to exit setup.
- 7) A fresh launch of the device should be used as a last resort to initiate the DADS. Run TFTOOLS.EXE from a DOS window and open the file CDR.TFB (source code). Select LAUNCH from the TATTLETALE drop down menu. The parallel cable must be attached for this operation. Note that the date and time are copied from the host computer during this operation. Care must also be taken to ensure that the source file (CDR.TFB) is not altered. A backup of the source application file should be kept on a write protected diskette. Source application file upgrades can be obtained and launched as they become available.

If the DADS begins operation but communication with the host is not being received. The configuration of the host may need to be changed.

- 1) Remove the parallel port if it is connected.
- 2) Check the settings in the Port/Baudrate dialog box found under the COMMPORTS, SERIAL PORT menu.
- 3) The baud rate should be 19200, and the port selected must be the port the DADS is connected to.
- 4) Try a cable loop back test. With the TFTools terminal window open, short the tip of the serial cable phone jack with the next ring down (a paper clip works well) and type some characters on the keyboard. Characters should appear in the terminal window. If characters do not appear check the cable and settings and try until it does.
- 5) Try another comport on the computer. Don't forget to change the port settings to reflect the new configuration.
- 6) If the above does not work you might try connecting to another computer. The software will need to be installed.



Refer to the section on communications for complete details on port configuration.

If some or all three lights are partially on it may indicate a CPU fault condition or a blown fuse. The fuse (2AG, 3/8 Amp) is located internally and can be replaced by removing the rear panel and sliding the card out of the enclosure. **Make sure power is disconnected when changing the fuse or backup battery. Do not exceed the 3/8 Amp rating specified. Observe standard CMOS practices and always ground yourself while handling the DADS printed circuit boards.**

If the device trips into "Stop Recording" mode immediately after powering it will need to be re-enabled. Offload the data file if required and re-enable data saving by pressing R from the DADS setup menu. Make sure all acceleration signals are within limits and properly functioning. Check sensor connections and voltages from the signal ports of the LG-Alert.

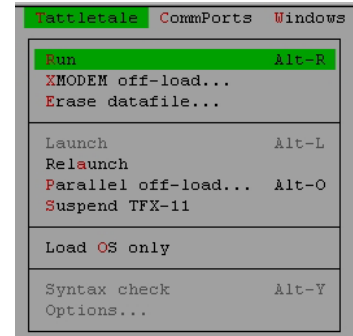
If the device fails to start after attempting the above procedures it may need to be returned to Stability Dynamics Ltd. for inspection and or repair. Refer to the front cover for contact information.

## LAUNCHING THE DADS

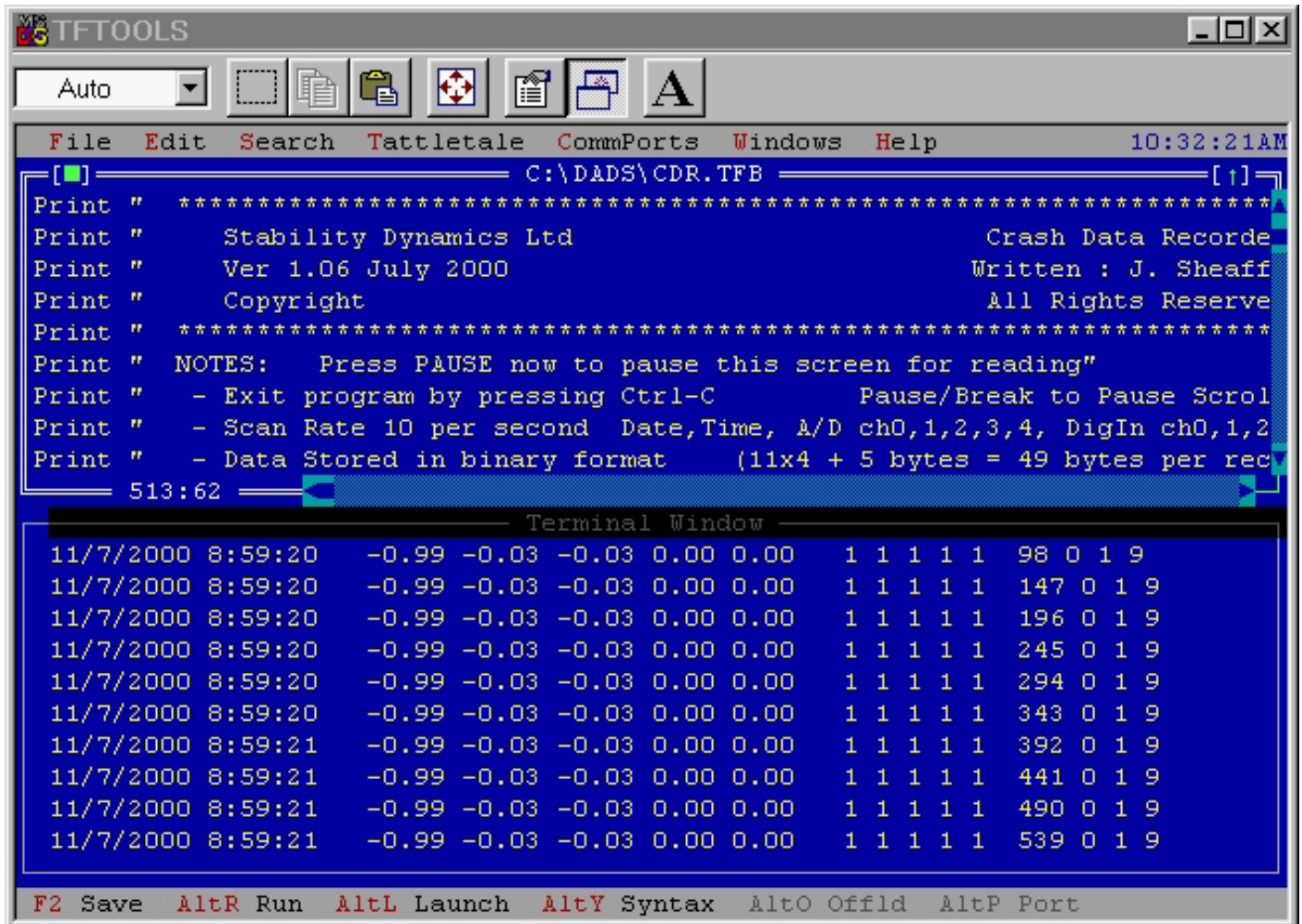
The DADS can be launched or started in three ways.

1. Selecting Run from the Tattletale drop down menu.

Run TFTOOLS from a DOS window and select  
TATTLETALE - RUN



If only the terminal window is open the DADS attempts to begin using the resident firmware. If the source code is open and currently the active window, the DADS will attempt to load the current source application code from the host to RAM and run. If any changes were made to the source, they will be reflected in the devices operation. The DADS firmware will be unaffected. Subsequent startups will resort to the previously burned program.



2. A Re-Launch will attempt to run resident firmware.
3. Launching requires both serial and parallel cables to be connected. This operation updates the resident firmware in the DADS using the source file. The application (source) file must be opened using TFTOOLS.EXE to perform this task. During a launch, the Host PC copies the operating

system and application file from the host to SFLASH then to RAM. It then checks to see if there is a valid program in RAM by verifying the checksum and performing other checks. The date and time are taken from the host and copied to the DADS. If the launch is successful the DADS will begin operation automatically after a brief pause. The DADS will then attempt to continuously monitor sensors as long as power is connected. Data saving will be dependant on sufficient motion or tilt being detected to warrant data saving.

Run TFTOOLS from a DOS Window and OPEN the source application FILE (CDR.TFB). Ensure that this file is never altered since this is the source code. Keep a backup copy on a write protected floppy disk to be sure. After the source application file is opened there will be two windows, one containing the source file and the other that echo's data received from the DADS. Only one window is active at a time.

With the cursor in the source file window select:  
TATTLETALE  
LAUNCH

The system will attempt to compile the source code and upload it to the DADS.

### **Resetting the DADS after it has been tripped**

If the accelerometer input signals are beyond a safe range or disconnected, the device will “trip” due to sustained signal over range. It will then cease recording activities and enter safe mode (assuming the vehicle has rolled over). All 3 lights will flash rapidly on the front panel. The DADS now thinks data in the device is crucial. If the data in the DADS is not required and the operator simply wants to re-activate the DADS, the following steps must be performed.

Note : The data file pointer must be zero for this task to be performed. If the data file pointer is not zero the software assumes there is data inside that is needed. The data must be offloaded if required and the data file erased inside the DADS to force the data file pointer to zero. This can be accomplished from TFTOOLS terminal window. Only the serial communication cable is required.

- Run TFTools.exe from a DOS window with the serial cable connected
- Press CTRL-C from the terminal window to halt DADS execution
- Select TATTLETALE Serial Offload or Parallel Offload if the data is required  
See the section on getting your data for details about data offloading.
- Select TATTLETALE - Erase Data File to erase the DADS data file  
Two '#' prompts should be printed to the host screen
- Select TATTLETALE – Run to restart the DADS
- Press S during DADS warm up sequence to enter setup menu
- Press R to Re-Enable Data Saving
- Press E to exit setup and begin normal program operation

**INTERNAL DATA STORAGE :**

The device holds approximately 15 minutes of data before it begins to overwrite previously saved measurements. The data is contained in a 470K circular buffer in EEPROM. Once written, the data in the EEPROM is secure even from system power failure. Even if the DADS becomes damaged, the data can likely be retrieved from the non-volatile EEPROM storage area.

The DADS scans each of 10 sensor inputs 10 times per second and determines if accelerometer readings are large enough to warrant saving. Each record contains 49 bytes. When the program reaches the end of the 470K byte data storage area the data file pointer is reset to zero and storing begins again at the beginning. The program manages the data storage area in 4K blocks, erasing the next block before it begins writing. The red light on the front of the DADS will blink when a 4K block is being erased for re-write.

Files are transferred from the DADS to the host computer using either serial or parallel cables. The data transferred is in binary format. No header is contained in the binary data structure.

```
101010000101010010101000101001010101010101011000010101010101010101010000010101010101010101010
10101000000010101011110010101010010101010101010101010101010000000011111100010100000111100000010
10010110101000010101001010100010100101010101010101100001010101010101010101000001010101010101010
101010101010000000101010111100101010100101010101010101010101010101010000000011111100010100000111100
000010100101101010000101010010101000101001010101010101010101011000010101010101010101000001010101010
```

Files transferred to the host computer must then be converted to ASCII (Text) using the file conversion program CONVERT.BAT. The text file created is a comma separated variable format (CSV) that can be imported to “spreadsheets” or database programs for inspection, processing, and analysis. The binary to text conversion utility CONVERT.BAT, prints a generic header to the ASCII text file, then proceeds to convert the binary data to ASCII values byte by byte. These values are then printed as individual records to the text file, each representing approximately 1/10 of a second.

```
Start of Data
Date,Time,,Latg,Axlg,Verg,A/Dch3,A/Dch4,Digch0,Digch1,Digch2,Digch3,Digch4
,,Raw,Raw,Raw,Raw,Raw,Raw,Raw,Raw,Raw,Raw,Raw,Raw

07/31/1998,17:30:26 PM,, 0.322, 0.198, 0.086, 269.07, 114.15 , 1 , 1 , 1 ,1 , 1
07/31/1998,17:30:27 PM,, 0.321, 0.200, 0.086, 222.40, 88.42 , 1 , 1 , 1 ,1 , 1
07/31/1998,17:30:27 PM,, 0.321, 0.201, 0.085, 218.91, 85.33 , 1 , 1 , 1 ,1 , 1
07/31/1998,17:30:27 PM,, 0.320, 0.203, 0.084, 218.22, 84.31 , 1 , 1 , 1 ,1 , 1
07/31/1998,17:30:27 PM,, 0.320, 0.201, 0.085, 218.91, 85.33 , 1 , 1 , 1 ,1 , 1
07/31/1998,17:30:27 PM,, 0.320, 0.200, 0.085, 218.91, 85.33 , 1 , 1 , 1 ,1 , 1
```

**KEYBOARD EQUIVALENTS FOR MOUSE ACTIONS****Dialog box navigation**

- |                       |                |
|-----------------------|----------------|
| ○ Cancel              | ESC            |
| ○ OK                  | Enter          |
| ○ Move within a group | Up/Down Arrows |
| ○ Toggle Check Box    | Space          |
| ○ Toggle Radio Button | Space          |
| ○ Next Group          | TAB            |
| ○ Previous Group      | Shift-TAB      |

**Editing Control Functions**

Move Cursor	Arrow Keys
Cursor Word Left	Ctrl-Left Arrow
Cursor Word Right	Ctrl-Left Right
Delete Line	Ctrl-Y
Marking Blocks	Shift-Arrow Keys
Select to Beginning of line	Shift-Home
Select to End of Line	Shift-End
Select to top of page	Shift-PgUp
Select to bottom of page	Shift-PgDn
Begin Block	Ctrl-K B
End block	Ctrl-K K
Move cursor 1 page	PgUp/Pg/Dn
Move to beginning of line	Home
Move to end of line	End
Delete to end of word	Ctrl-T
Delete character at cursor	Del or Ctrl-G
Toggle Insert Mode	Ins
Delete to end of line	Ctrl-Q Y
Move one character left	Ctrl-A
Move one word left	Ctrl-S
Move one character right	Ctrl-D
Move one word right	Ctrl-F
Delete character to the left	Backspace or Ctrl-H

**File Main/Submenu items**

File	Alt-F	
New	Alt-F N	
Open	Alt-F O	F3
Close	Alt-F C	
Save	Alt-F S	F2
Save As	Alt-F A	
Print	Alt-F P	

Print Selection	Alt-F R	
Change Directory	Alt-F H	
DOS Shell	Alt-F D	
Quit	Alt-F Q	Alt-Q
Edit	Alt-E	
Undo	Alt-E U	Ctrl-U
Cut	Alt-E T	Ctrl-X
Copy	Alt-E C	Ctrl-C
Paste	Alt-E P	Ctrl-V
Clear	Alt-E L	Ctrl-Del
Paste Date/Time	Alt-E D	Alt-D
Search	Alt-S	
Find	Alt-S F	
Find again	Alt-S A	Ctrl-L
Replace	Alt-S R	
TattleTale	Alt-T	
Run	Alt-T R	Alt-R
Xmodem off-load	Alt-T X	
Erase Data File	Alt-T E	
Launch	Alt-T L	Alt-L
Relaunch	Alt-T A	
Parallel off-load	Alt-T P	Alt-O
Suspend DADS	Alt-T S	
Load OS only	Alt-T O	
Syntax check	Alt-T Y	Alt-Y
Options	Alt-T P	
CommPort	Alt-C	
Serial Port	Alt-C S	Alt-P
Hex display	Alt-C H	Alt-X
Capture to file	Alt-C C	Alt-Z
Parallel Port	Alt-C P	
Windows	Alt-W	
Tile	Alt-W T	
Cascade	Alt-W C	
Next	Alt-W N	F6
Previous	Alt-W P	Shift-F6
25 line screen	Alt-W 2	
50 line screen	Alt-W 5	
Color Screen	Alt-W O	
Blk/Wht screen	Alt-W B	
Help	Alt-H	

About	Alt-H A
Command Line Options	Alt-H C
TFBasic Summary	Alt-H T
Keyboard Equivalent	Alt-H K

**GETTING YOUR DATA** (off loading data from the DADS and converting it to text)

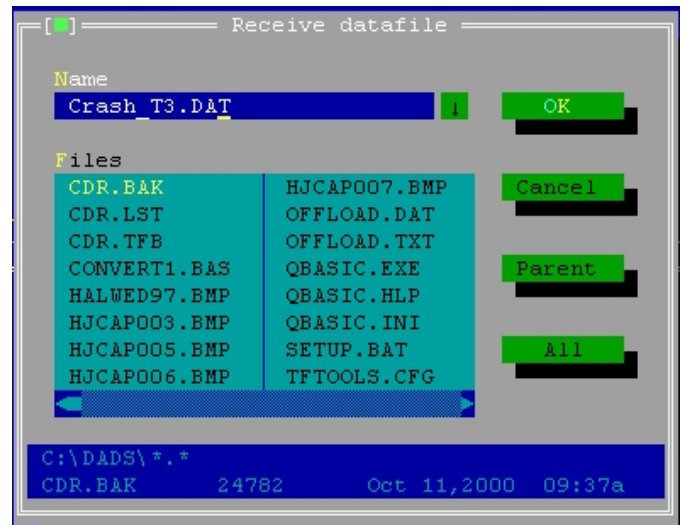
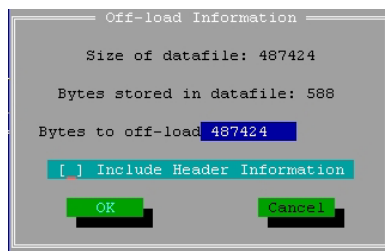
To retrieve the data from SFLASH you need to be running TFTools. The TFBASIC program, (if running), must be halted and the # prompt must appear in the terminal window. Next the TATTLETALE menu is pulled down to select serial or parallel offload. For high speed parallel offloads, the parallel cable must be connected.

With power to the DADS and cable(s) connected :

- RUN TFTOOLS.EXE from a DOS window on the host computer
  - Press CTRL-C to halt program if it is running (a # prompt should appear)
  - Choose Tattletale / Xmodem Off-load (Serial Cable offloads)  
or Tattletale / Parallel Off-load (for fast parallel down loading)
  - Select Bytes to offload to reflect what data you want
    - The data file storage area is a circular buffer about 470000 bytes in size.
    - For the whole memory area to be offloaded change Bytes to offload to the maximum file size.
    - For only part of the file change Bytes to offload to suit.
- NOTE : The device will assume that the size of the file is the current data file pointer value and may or may not include all the data you want.
- Disable the header information check box  Include Header Information  
Press OK to continue

INPUT file name (up to 8 characters)  
e.g., Crash\_T3.dat

- The default file name is “offload.dat”
- Select “OK”



The data file will now be located on the host computer hard drive if the transfer was successful. The file format is binary and can be converted to text format (ASCII). This file can then be imported to other software programs for review and analysis. Be sure to note item above (disable header information) since the conversion utility is specifically configured to read raw data records from the binary file (no header).

- Run CONVERT1.EXE to read the binary “dat” file and create a text file. The text file is made up of columns of data separated by commas. The binary “dat” file created by the DADS is simply a block

of data (since the header was disabled during offloading above). The conversion utility writes a default header then converts the binary data to text values and stores them in the file. Ensure that you use logical names for your files to identify them later.

e.g., Crash\_T3.dat (binary file) contains crash data from Truck number 3  
e.g., Crash\_T3.txt (ASCII text file) ready for importing and analysis.

The base DADS system identifies only A/D channels 0, 1 and 2 as the accelerometer inputs. Optional channels A/D 3, 4 and Digital I/O Channels 0, 1, 2, 3 and 4 are generically labeled in the header portion of the text file.

- The file can now be imported to a spreadsheet program by specifying the file as text with commas as delimiters.

# Technical Support Policy, Warranty and Disclaimers

## Read This Before You Contact Stability Dynamics Ltd. for Technical Assistance

Stability Dynamics provides technical support through a variety of channels. The first and most important is the user guide. We have made great effort, to provide you with all the information you need in an easy to read format. Please check through it carefully before calling. If you are unable to find what you need in the user guide, please be sure you understand what types of end user problems we do and do not support by reading the following paragraphs.

Software / Programming problems:

Stability Dynamics Ltd. provides support for its software only and does not provide instruction on how to program. The DADS system is provided with a base software package that is pre configured to record data from the 10 channels accessible on the rear panel of the device. If custom alterations are required in the base software package, you must contact Stability Dynamics Ltd. to determine if these changes are possible. Stability Dynamics Ltd. does not guarantee it's code to be free from errors.

Hardware / Circuit Design Problems :

Stability Dynamics Ltd. provides support for it's hardware only when it does not appear to meet our published specifications or otherwise perform as advertised. Stability Dynamics Ltd. does not provide instruction in electronics and electronic instrument design other than what is included in this manual and related application notes. If the optional sensor inputs to the DADS are required please refer to the section of the user guide on calibrating sensors. Contact Stability Dynamics Ltd. if you require assistance beyond what is covered in this user guide.

## Warranty

Hardware will be replaced or repaired (at Stability Dynamics Ltd. discretion) if found to be defective in materials or workmanship for a period of one year from original purchase. Software will be replaced only if the disk supplied is found to be defective. All other programs and other files are offered as-is. If you choose to use the software Stability Dynamics Ltd. cannot be held liable for any damages or loss of data incurred as a result of its use. While we hope you find the data recorder useful, it is up to you to determine the applicability, fitness, and correctness for your application.

## Returns

All returns require that you first request and obtain a Return Materials Authorization (RMA) number from Stability Dynamics Ltd. The RMA helps us track your return in our computer and speeds the processing. To obtain an RMA, call Stability Dynamics Ltd. Sales Support. Have available the model number, serial number, invoice number, date of purchase and a brief description of the problem if possible. They will assign you a number which should be plainly visible on the outside of any packaging and referred to in any

correspondence. Returns without prior authorization may be delayed. NOTE : some returns may be subject to a re-stocking fee.

## **Disclaimers**

Stability Dynamics Ltd does not authorize or approve the use of this equipment in life support or related safety equipment, and cannot be held responsible for an injury or death as a result of it being used in any related application.

If you choose to use the supplied software you do so at your own risk. Stability Dynamics Ltd. cannot be held liable for any damages incurred as a result of its use.

## **Contacting Stability Dynamics Ltd.:**

If you have searched the user guide and still have not found an answer, then you may need to contact Stability Dynamics Ltd. Before you contact Stability please have the following information available and be well prepared to describe your problems or difficulties by doing the following:

- DADS TFTOOLS version number (1.08, 1.09, 1.1)
- DADS serial number
- DADS software version number

Please be sure to include this information in any correspondence. If you phone, have this information available. If possible (and if appropriate to the problem) please try to be seated at your computer when you call.

You can contact us by phone, fax, email, standard mail or the internet. See inside the front cover of the user guide for the numbers and address.