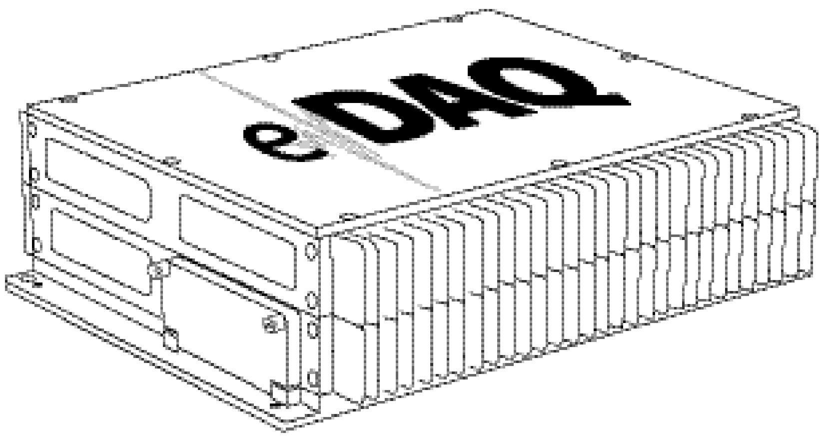
eDAQ Manual



eDAQ: Designed to efficiently collect data from vehicle networks and combine this data with strain, analog, and digital data for all your data acquisition needs.

SOMAT®

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About this Guide

Scope and Prerequisites

Primary Purpose of Guide

This Manual is intended for engineers, scientists, technicians, and others who want to use the eDAQ Field Computer System (FCS) to set up and run engineering and product reliability tests. Its primary purpose is to provide information on using the eDAQ and SoMat Test Control Environment (TCE) software and to illustrate features.

If more details on concepts introduced are necessary, refer to the TCE Online Help System or contact SoMat.

Expertise with Windows

You should be familiar with the Windows® operating system before installing and starting TCE. If you are not, complete the tutorials available in the Windows Help System.

Use of Ethernet

Communications between the eDAQ and the support (host) PC are done via Ethernet instead of using serial or parallel communications. A detailed description can be found in Appendix D, **Ethernet Communications**.

Guide Contents

The contents of the chapters in this Guide are as follows.

Chapter 1 • Overview of the eDAQ FCS

Introduces the eDAQ and the provided TCE and DataXplorer software.

Chapter 2 • Setting Up the eDAQ

Describes setting up the eDAQ and the support PC. It also covers the installation of TCE.

Chapter 3 • TCE for eDAQ

Explains the basic features, functions and operation of TCE.

Chapter 4 • DataXplorer

Introduces the SoMat DataXplorer software.

Chapter 5 • Transducer Cables and Wiring

Presents the wiring of transducers for use with the eDAQ.

Chapter 6 • eDAQ Test Process

Describes the six phases of the test process when using the eDAQ and the actions involved in each phase.

Chapter 7 • Transducer Channels

Presents procedures and other information to define channels for the transducers using TCE.

Chapter 8 • Computed Channels

Introduces computed channels and presents the procedures and other information in TCE.

Chapter 9 • DataModes

Introduces the various DataModes and explains their setup and use.

Chapter 10 • Monitoring Tests and Channels

Describes how to check the status of a test and the operation of transducers and computed channels.

Appendix A • Cable Wiring

Provides details on the cables provided with the eDAQ, particularly the connectors, pinout assignments, and wire color coding.

Appendix B • TCE Computed Channels

Lists a brief description of the computed channels provided with TCE.

Appendix C • eDAQ Dimensions

Contains diagrams showing the dimensions of the eDAQ.

Appendix D • Ethernet Communications

Provides information on establishing communications between the host computer and the eDAQ. Also provides an overview on the inner workings of Ethernet communications.

Appendix E • eDAQ Web Interface

Provides an overview of the Web Interface and using a Web Browser to change common parameters and functions of the eDAQ.

Conventions Used

Standard engineering abbreviations are used for this manual. Additionally, the following conventions are used.

Abbreviations

DRAM	Dynamic Random Access Memory
DVM	Digital Value Meter
EASE	Engineering Analysis Software Environment
EEPROM	Electrically Erasable Programmable Read Only Memory
FCS	Field Computer System
MB	Megabyte
RAM	Random Access Memory
SRAM	Static Random Access Memory
TCE	Test Control Environment

Use of “Select”

The term “select” is used when a particular action can be selected in more than one manner. This includes, but is not limited to, selection using a mouse or by using one key or a combination of keyboard inputs.

Related Documentation

SoMat EASE Version 3 Operating Manual (Included with purchase of EASE software)

Explains the use of the DataXplorer software provided with TCE. (DataXplorer is a special “viewing only” version of EASE.)

SoMat TCE for eDAQ Release Notes and Updates to Release Notes

Release notes may be distributed with SoMat TCE. They have information which supersedes all other documentation sources for TCE operation.

SoMat TCE for eDAQ Online Help System

The Online Help System is the main resource for the use of TCE. It has detailed information for TCE and can be used for amplification of concepts presented in this Guide.

Chapter 1 - Overview of the eDAQ FCS

Overview

The SoMat eDAQ Field Computer System (FCS) is a microprocessor-based data acquisition system designed for portable data collection in a variety of test environments.

The basic eDAQ system consists of:

- SoMat eDAQ Field Computer
- SoMat Test Control Environment (TCE) software
- SoMat DataXplorer software

Chapter 2 of this guide explains setting up the eDAQ and requirements for a support PC and power supply.

The eDAQ Field Computer System

Distinctive Features

The distinctive features of the eDAQ FCS include:

- Up to four eDAQ Low-Level Board units providing a total of 32 analog or strain channels (8 channels per unit)
- Ten digital I/O and eight pulse counter channels on the Main Processor Board
- Optional High-Level Board unit provides 16 analog channels
- Optional interface to a Vehicle Bus Network
- Small, portable system with built-in signal conditioning
- Windows®-based software for easy test setup and operation
- Almost all signal conditioner options can be selected via software
- Intelligent online data reduction with access to a library of data analysis modules
- Unattended short- and long-term data acquisition using multiple channels and a variety of transducers
- PCMCIA slot
- Use of Ethernet (10baseT) to communicate with the support (host) PC
- Power circuitry adapted for direct use of vehicle power
- Simplified calibration and setup
- Computed channels (construct data based on other channels)
- Tabular and multiple graphic modes for data display
- Sample rates up to 10,000 samples per second for Low-Level Board transducers, up to 2500 samples per second for most other transducers
- 16-bit A/D converter
- Digital filtering of data (Low-Level Board)
- Rugged construction: machined aluminum case with gaskets to protect it from moisture, corrosion, and dust
- Watchdog circuitry switches primary power to backup when a momentary power loss occurs
- Trickle-charged internal battery pack powers the eDAQ when main power voltage is low

Standard Configuration

The basic eDAQ consists of two layers:

- The bottom layer contains the Main Processor Board and a PCMCIA slot. It has ten digital input/output channels and eight pulse counter channels and handles the communications with the support PC. The optional 16-channel High-Level Analog Board and optional Vehicle Bus Interface, when installed, are in this layer.
- The top layer is a Low-Level Analog Board collecting eight channels of low-level analog or strain data. Up to three more low-level or similar layers can be added to the eDAQ to provide up to 32 channels.

Front Features

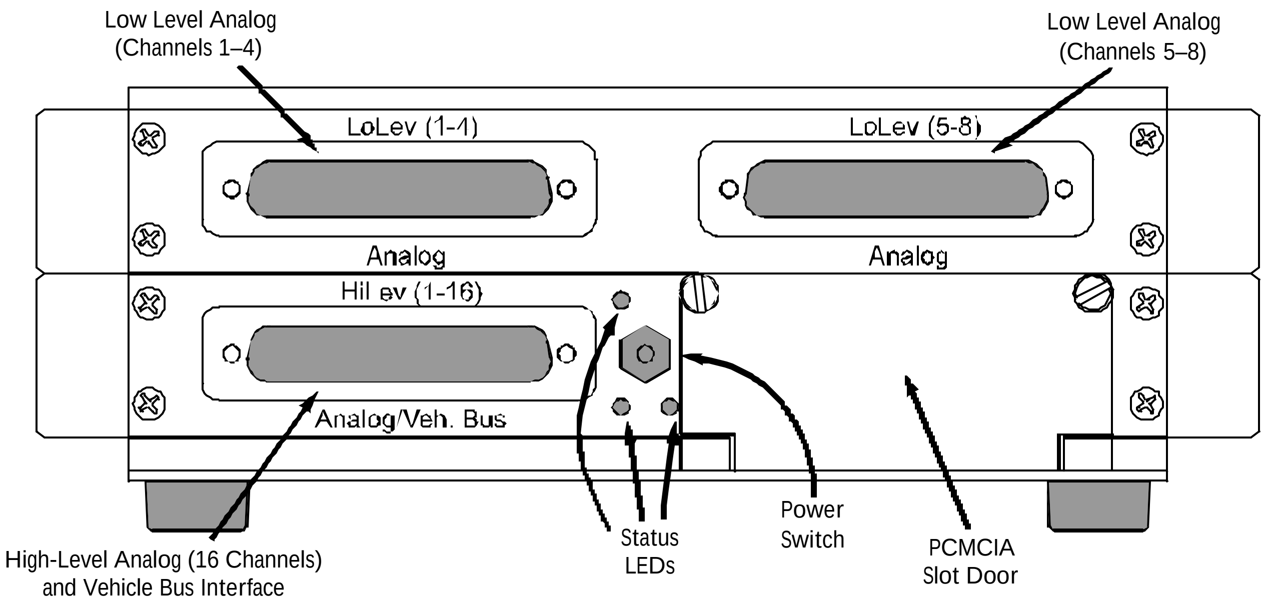


Figure 1-1: Front Panel of eDAQ

Connectors

The Low-Level Analog Board (upper layer) has two 37-Pin D-sub receptacles, one for channels 1–4, and the other for channels 5–8. The base (bottom) layer has a 52-Pin HDD-sub receptacle for high-level analog channels if the optional High-Level Analog Board is installed in the eDAQ; otherwise, the receptacle opening is covered.

Status LEDs

Three LEDs on the front panel indicate the eDAQ's operational status:

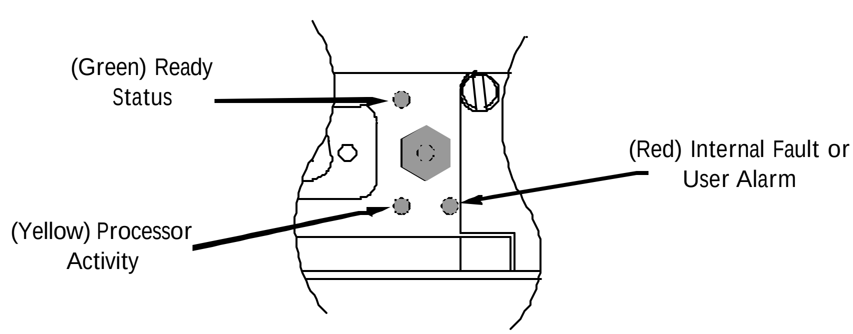


Figure 1-2: Status LEDs

Ready Status (Green) — When lit, indicates the eDAQ is available for use; when not lit, the eDAQ is unavailable due to processor activity or an internal fault. It lights briefly when you power up the eDAQ. When the eDAQ completes its bootup process, this LED lights again and stays lit.

Processor Activity (Yellow) — When lit continuously, indicates the eDAQ is busy and unavailable for new actions, such as during bootup and when starting a test run. After test initialization, this LED flashes on and off slowly to indicate a test run can be started. After the test run has started, this LED flashes on and off very quickly to indicate run progress.

Internal Fault or Alarm (Red) — When lit continuously, indicates an eDAQ error or user alarm has occurred. Use the command Get Test Status in the Test Control menu in SoMat TCE to get a description of the reason why the LED is lit. This action will normally clear the error or alarm.

Rear Features

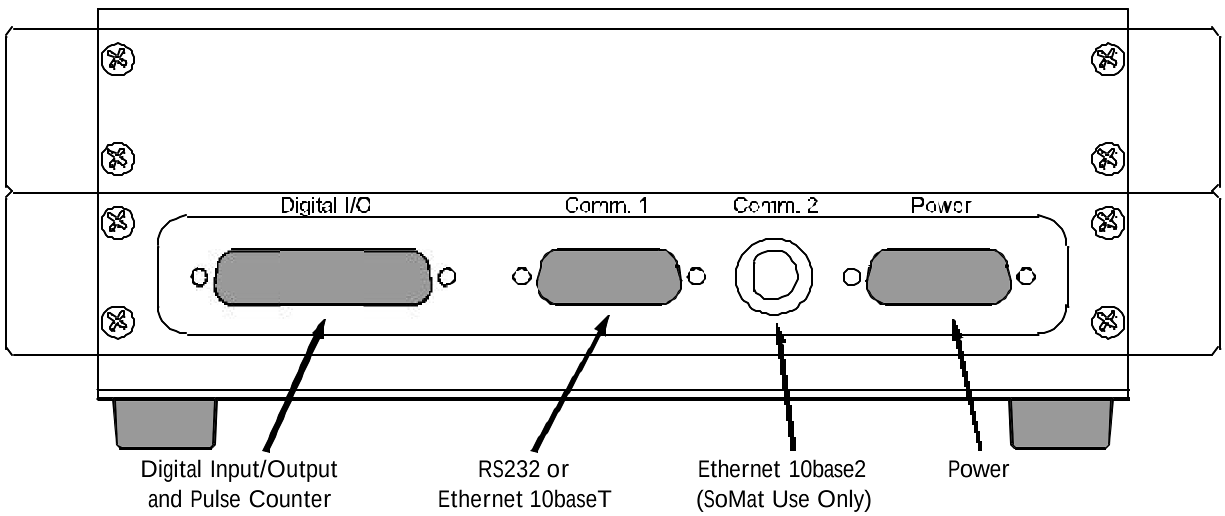


Figure 1-3: Rear Panel of eDAQ

The connectors on the rear panel of the base layer are:

- A 44-pin D connector for ten digital input/output channels and eight pulse counter channels (Digital I/O)
- A 28-pin D connector for Ethernet 10baseT and serial RS232 communications with the support PC
- A 9-pin D connector for power to the eDAQ (Power)

Dimensions

Basic eDAQ with two layers:	3.31" H × 9.13" W × 10.88" D (84mm × 232mm × 276mm)
Additional Low-Level Layer:	Add 1.23" to height

For more dimensions, see Appendix C, "**eDAQ Dimensions**."

Support Connections

The eDAQ comes fully assembled, but two support connections are required for operation:

- Connection to an appropriate power source

  The power cable provided with the eDAQ has pigtail ends to facilitate connecting to various power sources. The specifications for a power supply are found under **Power Supply** in the section Support Equipment in Chapter 2.

- Connection to a support PC so the eDAQ can be controlled, test channels set up, tests initialized, and test data uploaded

  The eDAQ is easily connected to its support PC using the Ethernet communications cable provided with the eDAQ. The requirements for the support PC (e.g. an Ethernet card must be installed) are specified in subsection **Support PC** under Support Equipment in Chapter 2.

Data Channels Available

Overview

The following briefly describes the hardware aspects of these data channels. More information on their use and how they are defined (set up) in TCE is found in Chapter 7, **Transducer Channels**.

Low-Level Analog

The low-level analog channels are used with analog and strain signals normally less than One Volt (usually in millivolts). Up to eight low-level channels can be defined for each Low-Level Board installed. The transducers are connected to the eDAQ via the LoLev (1–4) and LoLev (5–8) connectors on the Low-Level Board. Specification for the Low-Level Board can be found on **page 5**.

High-Level Analog

The high-level analog channels are used with analog signals normally greater than 5V. Up to sixteen high-level channels can be defined. The transducers for these channels are connected to the eDAQ via the connector labeled HiLev (1–16) Analog/Veh. Bus on the High-Level Board. Specifications for the High-Level Board can be found on **page 8**.

Digital Input/Outputs

Ten digital input/outputs are available. Each is configured as either input or output using SoMat TCE. The transducers are connected to the eDAQ via the 20-wire cable in the Digital I/O cable assembly going to the Digital I/O connector on the eDAQ's base (bottom) layer.

The sample rate for the Digital Bitwise input is 0.1 Hz – 2500 Hz (based on a master sample clock rate of 100,000 Hz).

An open circuit is sensed as a logic one (true). Voltages greater than 2.1 Vdc are consideres logic one (true); less than 0.5 Vdc are logic zero (false).

Pulse Counters

The eight pulse counter channels available can measure pulse time period, pulse count rate, pulse frequency, and duty cycle. The transducers are connected to the eDAQ via the 16-wire cable in the Digital I/O cable assembly going to the Digital I/O connector in the eDAQ's base (bottom) layer.

The sample rates for the Pulse Counter input is 0.5 Hz – 50,000 Hz (based on a master sample clock rate of 100,000 Hz).

An open circuit is sensed as a logic one (true). Voltages greater than 2.1 Vdc are consideres logic one (true); less than 0.5 Vdc are logic zero (false).

Low-Level Board

Features

Each Low-Level Board can collect up to eight channels of strain or analog data. Key features include:

- Simultaneous sample and hold for all low-level channels
- Guard filter on each channel to prevent aliasing of data
- Software selection of quarter, half, or full-bridges
- Either 120Ω or 350Ω internal quarter-bridge completion (determined when the board is built)
- Programmable digital filters
- Excitation options of 5, 10, and 20 V

Specifications

The specifications for each Low-Level Board are as follows:

Sample Rate:	0.1–10,000Hz
ADC Resolution:	16 Bit
Operating Temp.:	-20 to 65 °C
Temperature Drift (Worst Case):	Gain +/- 30 ppm/°C
	Offset +/- 12 ppm/°C
Initial Calibration:	>1 LSB
Input Resistance:	10^{10} Ω for $V_{-exc}<V_{in}<V_{+exc}$
Dynamic Range:	70 dB
Common Mode Rejection:	70 dB
Full-Scale Voltage Range:	±3 mV to ±10 V
Offset, Analog Output:	1000 µvolts

Supply Current in Addition to Processor Board Current (at 12 volts):

On state, no transducers	500 mA
Eight 350 full bridges, 5 V excitation	600 mA
Eight 350 full bridges, 10 V excitation	870 mA
Eight 120 quarter bridges, 5 V excitation	650 mA
Eight 120 full bridges, 5 V excitation	830 mA

Connectors

There are two 37-pin D connectors on each Low-Level Board, labeled LoLev (1-4) and LoLev (5-8). Both the input transducer connections and the high-level analog outputs are provided via these connectors.

Low-Level Signal Flow through eDAQ

The eDAQ is connected to transducers or sensors attached to the components being tested to detect movement, stress, strain, etc. Signal conditioners in the eDAQ derive digital data from the electrical signals generated by the transducers or sensors. The eDAQ's microprocessor manipulates and stores the test data in digital memory until uploaded to the support computer.

The following describes the flow of a low-level analog input signal through the eDAQ. The lettered steps match circled numbers from the signal flow diagram.

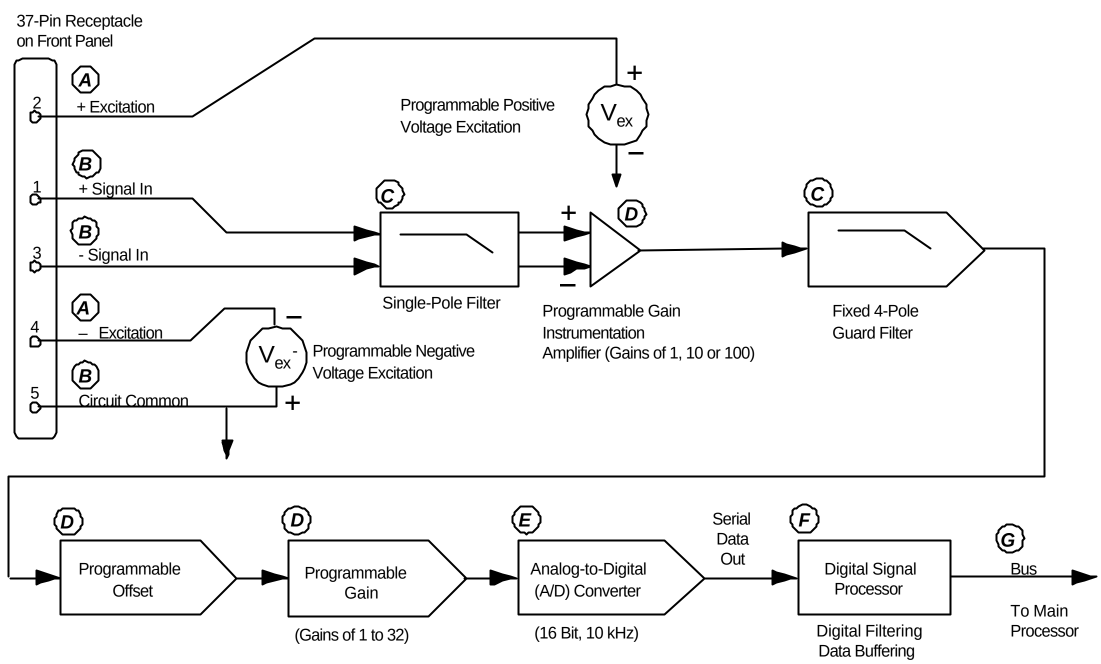


Figure 1-4: Low-Level Analog Signal Flow

A Signal conditioners supply both positive and negative excitation to transducers through the connector.

B The transducer supplies a differential signal to two pins on the input connector of the signal conditioner:

a. A signal ground (circuit common) is also available on one pin of the input connector.

b. 120Ω or 350Ω completion resistors are available (not in **Figure 1-4**).

C Each signal passes through an anti-aliasing analog guard filter.

D Each signal passes through an amplification/offset stage where the signal is conditioned for the A/D conversion. The hardware amplifies and offsets the signal using a programmable gain first stage amplifier, a set of fine and coarse voltage offset DAC's, and a programmable gain second stage amplifier. The amplification/offset values are computed automatically by TCE from the transducer calibration data and full-scale values.

E Each of the signals is processed through the A/D converter at a 10 KHz rate.

F Each digital signal passes through a digital filter (selected by the user via TCE) and is downsampled based on the sample rate specified by the user. The maximum sample rate at the output of the digital filter is 2,500 Hz.

NOTE: Data can be passed through the digital signal processor without filtering, permitting a maximum sample rate and data storage of 10,000 samples per second.

G The digital signals are then routed to the main processor for further processing and/or storage.

NOTE: Signals can be combined and modified by using computed channels to create new channels. The transducer and computed channel data can then be stored in memory (SRAM or PCMCIA card) with a specified DataMode. Some of the DataModes available are Time History, Time At Level, Burst History, Peak/Valley, Peak/Valley Matrix, and Rainflow.

Outputs

Figure 1-5 below is a block diagram of the outputs from a Low-Level Board unit.

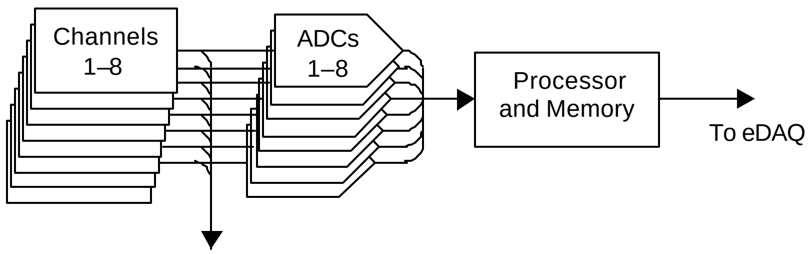


Figure 1-5: Low-Level Board Signal Flow with ADC

High-Level Board

Features

- Up to 16 high-level analog channels
- Vehicle Bus Interface (optional)
- One excitation source of ±10 V with 30 mA current output

Connectors

There is a 62-pin D connector labeled HiLev (1-16)/Veh Bus for each High-Level Board. All of the high-level input transducer connections are provided via this connector.

High-Level Signal Flow through eDAQ

The eDAQ is connected to transducers or sensors producing high-level analog signals via the High-Level Analog Board. The eDAQ's microprocessor manipulates and stores the test data in digital memory where it is held until uploaded to the support computer.

The following describes the high-level signal flow of an input signal through the High-Level Board. The numbered steps match circled numbers from the signal flow diagram, **Figure 1-6** (next page).

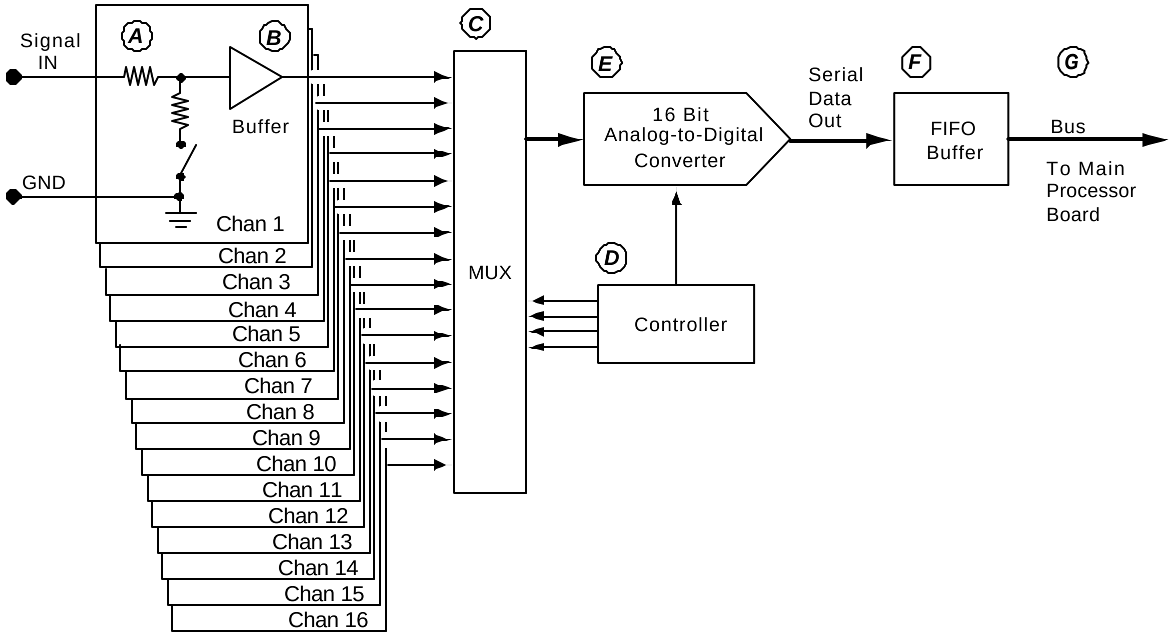


Figure 1-6: High-Level Signal Flow

A The high-level signals can be attenuated by selecting to double the signal range to ±20 V (an option within TCE).

B The signals are buffered.

C All 16 data channels are multiplexed.

D The Controller sequences the MUX and ADC.

E Each signal is processed through the A/D converter at up 2,500 Hz samples per second per channel.

F The data samples are stored temporarily in a FIFO buffer.

G The digital signals are then routed to the main processor for further processing and/or storage.

NOTE: Signals can be combined and modified by using computed channels to create new channels. The transducer and computed channel data can then be stored in memory (SRAM or PCMCIA card) with a specified DataMode. Some of the DataModes available are Time History, Time At Level, Burst History, Peak/Valley, Peak/Valley Matrix, and Rainflow.

Vehicle Bus Interface

Overview

The optional Vehicle Bus Interface (VBI) provides the means to acquire vehicle bus data while collecting data from other parts of a vehicle. It acts as an interface between the standard vehicle networks and the eDAQ. It does all of the communications translations and protocol conversions needed by the eDAQ to communicate with those vehicle networks.

Available Interface Types

These interface types are available—others are being developed:

CAN J1850 PWM ISO 9141 J1850 VPW

The VBI supports Vector format for CAN databases and complies with Ford Motor Standard Corporate Protocol (SCP).

Vehicle Connection

The data cable coming from the OBD-II connector in the vehicle is connected to the receptacle labeled HiLev (1–16) Analog/Veh. Bus on the front panel of the base layer.

Vehicle Bus Interface Signal Flow

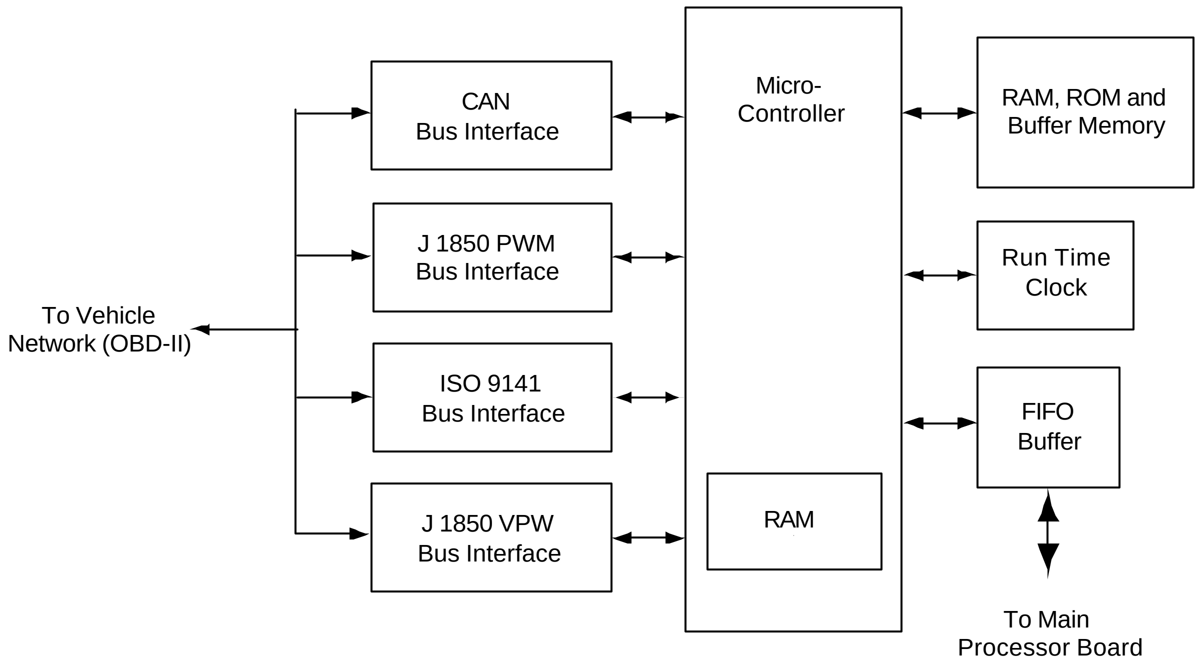


Figure 1-7: Vehicle Bus Interface Signal Flow

The signals from the vehicle network are first processed through the appropriate interface. The microcontroller then puts the data into packets for use by TCE and forwards those packets to the main processor board via a FIFO buffer.

Main Processor Board

Features

Key features of the Main Processor Board (MPB) unit include:

- Processes up to ten digital input/output channels and up to eight pulse counter channels (see **Data Channels Available**, page 4)
- PCMCIA slot for use of a hard drive or flash RAM card (see the following section, **PCMCIA Slot**)
- Communication with support PC via Ethernet 10baseT (300 Kbytes/second) or serial RS232

Specifications

The specifications for the MPB are as follows.

Sample Rate:	50–2,500 Hz
Processor:	AMD Elan 486
Memory:	4 MB SRAM, 16 MB DRAM, 4 MB flash memory
Operating Temp.:	-20 to 65 °C
PCMCIA Write Speed:	Up to 700 Kbyte/second
Supply Current (at 12 V):	1 Amp

PCMCIA Slot

Usable PCMCIA Cards

The eDAQ's PCMCIA slot accommodates Type II and III cards (hard drive or flash memory) in a variety of densities with write speeds up to 700 Kbytes/second.

NOTE: If the eDAQ will be used where it will be subject to vibration and movement, use a flash memory PCMCIA card instead of a disk drive card.

The hard drive card can be formatted with either LINUX or DOS for use with the eDAQ. The LINUX option will provide higher data throughput. Effortless formatting can be performed using the eDAQ Web server interface. See **Appendix E** for details on the eDAQ Web Interface.

The PCMCIA Door

To open the door covering the PCMCIA slot, loosen the screws holding the door closed. When done working with the PCMCIA slot (e.g. swapping out a card), be sure to close the door and fastened the screws tightly to prevent dust and moisture from entering.

Use of Ethernet

Ethernet 10baseT can be used for communications between the eDAQ and its support PC. Data transfer rates of up to 800 Kbytes per second are possible using the Ethernet connection. A 10baseT compatible Ethernet card must be installed in the support PC.

The eDAQ can be connected to its support PC directly (using the "cross over" cable provided) or via a network (using the optional "hub" cable). Using a network allows having the eDAQ in one room and the support PC in another room, another building, or even halfway around the world, depending on the size of your network.

A serial RS232 communications cable is also provided with the eDAQ. This is currently used only for some eDAQ setup operations and custom applications.

SoMat TCE for eDAQ Software

The SoMat Test Control Environment (TCE) software provided with the eDAQ is a Windows-based interface between you, the eDAQ, and the support PC. TCE is used to:

- Set up a test (includes defining the data channels and SoMat DataModes to be used in collecting data)
- Calibrate transducers
- Control a test (includes starting and stopping tests and monitoring transducer and channel outputs with various displays)
- Upload data from the eDAQ to the support PC

Test parameters set up in TCE are downloaded when the eDAQ is initialized for a test. After the test has run, the resulting test data is uploaded to the support PC. TCE is the means by which all such interactions take place.

Chapter 3, **TCE for eDAQ**, describes the TCE main window and the basics of operating TCE. Later chapters provide information on specific tasks that are done in TCE, such as setting up data channels and DataModes, controlling and monitoring tests, and so on.

SoMat DataXplorer Software

The SoMat DataXplorer software provided with the eDAQ can be used to display and analyze acquired test data. DataXplorer can be called (started and used) from within TCE. See Chapter 4, **DataXplorer**, for more on this software.

eDAQ Web Server Interface

The eDAQ provides a Web Server interface used for a number of System Configurations and other utility tasks including: formatting of PCMCIA cards, changing the TCP/IP protocol settings, RS-232 setup, upgrading the eDAQ firmware in conjunction with new TCE version releases, etc. Note that support for these tasks is not provided under TCE, so becoming familiar with the eDAQ Web server is necessary. See **Appendix E** for more details on using the eDAQ Web Interface.

Chapter 2 - Setting up the eDAQ

Overview

Setting up the SoMat eDAQ Field Computer System (FCS) consists of installing both hardware and software. This chapter describes the hardware and software provided with the eDAQ FCS, support equipment needed, and how to install the software and set up communications between the eDAQ and its support computer (PC).

The eDAQ is shipped fully assembled. Before the eDAQ can be made operational, it must be connected to a power source and a support PC, and then communications between the eDAQ and a support PC have to be established. User maintenance is limited to removing dust and dirt from the eDAQ, especially from the cable receptacles on the front and back panels.

What You Receive

The first time shipment of the eDAQ should contain the items described below.

NOTE: If any items you ordered did not arrive as expected, contact your system supplier, nearest SoMat agent, or SoMat Corporation immediately.

Hardware

Hardware provided includes the following items. Part numbers are shown in brackets.

eDAQ FCS: Base layer and one Low-Level Analog Board unit layer, plus these options as ordered: additional Low-Level Analog Board unit layer, High-Level Analog Board, Thermocouple layer, and/or Vehicle Bus Interface.

Low-Level Cable Assembly: [SAC-SLXDUC-SAC-*n* or SLXDUC-*n*-V; *n* indicates wiring option ordered] Two are provided with each Low Level Analog Board unit. Each has a 37-pin D-sub male plug with five cables coming out of it. All wires end in pigtails.

High-Level Analog Cable Assembly: [SAC-EHLB1] Provided if the optional High-Level Analog Board is installed in the eDAQ. The connector is a 62-pin HDD-sub male plug with one cable coming out of it. All wires end in pigtails.

Digital Input/Output (I/O) Cable Assembly: [EDIO] The connector is a 44-Pin HDD-sub male plug with two cables coming out of it (one for digital I/O signals and the other for pulse counters), both ending in pigtails.

Ethernet 10baseT / RS232 Cable: [E-Ethernet X/O or E-Ethernet Hub] The connector is a 26-pin HDD-sub male plug at one end with two cables ending in an RJ45 and a 9-pin D-Sub female plug on the other. The E-Ethernet Hub is used for network operations, while the E-Ethernet X/O is used for connection directly to the host computer.

Power Cable: [EPWR15] The connector is a D-sub 15-Pin female plug at one end with two cables coming out of it. The gray cable is for powering the eDAQ, and will be connected to the main power supply. The red wire will connect to positive (+), and the black wire will connect to negative (–). A thin black cable ending in pigtails is also present and is used for remote control of the eDAQ. Use of this cable is covered in detail later in this chapter.

PCMCIA Storage Card: (Provided if ordered.) Hard drive or flash RAM, as ordered.

Software

Installation kits on CD-ROM (or floppy disks if requested) are provided for the following software.

SoMat Test Control Environment (TCE) for eDAQ: Used to create test setup files which are used to run tests, calibrate and verify the operation of transducers, control the eDAQ during test runs, and upload test data to the support PC.

SoMat DataXplorer: Used to display and analyze acquired test data.

Documentation

For the eDAQ and TCE: This guide and the TCE online help system.
For DataXplorer: *SoMat EASE Version 3 Operating Manual* and the online help system for DataXplorer.

Support Equipment

Overview

Operation of the eDAQ will require a suitable power supply and a support computer (PC) on which to run TCE. The following describes the specifications for the power supply and support PC.

Power Supply

A power supply capable of providing voltages between 12V to 18V DC is required. Power consumption will vary according to eDAQ system configuration and transducers used. A typical eDAQ FCS draws 10–40 watts in steady-state operation (depending on the power consumed by transducers).

NOTE: If operation from a supply voltage greater than 18V is required, an optional power supply adapter is available from SoMat. Consult Customer Service for additional information regarding the power supply adapter.

Support PC

The support computer (PC) must meet these requirements in order to run SoMat TCE and DataXplorer and store test data uploaded from the eDAQ:

- Capable of running Microsoft® Windows® 95/98/2000 or NT (586 or higher processor)
- At least 40 MB of free hard disk space
- CD-ROM, 3.5” floppy drive or Web access (required for updating and installing software)
- 16 MB of RAM (32 MB is recommended)
- Mouse or other pointing device
- Microsoft Windows 95/98/2000 or NT installed and operational
- An Ethernet port card installed

Installing SoMat TCE

Overview

You should be familiar with the Windows operating system before starting this procedure. If you are not, complete the tutorial available in the Windows Help System.

Installation Procedure

Use the following procedure to install TCE on the support PC.

1. Start Windows (if it is not already running).
2. Insert the TCE installation CD (or the first installation floppy disk) in the appropriate disk drive.
3. In the **Start** menu, select **Run...**
4. In the command line text box of the **Run** dialog box, type in

   *d***:\setup**

   where *d* is the drive letter for the CD-ROM. Press Enter and wait for the eDAQ Test Control Environment Setup window to appear.

The installation is completed by InstallShield® Wizard, which will guide you through the process. To continue the process, select the **Next>** button at each dialog box (except the software license where you select the **Yes** button). To return to a previous action, select the **<Back** button.

The installation process can be cancelled at any time. Simply select the **Cancel** button at any installation dialog box, and InstallShield® will remove the files installed thus far on your hard drive.

The following steps indicate the actions to be performed at certain points during the installation process.

5. When you are prompted for a destination location, select the default, c:\Program Files\SoMat\Tce_eDAQ_3.5.5, unless it is necessary to use a different destination.

   To specify another destination, click **Browse...**, specify the directory to use via the dialog box and continue the process. To cancel this action, click **Cancel**.

NOTE: DO NOT install the eDAQ TCE in the directory where the 2500 FCS version of SoMat TCE is installed (if SoMat TCE for the 2500 FCS is installed on the PC).

6. When prompted to select the Program Folder for the icons, select the default folder SoMat TCE eDAQ.

NOTE: DO NOT store the eDAQ TCE icons in the 2500 version folder if TCE for the 2500 FCS is installed on the PC.

When the **Next>** button is selected, the installation program begins copying files to the destination directory. A progress indicator is located at the bottom of the screen to show the installation progress.

7. At the Setup Complete dialog box, select the **Finish** button to complete the installation.

SoMat TCE eDAQ will now appear in the Programs menu. See Chapter 3, **TCE for eDAQ**, for more information on TCE and its use.

Setting Up the System

Before Starting

Before setting up the eDAQ system, make sure to have the following items:

- SoMat eDAQ Field Computer.
- A support PC with the requirements specified under **Support PC** on page 14
- SoMat TCE for eDAQ properly installed on the support PC.
- Communications cable for the type of Ethernet connection you will be using between the eDAQ and the support PC. (See **What You Receive** on page 13.)
- The eDAQ power cable. Fasten spade or loop connectors to the pigtails to facilitate connecting the cable to the power supply.
- A suitable power supply for the eDAQ, set to the proper voltage.
- The appropriate transducer and digital cable(s) for the type of data to be collected. (See **What You Receive** on page 13.)

Chapter 5, **Transducer Cables and Wiring**, shows how various transducers and digital devices should be attached to these cables.

Setting up the Hardware

Follow this procedure for connecting and powering up the eDAQ system and its support PC. Refer to **Figures 1-1** and **1-2** in Chapter 1 as needed to identify the various connectors on the eDAQ.

NOTE: The support PC can be running prior to starting this procedure.

1. Connect the appropriate Ethernet cable between the eDAQ and the support PC.
   - If connecting the eDAQ directly to the PC, use the E-ETHERNET X/O (crossover) cable.
   - If connecting the eDAQ and PC via a 10baseT network, use the E-ETHERNET HUB cable to connect the eDAQ to a network hub.
2. Connect the appropriate cable(s) to the eDAQ for the type of transducers or sensors you will be using.
3. Make sure the power supply for the eDAQ is turned **off**, then connect the power cable between the eDAQ and the power supply and, if needed, plug the power supply into an appropriate electrical outlet.

   The eDAQ power cable assembly has two cables: a large gray one and a small black one. Use the red and black pigtails on the large gray cable for the power connections: **black** to the **negative** (–) or **ground** terminal; **red** to the **positive** (+) terminal.

   The smaller black cable is for remote control of the eDAQ power. To use it for such, connect a SPST switch to the cable. If the control wires are not used, make sure they are well insulated. Shorting the two wires together will turn the eDAQ off.
4. Turn on the power supply.
5. If the status LEDs do not light, press the power switch on the front of the eDAQ to apply power to the eDAQ.

The three LEDs around the power switch indicate the operational status of the eDAQ. The green Ready Status LED (above the switch) lights briefly when you turn on the eDAQ and then goes dark. The yellow Processor Busy LED (below the switch, left) is lit while the eDAQ boots up. When the bootup is completed, the yellow LED goes dark and the green LED lights and stays lit.

If the red Internal Fault/User Alarm LED lights (below the switch, right), set up the eDAQ–PC communications (as explained by the following subsection), then use the Get Test Status command in the Test Control menu. A message box describing the error or alarm condition will appear. Select OK or press Enter to close the box.

Proceed to the next part of the setup, "Setting up the eDAQ–PC Communications", once the eDAQ is up and running.

Setting Up eDAQ–PC Communications

The Ethernet communications between the eDAQ and the support PC is explained in this section. For additional guidance in using TCE, see Chapter 3, **TCE for eDAQ**.

1. If the support PC is not already running, boot it up.

   If the support PC is already running, it may be necessary to reboot to recognize the Ethernet connection. Check the documentation for the Ethernet card you are using if there are any problems.

2. Be sure the IP address and Network Mask are set properly in the network settings so the PC can network with the eDAQ without conflict. It may be necessary to get a new IP address from a network administrator and change the IP address on the eDAQ (see **Changing the eDAQ's IP Address** (page 18) or **Appendix D**)

3. Start TCE for eDAQ (see **Starting TCE** on page 21).

4. Open the TCE **Preferences** menu and select **Communications**. The eDAQ Ethernet Communications dialog box opens. **Figure 2-1** shows that dialog box with Ethernet setups already listed.

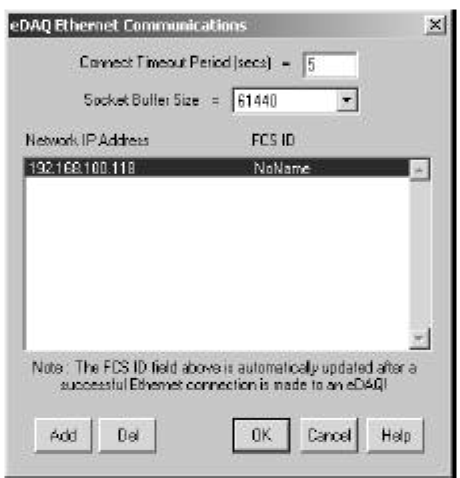


Figure 2-1: eDAQ Ethernet Communications Dialog Box

For Ethernet communications to occur, the correct IP address for the eDAQ has to be listed in this dialog box and selected (highlighted).

5. In the **Connect Timeout Period (secs)** box, specify how much time, in seconds, to allow the support PC and the eDAQ to establish communications; type in the number.

6. If there is an IP address listed for the eDAQ and support PC you are using, select it. (Either click on it or use the up and down arrow keys to move the highlight bar). If the IP address is listed, skip ahead to step 9.

   If the IP address and FCS ID are not listed, complete steps 7 and 8.

7. Select the **Add** button. The Add Network Node dialog box opens (Figure 2-2).
8. A default IP address was programmed into the eDAQ's nonvolatile memory before the eDAQ was shipped from SoMat. This is noted on a tag attached to the eDAQ.

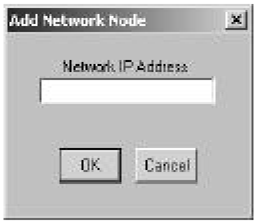


Figure 2-2: Add Network Node Dialog Box

   Type the default IP address and FCS ID in the appropriate box and then click **OK**. (You can change this information later as needed. See **Changing the eDAQ's IP Address** later on this page.

9. At the eDAQ Ethernet Communications dialog box, click on **OK**.
10. In the TCE **File** menu select **New Setup**. This causes the five TCE setup windows to appear in the TCE work area.
11. Go to the **Hardware Setup** window (click on it or press **F5** and **F6** to move between the windows) and select the **Query** button.

   If the PC can communicate with the eDAQ, a list of the hardware components in the eDAQ appears in the window.

   If the PC cannot communicate, an error message saying so appears. Click **OK** to clear the message and then check the communications cable connections and, if necessary, the operation of your Ethernet card.

When the hardware list appears in the Hardware Setup window, you have completed setting up the eDAQ system.

Changing the eDAQ's IP Address

Use the following procedure to change the IP address of the eDAQ if necessary. (See **Appendix D** or **Appendix E** for more details)

1. Turn off the power to the eDAQ if it is on.
2. Remove the Ethernet cable between the eDAQ and PC, then connect the ESR9 RS232 Serial communications cable to the Comm 1 connector on the eDAQ and the serial port on the PC.
3. Start the Windows HyperTerminal accessory using these settings: 19200 bits per second, 8 data bits, 1 stop, no parity, hardware flow control.
4. Turn on power to the eDAQ and wait for the log-in prompt.
5. Log in using the user name setup.

6. The name of the eDAQ can be changed at the Set Hostname prompt. The current name will be presented inside the brackets. Change the name of the eDAQ by typing the new name and pressing ENTER. To retain the current name, press ENTER.

NOTE: Although the hostname is not currently used by the TCE software, it is a way to verify the physical eDAQ when using the Web Browser interface to change the IP address, Subnet Mask and Gateway. This name must not be confused with the FCS ID, which is set via the TCE FCS setup ID parameters option.

7. The IP address of the eDAQ can be changed at the Set IP Address prompt. The current IP address will be presented inside the brackets. Change the IP address of the eDAQ by typing the new IP address and pressing ENTER. To retain the current IP address, simply press ENTER.

NOTE: When changing the IP address, use the format shown. The format of 192.168.100.100, where the groups are separated by decimal points, is the proper format for the IP address. A prompt will display after an error has been made in the IP address, followed by a prompt allowing the correct address to be entered.

8. If communications with the eDAQ will be done via a network, the Subnet Mask must be changed. This can be changed at the Set Netmask prompt. The current Subnet Mask will be presented inside the brackets. Change the Subnet Mask by typing the new Subnet Mask and pressing ENTER. To retain the current Subnet Mask, simply press ENTER.

NOTE: When changing the Subnet Mask, use the format shown. The format of 255.255.255.0, where the groups are separated by decimal points, is the proper format for the Subnet Mask. A prompt will display after an error has been made in the Subnet Mask, followed by a prompt allowing the correct Subnet Mask to be entered.

9. The next prompt will be Set Gateway. The current gateway will be presented inside the brackets. If the gateway requires change, type the new gateway and press ENTER. To retain the current gateway, simply press ENTER.

NOTE: When changing the gateway, use the format shown. The format of 192.168.100.1, where the groups are separated by decimal points, is the proper format for the gateway. A prompt will display after an error has been made entering the gateway, followed by a prompt allowing the correct gateway to be entered.

10. Once all the information has been entered, a prompt with the new Name, IP address, Subnet Mask and Gateway information will be displayed to confirm the changes. Following the "Confirm these new settings" dialog, a **y** or **n** must be entered.

    Typing **y** then ENTER will bring up the following dialog: Network settings successfully updated. Reboot the eDAQ for the new settings to take effect.

    Typing **n** then ENTER will bring bring up the following dialog: Network settings NOT updated.

11. When the changes are complete, power down the eDAQ and exit the HyperTerminal session.

12. Disconnect the serial communications cable from the eDAQ and PC and reinstall the Ethernet cable between them.

After changing the IP Address of the eDAQ, the eDAQ-to-PC communications settings must be changed in TCE, as explained by the following.

Changing Communications Settings

Change the eDAQ-to-PC communications settings as follows. See the preceding communications setup procedure for guidance.

1. Open the eDAQ Ethernet Communications dialog box (Steps 1–3 under "**Setting Up eDAQ–PC Communications**" on page 17).
2. Click the **Add** button and specify the revised IP in the Add Network Node dialog box.
3. Click on **OK** in the dialog boxes to close them and save your changes.

Test Setup Files

Once the hardware and communications are setup, test setup files can be created. A test setup file includes transducer channels, computed channels, SoMat DataModes, and other data to be used in running a test.

NOTE: The version of SoMat TCE provided with the eDAQ is specifically for the eDAQ. The test setup files created in it cannot be used with the SoMat 2500 Field Computer System (with which another version of TCE is used), nor can the test setup files for the 2500 FCS be used with the eDAQ.

For information on test setup files, as well as creating and editing transducer channels, computed channels, and SoMat DataModes, see Chapters **8**, **9**, and **10** in this guide.

Chapter 3 - TCE for eDAQ

Overview

SoMat Test Control Environment (TCE), the Windows-based test control software provided with the eDAQ, is used to:

- Create and save test setup files specifying (defining) what test data will be acquired with the eDAQ and how.
- Display the output from transducers and data channels.
- Calibrate transducers.
- Control the eDAQ FCS when doing test runs.
- Upload acquired data to files on the support (host) PC.

This chapter introduces TCE for eDAQ and presents basic user information and usage (starting and quitting, features of its main window, setting preferences, and so on). Details on using the functions of TCE for eDAQ are presented in subsequent chapters.

Starting and Quitting

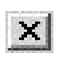
Starting TCE

In the Start menu, open the Programs menu and then select **SoMat TCE eDAQ** in the SoMat TCE eDAQ submenu.

You can also make a shortcut icon on the desktop for TCE. Using the TCE icon you can then start TCE.

Quitting TCE

To quit TCE, do one of these actions:

- In the TCE File menu select **Exit**.
- Click on the Window Close button. 
- Press ALT+F4.
- Click on the icon at the upper left end of the main window title bar; select **Close** from the flyout menu.

TCE Main Window

General Description

The TCE main window (**Figure 3-1**) has a title bar, menu bar, toolbar, work area, and status bar. The following describes these items.

Figure 3-1: TCE Main Window

Title Bar

The TCE title bar is a standard Windows title bar with the name of the test setup file currently loaded in TCE shown between square brackets; [No File] indicates no setup file is loaded. Your TCE title bar may differ from those shown in this guide depending on your version of Windows.

Main Menus

In the menu bar are the names of the TCE main menus. The following describes the commands and options in those menus. (Have TCE running as you read these descriptions so you can display the menus, submenus, and dialog boxes.)

File

The File menu contains the options and commands to create, open, and save test setup files and to exit from TCE. The related shortcut keys are shown in brackets at the end of the descriptions.

New Setup — Used to create a new test setup definition. [CTRL+N]

Open Setup… — Loads and opens a previously saved test setup definition. [CTRL+O]

Save Setup — Saves the current test setup definition to a file. [CTRL+S]

Save Setup As — Allows saving the current test setup definition to a different specified disk file.

Save Setup Listing… — Saves a TCE Setup File listing to a file.

Save Setup Tab Delimited… — Used to generate a tab delimited text file of the Hardware Setup portion of the current TCE setup file. The file can be used as an input to Microsoft Excel.

NOTE: This option is provided primarily for SoMat internal usage.

Open SIF File — Allows opening a SoMat Information File (*.sif). A standard Windows “open file” dialog will appear to select these files.

Call EASE / DataXplorer — Used to switch from TCE to either EASE or DataXplorer, which are used to display the test data acquired (whichever is your display application). [CTRL+D]

Exit — Shuts down TCE in a controlled manner.

Recent Setup Files — Displays a list of the last five setup files loaded into TCE. Selecting a file from this list will load it, replacing the setup file currently in TCE.

Test Control

The Test Control menu contains the commands used to monitor and control test runs and to upload test results and setup data to the host PC.

Control Panel… — Opens the TCE Test Control Panel dialog box, which has function buttons used to perform a test run (e.g. open a test setup file, start and stop the test, etc) and upload the test data to the support PC. It also shows elapsed run time and how much memory and PCMCIA card space are available for data storage. See **Test Control Panel** under **Phase 5: Run the Test** in Chapter 6. [CTRL+0]

Get Test Status… — Opens a dialog box that shows the status of the test and data storage conditions (e.g. whether a test has been initialized and is running and how much memory is available for data storage). See **Get Test Status** in Chapter 10. [CTRL+2]

Initialize Test — Starts the process of initializing the eDAQ for a test: the test setup is verified and saved, the eDAQ RAM disk is purged (if used, the PCMCIA card is also purged), the test setup files are downloaded to the eDAQ, a data file is created, and the eDAQ is otherwise prepared to run the test. [CTRL+I]

Remote Control — Allows the user to suspend or resume the remote control feature (applies only if the test was initialized with the remote control feature enabled). [CTRL+R]

Prerun Options… — Provides access to three pre-run checks you can do to help ensure the test run will go as it should:

Rezero Display… — Used to display and re-zero transducer channels for an initialized test. This is available whenever a test has been initialized but is not running. [CTRL+Z]

Transducer Checks… — Opens a dialog box where a variety of checks can be performed on transducer channels.

Reference Shunt Checks… — Opens a dialog box to check the repeatability of shunt calibrations from test run to test run.

Start Run… — Starts a run of the test loaded in the eDAQ, whether the test is a first run or a subsequent run. This command can be used from the time the test is initialized until the test is ended using the End Test command. [CTRL+3]

Interactive Triggering — Allows the user to interactively control triggers (previously defined using the Interactive Triggering channel) for control of TCE DataModes or other computed channels. [CTRL+4]

Run Time Display… — (Usable only while a test is running.) Opens the Run Time Display that shows, on a real-time basis, the output of the transducer and computed channels being used in the test. See the section **Run Time Display** in Chapter 10. [CTRL+5]

Stop Run — Stops the current test run. [CTRL+6]

End Test — Ends the current test. You cannot do another test run with the loaded test after you select this command, but you can upload data to the support PC. To do another test run after using this command, reinitialize the eDAQ for that test. [CTRL+E]

Auto Range Options… — Opens a dialog box where the minimum and maximum values recorded in time history channels during the last test run can be used to automatically scale the Full Scale values in those channels in future test runs.

Upload Test Data… — Used to upload the test results data (i.e. the .SIF file) stored in the eDAQ to a specified file on the support PC. [CTRL+7]

Upload Test Setup… — Used to upload the TCE test setup file in the eDAQ to a specified file on the support PC.

Save AOM File… — Used to generate a disk file containing the calibration parameters needed to relate high-level outputs from low-level signal conditioners to equivalent engineering unit values.

FCS Setup

The FCS Setup menu is used to set and change basic operating parameters and functions for the eDAQ.

Set FCS Master Sample Rate … —Allows setting the master sample rate for the eDAQ at either 100,000 Hz or 98,304 Hz.

Set FCS ID Parameters… —Allows assigning a unique unit name to the eDAQ unit.

Set FCS Reset Options… — Controls when and how the system will be reset when an abnormal event or serious operational error occurs within the eDAQ.

Set FCS Clock… — Used to set the real time clock in the eDAQ.

Set FCS Digital I/O… — Opens a dialog box where each of the ten digital input/output (I/O) bits can be set individually as an input or output.

Set FCS AOM Invert Option… —Allows the user to set or clear the option for automatically inverting the low-level analog outputs so the analog output voltage polarity is the same as the engineering units polarity.

Reset FCS… — Used to do a programmed reset of the eDAQ.

Format FCS RAM Disk… — Used to reformat the RAM disk in the eDAQ. All the files currently in the RAM disk are erased.

NOTE: Before using this command, make sure any data currently waiting to be saved in the eDAQ has been uploaded to the support PC.

FCS Diagnostics — Opens a submenu with commands used for diagnosing problems with the eDAQ. These tools were used in developing the eDAQ and are provided for troubleshooting purposes.

Preferences

The Preferences menu contains the commands used to set various basic aspects of how TCE operates and displays data, as well as warning messages. (See also "**TCE Preferences**" on page 31).

Communications — Used to set up Ethernet communications between the eDAQ and its support PC.

General… — Used to specify how TCE displays warning messages, use of channel description text for Y-axis labels, verification of test control actions, and use of the Auto Range Options when stopping a test run.

FCS Specific… —This option is used to configure various aspects of TCS specific to the target eDAQ. Options found in the FCS Specific menu deal with the Master/Slave synchronization mode for use with multiple eDAQs, enable Min-Max Tracking for Time History DataMode, use of Quick Shunts for calibrations and checks, the use of Quick Shunts for reference shunts checks, and the option to request an input from the user when making any references to the Quick Shunt options.

Remote Test Run Control… — Used to configure various aspects of the Remote Test Run Control functionality, including the assignment of Digital Input and (optional) Digital Output bits, memory low alarm levels, and how TCE will deal with enabling or disabling this feature when a test is initialized.

Scope and Spectrum Display… — Opens a dialog box where both the color scheme for scope and frequency is initially displayed.

Run Time Display… — Used to change the color scheme for the TCE Run Time Display (RTD) and how the RTD appears when it initially opens.

View

The View menu can be used to display and hide the test setup windows, the toolbar, and the status bar in the TCE main window. Selecting an item in the menu causes each particular item to be displayed or hidden (based on whether it was currently displayed or hidden). A check mark will be placed beside any item currently displayed.

Window

The Window menu provides the standard options for arranging, displaying, and resizing the windows in the TCE work area.

Cascade, Tile — The standard Windows Cascade and Tile commands.

Arrange Icons — When all windows have been minimized, this command will arrange them along the bottom edge of the work area.

Close All — Closes all of the windows in the work area.

Next Window — When the windows in the work area are cascaded, this brings the next window to the front, making it the active window. This cascade sequence also applies when windows are tiled. [F6]

Previous Window — Same as Next Window, but takes you backward in the cascade stack. [F5]

Toggle Maximized — Switches the size of the active window between maximized (full-screen) and its original size. [F7]

The names of the open windows are listed at the bottom of the menu. A check mark indicates the active window. To make a window active, click on its name with the mouse or press the number key for the reference number beside the window's name.

Help

The Help menu provides access to the TCE Help System and guidance on using the Help System.

Contents — Displays the main subject listing window for TCE Help.

How to Use Help — Explains how to use the Help System.

About TCE… — Displays the version information for TCE.

TCE Toolbar

The buttons on the TCE toolbar (Figure 3-2) provide quick access to commonly used TCE functions.

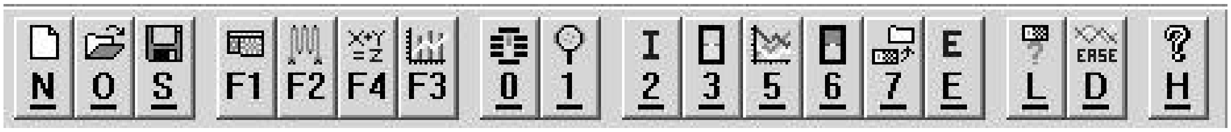
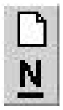
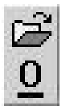
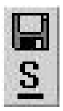


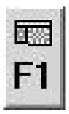
Fig 3-2: TCE Toolbar

The following shows the functions assigned to each button.

 Create new setup file

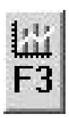
 Open existing setup file

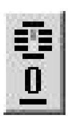
 Save setup file

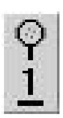
 Open Hardware window

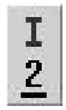
 Opens Transducer window

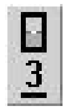
 Open Computed Channel window

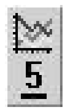
 Open DataMode window

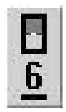
 Opens TCE test control panel

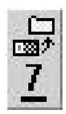
 Get test status

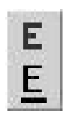
 Initialize test

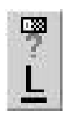
 Start test run

 Open Run Time display

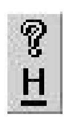
 Stop test run

 Upload test data to PC

 End Test

 Upload FCS log to PC

 Call EASE or DataXplorer

 Online Help System

Status Bar

The status bar at the bottom of the main TCE window shows various aspects of the test setup status, as shown in Figure 3-3.

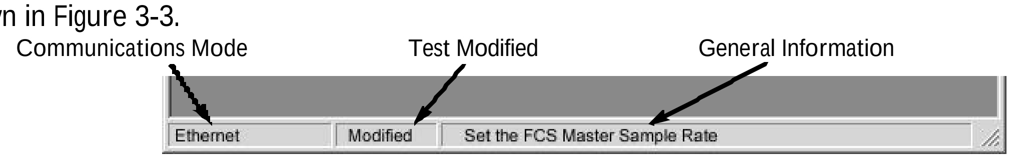


Figure 3-3: Status Bar Sections

The following describes the three sections of the Status Bar.

Communications Mode — The type of communications being used between TCE and the eDAQ (i.e. Ethernet) is shown here. The FCS ID for the eDAQ (as set via the FCS setup menu options) is also displayed in this section when an eDAQ is connected and powered.

Test Modified — If a test setup was modified since it was loaded into TCE, "Modified" appears in this section; otherwise, this is blank. TCE alerts allow saving the modified file before exiting TCE, loading another test setup file, or initializing another test.

General Information — General status information and activity messages are displayed here. It usually contains a brief description of what TCE is currently doing or the status of an action just completed.

Setup Windows

Overview

Creating a test setup file in TCE is done via the five setup windows appearing when a new or existing setup file is opened, as in Figure 3-4. The following describes the five setup windows.

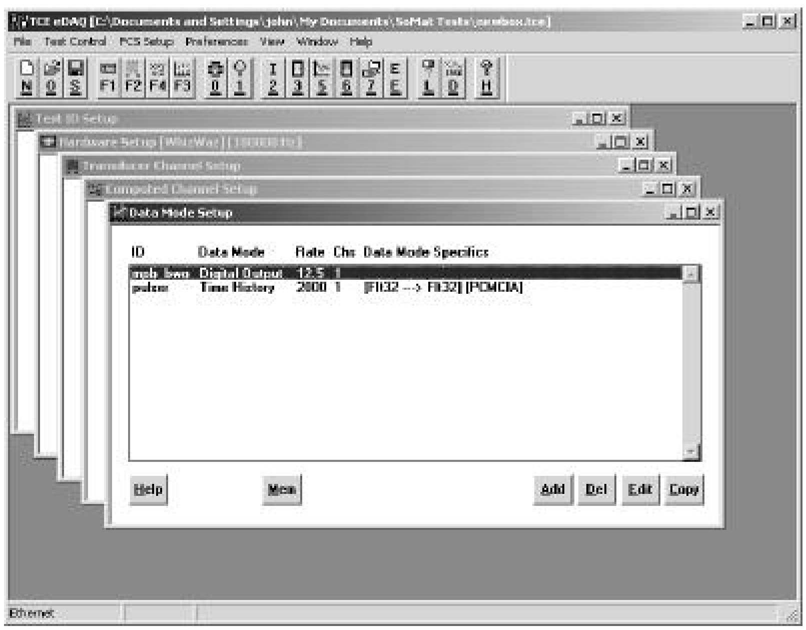


Figure 3-4: TCE Main Window with Setup Windows

Test ID Setup

The Test ID Setup window is where you specify a descriptive name for the test, the name(s) of the person(s) who will or did run the test, and the test date or date the file was created. There is also space for notes, comments regarding the test, special instructions, and so on.

Figure 3-5: Test ID Setup Window

Hardware Setup

The Hardware Setup window contains a list of the hardware components installed in the eDAQ used in creating or editing the setup file. The eDAQ's unit name and Master Sample Rate are shown in brackets in the window's title bar ([SD190] and [100000 Hz] in Figure 3-6). When you first open a new test setup file, this window is empty.

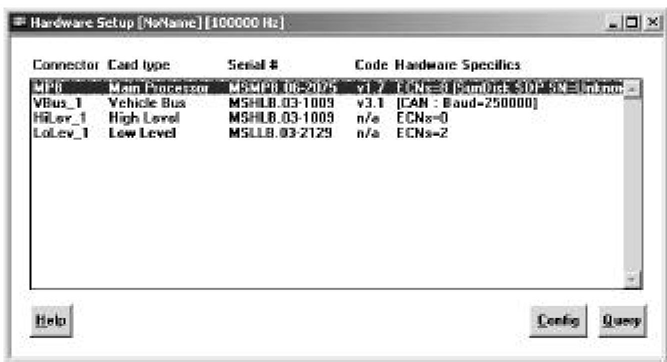


Figure 3-6: Hardware Setup Window

To acquire a hardware list for a new setup file or to update this window in an existing file, setup communications with the eDAQ, then press the **Query** button. The new or updated list then appears in the window. If the components in the queried eDAQ do not match the list in the current test setup file, TCE will prompt for user verification before updating the list.

NOTE: To do a hardware query, communication must be made between the eDAQ and the host PC. (See **Setting Up eDAQ–PC Communications** in Chapter 2.)

The function of the Config button changes according to the hardware line selected (highlighted) in the window:

- Select MPB Main Processor line: The Config button opens the MPB Card Config Options dialog box which has buttons for the following PCMCIA card options — Status, Purge, Test and Format.
- Select Low Level or High Level line (HiLev_1 or LoLev_1): The Config button opens a Card Config Options dialog box, which has a button for viewing the characterization data for the selected board.

Channels Setup

The Transducer Channels Setup and Computed Channels Setup windows (**Figures 3-7** and **3-8**) are used in setting up data channels for test situations.

Transducer Channel Setup

The Transducer Channel Setup window contains a list of the data channels and their associated information.

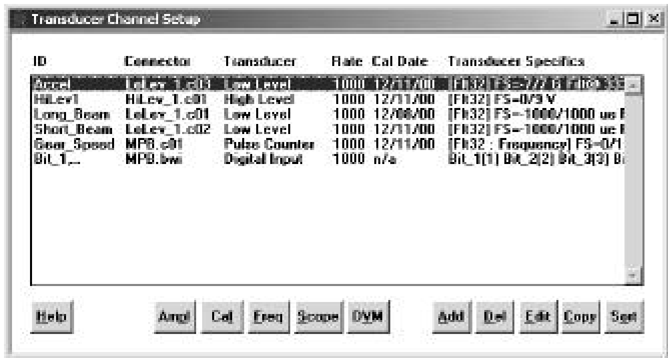


Figure 3-7: Transducer Channel Setup Window

Shown for each channel are the channel's ID name, the physical channel the transducer is to be connected to, the transducer type (high-level or low-level), sample rate, calibration date, and specifics about the transducer.

The buttons at the bottom of the window have these functions:

Ampl — Used primarily for SoMat development to report selected signal conditioner amplifier settings (e.g. gains, offsets).

Cal — Used to calibrate channels and delete or check calibrations.

Freq, Scope, DVM — Open display windows where you can view the signal from a transducer and thereby see if the transducer is working properly.

Add — Used to add a new transducer channel.

Del, Edit, Copy — Used to delete, edit, and make multiple copies of the selected channel.

Sort — Used to sort the transducer channels list alphabetically by the Connector ID.

Use of this window in setting up, editing, and using transducer channels is explained in detail in Chapter 7, **Transducer Channels**.

Computed Channel Setup

The Computed Channel Setup window contains a list of the computed channels and their associated information.

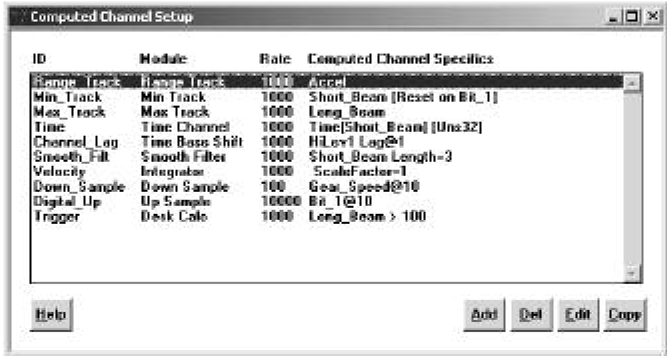


Figure 3-8: Computed Channels Setup Window

Shown for each channel is the channel's ID name, the module used in creating it, sample rate, and other specifics about the channels.

The **Add**, **Del**, **Edit**, and **Copy** buttons have the same functions as those in the Transducer Channel Setup window (**Figure 3-7**).

Use of this window in setting up, editing, and using computed channels is explained in detail in Chapter 8, **Computed Channels**.

DataMode Setup

SoMat DataModes determine how data is processed for subsequent file storage. The DataMode Setup window contains a list and pertinent information on the DataModes set up. Shown for each DataMode is its ID name, type, sample rate, the number of channels assigned to it, and other specifics about the DataMode.

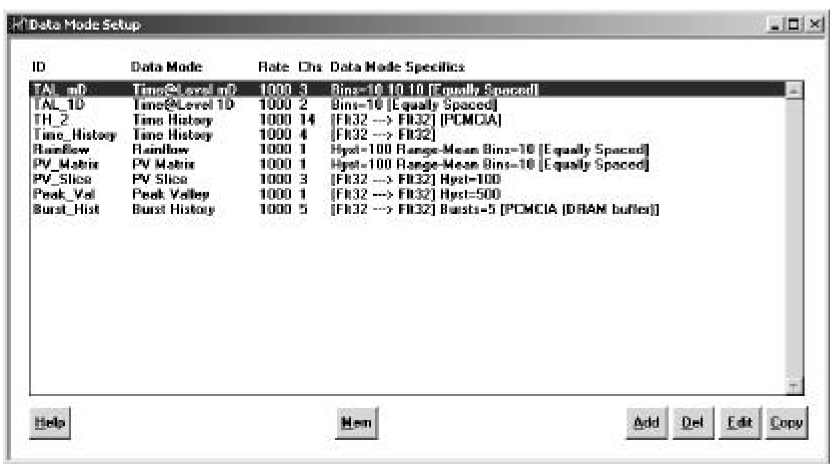


Figure 3-9: DataMode Setup Window

The **Add**, **Del**, **Edit**, and **Copy** buttons have the same functions as those in the Transducer Channel Setup window (**Page 29**).

The **Mem** button opens a message box showing the amount of raw data memory allocated at the start of each test run for the DataModes selected (highlighted) in the window.

Use of this window in setting up, editing, and using DataModes is explained in Chapter 9, **DataModes**.

TCE Preferences

Overview

The TCE Preferences menu contains the commands used to set various types of preferences in TCE.

This section explains the use of two of the preference commands, General and FCS Specific. Use of Communications is explained in the “Setting Up eDAQ–PC Communications” procedure under **Setting Up the System** in Chapter 2. Use of the Scope and Spectrum Displays and Run Time Display preferences are explained in Chapter 10. Refer to the TCE help system for details as the use of the Remote Test Run Control preferences is not discussed in this users guide.

General Preferences

The general preference options used to configure various aspects of TCE, including the display of warning messages, are in the TCE General Preferences dialog box. To open the dialog box, select **General** in the Preferences menu. The following explains the options available.

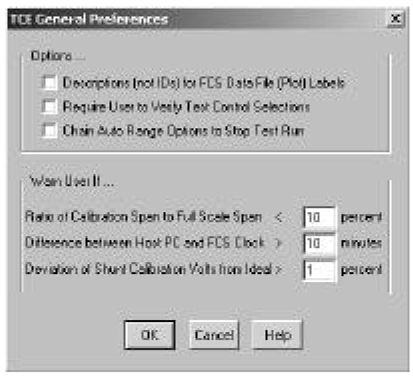


Figure 3-10: TCE General Preferences Dialog Box

Options:

Descriptions (not IDs) for FCS Data File (Plot) Labels — Select this option if text in the description boxes in the definition dialog boxes for transducer and computed channels are to be used for the Y-axis label in data plot graphs. If left unselected, the channel ID name will be used as the Y-axis labels. When selected, TCE checks for empty or duplicated description boxes, and will display a warning message if any are found.

NOTE: TCE uses this preference setting when a test is being initialized. Once the test is initialized, this option is “locked-in” for the duration of the test.

Both the Y-axis plot labels and the text in description boxes are limited to 31 characters. Certain DataModes (i.e. Rainflow and Peak Valley Matrix) add a prefix to user-defined plot labels automatically. This can cause such a label to be truncated. For example, a Rainflow range-mean histogram adds the prefixes “Range” and “Mean.” Thus, text in the description boxes should be limited to 24 characters when using the Rainflow and Peak Valley Matrix DataModes.

Require User to Verify Test Control Selections — Select this option to have TCE display a prompt to verify selection of most Test Control menu commands.

Chain Auto Range Options to Stop Test Run — Select this to have TCE display the Auto Range Options after a test run is stopped. The Auto Range Options present information on how close each Time History DataMode channel is to Full Scale saturation and provide a means for optimizing Full Scale settings.

Warn User if:

Ratio of Calibration Span to Full Scale Span < *nn* percent — Select this to have TCE display a warning message when the calibration span is less than *nn* percent of the full scale span for a transducer channel or vice-versa. This preference is checked at test setup time and also during the test initialization process.

Difference between Host PC and FCS Clocks > *nnnn* minutes — Select this to have TCE display a warning message when the real time clock in the support PC and the one in the eDAQ differ by more than *nnnn* minutes, or the real time clock in the eDAQ is not set. This check is done only during the test initialization process.

Deviation of Shunt Calibration Volts from Ideal > *nn* percent — Select this option to have TCE display a warning message when the measured shunt calibration span (in volts) deviates from the ideal shunt calibration span (in volts) by *nn* percent or more. This warning will be issued for both calibration checks and initial calibration runs.

FCS Specific Preferences

The TCE FCS specific preference options are used to configure various aspects of TCE specific to the target FCS.

Enable Master Slave Data Synchronization Mode — This option will enable the capability to synchronize the slave eDAQ to the master eDAQ in a network situation. If this option is not selected, TCE interacts with the eDAQs in the default (i.e. stand-alone) mode.

Enable Min-Max Tracking for Time History Data Modes — This option tracks the minimum and maximum values in each input channel for Time History DataModes. This option has to be selected to use the TCE Auto Range function. For optimum throughput performance by the eDAQ, do not select this option.

Use Quick Shunts for Calibrations and Checks — Check this option to use the Quick Shunt calibration mode for primary calibrations and checks on the calibrations (excluding the special Reference Shunt Checks that can be performed in-between test runs). For optimum calibration accuracy, this is not recommended.

Use Quick Shunts for Reference Shunt Checks — Check this option to use the Quick Shunt calibration mode for the Reference Shunt Checks to be performed in-between test runs. This is generally recommended since the primary purpose of the Reference Shunt Checks is to ensure nothing catastrophic has happened to a strain sensor during testing.

Always Ask User for the Quick Shunts Options – Check this option to have TCE always ask the user whether or not the Quick Shunt option is to be used. Primarily, this is provided as a tool to help users in experimenting with this option. For example, the user could do a set of primary calibrations with the Quick Shunt option not in use, and then follow up with a set of calibration checks that do use the option. TCE’s report on the numerical deviations found for the calibration check provides good information to help the user decide on how much accuracy loss (if any) is typically incurred when using the Quick Shunt calibration mode.

ID Name Conventions in TCE

A unique identification (ID) name must be assigned to each transducer channel, computed channel, and SoMat DataMode in TCE when defining these modules. All ID names must comply with these conventions:

- ID names are case-sensitive and can have up to 12 characters maximum.
- You can use only letters (a–z, A–Z), digits (0–9) and the underline character (_).
- The first character in an ID name must be a letter. This applies to transducer channels, computed channels, and DataModes.
- You cannot use system-reserved names (sin, cos, log, etc.).

Help System

The TCE online Help System can be accessed via the Help menu or by using the [CTRL+H] shortcut. There is context-sensitive help for TCE dialog boxes with Help buttons. For general help operation instructions, use the **How to Use Help** option in the Help menu.

Error Messages

Overview

There are three basic categories of TCE error messages:

- Basic TCE operation
- eDAQ communications
- eDAQ control interactions

The following describes each of these categories.

Basic TCE Operation

When TCE detects an invalid input (such as assigning the same ID tag to two different transducer channels), it will notify you of the problem and require changing the input. Since all inputs are done via dialog boxes, this form of error checking is a regular part of closing the dialog boxes. The message box presented is titled “TCE Message.” In some situations TCE will let test inconsistencies exist while defining a test. A warning will appear in such cases, in a message box titled “TCE Warning.”

eDAQ Communications

There are three basic sources of communication errors; a message box titled “TCE Communications Error” appears when one of these errors occurs:

- Faulty hardware, connections, or cables
- Faulty software
- Side-effects from other problems

eDAQ Control Actions

TCE determines the status of the eDAQ by examining a set of *error flags* and *status flags*. The eDAQ main processor maintains these flags and reports them when TCE issues a control command to the eDAQ (e.g. during test interaction, using the Get Test Status command, hardware queries, etc.). These flags are set only when a serious error is detected or an abnormal operating condition exists in the eDAQ.

A message box (with on-line help access) appears when TCE detects that an eDAQ error or status flag has been set. Refer to the TCE Help System for more information on this subject.

Modal Dialog Boxes

Modal dialog boxes appear to request or provide data for a task under operation. Unlike normal dialog boxes, when a Modal Dialog Box is displayed, no other TCE operation can occur (e.g. use the main window menus) and selecting a button with the keyboard is done differently. To use the keyboard to select a button in a modal dialog box, hold down the **ALT** key and press the key corresponding to the underlined letter in the button name. For example, to select the Help button, you would hold down **ALT** and press **H** (cited as "**ALT**+**H**" in text). Otherwise, keyboard operation is the same.

Chapter 4 - DataXplorer

Overview

SoMat DataXplorer is a special edition of SoMat EASE (Engineering Analysis Software Environment), SoMat's software tool for managing, controlling, and creating graphical analysis of engineering test data. DataXplorer is an essential adjunct to TCE if EASE is unavailable. DataXplorer can display test data in various ways and save it in various alternate formats.

Installation

Installing DataXplorer is done in a similar manner as with SoMat TCE for eDAQ.

Starting and Quitting

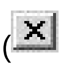
Starting

To ensure there is a proper working relationship between TCE and DataXplorer, start DataXplorer by pressing CTRL+D (Call DataXplorer) at the TCE main window.

NOTE: You can also start DataXplorer in the same way as other applications, but then the working directory will not be the TCE working directory.

Quitting

To quit DataXplorer, do any of these actions.

- In the DataXplorer File menu select Exit.
- Click on the window close () button.
- Press ALT+F4.

DataXplorer Main Window

Figure 4-1 shows the SoMat DataXplorer main window when DataXplorer is started. This window is similar to EASE version 2 or 3. The version of DataXplorer and log-on name are shown in the title bar.

Figure 4-1: DataXplorer Main Window

The data plotting functions and certain file and other functions available in EASE are available in DataXplorer. These functions can be accessed in two ways: select commands in the menus or click on function buttons in the toolbars.

Additional Information

For more information on using DataXplorer, refer to the EASE Version 3 Operating Manual provided with DataXplorer and the online help system for DataXplorer.

DataXplorer's online help system is nearly identical to the online help provided with EASE. The EASE manual and DataXplorer help system will provide information on the functionality and capabilities of EASE.

Chapter 5 - Transducer Cables and Wiring

Overview

This chapter describes the transducer cable assemblies used with the SoMat eDAQ FCS and covers the wiring of strain and analog traducers as well as typical digital input and output devices.

Transducer Cable Assemblies

Low-Level Analog

Four types of low-level analog transducer cable assemblies can be used with the eDAQ. Each has a 37-pin D-sub male plug for connection to the eDAQ. The number of cables from the connector is dependent on the part number. All cables end in pigtails.

4-Wire Option (SAC-SLXDUC-4 and SAC-SLXDUC-4V)

These cable assemblies support shunt calibrations where the shunt resistors are installed directly across excitation and signal leads in the eDAQ unit. Corrections for leadwire resistance must be considered during shunt calibration. The V suffix indicates there is an eight-wire VOLTAGE OUT cable to provide four amplified signal outputs.

6-Wire Option (SAC-SLXDUC-6 and SAC-SLXDUC-6V)

These cable assemblies support shunt calibrations where the shunt resistors are installed across the two extra wires provided; those wires are connected to one leg of the bridge. Leadwire resistance compensation is not an issue when the shunt calibration is done. The V suffix indicates there is an eight-wire VOLTAGE OUT cable to provide four amplified signal outputs.

High-Level Analog

A high-level analog transducer cable (SAC-EHLB1) is provided when a High-Level Analog Board is installed in the eDAQ. It has a 62-Pin HDD-sub male plug with one cable coming out of it. The cable ends in pigtails.

Vehicle Bus

The Vehicle Bus transducer cable (SAC-EHLB1/VB) is provided when a Vehicle Bus interface board is installed in the eDAQ. It has a 62-Pin HDD-sub male plug with two cables coming out of it. Each of the cables ends in pigtails.

Digital I/O

The Digital I/O cable assembly (EDIO) has two cables: one for ten digital I/O channels, the other for eight pulse counter channels. The cables all end in pigtails. The section **Digital I/O Device Wiring** on page 41 shows the wiring for various digital input and output devices.

Wire Colors and Pinouts

See Appendix A, **Cable Wiring** for the wire colors and pinouts for the transducer cable assemblies.

Low-Level Strain Transducer Wiring

4-Wire Options

Figures **5-1**, **5-2**, and **5-3** are examples of transducer wiring for quarter-, half-, and full-bridge strain gages with the 4-Wire Option transducer cable. (See also **Shield–Ground Connections** on page 44).

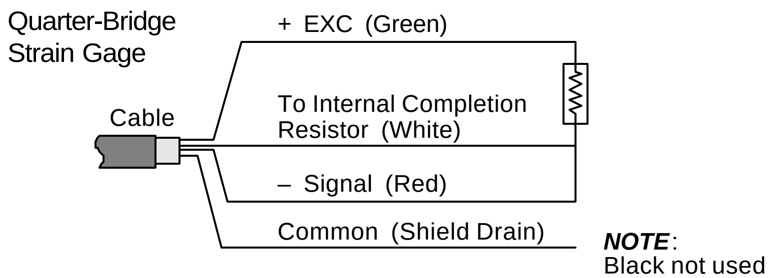


Figure 5-1: Quarter-Bridge Strain Gage, 4-Wire Option

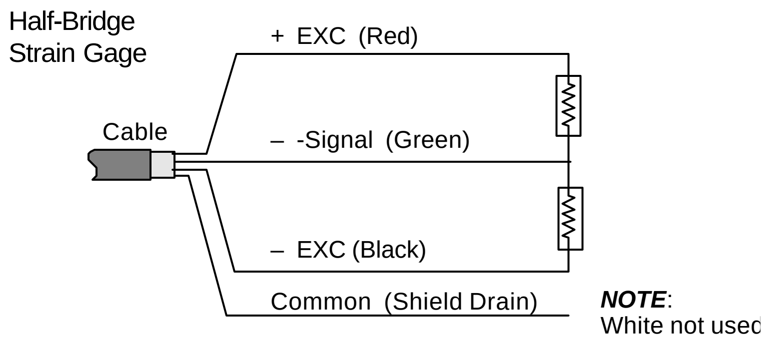


Figure 5-2: Half-Bridge Strain Gage, 4-Wire Option

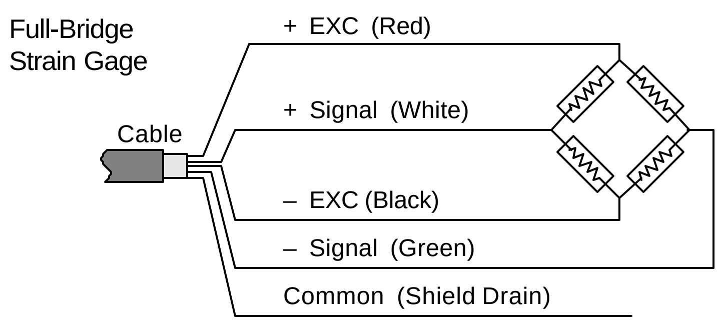


Figure 5-3: Full-Bridge Strain Gage, 4-Wire Option

6-Wire Options

Figures **5-4**, **5-6**, **5-7**, and **5-8** show examples of wiring for quarter-, half-, and full-bridge strain gages using the 6-Wire Option transducer cable. Note that with the half- and full-bridges, where the brown calibration wire is attached depends on the calibration used—upscale or downscale. (See also **Shield–Ground Connections** on page 44)

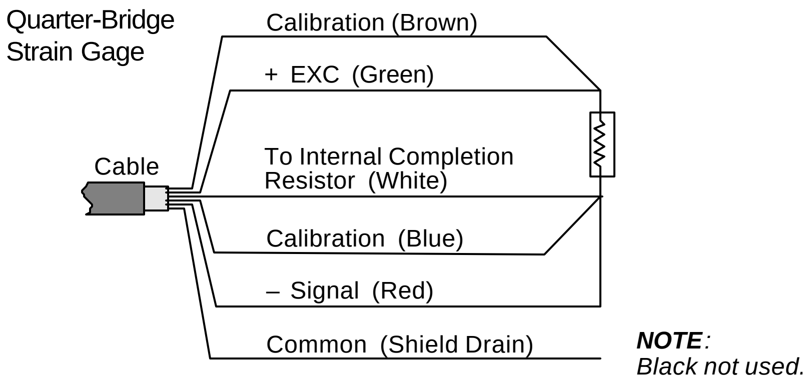


Figure 5-4: Quarter-Bridge Strain Gage, 6-Wire Option, Downscale Calibration

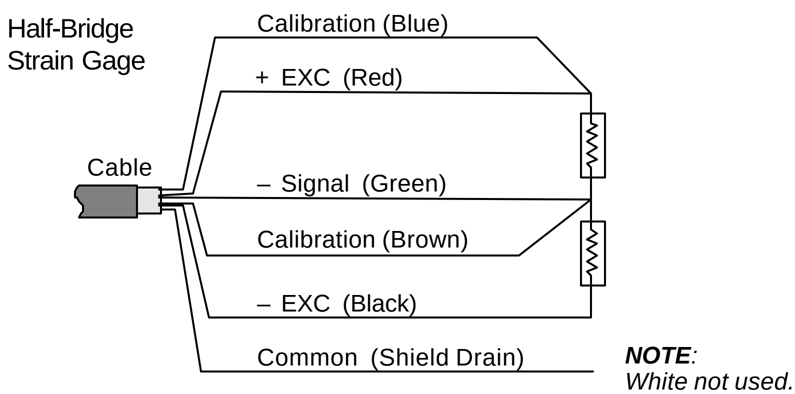


Figure 5-5: Half-Bridge Strain Gage, 6-Wire Option, Downscale Calibration

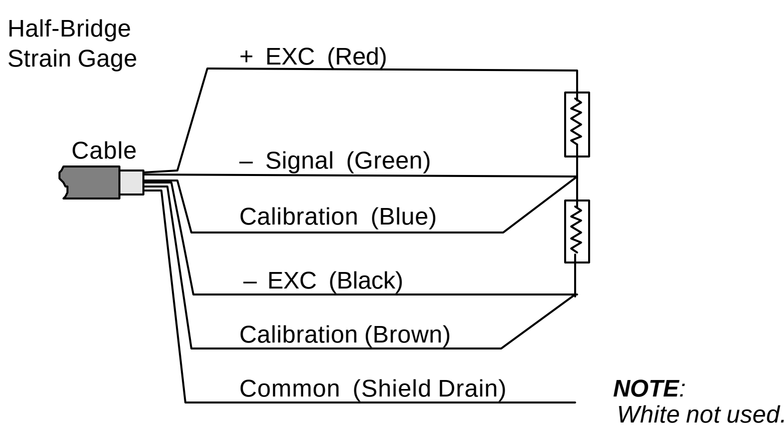


Figure 5-6: Half-Bridge Strain Gage, 6-Wire Option, Upscale Calibration

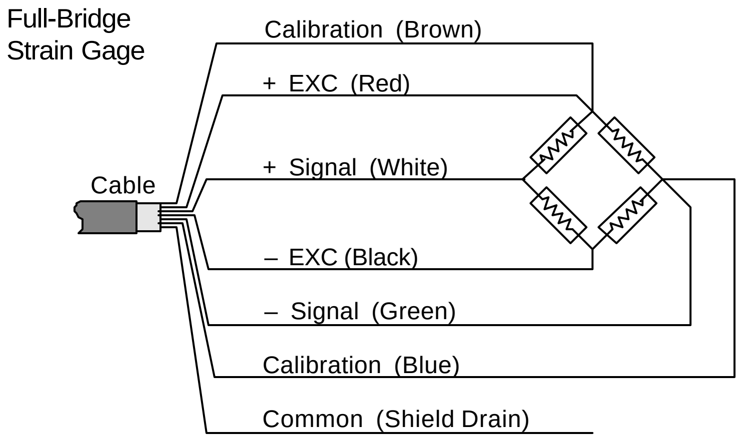


Figure 5-7: Full-Bridge Strain Gage, 6-Wire Option, Downscale Calibration

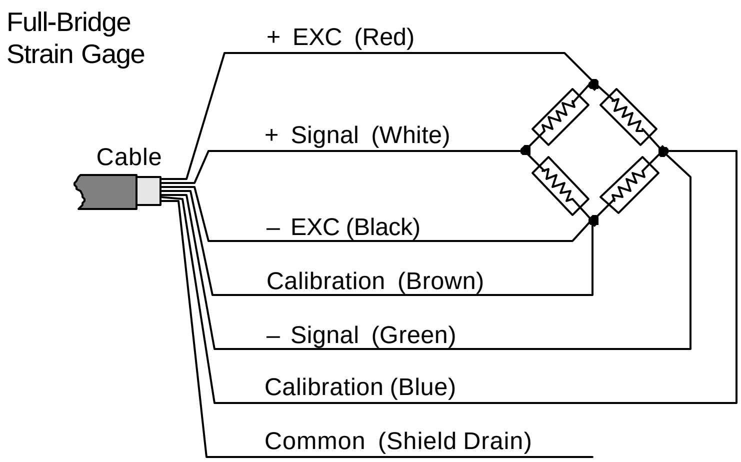


Figure 5-8: Full-Bridge Strain Gage, 6-Wire Option, Upscale Calibration

Analog Transducer Wiring

Figure **5-9** shows the wiring diagram for a general purpose analog voltage input. In the low-level analog cable assembly, the wire colors are white for +Signal, green for –Signal. In the high-level cable assembly, the wire colors are different for each of the 16 analog inputs (see Appendix A, **Cable Wiring**).

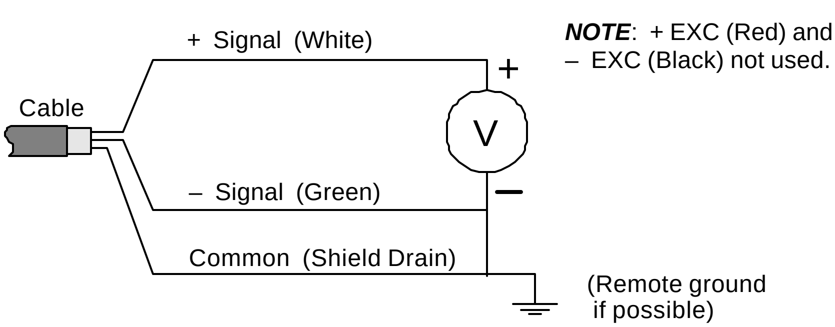


Figure 5-9: Strain/Analog: General Purpose Voltage Input Wiring

See also **Shield–Ground Connections** on page 44.

Digital I/O Device Wiring

Digital Inputs

Figures **5-10**, **5-11**, **5-12**, **5-13**, **5-14**, and **5-15** show the wiring diagrams for various digital input devices. An equivalent circuit as well as diagrams showing use of a switch closure, encoder, and magnetic pickup device is included.

Equivalent Circuit

Figure **5-10** shows the equivalent circuit for a digital input line.

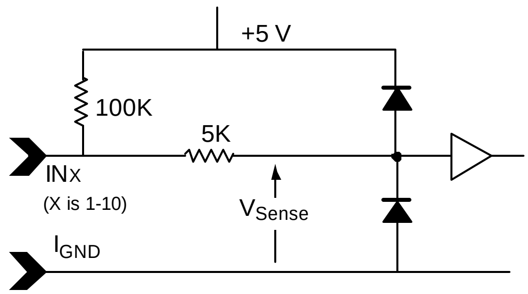


Figure 5-10: Equivalent Circuit for Digital Input Line

An open circuit is sensed as logic one (true). A V_{Sense} greater than 2.1 Vdc is logic one (true); less than 0.5 Vdc is logic zero (false).

Pulse Counter

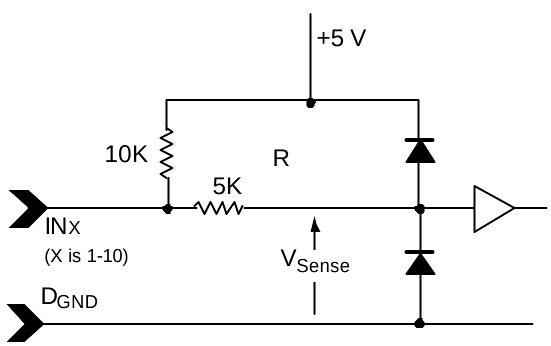


Figure 5-11: Equivalent Circuit for Pulse Counter Input Line

Preferred Switch Digital Input

Whenever possible, a single-pole, double-throw switch (SPDT), wired as shown in Figure 5-12, should be used for switched inputs.

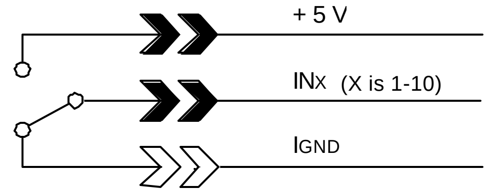


Figure 5-12: Preferred Switch Digital Input

This circuit solidly switches the input line to either ground (D_{GND}) or +5 volts and prevents coupling of the input line to other digital input lines. Moving the switch to the ground side is identified as logic zero (false).

NOTE: The +5 Volts must be supplied externally for this circuit to work correctly.

Alternate Switch Digital Input

Figure **5-13** shows the circuit wiring for an alternate digital input involving a switch closure function. An open switch as shown is logic one (true); a closed switch is logic zero (false).

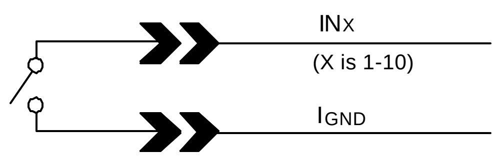


Figure 5-13: Alternate Switch Digital Input

This circuit is adequate for most applications. Contact SoMat for a special cable to eliminate coupling if you observe coupling from another input line.

Digital Outputs

The following shows the equivalent circuit for a digital output and use of an incandescent bulb and a light-emitting diode (LED) as digital outputs.

Equivalent Circuit

Figure **5-14** shows the equivalent circuit for a digital output line.

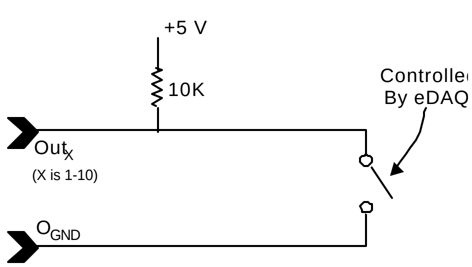


Figure 5-14: Equivalent Circuit for Digital Output Line

An output of logic zero closes the switch; a logic one output opens the switch. The switch can handle a maximum switching voltage of 20 volts. The 10 output lines can handle a cumulative current of up to 250 mA.

Use of an Incandescent Bulb

Figure **5-15** shows an incandescent bulb (3 watts maximum) used as an indicator in the digital output circuit.

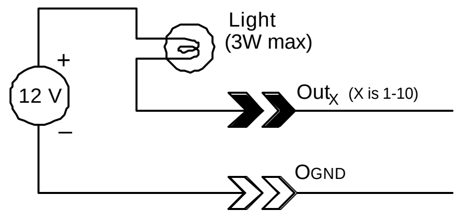


Figure 5-15. Operating a 12-volt Incandescent Bulb

An external 12v DC power supply provides power for the bulb. A three-watt bulb would use up the current capacity of all 10 lines. The light will be on when the output is set to logic zero.

Use of LED

Figure **5-16** shows the use of a light-emitting diode (LED) as an indicator in the digital output circuit. A logic zero causes the diode to light.

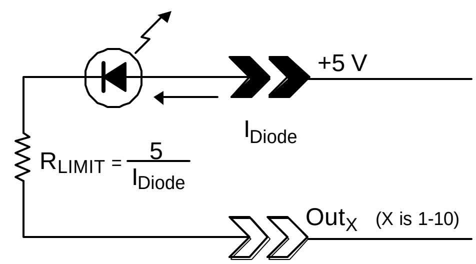


Figure 5-16: Operating an externally Powered LED

The total of all diode currents must be less than 250 mA.

NOTE: The +5 Volts must be supplied externally for this circuit to work correctly.

Shield–Ground Connections

Connect the shield drain wire in transducer cables to circuit ground at the eDAQ end of the cables.

Chapter 6 - eDAQ Test Process

Overview

There are six phases in conducting a test with the SoMat eDAQ FCS. Each phase builds upon the one preceding it:

Phase 1: Plan the test in advance to ensure the desired data will be acquired.

Phase 2: Prepare the hardware: Connect together all hardware items to be used in the test and verify they are operating correctly.

Phase 3: Set up transducer and computed channels to establish the test data sources.

Phase 4: Set up DataModes to designate how the test data is to be acquired and stored.

Phase 5: Run the test.

Phase 6: Upload the test data and analyze using EASE or DataXplorer.

Each phase is explained in a section of this chapter.

Phase 1: Plan the Test

Plan the test carefully before configuring the eDAQ FCS for a test. Four important questions to answer when planning a data acquisition test: Why? What? How? When?

Why do you need this data? The type of problem or objective is important in planning a test. Resolving a fatigue or durability problem may require an entirely different approach than a performance or usage application.

What is to be measured? What physical quantities are important to the problem? What information is required and in what form? Which channels would be best to collect this data?

How should the data be manipulated and stored so the essential data needed for solving the problem is obtained? TCE offers a wide range of online data reduction methods and DataModes.

When should this data be collected? Recording all data constantly may be unnecessary and/or undesirable. With TCE you can use gates and triggers so only the required data is collected.

Part of the test plan may be to minimize time in the field. For many jobs, much of the test preparation work can be done at a desk or lab setting before going to the test site. To facilitate such pre-test preparation, TCE can store and recall test setup files as needed. For example, if several different tests are to be run, you can:

- Use TCE to create a setup for each test and save them as a separate file (e.g. setup1, setup2, etc.).
- At the time and location of a test, load the particular test to be run into TCE.

Setting up tests in advance can make running tests as simple as start and stop. You can view the test data using DataXplorer or EASE.

Phase 2: Prepare the Hardware

Preparing test hardware involves installing the various gages, sensors, cables, etc. required for the test:

- Attachment of transducers to the components being tested
- Transducer cables to the transducers
- Transducer cables to the appropriate connectors on the eDAQ
- Power cable between the eDAQ and an appropriate power supply
- Communication cable between the eDAQ and support PC

Phase 3: Set Up Transducer and Computed Channels

The eDAQ collects test data primarily from transducers and secondarily from computed channels. A *computed channel* is a software (or virtual) channel that either modifies the data from one or more input channels (transducer or previously-defined computed channels), controls acquisition of data based on the input channel(s), or derives new data from the input channels.

Setting up your data channels involves the following steps.

1. Set up (define) all the transducer channels you will be using. Chapter 7, **Transducer Channels**, presents a general procedure and specifics for the various types of transducer channels.

   Transducer channels can be calibrated during the setup, or later while the equipment is in the field. **Calibrating Channels** in Chapter 7 explains the process.

2. Set up the computed channels to be used. Chapter 8, **Computed Channels**, describes the various types of computed channels and the process of setting them up.

3. Verify all data channels are operating properly using the appropriate channel display (Scope, DVM, or Run Time Display). See Chapter 10, **Monitoring Test and Channels**, for information on those displays and their use.

Phase 4: Set Up DataModes

This phase is used to set up (define) the DataModes to be used based on the type of data required, how it is to be collected, and the channels you are using.

SoMat DataModes determine how, and in what form, certain channel data is stored in the eDAQ and in the output data file. A transducer channel or computed channel can be assigned as an input to several DataModes, and a DataMode can have several input channels.

See Chapter 9, **DataModes**, for information on the DataModes available and the process of defining a DataMode.

Phase 5: Run the Test

Main Test Phases

The six steps in running a test are:

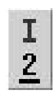
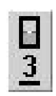
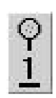
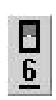
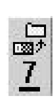
1. Initialize the eDAQ FCS
2. Start the test run
3. Collect data
4. Stop the test run
5. End the test session
6. Upload test data to the support PC

Running a test in TCE can be done in any of four ways:

- Use commands in the TCE Test Control menu
- Use buttons in the TCE toolba.
- Use function keys and CTRL+[key] keypress combinations assigned to test control functions (shortcut key)
- Use the TCE Test Control Panel

Using Buttons, Commands, and Shortcut Keys

The phases of a test, related Test Control commands, and toolbar buttons are:

Test Phase	*Menu Command*	*Toolbar Button*	*Shortcut key*
1. Initialize eDAQ FCS	Initialize Test		CTRL+2
Rezero transducers	Rezero Display (in Prerun Options submenu)		CTRL+Z
2. Start the test run	Start Run		CTRL+3
3. Collect data			
Check test status	Get Test Status		CTRL+1
Use Run Time Display	Run Time Display		CTRL+5
4. Stop test run	Stop Run		CTRL+6
5. End the test session	End Test		CTRL+E
6. Upload test data to PC	Upload Test Data		CTRL+7

More information on the commands in the Test Control menu and the TCE toolbar is in Chapter 3 in the section "**TCE Main Window**."

Test Control Panel

TCE Test Control Panel dialog box (**Figure 6-1**) is opened by selecting Control Panel in the Test Control menu. It has a button for each of the six test phases plus one for opening a test setup file. It also shows, by percent, the amount of SRAM available for data storage and the available space on the card in the PCMCIA drive. The time of each run is also shown in this dialog box.

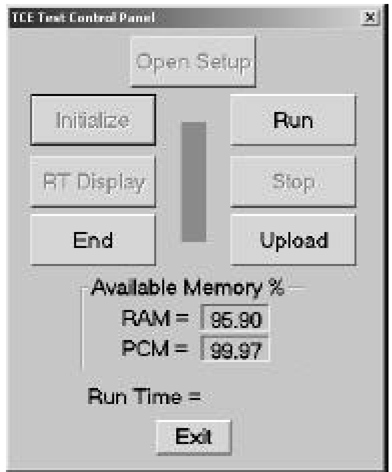


Figure 6-1: TCE Test Control Panel

Initialization Process

The initialization process prepares the eDAQ so a test can be run. When selected, the following steps are performed by TCE. Status messages appear in the lower left of the status bar of the TCE Main Window.

1. Verify the current test setup has been saved to a disk file.
2. Verify there are no internal inconsistencies in the test setup (uncalibrated channels, unresolved ID references, etc.).
3. Verify the eDAQ real-time clock agrees with the real-time clock in the support PC, within the tolerance specified in the TCE General Preferences dialog box.
4. Purge the RAM disk in the eDAQ (all traces of the previous test setup and data files are removed).
5. If the PCMCIA storage option is being used, purge the PCMCIA disk. If files are on the disk, you are prompted to verify the purge.
6. Download the required test setup files to the eDAQ. (Progress boxes showing the names of the files being downloaded to the eDAQ are displayed.)
7. Based on the setup file specifications, set up the FCS signal conditioner boards' excitation circuits (this allows the excitation circuits the maximum amount of time to stabilize before a test run is started).
8. Create the SIF data file and write some of the header fields.
9. For transducer channels with programmable gains and offsets, check the actual Full Scale limits to verify the 5% over-range protection is actually provided and the limits are not significantly greater than 5%. TCE will prompt if there are any unusual situations.

When the initialization is completed:

- “FCS test initialize completed” appears in the status bar.
- The green Ready Status LED is lit steadily, and the yellow LED blinks slowly on the FCS.

A test run can now be started to collect data.

Doing Multiple Test Runs

The eDAQ will support multiple test runs for an initialized test. You can use the Start Run command or button to start a new test run anytime after the previous run has been stopped with the Stop Test command or button. New runs can be started based on the current test initialized until ending the test with the End Test command or button. Once you end a test in this fashion, it cannot be run again unless you initialize the eDAQ again with the same test setup file.

Phase 6: Display and Analyze the Test Data

SoMat EASE or DataXplorer can be used to display the acquired test data. EASE can be used to manipulate the data and do extensive and various analyses.

To access EASE or DataXplorer, do any of these actions:

- Select Call EASE / DataXplorer in the File menu or
- Press CTRL+D or
- Click the Call EASE button () in the TCE toolbar

NOTE: If both EASE and DataXplorer are installed, the one installed last will open unless the EASEInstallDir= line has been changed in the [SoMat] section of your Win.ini file to point to the other.

For information on using SoMat EASE, refer to its operating manual. For DataXplorer, see Chapter 4, **DataXplorer**, in this guide and the *EASE Version 3 Operating Manual* provided with it.

Chapter 7 - Transducer Channels

Introduction

Channel Definitions

To acquire data during a test, a channel definition must be set up in TCE for each transducer data channel to be used. A channel definition contains information such as the channel's ID name, type of data in the channel, engineering units used, output sample rate, and so on.

Each of the defined transducer channels are assigned to a hardware channel (the pins in the eDAQ connector to which the wires of the transducer are connected). Appendix A, **Cable Wiring**, shows the channel/pin assignments for the various transducer cables.

Available Channel Types

Seven types of transducer data channels are currently available in TCE for the eDAQ:

Digital Input — Up to ten digital input/output channels can be defined. The transducers are connected to the eDAQ via the Digital I/O cable going to the Digital I/O connector on the rear of the eDAQ.

Pulse Counter — Eight channels are available to measure pulse rate, time periods, frequency, and duty cycle. The transducers are connected to the eDAQ via the Pulse Counter cable going to the Digital I/O connector on the rear of the eDAQ.

High-Level — These channels are for high-level analog signals normally greater than 1V. Up to sixteen high-level channels can be defined per high-level board. The transducers are connected to the eDAQ via the connector labeled HiLev (1–16) Analog/Veh. Bus on the front of the eDAQ.

Low-Level — These channels are for low-level analog and strain signals that normally are less than 1V (usually millivolts). Up to eight channels can be defined per Low-Level Board in the eDAQ. The transducers are connected to the eDAQ via the LoLev (1–4) and LoLev (5–8) connectors on the Low-Level Board.

Simulation FG, Simulation File — These channels generate signals containing known values. They are used primarily by SoMat engineers in testing and diagnosing the eDAQ FCS. Thus, their use is not described in this guide. For more information on these channels, refer to the TCE online Help System.

Vehicle Bus — Up to 128 channels of vehicle bus inputs can be defined. The vehicle bus inputs are connected to the eDAQ via the connector labeled HiLev (1-16) Analog/Veh.Bus on the front of the eDAQ.

Isolated Thermocouple - The Isolated Thermocouple layer is used to collect and record temperature data using thermocouples. Up to eight channels of thermocouple data can be defined per thermocouple layer. Each layer supports one of the following types: K, T, E, and J. To use two different types of thermocouples (i.e. K and J), two thermocouple layers must be installed; one to support J type, and one to support K type thermocouples.

Transducer Channel Setup Window

Overview

The Transducer Channel Setup window (**Figure 7-1**) is used to start the process of defining a transducer channel. Previously defined channels will also be listed. Shown for each defined channel are parameters from its definition: ID name, connector ID, transducer type, output sample rate, calibration date, and pertinent specifics about the channel.

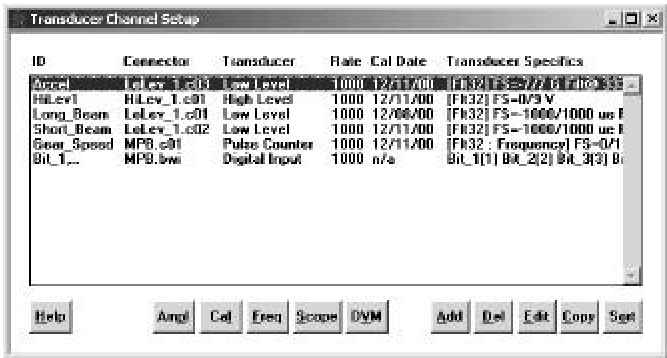


Figure 7-1: Transducer Channel Setup Window

Edit Functions

The Add, Del, Edit, and Copy buttons in the bottom right corner of the window activate the editing functions used with channel definitions. Their uses are explained in these chapter sections:

Add	"**Defining a Channel**" on page 53
Copy	"**Copying a Definition**" on page 74
Edit	"**Editing Channel Definitions**" on page 75
Del	"**Deleting a Definition**" on page 76

Display Functions

The Scope and DVM buttons (center group of buttons) in the dialog box let you view the transducer output on a real-time basis. See **Displaying Transducer Output** on page 73.

Calibrate Function

The Cal button allows calibration of one or more channels in this window rather than having to open the channel definition dialog box(s) and do it there. The current date appears in the Cal Date column of the channel list when a channel is calibrated. See **Calibrating Channels** on page 70.

Analysis Functions

The Freq button lets you run the Cumulative Spectrum Analyzer display on the transducer channel highlighted in the list box. (This display is limited to one channel at a time.)

The Ampl button is used to report selected signal conditioner amplifier settings (e.g. gains, offsets, etc.). This option is provided primarily for SoMat development usage.

Defining a Channel

The following is the general procedure for defining (setting up) a transducer channel in TCE.

NOTE: You can also set up a new channel definition by copying an existing one. See "**Copying a Definition**" on page 74.

1. Start SoMat TCE if it is not already running.
2. Open the setup file where you want to create the channel. Use New Setup or Open Setup in the File menu as appropriate, or use the corresponding buttons in the TCE toolbar.
3. If you are setting up a new file (used the New Setup command), go to the Hardware Setup window and select the Query button to perform a hardware query. A list of the hardware components in the eDAQ then appears in the window. (This step requires the eDAQ be set up and powered and able to communicate with the PC on which you are using TCE.)
4. Make the Transducer Channel Setup window active and select the Add button.
5. At the Select Transducer Channel Type dialog box (**Figure 7-2**), select the channel type you want. Either move the highlight bar to the type and select OK or double-click on the type name.

   A unique definition dialog box appears for each channel type. The following dialog box descriptions are provided in this chapter:

   Low-Level Channel (p. 54)
   High-Level Channel (p. 58)
   Digital Input Channel (p. 64)
   Pulse Counter Channel (p. 65)
   Vehicle Bus Channel (p. 68)
   Thermocouple Channel (p. 62)

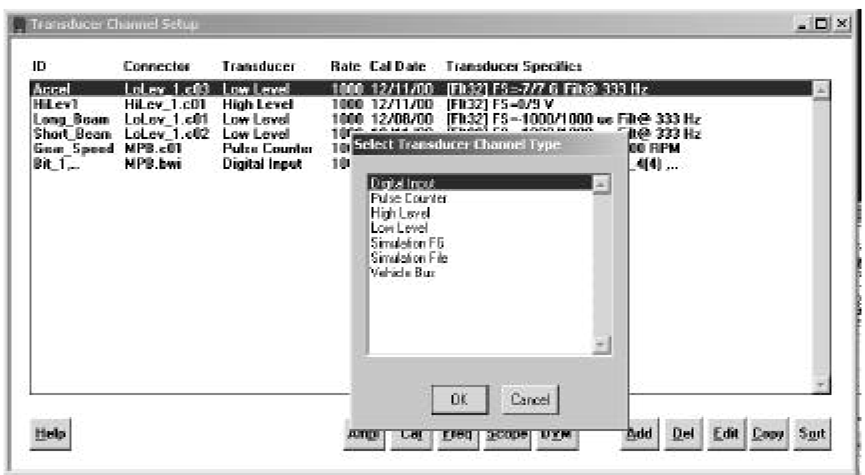


Figure 7-2: Select Transducer Channel Type Dialog Box

6. Enter the required information in the channel definition dialog box.
7. To calibrate the channel at this point, select the Calibrate button in the bottom-left corner of the channel definition dialog box.

   When the calibration is completed successfully, the current date appears in the Calibration Date box, and the parameter boxes related to calibration become unavailable.
8. Click OK or press Enter to save the channel definition.

   The new channel appears in the Transducer Channel Setup window list, above the highlighted channel.

For information on how to change, delete, and copy channel definitions, see these sections:

Copying a Definition (page 74)

Editing Channel Definitions (page 75)

Deleting a Definition (page 76)

Low-Level Channel

Overview

The general procedure for defining a transducer channel is under **Defining a Channel** on page 53. This section explains the actions involved with Steps 5–7 of the procedure as they relate to low-level channels.

Definition Procedure

Use the following procedure to define a low-level channel.

1. At the Select Transducer Channel Type dialog box select Low-Level. Page 1 of the Low-Level Transducer Channel definition dialog box then opens.

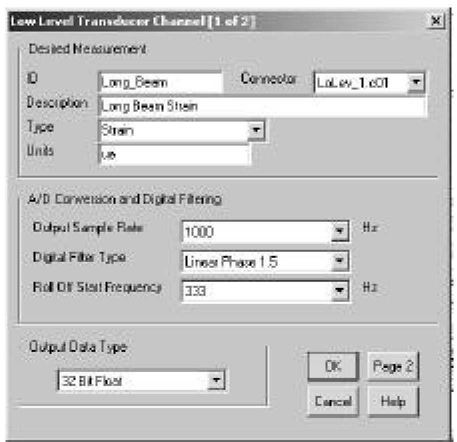


Figure 7-3: Low-Level Transducer Channel Dialog Box (Page 1)

Figure 7-3 shows the dialog box with sample data in it. Normally all boxes are blank when adding a channel. The Connector dialog box will have the ID name for the next hardware (physical) channel available for the channel type being defined. The output data type will also be set to 32-bit float.

2. Complete the boxes in the dialog box as described below.

Desired Measurement:

ID — Unique identification (ID) name for the channel conforming to TCE ID name conventions.

Description — Allows a brief description (up to 31 characters) of the defined channel (optional).

This text can be specified for use as the Y-axis label in a plot graph of the channel data, instead of the channel ID name (the default). This is done at the TCE General Preferences dialog box (**Figure 7-4**). See the section " **TCE Preferences**" in Chapter 3, **TCE for eDAQ**.

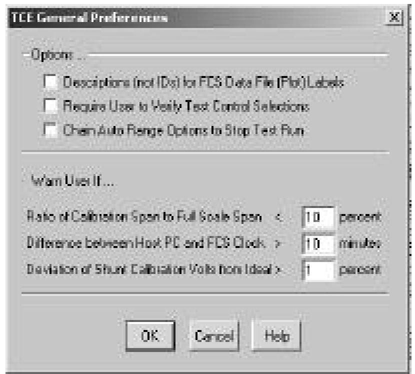


Figure 7-4: TCE General Preferences Dialog Box

Type — Type of measurement the channel is performing (Strain, Load, etc.). Select it from the box list or type it in. This parameter is used later in the test setup process, so always complete this box.

Units — Unit of measurement (engineering unit) for the channel (Degrees, Volts, etc.). An entry in this box is required, as it is used later in the test setup process.

Connector — This is the physical attachment of the transducer to the eDAQ FCS. The name LoLev_1.c01 in **Figure 7-3** indicates the channel is assigned to the channel 1 pins in the LoLev (1–4) connector. The ID name of the next available physical channel for the type of channel appears here by default. Use either the default or select one from the box list.

A/D Conversion and Digital Filtering:

Output Sample Rate — This is the rate at which data is passed on to computed channels or DataModes. Select the rate from the drop-down list for this box.

To limit the frequency content of the input signal, use a digital filter. SoMat over-samples the input signal to allow digital signal conditioning (digital filtering).

If you do not use a digital filter, then set the sample rate to at least twice the maximum frequency content of the signal. This ensures the bandwidth of the input signal is characterized adequately.

Digital Filter Type — This defines the type of digital filter to be used. Select the filter from the drop-list for this box.

Digital filters ensure aliasing of the input signal does not occur. Always use a digital filter unless you are absolutely certain of the frequency content of the input signal.

To decide on which digital filter to use, evaluate the filter's characteristics. For more information on digital filters and their use, refer to the TCE Help system.

Frequency — The name and function of this parameter box varies according to the type of digital filter selected:

Filter Selected	Box That Appears
Butterworth 8P	Break Frequency (3db)
Linear Phase 1.5	Roll Off Start Frequency
None	(Not Applicable)

Break Frequency is the frequency at which signal attenuation is -3 dB (the filtered signal voltage is 70.7% of the unfiltered signal voltage at that frequency).

Roll Off Start Frequency is the frequency at which digital filtration action begins.

TCE sets the value in this box automatically to ensure aliasing does not occur. This is based on the A/D converter rate and digital filter type. To override this value, select another value.

Output Data Type:

Specify the desired output type (32-Bit Float, 16-Bit Integer, or 8-Bit Integer). Select it from the list for this box. Use the 16-Bit integer for optimum throughput performance.

NOTE: Use the 32-bit float option if the channel will be used with the following: Computed Channels, Desk Calculator, Up Sample, Down Sample, etc.

3. Select the Page 2 button (bottom-right corner of dialog box) to continue to Page 2 of the dialog box.

   Figure 7-5 shows the Page 2 dialog box page with sample data in it. Normally all the boxes on Page 2 are blank or have "0" in them when adding a channel.

4. Fill in the parameter boxes as described by the following.

Excitation (Bipolar Voltage) / Bridge:

The excitation boxes define the setup of the transducer excitation circuits. If the transducer requires excitation, consult the transducer manufacturer's specifications and/or suggestions for the excitation settings to be used.

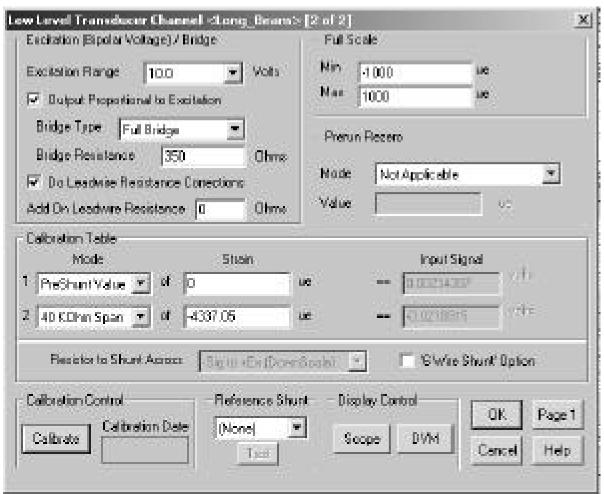


Figure 7-5: Low Level Transducer Channel Dialog Box (Page 2)

NOTE: If the transducer does not use excitation, ensure the Output Proportional to Excitation check box is clear.

Excitation Range — Range of voltage to be used for excitation, from negative to positive (5, 10, 20, or ~22 V). For example, selecting 10 from the excitation range provides –5 V to +5 V, which is a range of 10V.

Output Proportional to Excitation — Select this option if you are using a transducer such as a strain bridge circuit where the output voltage is linearly proportional to the excitation voltage applied. The eDAQ will then compensate for small differences between requested and characterized excitation voltage. For all other transducer types, leave this box unchecked.

Bridge Type — Type of bridge used with the channel. Select it from the drop-down list. If you will not be using a bridge, select Diff Ampl (differential amplifier) here.

Bridge Resistance — Size of the completion resistor for the bridge, in ohms (typically 120 or 350).

Do Leadwire Resistance Corrections — The normal transducer cable length averages one meter. If the transducer cable will be longer than the standard one-meter length, specify the resistance, in ohms, of the cable wiring.

The online Help System contains the topic "Resistance Table for Standard Tinned Copper Wire." This lists the ohms per 100 feet for various wires and is from the National Bureau of Standards Handbook 100, Copper Wire Tables.

Full Scale:

Min and Max — These define the expected upper and lower values of the range of the transducer, in the specified engineering units.

The eDAQ provides some over-range protection, normally at least 5% on both ends of the full scale definition. For details on possible variances in this 5% figure, refer to the online Help System.

Prerun Rezero:

Mode — How and when the channel is to be rezeroed before the start of a test run. Select the mode from the drop-down list. Use the default mode Not Applicable to refrain from zeroing the transducer. To manually rezero the channel, select Interactive Only.

Value — Engineering value associated with the transducer when the rezero is performed. Enter a value here when specifying any mode other than Not Applicable in the above Mode box.

Calibration Table/Options:

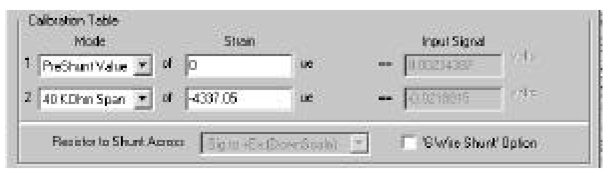


Figure 7-6: Sample Calibration Entries

This section of the dialog box is used to specify how the transducer is calibrated.

Calibrating transducers with the eDAQ differs from other systems, as it does not depend on the signal conditioner being used. The calibration is defined only in terms of a line representing the relationship between the transducer output signal (voltage) and the corresponding engineering units. (If the excitation signal is used for the transducer, the calibration line is affected by the excitation settings.)

The two value sets in the calibration table are used to define the two points involved in determining the calibration line (i.e. the linear relationship of engineering units to input signal voltage). In filling in these value sets, you specify either two points of the line or one point and a slope. **Figure 7-6** shows a calibration table set up for a strain transducer.

Mode column — Mode used for the calibration. Select from the list boxes. Refer to the online Help System for explanations of the available modes.

Depending on the mode selected, you may be prompted during the calibration run to apply the external transducer signal equivalent to the specified engineering units value. The eDAQ then measures the signal voltage.

Engineering units column (Strain in **Figure 7-6**) — The name of the measurement type assigned to the channel (Type box on Page 1) appears as the title for the second column. Enter the engineering units value(s) for the calibration point(s).

NOTE: Refer to the manufacturer's specifications for the transducer to ascertain the engineering units and input signal values to be used for calibration.

Input Signal — If you use the Defined Value mode, enter the input signal level, in volts, for the specified engineering units value. For other calibration modes, no entry is made here (the boxes are unavailable); TCE puts the resultant values in these boxes after the channel is calibrated.

Resistor to Shunt Across — Select the desired resistor to shunt across if one of the calibration steps involves a shunt resistor calibration.

'6 Wire Shunt' Option — Select this check box if the 6-wire option is to be used during calibration.

5. To perform reference shunt calibration checks on a bridge-type transducer, select one of the shunt resistors in the Reference Shunt box. Refer to the TCE online Help System for more information on using this option.

6. To calibrate the channel at this time, select the Calibrate button (bottom-left corner of dialog box); respond to any prompts.

   If the calibration is successful, the current date appears in the Calibration Date box, and the boxes related to the calibration become unavailable (are dimmed or "grayed out") to prevent change to these parameters.

   The calibration must be deleted to change any of the definition data after the channel is calibrated. See **Deleting a Calibration** on page 72.

7. Reference Shunt Calibration checks can be performed between test runs. Select one of the shunt resistors in the drop down list box to enable this feature. Refer to the online help system for more details.

8. Select OK to accept the entries and save the definition. This will close the dialog box. The new channel will appear in the channel list of the Transducer Channel Setup window, above where the highlight bar was located.

   If you want to go back to Page 1 instead of closing the dialog box, select the Page 1 button. You can also select OK on Page 1 to save the channel definition.

Display of Output Signal

Use the Scope or DVM buttons in the Display Control group box on the dialog box to view the real-time transducer output. See **Displaying Transducer Output** on page 73.

High-Level Channel

Overview

The general procedure for defining a transducer channel is under **Defining a Channel** on page 53. This section explains the actions involved in completing Steps 5–7 of that procedure as they relate to high-level channels.

Definition Procedure

Use the following procedure to define a high-level transducer channel.

1. At the Select Transducer Channel Type dialog box select High Level. Page 1 of the High Level Transducer Channel definition dialog box then opens.

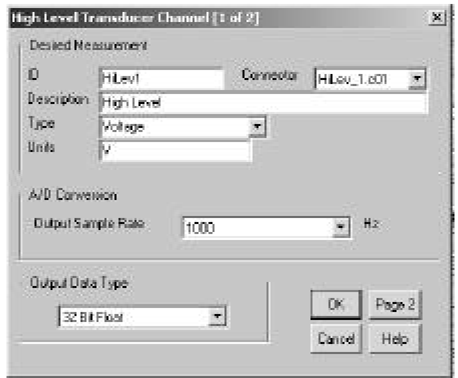


Figure 7-7: High Level Transducer Channel Dialog Box (Page 1)

Figure 7-7 shows the dialog box with sample data. Normally all the boxes are blank when adding a channel, except Connector, which contains the ID name for the next hardware (physical) channel available for the type of channel being defined, and the Output Data Type, which is set to 32-Bit Float.

2. Complete the boxes in the dialog box as described below.

Desired Measurement:

ID — Unique identification (ID) name for the channel conforming to TCE ID name conventions.

Description — Allows a brief description (up to 31 characters) of the defined channel (optional).

This text can be specified for use as the Y-axis label in a plot graph of the channel data instead of the channel ID name (the default). This is done from the TCE General Preferences dialog box (**Figure 7-4**). See the section "**TCE Preferences**" in Chapter 3, **TCE for eDAQ**.

Type — Type of measurement associated with the channel (e.g. Acceleration, Angular Displacement). Select this from the list or type it in the box. This parameter is used later in the test setup process so always complete this box.

Units — Unit of measurement (engineering unit) for the channel (Degrees, Volts, etc.). This parameter is used later in the test setup process so always complete this box.

Connector — This is the hardware (physical) channel to which this channel is assigned. The ID names of the available channels are sequentially displayed when defining channels. In **Figure 7-7** the name HiLev_1.c01 indicates the TCE channel is assigned to the Channel 1 pins in the High-Level (HiLev) connector on the eDAQ.

A/D Conversion:

Output Sample Rate — Rate at which data is to be acquired and passed on to computed channels or DataModes (0.1 to 2,500 Hz). Select the rate from the list for this box.

Set the sample rate to at least twice the maximum frequency content of the signal. This ensures the bandwidth of the input signal is characterized adequately.

Output Data Type:

Specify the desired output type (32-Bit Float, 16-Bit Integer, or 8-Bit Integer). Select it from the list for this box. Use the 16-Bit Integer for optimum throughput performance.

NOTE: Use the 32-bit float option if the channel will be used with the following: Computed Channels, Desk Calculator, Up Sample, Down Sample, etc.

3. Select the Page 2 button (bottom-right corner of dialog box) to go to Page 2 of the dialog box. **Figure 7-8** shows that dialog box page with sample data in it.

4. Complete the parameter boxes as described by the following.

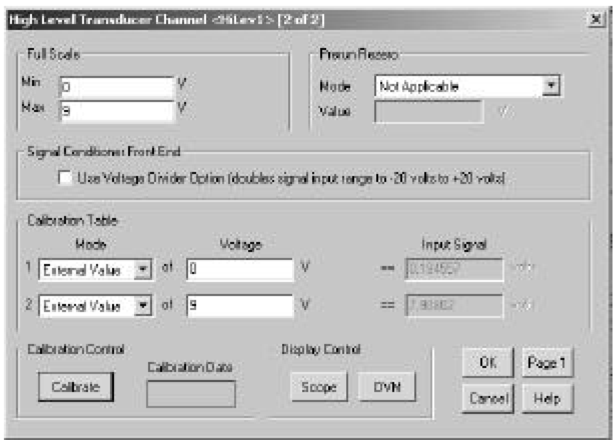


Figure 7-8: High Level Transducer Channel Dialog Box (Page 2)

Full Scale:

Min and Max — Lower and upper values of the range within which the transducer signal values are expected to be, expressed in terms of the engineering units being used.

Prerun Rezero:

Mode — How and when the channel is to be rezeroed before the start of a test run. Select the mode from the drop-down list. Use the default mode Not Applicable to refrain from zeroing the transducer. To manually rezero the channel, select Interactive Only.

Value — Engineering value associated with the transducer when the rezero is performed. Enter a value here when you specify any mode other than Not Applicable in the above Mode box.

Signal Conditioner Front End:

Select the check box in this group box if you want the range of input voltages expanded to ± 20 V to allow for greater signal values.

Calibration Table:

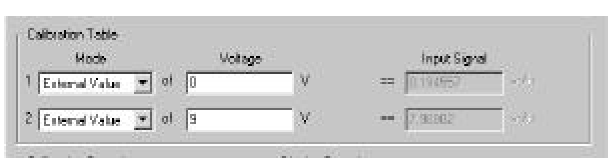


Figure 7-9: High-Level Channel Calibration Table

In this group box you specify how the transducer is to be calibrated.

Calibrating transducers with the eDAQ differs from other systems as it is defined in terms of a line representing the relationship between the transducer output signal (voltage) and corresponding engineering units. (This line depends on the excitation settings if an excitation signal is used.)

The two value sets in the calibration table are used to define the two steps involved in determining the calibration line (i.e. linear relationship of engineering units to input signal voltage). Filling in these value sets specifies either two points on a line or one point and a slope. **Figure 7-9** shows a calibration table set up for a transducer measuring displacement.

Mode column — Mode used for the calibration. Select the mode from the drop-down list boxes. Refer to the online help system for explanations of the available modes.

Depending on the mode selected, there may be a prompt during the calibration run to apply the external transducer signal equivalent to the specified engineering units value. The eDAQ then measures the signal voltage.

Engineering units column (Displacement in **Figure 7-9**) – The name of the measurement type assigned to the channel (Type box on Page 1) appears as the title for the second column. Enter the engineering units value(s) for the calibration point(s).

NOTE: Refer to the specifications from the transducer manufacturer to ascertain the engineering units and input signal values to be used for calibration.

Input Signal — When using the Defined Value mode, enter the input signal level, in volts, for the specified engineering units value. For other calibration modes, no entry is made here (the boxes are unavailable); TCE puts the resultant values in these boxes after the calibration is completed.

5. To calibrate the channel at this time, select the Calibrate button (bottom-left corner of dialog box); respond to any prompts.

   If the calibration is successful, the current date appears in the Calibration Date box, and the boxes related to the calibration become unavailable (are dimmed or “grayed out”) to prevent change to these parameters.

   The calibration must be deleted to change any of the definition data after the channel is calibrated. See **Deleting a Calibration** on page 72.

6. Select OK to accept the entries and save the definition. This will close the dialog box. The new channel will appear in the channel list of the Transducer Channel Setup window, above where the highlight bar was located.

If you want to return to Page 1 instead of closing the dialog box, select the Page 1 button. You can also select OK on Page 1 to save the channel definition.

Display of Output Signal

Use the Scope or DVM buttons in the Display Control group box to view the transducer output on a real-time basis. See **Displaying Transducer Output** on page 73.

Thermocouple Channel

Overview

The general procedure for defining a transducer channel is under **Defining a Channel** on page 53. This section explains the actions involved in completing Steps 5–7 of the procedure as they relate to thermocouple channels.

Definition Procedure

Use the following procedure to define a thermocouple transducer channel.

1. From the Select Transducer Channel Type dialog box select Isolated Thermocouple. Page 1 of the Isolated Thermocouple Channel definition dialog box then opens.

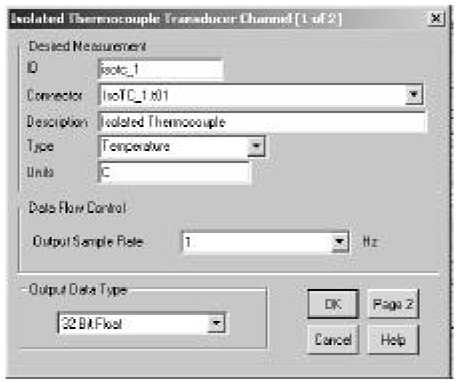


Figure 7-10: Isolated Thermocouple Transducer Channel Dialog Box (Page 1)

Figure 7-10 shows the dialog box with sample data in it. The only box requiring data entry will be the Description box. Many of the dialog boxes will contain data, as each thermocouple layer is specific to a thermocouple type. Items such as Type, Units, Full scale values, and calibration are all predetermined based on the thermocouple type.

2. Complete the boxes in the dialog box as described below.

Desired Measurement:

ID — Unique identification (ID) name for the channel conforming to TCE ID name conventions.

Description — Allows a brief description (up to 31 characters) of the defined channel (optional).

This text can be specified for use as the Y-axis label in a plot graph of the channel data instead of the channel ID name (the default). This is done at the TCE General Preferences dialog box (**Figure 7-4**). See the section "**TCE Preferences**" in Chapter 3, **TCE for eDAQ**.

Type — Type of measurement associated with the channel (e.g. Acceleration, Angular Displacement). Because this is a temperature device, temperature has been preselected. This parameter is used later in the test setup process so always complete this box.

Units — Unit of measurement (engineering unit) for the channel (Degrees, Volts, etc.). Because nearly all thermocouple devices are in Celsius, C has been preselected for this entry. This parameter is used later in the test setup process so always complete this box.

Connector — This is the hardware (physical) channel to which this channel is assigned. The ID names of the available channels are sequentially displayed when defining channels. In **Figure 7-10** the name IsoTC_1.t01 indicates the TCE channel is assigned to the Channel 1 connector of the Isolated Thermocouple layer.

A/D Conversion:

Output Sample Rate — Rate at which data is to be acquired and passed on to computed channels or DataModes (0.1 to 5 Hz). Select the rate from the list for this box.

Set the sample rate to at least twice the maximum frequency content of the signal. This ensures the bandwidth of the input signal is characterized adequately.

Output Data Type:

The Output Data Type for all Thermocouple devices are limited to 32-Bit float.

3. Select the Page 2 button (bottom-right corner of dialog box) to go to Page 2 of the dialog box. **Figure 7-11** shows that dialog box page with sample data.
4. Complete the parameter boxes as described by the following.

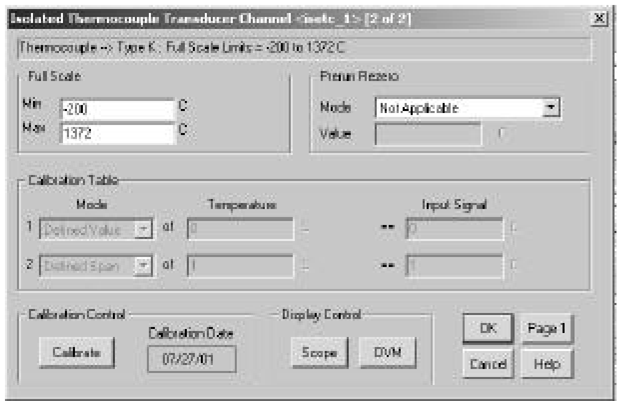


Figure 7-11: Isolated Thermocouple Transducer Channel Dialog Box (Page 2)

Full Scale:

Min and Max —The minimum and maximum values are predetermined based on the thermocouple type. However, these can be changed as desired for setting Run Time Display scaling and Histogram DataMode bounds.

Prerun Rezero:

Mode — How and when the channel is to be rezeroed before the start of a test run. Select the mode from the drop-down list. Use the default mode Not Applicable to refrain from zeroing the transducer. To manually rezero the channel, select Interactive Only.

Value — Engineering value associated with the transducer when the rezero is performed. Enter a value here when you specify any mode other than Not Applicable in the above Mode box.

Calibration Table:

The items in the calibration table are “grayed out”, as the values for calibration have been predetermined by the choice of thermocouple type. Normally there is no need to modify these default settings, unless the output is to be in Fahrenheit or another type of temperature unit. Follow the directions for Deleting a Calibration, then Calibrating a Transducer Channel.

Display of Output Signal

Use the Scope or DVM buttons in the Display Control group box to view the transducer output on a real-time basis. See **Displaying Transducer Output** on page 73.

Digital Input (BWI) Channel

Overview

The general procedure for defining a transducer channel is under **Defining a Channel** on page 53. This section explains the actions involved in doing Steps 5–7 of that procedure as they relate to digital input channels.

Before Defining a Channel

Before you define a digital input channel, you have to specify which of the ten digital I/O bits will be used for input channels. To do so, do the following.

1. In the TCE FCS Setup menu select Set FCS Digital I/O.
2. At the Set FCS Digital I/O Configuration dialog box that opens (**Figure 7-12**), put a check mark in the box for each digit bit to be used as an input channel.

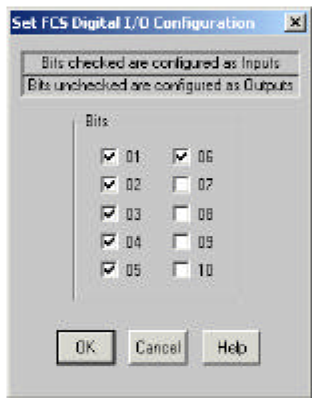


Figure 7-12: Set FCS Digital I/O Configuration Dialog Box

3. Click on the OK button to save the changes made.

It is suggested to place a note in the Comments area of the Test ID Setup window noting which digital bits are input and which are output. This provides easy access when checking the setting of the Digital I/O configuration for each test setup.

Definition Procedure

Perform the following procedure to define a digital input transducer channel.

1. Before proceeding, it will be necessary to specify which of the ten digital I/O bits will be input or output channels. This is described in the preceding subsection.
2. Select Digital Input at the Select Transducer Channel Type dialog box. The Bitwise Digital Input Channels dialog box then opens.

Figure 7-13 shows that dialog box with sample data. Normally all the boxes are blank when adding a channel except for Connector, which contains the connector ID name MPB.bwi, the only connector name available for digital I/O channels.

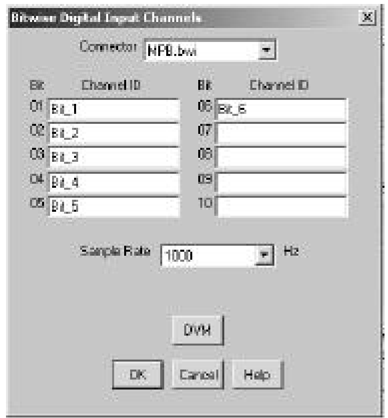


Figure 7-13: Bitwise Digital Input Channels Dialog Box

3. Complete the boxes as described below.

   Connector — This is the physical hardware connection for the channel. MPB.bwi is the only available option.

   Channel ID — Unique identification (ID) name for each digital bit used in the channel, up to 12 characters each. The names must conform to the conventions for TCE ID names. They are used in the definitions for computed channels and DataModes.

   Sample Rate — Rate at which data is to be passed on to computed channels or DataModes (0.1–2,500 Hz). Select the rate from the list for this box.

4. Select OK to save the definition.

The dialog box closes and the new channel appears in the channel list in the Transducer Channel Setup window, which is above where the highlight bar was located.

Display of Output Signal

The DVM button lets you display the digital inputs on a real-time basis using the DVM display function. See "**Transducer Checks**" in Chapter 10, **Monitoring Tests and Channels**, for more on using the DVM display.

Pulse Counter Channel

Overview

The general procedure for defining a transducer channel is under **Defining a Channel** on page 53. This section explains the actions involved in doing Steps 5–7 of the procedure as related to defining a pulse counter channel.

Definition Procedure

Use the following procedure to define a pulse counter transducer channel.

1. Select Pulse Counter at the Select Transducer Channel Type dialog box. The Pulse Counter Channel dialog box (Page 1) then opens.

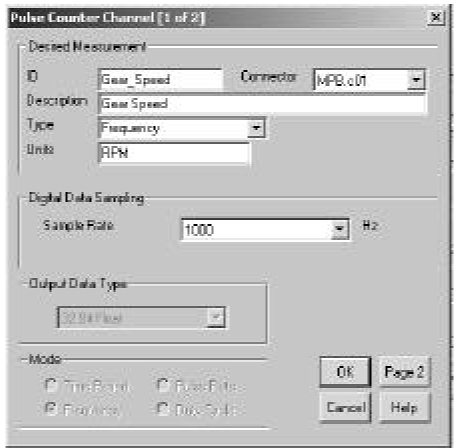


Figure 7-14: Pulse Counter Channel Definition Dialog Box (Page 1)

Figure 7-14 shows the dialog box with sample data entered. Normally all the boxes are blank when adding a channel except Connector, which will contain the ID name for the next available hardware channel available; Output Data Type, which is set to 32-Bit Float; and Mode, which is set to Frequency.

2. Fill in the boxes as described below.

Desired Measurement:

The boxes in this group box are identical to those in the dialog boxes for high-level and low-level channels, except the hardware channels are named MPB.c01 through MPB.c08.

Digital Data Sampling:

Sample Rate – Rate at which the eDAQ samples the pulse counter count registers (5–2,500 Hz). Select this rate from the list.

NOTE: The sample rate must be the same for all channels if using two or more digital pulse counter channels on the same digital board.

Output Data Type:

Either 32-Bit Float or 32-Bit Unsigned. Your choice here affects the set of operating modes available from the Mode group box.

Mode:

The option buttons in this group box are used to select the operating mode for the pulse counter channel.

NOTE: The effective working range of pulse counter transducers for all operating modes (except the Pulse Rate mode) is nominally 0.5 Hz to 50,000 Hz. At a frequency of 50,000 Hz, 100 counts are accumulated in the counter, resulting in a 1% measurement accuracy. At frequencies higher than 50,000 Hz, measurement accuracy rapidly deteriorates, and the Pulse Rate mode should be used.

Time Period — The pulse period in units of microseconds is the fundamental signal. The unsigned 24-bit counter can measure pulse widths from 200 nanoseconds to 3.3 seconds. This is the most efficient mode from a processing point of view.

Frequency — The pulse frequency in units of Hz is the fundamental signal. The measurement range is from 0.3 Hz to over 1 MHz. This mode is considerably more demanding computationally than the Time Period mode.

Pulse Rate — The number of pulse counts occurring in one sample period, in units of pulses per second (Hz), is the fundamental signal (e.g. at a 100 Hz sample rate, the period is 10 millisecs). Over 16 million counts can be accumulated per sample period. This mode is useful when a large number of pulses occur in the sample period. The measurement range is up to 1 MHz.

NOTE: This mode can be used in conjunction with the Integrator computed channel to track accumulated pulse counts. Refer to the online Help for details.

Duty Cycle — The pulse duty cycle as a dimensionless ratio is the fundamental signal. The measurement range is from 0.0 to 1.0. In this mode, one 24-bit register is used to measure the total pulse period (from rising edge to the next rising edge), and a second 24-bit register is used to measure the "on time" (i.e. the time period between the rising and falling edges). The fundamental signal is the ratio of the "on time" to the pulse period. This mode is the most demanding, computationally.

NOTE: To use the Duty Cycle mode, the input signal must be connected to the odd numbered input connector pins only (e.g. 1,3,5 or 7).

3. Select the Page 2 button (bottom-right corner of dialog box) to continue the definition process. Page 2 of the Pulse Counter Channel definition dialog box appears. **Figure 7-15** shows that dialog box page with sample data in it. Normally all the boxes will be blank or have "0" in them when you are adding a channel.

4. Fill in the boxes as described below.

   The Full Scale and Prerun Rezero group boxes are identical to the same group boxes on the Low Level and High Level definition dialog boxes. The Calibration Table group box is also identical except for Input Signal boxes (explained below). Descriptions for these areas and their boxes start on **page 71**.

An exception regarding the Input Signal boxes:

- If using the Defined Value mode, enter the input signal level in units other than the volts used with a high or low level channel.
- If the Mode box on Page 1 is set to Frequency, enter this value in hertz (Hz); if set to Time Period, in microseconds; and if set to Duty Cycle, as a ratio.

5. To calibrate the channel at this time, select the Calibrate button (bottom-left corner of dialog box); respond to any prompts that appear.

   When the calibration is done successfully, the current date appears in the Calibration Date box and the boxes on this page become unavailable, preventing changes to those parameters.

   The calibration must be deleted to change any of the definition data after the channel is calibrated. See **Deleting a Calibration** on page 72.

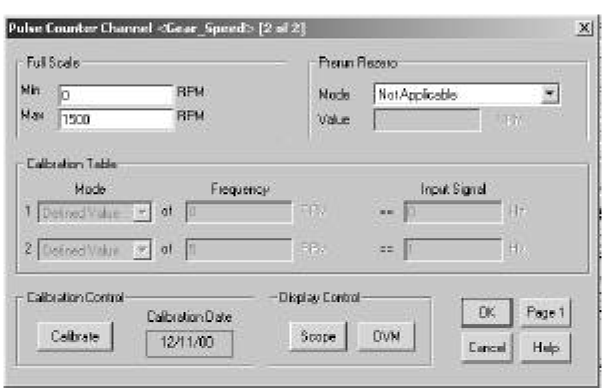


Figure 7-15: Pulse Counter Channel Definition Dialog Box (Page 2)

6. Select OK to save the definition. The dialog box closes, and the new channel appears in the channel list in the Transducer Channel Setup window, above where the highlight bar was located.

To return to Page 1 instead of closing the dialog box, select the Page 1 button. Selecting OK from Page 1 will also save the channel definition.

Display of Output Signal

Use the Scope or DVM buttons from the Display Control box to view the real-time transducer output. See **Displaying Transducer Output** on page 73.

Vehicle Bus Channel

Overview

The vehicle bus provides a way to collect data directly from the vehicle without the installation of specific transducers. In many instances, information such as engine RPM, engine temperature, battery voltages, etc. can be found transmitted on the vehicle bus. By using the eDAQ Vehicle Bus Interface, this information can be polled and collected in an output file as additional information regarding a particular test.

Defining a Vehicle Bus Channel

To access the vehicle bus, open the Hardware setup page by pressing F1 or selecting the window with the mouse. Highlight the vehicle bus, then click Config. This will open the Vehicle Bus Hardware Setup window.

Select the type of bus interface from the Hardware window. The eDAQ currently supports CAN J1939, J1850 PWM, and J1850 VPW.

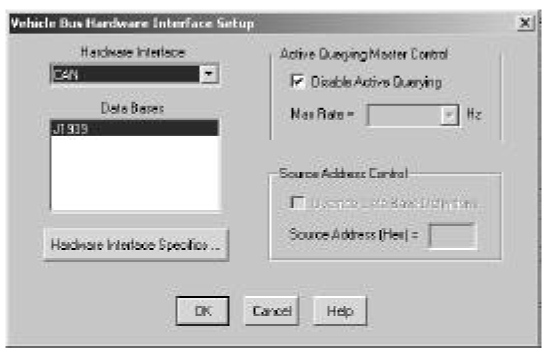


Figure 7-16: VBB Hardware Interface Setup

Selecting Channels from a Database

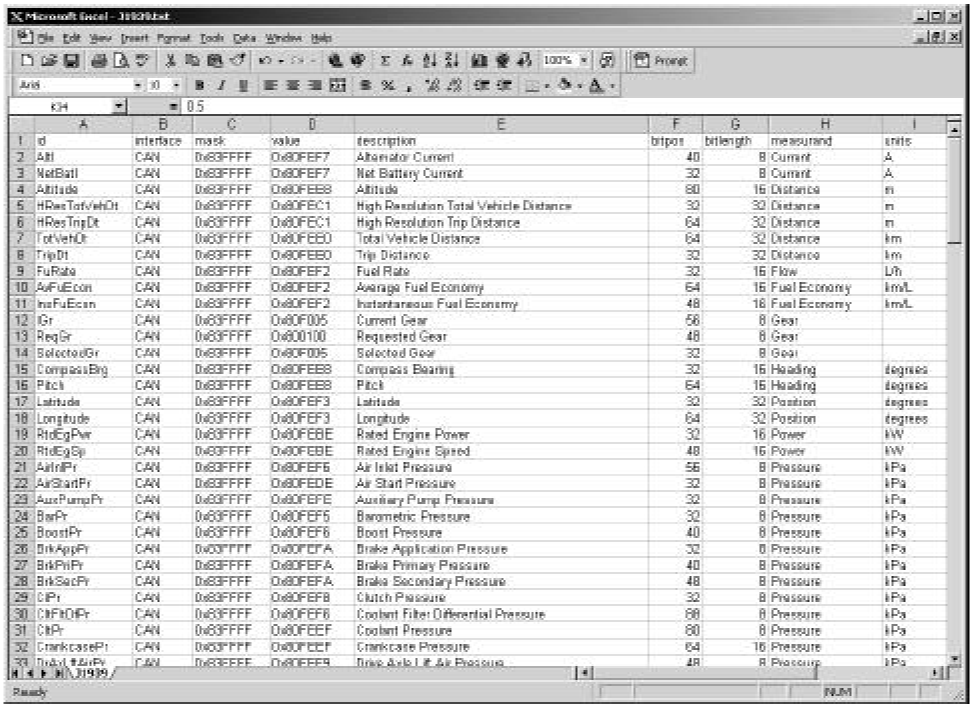
Make the Transducer Channel Setup window active by pressing F2 or selecting the window with the mouse. Click Add to open the Select Transducer Channel Type window. Highlight Vehicle Bus and click OK. This will open the list of currently defined channels available for data collection. Highlight the channel(s) from which to collect data, and click OK to complete the procedure. To select multiple, non-contiguous channels, hold the shift key while selecting each channel individually.

Figure 7-17: Select Transducer Channel Type

Figure 7-18: Select Vehicle Bus Input Channels

Editing the Database in Excel

The Vehicle Bus database is a tab delimited text file that can be edited and reloaded onto the eDAQ. Each database resides in the eDAQ and is uploaded to the PC when a hardware query is performed.



	A	B	C	D	E	F	G	H	I
1	id	interface	mask	value	description	bitpos	bitlength	measurand	units
2	Alt	CAN	0x83FFFF	0x80FEF7	Alternator Current	40	8	Current	A
3	NetBatt	CAN	0x83FFFF	0x80FEF7	Net Battery Current	32	8	Current	A
4	Altitude	CAN	0x83FFFF	0x80FEE8	Altitude	80	16	Distance	m
5	HResTotVehDt	CAN	0x83FFFF	0x80FEC1	High Resolution Total Vehicle Distance	32	32	Distance	m
6	HResTripDt	CAN	0x83FFFF	0x80FEC1	High Resolution Trip Distance	64	32	Distance	m
7	TotVehDt	CAN	0x83FFFF	0x80FEE0	Total Vehicle Distance	64	32	Distance	km
8	TripDt	CAN	0x83FFFF	0x80FEE0	Trip Distance	32	32	Distance	km
9	FuRate	CAN	0x83FFFF	0x80FEF2	Fuel Rate	32	16	Flow	L/h
10	AvFuEcon	CAN	0x83FFFF	0x80FEF2	Average Fuel Economy	64	16	Fuel Economy	km/L
11	InsFuEcon	CAN	0x83FFFF	0x80FEF2	Instantaneous Fuel Economy	48	16	Fuel Economy	km/L
12	IGr	CAN	0x83FFFF	0x80F005	Current Gear	56	8	Gear	
13	ReqGr	CAN	0x83FFFF	0x800100	Requested Gear	48	8	Gear	
14	SelectedGr	CAN	0x83FFFF	0x80F005	Selected Gear	32	8	Gear	
15	CompassBrg	CAN	0x83FFFF	0x80FEE8	Compass Bearing	32	16	Heading	degrees
16	Pitch	CAN	0x83FFFF	0x80FEE8	Pitch	64	16	Heading	degrees
17	Latitude	CAN	0x83FFFF	0x80FEF3	Latitude	32	32	Position	degrees
18	Longitude	CAN	0x83FFFF	0x80FEF3	Longitude	64	32	Position	degrees
19	RtdEgPwr	CAN	0x83FFFF	0x80FEBE	Rated Engine Power	32	16	Power	kW
20	RtdEgSp	CAN	0x83FFFF	0x80FEBE	Rated Engine Speed	48	16	Power	kW
21	AirInPr	CAN	0x83FFFF	0x80FEF6	Air Inlet Pressure	56	8	Pressure	kPa
22	AirStartPr	CAN	0x83FFFF	0x80FEDE	Air Start Pressure	32	8	Pressure	kPa
23	AuxPumpPr	CAN	0x83FFFF	0x80FEFE	Auxiliary Pump Pressure	32	8	Pressure	kPa
24	BarPr	CAN	0x83FFFF	0x80FEF5	Barometric Pressure	32	8	Pressure	kPa
25	BoostPr	CAN	0x83FFFF	0x80FEF6	Boost Pressure	40	8	Pressure	kPa
26	BrkAppPr	CAN	0x83FFFF	0x80FEFA	Brake Application Pressure	32	8	Pressure	kPa
27	BrkPriPr	CAN	0x83FFFF	0x80FEFA	Brake Primary Pressure	40	8	Pressure	kPa
28	BrkSecPr	CAN	0x83FFFF	0x80FEFA	Brake Secondary Pressure	48	8	Pressure	kPa
29	ClPr	CAN	0x83FFFF	0x80FEF8	Clutch Pressure	32	8	Pressure	kPa
30	CltFltDfPr	CAN	0x83FFFF	0x80FEF6	Coolant Filter Differential Pressure	68	8	Pressure	kPa
31	CltPr	CAN	0x83FFFF	0x80FEEF	Coolant Pressure	80	8	Pressure	kPa
32	CrankcasePr	CAN	0x83FFFF	0x80FEEF	Crankcase Pressure	64	16	Pressure	kPa
33	DrAxLftAirPr	CAN	0x83FFFF	0x80FEE9	Drive Axle Lift Air Pressure	48	8	Pressure	kPa

Figure 7-19 Microsoft Excel Spreadsheet

Calibrating Channels

General

In TCE you can calibrate transducer channels either individually or in a group. There are two basic ways to calibrate transducer channels:

- While defining a channel or editing a channel definition, select the Calibrate button in the channel definition dialog box.
- At the Transducer Channel Setup window, highlight the channel or set of channels to be calibrated, then select the Cal button.

When calibrating a set of channels, TCE first calibrates all the channels it can do at the same time (in parallel). The remaining channels are then calibrated sequentially (serially).

Various prompts appear during a calibration run, depending on the type of channel and calibration mode chosen. Respond to them accordingly.

When a channel is calibrated, these actions occur:

- The calibration date is shown in the Calibration Date box in the channel definition dialog box and in the Cal Date column of the channel list in the Transducer Channel Setup window.
- In the channel definition dialog box, the boxes for parameters related to the channel's calibration become unavailable, preventing changes to calibration references. To change any of those values, the calibration must be deleted using the Delete Calibration option in the TCE Calibration dialog box. For more information, see the following description of the calibration dialog box.

TCE Calibration Dialog Box

Use the TCE Calibration dialog box to check channels, delete calibrations and do zero adjusts on channels in the Transducer Channel Setup window (**Figure 7-20**). The Calibration dialog box is only available when working with calibrated channels.

Opening the Dialog Box

To access to the TCE Calibration dialog box, do one of the following:

- Select Calibrate from the channel definition dialog box.
- From the Transducer Channel Setup window select the channel(s) to work with, then select the Cal button.

The calibration dialog box will open. When selecting one channel, the channel's ID name is in the title bar, and the calibration date is under Calibration(s) Defined at the top of the box, as shown in **Figure 7-20**. When selecting two or more channels, the dialog box is titled TCE Group Calibration, and the number of channels selected appears under Calibration(s) Defined (i.e. Channels Selected = 5), as shown in **Figure 7-21**.

Figure 7-20: TCE Calibration Dialog Box (One Channel)

Figure 7-21: TCE Calibration Dialog Box (Multiple Channels)

Options

The Options group box has four options regarding the calibration.

Check Calibration — Performs a calibration run and displays a graph and numeric data comparing the original calibration with the one just run. (See "**Checking a Calibration**" below.)

NOTE: This option does not include zero adjustments done after the original calibrations.

Zero Adjust Calibration — Lets you adjust for a small difference between the original zero setting used in the calibration and the zero setting required for actual measurement (i.e. to compensate for "zero drift" common with many transducers).

TCE first prompts you to input the engineering value equivalent to the current transducer states. Next, the FCS measures the current transducer outputs and offsets the calibration lines as required to yield the specified engineering value. (A tilde [~] is added to the end of the calibration dates whenever the original [dated] calibration lines have been offset using this zero adjust functionality.)

NOTE: Use this option only when necessary and then only for very small adjustments. It changes the zero setting permanently. We recommend, if feasible, you delete the calibration and recalibrate the channel instead of using this option.

Delete Calibration — Deleting the calibration clears the calibration date field. You can then edit calibration-related fields in the channel definition dialog box and recalibrate the channel. (See **Deleting a Calibration** below.)

Shunt Calibration Loop – This option is provided primarily for SoMat development purposes in verifying the reliability and accuracy of shunt calibrations. It is available only when one or more transducer channels defined to use shunt calibrations were selected in the transducer channel list. All selected channels are run through the calibration process as if they were being calibrated anew. This is repeated the number of times specified in the box that is part of the option. This task has no affect on any existing calibration.

Recalibrating a Channel

To recalibrate a channel, first delete the current calibration (see the following **Deleting a Calibration**) and then use the calibration function button to calibrate the channel again.

Deleting a Calibration

Select the channel(s) from which you want to delete the calibration and then open the TCE Calibration dialog box (see **Opening the Dialog Box** on the preceding page).

Select the option Delete Calibration in the Options group box and select OK to complete the deletion. To cancel the procedure, select Cancel.

Checking a Calibration

Select the channels requiring a calibration check and then open the TCE Calibration dialog box (see **Opening the Dialog Box** on page 71). Select the option Check Calibration in the Options group box.

If checking one channel, a TCE Calibration Check window opens (see **Figure 7-22**). It shows the maximum deviation found and the defined and measured (checked) calibration values. Select OK to close the display.

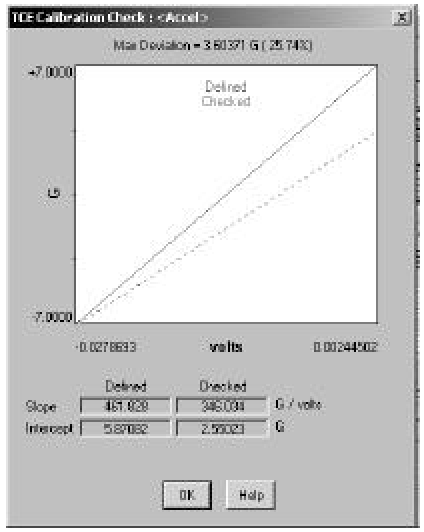


Figure 7-22: TCE Calibration Check Display

If you are checking two or more channels, a summary window showing each channel's maximum deviations in both engineering units and percentage of full scale appears instead of the TCE Calibration Check display. A More Info button in the display lets you view a TCE Calibration Check display for each channel. Select OK to exit.

Displaying Transducer Output

The Scope and DVM buttons in channel definition dialog boxes allow viewing the real-time transducer output. The Run Time Display accessed via the TCE Test Control menu will perform the same basic function. This will allow visualization of the functionality of the transducer if there is an appropriate signal output.

The DVM Display shows the transducer output in a digital (numeric) format and the signal is continually sampled. The output from one channel or from several channels can be viewed simultaneously. If the transducer is not calibrated, the reading is in signal units (e.g. volts for high-Level and low-level transducers); if it is calibrated, the reading is in the engineering units specified for the channel (you then have the option to display the reading in signal units also).

The Scope Display is similar to an analog oscilloscope, but differs in that the Scope Display is not updated until the eDAQ acquires all the data samples and transfers them to the host PC (this delays the data display).

NOTE: The Scope and DVM options are used during the test setup to verify the operation and calibration of the transducer channels. The Scope and DVM are not available when a test is running.

The Run Time Display shows raw signal data from up to 16 transducers, in real-time dynamic graphs or numeric form. Three display modes are available: Bar Chart Plot, Strip Chart Plot, and Digital Readout.

NOTE: The Run Time Display is only available when a test has been initialized and is running.

See the sections "**Transducer Checks**" and "**Run Time Display**" in Chapter 10, **Monitoring Test and Channels** for more on using these displays.

Copying a Definition

The Copy function allows one or more copies of an existing channel definition to be used in defining new transducer channels. At minimum, the only input required would be to assign an ID name to the new channel; the other defined data can be changed as needed for the new channel.
Perform the following to add a new channel by copying an existing definition:

1. From the list in the Transducer Channel Setup window, select the channel to be copied.
2. Select the Copy button. The Transducer Copy Setup dialog box opens.

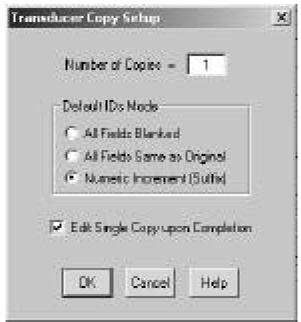


Figure 7-23: Transducer Copy Setup Dialog Box

3. At the Number of Copies box, specify how many copies you want. The number of connectors available for the transducer type limits the maximum quantity allowable.
4. In the Default IDs Mode group box, select how the ID name of the original channel (the default) is to be used in the copy process:

   All Fields Blanked — The default ID name will not appear in the ID Name field of the new channel definition dialog box.

   All Fields Same as Original — The default ID name will appear in each of the ID boxes for the new channels. This lets you quickly rename the channel by changing, deleting, and/or adding just a few characters.

   Numeric Increment (Suffix) — TCE automatically names all the new channels by using the default ID name with a sequence number added to it. For example, three copies of a channel named ustrut would be named ustrut2, ustrut3, and ustrut4.

NOTE: Using the Numeric Increment (Suffix) option is suggested as this is the fastest method when making multiple copies of a channel. This function keeps the original channel name and adds a numeric increment to the end of the channel name for each copy made (as shown in **Figure 7-26**).

5. To automatically edit the new channel definition after making one copy, select the Edit Single Copy Upon Completion option. Page 1 of the channel definition dialog box for the new channel will then appear after you select OK.

NOTE: This option is not available when making multiple copies of a channel.

6. Select the OK button.

   Complete either Step 7a or 7b based on how many copies are being made.

7a. When making multiple copies of a channel, the Edit Transducer ID dialog box will open (**Figure 7-26**). Type in or modify the channel ID names for the new channels, and then select OK to close the box and save the changes.

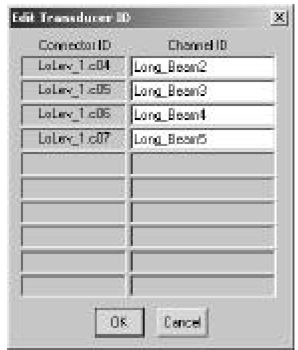


Figure 7-24: Edit Transducer ID Dialog Box

The new channels then appear in the Channels List window. You can edit them individually as needed. See the actions under Step 7b.

7b. When making one copy of a channel (and if you chose in Step 5 to edit the new channel definition), do the following actions at the channel definition dialog box.

a. If the ID box is empty, type in an ID name, up to 12 characters. If there is an ID name in that box, edit it as needed.

b. Edit the other boxes as needed.

c. Click OK or press Enter to save the new definition and return to the Transducer Channel Setup window.

Editing Channel Definitions

Overview

This section explains the functions for editing channel definitions provided by the Edit button in the Transducer Channel Setup window. Either one or multiple channel definitions can be edited at the same time.

One Definition

Use the following procedure to change a single transducer channel definition.

1. Select the channel to edit from the channel list in the Transducer Channel Setup window.

   Move the highlight bar to the desired channel and select Edit (click Edit or press E) or double-click on the highlighted channel. The definition dialog box for the channel appears.

2. Change the definition data fields as needed.
3. Click OK or press Enter to save the changes made and return to the Transducer Channel Setup window.

Multiple Definitions

TCE lets you change two or more channel definitions if they are all for the same type of transducer. To do this, complete the following.

1. Select the channels to edit from the channel list in the Transducer Channel Setup window.

   For a non-contiguous selection, hold down Ctrl and click on each channel to edit.

   For a contiguous selection, either click on the first and drag the mouse pointer as needed to include all the channels or click on the first channel, then hold down a Shift key and click on the last one.

2. Select the Edit button. The Group Transducer Edit dialog box opens (**Figure 7-25**).
3. Select the definition data to change and select OK.

   A dialog box for the transducer type and data to be changed appears. It has just the applicable boxes from the original definition dialog box instead of all the boxes. The Group Edit Transducers dialog box (**Figure 7-26**) is used to changing Sample Rates and Digital Filters for a group of low-level channels.

4. Change the data as needed and select OK to save the changes.

Figure 7-25: Group Transducer Edit Dialog Box

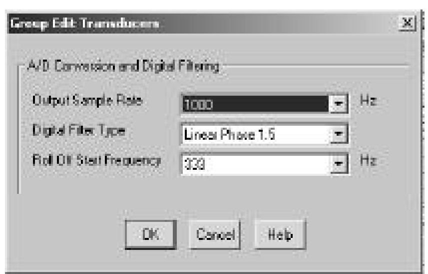


Figure 7-26: Sample Group Edit Definition Dialog Box

Deleting a Definition

Perform the following to delete transducer channel definitions.

1. Select the channel to edit from the channel list in the Transducer Channel Setup window.

   To delete one definition, move the highlight bar to it. To delete two or more definitions at the same time, select them as described under **Multiple Definitions** on page 75.

2. Select the Del (Delete) button.
3. At the verification dialog box that appears, select Yes to delete the definition(s). To cancel the delete process, select No.

Chapter 8 - Computed Channels

Definition and Types

Definition

A computed channel is a data channel derived from one or more transducer channels or from previously defined computed channels. For example, a computed channel can be constructed from data using a mathematical formula or expression, simulate a channel having a higher or lower sample rate, integrate data samples, etc.

Types

Currently many computed channels are provided with SoMat TCE for eDAQ. They are listed in Appendix B, **TCE Computed Channels**. This chapter describes the use of five commonly used ones:

Desk Calculator — Constructs data streams either from arithmetic results (floating point) or logical results (Boolean) based on a specified mathematical expression or formula. Desk Claculator begins on page 80.

Down Sampler — Simulates the input channel having a lower sample rate. Samples are extracted from the input channel data at a rate determined by a specified decrement factor (e.g. one out of every three input samples goes to the output channel). Down Sampler begins on page 82.

Elapsed Time (Time Channel) — Provides a time base channel for use in other computed channels and/or storage in SoMat Time History and Peak Valley Slice DataModes. Elapsed Time (Time Channel) begins on page 84.

Integrator — Generates an output channel that is the integral of the input channel. As long as the integrator is not reset or suppressed, each output channel sample is the cumulative sum of the current and all previous input channel samples, multiplied by a user-defined scale factor and added to a user-defined initial value. Integrator Channel begins on page 85.

Up Sampler — Simulates the input channel having a higher sample rate by repeating (echoing) each sample in the input channel a certain number of times during the interval between the input samples. Up Sampler Channel begins on page 87.

Each computed channel is covered in greater detail later in this chapter. Refer to Appendix B, **TCE Computed Channels**, and the TCE online Help System for information on other computed channels available.

Computed Channel Setup Window

Overview

The Computed Channel Setup window (**Figure 8-1**) is where you start the processes to define and modify computed channels used with the eDAQ. The following describes its data fields and options.

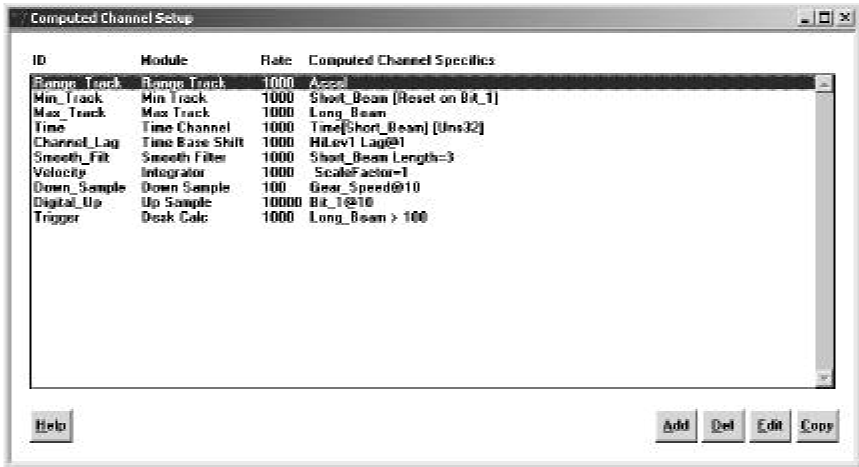


Figure 8-1: Computed Channel Setup Window

Data Fields

The Computed Channel Setup window shows the following data for the channels listed:

ID — ID name assigned to the channel.

Module — Channel type name as shown in the Select Computed Channel Type dialog box (see **Figure 8-2**).

Rate — Sample rate for the output channel. This may differ from the input channel sample rate based on the type of computed channel.

For Down Sample, Up Sample, and Pulse Counter channels, this is the rate resulting from applying the "up" or "down" conversion factor value specified in the channel definition. (see the sections on those channels for more information).

Computed Channel Specifics — Pertinent information on the channel; what is shown depends on the type of channel.

Desk Calculator — Mathematical expression or formula specified for the channel.

Down Sample, Up Sample — Name of the input channel and sample rate conversion factor value separated by "@" (e.g. SG2@10 for channel SG2 and a factor of 10).

Edit Functions

The Add, Del, Edit, and Copy buttons in the lower right corner of the window activate the editing functions used with computed channel definitions. Their uses are explained in these chapter sections:

Add "**Defining a Computed Channel**" (next section)

Edit "**Editing a Channel Definition**" on page 88

Copy "**Copying a Definition**" on page 89

Del "**Deleting a Definition**" on page 89

Defining a Computed Channel

Importance of Definition Order

The order in which the computed channels are defined can be important when defining more than one channel. These channels are computed in order, as listed in the Computed Channel Setup window. If a computed channel refers to another computed channel, the reference channel should precede the referring channel in the channel list; TCE checks the ordering at test initialization time and automatically reorders the computed channels list as required to ensure no computed channels are referenced before they are defined.

NOTE: The Add button for any Setup window inserts the new definition above the highlighted line on the list. To add a channel at the end of the list, highlight the empty line at the end of the list then select the Add button.

Before Starting

Before starting the defining of a computed channel, ensure that all the transducer input channels to be used by the computed channel are set up properly. (The input channels can be modified, if desired, after defining the computed channel.)

Procedure

The following is the general procedure for defining a computed channel.

1. Start TCE if it is not already running.
2. Open the setup file where you want to create the channel.
3. Make the Computed Channel Setup window active.
4. Select the Add button.
5. At the Select Computed Channel Type dialog box that opens, select the channel type and click OK.

Figure 8-2: Select Computed Channel Type Dialog Box

6. Enter the required information in the setup dialog box that opens.

   The definition dialog box that appears is unique for each channel type. The six most commonly used computed channels are explained later in this chapter. For the remaining computed channels, refer to the TCE Online Help System.

7. When done with the definition, click OK or press Enter to save it.

   The new channel appears above the channel highlighted in the Computed Channel Setup window list. For information on how you can change, copy, and delete a channel definition, see:

"**Editing a Definition**" on page 88

"**Copying a Definition**" on page 89

"**Deleting a Definition**" on page 89

Desk Calculator Channel

Description

This computed channel is so named because the TCE Desk Calculator function is used to define it. A Desk Calculator channel constructs either of two types of data results:

Arithmetic (floating point) — Channels can be set up for data storage in any DataMode.

Logical (Boolean) — Channels can be used as trigger conditions for DataModes (i.e. to control the sampling of data by another channel), and can also be set up for data storage in any DataMode.

The mathematical expression specified for the channel determines the type of results generated.

NOTE: The sample rate for the TCE Desk Calculator computed channel is determined by the sample rate of the input channel set; therefore, all of the input channels must have the same sample rate.

Floating Point Exceptions

Floating point exceptions can occur when certain Desk Calculator operators are misused (for example, taking the square root or logarithm of a negative number). The eDAQ detects these exceptions, and TCE will display an error message indicating an exception has occurred.

When an exception occurs, the result from the operations involved is usually the best approximation available (e.g. 0.0 for logarithm of a negative value, FLT_MIN or FLT_MAX for an overflow, etc.) but cannot be assumed in general. Care must be taken to ensure Desk Calculator expressions will not result in floating point exceptions.

Defining a Channel

The general procedure for defining a computed channel is described in **Defining a Channel** on page 79. That subsection explains the actions involved in completing Steps 5–7 of the procedure as related to a Desk Calculator channel.

1. Select Desk Calc at the Select Computed Channel Type dialog box.

   The Desk Calculator Computed Channel definition dialog box opens. **Figure 8-3** shows this dialog box with example data. This dialog box is often referred to as the TCE Desk Calculator because the calculations done are based on mathematical expression or specified formulas.

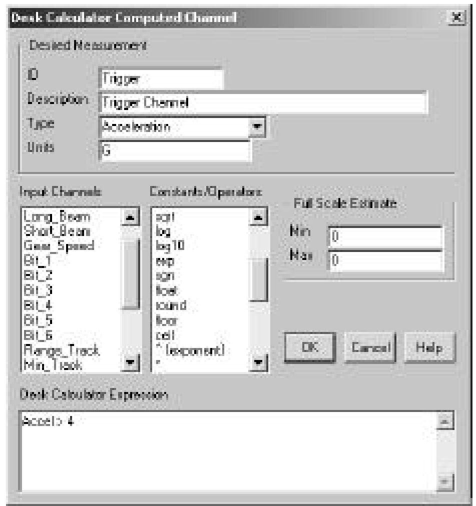


Figure 8-3: Desk Calculator Computed Channel Definition Dialog Box

2. Enter the required information in the Desired Measurement and Full Scale group boxes.

Desired Measurement:

ID — Unique name for the channel conforming to the TCE ID name conventions. This is used in the definitions for other computed channels and in DataModes.

Description — Brief description of the channel, up to 31 characters (optional).

This text can be specified for use as the Y-axis label in a plot graph of the channel data instead of the channel ID name (the default). This is done in the TCE General Preferences dialog box (**Figure 8-4**). See the section "**TCE Preferences**" in Chapter 3, **SoMat TCE for eDAQ**.

Type — Type of measurement associated with the channel (Strain, Load, etc.). Type this in or select it from the list.

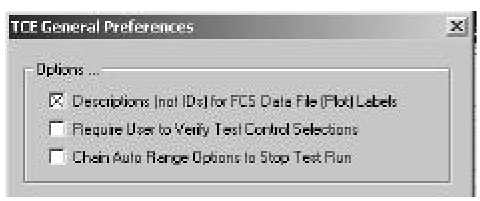


Figure 8-4: TCE General Preferences Dialog Box (Partial)

Units — Engineering unit for the channel (Degrees, Volts, etc.).

Full Scale Estimate:

Min and Max — Values for the lower (Min) and upper (Max) limits of the range within which the results from the mathematical expression in the Desk Calculator Expression box are expected to fall. When the channel output will be stored in an integer data mode format, values must be entered in these boxes; otherwise, entries in them are optional.

The Full Scale Estimate values are also used for Run Time Display scaling and to set the initial (default) values for histograms specified in the test setup data modes.

NOTE: If histogram bounds in a computed channel are already defined, they do not change if the Full Scale Estimate values are changed.

3. Specify, in the Desk Calculator Expression box, the mathematical expression to be applied to the data in the input channel(s). The syntax for this is modeled after the standard syntax for the C programming language. All operators and input channel names are case-sensitive.

   To enter the expression in the Desk Calculator Expression box, either type it in or select the items for it from the Constants/Operators and Input Channels list boxes, typing other text as needed.

   The Input Channels box lists the ID names of available transducer channels and computed channels. The Constants/Operators list box has the constants and operators available for use in the expression. Both list boxes are TCE autolist boxes.

   Use either the mouse or keyboard to select items from either list boxes as explained by the following:

- Double-click on the desired item. To add text to the expression by typing, click at the end of the expression text.
- Use **Tab** and **Shift**+**Tab** to move among the boxes on the dialog box.
- Move the highlight bar to the item you want (using the cursor movement keys) and press the spacebar. If the highlight bar is not displayed in the box, press any cursor movement key; it will then appear.

NOTE: When Tab is pressed to go to the Expression box, the entire expression is highlighted. To go end of the expression, press the End key, or, to delete the expression, press the Delete key. When an item is selected from one of the list boxes, it appears at the end of the expression. To insert a channel or operator within the expression instead of at the end, click where the channel or operator is located (an insertion bar appears) and then type in what to add. This click-and-type method can also be used to edit the expression.

4. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Refer to the TCE Help System for more detailed information using the Desk Calculator and the mathematical expressions.

Down Sampler Channel

Description

The Down Sampler computed channel reduces, by a specified factor, the number of samples taken from the input channel. For example, with a factor of 4, one out of four input samples will go to the output channel. Thus, this channel type simulates the input channel having a lower sample rate. This decreases the amount of memory needed for storing test data and lets you store more data in the memory available.

NOTE: This channel should be used only where data values in the input channel change slowly and the possibility of losing significant data is minimal.

To set the output channel sample rate, TCE divides the sample rate of the input channel by a specified decrement (divide) factor value. For example, if the divide factor is 3, the first sample (data point) and then every third one thereafter would be present in the output channel as shown in **Figure 8-5**.

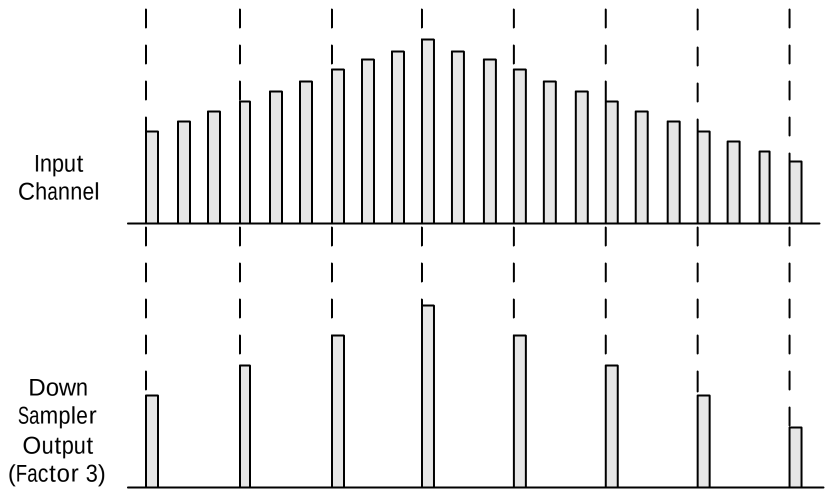


Figure 8-5: Down Sampler Input vs. Output

Defining a Channel

The general procedure for defining a computed channel is described in **Defining a Computed Channel** on page 79. This subsection explains the actions involved in completing Steps 5–7 of that procedure as they relate to a Down Sampler channel.

To define a Down Sample computed channel, do the following:

1. Select Down Sample in the Select Computed Channel Type dialog box. The Down Sampler Computed Channel definition dialog box opens. **Figure 8-6** shows it with example data.
2. Specify the appropriate data as described below.

   ID — Unique identification (ID) name for the output channel that conforms to the TCE ID name conventions. This ID name is used in the definitions for other computed channels and in DataModes.

   Description — Brief description of the output channel, up to 31 characters (optional entry).

   You can specify that the text here be used for the Y-axis label in a plot of the channel data, instead of the channel ID name (the default). See **Figure 8-4**.

   Input Channel ID with Sample Rate — Select the input channel from the channels listed. The sample rates of the channels are provided for reference.

   Factor — Value by which the input channel sample rate is to be divided. For example, a factor of 10 would result in every tenth sample in the input channel (sample 1, 11, 21, 31 and so on) being written to the output channel.
3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

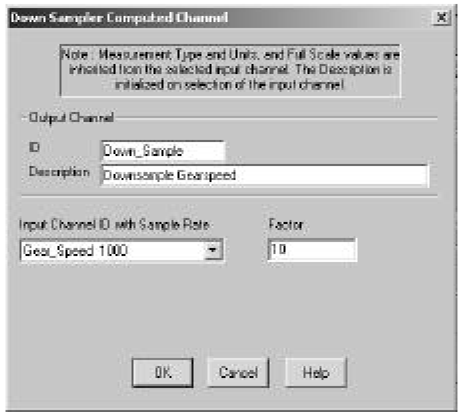


Figure 8-6: Down Sampler Definition Dialog Box

Elapsed Time (Time Channel)

Overview

The Elapsed Time computed channel provides a time base channel for use in other computed channels and can be stored in Time History and Peak Valley Slice DataModes.

Defining a Channel

The general procedure for defining (creating) a computed channel is in the section **Defining a Computed Channel** on page 79. This subsection explains the actions involved in completing Steps 5–7 of that procedure as they relate to an Elapsed Time channel.

To define an Elapsed Time computed channel, do the following.

1. Select Time Channel at the Select Computed Channel Type dialog box. The Elapsed Time Computed Channel dialog box then opens. **Figure 8-7** shows it with example data.

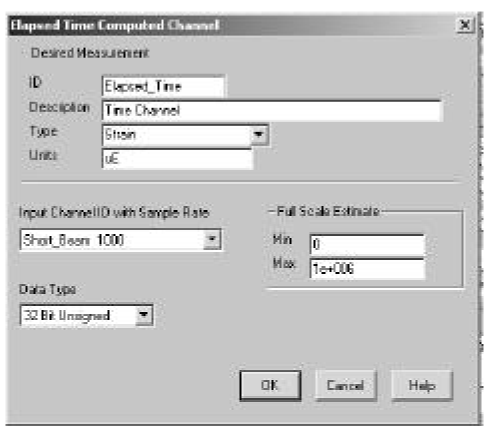


Figure 8-7: Elapsed Time Computed Channel Dialog Box

2. Specify the appropriate data as described below.

Desired Measurement:

Enter the channel ID name, description, type, and engineering units for the channel. See the **Desired Measurement** description on page 81 for explanations of these entries.

Full Scale Estimate:

In the Min and Max boxes, enter the lower and upper limits of the expected range of output values for the channel. See the **Full Scale Estimate** description on page 81 for more about the entries to be made.

Input Channel ID with Sample Rate — Select any channel with the desired sample rate from the channels listed in the drop-down list for this box. The sample rates of the defined channels are provided for reference.

Data Type — Data type for the output Time Channel: 32-Bit Float or 32-Bit Unsigned.

NOTE: The limited precision available with the 32-Bit Float data type causes some error in the time data samples output. This error becomes more significant in long duration tests.

Time channels are unique as the data type selected here determines the data type used for these channels in DataModes.

3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Integrator Channel

Overview

The Integrator computed channel generates an output channel that is the integral of the input channel. As long as this channel is not reset or suppressed, each output channel sample is the cumulative sum of the current and all previous input channel samples, multiplied by a user defined scale factor and added to a user-defined initial value.

A logical channel can be specified as a trigger to reset the Integrator channel or to suppress it conditionally.

Defining a Channel

The general procedure for defining (creating) a computed channel is in the section **Defining a Computed Channel** on page 81. This subsection explains the actions involved in completing Steps 5–7 of that procedure as they relate to an Integrator computed channel.

To define an Integrator computed channel, do the following:

1. Select Integrator at the Select Computed Channel Type dialog box. The Sample Integrator Computed Channel definition dialog box opens. **Figure 8-8** shows that dialog box with example data.

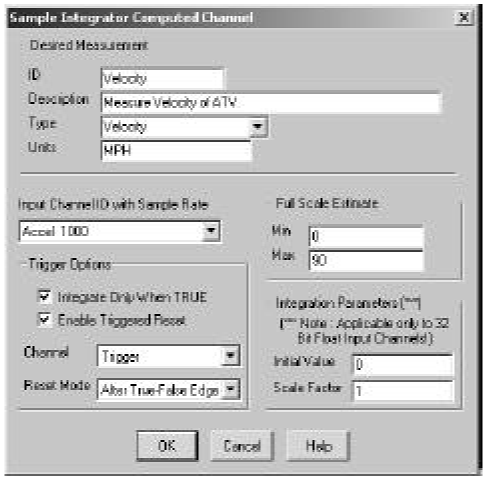


Figure 8-8: Integrator Channel Definition Dialog Box

2. Specify the appropriate data as described below.

Desired Measurement:

Enter the channel ID name, description, type, and engineering units for the channel. See the **Desired Measurement** description on page 81 for explanations of these entries.

Input Channel ID with Sample Rate — Arithmetic input channel to be integrated. Select it from the channels listed in the list for this box. The sample rates of the defined channels are provided for reference.

Full Scale Estimate:

In the Min and Max boxes, specify the lower and upper limits of the expected range of output values for the computed channel. See the **Full Scale Estimate** description on page 81 for more about the entries to be made.

Integration Parameters:

Initial Value — Value at which the Integrator channel is to be set before the start of each run and whenever the channel is reset.

Scale Factor — Value by which each input sample is to be multiplied before it is added to the previous integration sum. Setting the Scale Factor to the sample period will result in the time integral of the input channel.

Trigger Options:

A logical trigger channel can be specified for either or both of the following two purposes.

Integrate Only When True — Select this option to have the integration suppressed when the trigger channel state is False.

Enable Triggered Reset — Select this option to have the integrator value reset (set to the specified Initial Value) whenever the trigger channel satisfies the condition specified at the Reset Mode box.

Channel — This selects the channel to be used as the trigger and is selected from the list for this box.

Reset Mode — Desired trigger reset mode. Select it from the list for this box. Three trigger reset modes are available:

When True — Reset whenever the trigger channel state is True.

On False-True Edge — Reset when the of the trigger channel state changes from False to True.

After True-False Edge — Reset on the sample after the trigger channel changes from True to False. If the Integrate Only When True option is not selected, then the output sample after the True to False edge is the sum of the Initial Value and the scaled input sample.

NOTE: When both the Integrate Only When True and the Enable Triggered Reset options are selected, the Reset Mode is limited to After True-False Edge.

3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

For more information, refer to the online TCE Help System.

Up Sampler Channel

Description

The Up Sampler channel simulates the sample rate of the input channel being higher than it actually is. This enables you to correlate the input channel data to a channel with a higher sample rate on a point-for-point basis.

Each input channel sample is repeated a number of times during the interval between the first sample and the next one based on a conversion factor value. For example, with a factor of 3, the sample is repeated twice after the original, giving three samples per original sample, as shown in Figure 8-10. These added samples “bridge the gap” between the input samples and, together with the original samples, simulate the higher sample rate desired.

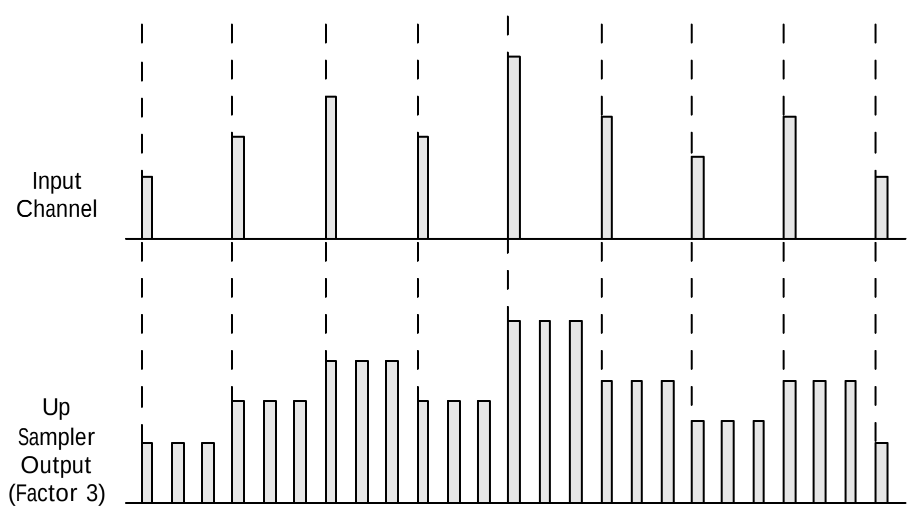


Figure 8-10: Up Sampler Input vs. Output

NOTE: How the Up Sample channel is used affects how much memory will be required to store test data. If its output will be stored in memory, the amount of memory required for test data increases in proportion to an increase in the “up” factor. But, if the output will be used only for intermediate calculations, memory is not affected.

Defining a Channel

The general procedure for defining (creating) a computed channel is in the section **Defining a Computed Channel** on page 81. This subsection explains the actions involved in completing Steps 5–7 of that procedure as they relate to an Up Sampler channel.

Perform the following to define an Up Sample computed channel.

1. Select UpSample at the Select Computed Channel Type dialog box. The Upsample Computed Channel dialog box that opens is identical to the Down Sample dialog box except for its title (**Figure 8-6** on page 84).
2. Specify the appropriate data as described below.

   ID — Unique identification (ID) name for the output channel conforming to the TCE ID name conventions. This ID name is used in the definitions for other computed channels and in SoMat DataModes.

   Description – Brief description of the output channel, up to 31 characters (optional).

   You can specify that the text in this box be used for the Y-axis label in a plot of the channel data instead of the channel ID name (the default). See Figure 8-4.

   Input Channel ID with Sample Rate — Select the input channel from the channels in the drop-down list for this box. The sample rates of the channels are provided for reference.

   Factor — Number of output samples for each input sample. A factor of 10 would result in ten samples (the original input sample plus nine copies of it) being written to the output channel for each input sample, resulting in a simulated ten-times increase in sample rate.
3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Editing a Definition

To change the setup definition for an existing computed channel, do the following:

1. In the Computed Channel Setup window, move the highlight bar to the channel definition to be changed.
2. Either select the Edit button or double-click on the highlighted channel. The setup dialog box for the channel appears.
3. Change the definition data boxes as necessary.
4. Either click OK, or press Enter to save the changes made and to return to the Computed Channel Setup window. To cancel the changes made, click on the Cancel button.

Copying a Definition

The Copy function allows a copy of an existing channel definition to be used in defining a new transducer channel. At minimum, the only input required would be to assign an ID name to the new channel; the other defined data can be changed as needed for the new channel.

The following procedure describes how to create a new channel by copying an existing channel definition:

1. Select the channel definition to copy in the Computed Channel Setup window.
2. Select the Copy button. The setup dialog box for the selected channel opens.
3. In the ID box enter a unique ID for the new channel conforming to the conventions for TCE ID names. This ID name is used in the definitions of other computed channels and in DataModes.
4. Edit the other boxes as necessary.
5. Either click OK or press Enter to save the new definition and return to the Computed Channel Setup window.

Deleting a Definition

The following procedure describes how to delete one or more computed channel definitions:

1. Move the highlight bar to the channel definition(s) to be deleted in the Computed Channel Setup window. To select multiple consecutive channels, click the first channel and hold down SHIFT while clicking the last channel. To select multiple individual channels, hold down CTRL while clicking each channel to be deleted.
2. Click Del or press D.
3. At the verification dialog box that appears, select Yes to delete the definition (either press Y then ENTER, or click Yes). To cancel the delete process, click No.

Chapter 9 - DataModes

Definition and Types

Definition

SoMat DataModes determine how, and in what form, test data will be stored and displayed (i.e. a sequential or histogram plot). A DataMode definition consists of a list of input channels, a data storage/processing rate, triggering conditions, and other parameters specific to the DataMode.

Types

SoMat TCE supports several types of SoMat DataModes. Those most commonly used are listed below with a brief explanation of each. They are covered in greater detail in other sections of this chapter.

Time History — Stores multiple channels of triggered or untriggered time history (sequential) data streams in the output data file. Time History DataMode begins on page 95.

Burst History — Stores channels of burst-triggered time history data streams in the output data file when a user-defined triggering event occurs. Burst History DataMode begins on page 96.

Time at Level — Stores Time at Level histograms in the output data file. Two types are available: one dimensional and multidimensional. Time At Level DataModes begins on page 98.

Peak Valley — Stores multiple channels of peak and valley sequences acquired from triggered or untriggered time history data streams in the output data file. Peak Valley DataMode begins on page 100.

Peak Valley Matrix — Stores multiple channels of peak valley reversal histograms in the output data file. Peak Valley Matrix DataMode begins on page 102.

Rainflow — Stores multiple channels of rainflow cycle histograms in the output data file. Rainflow DataMode begins on page 104.

For information on using the other DataModes, see the TCE online Help System.

DataMode Setup Dialog Box

Overview

The DataMode Setup window is used to start the processes of defining and modifying DataModes.

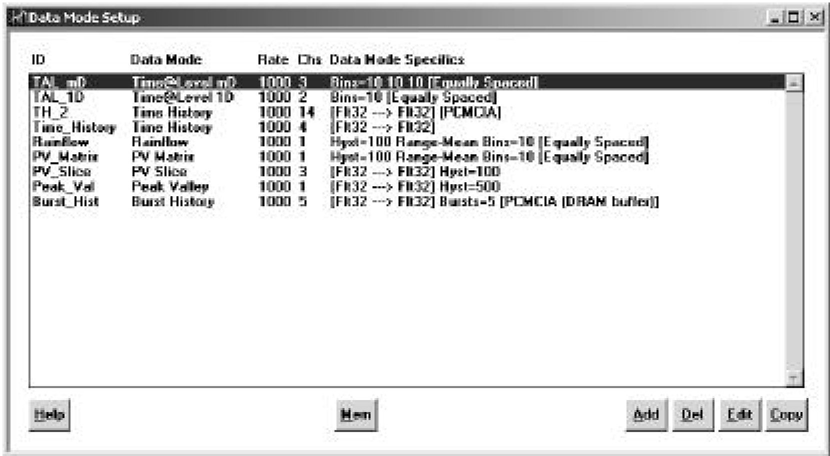


Figure 9-1: DataMode Setup Window

Data Displayed

The following are the descriptions for the columns listed in the SoMat DataModes setup screen.

ID — ID name assigned to the DataMode.

Data Mode — DataMode type as selected from the Select DataMode Type dialog box (**Figure 9-2** on page 93).

Rate — Rate at which data samples are input to the DataMode.

Chs — Number of input channels assigned to the DataMode.

Data Mode Specifics — Pertinent information regarding the DataMode (number and type of bins, hysteresis value, and so on).

Edit Functions

The Add, Del, Edit, and Copy buttons (at the bottom-right corner of the DataMode Setup window) activate the editing functions within the DataMode definitions. Use of Add is explained in the following section, **Defining a DataMode**; for the Del, Edit, and Copy functions see **Deleting a DataMode** on page 106, **Editing a DataMode Definition** on page 106, and **Copying a DataMode** on page 106.

Memory Allocation

The Mem button displays the total amount of raw eDAQ SIF file memory the eDAQ will allocate for selected SoMat DataModes at the start of each test run (not included are linked list pointer records, statistics records, etc.). Memory is allocated for all histogram DataModes and for the Burst History DataMode which pre-allocates memory for the first Burst record. To see the memory to be allocated for a DataMode, select the DataMode and then select the Mem button; to see the total memory for all DataModes, select all of them and select Mem.

Defining a SoMat DataMode

Before Starting

Before defining a SoMat DataMode, all the transducer and computed data channels the DataMode will use should be defined. Additional channels can be added at a later time.

Procedure

The general procedure for defining a SoMat DataMode is as follows.

1. Start SoMat TCE if it is not already running.
2. Open the setup file where the DataMode will be created and used. (The input channels for the DataMode should be defined.)
3. Make the DataMode Setup window the active window.
4. Select the Add button.

NOTE: The new DataMode will be added to the list immediately above the line highlighted on the list. To add the new DataMode to the end of the list, place the highlight bar under the last DataMode before selecting Add.

5. At the Select Data Mode Type dialog box (**Figure 9-2**), select the DataMode type. Either place the highlight bar on the DataMode, select the OK button, or double-click on the DataMode.

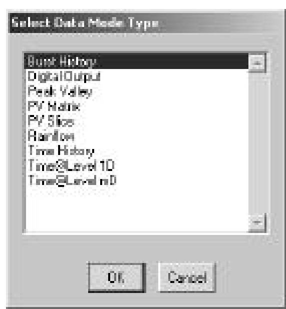


Figure 9-2: Select DataMode Type Dialog Box

Most of the names in the Select DataModes box are self-explanatory. The following definitions are for those DataModes that may not be.

Time@Level 1D = Time at level, one dimensional

Time@Level mD = Time at level, multidimensional

PV Matrix = Peak Valley Matrix

PV Slice = Peak Valley Slice

6. Enter the required information in the DataMode definition dialog box that appears, then either click on OK or press Enter when done.

   A unique dialog box appears for each DataMode type. The use of the dialog box for some DataMode types are explained later in this chapter. (Refer to the TCE online Help System for DataModes not covered in this chapter.)

The new DataMode then appears above the highlighted line in the Data Mode Setup window list.

Use of Triggers

Overview

Each DataMode can further refine data storage through the use of triggers. Triggering controls data storage by allowing data collection only when specified triggering conditions are met. This provides a means to eliminate unwanted segments of the input data stream before a DataMode algorithm processes it.

Triggering Condition

The triggering condition is defined by the combined selections for the triggering option and trigger channel in the DataMode setup box.

Trigger Channel

A trigger channel can be any logical (Boolean) transducer or logical computed channel. The data in the trigger channel indicates whether the trigger channel's state is True (1) or False (0).

Basic Trigger Options

The four basic triggering options for DataModes (other than burst history) are the following.

Always On — Triggering is not used. Sampling is continuous.

Trigger — Begin sampling when trigger channel state becomes True and continue sampling regardless of any future changes in the state of the trigger channel.

Gate — Sample only while the trigger channel state is True.

One Shot — Take one sample when the trigger channel state changes from False to True, or if the trigger channel state is True on the first sample of any run.

Burst History Trigger Options

For burst histories, two trigger options are available:

When True – Store a burst whenever the trigger channel state is True.

On False-True Edge – Store a burst when the trigger channel state changes from False to True (the trigger condition must be reset) and if the trigger channel is True on the first sample of any run.

Time History DataMode

Description

The Time History DataMode stores multiple channels of triggered or untriggered time history (sequential) data streams in the output data file when triggering occurs and the specific trigger channel is user specified.

Defining a Time History DataMode

The general procedure for defining a DataMode is under **Defining a SoMat DataMode** on page 93. The following explains the actions to perform Step 6 of the procedure as related to the Time History DataMode.

Perform the following to define a Time History DataMode.

1. Select Time History at the Select DataMode Type dialog box. The Time History DataMode definition dialog box appears. **Figure 9-3** is shown with example definition data. The channels highlighted in the Input Channels list box have been selected as the input channels for the DataMode.
2. Specify the parameters described by the following.

   Input Channels — This is a standard Windows multiple-select list box that has all of the available input channels. Select from that list the channels to be included in the DataMode. You can select up to 128 input channels for a Time History DataMode.

NOTE: The sample rates of the input channels determine the sample rate for this DataMode. The sample rate must be the same in all of the input channels (including the trigger channel if one is defined).

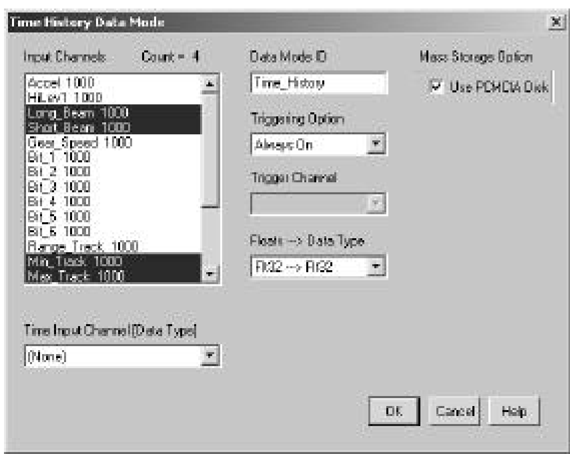


Figure 9-3: Time History Definition Dialog Box

DataMode ID — ID name for the DataMode. This must be unique within the DataMode setup dialog box for each test.

Triggering Option — Type of triggering to be used. The available triggering options are in the list for this box. Data will be stored only when the triggering condition specified here occurs. See **Basic Trigger Options** on page 94 and the TCE Help System for explanations of the options.

Trigger Channel — ID name of the desired trigger channel. The list for this box has the ID names of all logical channels currently defined. An undefined logical channel can be specified, but must be defined before the test is initialized.

Floats ® Data Type — Select the desired data compression mode for storage in the data file (this applies to 32-Bit Float input channels but not the optional Time channel). The list for this box has the available format options. Refer to the Help System for more information on these options, their storage sizes, and resolution.

Time Input Channel (Data Type) — This is the channel is used to provide the time base for the data. Selecting a channel to be used as the time input channel is optional. The only channels listed in this box are Elapsed Time (Time Channel) computed channels. Note the data storage mode for the Time Channel is based on the definition made in the computed channel.

NOTE: If a channel is selected from the Time Input Channel, a maximum of 127 channels can be selected from the input channel list.

Mass Storage Option — You can store the data on the PCMCIA disk or in SRAM memory. SRAM is faster, but is very limited in size (less than 4 MB is available). To store data on the PCMCIA disk, select the Use PCMCIA Disk check box.

3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Burst History DataMode

Description

The SoMat Burst History DataMode stores channels of burst-triggered time history (sequential) data streams in the output data file. It records one data burst for each input channel when a specified triggering event occurs. (The term burst refers to a set or group of contiguous data samples.) This DataMode is particularly useful in characterizing rare events at high data sampling rates.

A special feature of this DataMode is that a specific number of data points (samples) can be stored before and after the trigger; this is accomplished by using a circular buffer.

Defining a Burst History DataMode

The general procedure for defining a DataMode is under **Defining a SoMat DataMode** on page 93. The following explains the actions in doing Step 6 of the procedure as it relates to a Burst History DataMode.

Perform the following to define a Burst Time History DataMode.

1. Select Burst History at the Select DataMode Type dialog box. The Burst History DataMode definition dialog box opens. **Figure 9-4** shows it with example definition data. The channels highlighted in the Input Channels list box have been selected as input channels for the DataMode.

2. Specify the following parameters.

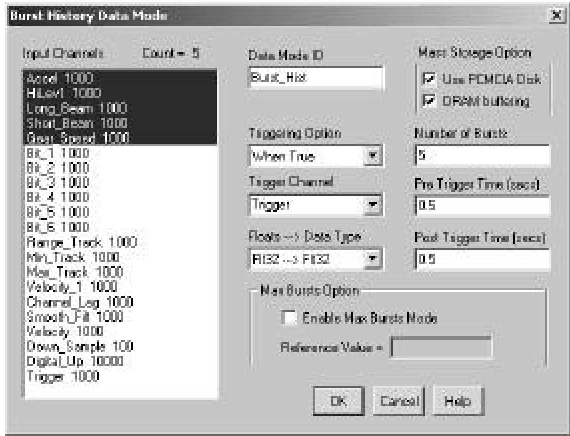


Figure 9-4: Burst History Definition Dialog Box

Input Channels — From the list provided, select the input channels to be included in the DataMode. This box is a standard multiple-select list box. A maximum of 128 input channels can be selected.

NOTE: The sample rates of the input channels determine the sample rate for this DataMode. All the input channels (including the required trigger channel) must have the same sample rate.

DataMode ID — Unique ID name for the DataMode. This name must be unique within the DataMode setup window for each test.

Triggering Option — Type of triggering to be used. The list for this box has the available triggering options. A burst of data is stored when the specified triggering condition occurs.

See **Burst History Trigger Options** on page 94 and the TCE Help System for explanations of the options.

Trigger Channel — ID name of the desired trigger channel. The list for this box has the ID names of all logical channels currently defined. Normally one of these channels is selected for use as a trigger channel. An undefined logical channel can be specified, but must be defined before the test is initialized.

Floats ® Data Type — Select the desired data compression mode for storage in the data file (this applies to 32-Bit Float input channels). The list for this box has the available format options. Refer to the Help System for more on these options, their storage sizes, and resolution.

Pre Trigger Time (secs) — This is the time period, in seconds, before the trigger during which data samples are to be acquired.

Post Trigger Time — This is the time period, in seconds, after the trigger, during which data samples are to be acquired.

NOTE: The total number of points stored is the sum of the post-trigger and pre-trigger time periods multiplied by the sampling rate, plus one (the trigger sample is always stored). With a 100 Hz sampling rate and 2.5 second pre- and post-trigger periods, the total number of samples acquired would be 501: ([2.5 + 2.5] × 100) + 1.

Mass Storage Option — Two different options are available for storing the data collected in the Burst History mode.

The first mass storage option uses the FCS SRAM memory only. The SIF data file is built “on the fly” in the SRAM memory. This file can be copied to a PC using the TCE Test Control option Upload Test Data.

The second mass storage option is the PCMCIA storage mode. In this mode, burst data for each channel of each Burst History data mode is stored in a file on the PCMCIA memory card. All other data file components (e.g. the SIF header file information, keywords, etc.) are stored in the SRAM memory. The TCE Test Control option Upload Test Data can be used to generate a consolidated SIF data file on the PC after the test has been stopped.

Number of Bursts — Maximum number of bursts to store. When the selected quantity of bursts have been stored, the DataMode is effectively turned off and data is no longer stored.

Max Bursts Mode — This mode lets you store the most significant burst records based on the specified quantity at Number of Bursts. Burst significance is based on the maximum deviation from the value specified in the Reference Value box.

Select the Enable Mode check box to use this mode. Refer to the Help System for more information on this mode.

NOTE: Using the Max Bursts Mode adds significant processing overhead for this DataMode.

3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Time At Level DataMode

Description

The SoMat Time At Level DataModes store Time At Level (TAL) histograms in the output data file. There are two types of this DataMode:

One-dimensional (1D) — You can specify multiple input channels to generate multiple one-dimensional TAL data channels.

Multi-dimensional (mD) — You can specify up to six dimensions (input channels) for the one output histogram.

Defining a Time At Level DataMode

The general procedure for defining a DataMode is under **Defining a DataMode** on page 93. This subsection explains the actions involved in completing Step 6 as it relates to defining a Time At Level (TAL) DataMode.

Perform the following to define a TAL DataMode.

1. Select the particular Time At Level at the Select Data Mode Type dialog box (1D for one-dimensional, mD for multi-dimensional); the appropriate Time at Level DataMode definition dialog box opens. **Figure 9-5** shows the dialog box for a one-dimensional TAL DataMode with sample definition data. The dialog box is essentially the same for both Time At Level types except for the box title.

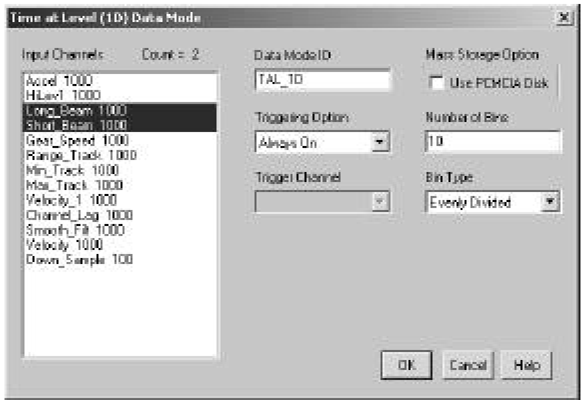


Figure 9-5: Time at Level (One Dimensional) Definition Dialog Box

2. Specify the following parameters.

Input Channels — This is a standard Windows multiple-select list box with all the available input channels. Select the channel(s) you want included in the DataMode. With each TAL DataMode, you can specify a maximum of 128 input channels for a one-dimensional TAL and up to six input channels (dimensions) for a multidimensional TAL.

NOTE: The sample rates of the input channels determine the sample rate for this DataMode. All the input channels (including the trigger channel, if defined) must have the same sample rates.

Data Mode ID — Unique ID name for the DataMode conforming to the TCE ID name conventions. This name must be unique within the DataMode setup window for each test.

Triggering Option — Type of triggering to be used. The list for this box has the available triggering options. Data is stored only when the triggering condition specified here occurs. See **Basic Trigger Options** on page 94 and the TCE Help System for explanations of the options.

Trigger Channel — ID name of the desired trigger channel. The list for this box has the ID names of all logical channels currently defined. Normally one of these channels is selected for use as a trigger channel. An undefined logical channel can be specified, but must be defined before the test is initialized.

Mass Storage Option — By selecting the PCMCIA storage mode, the histogram data for each channel of each data mode is maintained in DRAM memory while the test is running and then copied to a file on the PCMCIA memory card after the test is stopped. All other data file components (e.g. the SIF header file information, keywords, etc.) are stored in the SRAM memory. When a test run is stopped, the TCE Test Control option Upload Test Data can be used to generate a consolidated SIF data file on the PC.

Number of Bins — Number of bins per input channel or per dimension according to the type of TAL DataMode being defined.

One-Dimensional: This number applies to each of the specified input channels. The maximum number of bins available is 10,000. TCE adds two more bins to each one dimensional TAL histogram to store overflows and underflows. If you specify 20 bins, a 22 bin histogram is internally allocated and used.

Multi-Dimensional: Specify the number of bins for each dimension, in the order in which the selected channels are listed in the Input Channels box; separate the numbers with spaces or commas (or both). For example, if you selected four input channels, putting “10, 20, 5, 15” in this box would result in 10 bins for the first channel, 20 for the second, and so on.

The total number of bins for a Multi-Dimensional Time at Level histogram is computed by the formula below to determine storage requirements. (The “+2” in the formula and the example calculation are the two special bins that TCE adds for each dimension to handle histogram underflow and overflow situations.)

Thus, the calculation for the above multi-dimension example is:

Total Bins = (10+2) × (20+2) × (5+2) × (15+2) = 31,416

At four bytes per bin, at least 123 KB of memory will be needed for storing the histogram data:

4 bytes × 31,416 bins = 125,664 bytes or 122.7 KB

NOTE: Each histogram bin requires four bytes of storage space and can accumulate counts up to 4,294,967,295.

Bin Type — Two types of bin spacing are listed for this box:

Evenly Divided — The bins for the test data are evenly divided between the histogram bounds.

User Defined — You set the size of each bin. See **User Defined Bins** on page 104.

3. Select OK to accept and save the entries made. The Histogram Bounds dialog box appears.

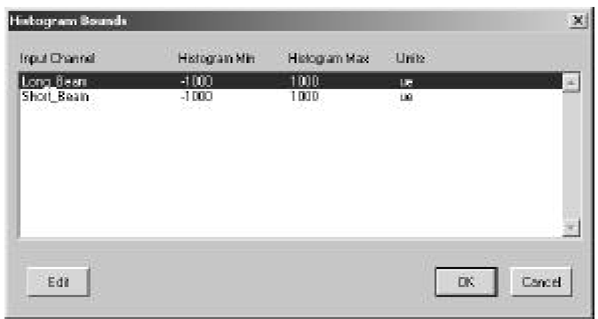


Figure 9-6: Histogram Bounds Dialog Box

The default histogram bounds are the Min and Max values specified for the channel (Full Scale Estimate values from Computed Channel Setup dialog box or Full Scale values from Page 2 of the Transducer Channel Setup dialog box). These bounds can be overridden by selecting Edit in the lower left of the dialog box.

If the User Defined bin type was selected, question marks will be in the Min and Max columns instead of values. Select Edit and set the bin boundaries. The appropriate values will then be in the Min and Max columns. (See **User Defined Bins** on pages 104.)

4. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Peak Valley DataMode

Description

SoMat Peak Valley DataModes store multiple channels of peak and valley sequences in an output data file. Peaks and valleys are acquired from triggered or untriggered time history data streams, using the hysteresis value specified and the peak valley processing algorithm.

Defining a Peak Valley DataMode

The general procedure for defining a SoMat DataMode is under **Defining a SoMat DataMode** on page 93. The following explains the actions involved in completing Step 6 of the procedure as it relates to defining a Peak Valley DataMode.

Perform the following to define a Peak Valley DataMode.

1. Select Peak Valley from the Select Data Mode Type dialog box. The Peak Valley Data Mode definition dialog box opens. **Figure 9-7** shows the dialog box with sample data.

2. Specify the following parameters.

   Input Channels — This multiple-select list box has all of the available input channels. Select from the channels to be included in the DataMode. You can select up to 128 input channels.

NOTE: The sample rates of the input channels determine the sample rate for this DataMode. All the input channels (including the trigger channel if one is defined) must have the same sample rate.

   Data Mode ID — Unique ID name for the DataMode, conforming to the TCE ID name conventions. This name must be unique within the DataMode setup window specified for any particular test.

   Triggering Option — Type of triggering to be used. The list for this box has the available triggering options. The Peak Valley DataMode processes data samples from the input channel data streams only when the triggering condition specified here occurs. See **Basic Trigger Options** on page 94 and the TCE Help System for explanations of the options.

   Trigger Channel — ID name of the desired trigger channel. The list for this box has the ID names of all logical channels currently defined. Normally one of these channels is selected for use as a trigger channel. An undefined logical channel can be specified but must be defined before the test is initialized.

   Floats ® Data Type — Select the desired data conversion mode for storage in the data file (this applies to 32-Bit Float input channels). The list for this box has the available format options. Refer to the Help System for more information on these options, their storage sizes, and resolution.

   Hysteresis — Hysteresis level value for the peak valley processing algorithm.

   Mass Storage Option — Allows the option of storing the collected data to the PCMCIA disk or in SRAM memory. SRAM is faster, but is very limited in size (less than 4 MB is available). To store data on the PCMCIA disk, select the Use PCMCIA Disk check box.

3. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

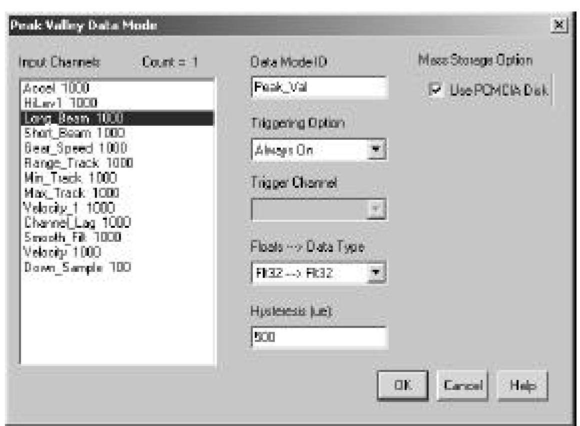


Figure 9-7: Peak Valley Definition Dialog Box

Peak Valley Matrix DataMode

Description

SoMat Peak Valley Matrix DataModes store multiple channels of peak valley reversal histograms to the output data file. Peaks and valleys are acquired from triggered or untriggered time history data streams using the hysteresis value specified, and the peak valley processing algorithm. The resulting peak valley stream defines the set of peak valley reversals, which are then put into a histogram using the type and size options specified.

Defining a Peak Valley Matrix DataMode

The general procedure for defining a SoMat DataMode is under **Defining a SoMat DataMode** on page 95. The following explains the actions in doing Step 6 of the procedure as it relates to a Peak Valley Matrix DataMode.

Perform the following to define a Peak Valley Matrix DataMode.

1. Select PV Matrix from the Select Data Mode Type dialog box. The Peak Valley Matrix Data Mode definition dialog box opens. **Figure 9-8** shows it with example definition data. The channel highlighted in the Input Channels list box is the channel selected as the input for the DataMode.

2. Specifying the following parameters.

   Input Channels — This multiple-select list box has all of the available input channels. Select the channels to be included in the DataMode. Up to 128 input channels can be selected.

NOTE: The sample rates in the input channel determine the sample rate for this DataMode. All of the input channels (including the trigger channel) must have the same sample rate.

   Data Mode ID — Unique ID name for the DataMode, conforming to the TCE ID name conventions. This name must be unique within the DataMode setup window for each test.

   Triggering Option — Type of triggering to be used. The list for this box has the available triggering options. A Peak Valley Matrix DataMode processes data samples from the input channel data streams only when the triggering condition specified here occurs. See **Basic Trigger Options** on page 94 for more on this.

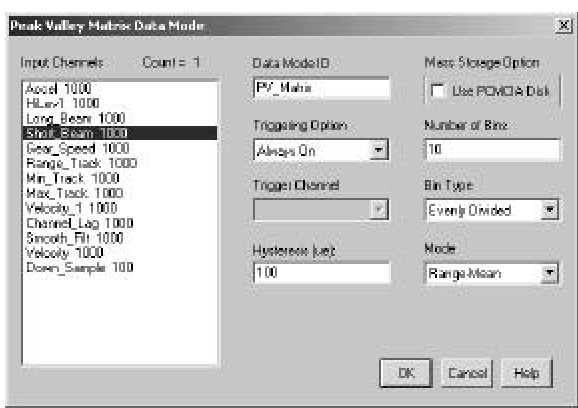


Figure 9-8: Peak Valley Matrix Definition Dialog Box

Trigger Channel — ID name of the desired trigger channel. The list for this box has the ID names of all logical channels currently defined. Normally one of these channels is selected for use as a trigger channel. An undefined logical channel can be specified but must be defined before the test is initialized.

Hysteresis — Hysteresis level value for the peak valley processing algorithm.

Mass Storage Option — Allows the option of storing the collected data to the PCMCIA disk or in SRAM memory. SRAM is faster, but is very limited in size (less than 4 MB is available). To store data on the PCMCIA disk, select the Use PCMCIA Disk check box.

Number of Bins — Number of bins for the histogram. For range-mean and to-from histograms, the maximum value is 500 for both histogram dimensions. For Range only, the maximum value is 10,000.

NOTE: TCE adds two more bins to each row and column of a histogram to store overflows and underflows. If you specified 32 x 32 bins, a 34 x 34 bin histogram is allocated and used internally.

Each histogram bin requires 4 bytes of storage space and can accumulate counts up to 4,294,967,295.

Bin Type — Two types of bin spacing are available in the box list:

Evenly Divided — The bins for the test data are evenly divided between the histogram bounds.

User Defined — The size of each bin is user defined. See **User Defined Bins** on page 104.

Mode — Histogram mode to be used:

Range-Mean — Cycle counts are accumulated in bins having a cycle range dimension and a cycle mean value dimension.

Range Only — Cycle counts are accumulated in bins having only a cycle range dimension.

To-From — Cycle counts accumulate in bins with both to and from dimensions. For the Peak Valley Matrix DataMode, these to and from designations are straightforward since each reversal has a start and an end. However, for the Rainflow Cycle DataMode, the to and from designations can be assigned to either reversal that makes up the full cycle. The eDAQ is programmed so to and from designations apply to the first reversal (and not the second reversal) on which the cycle closes.

3. Select OK to save the entries. The Histogram Bounds dialog box opens.

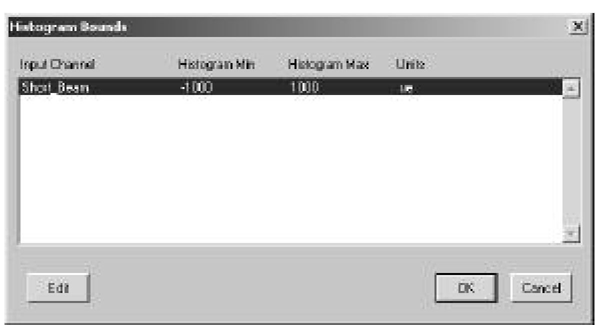


Figure 9-9. Histogram Bounds Dialog Box

The default histogram bounds shown in this dialog box are the Min and Max values specified for the channels (either Full Scale Estimate values from the Computed Channel Setup dialog box or Full Scale values from the Page 2 of the Transducer Channel Setup dialog box). These bounds can be overridden by selecting Edit in the lower left of the dialog box.

If User Defined bin type has been selected, question marks will be in the Min and Max columns instead of values. Select the Edit button to set the bin boundaries. The appropriate values will then be in the Min and Max columns. (See **User Defined Bins** below.)

4. Select OK or press Enter to save the definition. To cancel the definition, select Cancel.

Rainflow DataMode

Description

The SoMat Rainflow DataMode stores multiple channels of rainflow cycle histograms in the output data file. Peaks and valleys are acquired from both triggered or untriggered time history data streams using the hysteresis value specified and the peak valley processing algorithm. The resulting peak valley stream is processed through the rainflow cycle counting algorithm which yields the set of closed cycles. Finally, the closed cycles are put into a histogram using the type and size options specified.

Defining a Rainflow DataMode

The procedure, dialog boxes, and parameters to be defined for a Rainflow DataMode are identical to those for a Peak Valley Matrix DataMode, except Rainflow is selected at the Select Data Mode Type dialog box and the title bar of the dialog box reads "Rainflow DataMode."

For explanations of the dialog boxes and parameters, see **Defining a Peak Valley Matrix DataMode** on page 102.

User Defined Bins

Overview

The size of the individual bins for Time At Level, Peak Valley Matrix, and Rainflow DataModes can be specified by the user. This can be done by specifying an upper boundary value for each bin, either manually, by using the algorithms provided, or by loading a file containing a set of bin boundaries.

Defining Bins

Select the option User Defined in the Bin Type box in the DataMode definition dialog box to allow the bins to be user defined. When selecting the OK button to save the entries in the dialog box, the User Defined Histogram Bin Bounds dialog box opens. **Figure 9-10** shows the dialog box for a Peak Valley Matrix DataMode, and Range-Mean histogram mode. The Histogram Min and Max columns will contain question marks instead of values to indicate the bin sizes have not been defined.

Figure 9-10: User Defined Histogram Bin Bounds Dialog Box

To define the bins, select the channel in which the bins require defining. Each defined channel will require bin definitions in the DataMode. Select the Edit Bins button. The Edit User Defined Bins dialog box then opens.

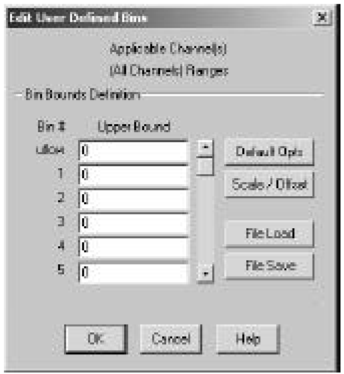


Figure 9-11: Edit User Defined Bins Dialog Box

In the Upper Bound boxes specify the upper boundary for each bin by typing the appropriate values in the boxes provided (one for each bin plus underflow). To move down and up the list of bin boxes, use the scroll bar, cursor up and down keys, or Page Down (PgDn) and Page Up (PgUp) keys.

A set of buttons beside the bin boxes further facilitates defining the bin boundary. These button controls are detailed as follows.

Default Opts — Opens a dialog box where you select one of the two options for loading default values.

Figure 9-12: User Defined Bins Default Options Dialog Box

Linear — Defines the bin boundaries with equal spacing from the full scale minimum to the full scale maximum.

Geometric — Defines the bin boundaries with geometric spacing from the full scale minimum to the full scale maximum, based on the user defined ratio of the size of last bin to the size of the first bin. For example, if the user specifies this ratio as 0.1, then the first bin will be 10 times larger than the last bin.

NOTE: The minimum and maximum full scale values used above are taken from the first channel in the input channel list with valid full scale values defined. If full scale values are undefined for all selected channels, this option is not available.

Select the mode to use and then select the OK button.

Scale / Offset — Opens a dialog box where the scale and offset values to be applied to all bin boundaries are specified (**Figure 9-13**). This is provided primarily to support changes in units and full scale limits.

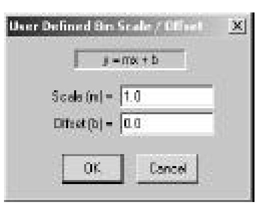


Figure 9-13. User Defined Bins Default Options Dialog Box

Type in the value(s) to use, then select OK.

File Load — Used to load a set of bin boundaries from a bin boundary definition (*.ubd) file. Such a file is normally created by using the File Save button as described below or by the equivalent option in DataModes (see that chapter on DataModes in the EASE Version 3 Operating Manual).

File Save — Used to save the defined bin boundaries to a boundary definition (*.ubd) file, in the standard Windows "initialization file" format. TCE verifies the bin boundary definition set is valid before writing the file.

Once the bin boundaries are specified select the OK button to close the Edit User Defined Bins dialog box and save your changes.

Editing a DataMode Definition

The following describes how to edit a SoMat DataMode definition:

1. Select the DataMode to be changed by moving the highlight bar to the channel using the arrow keys.
2. Select the Edit button, double-click on the DataMode, or press E. The definition dialog box for the DataMode then opens.
3. Change the DataMode parameters as needed.
4. Click OK or press Enter to save the changes made. When selected, this will return back to the DataMode Setup window.

Copying a DataMode

The Copy function provides a way to copy an existing DataMode definition for use in defining a new DataMode. The minimum requirements for copying a definition would be to assign an ID name using the naming conventions for TCE. Other definition data can be edited as needed for the new DataMode.

Use the following to create a copy of an existing DataMode.

1. Select the DataMode to copy from the DataMode Setup window.
2. Select the Copy button. The definition dialog box for the selected DataMode will appear with the ID box empty.
3. In the ID box enter a unique ID name for the new DataMode.
4. Edit the data in the other data boxes as necessary.
5. Either click on OK or press Enter to save the new definition and return to the DataMode Setup window.

Deleting a DataMode

To delete a DataMode definition, do the following.

1. Move the highlight bar to the channel definition(s) to delete in the DataMode Setup window. To select multiple consecutive channels, click the first channel and hold down SHIFT while clicking the last channel. To select multiple individual channels, hold down CTRL while clicking each channel to be deleted.
2. Click Del or press D.
3. At the verification dialog box that appears, select Yes to delete the definition (either press Y then ENTER, or click Yes). To cancel the delete process, select No.

Chapter 10 - Monitoring Tests and Channels

Overview

SoMat TCE can verify the eDAQ's status and the operation of transducer and computed channels before starting a test and monitor them during the test. The current status of the test can also be checked using TCE. This chapter explains how the following functions are used to do these actions.

Before a Test is Initialized

The following TCE display options are available for checking transducer channels prior to starting a test session:

- DVM and Scope functions in the Transducer Channel Setup window and in the dialog box where you define a channel
- Freq (Cumulative Spectrum Analyzer) function in the Transducer Channel Setup window

The eDAQ must be powered and communicating with the support PC to use these display functions.

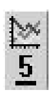
Between Test Runs

After a test has been initialized and before and after each test run, use the Transducer Checks function to check how the transducers are operating. This function is a command in the Prerun Options menu under the Test Control menu.

During Test Runs

For monitoring a test and transducers during a test run, there are two commands in the TCE Test Control menu and corresponding buttons in the TCE toolbar:

Get Test Status  — Shows the status of the test and memory available in the eDAQ for data storage.

Run Time Display  — Displays the output from transducers in a bar chart, strip chart, or a digital (numeric) table.

Get Test Status

Overview

Use TCE's Get Test Status function any time the eDAQ is powered up and connected to the support PC. The function opens the FCS Test Status dialog box (**Figure 10-1**), which shows the status of the test currently set up in the eDAQ, the setup and data file being used, and the space available in SRAM and the PCMCIA drive within the eDAQ for storing data. The unit name for the eDAQ is inside square brackets in the box title bar.

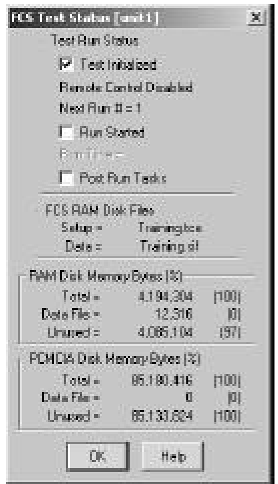


Figure 10-1: Test Status Dialog Box

To open this dialog box, do either of these actions:

- Select Get Test Status in the Test Control menu
- Click on the Test Status button  in the TCE toolbar

To close the dialog box, select OK.

Status Data Displayed

The FCS Test Status dialog box provides the following information on the current test, files being used, and space available for data storage. If eDAQ FCS operating errors have occurred, they are also reported.

Test Run Status:

The three check boxes and run information in this group box indicate the status of the current test.

Test Initialized — An ✕ or ✓ indicates a test has been initialized on the eDAQ.

Run # or Next Run # = — If a test is running, its run number appears here. If no test is running, the run number for the next test run appears here. If a test was initialized, but not yet run, 1 appears here.

Run Started — An ✕ or ✓ indicates a test is running.

Run Time = — If a test is running, the elapsed time since the start of the run is shown here.

Post Run Tasks — An ✕ or ✓ indicates a test run has been stopped, but a required post-run task has not been completed.

FCS RAM Disk Files:

This group box shows the test setup and data files currently resident on the eDAQ RAM disk file system:

Setup = — Name of the test setup file being used. (That setup file can be uploaded to the support PC if the test is not running.)

Data = — Name of the current test data file. (TCE opens the data file and writes the data file header information when the test is initialized.)

RAM Disk Memory Bytes (%):

Usage of the data storage space in RAM disk memory and the size of the SIF data file are shown in this group box.

Total = — Total space available within the eDAQ's RAM disk memory for storing data.

Unused = — Amount of unused space available in the RAM disk memory for subsequent data storage.

Data File = — Current size of the RAM disk memory component of the SIF file containing the test data.

PCMCIA Disk Memory Bytes (%):

Usage of the data storage space on the PCMCIA memory card and the size of the SIF data files are shown in this group box.

Total = — Total amount of space available on the PCMCIA memory card for storing data and other files.

Unused = — Amount of unused space available on the PCMCIA memory card for subsequent data storage.

Data File = — Current size of the PCMCIA disk memory component of the SIF data file.

To close this window, click OK.

Transducer Checks

Overview

The command Transducer Checks in Prerun Options submenu within the Test Control menu provides the commands for running the TCE DVM and Scope displays and for doing calibration checks after a test has been initialized. This command is available when a test has been initialized but is not running.

Transducer Checks Dialog Box

The command Transducer Checks opens the Initialized Transducer Check Options dialog box. The following explains the items in it.

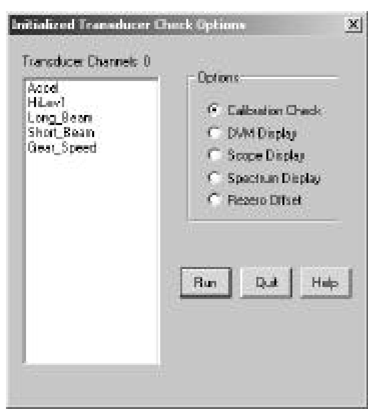


Figure 10-2: Transducer Checks Dialog Box

Transducer Channels — In this list box (a standard Windows multiple-select list box) are the transducer channels defined for the initialized test. They are listed in the same order as in the Transducer Channel Setup windows. Select the channel(s) to check.

Options — Select one of the five different display options available:

Calibration Check — Run a calibration check. The defined calibration is the current transducer calibration. It may differ in terms of the calibration intercept from the calibration defined at test initialization time if the transducer re-zero option was used.

DVM Display — Run the TCE DVM display. (See **DVM Display** on page 110.)

Scope Display — Run the TCE Scope display. (See **Scope Display** on page 112.)

Spectrum Display — Run the TCE Cumulative Spectrum Analyzer display. (See **Spectrum Analyzer Display** on page 118.)

Rezero Offset – TCE reports the difference (in engineering units) between the current transducer calibration intercept and the intercept defined at test initialization time. This difference is the cumulative sum of all re-zero offsets imposed since the test was initialized.

Select the Run button or press Enter to execute the option selected.

To close the dialog box, click Quit or press Esc.

The Help button brings up the TCE online Help System.

Signal Displays for Transducers

Transducer signals can be displayed before, or after, a transducer is calibrated. Output from an uncalibrated transducer is displayed in signal units (volts for low-level transducers, counts for pulse counters, etc.). Output from a calibrated transducer is initially displayed in the engineering units specified for the channel. The one-channel DVM and Scope display have an option to display the output in signal units.

In running the DVM and Scope displays, the eDAQ FCS uses the sample rate and, where applicable, the digital filtering specified for the particular transducer.

NOTE: Ensure the excitation circuitry and level is set up properly before displaying signals from low-level transducers.

The following sections “DVM Display” and “Scope Display” provide more information about those displays.

DVM Display

Overview

The DVM (Digital Value Meter) Display shows the output from one or several transducer channels in a digital (numeric) format, either in signal units or the engineering units for the channel(s). The transducer signal is sampled continually. If the transducer is not calibrated, the reading is in signal units; if it is, the reading is in the engineering units specified for the channel (the value can be displayed in signal units also).

Types of DVM Displays

Two DVM displays are available. The number of channels selected to display determines the display that appears.

DVM Display — Shows the output from one channel.

Figure 10-3: DVM Display, One Channel

Group Transducer DVM Display — (**Figure 10-4**) Displays the outputs from up to 16 channels at the same time.

Opening a DVM Display

The DVM displays can be opened in any of these ways:

- At the TCE Transducer Setup window, select the channel(s) to display; then select the DVM button. (This method cannot be used after a test has been initialized.)

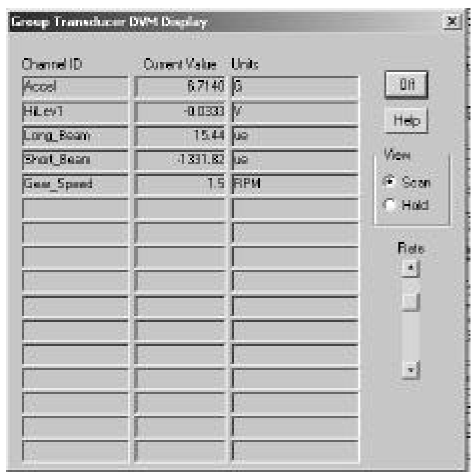


Figure 10-4: Group Transducer DVM Display

- In the Test Control menu, select Prerun Options and in its submenu, select Transducer Checks. At the Transducer Checks dialog box, select the channel to display, select the DVM Display option, and select Run.
- From the channel definition dialog box, select the DVM button (this displays just the single channel).

To close the display, select Off (in the upper-right corner) or press the Esc key.

Display Controls

The options provided in a DVM Display dialog box vary according to the type of transducer being checked. Refer to the TCE Help System for explanations of the various DVM Display options.

Figure 10-5 shows the controls on a one-channel DVM Display for a low-level transducer as they appear when the display is on hold (stopped) and the display units are in volts.

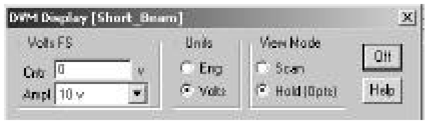


Figure 10-5: Controls for One-Channel Analog/Strain DVM Display

To use any of the controls, put the display in Hold mode by selecting Hold (Opts) in the View Mode group box, make the changes, and then select Scan in the View Mode group box to have the display run again. For example, to change the display units from the engineering (Eng) units to volts, select Hold under View Mode, select Volts in the Units group box, and then select Scan in the View Mode group box to restart the display.

The only controls on the multi-channel DVM display are the Scan and Hold options and the Off button.

To close a DVM Display, click Off.

Scope Display

The Scope Display (**Figure 10-6**) is similar to an analog oscilloscope but with this major difference: the Scope Display is not updated until all the data samples have been acquired by the eDAQ FCS and transferred to the support PC; this delays display of the data.

Opening the Scope Display

The Scope Display can be opened in any of three ways:

- At the Transducer Setup window, move the highlight bar to the channel to view and select the Scope button. (This method cannot be used after a test has been initialized.)
- In the Test Control menu, select Prerun Options, and in its submenu select Transducer Checks. Then, at the Transducer Checks dialog box, select the channel to view, select the Scope Display option, and select Run.
- From the channel definition dialog box, select the Scope button.

To exit the display, click Off (in the upper-right corner) or press Esc.

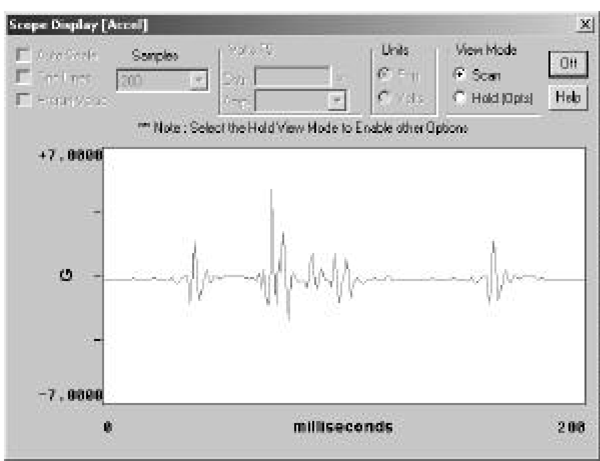


Figure 10-6: Scope Display

Display Controls

The options for the Scope Display dialog box vary according to the transducer being checked. Refer to the TCE Help System for explanations of the various Scope Display options. **Figure 10-7** shows the controls on a Scope Display for a low-level transducer as they appear when the display is on hold (stopped) and the display units is in volts.

To use any of the controls, put the display in Hold mode (select Hold under View), make the changes you want, and then select Scan under View to have the display run again.

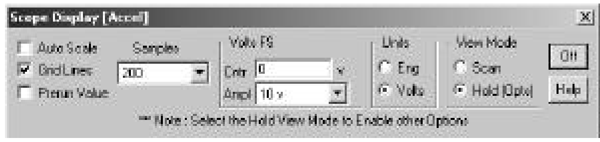


Figure 10-7: Controls for One-Channel Analog/Strain Scope Display

To close a Scope Display, click Off or press Esc.

Display Preferences

The trace color, screen color, and three initial settings for Scope Displays can be changed. To do so, select Scope and Spectrum Display in the TCE Preferences menu to open the Scope and Spectrum Preferences dialog box.

Figure 10-8: Scope Preferences Dialog Box

The following are the preferences you can set:

Trace Color — Select the color for the signal trace.

Screen Color — Selects the background color for the display graph (black or white).

Initial Settings — These three check boxes determine how the data graph is displayed — select them as desired:

Auto Scale Mode — The Y-axis of the plot graph is scaled automatically, based on the amplitude of the input signal, so the trace fills the graph vertically. (The Spectrum display always uses this mode.)

Show Grid Lines — Displays grid lines in the plot graph.

Show Prerun Value — Start up with the Prerun Value shown (when applicable). This option does not apply to the Spectrum display.

Click OK to save the changes and close the dialog box.

Run Time Display

Overview

The Run Time Display (RTD) shows the raw signals from transducers and computed channels on a real-time basis, thus giving you the means to see if the transducer and computed channels are functioning properly. It is available only while a test is running.

Three display modes are provided: Bar Chart Plot, Strip Chart Plot, and Digital Readout. Any one of the display modes can be selected as the default when the RTD is called. The default mode is set using the Run Time Display Preferences dialog box (described under **Display Preferences** on page 115). The following describes these display modes.

NOTE: The eDAQ keeps track of the minimum and maximum channel data values that have occurred since the previous update of the Run Time Display. These are referred to below as the latest minimum and maximum readings.

Bar Chart Plot

The Bar Chart plot (**Figure 10-9**) continuously shows the latest minimum and maximum readings for up to 16 channels using solid horizontal bars.

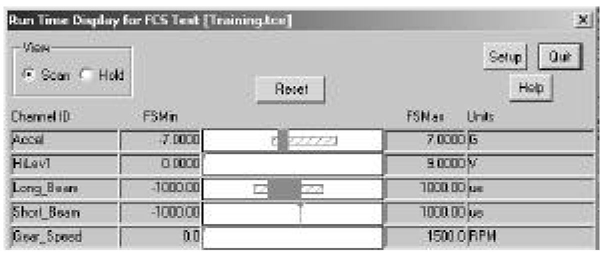


Figure 10-9: Bar Chart Plot, Run Time Display (Partial display)

An arrow head points to the bar when the bar is very thin (such as with the channel Short_Beam in Figure 10-9). Overall minimum and maximum values recorded since the display was started or reset are shown as a cross-hatched horizontal bar.

Strip Chart Plot

The Strip Chart plot (**Figure 10-10**) shows the minimum and maximum readings for each channel as a sequence of solid vertical bars (one pixel wide) along the X-axis. About 400 minimum/maximum samples and up to four channels can be displayed at a time.

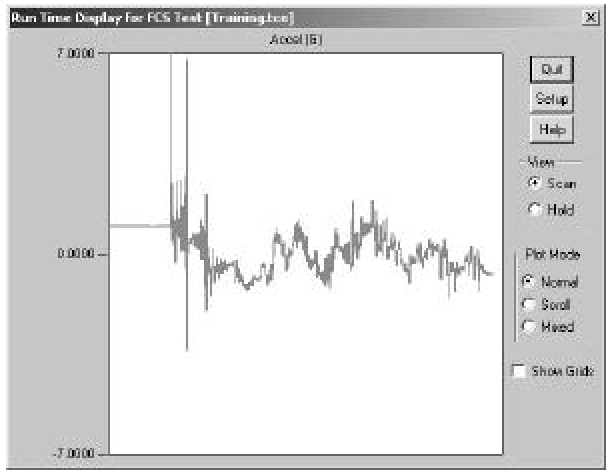


Figure 10-10: Strip Chart Plot, Run Time Display

NOTE: The X-axis of the strip chart display is not a linear time base. The processing time required plus a built-in delay determines the display update period. Actions such as changing the plot mode or placing the display in hold will change the update period significantly. However, in steady-state operation, the X-axis is usually a good approximation of a linear time base. In all cases, all channels are read simultaneously and displayed at the same position on the X-axis.

Digital Readout

The Digital Readout display (**Figure 10-11**) continuously shows two sets of minimum and maximum readings in a digital (numeric) format. Up to 16 channels can be displayed at one time. The Last Reading columns show the latest values read. The Since Reset columns show the overall minimum and maximum values encountered since the display was started. Selecting the Reset button restarts the tracking of minimum and maximum values.

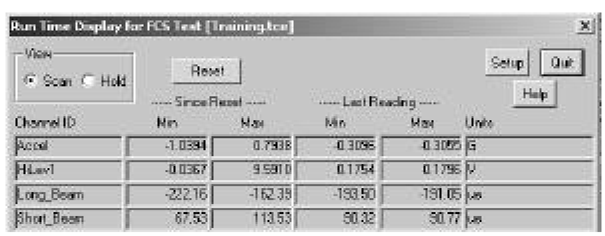


Figure 10-11: Digital Readout Mode, Run Time Display

Display Preferences

The Run Time Display Preferences dialog box (**Figure 10-12**, next page) is used to select the default Display mode, Trace/Bar color, Screen color and Strip Chart Plot Mode.

Figure 10-12: Run Time Display Preferences Dialog Box

To open the Run Time Display Preferences dialog box, select Run Time Display in the TCE Preferences menu.

Any changes made to the Run Time Display Preferences will be used as the default when the run time display is used during a test.

Display Mode — Selects the preferred display mode for use as the default when the run time display is opened during a test.

Trace/Bar Color — Selects the color for the signal trace or bar.

Screen Color — Selects the background color (black or white).

Strip Chart Plot Mode — Select how the signal trace and plot is displayed as data is acquired. The three modes differ in what happens when the signal trace reaches the right edge of the graph.

Normal — The signal trace starts again at the left side of the graph.

Scroll — The signal trace starts scrolling continuously to the left, at the rate at which data is being received, with the current value at the right edge.

Mixed — The last (right) half of the signal trace moves to the left half of the graph, and the signal trace continues from the middle of the graph.

Click OK to save these changes and close the dialog box.

Using the Display

The Run Time Display option can be used only while a test is running. Select either of the two following methods to activate the Run Time Display during a test:

- Select Run Time Display in the Test Control menu
- Click on the Run Time Display button  in the TCE toolbar

When the RTD starts, it automatically shows the data from the first set of channels listed in the Display Channels list box in the Run Time Display Setup dialog box (**Figure 10-13**, next page). These channels are determined based on the display mode: four channels for the Strip Chart mode and 16 for the Bar Chart and Digital Readout modes. (The channels are in the same order as they are in the channel setup windows; transducer channels are listed first, followed by computed channels.)

For example, when using the Strip Chart mode, and when seven channels are selected from the Display Channels list box, the first four channels are displayed in the RTD; but when the Bar Chart or Digital Readout mode is used, all seven channels are displayed.

To display a different group of channels, click setup in the RTD. From the the Run Time Display Setup dialog box, select the channel(s) to be displayed and the mode in which to display these channel(s). Click OK to open the selected RTD.

Figure 10-13: Run Time Display Setup Dialog Box

To quit the RTD function, click Quit in any RTD.

Display Controls

The following controls are common to the display modes:

View — The default setting is Scan (display data continuously). To stop (pause) the display, select the Hold option. The display will not update while in the hold condition. To restart it, select the Scan option.

Reset — Resets and restarts the display. Existing display data is cleared, and the minimum and maximum values are reset to 0.

Quit — Closes the display.

For further explanations of other display mode controls, configuration options, and the run time display algorithm, refer to the TCE Help System (click Help).

Spectrum Analyzer Display

Overview

The Cumulative Spectrum Analyzer display (**Figure 10-14**) shows the frequency content of a transducer signal. The display's linear X-axis is scaled from 0 Hz to the Nyquist frequency (i.e. half the sample rate). The log Y-axis is scaled automatically to cover up to six decades. The data points are the approximate sine amplitude of the signal components at each frequency. The data point at 0 Hz is the DC level of the signal.

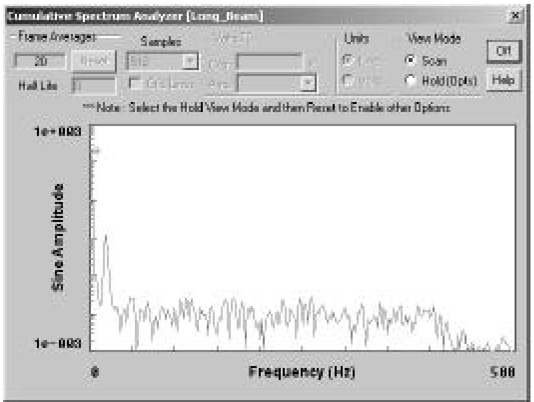


Figure 10-14: Spectrum Analyzer Display

Opening the Spectrum Display

The procedure for opening the Spectrum Analyzer Display depends on whether a test has been initialized or not:

Before the test is initialized:

At the Transducer Channel Setup window select (highlight) the channel to display and then select the Freq button.

After the test is initialized:

1. Open the Test Control menu, select Prerun Options, and select Transducer Checks.
2. At the Transducer Checks dialog box, select the channel to view, select the Spectrum Display option, and select Run.

To exit the display, Click Off (in the upper-right corner) or press Esc.

Display Preferences

The display preferences are set at the Scope and Spectrum Preferences dialog box. See **Display Preferences** on page 115 for a description of the dialog box.

Display Controls

The options provided in the Spectrum Analyzer Display dialog box vary according to the type of signal conditioner being used (low-level or high-level). **Figure 10-15** shows the controls on a high-level Spectrum Display, as they appear when the display is on hold (stopped) and the display units are engineering units.

Figure 10-15: Spectrum Display Controls

To use any of the controls, put the display in Hold mode by selecting Hold (Opts) in the View Mode group box, make the changes, and then select Scan in the View Mode group box to run the display.

For information on these controls, refer to the TCE Help System (using the Help button provided).

Appendix A - Cable Wiring

Cable Hardware

		To eDAQ	***Other End***
Cable Type	*Part No.*	*Connector*	*Connector*
Digital I/O / Pulse Counter	EDIO	HDD-sub 44-Pin (M)	Pigtails
Comm 1 (Ethernet 10baseT) [1]	E-Ethernet Hub	HDD-sub 26-Pin (M)	RJ-45
Serial RS232	E-Ethernet X/O	HDD-sub 26-Pin (M)	RJ-45 D-sub 9-pin (F)
High Level Analog	SAC-EHLB1	HDD-sub 62-Pin (M)	Pigtails
High Level Analog w/ Veh Bus	SAC-EHLB1/VB	HDD-sub 62-Pin (M)	Pigtails
Low Level Analog [2]	SAC-SLXDUC-n[-V] [2]	D-sub 37-Pin (M)	Pigtails
Power / Remote Power	EPWR15	D-sub 15-Pin (F)	Pigtails

HD = High Density (M) = Male (F) = Female

[1] Two different cables are available for Ethernet connection for the eDAQ. These are for either connection directly to the computer (E-Ethernet X/O) or to an Ethernet Hub (E-Ethernet Hub). Both cables have a HDD-sub 26-Pin (M) for connection to the eDAQ, a D-sub 9-pin (F) for connection to the comm port of a host computer, and an RJ-45 for Ethernet connections. Only the wiring is different between the E-Ethernet X/O and E-Ethernet Hub.
[2] The part number depends on the type of cables, the cable wiring option ordered (4-wire or 6-wire), voltage out or no voltage out.

Wiring Standards

The following details the pin assignments at the plug connecting to the eDAQ.

Comm 1 — Ethernet (E-ETHERNET xxx)

	RJ-45 Connector—	***E-ETHERNET X/O***	***E-ETHERNET HUB***
Function	*Pin*	*Wire Color*	*Wire Color*
10baseT Receive +	3	White/Orange	White/Green
10baseT Receive –	4	Orange	Green
10baseT Transmit +	2	White/Green	White/Orange
10baseT Transmit –	1	Green	Orange

	eDAQ 26-pin Plug		***PC 9-pin Plug***	
Function	*Pin*	*Wire Color*	*Pin*	*Wire Color*
CTS (CTS)	17	Yellow	7	Yellow
DCD (DCD)	10	Red	4	Red
DSR (DSR)	15	Violet	1	Violet
DTR (DTR)	13	Orange	6	Orange
Receive (RX)	11	Brown	3	Brown
Rcv Intrpt (RI)	18	Blue	9	Blue
RTS (RTS)	16	Green	8	Green
Transmit (TX)	12	Black	2	Black
Ground (Dgnd)	14	White	5	White

Digital Input/Output/Pulse Counter Cable Set (EDIO)

Function	*Pin*	*Wire Color*	*Function*	*Pin*	*Wire Color*
Pulse Counter Cable			***Digital I/O Cable***		
Clock 1 - Return	1	Black	Port 1 - Return	23	Black
Clock 1 - Signal	2	White	Port 1 - Signal	24	White
Clock 2 - Return	3	Green	Port 2 - Return	25	Green
Clock 2 - Signal	4	Red	Port 2 - Signal	26	Red
Clock 3 - Return	5	Blue	Port 3 - Return	27	Blue
Clock 3 - Signal	6	Orange	Port 3 - Signal	28	Orange
Clock 4 - Return	7	Red/Black	Port 4 - Return	29	Red/Black
Clock 4 - Signal	8	White/Black	Port 4 - Signal	30	White/Black
Clock 5 - Return	9	Green/Black	Port 5 - Return	31	Green/Black
Clock 5 - Signal	10	Orange/Black	Port 5 - Signal	32	Orange/Black
Clock 6 - Return	11	Black/White	Port 6 - Return	33	Black/White
Clock 6 - Signal	12	Blue/Black	Port 6 - Signal	34	Blue/Black
Clock 7 - Return	13	Green/White	Port 7 - Return	35	Green/White
Clock 7 - Signal	14	Red/White	Port 7 - Signal	36	Red/White
Clock 8 - Return	17	Blue/White	Port 8 - Return	37	Orange/Red
Clock 8 - Signal	16	Orange/Red	Port 8 - Signal	38	Blue/White
			Port 9 - Return	39	White/Red
			Port 9 - Signal	40	Black/Red
			Port 10 - Return	41	Red/Green
			Port 10 - Signal	42	Blue/Red

NOTE: When using the EDIO cable, the Function references the physical hardware connections.

High-Level Analog Cable/Vehicle Bus Cable (SAC-EHLB1)

Function	*Pin*	*Wire Color*	*Function*	*Pin*	*Wire Color*
+ Excitation	61	Red	– Excitation	59	Black
Analog Gnd	40	White/Black/Red	Analog Gnd	42	White/Red/Black
Analog 1 In	29	White	Analog 1 Gnd	49	Green
Analog 2 In	8	Orange	Analog 2 Gnd	7	Blue
Analog 3 In	31	Brown	Analog 3 Gnd	51	Yellow
Analog 4 In	10	Violet	Analog 4 Gnd	9	Grey
Analog 5 In	33	Pink	Analog 5 Gnd	53	Tan
Analog 6 In	12	Red/Green	Analog 6 Gnd	11	Red/Yellow
Analog 7 In	55	Red/Black	Analog 7 Gnd	34	White/Black
Analog 8 In	35	White/Red	Analog 8 Gnd	56	White/Green
Analog 9 In	14	White/Yellow	Analog 9 Gnd	13	White/Blue
Analog 10 In	57	White/Brown	Analog 10 Gnd	36	White/Orange
Analog 11 In	37	White/Grey	Analog 11 Gnd	58	White/Violet
Analog 12 In	16	White/Red/Blue	Analog 12 Gnd	15	White/Black/Green
Analog 13 In	39	White/Black/Yellow	Analog 13 Gnd	60	White/Black/Blue
Analog 14 In	18	White/Black/Brown	Analog 14 Gnd	17	White/Black/Orange
Analog 15 In	41	White/Black/Grey	Analog 15 Gnd	62	White/Black/Violet
Analog 16 In	20	White/Black/Black	Analog 16 Gnd	19	White/Red/Green

NOTE: When using the SAC–EHLB1 cable, the Function references the physical hardware connections.

Low-Level Analog Cable Set, 4-Wire Option (SAC-SLXDUC-4 and SAC-SLXDUC-4-V)

Function	*Pin*	*Wire Color*	*Function*	*Pin*	*Wire Color*
Voltage Out Cable *(Not available on SAC-SLXDUC-4)*					
Ground	1	Shield Drain	Voltage Out 3	2	Orange
Voltage Out 1	19	Brown	Ground 3	3	White
Ground 1	18	Black	Voltage Out 4	20	Yellow
Voltage Out 2	37	Red	Ground 4	21	Blue
Ground 2	36	Green			
Channel 1/5 Cable					
+ Excitation 1	35	Red*	+ Signal 1	16	White
– Excitation 1	15	Black	– Signal 1	33	Green*
Ground 1	17	Shield Drain			
Channel 2/6 Cable					
+ Excitation 2	13	Red*	+ Signal 2	31	White
– Excitation 2	30	Black	– Signal 2	11	Green*
Ground 2	32	Shield Drain			
Channel 3/7 Cable					
+ Excitation 3	28	Red*	+ Signal 3	9	White
– Excitation 3	8	Black	– Signal 3	26	Green*
Ground 3	10	Shield Drain			
Channel 4/8 Cable					
+ Excitation 4	6	Red*	+ Signal 4	24	White
– Excitation 4	23	Black	– Signal 4	4	Green*
Ground 4	25	Shield Drain			

NOTE: With a quarter bridge strain transducer, wire colors for + Excitation and – Signal are reversed: + Excitation is Green, – Signal is Red. See Figure 5-1 in Chapter 5, "**Transducer Cables and Wiring**."

Low-Level Analog Cable Set, 6-Wire Option (SAC-SLXDUC-6 and SAC-SLXDUC-6-V)

Function	*Pin*	*Wire Color*	*Function*	*Pin*	*Wire Color*
Voltage Out Cable *(Not available on SAC-SLXDUC-6)*					
Ground	1	Shield Drain	Voltage Out 3	2	Orange
Voltage Out 1	19	Brown	Ground 3	3	White
Ground 1	18	Black	Voltage Out 4	20	Yellow
Voltage Out 2	37	Red	Ground 4	21	Blue
Ground 2	36	Green			
Channel 1/5 Cable					
+ Calibration 1	34	Blue	+ Signal 1	16	White
– Calibration 1	14	Brown	– Signal 1	33	Green*
+ Excitation 1	35	Red*	Ground 1	17	Shield Drain
– Excitation 1	15	Black			
Channel 2/6 Cable					
+ Calibration 2	12	Blue	+ Signal 2	31	White
– Calibration 2	29	Brown	– Signal 2	11	Green*
+ Excitation 2	13	Red*	Ground 2	32	Shield Drain
– Excitation 2	30	Black			
Channel 3/7 Cable					
+ Calibration 3	27	Blue	+ Signal 3	9	White
– Calibration 3	7	Brown	– Signal 3	26	Green*
+ Excitation 3	28	Red*	Ground 3	10	Shield Drain
– Excitation 3	8	Black			
Channel 4/8 Cable					
+ Calibration 4	5	Blue	+ Signal 4	24	White
– Calibration 4	22	Brown	– Signal 4	4	Green*
+ Excitation 4	6	Red*	Ground 4	25	Shield Drain
– Excitation 4	23	Black			

NOTE: With a quarter bridge strain transducer, wire colors for + Excitation and – Signal are reversed: + Excitation is Green, – Signal is Red. See Figure 5-4 in Chapter 5, "**Transducer Cables and Wiring**."

Power Cable (EPWR15)

Function	*Pin*	*Wire Color*
Gray Main Power Cable		
+ Main Power (+PWR)	1	Red
Main Power Return (RET)	8	Black
Black Remote Control Cable		
+ Remote Power (+PWR)	6	Red
Remote Power Return (RET)	14	Black

NOTE: Pin 3 is jumpered to Pin 4

Appendix B - TCE Computed Channels

Listed below are the computed channels provided with SoMat TCE for eDAQ along with a brief description of each channel. Five of the most commonly used channels are described in Chapter 8 of this guide. For more information on the other computed channels, refer to the TCE online Help System.

Desk Calculator

[Chap. 8] Constructs data streams with either arithmetic results (floating point) or logical results (Boolean) based on a mathematical expression or specified formula.

Discrete State Mapper

Maps the input channel into a discrete state output channel, based on a set of mapping conditions defined in an ASCII file. Each mapping condition is defined in terms of a minimum input value, a maximum output value, and the associated output state value.

Down Sampler

[Chap. 8] Simulates the input channel having a lower sample rate. Samples are extracted from the input channel data at a rate determined by a user-specified decrement factor.

Elapsed Time – (Time Channel)

[Chap. 8] Provides a time base channel for use in other computed channels and/or can be stored in SoMat Time History and Peak Valley Slice DataModes.

Engineering Scaler

Converts the data type in transducer or computed channels from integer to engineering floating point.

Interactive Trigger

Provides a means to trigger data modes and computed channels directly from TCE.

Integrator

[Chap. 8] Generates an output channel, which is the integral of the input channel. As long as the integrator is not reset or suppressed, each output channel sample is the cumulative sum of the current and all previous input channel samples multiplied by a user-defined scale factor and added to a user-defined initial value.

Maximum Value Track

Generates an output channel tracking the maximum value for the input channel.

Minimum Value Track

Generates an output channel tracking the minimum value for the input channel.

Pulse Counter

Measures pulse frequencies for inputs at relatively low pulse rates (i.e. 100 Hz or less). It is used primarily in conjunction with digital inputs from the Bitwise Digital Input lines.

Range Track

Generates an output channel that tracks the maximum range for the input channel.

Smoothing Filter

Generates a smoothed representation of the input channel to an output channel without generating any phase lead or lag. The filter is a simple “Box Car” filter where each output sample is the linear average of the specified number of input samples.

Time Base Shifter

Generates an output channel either leading or lagging the selected input channel by a user-defined number of samples.

Trigger Generator

Generates a trigger channel consisting of an (optional) Initial Delay Period followed by a repetitive cycle of On periods (i.e. logical True) and Off periods (i.e. logical False). It is typically used as an elapsed time trigger for SoMat DataModes or other computed channels that support triggering. For example, this computed channel could be used to store 10 minutes of data for every hour of test time, beginning after the first sample is taken.

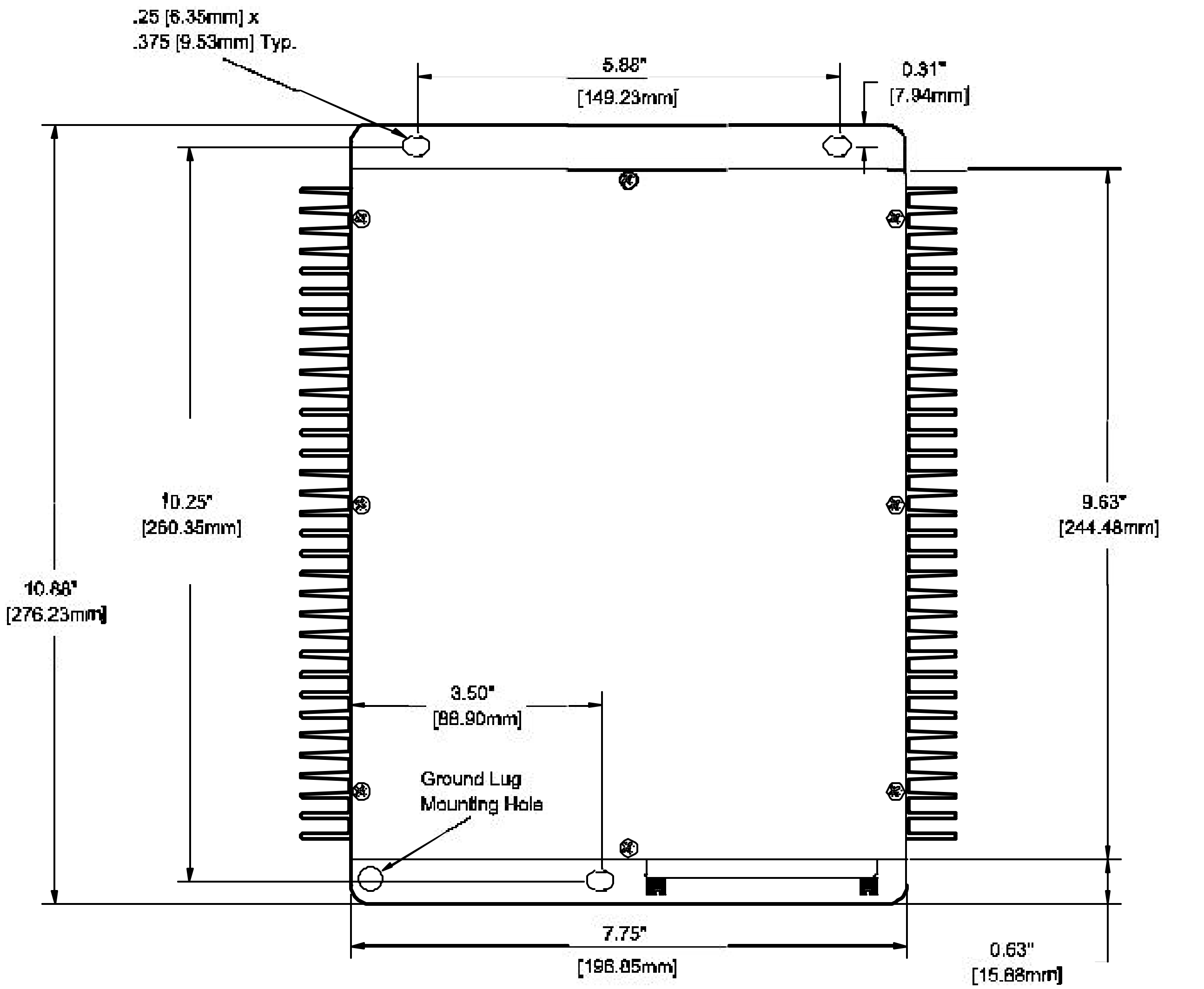
Up Sampler

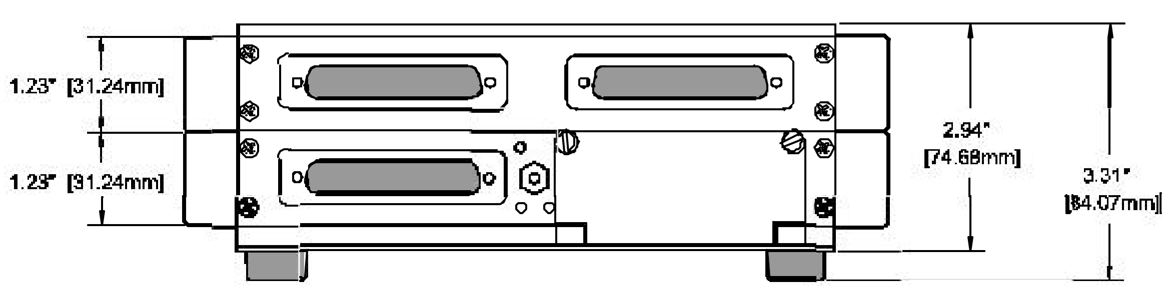
[Chap. 8] Simulates the input channel having a higher sample rate by repeating (echoing) each sample in the input channel a certain number of times during the interval between the input samples.

Valid Gate Data

This computed channel is used to generate a logical channel data stream on a sample by sample basis. The output sample is 1 (TRUE) if, and only if, the data samples for all input channels are marked as valid; otherwise, the output sample is 0 (FALSE). This computed channel can be used independently or in conjunction with other logical channels as a Gate trigger for data modes and will eliminate any data samples marked as invalid.

Appendix C - eDAQ Dimensions





Appendix D - Ethernet Communications

Basics of Ethernet Communications

The following is a very brief and condensed description of how Ethernet communications work. This example is based on a class C network connection between the eDAQ and the host computer.

What is a compatible address?

A compatible IP address is when both the host computer and eDAQ have the same network address, and a unique address, or node.

In a class C network, the address is defined in the first three number groupings (seperated by decimal points). The last number grouping is the actual address, or node, of the eDAQ or computer. From the IP address of 192.168.100.100, the following information can be derived (The *n* indicates numbers not pertaining to information for the definition.):

192.168.100.*nnn* = Defines the network for the eDAQ or computer

nnn.nnn.nnn.100 = Defines the address (node) of the eDAQ or computer

The subnet mask acts as a filter for the IP addressing, allowing the host computer and eDAQ to communicate on the same network.

The IP address and subnet mask are added together using Boolean logic. The results for both the eDAQ and host computer must match for communication to occur.

The following example illustrates a bitwise AND of the IP address (192.168.100.100) and subnet mask (255.255.255.0) programmed into the eDAQ.

eDAQ Address

11000000. 10101000. 01100100. 01100100	192.168.100.100	eDAQ IP Address
11111111. 11111111. 11111111. 00000000	255.255.255.0	eDAQ subnet mask
11000000. 10101000. 01100100. 00000000	192.168.100.0	Anded eDAQ Address

The following completes the example by performing a bitwise AND of the IP address (192.168.100.90) and subnet mask (255.255.255.0) of the host computer.

PC Address

11000000. 10101000. 01100100. 01011010	192.168.100.90	PC IP Address
11111111. 11111111. 11111111. 00000000	255.255.255.0	PC subnet mask
11000000. 10101000. 01100100. 00000000	192.168.100.0	Anded PC Address

The results from both the eDAQ and host computer produce the same bitwise AND between the IP addresses and subnet masks. This allows communication between the eDAQ and host computer. Because of the 0 in the fourth position of the subnet mask, any compatible address can be used at the host computer, so long as the network addresses match.

Communications via Ethernet

Overview

The following instructions are for configuring the eDAQ for Ethernet communications. These instructions cover communications with a dedicated host computer or communications over a network.

Depending on the method of communication, follow the instructions in either **Section 1** or **Section 2**. Follow **Section 3** to verify the communication settings are properly assigned to the eDAQ.

Section 1: Using the eDAQ in a network scenario

Before using the eDAQ in a network, the IP address and subnet mask must be changed to be compatible with the network. This procedure may also be necessary if the privileges to change the IP address and subnet mask on the host computer have been removed. Contact a Network Administrator and obtain the IP address and subnet mask as the first step of this procedure.

Connect the eDAQ to the COM port of a host computer using the ESR9 cable. Use the fasteners to prevent poor connections that could interrupt data flow.

Host computer preparation

Open a session of HyperTerminal on the host computer. In most cases, HyperTerminal can be found in the Start menu under Programs → Accessories → Communications → HyperTerminal.

When prompted for a session name, enter “eDAQ” to distinguish this session from other sessions.

The next screen will prompt for the connection port of the host computer. Select either COM1 or COM2 depending on which the eDAQ is plugged into.

Next are the properties for the COM port. Use the following for the required entries:

Bits Per Second:	19200
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	None

Once this dialog box has been completed, click OK. Once all of the connections have been made between the eDAQ and the host computer and the HyperTerminal session has started, connect the power to the eDAQ and power it up. The LED’s on the front will indicate the power-up status of the eDAQ as described in Chapter 1.

HyperTerminal Communications between host computer and eDAQ

After powering up the eDAQ, the HyperTerminal session will begin. A listing of the power-up checks will be listed as they are performed during this procedure.

NOTE: The eDAQ name and IP address will be listed in this grouping.

To change the eDAQ name and/or IP address, press Enter four times once the **AT** prompt is displayed at the end of the power-up process. Type “setup” then press Enter when prompted for a login.

Name Entry

The name of the eDAQ can be changed at the Set hostname prompt. The current name will be presented inside the brackets. Change the name of the eDAQ by typing the new name and pressing ENTER. To retain the current name, press ENTER.

NOTE: Although the hostname is not currently used by the TCE software, it is a way to verify the physical eDAQ when using the Web Browser interface to change the IP address, Subnet Mask and Gateway. This name must not be confused with the FCS ID, which is set via the TCE FCS setup ID parameters option.

IP Address

The IP address of the eDAQ can be changed at the Set IP address prompt. The current IP address will be presented inside the brackets. Change the IP address of the eDAQ by typing the new IP address and pressing ENTER. To retain the current IP address, press ENTER.

NOTE: When changing the IP address, use the format shown. The format of 192.168.100.100, where the groups are separated by decimal points, is the proper format for the IP address. A prompt will be displayed if an error has been made in the IP address, followed by a prompt allowing the correct address to be entered.

Subnet Mask

If communications with the eDAQ will be done via a network, the Subnet Mask will require changing. This can be changed at the Set Netmask prompt. The current Subnet Mask will be presented inside the brackets. Change the Subnet Mask by typing the new Subnet Mask and pressing ENTER. To retain the current Subnet Mask, press ENTER.

NOTE: When changing the Subnet Mask, use the format shown. The format of 255.255.255.0, where the groups are separated by decimal points, is the proper format for the Subnet Mask. A prompt will be displayed if an error has been made in the Subnet Mask, followed by a prompt allowing the correct Subnet Mask to be entered.

Gateway

The next prompt will be Set Gateway. The current Gateway will be presented inside the brackets. If the Gateway requires change, type the new gateway and press ENTER. To retain the current gateway, simply press ENTER.

NOTE: When changing the Gateway, use the format shown. The format of 192.168.100.1, where the groups are separated by decimal points, is the proper format for the Gateway. A prompt will be displayed if an error has been made entering the Gateway, followed by a prompt allowing the correct Gateway to be entered.

Once all of the information has been entered, a prompt with the new Name, IP address, Subnet Mask and Gateway information will be displayed to confirm the changes. Following the “Confirm these new settings” dialog, a **y** or **n** must be entered.

Typing **y** then ENTER will bring up the following dialog: Network settings successfully updated. Reboot the eDAQ for the new settings to take effect.

Typing **n** then ENTER will bring bring up the following dialog: Network settings NOT updated.

When the changes are complete, power down the eDAQ and exit the HyperTerminal session.

Disconnect the serial communications cable from the eDAQ and PC and reinstall the Ethernet cable.

After changing the IP Address of the eDAQ, the eDAQ-to-PC communications settings must be changed in TCE, as explained by the following.

Continue on to **Section 3**: Checking Ethernet Communications.

Section 2: Using the eDAQ with a dedicated computer

To communicate with an eDAQ directly from a dedicated PC using an Ethernet connection, the IP address and subnet mask of the eDAQ must be added (or changed) in the support PC's operating system.

The following example assumes the eDAQ has been shipped with the default IP address of 192.168.100.100 and a Subnet mask of 255.255.255.0. If the eDAQ has been received with a different IP address and Subnet mask, or if it has been changed by the end user, make sure to use the correct IP address and Subnet mask during set-up. A tag with this information will be attached to all new eDAQs.

If a tag was not included with the eDAQ, or possibly the IP address or subnet mask is unknown, follow the procedure in Section 1: Using the eDAQ in a network scenario. This will allow checking and changing the current IP address and subnet mask programmed into the eDAQ.

Communication using Ethernet can not be performed without knowing the IP address and subnet mask programmed into the eDAQ.

The IP address of the host computer can be found in the network options of your PC's operating system. In most cases, this can be found in the Start menu under Settings → Control Panel → Network. Select the TCP/IP Properties from the Network window.

NOTE: For Windows 2000, select Settings → Network and Dialup Connections → Local Area Connection. Click Properties then double-click the Internet Protocol (TCP/IP).

Change both the IP Address and subnet mask of the support PC as follows: the IP address must have the same network address (192.168.100.xxx) as the eDAQ to communicate. The node (last three digits) can be anything (i.e. 110, 90, etc.), just as long as it is not the same as the eDAQ node of 100.

NOTE: DO NOT use the exact same IP address, as this will cause a conflict between the support PC and eDAQ. However, the subnet mask must exactly match the subnet mask of the eDAQ.

NOTE: If using Windows 2000, the IP address and subnet mask can be added to the current listing of IP addresses and subnet masks under Local Area Connections by clicking Advanced in the Internet Protocol (TCP/IP) Properties window.

Once the IP address and subnet mask have been added (or changed), restart the PC if prompted to do so.

Section 3: Checking Ethernet Communications

When using the eDAQ on a network, use the E-Ethernet Hub cable to connect the eDAQ to the Ethernet hub. When using the eDAQ directly with a host computer, use the E-Ethernet X/O cable to connect the eDAQ to the host computer. Make sure the eDAQ is off when connecting the cables. DO NOT connect the eDAQ during the boot process or while powered up.

Power up the eDAQ after connecting it to the hub or host computer. Wait until the eDAQ has properly booted (as described in Chapter 1) before continuing.

Once the eDAQ has fully powered-up, use Netscape or Internet Explorer to view the eDAQ by entering the IP address http://192.168.100.100 in your browser address/location bar (or the IP address assigned during the HyperTerminal session). A welcome page will appear when the connection is complete. This will verify the communications have been properly set and all is working.

Appendix E - eDAQ Web Interface

Overview

By using the Web Interface, various maintenance tasks can be performed quickly and easily, without the need to connect the eDAQ to the computer via the RS232 cable. Although there are numerous items available, the most frequently used items will be: Formatting of the PCMCIA card, Updating the Firmware, and Changing the IP Address and Name of the eDAQ.

Using the Web Interface

To use the Web Interface, a connection must be made between the host computer and the eDAQ as described in **Chapter 2**. Once the connection is complete, the eDAQ can be accessed using either Microsoft Internet Explorer or Netscape Navigator. Type the IP Address of the eDAQ into the Address Bar as shown in Figure D-1. This will allow access to the main screen of the eDAQ. To access the complete selection of options, click on the logo or on **Click here to begin...** near the bottom of the screen.

Figure D-1: Web Browser

Formatting the PCMCIA Disk

Click **System Setup** from the bottom of the page. From the page that opens, locate the section **PC Card Slots**. The options located in this section for the PCMCIA card are: Show PC Card Info, Show detailed PC Card Info, Show PC Card resources used, Eject PC Card, and Initialize/Format ATA PC Card. The option used most frequently will be the Initialize/Format option.

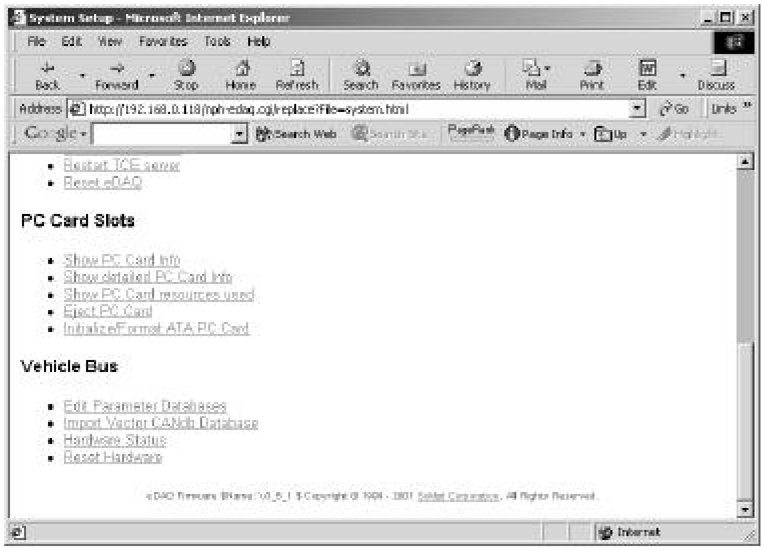


Figure D-2: PC Card Slot Selections

To format the PCMCIA card, make sure a PCMCIA card has been installed properly into the eDAQ. Click **Initialize/Format ATA PC Card**. A window will then open with two options for formatting the card. These options are **Format with DOS VFAT filesystem**, and **Format with Linux ext2 filesystem**. Formatting the PCMCIA card to the Linux system will provide higher data throughput than DOS VFAT. Formatting the PCMCIA card to DOS VFAT will allow a PC with a PCMCIA slot to read the data directly from the PCMCIA card. After clicking the appropriate choice, a window will open, showing the progress of the formatting procedure. Once the procedure is complete, simply return to the main screen by clicking **Top** at the top of the page.

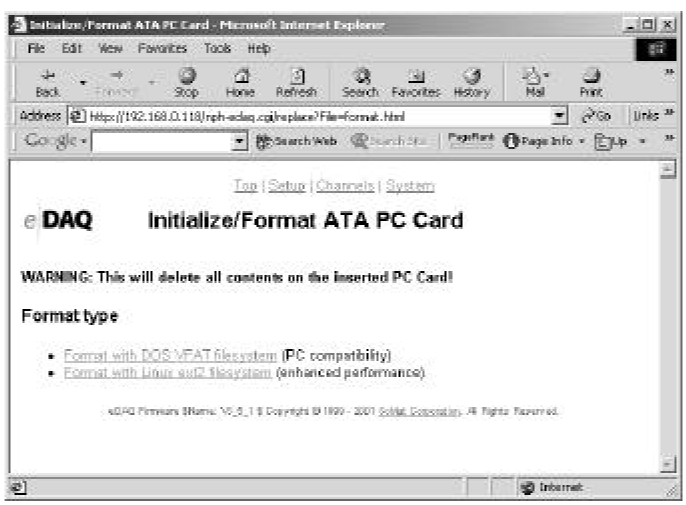


Figure D-3: Initialize/Format ATA PC Card

NOTE: The eDAQ must be running the TCE software version 3.5.1 or greater to use the Linux ext2 filesystem format.

The remaining options are self-explanatory, providing information regarding the PC Card.

Changing the IP Address and name

To update the IP address and name of the eDAQ, click **System Setup** from the bottom of the second page. From the page that opens, click **TCP/IP Setup** located near the top of the page. A window will then open with fields to enter the **Hostname**, **IP Number (Address)**, **Netmask**, and **Gateway**. After entering the information into the appropriate fields, click **Reconfigure TCP/IP** to change this information. A final screen will open verifying the changes have been made (TCP/IP reconfigured successfully), and a prompt to reboot the eDAQ to complete the changes (Changes will take effect on rebooting the eDAQ). Rebooting the eDAQ is the final step in changing the IP Address and name of the eDAQ.

To exit without making changes to the eDAQ configuration, click **Cancel**.

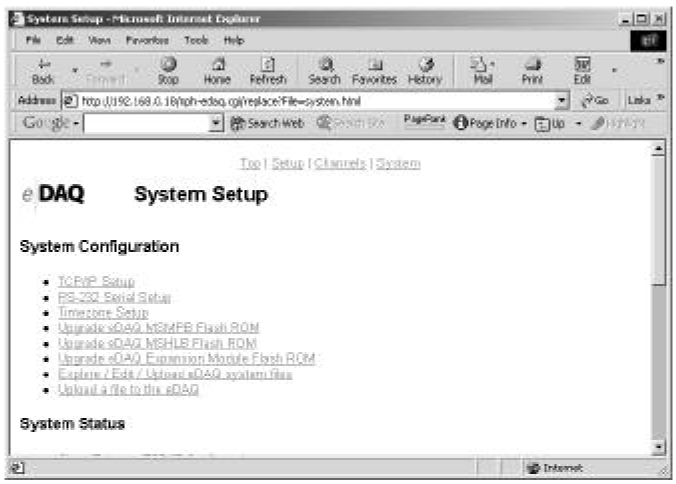


Figure D-4: System Configuration Selections

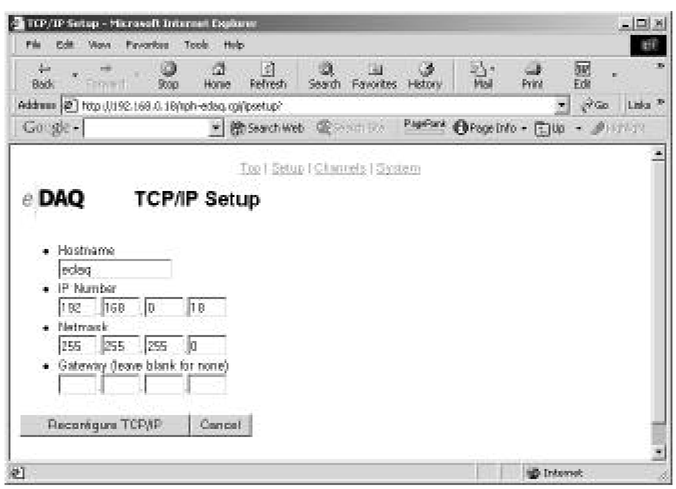


Figure D-5: TCP/IP Setup Configuration

Updating the Firmware

The Web Interface is also used to update the Firmware of the eDAQ when new versions of TCE are been posted on the SoMat Website. Once the TCE software has been downloaded and installed on the host computer, use the Web Interface to access the eDAQ.

To begin the Firmware update, click **System Setup** from the bottom of the second page. From the page that opens, click **Upgrade eDAQ MSMPB Flash ROM** located near the top of the page.

The next page that opens is used to select the .mpb file used for the upgrade. Click **Browse...** to locate the .mpb file specific to the version of TCE. This file should be located in the folder where the current version TCE is installed.

NOTE: If there is any possibility of an interruption in network communications, or if this is the first attempt to upgrade a specific eDAQ, make sure **Just Testing...** has been selected. If any problems occur during the upgrade, no damage will come to the firmware when **Just Testing...** has been selected. If any failures occur during the upgrade when **Really Write FLASH** is selected, the eDAQ firmware will be corrupted and must be returned to SoMat to be reinstalled by a qualified SoMat Technician.

After locating the .mpb files and choosing either **Just Testing...** or **Really Write FLASH**, begin the upgrade by clicking **Go!**.

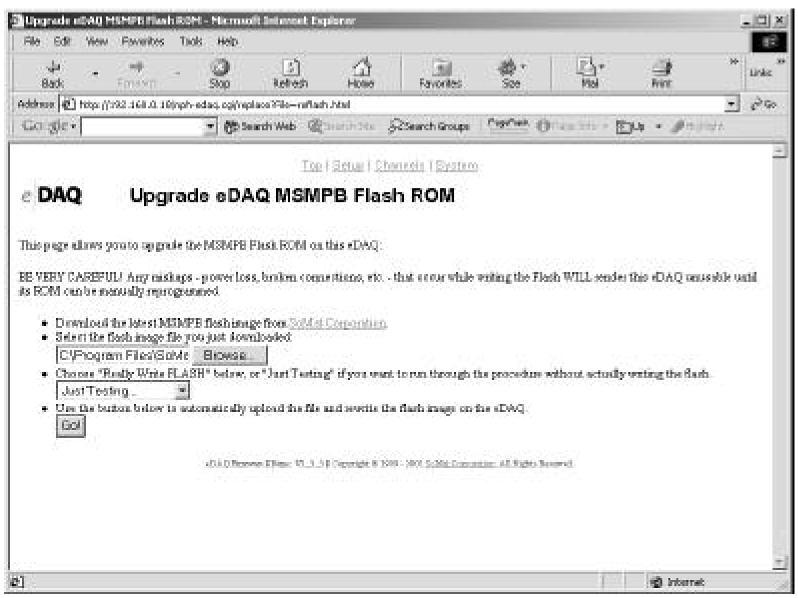


Figure D-6: Upgrade eDAQ MSMPB Flash ROM

A series of dialogs to indicate the progress of the upgrade will be displayed. At the end, a prompt will be displayed to reboot the eDAQ to finalize the upgrade.

Cycle the power on the eDAQ once the upgrade is complete. Use the Web Interface to access the eDAQ. At the bottom of every page will be the version of the Firmware installed on the eDAQ (if using versions 3.41 or greater). Use this to verify the current version of firmware, and that the upgrade was completed successfully.