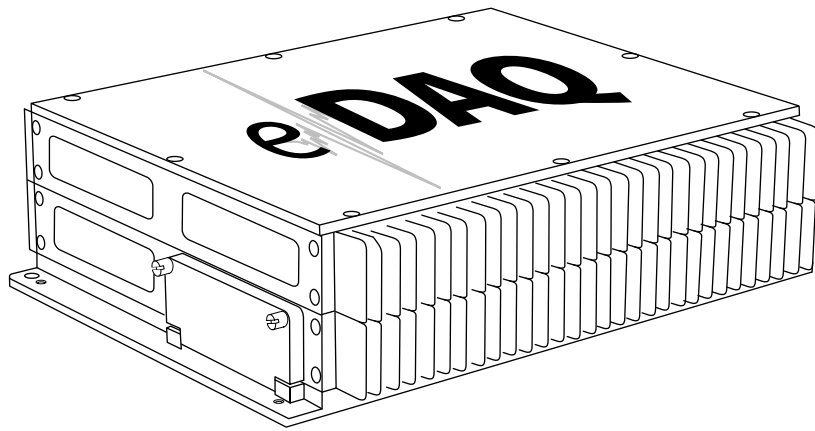
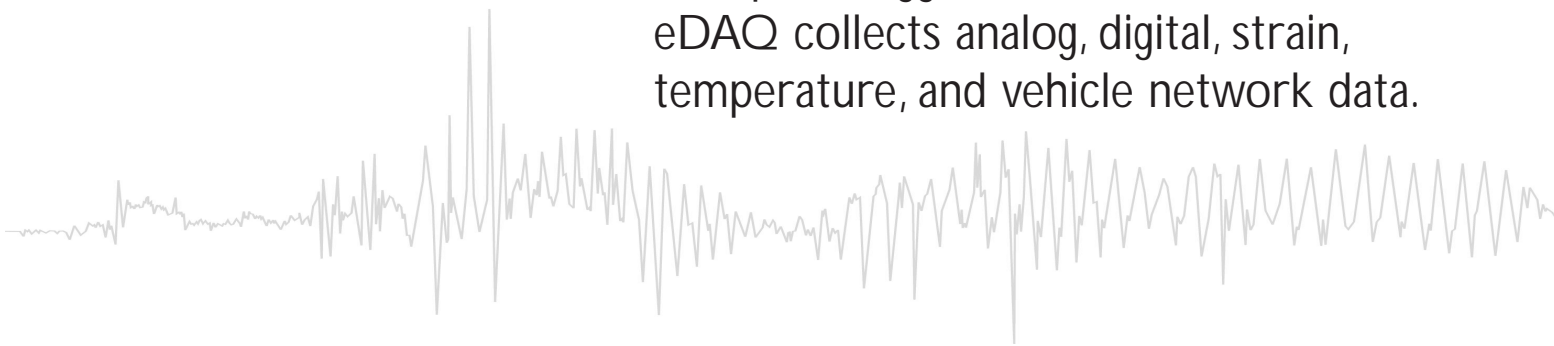


eDAQ Manual



Compact, rugged, and modular, the eDAQ collects analog, digital, strain, temperature, and vehicle network data.



This manual is for use with the SoMat eDAQ Field Computer System. This information is subject to change at any time.

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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 for the use of the eDAQ, eDAQ web interface, and SoMat Test Control Environment (TCE) software.

If more details on concepts introduced are necessary, refer to the online help system or contact SoMat.

Guide Contents

Chapter 1 • Overview of the eDAQ FCS

Introduction to the eDAQ

Chapter 2 • Setting Up the eDAQ

Description of setting up the eDAQ and the support PC

Chapter 3 • eDAQ Test Process

Description of the phases of the eDAQ test process and the actions involved in each phase.

Chapter 4 • Transducer and Message Channels

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

Chapter 5 • Computed Channels

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

Chapter 6 • DataModes

Introduces the various DataModes and explains their setup and use.

Chapter 7 • Monitoring Tests and Channels

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

Chapter 8 • TCE for eDAQ

Explanation of the basic features, functions and operation of TCE.

Chapter 9 • eDAQ Web Interface

Explanation of the basic features, functions and operation of the eDAQ web interface.

Appendix • Using Networked eDAQs

Provides details on hardware setup and test control using multiple eDAQs to acquire data synchronously.

Appendix • Technical Specifications

Provides details of technical specifications for the eDAQ Main Processor Board (MPB) and expansion layers and wire color coding and pin-outs for the cables used in conjunction with the eDAQ and expansion layers.

Conventions Used

Standard engineering abbreviations are used for this manual.

Unless stated otherwise, statements that simply reference “eDAQ” refer to both the eDAQ-Classic and eDAQ-Plus Main Processor Boards.

Related Documentation

SoMat TCE for eDAQ Release Notes and Updates to Release Notes

Release notes are distributed with every release of 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.

SoMat eDAQ Web Interface Online Help System

The online help system contained within the eDAQ web interface currently contains highly technical information regarding specific channel formats.

SoMat InField Analysis Software Online Help System

The online help system contained within the InField Analysis Software provides the most in-depth documentation of the evaluation and data manipulation tools available within the InField software package.

SoMat InField Field Analysis Software User's Guide

An optional printed guide documenting the evaluation and data manipulation tools available within the InField software package is available from SoMat Corporation.

Chapter 1 - Overview of the eDAQ FCS

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 eDAQ web interface

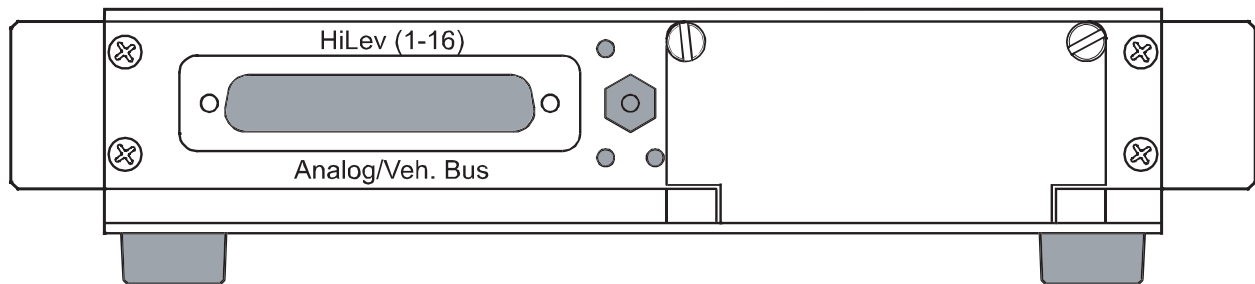
Chapter 2 of this guide explains setting up the eDAQ and the requirements for a support PC and power supply.

The eDAQ Field Computer System

Base Layer Configuration

The base layer contains the Main Processor Board and PC Card slot. When installed, the optional 16-channel High-Level Analog Board with its optional Vehicle Bus Interface is located in this layer.

Front Panel



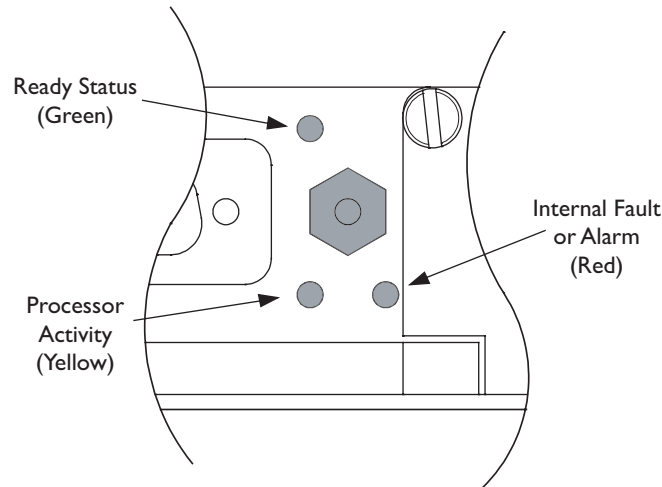
Front Panel of eDAQ

If the High Level Board is present, a 62-pin HDD-sub female connector for analog input is located on the front panel of the eDAQ. If not, the opening is covered.

The access door for the PC Card slot(s) is also located on the front panel. The eDAQ-Classic has a single PC Card slot, while the eDAQ-Plus has two.

Status LEDs

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



Status LEDs

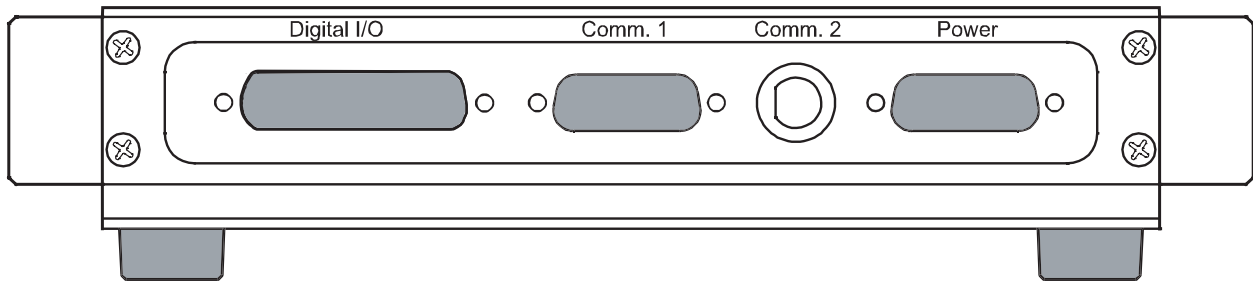
Ready Status (Green) – When lit, indicates the eDAQ is available for use; when not lit, the eDAQ is unavailable due to processor activity or an internal fault. It lights briefly during the eDAQ boot process. Once bootup is complete, this LED lights again and stays lit.

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. A description of the reason the LED is lit can be found in the eDAQ Logbook. The Logbook can be accessed through SoMat TCE or the eDAQ web interface. For more information consult the appropriate chapter in this guide, [TCE for eDAQ](#) or [eDAQ Web Interface](#).

NOTE: When the eDAQ is functioning as a slave in a group of networked eDAQs, the Ready Status (green) light will flash slowly in unison with the Processor Activity (yellow) light when a test is initialized but not currently running (i.e., the slave is waiting for the master to assert the MSR [Master Sample Rate]).

Rear Panel



Rear Panel of eDAQ

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

- A 44-pin D-Sub female connector for ten digital input/output channels and eight pulse counter channels
- A 28-pin D-Sub female connector for Ethernet and serial RS232 communications with the support PC
- A BNC Ethernet connector - Obsolete (This connector is not present on either the eDAQ-Plus or the eDAQ-Classic manufactured after October 2003).
- A 9-pin D-Sub male connector for power to the eDAQ

Technical Specifications

	eDAQ-Classic	eDAQ-Plus
Processor:	AMD Elan SC400 - 66 MHz	Geode SC3200
Memory:	4 MB SRAM 16 MB DRAM 4 MB flash memory	64 to 256 MB DRAM 2 MB flash memory 32 MB Compact Flash memory card
Operating Temp.:	-20° to 65° C	-20° to 65° C
Ethernet:	10BaseT	100BaseT

NOTE: The operating temperature range is dependent upon the configuration of the eDAQ stack. Generally, extra layers/boards installed within the eDAQ cause the upper bound of the operating temperature range to be lower than stated here.

Digital Input/Outputs (Main Processor Board)

Ten TTL level digital input/outputs are available. Each can be 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, SAC-EDIGIO.

The sample rate range 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 considered logic one (true); less than 0.5 Vdc are logic zero (false).

Pulse Counters (Main Processor Board)

The eight Pulse Counters available can count pulses or measure the time interval between pulses. The transducers are connected to the eDAQ via the 16-wire cable in the Digital I/O cable assembly, SAC-EDIGIO.

The sample rate range for the Pulse Counter input is 5 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 considered logic one (true); less than 0.5 Vdc are logic zero (false).

NOTE: For the eDAQ-Classic, the MPB board Digital Input and Pulse Counter sample rates are effectively limited to 1000 Hz or less if any other input channels are defined in the test. Attempting to use sample rates above 1000 Hz will typically result in a Missed Interrupt error. For the eDAQ-Plus, this is not an issue.

PC Card Slot

Usable PC Card Types

The eDAQ's PC Card slot accommodates Type II and III cards (hard drive or flash memory) in a variety of densities.

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

The hard drive card can be formatted with either a Linux ext2 or DOS FAT32 filesystem for use with the eDAQ. The Linux option will provide higher data throughput. Effortless formatting can be performed using the eDAQ web server interface.

The PC Card Access Door

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

Use of Ethernet

Ethernet 10BaseT can be used for communications between the eDAQ-Classic and its support PC (100BaseT for eDAQ-Plus). Data transfer rates of up to 800 KB per second for the eDAQ and of up to 4 MB per second for the eDAQ-Plus 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 crossover 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.

SoMat TCE for eDAQ Software

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

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

Test parameters set up in TCE are transferred to the eDAQ when a test is initialized. After the test has run, the resulting test data is transferred to the support PC.

TCE for eDAQ describes the TCE main window and the basics of operating TCE. Other chapters of this manual provide information on specific tasks in TCE, such as setting up input and computed channels and DataModes, controlling and monitoring tests, and so on.

SoMat InField Field Analysis Software

SoMat's InField Field Analysis Software can be used with the eDAQ to display and verify acquired test data. A Test Control module is also available for certain aspects of eDAQ test control and provides enhanced Run Time Display capabilities. More information regarding InField is available in the InField User's Manual.

eDAQ Web Interface

The eDAQ web interface can be used to perform test control operations including activating saved test initializations, starting and stopping of test runs, monitoring test status, and ending initialized tests. It can also be used to perform a number of system configuration and other utility tasks including formatting PC Cards, modifying Ethernet and serial communication settings, and upgrading eDAQ firmware with new version releases. Not all of these tasks are supported under TCE, so becoming familiar with the eDAQ web interface is necessary.

eDAQ Web Interface provides more detailed information regarding the web interface.

Chapter 2 - Setting up the eDAQ

Setup of the SoMat eDAQ Field Computer System (FCS) requires installation of SoMat Test Control Environment (TCE) on the support PC, connection of the eDAQ to its power supply and support PC, and installation of cable assemblies. This chapter describes the hardware and software provided with the eDAQ FCS, support equipment needed, and set up of the eDAQ.

What You Receive

The first time shipment of the eDAQ should contain at least the items described below. The most basic eDAQ FCS will arrive with only the hardware listed; additional hardware may be included based on options ordered. For more information regarding expansion options, see [Appendix – Technical Specifications - Layer Expansion Options](#).

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

Hardware

Provided hardware includes (part numbers are shown in brackets):

eDAQ FCS: Base layer plus optional layers ordered, if any.

Digital Input/Output (I/O) Cable Assembly: [SAC-EDIGIO] A 44-pin HDD-Sub male plug with two connector cables ending in pigtails.

Ethernet / RS232 Cable: [SAC-ESR9/XO (or optionally SAC-ESR9/HUB)] A 26-pin HDD-Sub male plug with two connector cables, one labeled either E-ETHERNET XO or E-ETHERNET HUB which ends in an RJ45 connector and the other labeled RS232 which ends in a 9-pin D-Sub female plug. The SAC-ESR9/XO is used for connection directly to the host computer, while the SAC-ESR9/HUB is used for network operations.

Power Cable: [EPWR15] A 15-pin D-Sub female plug with two connector cables ending in pigtails.

Software

SoMat Test Control Environment (TCE) for eDAQ: An installation CD (floppy disks are available upon request) with an installation document is provided. TCE creates test setup files and can be used to run tests, calibrate and verify the operation of transducers, control the eDAQ during test runs, and transfer test data to the support PC.

SoMat eDAQ web interface: Factory-installed on the eDAQ, the web interface can be used to set up communications between the eDAQ and its support PC, configure remote users, check system status, view hardware serial numbers, software version installed and ECNs completed, view configured channels, check test status, activate previously saved test initialization files, perform test control operations, end initialized tests, and transfer data files (*.SIF files) from the eDAQ to the support PC.

Documentation

Electronic copies of documentation are provided for the eDAQ: a PDF version of this manual, the SoMat eDAQ Test Control Environment (TCE) help system, and the eDAQ web interface help system.

Support Equipment

Power Supply - eDAQ-Classic

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 10–50 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 (E-DC) is available from SoMat.

Support PC

The support computer (PC) must meet these minimum requirements for TCE to operate correctly:

- 40 MB of available hard disk space
- CD-ROM drive, 3.5" floppy drive or Internet access (required for updating and installing software)
- 16 MB of RAM (32 MB recommended)
- Mouse or other pointing device
- Microsoft Windows® 95/98/NT/2000/XP
- An Ethernet card installed

NOTE: The minimum requirements necessary to run SoMat's InField Field Analysis Software are documented separately. Please consult the documentation included with InField.

Installing SoMat TCE

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 drive. Press Enter or click OK to launch the wizard that will perform the installation.

5. A confirmation dialog will appear. Click Yes to continue or No to abandon the installation process.

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

6. When prompted, enter the name of the user and company to which the software will be registered.
7. When prompted, select the default installation location 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.

8. When prompted, select the default folder for installation of the program icons.

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.

The installation process can be cancelled at any time prior to the completion of the following step. Simply select the Cancel button, and InstallShield® will remove the files installed on your hard drive.

9. At the Setup Complete dialog box, click Finish to complete the installation.

SoMat TCE eDAQ will appear in the Programs menu. See [TCE for eDAQ](#) for more information on TCE and its use.

Setting Up the System

Before Starting

The following items are necessary to the setup process.

- The eDAQ base system
- A support PC which meets the requirements previously specified
- SoMat TCE for eDAQ properly installed on the support PC
- Ethernet cable for the connection between the eDAQ and the support PC
- The eDAQ power cable
- 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

Setting up the Hardware

Follow this procedure for connecting and powering up the eDAQ system and its support PC.

NOTE: The support PC can be running during this procedure.

1. Connect the eDAQ and the support PC.
 - Ethernet connection:
 - If connecting the eDAQ directly to the PC, use the cable labeled E-ETHERNET XO.
 - If connecting the eDAQ and PC via an Ethernet network, the cable must be specifically requested from SoMat and will be labeled E-ETHERNET HUB.
 - Serial connection:
 - Use the cable labeled RS232.
 - This connection may be removed once the setup process is completed (if the support PC and the eDAQ are to be situated remotely from one another), but it may be necessary for the setup of network parameters should any difficulties arise with Ethernet communication.
2. Connect the appropriate cable(s) to the eDAQ for the type of transducers or sensors used.

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 attached. Use the red and black pigtails on the cable labeled POWER for the power connections: black to the negative (–) or ground terminal; red to the positive (+) terminal.

The other cable is for remote control of the eDAQ power and is labeled REMOTE POWER. To use it, 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 panel to apply power to the eDAQ. See [Overview of the eDAQ FCS - Status LEDs](#) for more information.

Changing the eDAQ's IP Address

In order to change the IP address of the eDAQ, communication must be established between the eDAQ and the support PC. The following sections describe the appropriate steps to follow for each of the methods of communication.

Via a Serial Connection

1. Open the HyperTerminal application.
 - Windows 95/98 From the Start menu select Programs - Accessories - HyperTerminal. Double-click the icon titled Hypertrm.exe.
 - Windows 2000/NT/XP From the Start menu select Programs - Accessories - Communications - HyperTerminal
2. Enter a name for the connection in the Connection Description dialog box. eDAQ is suggested, then click OK.
3. Select the COM port to which the eDAQ is connected from the Connect using: drop-down list, then click OK.
4. Select 19200 (eDAQ-Classic; 115200 for eDAQ-Plus) from the Bits per second: drop-down list. All other values should be left set to the default value (Data bits: 8, Parity: None, Stop bits: 1, Flow control: Hardware), then click OK.
5. Press Enter four (4) times to activate the login prompt.
6. Type "setup" as the login name, then press Enter.
7. There are four network parameters that are available for modification. Each will have a separate prompt with the current/default value appearing in brackets after the description. Enter the new value or press Enter to accept the existing value for each of the four parameters.

8. After all of the parameters have been entered, the network settings will be listed and confirmation requested prior to saving the modifications. Type yes, and press Enter to accept the changes.

```

eDAQ - HyperTerminal
File Edit View Call Transfer Help
ATE0V1S0=0
edaq47 login: setup

Enter new eDAQ network parameters: (<Enter> for current value)

Set hostname [edaq47]:
Set IP address [192.168.0.47]:
Set netmask [255.255.255.0]:
Enter 'none' to disable gateway.
Set gateway [none]:

New network settings:

Hostname:      edaq47
IP address:    192.168.0.47
Netmask:      255.255.255.0
Gateway:      none

Confirm these new settings? yes

Network settings successfully updated.  Reboot the eDAQ
for the new settings to take effect.

ATE0V1S0=0
  
```

HyperTerminal Window

9. Reboot the eDAQ to complete the procedure and allow the modifications to take effect.

Via an Ethernet Connection

1. Open a web browser on the support PC. Microsoft Internet Explorer should be installed by default with the Windows operating system. These instructions are based on IE and may differ slightly if another web browser is used.
2. Type the IP address of the eDAQ in the Address field. Press enter to open the eDAQ web interface.

NOTE A default IP address (typically 192.168.100.100) 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.

3. Click System to open the eDAQ System page.
4. Select Network Setup to open the eDAQ Network Setup page.
5. Make any necessary changes to the Hostname, IP address, Netmask, and Gateway. Check with the Network Administrator for the appropriate settings for these fields.

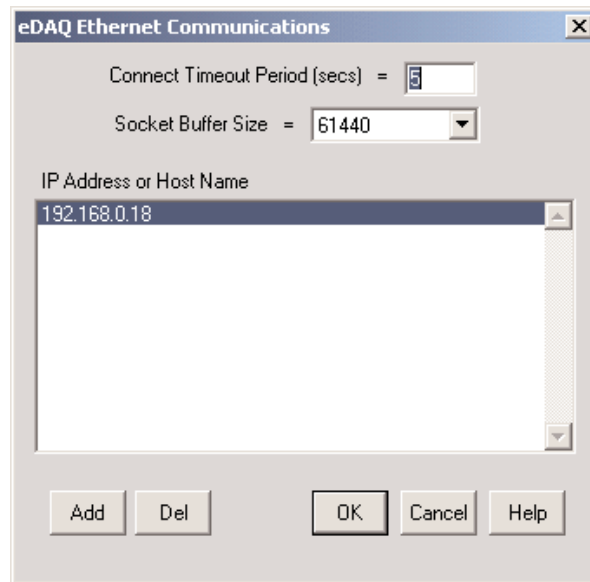
NOTE: Use dotted quad format (i.e. 192.168.100.100) for IP address, Netmask, and Gateway.

6. Click Reconfigure Network to save changes to the eDAQ.
7. Click OK to return to the eDAQ System page within the web interface.
8. Turn off power to the eDAQ, then restart for changes to take effect.

Setting Up eDAQ-PC Communication

Follow this procedure to set up Ethernet communication between the eDAQ and the support PC.

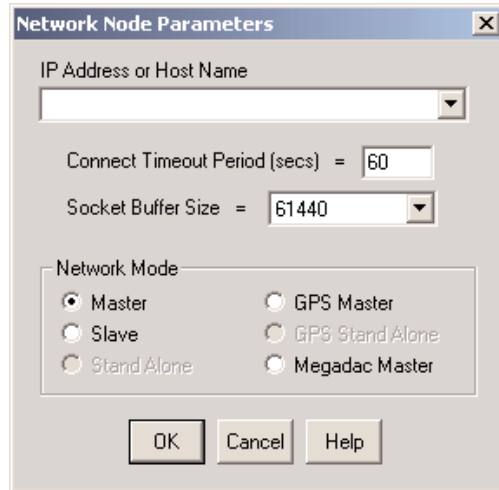
1. If the support PC is not running, turn it on, and launch Windows if it does not start automatically.
If the support PC is already running, it may be necessary to restart Windows so that it can recognize the Ethernet connection. Check the documentation for the Ethernet card if there are any problems.
2. Be sure the IP address and Network Mask are set properly 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](#)) to open communication between the PC and eDAQ.
3. Start TCE for eDAQ.
4. Open the TCE Preferences menu and select Communications. The eDAQ Ethernet Communications dialog box with a single IP address configured is shown below.



eDAQ Ethernet Communications Dialog Box

For Ethernet communications to occur, the correct IP address for the eDAQ has to be one of the entries in this dialog box and be active (highlighted when the dialog is opened).

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 before assuming failure, i.e. timeout. The TCE default value will work with most hardline Ethernet connections. Refer to the TCE online help system for more information.
6. If the correct IP address is listed for the eDAQ you are using, select (highlight) it. Skip ahead to step 9.
If the correct IP address is not listed, continue with steps 7 and 8.
7. Select the Add button. The Add Network Node dialog box opens.



Add Network Node Dialog Box

8. A default IP address (typically 192.168.100.100) 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.
Type the default IP address and click OK. (This information can be modified later as needed).
9. At the eDAQ Ethernet Communications dialog box, click OK.
10. In the TCE File menu select New Setup. This causes the five TCE setup windows to open in the work area.
11. Go to the Hardware Setup window (click on it or press F5 and F6 to move – backward and forward, respectively – between the windows) and select the Query button.

If the PC can establish communication with the eDAQ, a list of the hardware components present in the eDAQ is generated and displayed in the window.

If the PC cannot establish communication with the eDAQ, an error message appears. Click OK to clear the message window, and then check to ensure the communications cable connections are secure, the eDAQ is on, and the Ethernet card is operational.

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

Chapter 3 - eDAQ Test Process

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

- 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 correct operation.
- 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 and analyze the test data.

Phase 1: Plan the Test

There are four important questions to answer when planning a data acquisition test: Why? What? How? When?

Why is the data needed? 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?

When should this data be collected? Recording all data constantly may be unnecessary and/or undesirable. Gates and triggers may be used 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 in a 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 separate files.
- At the time and location of a test, load the particular test to be performed.

Setting up tests in advance can make running tests as simple as start and stop.

Phase 2: Prepare the Hardware

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

- The components being tested to the transducers
- The transducers to the transducer cables
- The transducer cables to the appropriate connectors on the eDAQ

Phase 3: Set Up Transducer and Computed Channels

The eDAQ collects test data from transducers and other input sources and from computed channels.

A *computed channel* is a software (or virtual) channel that is generated through the modification of the data from one or more input channels (transducer or previously-defined computed channels), control of acquisition of data based on the input channel(s), or derivation of new data from the input channels.

Setting up data channels involves the following steps.

1. Define all the transducer and message channels that will be used. [Transducer and Message Channels](#) presents a general procedure for channel definition and provides specific setup information for the each type of transducer or message channel available.

Transducer channels can be calibrated during the setup process or while the equipment is in the field. [Transducer Channels – Calibrating Channels](#) explains the procedure.

2. Set up the computed channels to be used. [Computed Channels](#) provides a general description and the setup process required for computed channels.
3. Verify all data channels are operating properly using the appropriate channel display (Scope, DVM, or Run Time Display). See [Monitoring Tests and Channels](#) for information on those displays and their use.

Phase 4: Set Up DataModes

This phase is used to select the DataModes to be used based on the type of data required, how the data is to be collected, and the channels to be used.

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

See [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 | 4. Stop the test run |
| 2. Start the test run | 5. End the test session |
| 3. Collect data | 6. Transfer test data from the eDAQ to the support PC |

Running a test can be done in any of the following ways:

- Use TCE menu commands, toolbar buttons, function keys, CTRL+[key] keyboard shortcuts, and/or Test Control Panel
- Use the InField Test Control Module toolbar buttons
- Use the eDAQ web interface in conjunction with TCE or InField

TCE Control Panel

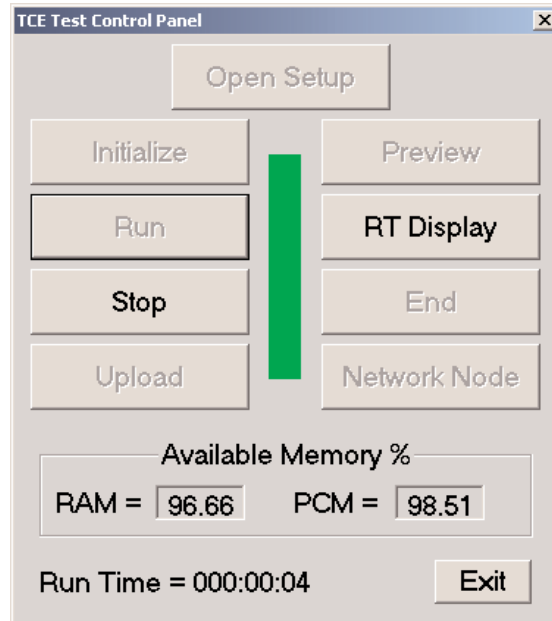
Using Buttons, Commands, and Shortcut Keys for Test Control

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

More information about the menu commands and the TCE toolbar can be found in [TCE for eDAQ](#).

TCE Test Control Panel

TCE Test Control Panel dialog box is accessed by selecting Control Panel from 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 RAM available for data storage and the available space on the card in the PC Card drive. While a test run is in progress, the total elapsed run time is also shown.



TCE Test Control Panel

Initialization Process

The initialization process prepares the eDAQ for a test to 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 PC Card. If files are on the disk, you are prompted to verify the purge.
6. Transfer the required test setup files to the eDAQ. (Progress boxes showing the names of the files being transferred 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 over-range protection is actually provided and the limits are not significantly greater than 5% for Low Level boards or 1% for High Level boards. TCE will prompt if there are any unusual situations.

NOTE: This step can be eliminated by using the Test Initialize Options available under FCS Specific Preferences.

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.

eDAQ Web Interface

The Test tab in the web interface provides general test run information and allows for the starting and stopping of a test run, getting the status of a test, transferring a SIF file from the eDAQ to the support PC, viewing test run data for initialized tests, viewing the eDAQ logbook, and getting a TCE setup file. Other test control operations currently must be performed from either TCE or the InField Test Control Module.



eDAQ Web Interface – Test tab

Information provided by this page includes the filename of the currently initialized test and the number of the next test run. The controls also allow for providing a description of the next test run.

Performing Multiple Test Runs

After a test has been initialized, multiple test runs can be started and stopped using the controls found within TCE, InField, or the eDAQ web interface. Testing can be concluded using the End Test function within TCE or InField Test Control Module.

Phase 6: Display and Analyze the Test Data

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

For information on using SoMat InField, refer to its operating manual.

Chapter 4 - Transducer and Message Channels

Channel Definitions

To acquire data during a test, channel definitions must be set up in TCE for each of the input channels to be used. Input channels can be transducer channels, message channels, or data channels derived from various message-oriented data sources.

Each channel definition contains some common information such as the ID tag, the hardware connector ID, output data type, desired full scales, output sample rate, etc. In addition, there is usually some input channel type specific information that must be defined.

Many of the input channels require that a Hardware configuration be defined prior to defining the specifics of the input channel. For example, the vehicle bus input channels available are dependent on the hardware interface (e.g., CAN) and the database file(s) that are selected in the Hardware configuration dialog.

The input channels are assigned a hardware connector ID, and this usually relates to specific pins on the hardware connector for the board in the eDAQ stack. [Appendix - Technical Specifications - Wire Color Coding and Cable Pin Outs](#) describes the pin out assignments for the various cables.

Available Channel Types

The following input channel types are currently available for the eDAQ. They are grouped according to the hardware board type.

Main Processor Board

Digital Input (MPB) – There are 10 digital input/output channels available. The user can configure any channel to be either input or output. Standard TTL switching logic is used to determine the Boolean state of the channels. Input channels are connected to the eDAQ via the Digital I/O connector on the rear panel of the MPB board.

Pulse Counter (MPB) – There are 8 digital pulse counter channels available. Standard TTL switching logic is used to determine the Boolean state of the channels. There are two basic counting modes. One mode counts pulses, and the other mode measures the time periods between pulses. Pulse counter channels are connected to the eDAQ via the Digital I/O connector on the rear panel of the MPB board.

Serial Bus (MPB) – The MPB RS-232 serial port can be used to acquire serial data streams from various sources. Specialized code must be written to deal with the specifics of the particular serial data streams. Therefore, serial data sources are supported on a custom basis for such things as serial GPS, customer specific vehicle buses, etc. A serial data source is connected to the eDAQ via the Comm-1 connector on the rear panel of the MPB board.

High Level/Vehicle Bus Board

High Level – The High Level board has 16 single ended analog channels available. The Full Scale range for each channel can be independently set to either ± 10 volts or ± 20 volts. The 16 channels are multiplexed into a 16 bit A/D converter with a channel to channel skew of approximately 25 microseconds. Transducers are connected to the eDAQ via the connector labeled HiLev (1-16)/Veh. Bus located on the front panel.

Vehicle Bus – The Vehicle Bus sub-board provides for 128 channels of vehicle bus data channels. The specific hardware interface (e.g., CAN, VPW, PWM, ISO9141) and the associated database file(s) must be defined in the Hardware configuration before individual data channels can be selected. When vehicle bus message packets are received, they are time stamped and processed into individual data streams, and then re-sampled as necessary to be output at the user-selected output rate.

Vehicle Bus Message – Raw vehicle bus packets are acquired using this input channel type. Every packet is time stamped upon receipt and can subsequently be stored in the specialized Message Logger DataMode.

Low Level Board

Low Level – The Low Level board has 8 analog channels available and supports a differential amplifier mode as well as full, half, and quarter bridge modes (selectable on a channel by channel basis). Internal and external shunt calibrations are supported. The Full Scale range for each channel can independently range from ± 3 millivolts to ± 10 volts. All 8 channels are simultaneously sampled using independent 16 bit A/D converters. Various sample rate/digital filter options are available; all 8 channels must use the same sample rate/digital filter option. Regulated excitation voltages (5, 10, 20 volts) are available; all 8 channels must use the same excitation voltage. High-level analog output signals are also available. Transducers are connected to the eDAQ via the connectors labeled LoLev (1-4) and LoLev (5-8) located on the front panel. A 4 channel ICP accelerometer adapter module is available. This ICP accelerometer adapter module is for use with a single bank (4 channels) of low level channels. A maximum of 2 modules can be used with each Low Level board.

High Level Simultaneous Sampling (HLS) Board

High Level Simultaneous Sampling – The High Level Simultaneous Sampling board has 16 differential analog channels available. The Full Scale range for each channel can independently range from ± 64 millivolts to ± 80 volts. All 16 channels are simultaneously sampled using independent 16 bit A/D converters. Various sample rate/digital filter options are available and can be selected on a channel-by-channel basis. Unregulated transducer power (in the range of 3 to 28 volts) can be set independently for each channel. High-level analog output signals are also available. Transducers are connected to the eDAQ individually via the 16 front panel Turck connectors located on the front panel. Single channel ICP accelerometer adapters are available.

Smart Modules – Smart Modules are adapters that connect to the HLS connectors and provide specialized signal conditioning as a front end to the HLS signal conditioning. Each Smart Module has independent self-identification capabilities and self-calibration parameters. Currently, a universal Smart Bridge Module is available to support full, half, and quarter bridge transducers, with internal shunt calibration capability; the Full Scale range can be configured to less than ± 1 millivolt.

Digital I/O/GPS Board

Digital Input (DIO) – There are 36 digital input/output channels available. The user can individually configure 24 of these channels to be either input or output. The other 12 channels are fixed as inputs only. The 24 configurable channels support input from 0 to +45 volts; the 12 fixed channels support inputs from -45 to +45 volts. Threshold values for determining the Boolean state of the input channels are user programmable. Input channels are connected to the eDAQ via the Turck connectors on the front panel of the Digital I/O board.

Pulse Counter (DIO) – There are 18 pulse counter channels available. The pulse counter channels share the same input lines that the digital input/output channels use. There are three basic counting modes. One mode counts pulses, another mode measures the time periods between pulses, and the other mode supports quadrature encoders. Pulse counter channels are connected to the eDAQ via the Turck connectors on the front panel.

GPS – A 12 channel GPS receiver provides standard GPS position, speed, and time data. The 1 pulse per second (PPS) signal generated by the GPS system can be used to synchronize eDAQ sample rate clocks to the GPS time base. The GPS antenna is connected to the rear panel of the Digital I/O board.

Isolated Thermocouple Board

Isolated Thermocouple – The Isolated Thermocouple board has 8 isolated thermocouple input channels available. Each board is factory configured for type T, J, K, or E thermocouples, and is operational over the full range of the thermocouple (based on the type). Each channel has independent cold junction compensation and has a notched filter processor that generates about 7 samples per second. Each channel is independently isolated from the other channels to 500 volts, which means that the thermocouples can be attached to structures that have large differences in ground potential. The thermocouples are connected to the eDAQ via the standard Omega miniature thermocouple connectors located on the front panel.

Standard Thermocouple Board

Thermocouple – The (standard) Thermocouple board has 32 non-isolated input channels available. Thermocouple types T, J, K, and E are supported, and each channel can be assigned any thermocouple type independent of the other channels. Each bank of 16 channels has independent cold junction compensation. Each channel uses a notched filter processor that generates about 7 samples per second. Since these channels are not isolated from each other, they can only be used in applications where the individual thermocouples are electrically isolated from each other. Each channel bank has a 16 channel junction box that is connected to the eDAQ with the cables provided via the connectors labeled A01-A16 and B01-B16 located on the front panel. Each thermocouple is connected to the miniature barrier strip type paired inputs in the junction box.

Simulation Channels (board independent)

Simulation FG, Simulation File, Simulation Message – 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.

Data Synchronization

eDAQ data acquisition synchronization across low level, high level, high level simultaneously sampled and most digital channels is accomplished by using a single master clock source that drives the data acquisition algorithms. The master clock runs at the user selectable master sample rate of 100,000 Hz or 98,304 Hz. There are some limitations on the synchronization of the data samples.

NOTE: In the following discussions, the term lag means that the data will appear in a Time History DataMode plot later than it should; The term lead means that the data will appear in a Time History DataMode plot earlier than it should.

NOTE: Unless otherwise noted, the following discussions and numerical examples are for the 100,000 Hz master clock rate.

Compensation for Guard Filters

The low level channels use a Butterworth 5 pole guard filter, which creates a time lag of approximately 300 to 350 microseconds and is compensated for by using a fixed value of 300 microseconds to “pre-start” data sampling. (The final “pre-start” period resolution ends up being 100 microseconds for the low level channels.) Data synchronization across low level channels will also vary slightly (probably around a few microseconds) due to variations in the guard filters.

The high level simultaneously sampled channels use a Butterworth 8 pole guard filter, which creates a time lag of approximately 100 microseconds and is compensated for by using a fixed value of 100 microseconds to “pre-start” data sampling. (The final “pre-start” period resolution ends up being 10 microseconds for the high level simultaneously sampled channels.) Data synchronization across high level simultaneously sampled channels will also vary slightly (probably around a few microseconds) due to variations in the guard filters.

Therefore, the low level and high level simultaneously sampled channels are synchronized to within less than 50 microseconds skew.

High Level to Low Level and High Level SS

The synchronization of the low level and high level simultaneously sampled channels to the first channel of the 16 multiplexed high level channels is primarily a function of the accuracy of the “pre-start” time period. As such, the synchronization is limited to about ± 50 microseconds (if the master sample rate is set at 100,000 and to about ± 60 microseconds if the master sample is set at 98,304). There is approximately a 25 microsecond skew from channel to channel for the high level channels, which means that the last high level channel will lead the first channel by approximately 375 microseconds.

Digital Inputs to Low Level and High Level SS

The digital input channels for the Digital I/O board (DIO) and the eDAQ-plus MPB boards are synchronized to the low level and high level simultaneously sampled channels within the “pre-start” discussed in the High Level to Low Level and High Level SS section above.

The digital inputs for the (original) MPB board are polled in the interrupt service routine (ISR) which is driven off the master clock. The digital inputs are always read some time after the clock pulse that sets the interrupt request (depending on other ISR activity). Therefore the (original) eDAQ MPB digital inputs are expected to lead the low level and high level channels by a variable amount. The user should assume that the digital inputs lead up to a full sample period for a worst case scenario.

Vehicle Bus and MPB Serial Bus to Low Level and High Level SS

The vehicle bus messages are time stamped as they are received by the eDAQ; the time stamps are synchronized to the same master sample clock used for all other inputs. As such, the skew (always a lag) for vehicle bus inputs is dependent on how much time elapses between the actual data sampling on the vehicle computer(s) and the time it takes for the vehicle bus message to be posted (by the vehicle computer) and read (by the eDAQ).

Standard and Isolated Thermocouple to Low Level and High Level SS

These channels will lag the other synchronized channels by approximately 70 milliseconds.

Simulation Channels to Other Channel Types

The simulation transducer channels are not synchronized to any other device types; they will typically start approximately 1 second ahead of all other device types.

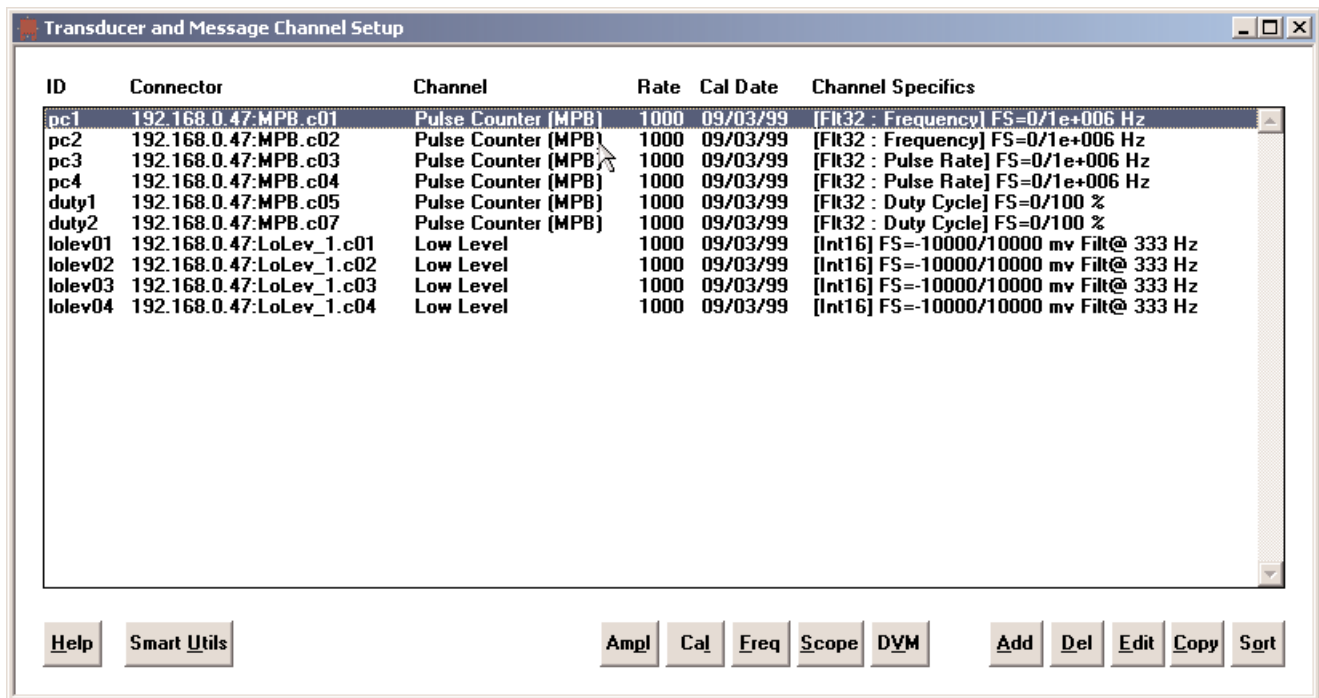
Phase Shifts

The above discussions regarding data synchronization are based on the use of either no digital filtering or the use of the Linear Phase digital filters (for the low level and the high level simultaneously sampled channels), which do not result in phase shifts. However, the Butterworth digital filters are designed to match their analog equivalents and therefore, these filters do generate phase shifts, which in turn affects synchronization with other transducer channels.

Transducer and Message Channel Setup Window

The Transducer and Message Channel Setup window is used to begin the process of defining an input channel. Previously defined channels will also be listed. Shown for each defined channel are parameters from its definition: ID, connector ID, channel type, output sample rate, calibration date, and pertinent specifics about the channel.

Additional information about this window, its buttons, and their uses can be found within the TCE online help system.



Transducer Channel Setup Window

Edit Functions

The Add, Del, Edit, and Copy buttons in the lower-right corner of the window activate the editing functions used with channel definitions. Their uses are described later in this chapter.

Display Functions

The Scope and DVM buttons allow real-time viewing of transducer and message channel output data. See [Displaying Transducer and Message Channel Output](#).

Calibrate Function

The Cal button provides access to various calibration tasks for the selected channel(s). If previously calibrated, options to check, zero adjust, or delete the calibration are provided for the current selection(s). If not previously calibrated, calibration tasks are initiated for the current selection(s). For more information see [Calibrating Channels](#).

Analysis Functions

The Freq button launches the Cumulative Spectrum Analyzer for the selected (highlighted) input channel from the Transducer and Message Channel window. This function is limited to providing information for a single channel at a time.

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

Defining a Channel

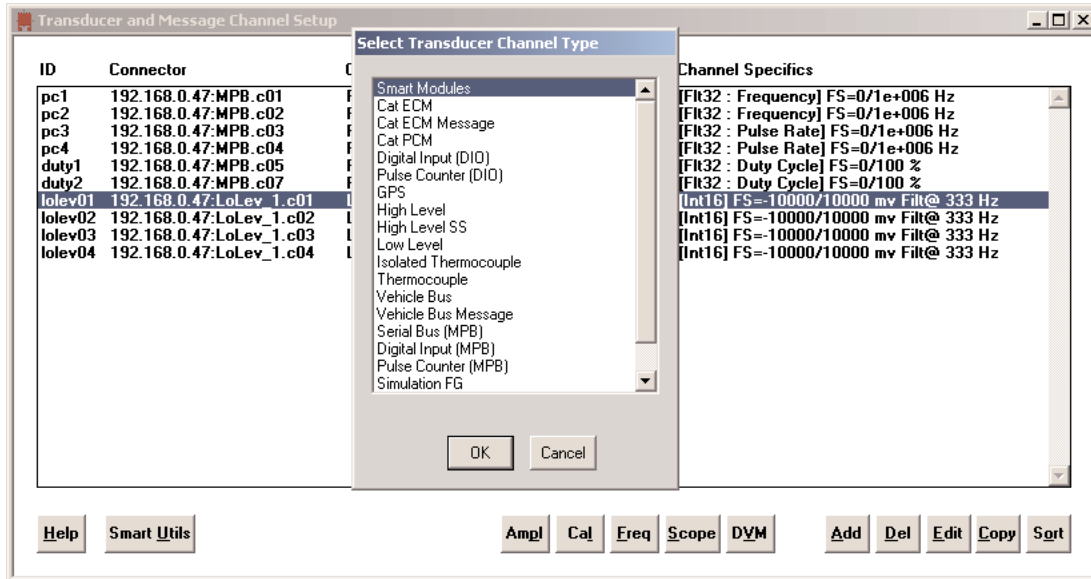
The general procedure for defining a transducer or message channel in TCE is as follows.

NOTE: You can also set up a new channel by copying an existing definition. See [Copying a Channel Definition](#) for more information.

1. Start TCE eDAQ if it is not already running.
2. Open the setup file to which the new channel should be added by selecting Open Setup from the File menu or clicking the Open Setup button on the toolbar. If the channel is to be part of a new setup, select New Setup from the File menu or click the New Setup button on the toolbar.

NOTE: If a new setup is used, it is necessary to perform a Hardware Query from the Hardware Setup window before any channels can be created. See [TCE for eDAQ - Hardware Setup](#) for more information.

3. Depending on the type of channel to be added, it may be necessary to configure certain hardware settings using the Config button in the Hardware Setup window within TCE. This is discussed as applicable in the detailed discussions for each channel type later in this section.
4. Click on the Transducer and Message Channel Setup window to make it active and bring focus to it. This can also be accomplished by pressing either F5 or F6 to scroll (forward and backward, respectively) through the setup windows.
5. Click Add.
6. Select the desired channel type from the Select Transducer Channel Type dialog box by highlighting the appropriate type and selecting OK.



Select Transducer Channel Type Dialog Box

- For most input channel types a dialog box containing a set of predefined channel configurations and a Blank (No defaults) configuration will appear. Select a input channel type from the provided list, and click OK.

Using a pre-defined channel configuration will provide a set of default parameters, which simplifies final configuration and calibration.

If this dialog box does not appear, skip to the next step.

- Enter the required parameter information in the channel definition dialog box (pages 1 and 2), then click OK.

There are many parameters that are common to all types of input channels. Descriptions of these common parameters can be found in [Common Input Channel Parameters](#). Other parameters or available values for parameters are specific to the type of input channel being defined. Information regarding these parameters and the available values can be found in the section of this chapter specific to that input channel type.

- To calibrate the channel at this point, click the Calibrate button in the lower-left corner of page 2 of the channel definition dialog box.

When calibration is completed successfully, the current date is shown in the Calibration Date box (located next to the Calibrate button in the lower-left corner of page 2), and the parameter boxes related to calibration become unavailable for editing (greyed-out).

- Click OK to save the channel definition.

The new channel appears above the highlighted channel in the Transducer and Message Channel Setup window.

Common Input Channel Parameters

Desired Measurement

ID, Channel ID – Unique identifier (ID) for the channel. This must conform to TCE ID naming conventions.

Valid TCE ID names:

- are case sensitive
- are limited to a maximum of 12 characters
- contain only valid characters (i.e., letters (a-z,A-Z), digits (0-9), and the underscore (_) character)
- start with a letter
- are not duplicates of system reserved names (sin, cos, log, etc.)

Connector – The physical attachment of the transducer to the eDAQ FCS. The name provided by default consists of the network node identifier (from the Test ID/Network Setup window), a colon, the board identifier (from the Hardware Setup window), a period, and the next available physical/logical channel for the type selected. This physical/logical channel selection can be modified by selecting another available channel from the drop-down list.

Description – A brief description (up to 63 characters) of the defined channel. Completion of this field is optional.

A preference can be set within the TCE General Preferences dialog box which will cause this value rather than the channel ID to be used as the Y-axis label in a graph of the channel data. See [TCE for eDAQ - TCE Preferences](#) for more information.

Type – Type of measurement (Strain, Load, etc.) the channel performs. This value can be selected from the drop-down list or entered using the keyboard.

Units – Unit of measurement (engineering unit) for the channel (Degrees, Volts, etc.).

Output Data Type

There are often some options provided for specifying the output data type for the various input channel types.

For example, input channel types that source from a 16-bit A/D converter (e.g., the low level, high level and high level simultaneously sampled input channels) can be configured to propagate data to DataModes or computed channels in 16-bit integer, 8-bit integer, or 32-bit floating point formats. The 16-bit integer option is generally recommended, since it consumes the least amount of data storage while maintaining full 16-bit data resolution. The 8-bit integer option can be used to further reduce data storage consumption, but significantly reduces the data resolution. The 32-bit floating point option is recommended only if the input channel is to be used in subsequent computed channels or data modes that require the input channels to be 32-bit floating point; it does not improve or degrade data resolution.

In general, the user needs to consider a number of factors when selecting the data output type, including - maintaining data resolution, mass storage consumption, and to which DataModes or computed channels the input channel will be routed.

NOTE For the eDAQ-Plus, there is minimal computational overhead in using the 32-bit floating point option; however, for the eDAQ-Classic, there is significant computational overhead.

NOTE There is an Engineering Scaler computed channel that can be used to generate a 32-bit floating point output data stream from any input channel defined with an integer output data type. Using this is recommended when the Engineering Scaler channel will be used in a Desk Calculator computed channel (which requires the 32-bit floating point data type), and the original input channel will be stored in a Time History data mode in 16-bit integer format to minimize data storage consumption.

Full Scale

Min and Max – For input channels on boards that have programmable gain and offset capabilities (e.g., low level and high level simultaneously sampled channels), the Min and Max values are used in conjunction with the calibration parameters to set the gain(s) and offset(s). The eDAQ provides some over range protection (5% on low level channels and 1% on high level simultaneously sampled channels). Therefore, if the user specifies ± 2000 microstrain for the Full Scale values on a low level channel, the eDAQ will set up the gain and offset circuitry as close as possible to ± 2100 microstrain, without going under ± 2100 microstrain.

For input channels on boards that do not have programmable gain(s) and offset(s) capabilities (i.e., most types of input channels), the Min and Max values are less critical. However, they are used for such things as setting the scales for Run Time Display plots and setting the default bin boundaries for the histogram based data modes.

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 input channel. To manually rezero the channel, select Interactive Only.

Value – Engineering value associated with the input channel when the rezero is performed. Enter a value here when specifying any Mode other than Not Applicable.

Calibration Table

Calibrating input channels 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 or message channel output signal (e.g., voltage) and the corresponding engineering units. Note that this line is dependent on the excitation settings, if an excitation signal is used for the input channel, and the bridge settings (e.g. Full 350, Quarter 120, etc.), where applicable.

Calibration Table			
	Mode	Ang Velocity	Input Signal
1	<input type="text" value=""/>	of <input type="text" value=""/>	== <input type="text" value=""/> volts
2	<input type="text" value=""/>	of <input type="text" value=""/>	== <input type="text" value=""/> volts

Sample Calibration Entries

The two rows of 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, specify either two points of the line or a single point and the slope.

Mode – Select a mode to be used for the calibration from the drop-down list. The following generic modes are applicable to all eDAQ input channels. Some types of input channels have additional calibration mode options. These are discussed later in this chapter in the section specific to the channel type.

External Value – Used to set a single point on the calibration line. During the actual calibration, the user is prompted to (externally) apply the input channel signal value that is equivalent to the specified engineering units value. The eDAQ then measures the signal voltage.

External Span – Used to set the slope of the calibration line. During the actual calibration, the user is prompted to (externally) apply two input channel signals that differ by the specified engineering units value. The eDAQ then measures the signal voltages.

Defined Value – Used to set a single point on the calibration line. Both the input channel signal value and the engineering units equivalent are to be provided.

Defined Span – Used to set the slope of the calibration line. Both the input channel signal value and the engineering units equivalent are to be provided.

Engineering units (labeled Ang Velocity in the Sample Calibration Entries graphic) — 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 to ascertain the engineering units and input signal values to be used for calibration.

Input Signal – If the Defined Value mode is used, 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 enters the resultant values in these boxes when the channel is calibrated.

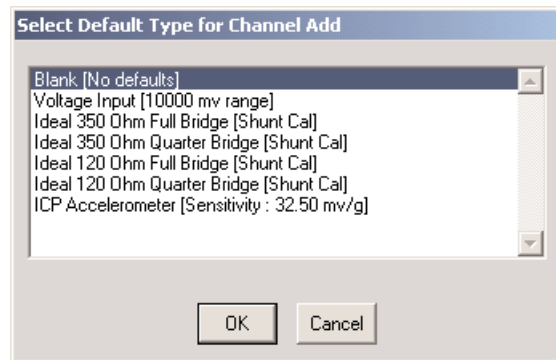
Calibration Control

Calibrate – Initiate calibration of the channel. If the calibration is successful, the current date appears in the Calibration Date box, and the boxes related to the calibration become unavailable (i.e., "greyed out") to prevent change to these parameters. After calibration is complete, the calibration must be deleted in order to change any of the definition data. See [Deleting a Calibration](#).

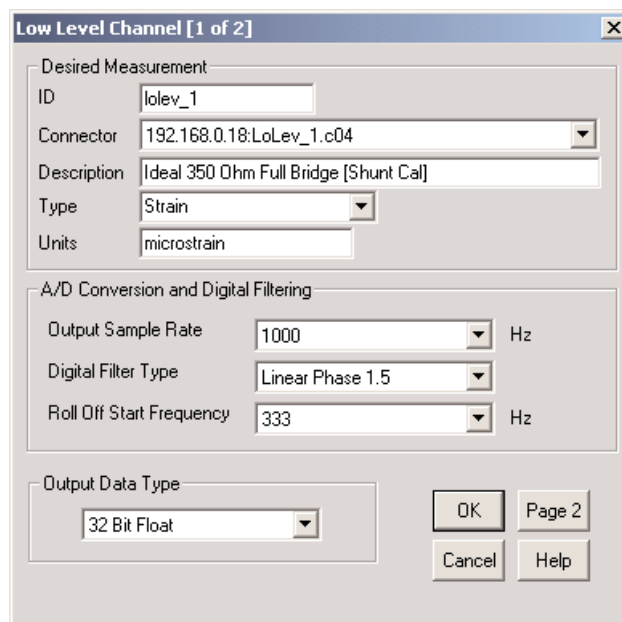
Display Control

Use the Scope or DVM buttons to view the real-time transducer and message channel output. See [Displaying Transducer and Message Channel Output](#).

Low Level Channel



Default Types for Low Level Input Channels



Low Level Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the low level input channel type. See also [Common Input Channel Parameters](#).

A/D Conversion and Digital Filtering

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

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

If a digital filter is not used, set the sample rate to at least twice the maximum frequency content of the signal. This will ensure the bandwidth of the input signal is characterized adequately.

Digital Filter Type – The type of digital filter to be used. Select the filter from the drop-list.

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

Evaluate the filter's characteristics to decide which digital filter is appropriate. For more information on digital filters and their use, refer to the TCE online help system.

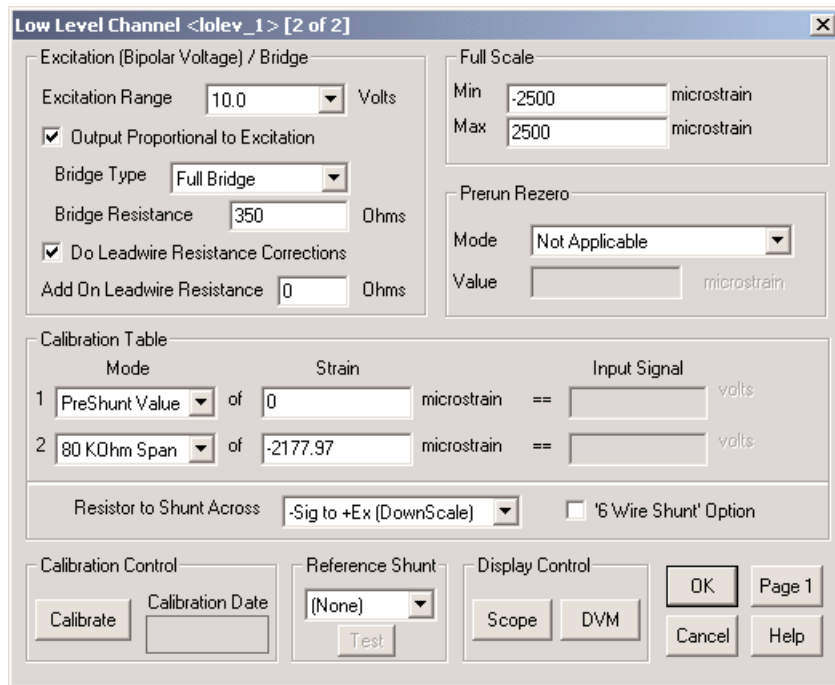
The name and function of the parameter box located directly below the Digital Filter Type is determined by the type of digital filter selected.

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

Break Frequency – 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 – The frequency at which digital filtration action begins.

TCE sets the value for these parameters based on the A/D converter rate and digital filter type in order to automatically ensure aliasing does not occur. If required, a different value can be selected from the drop-down list.



Low Level Input Channel Setup Dialog Box (Page 2)

Excitation (Bipolar Voltage)/Bridge

The fields in this group box define the setup of the input channel excitation circuits, the bridge type, and other bridge related parameters. If the input channel requires excitation, consult the manufacturer's specifications and/or suggestions for the excitation settings to be used.

NOTE: If the input channel does not use excitation, ensure the Output Proportional to Excitation check box is not checked.

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.

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

Bridge Type – Type of bridge used with the channel. Select it from the drop-down list. If a bridge is not used, select Diff Ampl (differential amplifier).

Bridge Resistance – The resistance (in Ohms) of the transducer bridge.

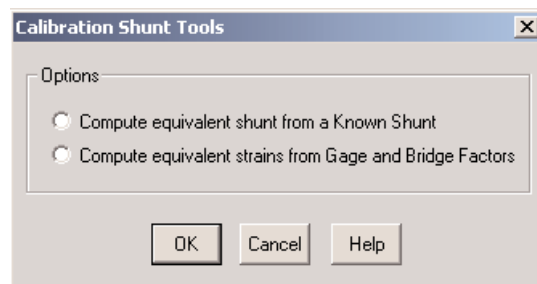
Do Leadwire Resistance Corrections – Compensate for the leadwire resistance effects during the calibration of transducer bridges and during the subsequent use of the transducer. TCE always performs this compensation when shunt calibrations are performed without the 6 wire shunt option. The user can also specify leadwire resistance compensation for transducers calibrated using either the Defined Span or the External Span calibration modes.

Calibration Table

Mode – Select a mode to be used for the calibration from the drop-down list.

In addition to the modes common to all input channel types, the following modes based on an internally applied shunt resistor to simulate strain, load, etc. are provided: 10 KOhm Span, 20 KOhm Span, 40 KOhm Span, 80 KOhm Span, 160 KOhm Span, 320 KOhm Span, 640 KOhm Span, and 1280 KOhm Span. These are used to set the slope of the calibration line. The eDAQ internally applies the selected shunt resistor across one arm of the bridge and measures the preshunt and postshunt signal voltages. The user supplies the engineering units equivalent for the span.

Selecting Shunt Tools... from the list of modes will open the Calibration Shunt Tools dialog box. These tools allow the user to indirectly define a shunt span calibration step (which consists of a FCS shunt resistor selection, e.g., 40K Ohm Span, and the desired engineering units span.)



Calibration Shunt Tools Dialog Box

Compute equivalent shunt from a Known Shunt – This shunt tool allows the user to define a calibration step consisting of the selection of any one of the FCS shunt resistors along with the corresponding equivalent engineering value based on another Known Shunt calibration.

After entering the 2 requested values, Shunt Resistor (in KOhms) and Eng Value (microstrain), a list of computed calibration step definitions is generated and displayed in the Shunt Span Equivalent dialog box. Select the desired item based on the strains that are expected to be seen in the field. TCE will initially

highlight the FCS shunt resistor that results in the engineering value that is closest to the engineering value for the Known Shunt calibration. If it is necessary to change the Known Shunt values, click the Edit Known Shunt button.

The equivalent engineering values for the FCS shunt resistors are computed using the following formula:

$$V_e = V_k * ((R_g + 2 * R_{sk}) / (R_g + 2 * R_{se}))$$

where,

- V_e = equivalent engineering units value
- V_k = known engineering units value
- R_g = nominal gage resistance
- R_{sk} = known shunt resistance
- R_{se} = equivalent shunt resistance

NOTE: Be careful to ensure that the Known Shunt calibration applies to the same leg of the bridge circuit that will be used in the FCS shunt calibration; otherwise, the polarity of the computed shunt span may be inverted.

Compute equivalent strains from Gage and Bridge factors – This shunt tool allows the user to define a calibration step consisting of the selection of any one of the FCS shunt resistors along with the corresponding equivalent strain based on the Gage Factor of the active strain gage and the Bridge Factor for the bridge configuration.

NOTE: This tool assumes that the engineering units are microstrain. If dimensionless strain units are being used, divide the equivalent strain value by 1,000,000.

A list containing the calibration step definitions is generated and displayed in the Equivalent Strain from Gage/Bridge Factors dialog box. Select the desired item based on the strains expected in the field.

The equivalent strain is computed using the following formula :

$$E_s = 1000000 * R_g / (BF * GF * (R_g + R_s))$$

where,

- E_s = equivalent strain (in microstrain units)
- R_g = nominal gage resistance
- R_s = shunt resistance
- GF = gage factor
- BF = bridge factor

NOTE: E_s is multiplied by -1.0 if the user specified resistor to shunt across results in a down scale shunt.

The Edit Gage/Bridge Factors button is enabled only for Transducer Channel types that do not define these factors directly in the Transducer Channel setup dialog window. The Gage Factor is initially set to a default value of 2.000. The Bridge Factor is initially set to either 1.000, 2.000, or 4.000 based on the defined bridge type of quarter, half, or full respectively. Both the actual Gage Factor and Bridge Factor are typically/often different from these default values. It's the user's responsibility to set the values correctly.

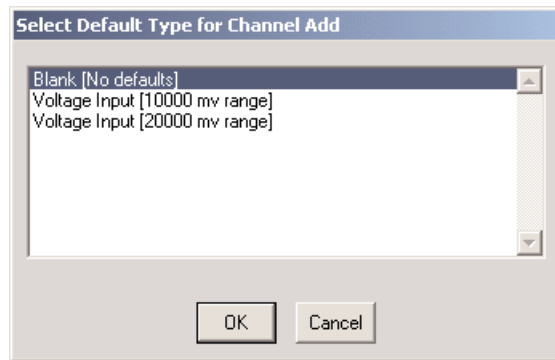
Resistor to Shunt Across – Select the desired bridge leg to shunt across if one of the calibration steps involves a shunt resistor calibration.

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

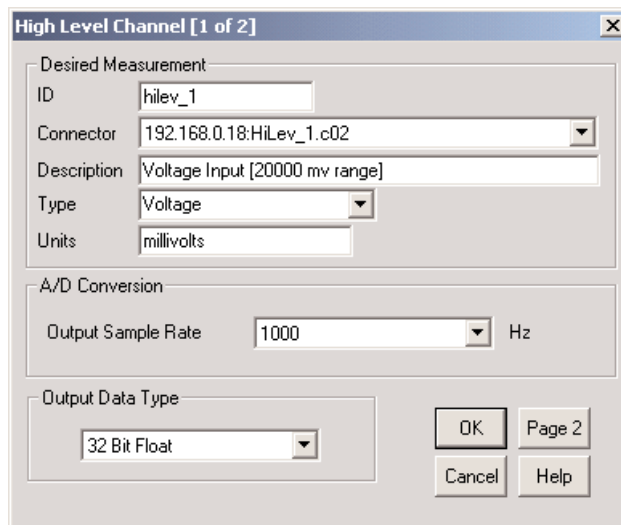
Reference Shunt

The desired shunt resistor to be used for checking the low level input channel response from test run to test run when Prerun Options – Reference Shunt Checks is enabled within TCE. Refer to the TCE online help system for more details.

High Level Channel



Default Types for High Level Input Channels



High Level Input Channel Setup Dialog Box (Page 1)

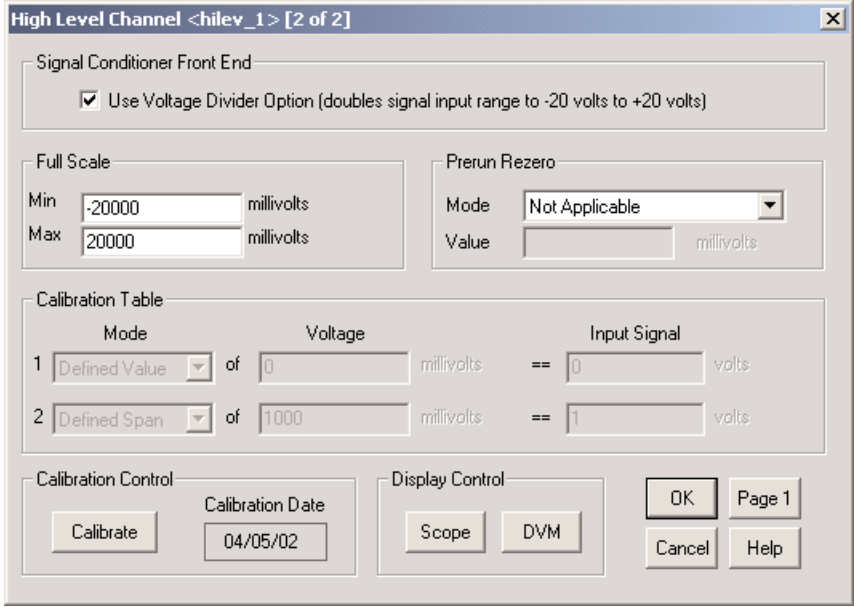
Parameters

The following parameters are specific to the high level input channel type. See also [Common Input Channel Parameters](#).

A/D Conversion

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

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.

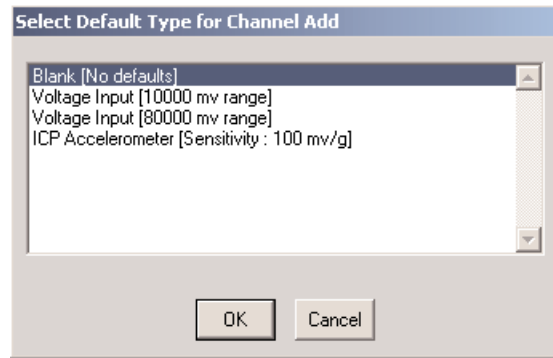


High Level Input Channel Setup Dialog Box (Page 2)

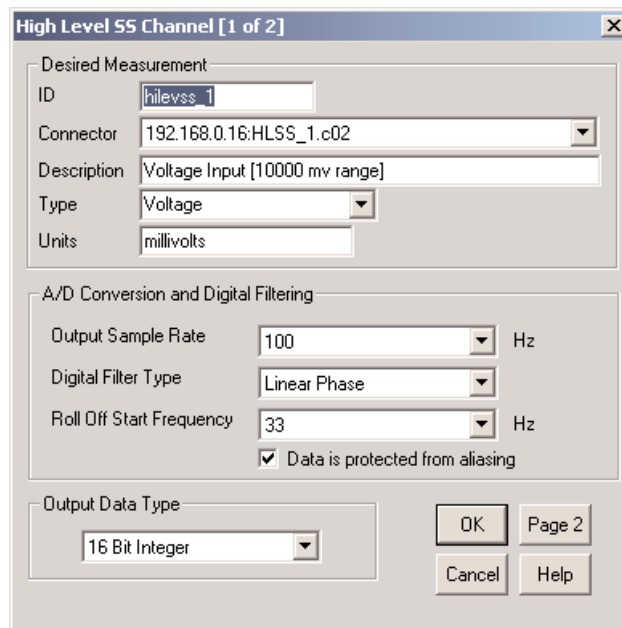
Signal Conditioner Front End

Place a check in this check box if the range of input voltages should be expanded to ± 20 V to allow for greater signal values.

High Level Simultaneous Sample



Default Types for High Level SS Input Channels



High Level SS Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the high level SS input channel type. See also [Common Input Channel Parameters](#).

A/D Conversion and Digital Filtering

Output Sample Rate – The minimum rate that ensures that the bandwidth of the input signal is completely characterized. The sample rate should be at least two times the maximum frequency content of the signal.

Digital Filter Type – Type of digital filtering to be used. Digital filters ensure that aliasing of the input signal will not occur. Always use a digital filter unless absolutely certain of the frequency content of the input signal.

Roll Off Start Frequency – The approximate frequency at which the signal starts to attenuate (i.e., starts to roll off).

Data is protected from aliasing – When checked, the current digital filter selection ensures that no aliasing occurs. This field is controlled by TCE.

The dialog box is titled "High Level SS Channel <hilevss_1> [2 of 2]". It contains several sections:

- Smart Module:** Type = None, with a Configure button.
- Signal Conditioner Front End:** A checkbox for "Use Voltage Divider (100 KOhm Impedance)".
- Transducer Power:** Power (0, 3-28 in Integer Steps) set to 0 Volts.
- Full Scale:** Min: -10000 millivolts, Max: 10000 millivolts.
- Prerun Rezero:** Mode: Not Applicable, Value: millivolts.
- Calibration Table:**

	Mode	Voltage	Input Signal
1	Defined Value	0 millivolts	0 volts
2	Defined Span	1000 millivolts	1 volts
- Calibration Control:** Calibrate button, Calibration Date: 09/25/03.
- Display Control:** Scope, DVM buttons.
- Buttons:** OK, Page 1, Cancel, Help.

High Level SS Input Channel Setup Dialog Box (Page 2)

Smart Module

Type – Type of Smart Module that is connected to this channel.

Configure – Access the applicable dialog window for defining the Smart Module specific parameters.

Signal Conditioner Front End

Place a check in this check box if the range of input voltages should be expanded to allow for greater signal values greater than $\pm 10V$.

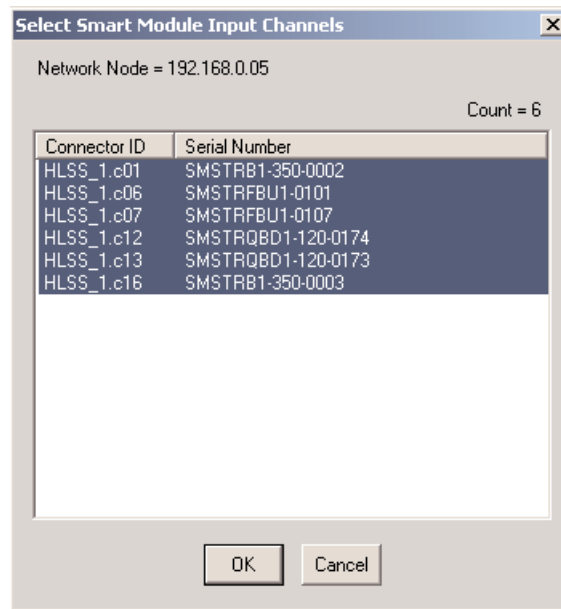
Transducer Power

Use the edit control to set the power voltage for the transducer; the power can be set from 3 to 28 volts (in integral steps of 1 volt). If the transducer does not require power, set this field to 0. The power is limited to approximately 400 milliwatts for each channel.

NOTE: For certain types of Smart Modules, this field is restricted to a fixed setting defined by the FCS.

NOTE: Power sources from multiple channels can be tied together to supply power greater than 400 milliwatts to a single transducer if this is necessary. If this is done, the user is responsible for ensuring that the same voltage setting is defined on all channels that are tied together. All such channels must be defined in the TCE channels list, even if they are used only to supply extra transducer power to another channel.

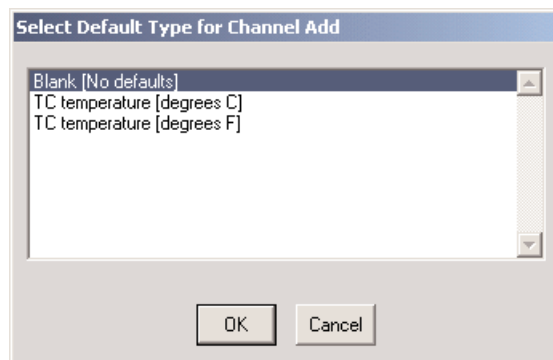
Smart Module Channel



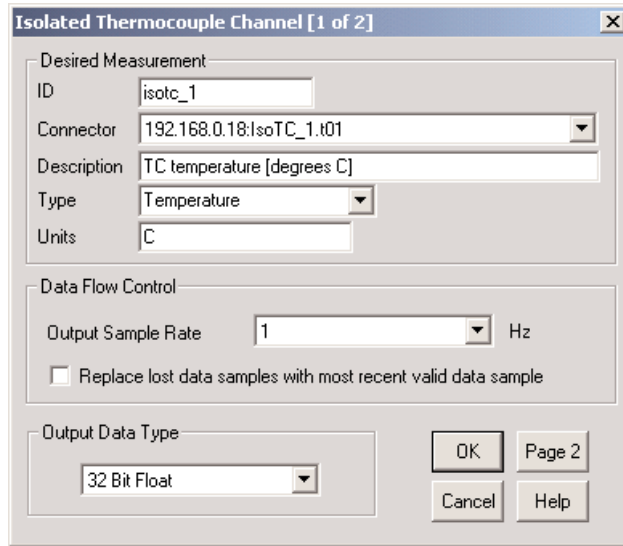
Select Smart Module Input Channels Dialog Box

Smart Module channels are created as high level SS channels. See [High Level SS Channel](#) for definition information.

Isolated Thermocouple Channel



Default Types for Isolated Thermocouple Input Channels



Isolated Thermocouple Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the Isolated Thermocouple input channel type. See also [Common Input Channel Parameters](#).

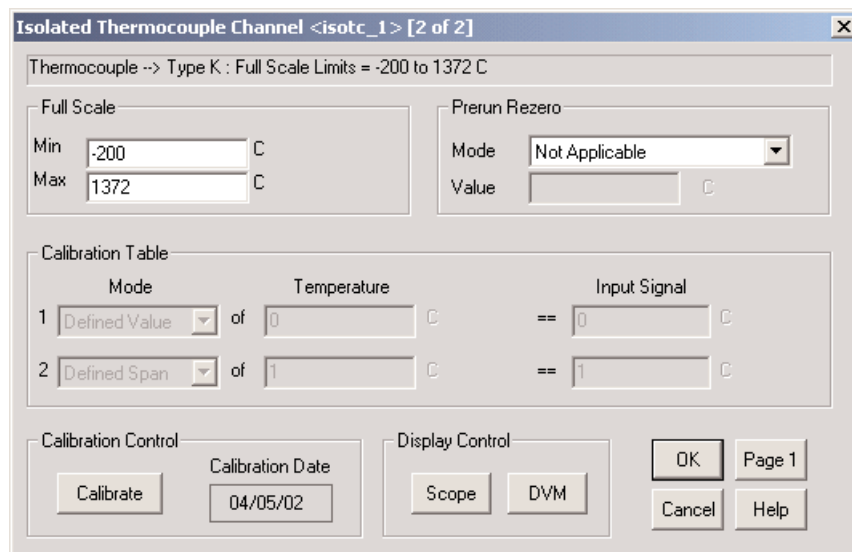
Data Flow Control

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

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.

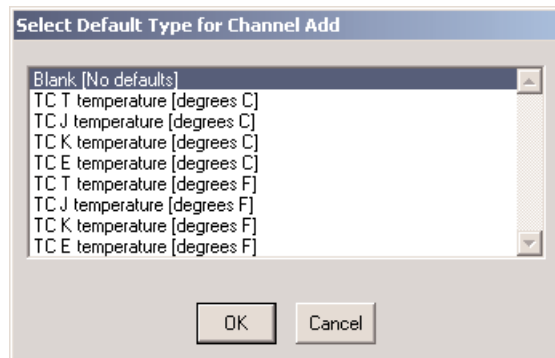
Output Data Type

The Output Data Type for all Thermocouple devices is always 32-bit float.

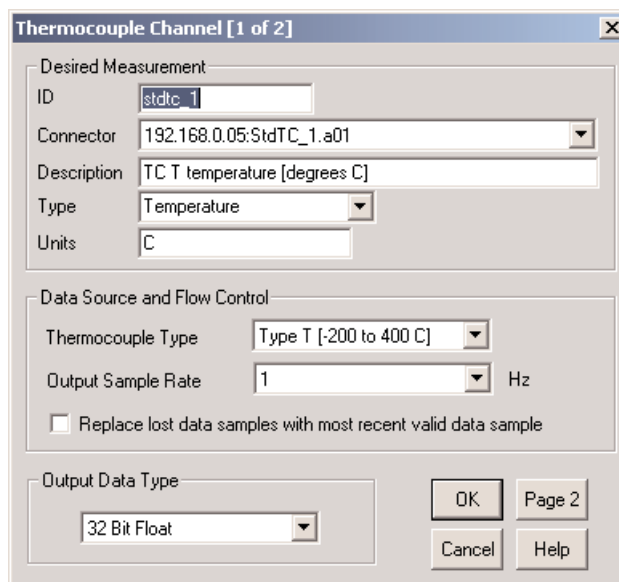


Isolated Thermocouple Input Channel Setup Dialog Box (Page 2)

Thermocouple Channel



Default Types for Thermocouple Input Channels



Thermocouple Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the Thermocouple input channel type. See also [Common Input Channel Parameters](#).

Data Source and Flow Control

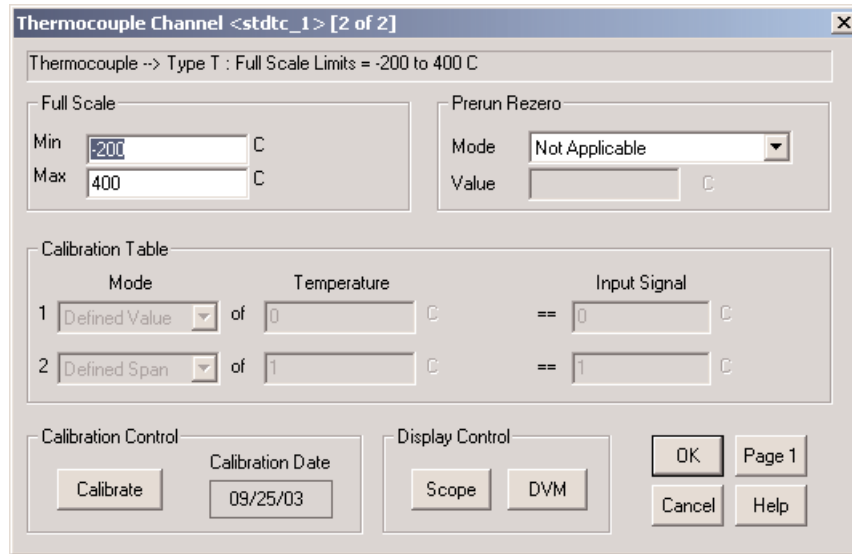
Thermocouple Type – The desired thermocouple type.

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

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.

Replace lost data samples with most recent valid data sample – Automatically fill lost data samples (that are initially assigned a value of $-1.0e+06$) with the most recent valid data sampled for the channel.

Output Data Type – The Output Data Type for all Thermocouple devices is always 32-bit float.



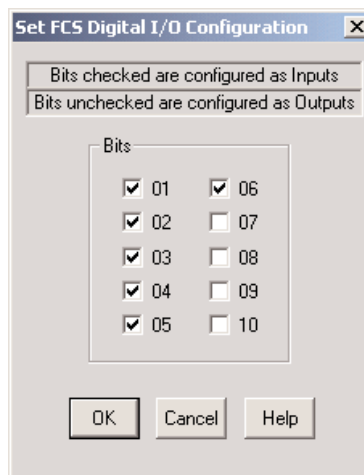
Thermocouple Input Channel Setup Dialog Box (Page 2)

Digital Input (MPB) Channel

Before Defining a Channel - Input/Output Configuration

Before defining an eDAQ-Classic or eDAQ-Plus MPB digital input channel, the ten digital I/O bits must be configured as either input or output bits.

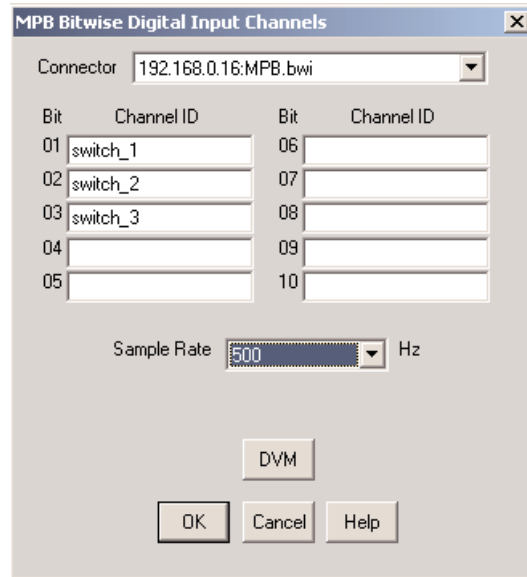
1. Select Set FCS Digital I/O from the TCE FCS Setup menu.
2. Put a check in the check box for each digit bit to be used as an input channel.



Set FCS Digital I/O Configuration Dialog Box

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

Once the bit configuration is complete, a digital input (MPB) channel can be added as described in [Defining a Channel](#).



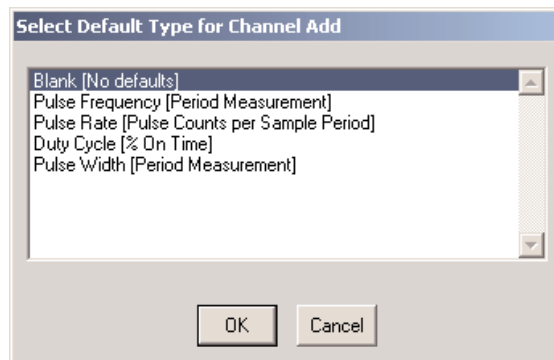
MPB Bitwise Digital Input Channels Setup Dialog Box

Parameters

The following parameters are specific to the digital input (MPB) channel type. See also [Common Input Channel Parameters](#).

Sample Rate – The rate at which the FCS samples the 10 bit digital input register.

Pulse Counter (MPB) Channel



Default Types for Pulse Counter (MPB) Input Channels

Pulse Counter Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the eDAQ and eDAQ-Plus Pulse Counter (MPB) input channel type. See also [Common Input Channel Parameters](#).

Digital Data Sampling

Sample Rate – The rate at which the FCS samples the pulse counter count register.

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 input channels 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.

Pulse Time Period – The pulse period in units of microseconds is the output parameter. The unsigned 24-bit counter can measure pulse widths from 400 nanoseconds to 3.3 seconds. This is the most efficient mode from a processing point of view.

Pulse Frequency – The pulse frequency in units of Hz is the output parameter. The measurement range is from 0.3 Hz to over 1 MHz. While this mode is more demanding computationally than the Time Period mode, it should be used where the desired measurement is (directly) proportional to frequency. This mode is available if and only if the Output Data Type is set to 32-bit float.

Pulse Rate – The number of pulse counts occurring in one sample period, in units of pulses per second (Hz), is the output parameter (e.g. at a 100 Hz sample rate, the sample period is 10 milliseconds). Use this mode in conjunction with the Integrator computed channel to measure accumulated pulse counts, or other parameters that are directly proportional to accumulated pulse counts (such as distance traveled,

revolutions, etc.). 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, however the maximum input pulse rate is limited to approximately 1.0 MHz.

Pulse Duty Cycle – The pulse duty cycle as a dimensionless ratio is the output parameter. The measurement range is from 0.0 to 1.0. In this mode, one 24-bit counter is used to measure the total pulse period (from rising edge to the next rising edge), and a second 24-bit counter is used to measure the “off time” (i.e. the time period between the falling and next rising edge). The output parameter is the ratio of the “on time” to the pulse period. This mode is available if and only if the Output Data Type is 32-bit float.

NOTE: The Pulse Duty Cycle mode uses two of the input signal lines (e.g., 1 and 2, 3 and 4, etc.) for each Pulse Counter channel defined, the input signal must be physically connected to the odd numbered input connector pin only (e.g., 1, 3, 5, or 7).

Output Data Type

Either 32-bit float or 32-bit unsigned. If 32-bit float is selected, all of the operating modes described above are available. If 32-bit unsigned is selected, only a subset of the modes are available. 32-bit unsigned is considerably more efficient from a processing perspective.

NOTE: The above mention of processing efficiency is made in reference to the eDAQ. The eDAQ-Plus has a floating-point unit; therefore the use of floating-point data types is not a significant processing issue.

The screenshot shows a dialog box titled "Pulse Counter Channel <digpc_1> [2 of 2]". It contains the following fields and controls:

- Full Scale:** Min: 0 Hz, Max: 50000 Hz.
- Prerun Rezero:** Mode: Not Applicable (dropdown), Value: Hz.
- Calibration Table:**

	Mode	Frequency	Input Signal
1	Defined Value	0 Hz	0 Hz
2	Defined Span	1 Hz	1 Hz
- Calibration Control:** Calibrate button, Calibration Date: 04/05/02.
- Display Control:** Scope, DVM buttons.
- Buttons:** OK, Page 1, Cancel, Help.

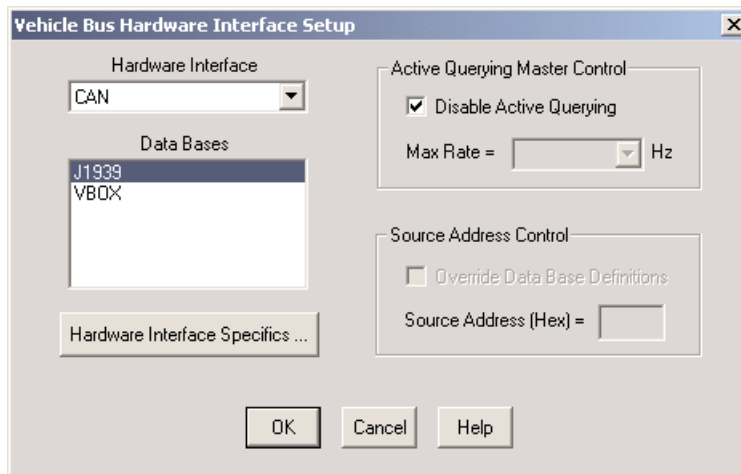
Pulse Counter Input Channel Definition Dialog Box (Page 2)

Vehicle Bus Channel

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.

Before Defining a Channel - Hardware Configuration

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.



Vehicle Bus Hardware Interface Setup

Parameters

Hardware Interface – The desired Vehicle Bus hardware interface.

Data Bases – A list of available database files

Hardware Interface Specifics – Modify configuration parameters that are applicable to specific vehicle bus hardware interface. If the button is disabled, there are no hardware specifics for the selected type of hardware interface.

Active Querying Master Control

Disable Active Querying – A checkmark indicates that active querying will be disabled for all vehicle bus input channels

Max Rate – When Active Querying is enabled, the maximum active query rate (which will override any higher query rates defined in the vehicle bus input channel setups).

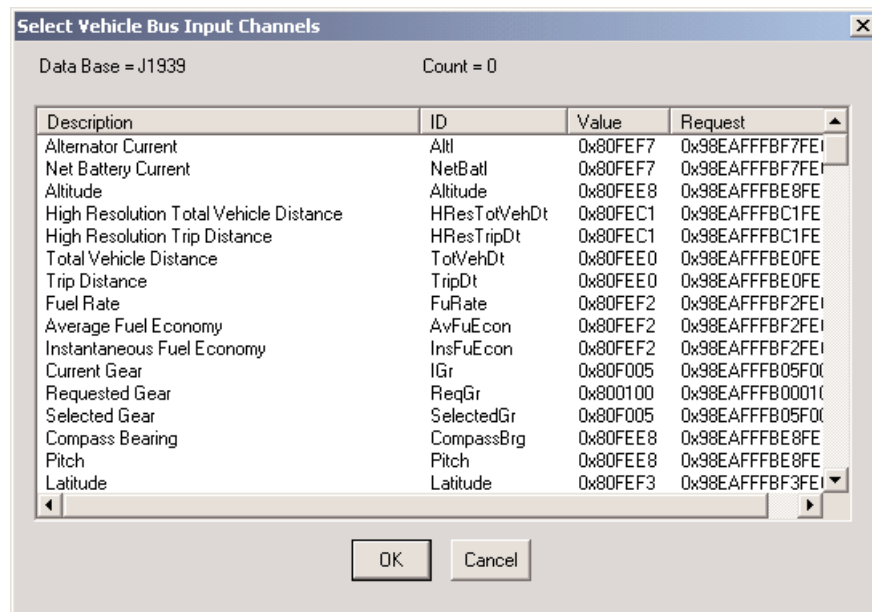
Source Address Control

Override Data Base Definitions – A checkmark indicates that the source address (vehicle bus node address) will be modified from the default database definition using the value entered in the Source Address (Hex) field.

Source Address (Hex) – The Source Address byte (in hexadecimal format) used to override the database definitions.

Selecting Channels from a Database

Once the hardware configuration is complete, a vehicle bus channel can be added as described in [Defining a Channel](#). The required parameters are imbedded within the standard definition; therefore no parameter definition dialog boxes will appear upon creation of the channel. Multiple channels can be created at one time. Select a block of channels by pressing the Ctrl key while selecting individual channels with the mouse.



Vehicle Bus Input Channels from CAN J1939 Database

To edit the definition parameters for a vehicle bus input channel, double-click on the definition line within the Transducer and Message Channel Setup window or highlight the line then click Edit. The channel definition dialog box will appear.

Vehicle Bus Channel [1 of 2]

Desired Measurement

ID:

Connector:

Description:

Type:

Units:

Data Base Info

Data Flow Control

Enable Active Querying

Desired Rate = Hz

Output Sample Rate: Hz

Stale and Invalid Data Handling

Stale Data Expiration (secs) =

Invalid Data Output Value ==>> A

Output Data Type

Raw Data Type:

Convert Raw Data to 32 Bit Float

OK Page 2

Cancel Help

Vehicle Bus Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the vehicle bus input channel type. See also [Common Input Channel Parameters](#).

Data Flow Control

Enable Active Querying – A checkmark indicates that Active Querying is enabled.

Desired Rate – The rate for Active Querying.

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

NOTE: There is limit on how much active querying can actually be done, and this limit is a function of multiple parameters including the type of Vehicle Bus, the amount of data being broadcast on the Vehicle Bus, etc. Users will need to investigate this limit on a case-by-case basis.

NOTE: Most active query requests are for packets that contain more than one vehicle bus channel. If the user specifies an active query rate of say 10 Hz for say 3 channels that have the same request message, then the eDAQ will ensure that the request is generated at 10 Hz (and not at 30 Hz). If different query rates are specified for the 3 channels, then the actual query rate is set as the maximum of the 3 channel specified query rates.

NOTE: The active querying configuration defined in this setup can be disabled (or query rate limited) by using the Active Querying Master Control setting defined in the hardware configuration dialog window.

NOTE: The same sample rate must be specified for all vehicle bus input channels for any given Vehicle Bus sub-board.

Stale and Invalid Data Handling

Stale Data Expiration (secs) – The time period for which data received will remain valid and will be used as the output data value. When the Stale Data Expiration time period elapses before new data is received, the Invalid Data Output Value will be used as the output data value.

NOTE: Input of a time period less than the sample rate period will cause the eDAQ to override the Stale Data Expiration value and set it so that data will not expire in one sample period or less.

Invalid Data Output Value – The value that will be substituted for all data that is flagged as invalid.

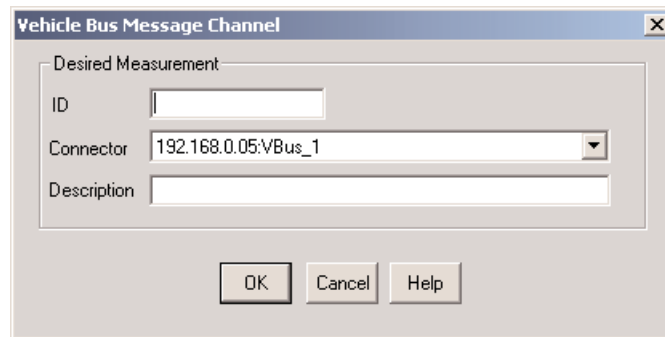
Output Data Type

Raw Data Type – Typically, the data type defined in the database (i.e., 8-bit unsigned, 16-bit unsigned, or 32-bit unsigned); however, for database bit sizes other than 8, 16, or 32, the raw data type is promoted to one of these 3 bit lengths (e.g., a 1-bit unsigned is promoted to 8-bit unsigned, a 24-bit unsigned is promoted to 32-bit unsigned, etc.)

Convert New Data to 32 Bit Float – Optionally set the output data type to 32-bit float.

Vehicle Bus Input Channel Setup Dialog Box (Page 2)

Vehicle Bus Message Channel



Vehicle Bus Message Input Channel Setup Dialog Box

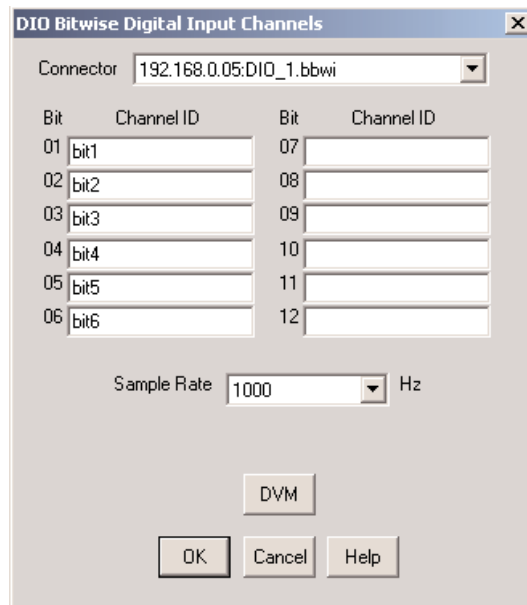
Parameters

There are no parameters specific to the vehicle bus message input channel type. See [Common Input Channel Parameters](#).

Serial Bus (MPB) Channel

The process by which a Serial Bus (MPB) channel is defined is identical to the definition process for the [Vehicle Bus Channel](#).

Digital Input (DIO) Channel



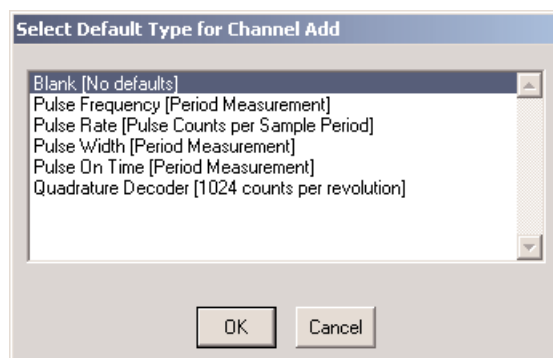
DIO Bitwise Digital Input Channels Dialog Box

Parameters

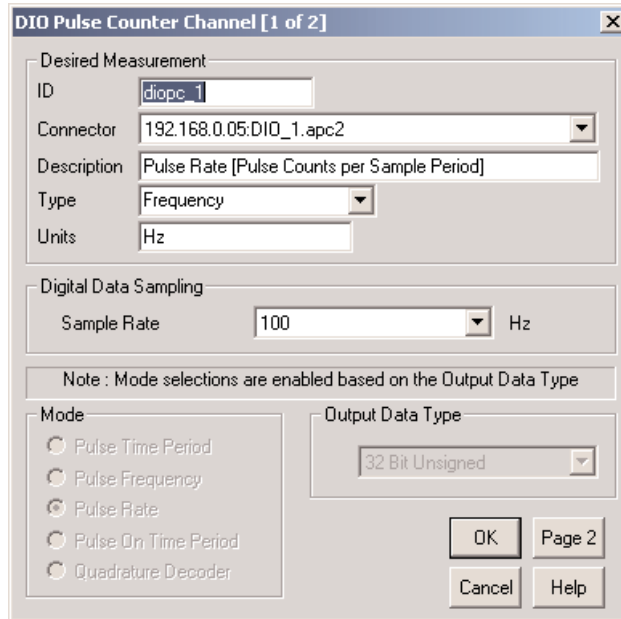
The following parameters are specific to the digital input (DIO) channel type. See also [Common Input Channel Parameters](#).

Sample Rate – The rate at which the FCS samples the digital input channels.

Pulse Counter (DIO) Channel



Default Types for Pulse Counter (DIO) Input Channels



Pulse Counter (DIO) Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the Pulse Counter (DIO) input channel type. See also [Common Input Channel Parameters](#).

Digital Data Sampling

Sample Rate – The rate at which the FCS samples the pulse counter count register.

Mode

Pulse Time Period – The pulse period in units of microseconds. The unsigned 32-bit counter can measure pulse widths from 200 nanoseconds to well over 100 seconds. This mode is the most efficient from a processing point of view.

Pulse Frequency – The pulse frequency in units of Hz. The measurement range is from well under 0.01 Hz to over 1 MHz. While this mode is more computationally demanding than the Pulse Time Period mode (since it requires a divide operation) it should be used where the desired measurement is (directly) proportional to frequency. This mode is available if and only if the Output Data Type is 32-bit float.

Pulse Rate – The number of pulse counts that occur in one sample period in units of pulses per second (i.e., Hz). Use this mode in conjunction with the Integrator computed channel to measure accumulated pulse counts, or other parameters that are directly proportional to accumulated pulse counts (such as distance traveled, revolutions, etc.). Over 4 billion counts can be accumulated in each sample period; however, the maximum pulse rate is limited to approximately 1.0 MHz.

Pulse On Time Period – The time period that the pulse is at logic 1 in units of microseconds. The unsigned 32-bit counter can measure pulse on time widths from 200 nanoseconds to well over 100 seconds. This mode can be used in conjunction with the mode to compute duty cycles.

Quadrature Decoder – The encoder position in terms of the accumulated encoder counts. The signed 32-bit counter can accumulate over 2 billion counts in either direction before the counter rolls over.

NOTE: Quadrature Decoder channels are rezeroed (or Calibration “Zero Adjusted”) in a special way. The internal counter value is always reset to 0 before any rezero or Zero Adjust is performed.

Output Data Type

If the 32-bit float data type is selected, then the user can use any of the operational Modes described below. If the 32-bit signed or unsigned type is selected, then only a subset of the operational Modes will be available. For the eDAQ-Classic the 32-bit signed or unsigned data type is considerably more efficient from a processing point of view.

Pulse Counter Channel <diopc_1> [2 of 2]

Full Scale
 Min: 0 Hz
 Max: 1e+006 Hz

Prerun Rezero
 Mode: Not Applicable
 Value: Hz

Calibration Table

	Mode	of	Frequency		Input Signal
1	Defined Value		0 Hz	==	0 Hz
2	Defined Span		1 Hz	==	1 Hz

Calibration Control
 Calibrate
 Calibration Date: 10/02/03

Display Control
 Scope DVM

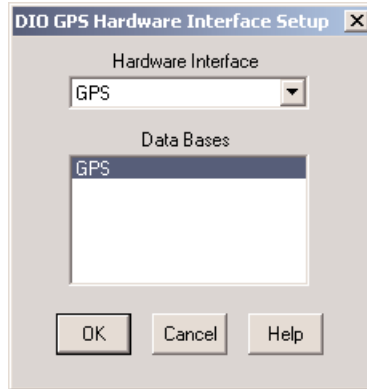
OK Page 1
 Cancel Help

Pulse Counter (DIO) Input Channel Setup Dialog Box (Page 2)

GPS

Before Defining a Channel - Hardware Configuration

The Digital GPS board must be configured prior to the addition of any GPS input channels. To perform this configuration, open the Hardware Setup page by pressing F1 or selecting the window with the mouse. Highlight the Digital GPS board, then click Config. This will open the DIO GPS Hardware Interface Setup dialog.

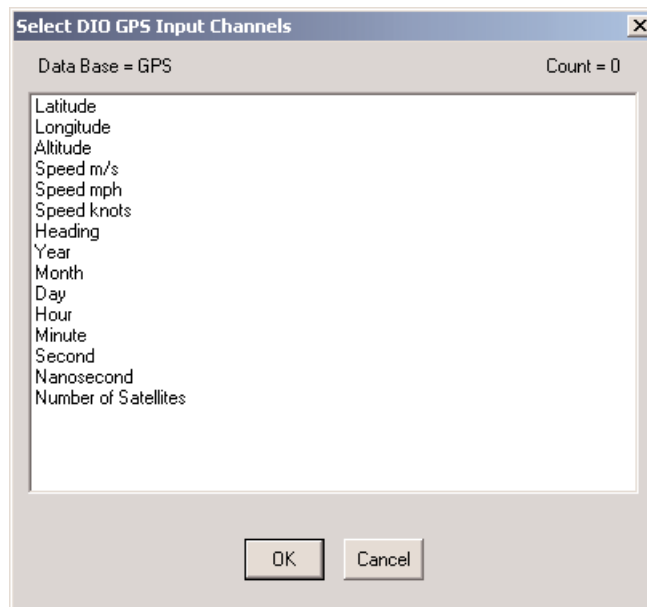


DIO GPS Hardware Interface Setup

Select one or more of the database files from the list to complete the configuration of the hardware.

Selecting Channels from a Database

Once the hardware configuration is complete, a GPS channel can be added as described in [Defining a Channel](#). The GPS input channel setups are always loaded from a database file; therefore, the information required for each of the channel definition parameters will be available after the database is loaded. No parameter definition dialog boxes will appear upon creation of the channel(s). Multiple channels can be created at one time. Select a block of channels by pressing the Ctrl key while selecting individual channels with the mouse or by click-and-drag for selection of a contiguous block of channels.



Digital GPS Input Channels from GPS Database

To edit the definition parameters for a GPS input channel, double-click on the definition line within the Transducer and Message Channel Setup window or highlight the line then click Edit. The channel definition dialog box will appear.

GPS Input Channel Setup Dialog Box (Page 1)

Parameters

The following parameters are specific to the GPS input channel type. See also [Common Input Channel Parameters](#).

Data Base Info – Open a read-only dialog containing a summary of database parameters.

Data Flow Control

Enable Active Querying – This parameter is not applicable to GPS and is greyed out.

Desired Rate – This parameter is not applicable to GPS and is greyed out.

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

Stale and Invalid Data Handling

Stale Data Expiration (secs) – The time period for which data received will remain valid and will be used as the output data value. When the Stale Data Expiration time period elapses before new data is received, the Invalid Data Output Value will be used as the output data value.

NOTE: If the user inputs a time period less than the sample rate period, the eDAQ will override the user input Stale Data Expiration value and set it so that data will not expire in one sample period or less.

Invalid Data Output Value – The value that will be substituted for all data that is flagged as invalid.

Output Data Type

Raw Data Type – Typically, the data type defined in the database (i.e., 8-bit unsigned, 16-bit unsigned, or 32-bit unsigned); however, for database bit sizes other than 8, 16, or 32, the raw data type is promoted to one of these 3 bit lengths (e.g., 1-bit unsigned is promoted to 8-bit unsigned, a 24-bit unsigned is promoted to 32-bit unsigned, etc.)

Convert Raw Data to 32 Bit Float – Optionally set the output data type to 32-bit float.

GPS Input Channel Setup Dialog Box (Page 2)

Calibrating Channels

General

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

- Click the Calibrate button in the lower-left corner of Page 2 of the channel definition dialog box while defining or editing a channel.
- Highlight the channel or set of channels to be calibrated, then click the Cal button in the Transducer and Message Channel Setup window.

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

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

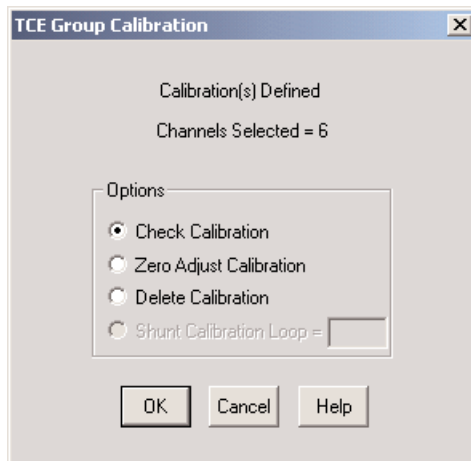
Once a channel is calibrated, the calibration date is shown in the Calibration Date box in the channel definition dialog box and the Cal Date column of the Transducer and Message Channel Setup window, and the parameter definition boxes related to calibration become unavailable for editing (greyed-out) in the channel definition dialog boxes. See [Deleting a Calibration](#) for information regarding changing the calibration parameters after calibration is completed.

TCE Calibration Dialog Box

Use the TCE Calibration dialog box to check channel calibrations, delete calibrations, and perform zero adjustments on channel calibrations. The Calibration dialog box is only available when working with calibrated channels.

The TCE Calibration dialog box can be accessed by clicking the Calibrate button within the channel definition dialog box or by clicking the Cal button within the Transducer and Message Channel Setup window.

The appearance of the dialog is determined by the channel(s) selected when it is opened. When a single channel is selected, the dialog box is titled with the channel's ID, and the calibration date is displayed. When selecting two or more channels, the dialog box is titled TCE Group Calibration, and the number of channels selected is displayed.



TCE Calibration Dialog Box (Multiple Channels Selected)

Options

Check Calibration – Perform a calibration run and display a graph and numeric data comparing the original calibration with the one just performed. See [Checking a Calibration](#).

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

Zero Adjust Calibration – Adjust for a small difference between the original zero setting used in calibration and the zero setting required for actual measurement (i.e. compensate for “zero drift” common with many input channels).

TCE first prompts for input of the engineering value equivalent to the current input channel states. Next, the FCS measures the current input channel 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. The zero setting is permanently modified. Due to this fact, it is recommended that the calibration be deleted and the channel be recalibrated instead of using this option.

Delete Calibration – Deleting the calibration clears the calibration date field. Calibration-related fields in the channel definition dialog box can then be edited and the channel recalibrated.

Shunt Calibration Loop – This option is provided primarily for SoMat development purposes in verifying the reliability and accuracy of Low Level board shunt calibrations. It is available only when one or more low level channels defined to use shunt calibrations were selected in the transducer and message 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 effect on any existing calibration.

Recalibrating a Channel

To recalibrate a channel, delete the current calibration. See [Deleting a Calibration](#). Then perform a new calibration.

Deleting a Calibration

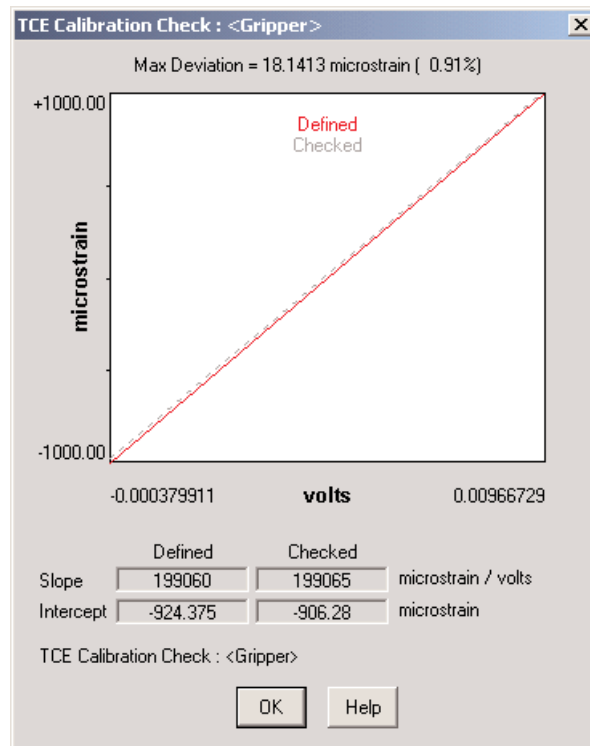
Select the channel(s) from which calibration information should be removed. Open the TCE Calibration dialog box as described in [TCE Calibration Dialog Box](#). Select the option Delete Calibration in the Options group box. Click OK to complete the deletion.

Checking a Calibration

Select the channel(s) which require calibration to be checked. Open the TCE Calibration dialog box as described in [TCE Calibration Dialog Box](#). Select the option Check Calibration in the Options group box.

If checking one channel, a TCE Calibration Check window opens showing the maximum deviation found and the defined and measured (checked) calibration values. Click OK to close the display.

If two or more channels are selected, 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. The More Info button provides access to the TCE Calibration Check window for the highlighted channel in the summary window. Click OK to close the summary.



TCE Calibration Check Display

Displaying Transducer and Message Channel Output

There are multiple ways in which to view real-time transducer and message channel output. The manner in which the displays are accessible is dependent upon the state of the eDAQ (i.e. no test initialized or running, test initialized, and test initialized and running.)

To display transducer and message channel output when there is no test initialized or running, use the Scope and DVM buttons in channel definition dialog boxes or in the Transducer and Message Channel Setup window. When a test is initialized but there is no test run in progress, use the Scope and DVM displays found within Prerun Options - Transducer Checks located in the Test Control menu. When there is a test run in progress, use Run Time Display within the Test Control menu.

The DVM Display shows the transducer and message channel 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 or input channel 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 (an option is available to display the reading in signal units.)

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.)

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

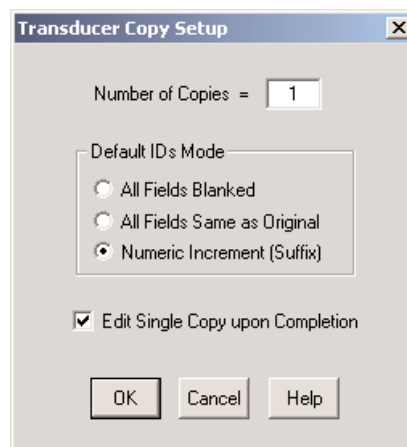
See [Monitoring Tests and Channels](#) for more information on these displays.

Copying a Channel Definition

The Copy function allows one or more copies of an existing channel definition to be created to define new input channels. The minimum input required is assigning an ID name to the new channel; other defined data can be modified as needed for the new channel.

To add a new channel by copying an existing definition:

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



Transducer Copy Setup Dialog Box

3. Specify how many copies should be created in the Number of Copies: text box. The number of connectors available for the input channel type limits the maximum number of copies which can be created.
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:

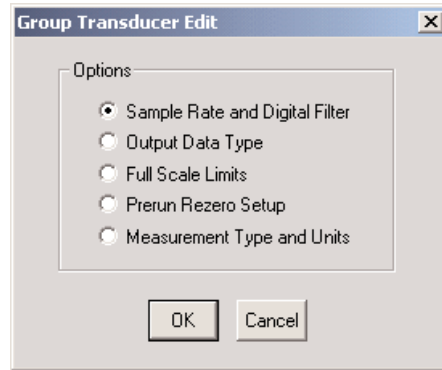
All Fields Blanked – The original ID will not appear in the Channel ID field of the new channel definition dialog box.

All Fields Same as Original – The default ID name will appear in each of the ID boxes for the new channels.

Numeric Increment (Suffix) – TCE automatically names all the new channels by using the default ID name with a sequence number appended 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.

5. When creating a single copy of a channel, select the Edit Single Copy Upon Completion option to automatically open the channel definition dialog box for the new channel after it is created.
6. Click the OK button.
7. The Edit Transducer ID dialog box will open when creating multiple copies or when creating a single copy with either the All Fields Blanked or All Fields Same as Original option. Enter the channel ID for the new channel(s), and click OK to close the dialog box and save the changes.



Group Transducer Edit Dialog Box

3. Select the type of definition data to modify and click OK. The options provided for group editing vary based on the input channel type.

A dialog box for the input channel and data type to be modified appears. It contains the applicable boxes from the original channel definition dialog box.

4. Modify the data as needed and click OK to save the changes.

Deleting a Definition

1. Select the channel(s) to edit from the channel list in the Transducer and Message Channel Setup window.
2. Select the Del (Delete) button.
3. Click Yes in the confirmation dialog to delete the definition(s). To cancel the delete process, click No.

Chapter 5 - Computed Channels

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 generate a channel having a higher or lower sample rate (using Up Sample or Down Sample), be constructed from data using a mathematical formula or expression (using the Desk Calculator), integrate data samples (using the Integrator), etc.

Types of Computed Channels

There are two basic types of computed channels. Although all of the Computed Channels are derived from previously defined channels, the difference between the two types lies in how the definition parameters are determined. The first type inherits some of the definition parameters from the channel on which it is based. The required parameters for this Computed Channel type are a unique ID and selection of the channel upon which the new channel is to be based. The other type is defined in the same manner as the transducer and message channels; the values for the parameters are provided when the channel is created.

Computed Channels with Inherited Parameters

Down Sample – Generate an output channel at a lower sample rate than the input channel. Samples are extracted from the input channel data at an interval determined by a user-specified decrement factor.

Engineering Scaler – Generate an output channel with floating point data type from an input channel with integer data type.

Max Track – Generate an output channel that tracks the maximum value for the input channel data.

Min Track – Generate an output channel that tracks the minimum value for the input channel data.

Range Track – Generate an output channel that tracks the maximum range for the input channel.

Smooth Filter – Generate a smoothed representation of the input channel in 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 – Generate an output channel either leading or lagging the selected input channel by a user-defined number of samples.

Up Sampler – Generate an output channel with a higher sample rate than the input channel by echoing (repeating) each sample in the input channel a certain number of times during the interval between input samples.

Computed Channels with Defined Parameters

Desk Calculator – Generate data streams with either arithmetic results (floating point) or logical results (Boolean) based on a mathematical expression or specified formula.

Integrator – Generate 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.

Interactive Trigger – Provide a means to trigger data modes and computed channels directly from TCE.

Pulse Counter – Measure 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.

State Mapper – Map the input channel into a discrete state output channel, based on a set of mapping conditions defined by the user. Each mapping condition is defined in terms of a minimum input value, a maximum output value, and the associated output state value.

Test Run Stopper – Provide a method of stopping a test based on an assigned input channel. It should be noted there are some cases in which the test may require a few seconds.

Time Channel – Provide a time base channel for use in other computed channels and/or storage in various SoMat DataModes.

Timed Trigger – Generate a logical channel used for triggering DataModes or other Computed Channels. The input to the Timed Trigger can be any logical channel setup within TCE. The trigger created can be defined with optional sustain and delay periods on a variety of conditions.

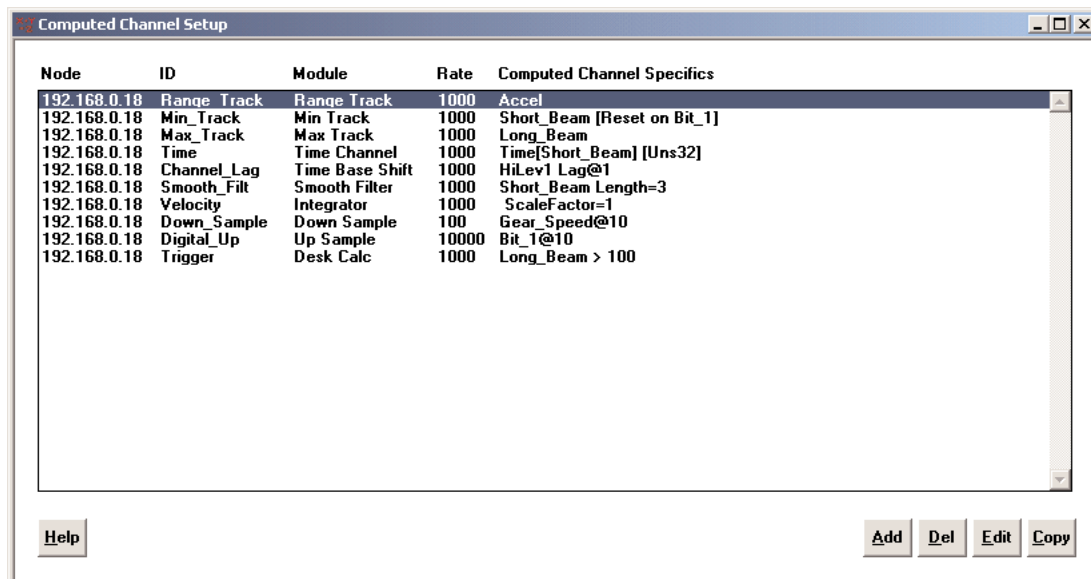
Trigger Generator – Generate a trigger channel consisting of an optional initial delay period followed by a repetitive cycle of “on” periods (i.e. logical True) and “off” periods (i.e. logical False). This channel type is typically used as an elapsed time trigger for SoMat DataModes or other computed channels that support triggering.

Valid Data Gate – 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.

Computed Channel Setup Window

The Computed Channel Setup window is used to begin the process of defining a computed channel. Shown for each defined channel are parameters from its definition: Network Node, ID, module type, output sample rate, and pertinent specifics about the channel.

Additional information about this window, its buttons, and their uses can be found within the TCE online help system.



Computed Channel Setup Window

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 described later in this chapter.

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 the order in which they are 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.

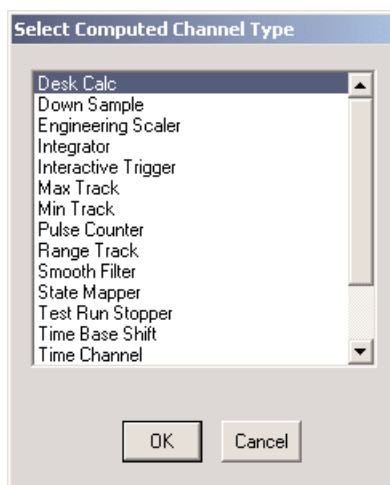
NOTE: The Add button inserts the new definition above the highlighted channel in the list. To add a channel at the end of the list, highlight the empty line at the bottom of the list then click Add.

The Definition Process

Before beginning the definition process for 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 necessary, after defining the Computed Channel.

Follow these steps to define a computed channel.

1. In TCE, open the setup file in which the channel is to be created.
2. Make the Computed Channel Setup window active.
3. Click the Add button.
4. Select the channel type from the list in the Select Computed Channel Type dialog box, and click OK.



Select Computed Channel Type Dialog Box

5. Enter the required parameter information in the setup dialog box that opens.
The definition dialog box that appears is unique for each channel type. Some commonly used Computed Channels are explained in this chapter. For the remaining Computed Channels, refer to the TCE online help system.
6. 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.

Common Parameters

The following parameters are common to the Computed Channels that require parameter definitions upon creation (i.e. channels that do not inherit parameter definitions).

NOTE: The Input Channel ID with Sample Rate, ID, Description, and Network Node parameters are also common to all the "Inherited Parameter" channel types.

Input Channel ID with Sample Rate – A list of the available channels with their sample rates. (This parameter is not present for all types of Computed Channels. Desk Calculator and Valid Data Gate contain a list, labeled Input Channel, of available channels without their respective sample rates.)

Desired Measurement

ID – Unique identifier (ID) for the channel. This must conform to TCE ID naming conventions.

Network Node – The IP address or Host name associated with the computed channel being defined. If there are multiple eDAQ units running on a network, make sure the correct eDAQ is being addressed.

Description – Brief description of the channel, up to 63 characters (optional).

A preference can be set within the TCE General Preferences dialog box which will cause this value rather than the channel ID to be used as the Y-axis label in a plot graph of the channel data. See [TCE for eDAQ - TCE Preferences](#) for more information.

Type – Type of measurement (Strain, Load, etc.) the channel performs. This value can be selected from the drop-down list or entered using the keyboard.

Units – Unit of measurement (engineering units) for the channel (Degrees, Volts, etc.) This is a required field.

Full Scale Estimate

Min and Max – The expected extreme values of the computed channel expression. These fields are required if the output channel is a 32-bit float data type, and is subsequently stored in a DataMode that converts from 32-bit float to an integer format (16-bit signed or 8-bit signed); otherwise they are optional.

The full scale estimates are also used to set the initial (default) values for any histograms specified in the test setup DataModes.

NOTE: If histogram bounds have already been defined for a Computed Channel, then changing the Full Scale estimates for that Computed Channel will not change the specified histogram bounds.

Desk Calculator Channel

A Desk Calculator channel constructs an output channel from one or more input channels. The two types of output channels are:

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 also can 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 some form of an IEEE NAN (not a number). Care must be taken to ensure Desk Calculator expressions will not result in floating point exceptions.

Defining a Channel

1. Select Desk Calculator at the Select Computed Channel Type dialog box. The Desk Calculator Computed Channel definition dialog box opens.

Desk Calculator Computed Channel Definition Dialog Box

2. Enter the required information. See [Common Parameters](#).

- Specify, in the Desk Calculator Expression text area, 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 or select items from the Constants/Operators and Input Channels list boxes, typing any other text as needed.

The Input Channels box lists the IDs of available transducer channels and computed channels. The Constants/Operators list box has the constants and operators available for use in the expression.

Use either the mouse (double-click on the desired item) or keyboard (highlight the item, then press the space bar) to select items from either list box.

NOTE: Any item selected or typed when no insertion point is active within the expression appears at the end of the expression. To insert a channel or operator within the expression instead of at the end, click within the expression to place the insertion point (a flashing vertical bar) in the desired location and use the keyboard to enter it.

- Click OK or press Enter to save the definition. To cancel the definition, click Cancel.

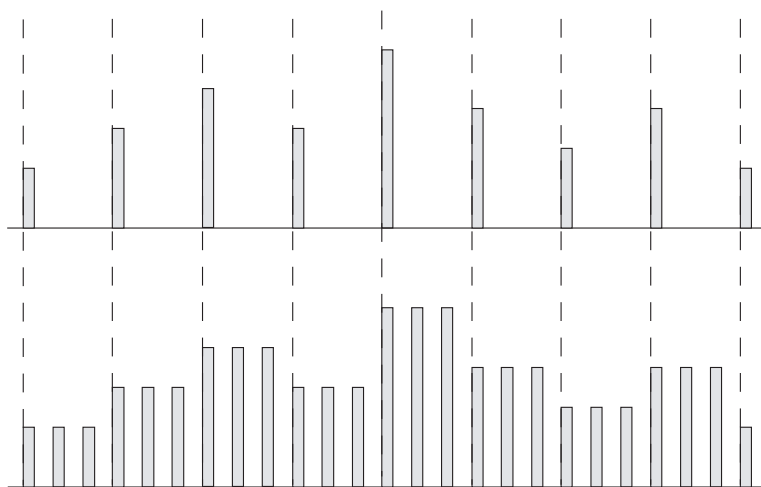
Refer to the TCE online help system for more detailed information regarding the Desk Calculator and the mathematical expressions associated with it.

Up/Down Sampler Channel

Up Sampler

The Up Sampler channel increases, by a specified factor, the number of samples taken from the input channel. This enables correlation of input data with that of a channel having 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 the graphic below. These added samples “bridge the gap” between the input samples and, together with the original samples, simulate the higher sample rate.



Up Sampler Input vs. Output

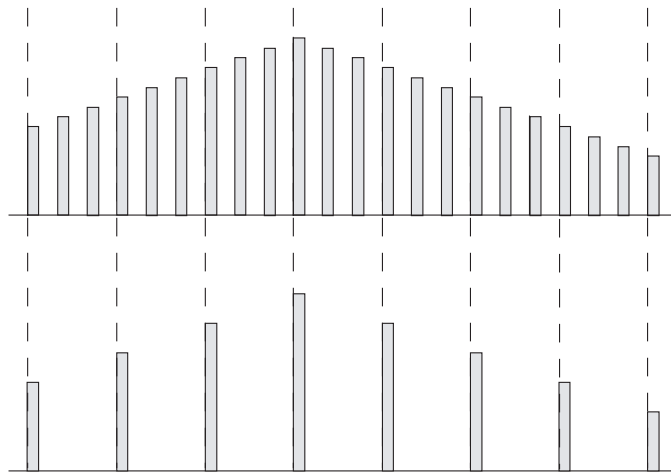
NOTE: How the Up Sample channel is used affects how much memory will be required to store test data. If output will be stored in memory, the amount of memory required for test data increases in proportion with the “up” factor. But, if the output will be used only for intermediate calculations, memory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

Down Sampler

The Down Sampler 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 the storage of test data.

NOTE: This channel type 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 the specified factor. For example, if the factor is 3, the first sample (data point) and then every third one thereafter would be present in the output channel, as shown in the following graphic.



Down Sampler Input vs. Output

Defining a Channel

1. Select Up/Down Sample in the Select Computed Channel Type dialog box. The Up/Down Sampler Computed Channel definition dialog box opens.

Down Sampler Computed Channel Definition Dialog Box

2. Enter the required information. See [Common Parameters](#).

Factor – Value by which the input channel sample rate is to be modified. For example, a down sample 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. For Up Sample a factor of 10 would result in 10 samples being written to the output channel for every sample from the input channel.

3. Click OK or press Enter to save the definition. To cancel the definition, click Cancel.

Time Channel

The Time Channel channel provides a time base channel for use in other Computed Channels and can be stored in Time History, Peak Valley Slice, and Event Slice DataModes.

Defining a Channel

1. Select Time Channel at the Select Computed Channel Type dialog box.

Time Channel Computed Channel Dialog Box

2. Enter the required information. See [Common Parameters](#).

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 in the definition dialog determines the data type used for these channels in DataModes.

3. Click OK or press Enter to save the definition. To cancel the definition, click Cancel.

Integrator Channel

The Integrator 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

1. Select Integrator at the Select Computed Channel Type dialog box.

Integrator Channel Definition Dialog Box

2. Enter the required information. See [Common Parameters](#).

Integration Parameters

Initial Value – Value at which the Integrator channel is to be set before the start of each run and when 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 purposes.

Integrate Only When TRUE – Integration is suppressed when the trigger channel state is False.

Enable Triggered Reset – Integrator value is reset (set to the specified Initial Value) whenever the trigger channel satisfies the condition specified within the Reset Mode box.

Channel – The channel to be used as the trigger.

Reset Mode – Desired trigger reset mode. Three trigger reset modes are available:

When True – Reset whenever the state of the trigger channel is True.

On False-True Edge – Reset when the state of the trigger channel 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. Click OK or press Enter to save the definition. To cancel the definition, click Cancel.

Editing a Definition

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

Copying a Definition

The Copy function allows a copy of an existing channel definition to be used in defining a new Computed Channel. The minimum input required is assigning an ID name to the new channel; the other defined data can be modified as needed for the new channel.

1. Select the channel definition on which to base the copy in the Computed Channel Setup window.
2. Click 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

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, either click Yes or press Y then Enter to delete the definition. To cancel the delete process, click No.

Chapter 6 - DataModes

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. Detailed descriptions can be found in subsequent sections of this chapter.

Time History – Store multiple channels of triggered or untriggered time history (sequential) data streams in the output data file.

Burst History – Store channels of burst-triggered time history data streams in the output data file when a user-defined triggering event occurs.

Time at Level – Store Time at Level histograms in the output data file. Two types are available: one dimensional and multidimensional.

Peak Valley – Store multiple channels of peak and valley sequences acquired from triggered or untriggered time history data streams in the output data file.

Peak Valley Matrix – Store multiple channels of peak valley reversal histograms in the output data file.

Peak Valley Slice – Store one Master channel peak/valley sequence with additional Slave channels in the output data file.

Rainflow – Store multiple channels of rainflow cycle histograms in the output data file.

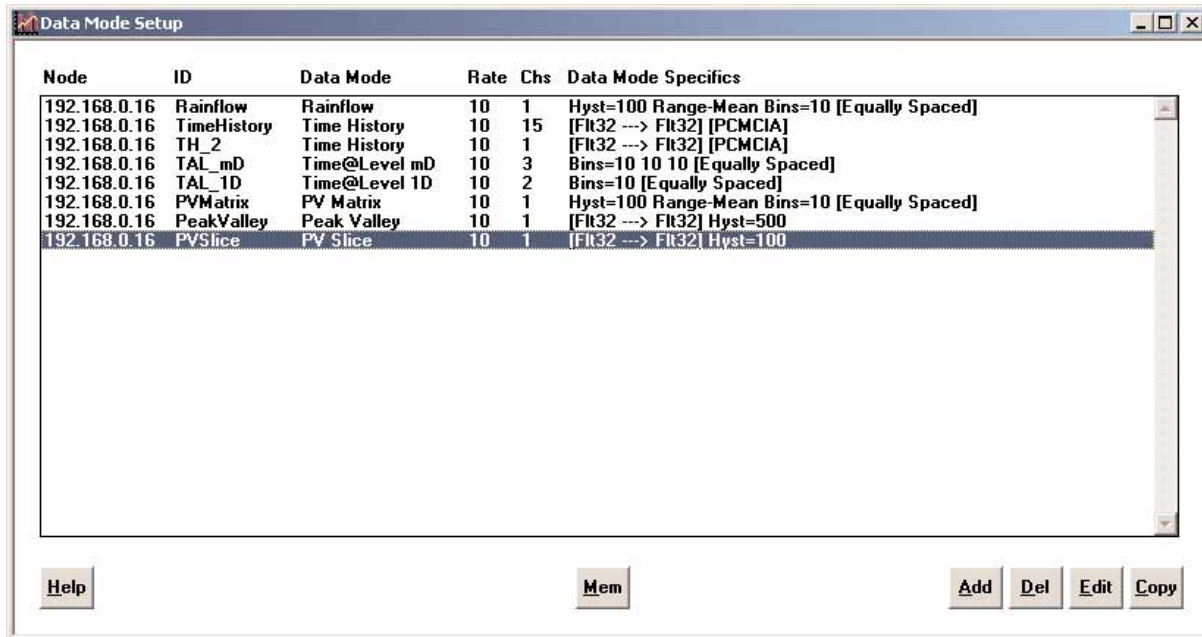
Event Slice – Store one Master Channel event sequence with additional slave channels in the output data file. When an event is detected on the Master Channel, data samples for all channels (Master and Slave channels) are stored.

Message Logger – Store input message channels into the SIF data file.

MPB and DIO Digital Output – Pseudo DataModes used to control the state of the MPB and DIO boards digital output lines on a bitwise basis. Unlike other DataModes, these DataModes do not store data.

DataMode Setup Dialog Box

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



DataMode Setup Window

Data Displayed

Node – The IP Address (Network Node) of the eDAQ associated with the DataMode.

ID – ID name assigned to the DataMode.

Data Mode – DataMode type.

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 (e.g., number and type of bins, hysteresis value, etc.).

Edit Functions

The Add, Del, Edit, and Copy buttons in the lower-right corner of the window activate the editing functions used with DataMode definitions. Their uses are described later in this chapter.

Memory Allocation

The Mem button displays the total amount of raw eDAQ SIF file memory the eDAQ will allocate at the start of each test run for selected DataModes (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 entry in the DataMode Setup window and click the Mem button; to see the total memory allocated for all DataModes, select all entries and click Mem.

Defining a SoMat DataMode

Before Starting

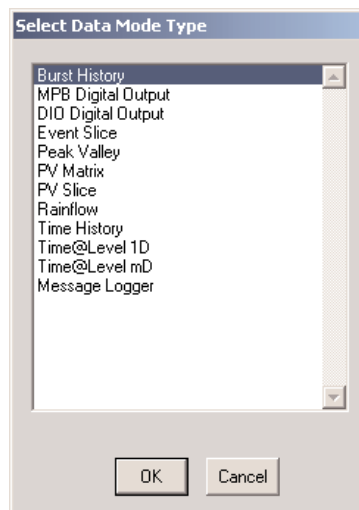
Before defining a DataMode, all the input and computed data channels that the DataMode will use should be defined. Additional channels can be added at a later time.

Procedure

1. Start TCE if it is not already running.
2. Open the setup file where the DataMode will be created and used by selecting Open Setup from the File menu or clicking the Open Setup button on the toolbar.
3. Click on the DataMode Setup window to make it active and bring focus to it. This can also be accomplished by pressing either F5 or F6 to scroll (forward and backward, respectively) through the setup windows.
4. Click Add.

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

5. Select the desired DataMode type from the Select DataMode Type dialog box by highlighting the appropriate type and clicking OK. A unique dialog box appears for each DataMode type. Descriptions of the definition dialog box for DataMode types are provided in a section specific to the DataMode type later in this chapter.



Select DataMode Type Dialog Box

6. Enter the required parameter information in the DataMode definition dialog box, then either click OK or press Enter to save the definition.

Use of Triggers

Most DataModes can 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 selections for Triggering Option and Trigger Channel in the DataMode definition dialog 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

There are four basic triggering options for DataModes (other than Burst History).

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.

Common DataMode Parameters

Network Node – When running multiple eDAQ units in a network, the Network Node for the eDAQ to collect the data must be selected.

Input Channels – The list provided in this list box provides all of the available input channels. Multiple channel selections are supported, and up to 128 channels can be selected simultaneously.

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. Data will be stored only when the triggering condition specified here occurs.

Trigger Channel – ID name of the desired 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 but not the optional Time channel).

Mass Storage Option – Data can be stored on the PC Card or in internal memory. Internal memory is limited in size (less than 4MB is available). To store data on the PC Card, select the Use the PCMCIA Disk check box.

Time History DataMode

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.

NOTE: The sample rates of the input channels determine the sample rate for this DataMode. The sample rate of all of the input channels (including the Trigger Channel and Time Input Channel if one is defined) must be the same.

The screenshot shows the 'Time History Data Mode' dialog box. The 'Network Node' is set to '192.168.0.16'. The 'Input Channels' list includes: All [Flt32] 10, NetBall [Flt32] 10, Altitude [Flt32] 10, HResTotVehDt [Flt32] 10, HResTripDt [Flt32] 10, TotVehDt [Flt32] 10, TripDt [Flt32] 10, FuRate [Flt32] 10, AvFuEcon [Flt32] 10, InsFuEcon [Flt32] 10, IGr [Flt32] 10, ReqGr [Flt32] 10, and SelectedGr [Flt32] 10. The 'Count' is 0. The 'Data Mode ID' field is empty. The 'Mass Storage Option' is checked for 'Use PCMCIA Disk'. The 'Triggering Option' is set to 'Always On'. The 'Trigger Channel' is empty. The 'Floats --> Data Type' is set to 'Flt32 --> Flt32'. The 'Time Input Channel' is set to '(None)'. Buttons for 'OK', 'Cancel', and 'Help' are at the bottom.

Time History DataMode Definition Dialog Box

Parameters

The following parameters are specific to the Time History DataMode. See also [Common DataMode Parameters](#).

Time Input Channel (Data Type) – (Optional) The channel to be used to provide the time base for the data. Only Elapsed Time (Time Channel) Computed Channels are listed in this drop-down list. 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 as the Time Input Channel, a maximum of 127 channels can be selected from the input channel list.

Burst History DataMode

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 (accomplished by using a circular buffer).

Burst History DataMode Definition Dialog Box

Parameters

The following parameters are specific to the Burst History DataMode. See also [Common DataMode Parameters](#).

Pre Trigger Time (secs) – The time period, in seconds, before the trigger during which data samples are to be collected.

Post Trigger Time – The time period, in seconds, after the trigger during which data samples are to be collected.

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: $([2.5 + 2.5] \times 100) + 1$.

Mass Storage Option – Two different options are available for storing the data collected in the Burst History mode.

Use PCMCIA Disk – See [Common DataMode Parameters](#).

DRAM buffering – This box is enabled only if the Use PCMCIA Disk is checked. If this option is selected, the circular buffer used for Burst data capture is allocated in DRAM memory; if this option is not selected, the circular buffer is allocated directly on the PC Card. See the TCE online help system for guidelines for setting the DRAM buffering option.

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 – Allows for storage of the most significant burst records based on the specified quantity for Number of Bursts. Burst significance is based on the maximum deviation from the value specified in the Reference Value box.

Select the Enable Max Bursts Mode check box to use this mode. Refer to the online help system for more information on this mode.

NOTE: This option is available only when the PCMCIA mass storage option is **not** used.

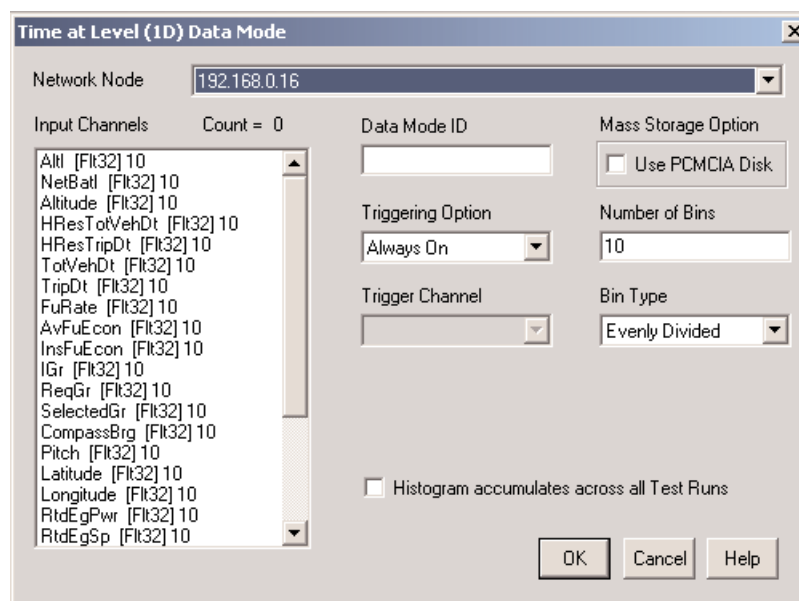
NOTE: Using Max Bursts Mode adds significant processing overhead for this DataMode.

Time At Level DataMode

The 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) – Multiple input channels generate multiple one-dimensional TAL data channels.

Multi-dimensional (mD) – Up to six dimensions (input channels) are created for the one output histogram.



Time at Level (One Dimensional) Definition Dialog Box

Parameters

The following parameters are specific to the TAL DataMode type. See also [Common DataMode Parameters](#).

Histogram Accumulates across all Test Runs – Select this option if only one histogram is to be generated for all test runs. If this option is not selected, a unique histogram will be generated for each test run.

NOTE: The option to accumulate across all test runs is available only when the PCMCIA mass storage option is **not** used.

Number of Bins – Number of bins per input channel or per dimension according to the type of TAL DataMode being defined. Two more bins are added to store overflows and underflows. If a 20 bin histogram is specified, a 22 bin histogram is internally allocated and used.

One-Dimensional: The maximum number of bins available is 10,000 per channel.

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 four input channels are selected, entering "10, 20, 5, 15" in this field would result in 10 bins for the first channel, 20 for the second, 5 for the third, and 15 for the fourth.

The total number of bins for a Multi-Dimensional Time at Level histogram is computed by the formula as shown. (The "+2" in the example calculation are the underflow and overflow bins added by TCE.)

The calculation for the aforementioned multi-dimension example is:

$$\text{Total Bins} = (10+2) \times (20+2) \times (5+2) \times (15+2) = 31,416$$

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 available:

Evenly Divided – The bins for the test data are evenly divided between the histogram bounds.

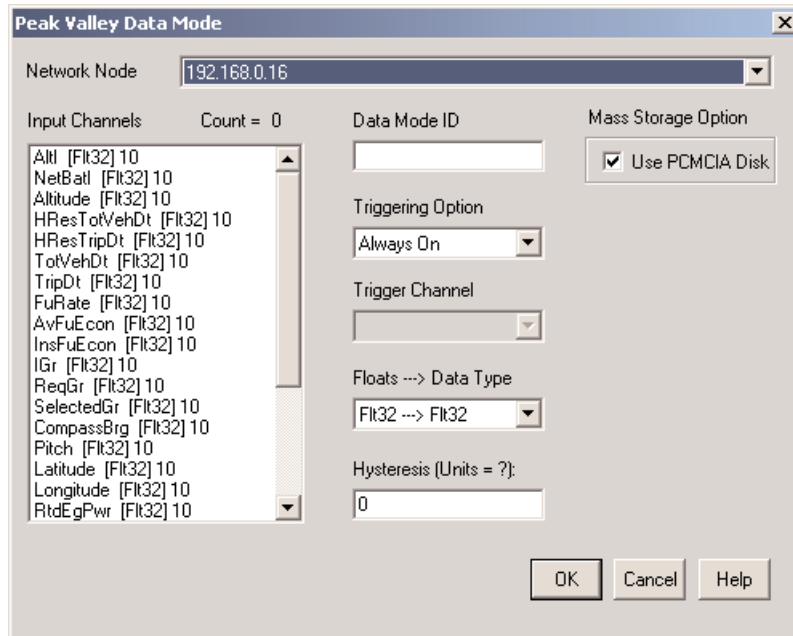
User Defined – The size of each bin is user defined. See [User Defined Bins](#).

Once the parameters have been entered and the definition saved (by clicking OK or pressing Enter), the Histogram Bounds dialog box opens. See [Histogram Modes](#).

If the User Defined bin type was selected, question marks will be in the Min and Max columns instead of values. Click Edit and set the bin boundaries. The appropriate values will then be in the Min and Max columns. See [User Defined Bins](#).

Peak Valley DataMode

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.



Peak Valley DataMode Definition Dialog Box

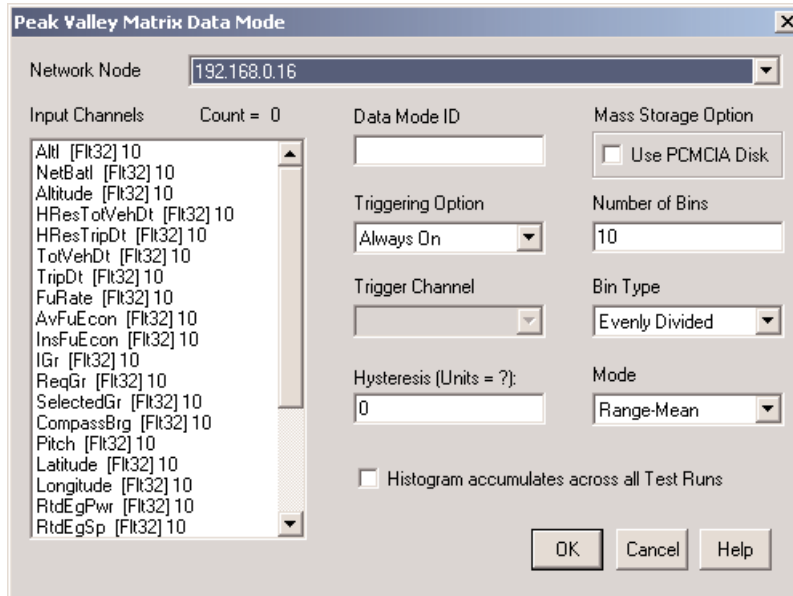
Parameters

The following parameters are specific to the Peak Valley DataMode. See [Common DataMode Parameters](#).

Hysteresis – Hysteresis level value for the peak valley processing algorithm.

Peak Valley Matrix DataMode

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 put into a histogram using the type and size options specified.



Peak Valley Matrix DataMode Definition Dialog Box

Parameters

The following parameters are specific to the Peak Valley Matrix DataMode. See also [Common DataMode Parameters](#).

Hysteresis – Hysteresis level value for the peak valley processing algorithm.

Histogram Accumulates across all Test Runs — Select this option if only one histogram is to be generated for all test runs. If this option is not selected, a unique histogram will be generated for each test run.

NOTE: The option to accumulate across all test runs is available only when the PCMCIA mass storage option is **not** used.

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. 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:

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](#).

Once the parameters are entered and the definition saved (by clicking OK or pressing Enter), the Histogram Bounds dialog box opens. See [Histogram Modes](#).

Peak Valley Slice DataMode

Peak Valley Slice DataModes store one master channel peak/valley sequence with additional slave channels into the output data file. Peaks and valleys are acquired from the triggered or untriggered master time history data stream, using the user specified hysteresis value and the peak valley processing algorithm. When a peak or valley is detected on the master channel, data samples for all channels (master and slaves) are stored in the output data file (this is described as a “slice” of data samples).

The screenshot shows the 'Peak Valley Slice Data Mode' dialog box. It features a title bar with a close button. The main area is divided into several sections:

- Network Node:** A dropdown menu showing '192.168.0.16'.
- Master Input Channel:** An empty dropdown menu.
- Data Mode ID:** An empty text input field.
- Mass Storage Option:** A checkbox labeled 'Use PCMCIA Disk' which is checked.
- Slave Input Channels:** A list box with 'Count = 0'. The list contains: Alt [Flt32] 10, NetBatl [Flt32] 10, Altitude [Flt32] 10, HResTotVehDt [Flt32] 10, HResTripDt [Flt32] 10, TotVehDt [Flt32] 10, TripDt [Flt32] 10, FuRate [Flt32] 10, AvFuEcon [Flt32] 10, InsFuEcon [Flt32] 10, IGr [Flt32] 10, and ReqGr [Flt32] 10.
- Triggering Option:** A dropdown menu set to 'Always On'.
- Trigger Channel:** An empty dropdown menu.
- M/S Floats ---> Data Type:** A dropdown menu set to 'Flt32 ---> Flt32'.
- Hysteresis (Units = ?):** A text input field containing '0'.
- Time Input Channel:** A dropdown menu set to '(None)'.

 At the bottom right, there are three buttons: 'OK', 'Cancel', and 'Help'.

Peak Valley Slice DataMode Dialog Box

Parameters

The following parameters are specific to the Peak Valley Slice DataMode. See also [Common DataMode Parameters](#).

Master Input Channel – The channel which is monitored for peaks and valleys, which determine when samples are written to the output channel from the master and all slave input channels.

Slave Input Channels – The channels from which to gather data samples when a peak or valley is detected on the master input channel.

Time Input Channel – (Optional) The channel to be used to provide the time base for the data. Only Elapsed Time (Time Channel) computed channels are listed in this drop-down list. Note the data storage mode for the Time Channel is based on the definition made in the computed channel.

Hysteresis – Hysteresis level value for the peak valley processing algorithm.

Event Slice DataMode

The Event Slice DataModes store one master channel Event sequence with additional slave channels into the output data file. Events are acquired from the triggered or untriggered master time history data stream. When an Event is detected on the master channel, data samples for all channels (master and slaves) are stored in the output data file (this is described as a “slice” of data samples).

NOTE: An Event is defined here as any change in state of the master input channel.

The screenshot shows the 'Event Slice Data Mode' dialog box. It features a 'Network Node' dropdown set to '192.168.0.16'. Below this are three columns of settings: 'Master Input Channel' (empty), 'Data Mode ID' (empty), and 'Mass Storage Option' (checked 'Use PCMCIA Disk'). The 'Slave Input Channels' section shows a list of channels with a 'Count = 0'. The 'Triggering Option' is set to 'Always On'. The 'Trigger Channel' is empty. The 'M/S Floats ---> Data Type' is set to 'Flt32 ---> Flt32'. The 'Time Input Channel' is set to '(None)'. The 'Control Options' section has 'Store Initial State' checked. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Event Slice DataMode Dialog Box

Parameters

The following parameters are specific to the Event Slice DataMode. See also [Common DataMode Parameters](#).

Master Input Channel – The channel which is monitored for an Event, which determines when samples are written to the output channel from the master and all slave input channels.

Slave Input Channels – The channels from which to gather data samples when an Event is detected on the Master Input Channel.

Time Input Channel – (Optional) The channel to be used to provide the time base for the data. Only Elapsed Time (Time Channel) computed channels are listed in this drop-down list. Note the data storage mode for the Time Channel is based on the definition made in the computed channel.

Control Options

Store Initial State – Store the initial state at the start of each test run.

Rainflow DataMode

The Rainflow DataMode stores multiple channels of rainflow cycle histograms in the output data file. Peaks and valleys are acquired from both triggered and 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.

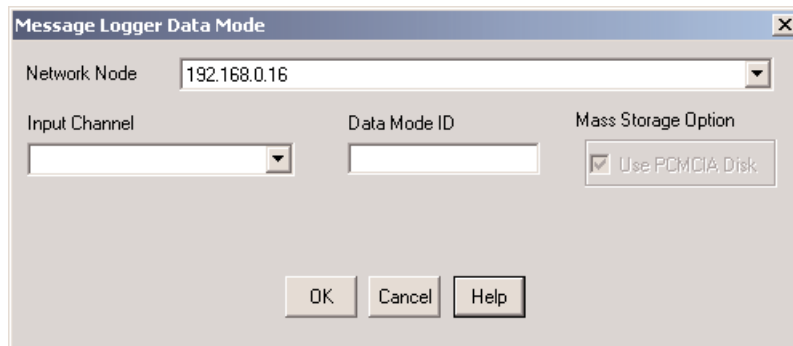
The procedure, dialog boxes, and parameters to be defined for a Rainflow DataMode are identical to those for a Peak Valley Matrix DataMode, except Rainflow is selected at the Select Data Mode Type dialog box and the title bar of the dialog box reads "Rainflow DataMode."

Parameters

For explanations of the dialog boxes and parameters, see [Peak Valley Matrix DataMode](#).

Message Logger DataMode

The Message Logger DataModes store input message channels into the SIF data file.



Message Logger DataMode Dialog Box

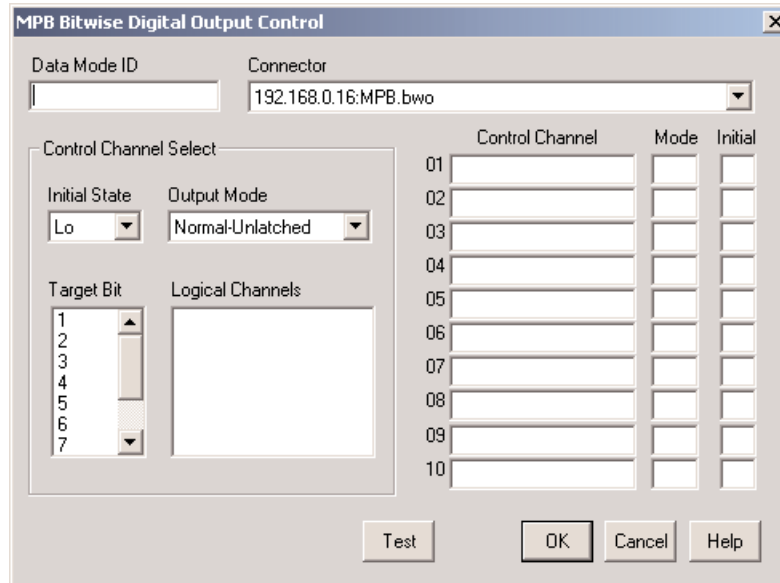
Parameters

There are no parameters specific to the Message Logger DataMode. See [Common DataMode Parameters](#).

MPB and DIO Digital Output DataMode

The MPB and DIO Digital Output DataModes are pseudo data modes used to control the state of the MPB and DIO board digital output lines on a bitwise basis. (Unlike other DataModes, these DataModes do not result in any data file storage.)

NOTE: The state of the digital outputs is defined in terms of logic levels 0 and 1. Logic 0 means that the output line is connected to ground and can sink current. Logic 1 means that the output line is set open so that no current can flow. As such, logic 0 is required to turn LEDs and other devices on, and logic 1 is used to turn them off. This may seem backwards; however, it is essentially a moot point since both Normal and Inverted Mode output control options are available.



MPB Digital Output DataMode Dialog Box

Parameters

The following parameters are specific to the MPB and DIO Digital Output DataModes. See also [Common DataMode Parameters](#).

Connector – The output connector of the MPB/DIO board. The list box used for this field definition always contains the current hardware connectors which are available for bitwise digital output.

Control Channel/Mode/Initial – The desired set of bitwise control channels. Anywhere from 1 to 10 (for MPB; 1 to 8 for each DIO bank of channels) output channels can be specified. (Only the digital I/O lines configured as outputs are available.) The control channel fields for unused bits should be left blank. For each channel specified, the associated Output Mode and Initial State (described below) must also be specified. The user can type directly in any of the field sets provided, or can use the special control channel selection functionality described below.

Control Channel Select

Initial State – Either Hi (logic 1) or Lo (logic 0). The initial state is imposed when the test run is started.

Output Mode

N-U (Normal-Unlatched) – The associated output line will be set to logic 1 if the associated input channel has any TRUE value in the sample interval (i.e., 80 or 400 msec for the master sample rate of 100,000 Hz depending on the user selected pipe frame size); otherwise it will be set to logic 0.

I-U (Invert-Unlatched) – The associated output line will be set to logic 0 if the associated input channel has any TRUE value in the sample interval; otherwise it will be set high (TRUE).

N-L (Normal-Latched) – The associated output line will be set high to logic 1 and will stay at logic 1 (until the test run is ended) as soon as the associated input channel has any TRUE value in the sample interval.

I-L (Invert-Latched) – The associated output line will be set to logic 0 and will stay at logic 0 (until the test run is ended) as soon as the associated input channel has any TRUE value in the sample interval.

T-L (Toggle-Latched) – The associated output line will be latched to toggle between the logic 1 and logic 0 states as soon as the associated input channel has any TRUE value in the sample interval. The toggle rate is nominally one second.

Target Bit – The output bit being defined.

Logical Channels – All logical channels defined in the Transducer and Message Channel Setup window or Computed Channel Setup window.

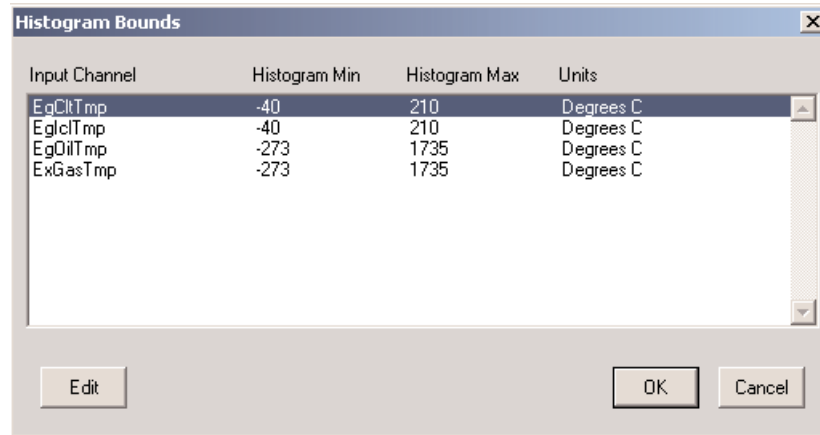
Histogram Mode

The histogram mode to be used is selected from the Mode drop-down list in the DataMode definition dialog box. There are three histogramming modes currently supported in the FCS. The following descriptions apply to histogramming (rainflow) cycles and to histogramming (peak valley matrix) reversals.

Range-Mean – Counts are accumulated in bins that have both a range dimension and a mean value dimension.

Range Only – Counts are accumulated in bins that have only a range dimension.

To-From – Counts are accumulated in bins that have both a “to” dimension and a “from” dimension. For the Peak Valley Matrix DataMode, the “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 could be assigned to either reversal that makes up the full cycle. The FCS is programmed such that “to” and “from” designations apply to the first reversal (and not the second reversal on which the cycle actually closes).



Histogram Bounds Dialog Box

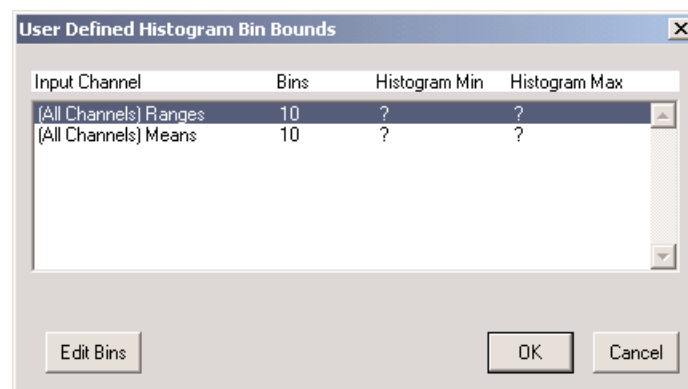
The default histogram bounds are the Min and Max values specified for the channel (Full Scale Estimate values from Computed Channel Setup dialog box or Full Scale values from Page 2 of the Input Channel Setup dialog box). These bounds can be overridden by clicking the Edit button in the lower-left corner of the dialog box.

User Defined Bins

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 manually, by using the algorithms provided, or by loading a file containing a set of bin boundaries.

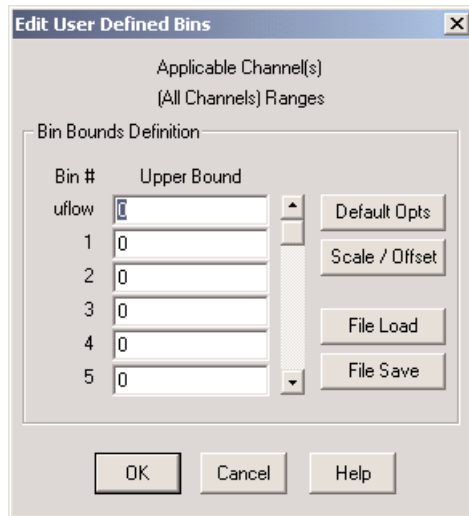
Defining Bins

Select the option User Defined from the Bin Type box in the DataMode definition dialog box to allow the bins to be user defined. After clicking the OK button to save the entries in the dialog box, the User Defined Histogram Bin Bounds dialog box opens. The graphic provided shows the dialog box for a Peak Valley Matrix DataMode using the Range-Mean histogram mode. The Histogram Min and Max columns contain question marks instead of values to indicate the bin sizes have not been defined.



User Defined Histogram Bin Bounds Dialog Box

To define the bins, select the channel in which the bins require definition. Each channel will require bin definitions in the DataMode. Click the Edit Bins button. The Edit User Defined Bins dialog box opens.

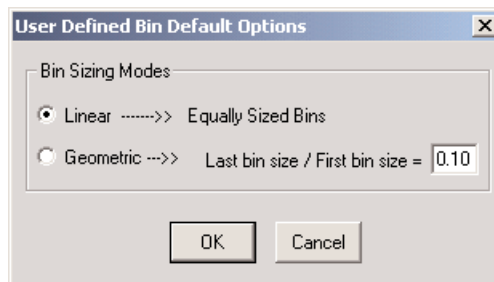


Edit User Defined Bins Dialog Box

In the Upper Bound column specify the upper boundary for each bin by entering the appropriate value in the box provided.

A set of buttons beside the text boxes further facilitates defining the bin boundaries. Descriptions for these button controls follow.

Default Opts – Open the User Defined Bin Default Options dialog box allowing selection of one of the two options for loading default values.



User Defined Bins Default Options Dialog Box

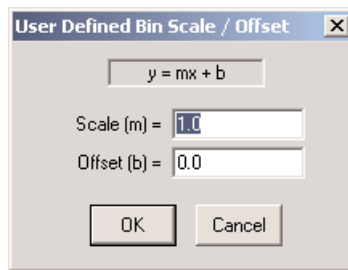
Linear – Define the bin boundaries with equal spacing from the full scale minimum to the full scale maximum.

Geometric – Define 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 click the OK button.

Scale/Offset – Open the User Defined Bin Scale/Offset dialog box where the scale and offset values to be applied to all bin boundaries are specified. This functionality is provided primarily to support changes in units and full scale limits.



User Defined Bins Default Options Dialog Box

Type in the value(s) to use, then click OK.

File Load – 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.

File Save – 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, click the OK button to close the Edit User Defined Bins dialog box and save the changes.

Editing a DataMode Definition

1. Select the DataMode from the DataMode Setup window.
2. Click Edit, double-click on the DataMode, or press E to open the definition dialog box for the DataMode.
3. Modify the parameters as needed.
4. Click OK or press Enter to save the changes made.

Copying a DataMode

The Copy function provides a way to copy an existing DataMode definition to create a new DataMode definition. The minimum input required is assigning an ID name for the new DataMode definition; other definition data can be modified as needed.

1. Select the DataMode to copy from the DataMode Setup window.
2. Click the Copy button. The definition dialog box for the selected DataMode will appear with no value in the ID field.
3. Enter a unique ID name for the new DataMode.
4. Edit the data in the other parameter fields as necessary.
5. Click OK, or press Enter to save the new definition.

Deleting a DataMode

1. Select the channel definition(s) to delete from 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, click Yes to delete the definition (either press Y then ENTER, or click Yes). To cancel the delete process, click No.

Chapter 7 - Monitoring Tests and Channels

TCE for eDAQ, InField Field Analysis Software, and the eDAQ web interface all provide methods by which to monitor tests and channels. Some functionality is common between the three, and some is specific to each application. The use of the InField Field Analysis Software is described in the online help system available with the software or in a separate manual. Descriptions of the functionality, uses, and methods of access for TCE for eDAQ and the eDAQ web interface are contained in this chapter.

Signal Displays for Input Channels

Input channel signals can be displayed before or after a channel is calibrated. Output from an uncalibrated channel is displayed in signal units (volts for low-level transducers, counts for pulse counters, etc.). Output from a calibrated input channel is initially displayed in the engineering units specified for the channel. DVM and Scope displays have an option to display the output in signal units rather than engineering units.

The FCS uses the user-defined sample rate and where applicable the digital filtering specified for the particular input when running the DVM, Scope, and Spectrum displays. Note that the excitation circuitry (if applicable) should always be properly set up before displaying the input signal.

Monitoring Before a Test is Initialized

TCE offers the following display options for checking input channels prior to initializing a test session:

- DVM and Scope buttons in the Transducer and Message Channel Setup window and in the channel definition dialog box
- Freq (Cumulative Spectrum Analyzer) button in the Transducer and Message Channel Setup window

DVM Display

The DVM (Digital Value Meter) Display shows the output (sampled continually) from one or several input channels in a digital (numeric) format, either in signal units or the engineering units for the channel(s). If the transducer is not calibrated, the reading is in signal units; if it is, the output is displayed in the engineering units specified for the channel with the option to use signal units instead.

Opening a DVM Display

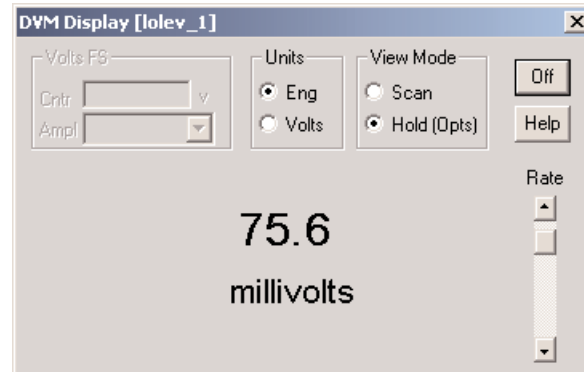
The DVM displays can be opened in any of these ways:

- Select the channel(s) to display from the Transducer and Message Channel Setup window; then click the DVM button. (This method cannot be used after a test has been initialized.)
- Select Transducer Checks from the Prerun options submenu of the Test Control menu. In the Transducer Checks dialog box, select the channel(s) to display, select the DVM Display option, and click Run. (This method can only be used when a test is initialized but there is no test run in progress.)
- From the channel definition dialog box, select the DVM button. (This method cannot be used after a test has been initialized.)

Single Channel DVM Display

When the DVM Display is opened with only a single channel selected, the dialog box shown below is displayed.

DVM Display – The output from a single channel. The channel ID is shown in square brackets in the title bar of the dialog box.



DVM Display, One Channel

Display Controls

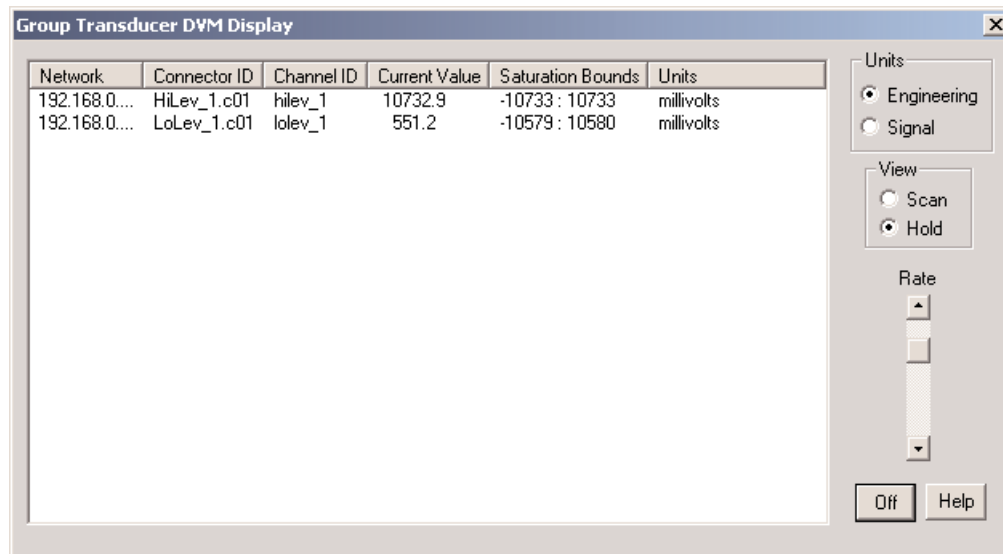
The options provided in a DVM Display dialog box vary according to the type of input being monitored. Refer to the TCE online help system for more information regarding the various DVM Display options.

The example graphic provided above shows the controls for a one-channel DVM Display for a Low Level transducer when the display is on hold (stopped) and the display units are the engineering units (in this case millivolts).

To use any of the controls, put the display in Hold mode by selecting Hold (Opts) in the View Mode group box, make the desired changes, and then select Scan in the View Mode group box to restart the display. 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.

Group DVM Display

Group Transducer DVM Display – Display the outputs from multiple channels at the same time.



Group Transducer DVM Display

Display Controls

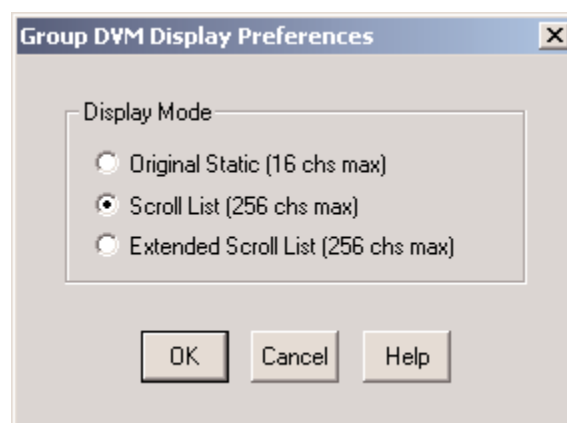
The options provided in a DVM Display dialog box vary according to the type of input being monitored. Refer to the TCE online help system for more information regarding the various DVM Display options.

The example graphic provided above shows the controls for a multi-channel DVM Display when the display type is extended scroll (see [Group DVM Display Preferences](#)), the display is on hold (stopped), and the display units are the engineering units.

To use any of the controls, put the display in Hold mode by selecting Hold (Opts) in the View Mode group box, make the desired changes, and then select Scan in the View Mode group box to restart the display.

Group DVM Display Preferences

Select Group DVM Display from the TCE Preferences menu to open the Group DVM Display Preferences dialog box.



Group DVM Display Preferences Dialog Box

Original Static (16 chs max) – The original TCE dialog window that uses static control fields and is limited to a maximum of 16 channels.

Scroll List (256 chs max) – A TCE dialog window that uses a scrollable list control with sizable fields (Channel ID, Current Value, and Units), and is limited to a maximum of 256 channels.

Extended Scroll List (256 chs max) – A TCE dialog window that uses a scrollable list control with sizable fields (Network, Connector ID, Channel ID, Current Value, Saturation Bounds, and Units), and is limited to a maximum of 256 channels.

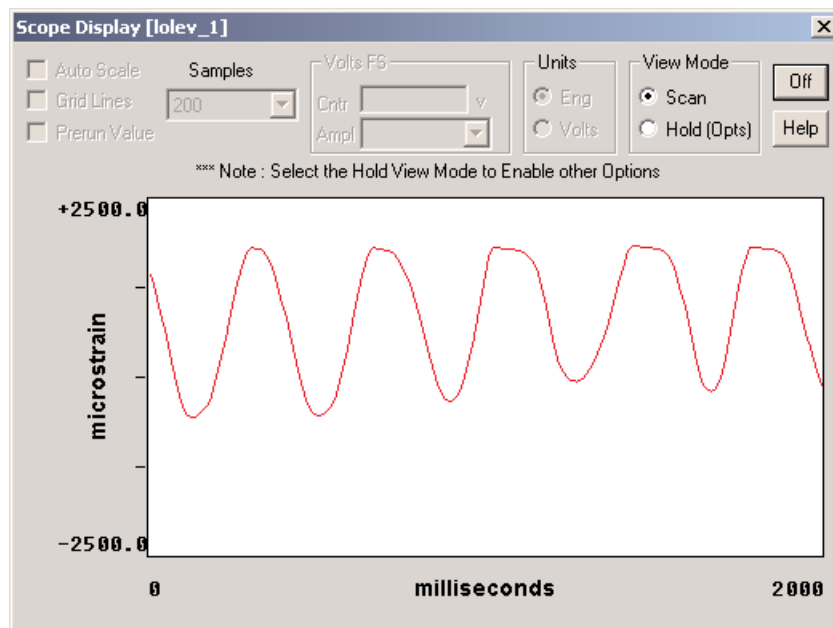
Scope Display

The Scope Display 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:

- In the Transducer and Message Channel Setup window, select the channel to view, and click the Scope button. (This method cannot be used after a test has been initialized.)
- Select Transducer Checks from the Prerun options submenu of the Test Control menu. Select the channel to view, select the Scope Display option, and click Run. (This method can only be used when a test has been initialized but there is not test run in progress.)
- From the channel definition dialog box, click the Scope button. (This method cannot be used after a test has been initialized.)

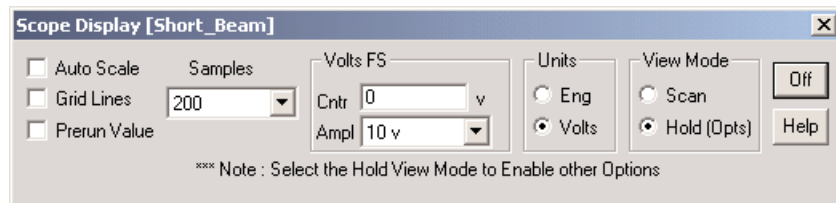


Scope Display

Display Controls

The options for the Scope Display dialog box vary according to the type of input being monitored. Refer to the TCE online help system for explanations of the various Scope Display options. The example graphic provided below shows the controls for a Scope Display for a Low Level transducer channel when the display is on hold (stopped) and the display units is volts.

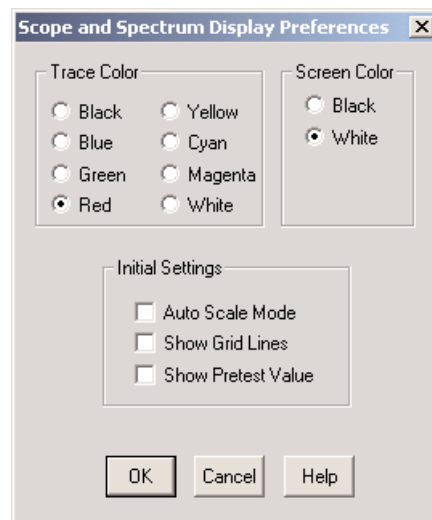
To use any of the controls, put the display in Hold mode (select Hold under View), make the desired changes, and then select Scan under View to restart the display.



Controls for One-Channel Analog/Strain Scope Display

Display Preferences

Select Scope and Spectrum Display from the TCE Preferences menu to open the Scope and Spectrum Display Preferences dialog box.



Scope and Spectrum Display Preferences Dialog Box

Trace Color – The color for the signal trace.

Screen Color – The background color for the display graph (black or white).

Initial Settings – How the graph is displayed

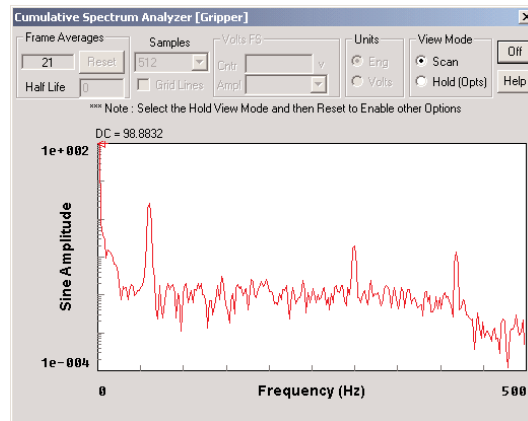
Auto Scale Mode – The Y-axis of the plot is scaled automatically, based on the amplitude of the input signal, so the trace fills the graph vertically. The Spectrum display always uses this mode.

Show Grid Lines – Display grid lines in the plot graph.

Show Pretest Value – Start up with the Pretest Value shown (when applicable). This option does not apply to the Spectrum display.

Spectrum Analyzer Display

The Cumulative Spectrum Analyzer display shows the frequency content of an input 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.



Spectrum Analyzer Display

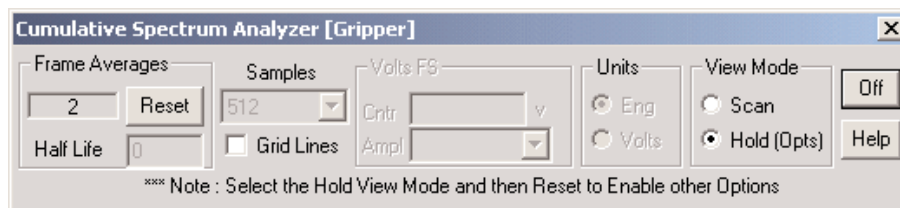
Opening the Spectrum Analyzer Display

The Spectrum Analyzer Display can be opened in one of two ways:

- In the Transducer and Message Channel Setup window, select the channel to view and click the Freq button. (This method cannot be used after a test has been initialized.)
- Select Transducer Checks from the Prerun options submenu of the Test Control menu. Select the channel to view, select the Spectrum Display option, and click Run. (This method can only be used when a test has been initialized but there is not test run in progress.)

Display Controls

The options provided in the Spectrum Analyzer Display dialog box vary according to the type of signal conditioner being used. The example graphic provided shows the controls for a Low Level channel Spectrum Display when the display is on hold (stopped) and the display units is engineering units.



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 desired changes, and then select Scan in the View Mode group box to restart the display.

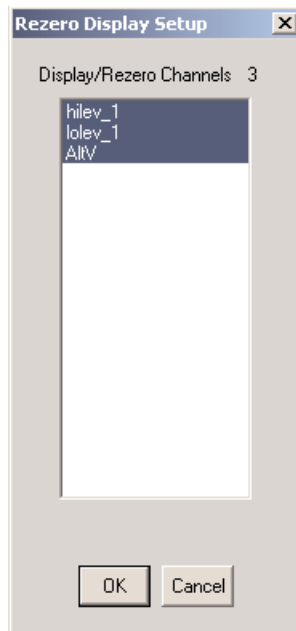
Display Preferences

See [Before a Test is Initialized - Scope Displays - Display Preferences](#).

Monitoring Between Test Runs

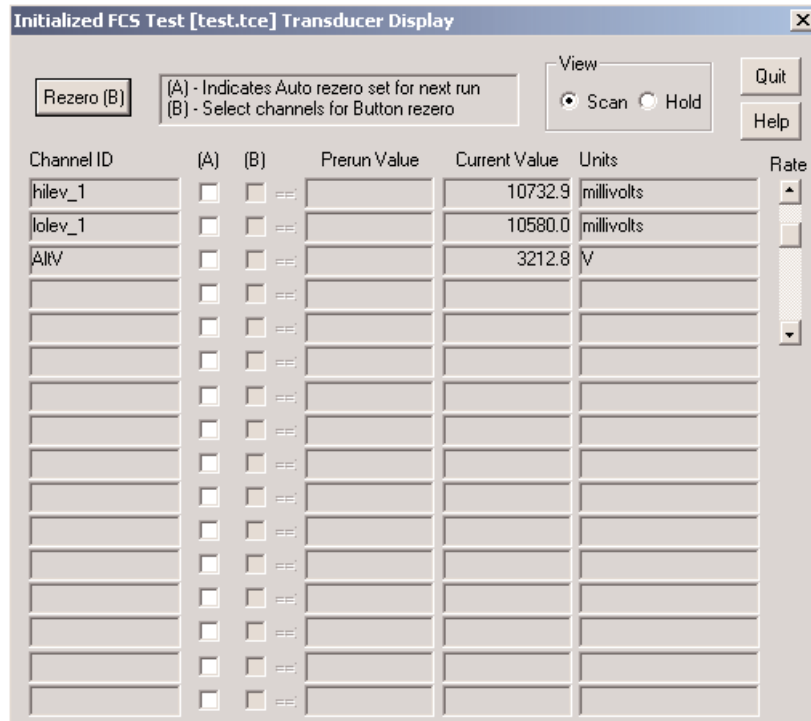
Rezero Display

The Rezero Display command in the Prerun Options submenu of the Test Control menu provides the means to display and optionally rezero the transducer channels of an initialized test. The current transducer signals for each selected transducer channel are continuously read and displayed in engineering units. This command is available when a test has been initialized but is not running.



Rezero Display Setup Dialog Box

The Rezero Display Setup dialog box contains a list of the defined channels from the Transducer and Message Channel Setup window. Select up to 16 channels and click OK to open the Rezero Display dialog box.



Prerun Options, Rezero Display Dialog Box

Rezero (B) – Rezero the transducers selected in the (B) column check boxes. The desired channels for rezeroing can be selected at any time (although it may be expedient if the display is put in the Hold mode first).

Channel ID – The unique identifier for the channel.

(A) – A checkmark indicates the transducer will be automatically rezeroed just prior to the start of the next run.

(B) – A checkmark indicates the transducer will be rezeroed if/when the Rezero (B) button is clicked.

Prerun Value – The value that was provided when the channel was defined. This value is only present when a Prerun Zero mode other than Not Applicable was selected in the channel definition.

Current Value – In Scan View mode, the value of the signal of the input channel. When in Hold View mode, this value represents what the input channel signal value was when the display was placed into Hold mode.

Units – The unit of measurement that was provided when the channel was defined.

Rate – Adjust the rate at which the rezero display is updated.

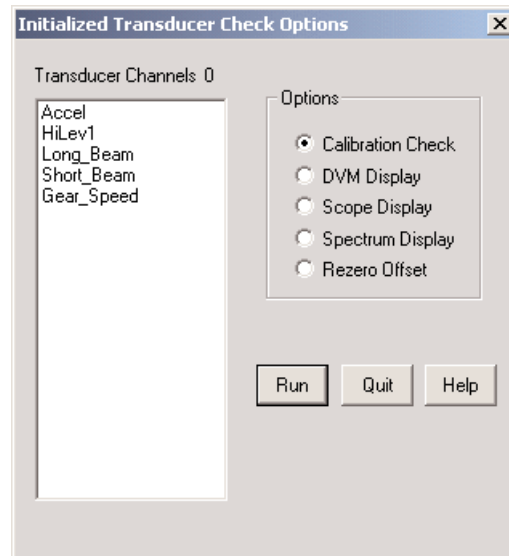
View

Scan – Data is updated within the display as it is received while in Scan mode.

Hold – Data is not updated in the display while in Hold mode.

Transducer Checks

The Transducer Checks command in Prerun Options submenu of the Test Control menu provides the commands for running the TCE DVM, Scope, and Spectrum displays and for performing calibration checks after a test has been initialized. This command is available when a test has been initialized but is not running.



Initialized Transducer Check Options Dialog Box

Transducer Channels – The transducer channels defined for the initialized test. They are listed in the same order as in the Transducer and Message Channel Setup window.

Options – Five different display options are available:

Calibration Check – Perform 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. See [Transducer and Message Channels - Calibrating Channels - Checking a Calibration](#).

DVM Display – See [Before a Test is Initialized - DVM Display](#).

Scope Display – See [Before a Test is Initialized - Scope Display](#).

Spectrum Display – See [Before a Test is Initialized - Spectrum Analyzer Display](#).

Rezero Offset – 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.

Monitoring 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 – Show the status of the test and memory available for data storage.



Run Time Display – Display the output from transducer and message channels in a bar chart, strip chart, or a digital (numeric) table.

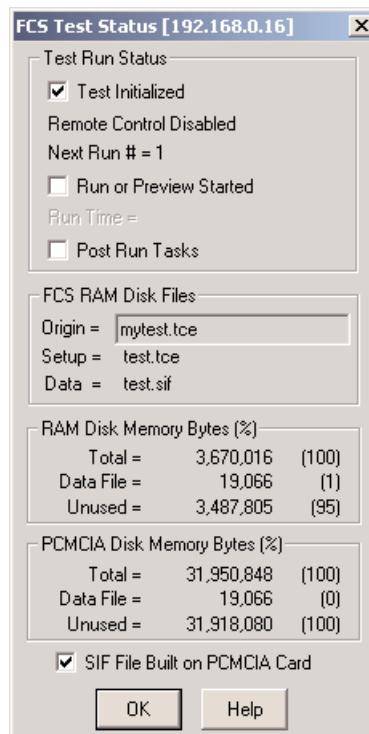
Get Test Status

Get Test Status opens the FCS Test Status dialog box, which shows the status of the test currently initialized in the eDAQ, the setup and data file being used, and the space available in the RAM disk and the PC Card within the eDAQ for storing data. The IP Address/Host Name for the eDAQ is displayed in square brackets in the title bar.

This dialog box can be accessed by either selecting Get Test Status from the Test Control menu or clicking on the



Test Status button, , on the toolbar.



Test Status Dialog Box

Test Run Status

Test Initialized – A checkmark indicates a test has been initialized on the eDAQ.

Remote Control Disabled/Suspended/Enabled – An indicator of the status of remote control operations.

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 is initialized, but no test runs have been performed, 1 appears here.

Run or Preview Started – A checkmark indicates a test is running or previewing.

Run Time – If a test is running, the elapsed time since the start of the run is shown here.

Post Run Tasks – A checkmark indicates a test run has been stopped, but a required post-run task has not been completed.

FCS RAM Disk Files

Origin – Name of the original setup file used to initialize the test.

Setup – Internal name of the test setup file being used.

Data – Internal name of the current test data file.

RAM Disk Memory Bytes (%)

Total – Total space available within the eDAQ's RAM disk memory for storing data.

Data File – Current size of the RAM disk memory component of the SIF file containing the test data.

Unused – Amount of unused space available in the RAM disk memory for data storage.

PCMCIA Disk Memory Bytes (%)

Total – Total amount of space available on the PC Card memory card for storing data and other files.

Data File – Current size of the PC Card memory component of the SIF data file.

Unused – Amount of unused space available on the PC Card memory card for data storage.

SIF File Built on PCMCIA Card – A checkmark indicates that a consolidated SIF file is resident on the PC Card and that the SIF file can be transferred to the support PC.

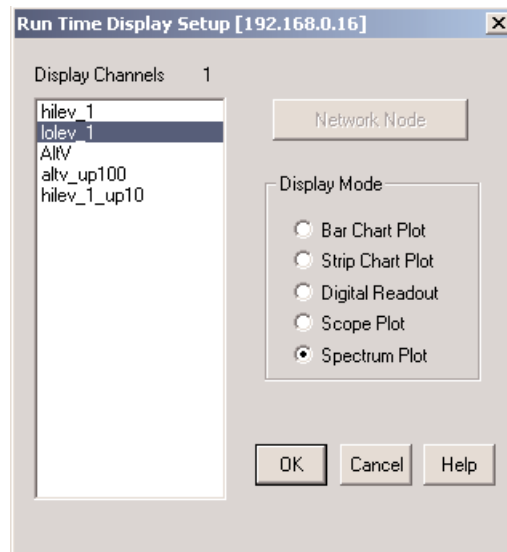
Run Time Display

The Run Time Display (RTD) displays the raw signals from input and computed channels on a real-time basis, thus providing the means to verify that input and computed channels are functioning properly. It is available only while a test is running.

Five display modes are provided: Bar Chart Plot, Strip Chart Plot, Digital Readout, Scope Plot, and Spectrum Plot. 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 (see [Run Time Display Preferences](#)).

This dialog can be accessed either by selected Run Time Display from the Test Control menu or by clicking the

Run Time Display button, , on the toolbar.



Run Time Display Setup Dialog Box

The highlighted channels will be displayed in the selected Display Mode when it is launched by clicking OK. Each of the display modes has a limit in the number of channels it can display at one time. See the section for the specific Display Mode for information regarding these limits.

Common Controls

View

The following view modes are available for each of the display modes.

Scan – Data is updated within the display as it is received while in Scan mode.

Hold – Data is not updated in the display while in Hold mode.

Buttons

The following set of buttons is available in each of the display mode dialog boxes.

Start Run – Start a test run while previewing a test run. This button is disabled when a test run has already been started.

Reset – Reset the tracking and display of the overall minimum and maximum values encountered.

Quit – Exit Run Time Display.

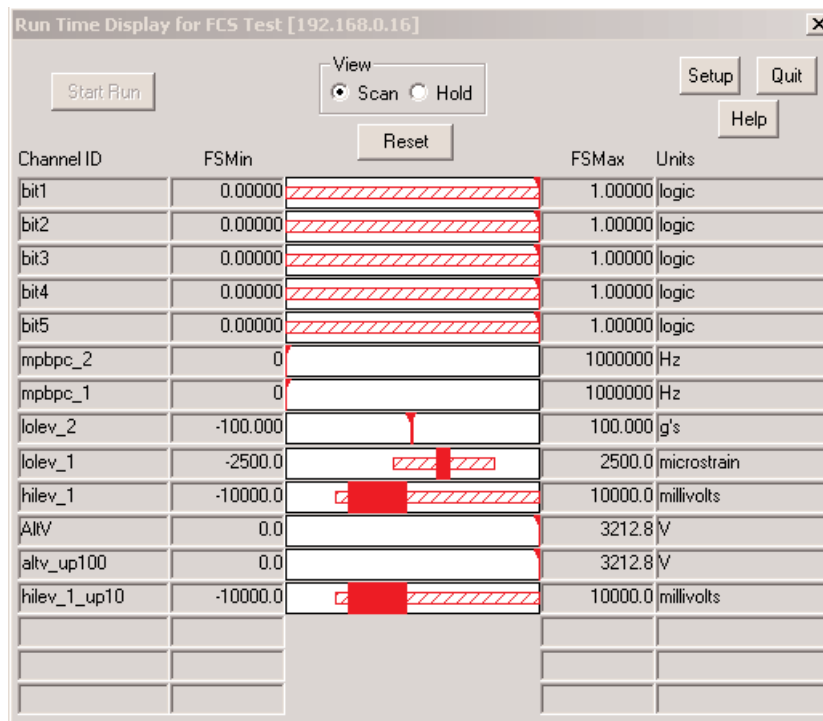
Setup – Exit the current display and return to the Run Time Display setup dialog window.

Help – Open the TCE help system to the topic specific to the display mode type.

Bar Chart Plot

The Bar Chart plot continuously shows, using solid horizontal bars, the most recent minimum and maximum channel data values that have occurred since the previous update of the Run Time Display for up to 16 channels.

An arrow head points to the bar when the bar is very thin. Overall minimum and maximum values recorded since the display was started or reset are shown as a cross-hatched horizontal bar.



Bar Chart Plot, Run Time Display

See [Common Controls](#) for explanations of the buttons and the View group box.

Channel ID – Unique identifier (ID) for the channel provided during the channel's definition.

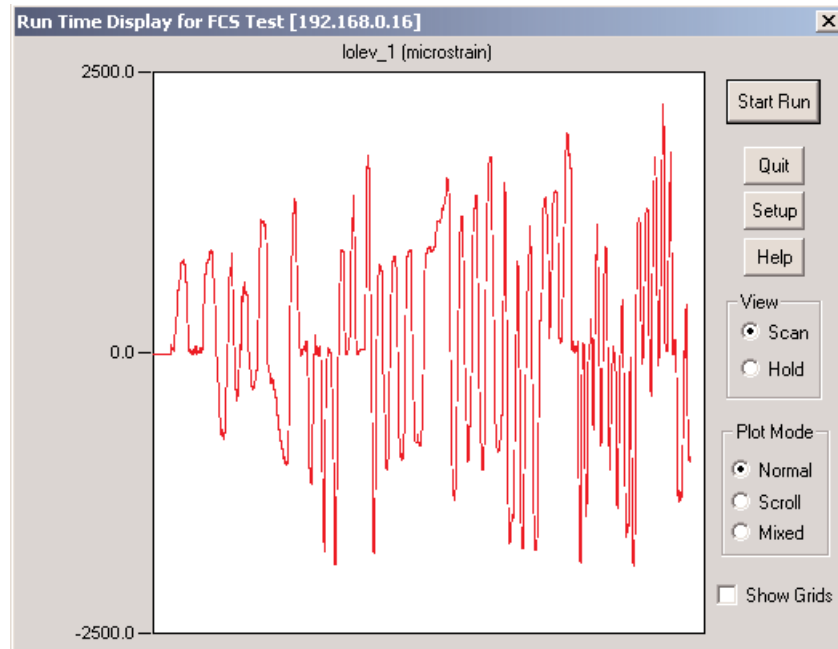
FS Min – The Full Scale Min value provided during the channel's definition.

FS Max – The Full Scale Max value provided during the channel's definition.

Units – Unit of measurement for the channel provided during the channel's definition.

Strip Chart Plot

The Strip Chart plot 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 4 channels can be displayed at a time.



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.

See [Common Controls](#) for explanations of the buttons and the View group box.

Plot Mode

Normal – When the plot reaches the end of the x-axis, the display is erased and the next vertical bar is drawn at the beginning of the x-axis.

Scroll – The vertical bars continuously scroll (from right to left) after the plot reaches the end of the x-axis for the first time; the latest min/max values are then always at the end of the x-axis.

Mixed – When the plot reaches the end of the x-axis, the last half of the display is swapped to the first half of the display and plotting resumes from the middle of the display.

Show Grids – Toggle the visibility of the grid lines on the display plots.

Digital Readout

The Digital Readout display 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 Min and Max columns show the latest values read. The Since Reset Min and Max columns show the overall minimum and maximum values encountered since the display was started or last reset.

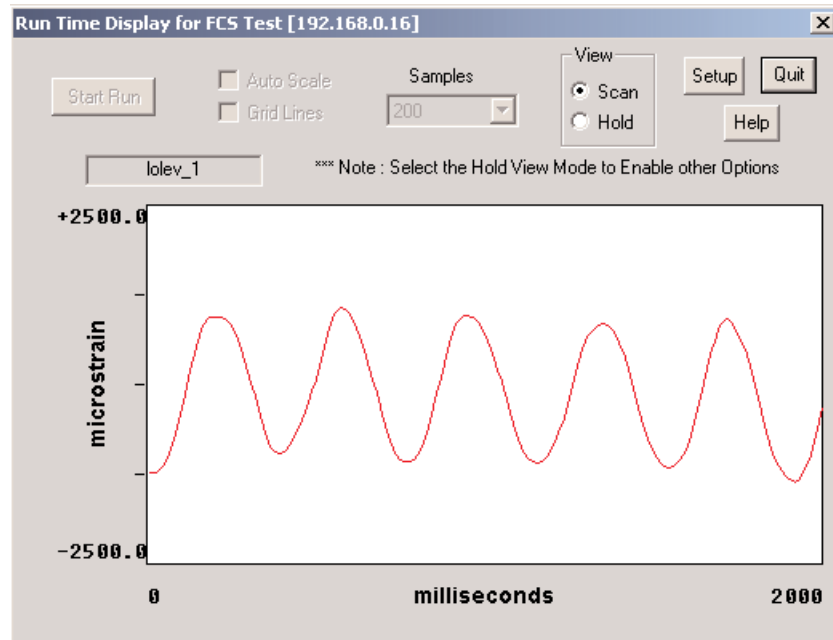
Channel ID	----- Since Reset -----		----- Last Reading -----		Units
	Min	Max	Min	Max	
lolev_2	-0.537	0.530	-0.000	0.003	g's
lolev_1	-1714.1	1134.9	-23.0	-22.7	microstrain
hilev_1	-9961.2	9949.8	-438.9	-436.0	millivolts

Digital Readout Mode, Run Time Display

See [Common Controls](#) for explanations of the buttons and the View group box.

Scope Plot

Scope Plot display is generated from blocks of contiguous data acquired from the FCS. A block of data is requested and displayed; then a new block of data is requested, and the process is repeated. This display mode is limited to display of a single input channel.



Scope Plot, Run Time Display

When previewing a test, the Start Run button can be used to start the test run directly from this dialog box. See [Common Controls](#) for explanations of the buttons and the View group box.

Options

While in Hold mode, the following options are available.

Auto Scale – Automatic Y-axis scaling mode. In this mode, the Y-axis limits are set to the maximum and minimum values in the data set for each Scope scan.

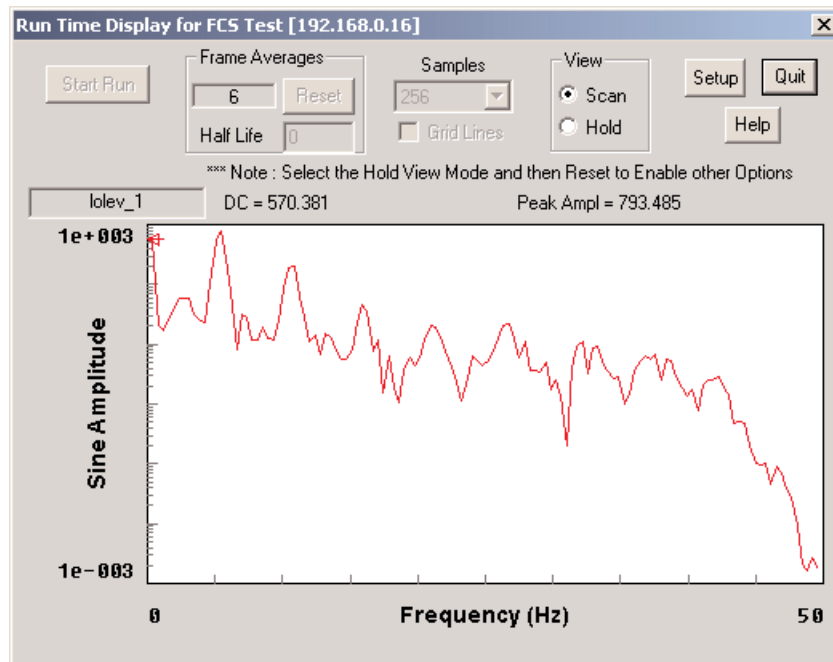
Grid Lines – Place grid lines on the Scope display. The grid lines divide the X-axis and the Y-axis into 10 equal parts. If the Auto Scale option is selected, only the vertical (X-axis) grid lines are presented.

Samples – The desired number of samples to be displayed on each Scope scan.

Spectrum Plot

Spectrum Plot display is generated from blocks of contiguous data acquired from the FCS. A block of data is requested and displayed; then a new block of data is requested, and the process is repeated. This display mode is limited to display of a single input channel.

The (linear) X-axis of the display is scaled from 0 Hz to the Nyquist frequency (i.e., half of the sample rate). The (log) Y-axis is auto scaled with up to 6 decades of coverage. 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.



Spectrum Plot, Run Time Display

See [Common Controls](#) for explanations of the buttons and the View group box.

Frame Averages – The total number of blocks of data processed since the last reset.

Options

Grid Lines – Place grid lines on the Spectrum display. The grid lines divide the X-axis into 10 equal parts, and the Y-axis on log10 decade boundaries. This option is only available while in Hold mode.

The following options are available immediately following a Reset while in Hold mode.

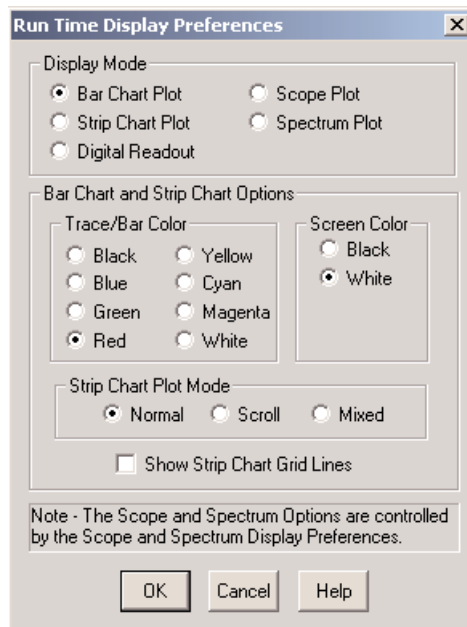
Half Life – As each block of data is acquired, it is passed to the FFT algorithm which generates the “new” contribution to the data displayed. This new data is combined with the “old” (accumulated since the last reset) based on the value defined here. A value of 0 results in no accumulations (i.e., each display is independent of all previously displayed signal content). A value of 1 results in old data accounting for half that of new data within the display. A value of 10 results in 10 blocks of new data being accumulated before old data accounts for half of the data displayed.

For situations where the signal content is stable, using a larger Half Life value will produce displays with less fluctuation and a better representation of signal content.

Samples – The desired number of samples to be used in the FFT algorithm to generate the frequency spectrums.

Run Time Display Preferences

The Run Time Display Preferences dialog box is used to select the default Display mode, Trace/Bar color, Screen color and Strip Chart Plot Mode.



Run Time Display Preferences Dialog Box

To open the Run Time Display Preferences dialog box, select Run Time Display from the TCE Preferences menu.

Display Mode — The preferred display mode for use as the default when the run time display is opened during a test.

Trace/Bar Color — The color for the signal trace or bar.

Screen Color — The background color (black or white).

Strip Chart Plot Mode — The manner in which the signal trace and plot are displayed as data is acquired. This mode controls 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.

Show Strip Chart Grid Lines – Activate visible grid lines in the Strip Chart display.

Chapter 8 - TCE for eDAQ

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 input channels.
- Control the eDAQ FCS when doing test runs.
- Transfer 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). More information about TCE's functions and interfaces can be found in the online help system within the application.

Starting and Quitting


Starting TCE

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

It should be noted that when new, updated versions of TCE are installed on the support PC, they are often installed in a directory specific to the release. The default installation location selected by the installation application will contain the TCE version number. This also applies to entries made in the Start menu within Windows. If TCE updates have been installed, care should be taken to select the most recent version of TCE for use unless there is compelling reason to use an older version.

Quitting TCE

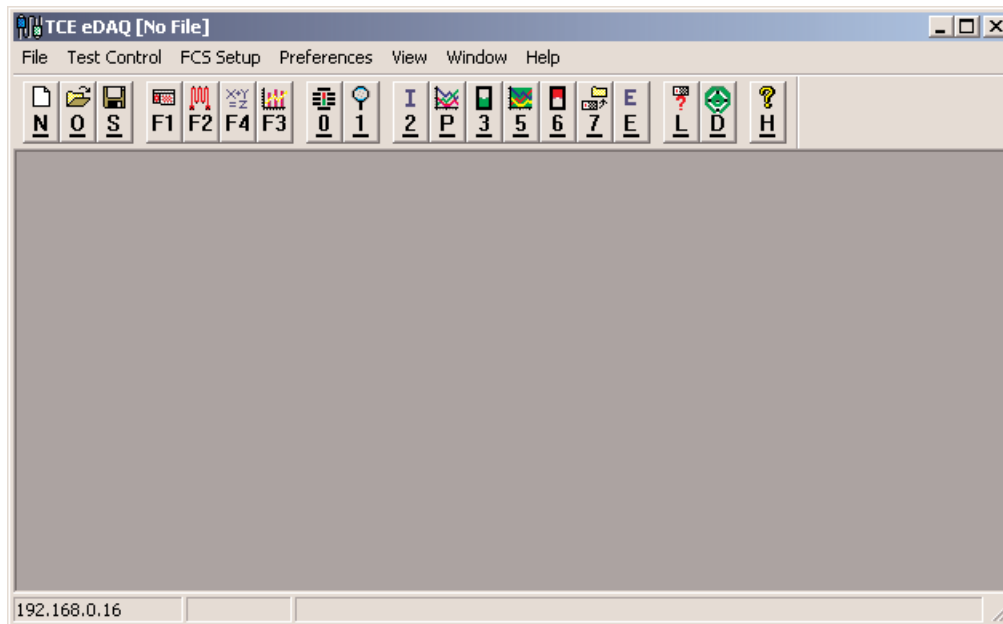
To quit TCE, do one of these actions:

- Select Exit from the File menu.
- 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 application window has a title bar, menu bar, toolbar, work area, and status bar.



TCE Application 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. The TCE title bar may differ from those shown in this guide depending on the version of Windows.

Main Menus

The menu bar contains all of the main menu selections. Descriptions of these main menus and the items they contain follow.

File

The File menu contains the functions used 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 – Create a new test setup definition. [CTRL+N]

Open Setup... – Load and open a previously saved test setup definition. [CTRL+O]

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

Save Setup As... – Save the current test setup definition to a different specified disk file.

Save Setup Listing... – Save a TCE Setup File listing to a file.

Save Setup Tab Delimited... – Generate a tab delimited text file of the Hardware Setup portion of the current TCE setup file. This option is provided primarily for SoMat internal usage.

Open SIF File... – Open a SoMat Information File (*.sif). Refer to the TCE online help system for more information on SIF file data extraction options.

Consolidate SIC Files... – Generate a complete SIF file from the set of SIF component files (i.e. SIC files). The file set usually originates from the PC Card used in the eDAQ for test data collection. TCE performs a number of validity checks on the SIC file set during the SIF file generation process.

Call InField/EASE/DataXplorer – Switch from TCE to the installed display application for test data. [CTRL+D]

Exit – Shut down TCE in a controlled manner.

Recent Setup Files – Display 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 functions used to monitor and control test runs and to upload test data to the host PC.

Control Panel... – Open the TCE Test Control Panel dialog box, which has function buttons used to perform test runs (e.g. open a test setup file, start and stop the test runs, etc) and upload the test data to the support PC. It also shows elapsed run time and how much memory RAM disk and PCMCIA card space are available for data storage. See [eDAQ Test Process - Phase 5: Run the Test - TCE Test Control Panel](#). [CTRL+0]

Get Test Status... – Open 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 [Monitoring Tests and Channels - Monitoring During Test Runs - Get Test Status](#). [CTRL+2]

Initialize Test – Start 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... – Suspend or resume the remote control feature (applies only if the test was initialized with the remote control feature enabled). [CTRL+R]

Prerun Options – Transducer channel display and calibration options that can be used after the test is initialized to help verify that the test runs are operating as expected. These are available only when a test run is not in progress. See [Monitoring Tests and Channels - Monitoring Between Test Runs](#).

Rezero Display... – Display and re-zero transducer channels for an initialized test. [CTRL+Z]

Transducer Checks... – Open a dialog box where a variety of checks can be performed on transducer channels.

Reference Shunt Checks... – Open a dialog box to check the repeatability of shunt calibrations from test run to test run.

Preview Run... – Effectively start a test run with all data mode storage suppressed. All of the Transducer channels, Computed channels, and any Data Modes that do not use mass storage (e.g., the Bitwise Digital Output data mode) run in preview mode just as they would run when a data collection run is started. When Preview Run starts, TCE automatically launches the Run Time Display dialog. The user can start a test run directly from Preview Run mode via the Start Run button on the Run Time Display dialog.

Start Run... – Start a run of the test initialized 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... – Interactively control triggers (previously defined using the Interactive Triggering computed channel) for control of TCE DataModes or other computed channels. [CTRL+4]

Run Time Display... – (Available only while a test is running.) Display, on a real-time basis, the output of the input and computed channels being used in the test. See [Monitoring Tests and Channels - Monitoring During Test Runs - Run Time Display](#) [CTRL+5]

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

Eject PCMCIA Card... – Allow safe removal of the PCMCIA card from a powered eDAQ after a test run has been completely stopped, and any post run Reference Shunt checks have been performed. The user must always confirm this requested action. After this procedure is executed, the PCMCIA card is logically removed from the eDAQ operating system; it cannot be accessed again until it is removed and reinserted, or the eDAQ is reset with the PCMCIA card inserted.

NOTE: The PCMCIA card can also be removed safely after switching off the power to the eDAQ and waiting for the eDAQ to complete the power shutdown sequence.

Warning: Removing the PCMCIA card from a powered eDAQ before using this command (or an equivalent command) will almost always result in lost test data!

End Test – End the current test. Selection of this command prevents another test run from being performed without reinitializing the test, but data can be uploaded to the support PC. [CTRL+E]

Auto Range Options... – Open 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 for future test runs.

Upload Test Data... – 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... – Upload the TCE test setup file in the eDAQ to a specified file on the support PC.

Save AOM File... – Generate a disk file containing the calibration parameters needed to relate analog outputs 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... – Set the master sample rate at either 100,000 Hz or 98,304 Hz.

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

Set FCS Clock... – Set the real time clock in the eDAQ.

Set FCS Digital I/O... – Open a dialog box where each of the ten MPB digital input/output (I/O) bits can be set individually as an input or output. See [Transducer and Message Channels - Defining a Channel - Digital Input \(MPB\) Channel](#).

Set FCS AOM Invert Option... – Set or clear the option for automatically inverting the Low-Level board analog outputs so the analog output voltage polarity is the same as the engineering units polarity.

Reset FCS... – Perform a programmed reset of the eDAQ.

Delete FCS RAM Disk Files... – Delete all of the FCS resident test and data files from the RAM disk. This option is available only if no test is initialized on the FCS, and should be used only after all test data has been uploaded from the FCS.

Format FCS RAM Disk... – Reformat the RAM disk in the eDAQ. All the files in the RAM disk are erased.

NOTE: Before using this command, make sure the data has been uploaded to the support PC.

FCS Diagnostics – Open 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 basic aspects of how TCE operates and displays data, as well as warning messages.

Communications... – Set up Ethernet communications between the eDAQ and its support PC. See [TCE Preferences - Communications](#).

General... – Specify how TCE displays warning messages and other general preferences that relate to all FCSs that TCE supports. See [TCE Preferences - General Preferences](#).

FCS Specific... – Configure various aspects specific to the target FCS. These preferences vary from one FCS to another. See [TCE Preferences - FCS Specific Preferences](#).

Remote Test Run Control... – Configure various aspects of the Remote Test Run Control functionality, including the assignment of Digital Input and (optional) Digital Output bits, and memory low alarm levels. See the TCE online help system for more information.

Scope and Spectrum Display... – Select the color scheme and initial settings for scope and frequency displays. See [Monitoring Tests and Channels - Monitoring Before a Test is Initialized - Scope Display - Display Preferences](#).

Run Time Display... – Change the color scheme and initial appearance for the TCE Run Time Display (RTD). See [Monitoring Tests and Channels - Monitoring During Test Runs - Run Time Display - Run Time Display Preferences](#).

Group DVM Display... – Select from one of the 3 following display modes. See [Monitoring Tests and Channels - Monitoring Before a Test is Initialized - DVM Display - Group DVM Display - Group DVM Display Preferences](#).

Original Static (16 chs max) – The original TCE dialog window that uses static control fields and is limited to a maximum of 16 channels.

Scroll List (256 chs max) – A TCE dialog window that uses a scrollable list control with sizable fields (Channel ID, Current Value, and Units), and is limited to a maximum of 256 channels.

Scroll List Extended (256 chs max) – A TCE dialog window that uses a scrollable list control with sizable fields (Network, Connector ID, Channel ID, Current Value, Saturation Bounds, and Units), and is limited to a maximum of 256 channels.

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 – Standard Windows Cascade and Tile commands.

Arrange Icons – Arrange minimized windows along the bottom edge of the work area.

Close All – Close all of the windows in the work area.

Next Window – When windows in the work area are cascaded or tiled, bring the next window to the front, making it the active window. [F5]

Previous Window – When windows in the work area are cascaded or tiled, bring the previous window to the front, making it the active window. [F6]

Toggle Maximized – Change the size of the active window from maximized (full-screen) to original size and vice versa. [F7]

A list of open windows is provided 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 and guidance on using the TCE online help system.

Contents – Display the main subject listing window for TCE Help.

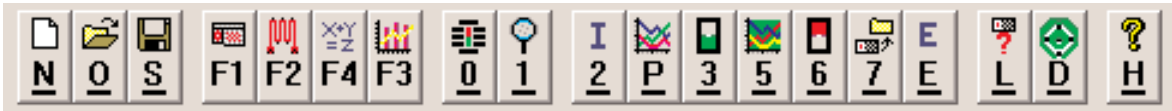
How to Use Help – How to use the Help System.

About TCE... – Display the version information for TCE.

SoMat Webpage – Open the SoMat Corporation Webpage if the computer is connected to the internet.

TCE Toolbar

The buttons on the TCE toolbar provide quick access to commonly used TCE functions.



TCE Toolbar

A short description of the function activated by each button follows.



Create new setup file



Open existing setup file



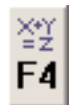
Save setup file



Open Hardware window



Open Transducer window



Open Computed Channel window



Open DataMode window



Open TCE test control panel



Get test status



Initialize test



Preview test run



Start test run



Open Run Time display



Stop test run



Upload test data to PC



End Test



Upload FCS log to PC



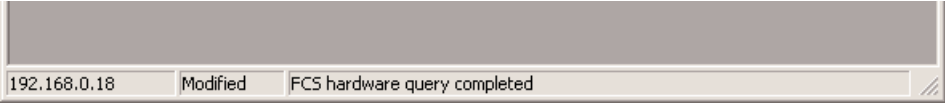
Call InField



Online Help System

Status Bar

The status bar at the bottom of the main TCE window shows various aspects of the test setup status.



TCE Status Bar

Descriptions of the three sections of the Status Bar follow.

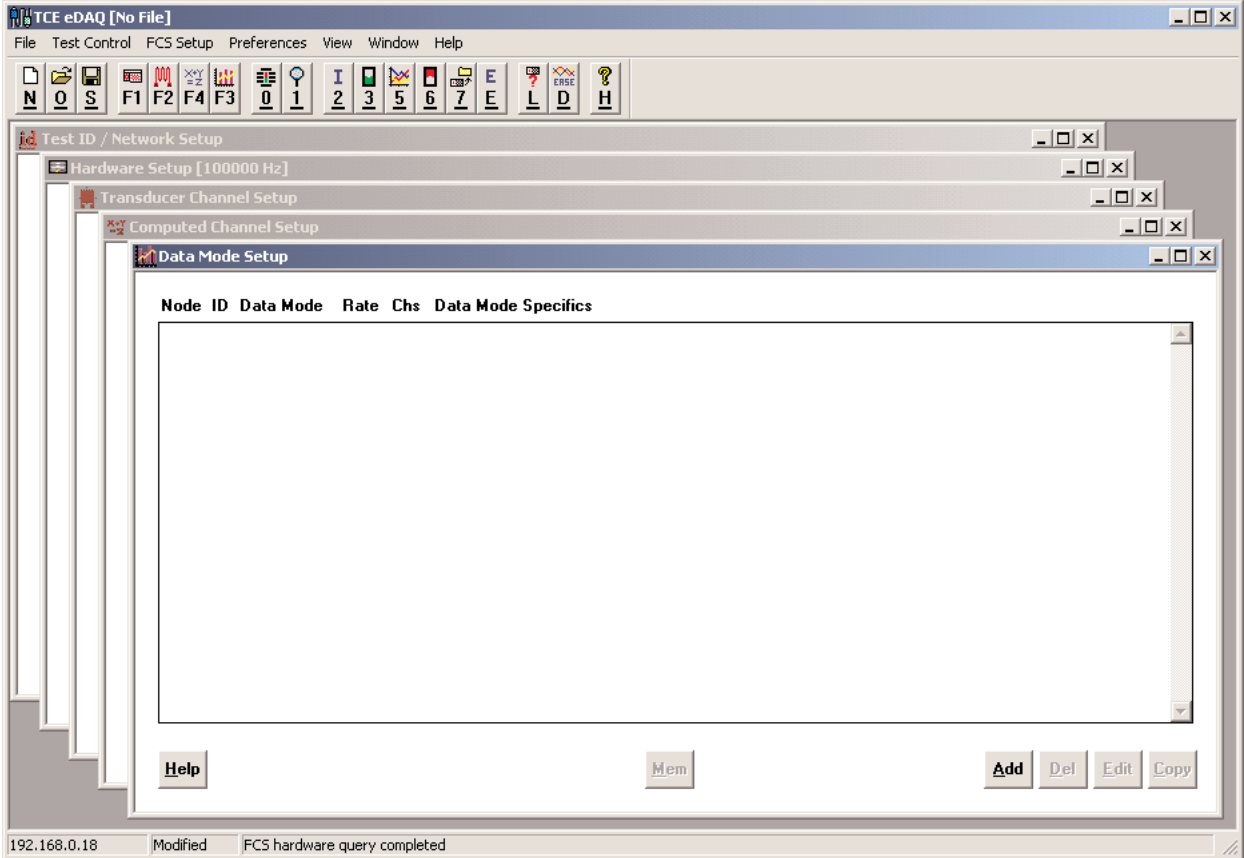
Communications Mode – The IP address or host name currently selected (via the Communication Preferences dialog).

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. It usually contains a brief description of what TCE is currently doing or the status of an action just completed.

Setup Windows

Creating a test setup file in TCE is done via the 5 setup windows opened when a new or existing setup file is loaded. Descriptions of each of these 5 setup windows follows.

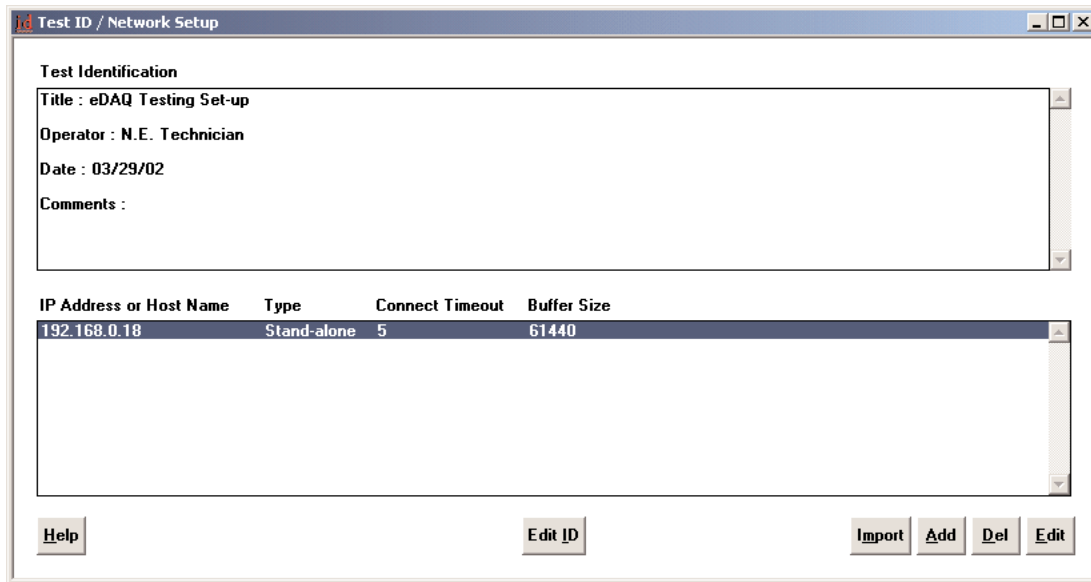


TCE Main Window with Setup Windows

Test ID/Network Setup

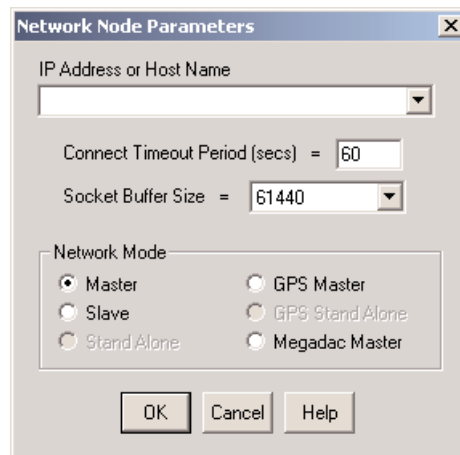
The upper half of the Test ID/Network Setup window contains a descriptive name for the test, the name(s) of the person(s) who will or did run the test, and the test date or date the file was created. There is also space for notes/comments regarding the test, special instructions, etc.

In the lower half of the window, the current Network Node parameters are provided. Information includes the IP Address or Host Name of the FCS, the network mode that in which the FCS has been set to operate, the number of seconds to allow before connection timeout, and the buffer size.



Test ID/Network Setup Window

To add a Network Node to the Test ID/Network Setup, click Add. The Network Node Parameters dialog box appears.

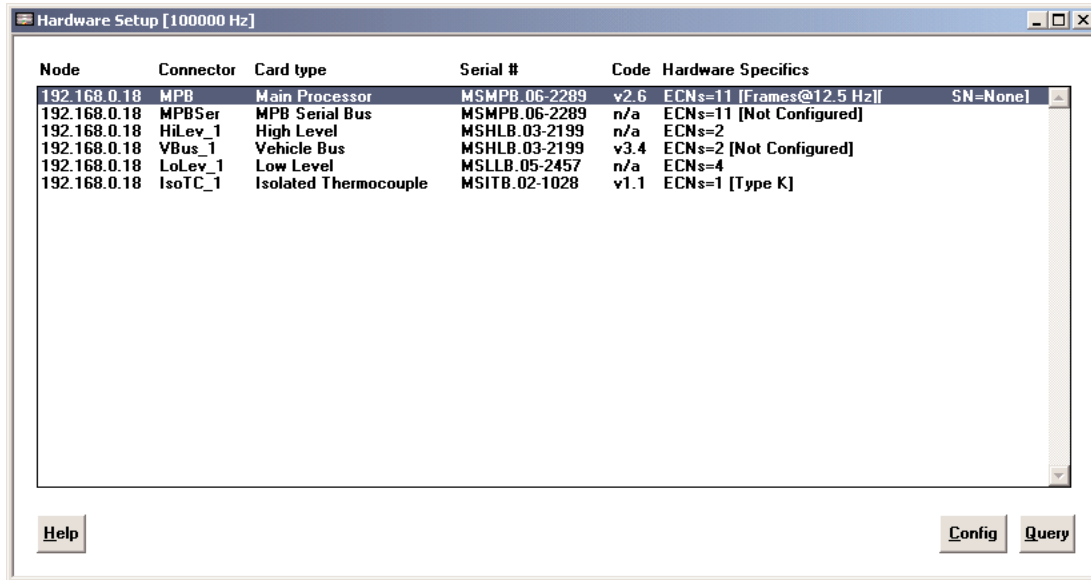


Network Node Parameters Dialog Box

Type the IP Address or Host Name in the text box. Modify the Connect Timeout Period (secs) and Socket Buffer Size as needed. Select a Network Mode for the node to be added. The Stand Alone mode will be available only when there is a single entry in the Network Node list. The Master, GPS Master, Megadac Master, and Slave modes are for use with a network of eDAQs. See [Appendix - Using Networked eDAQs](#) for more information.

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 Master Sample Rate is shown in brackets in the window's title bar. This window is blank when a new setup file is created.



Hardware Setup Window

To acquire a hardware list for a new setup file or to update this window in an existing file, set up communications with the eDAQ, then click the Query button. TCE generates a current hardware list 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 operational between the eDAQ and the support PC.

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

- Select an 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 a Low Level, High Level, or High Level SS line: The Config button opens a Card Config Options dialog box, which has a button for viewing the characterization data for the selected board.
- Select a Serial Bus, Vehicle Bus, or GPS line: The Config button opens a hardware interface setup dialog box, which contains database selections and hardware interface specifics.
- Select a DIO line: The Config button opens a dialog box used to set Digital Ins versus Outs, Pulse Counter modes, input thresholds, GPS interface configuration, and Megadac interface configuration.

Transducer Channel Setup

The Transducer Channel Setup window contains a list of the input channels and their associated information. See [Transducer and Message Channels](#).

ID	Connector	Channel	Rate	Cal Date	Channel Specifics
pc1	192.168.0.47:MPB.c01	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Frequency] FS=0/1e+006 Hz
pc2	192.168.0.47:MPB.c02	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Frequency] FS=0/1e+006 Hz
pc3	192.168.0.47:MPB.c03	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Pulse Rate] FS=0/1e+006 Hz
pc4	192.168.0.47:MPB.c04	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Pulse Rate] FS=0/1e+006 Hz
duty1	192.168.0.47:MPB.c05	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Duty Cycle] FS=0/100 %
duty2	192.168.0.47:MPB.c07	Pulse Counter (MPB)	1000	09/03/99	[Ftr32 : Duty Cycle] FS=0/100 %
lolev01	192.168.0.47:LoLev_1.c01	Low Level	1000	09/03/99	[Int16] FS=10000/10000 mv Filt@ 333 Hz
lolev02	192.168.0.47:LoLev_1.c02	Low Level	1000	09/03/99	[Int16] FS=10000/10000 mv Filt@ 333 Hz
lolev03	192.168.0.47:LoLev_1.c03	Low Level	1000	09/03/99	[Int16] FS=10000/10000 mv Filt@ 333 Hz
lolev04	192.168.0.47:LoLev_1.c04	Low Level	1000	09/03/99	[Int16] FS=10000/10000 mv Filt@ 333 Hz

Transducer and Message Channel Setup Window

Computed Channel Setup

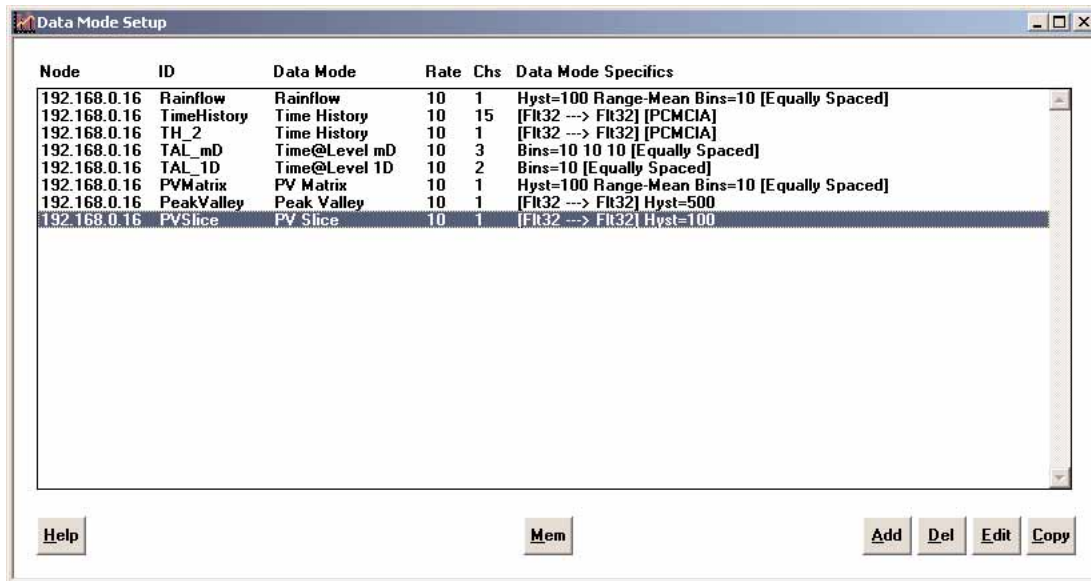
The Computed Channel Setup window contains a list of the computed channels and their associated information. See [Computed Channels](#).

Node	ID	Module	Rate	Computed Channel Specifics
192.168.0.18	Range_Track	Range Track	1000	Accel
192.168.0.18	Min_Track	Min Track	1000	Short_Beam [Reset on Bit_1]
192.168.0.18	Max_Track	Max Track	1000	Long_Beam
192.168.0.18	Time	Time Channel	1000	Time[Short_Beam] [Uns32]
192.168.0.18	Channel_Lag	Time Base Shift	1000	HiLev1 Lag@1
192.168.0.18	Smooth_Filt	Smooth Filter	1000	Short_Beam Length=3
192.168.0.18	Velocity	Integrator	1000	ScaleFactor=1
192.168.0.18	Down_Sample	Down Sample	100	Gear_Speed@10
192.168.0.18	Digital_Up	Up Sample	10000	Bit_1@10
192.168.0.18	Trigger	Desk Calc	1000	Long_Beam > 100

Computed Channels Setup Window

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. See [DataModes](#).



DataMode Setup Window

TCE Preferences

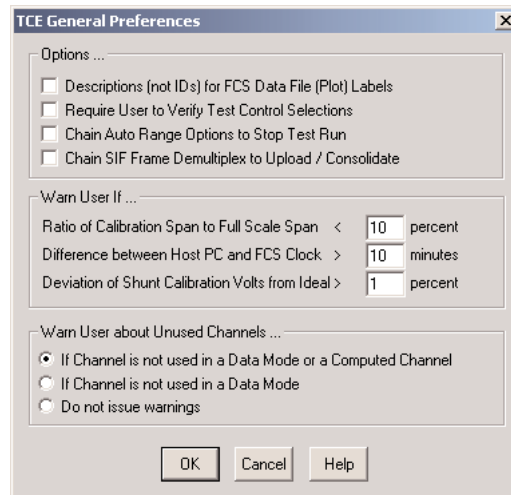
The TCE Preferences menu contains the commands used to set various types of preferences in TCE.

Communications

See [Setting up the eDAQ - Setting Up eDAQ-PC Communications](#).

General Preferences

The general preference options are used to configure general aspects of TCE.



TCE General Preferences Dialog Box

Options

Descriptions (not IDs) for FCS Data File (Plot) Labels – Text in the description boxes in the definition dialog boxes for transducer, message, and computed channels are 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.

Text in description boxes may contain up to 63 characters, but the Y-axis plot labels are limited to 31 characters. This can cause labels to be truncated. In addition to this, certain DataModes (i.e. Rainflow and Peak Valley Matrix) add a prefix to user-defined plot labels automatically. For example, a Rainflow range-mean histogram adds the prefixes “Range” and “Mean.” These facts should be considered when activating this preference so that truncation can be avoided.

Require User to Verify Test Control Selections – Prompt the user to verify selection of most Test Control menu commands.

Chain Auto Range Options to Stop Test Run – 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.

Chain SIF Frame Demultiplex to Upload / Consolidate – Demultiplex all of the multiplexed SIF file data records after successfully Uploading or Consolidating the FCS SIF data file. Doing so will in general significantly improve data analysis performance by such products as SoMat InField. Note that the demultiplexing will not be chained if there are any abnormalities in the Upload or Consolidation (such as corruption of the SIF file for whatever reason).

Warn User if

Ratio of Calibration Span to Full Scale Span < *nn* percent – 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 – 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 – 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.

Warn User About Unused Channels

There are 3 available options for generating user warnings at test initialization time about channels that are not used in a Data Mode or a Computed Channel. If a warning is issued, the user can elect to continue with the test initialization or abort it. These options are:

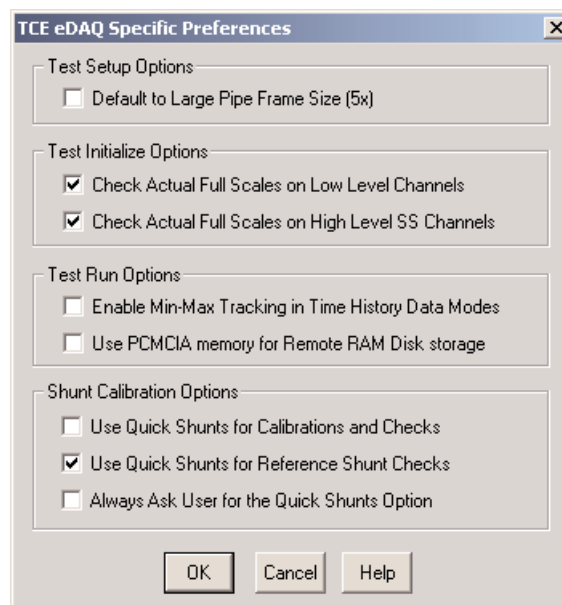
If Channel is not used in a Data Mode or a Computed Channel

If Channel is not used in a Data Mode

Do not issue warnings

FCS Specific Preferences

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



TCE eDAQ Specific Preferences Dialog Box

Test Setup Options

Default to Large Pipe Frame Size (5x) – Use the large pipe frame size option as the default for new TCE test setup definitions (and for older TCE setup files that were generated before this option was available). The user can always override this default by editing this option in the MPB board user configuration dialog window.

Test Initialize Options

Check Actual Full Scales on Low Level Channels – Check the actual Full Scale limits for all Low Level channels defined in the test. This check is performed immediately after the test is initialized. Full Scale limits that deviate from the user requested limits in either of the two following ways will be reported - either the over range protection is less than 5%, or the over range protection exceeds 25%.

Check Actual Full Scales on High Level SS Channels – Check the actual Full Scale limits for all High Level SS channels defined in the test. This check is performed immediately after the test is initialized. Full Scale limits that deviate from the user requested limits in either of the two following ways will be reported - either the over range protection is less than 1%, or the over range protection exceeds 25%.

Test Run Options

Enable Min-Max Tracking for Time History Data Modes – Track the minimum and maximum values in each input channel for Time History Data Modes. 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 PCMCIA memory for Remote RAM Disk storage – store the static part of the RAM disk file on the PCMCIA card. This will effectively limit the size of the RAM disk file, and prevent the situation where the RAM disk memory fills up before the PCMCIA card memory fills up. Note - If this option is selected, the capability to Upload individual test runs will not be available.

Shunt Calibration Options

Use Quick Shunts for Calibrations and Checks – 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 – 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 – Prompt the user as to whether or not the Quick Shunt option is to be used. Primarily, this is provided as a tool to assist 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 how much accuracy loss (if any) is incurred when using the Quick Shunt calibration mode.

Remote Test Run Control

See the TCE online help system for more information.

Scope and Spectrum Displays

See [Monitoring Tests and Channels - Monitoring Before a Test is Initialized - Scope Display - Display Preferences](#).

Run Time Display

See [Monitoring Tests and Channels - Monitoring During Test Runs - Run Time Display - Run Time Display Preferences](#).

Group DVM Display

See [Monitoring Tests and Channels - Monitoring Before a Test is Initialized - DVM Display - Group DVM Display - Group DVM Display Preferences](#).

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

There are three basic categories of TCE error messages:

- Basic TCE operation
- eDAQ communications
- eDAQ control interactions

Basic TCE Operation

When TCE detects an invalid input (such as assigning the same ID to two different transducer channels), it will flag the problem and require the input be changed. 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" is generated 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 within the eDAQ.

A message box (with online help access) appears when TCE detects that an eDAQ error or status flag has been set. Refer to the TCE online help system for more information on this topic.

Chapter 9 - eDAQ Web Interface

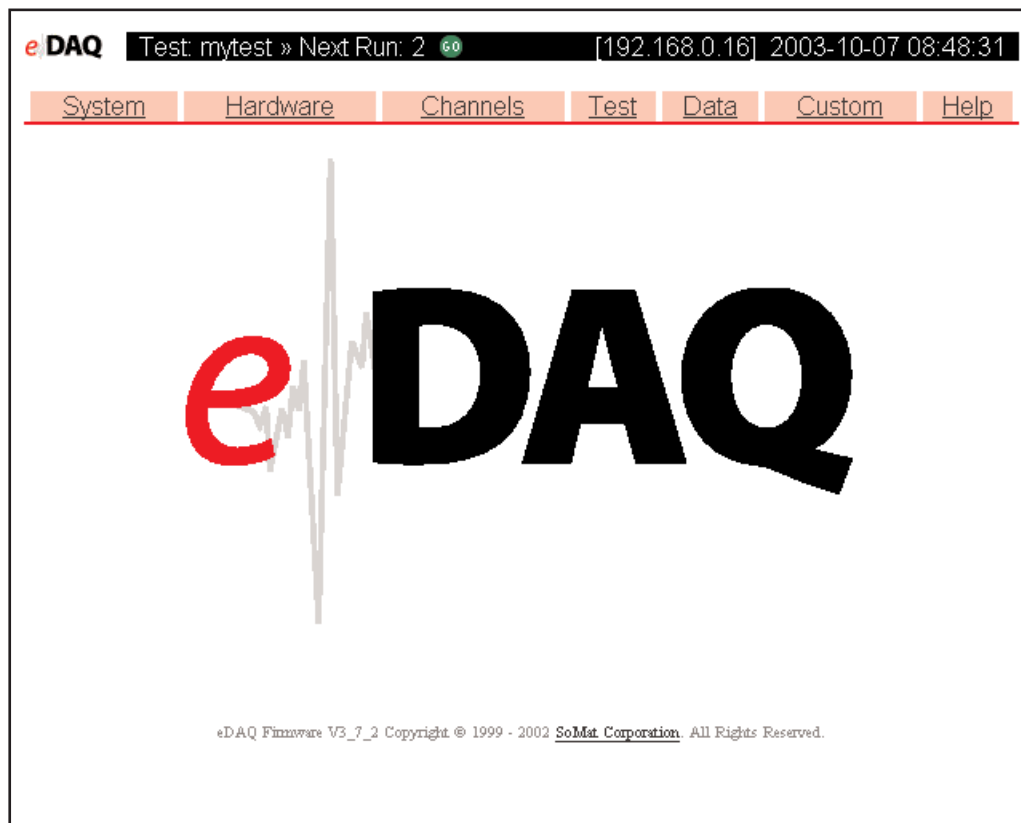
The eDAQ web interface can be used to perform test control operations including the activation of saved test initializations, starting and stopping of test runs, monitoring test status, and ending initialized tests. It can also be used to perform a number of system configuration and other utility operations including formatting PC Cards, modifying Ethernet and serial communication settings, and upgrading eDAQ firmware with new version releases.

Accessing the eDAQ Web Interface

A TCP/IP connection must be made between the support computer and the eDAQ before the eDAQ web interface is available. Once the connection is available, the eDAQ can be accessed with a web browser (e.g., Microsoft Internet Explorer, Netscape Navigator, Mozilla, etc.) Enter the IP Address of the eDAQ into the Address bar of the browser. This will open the main screen of the eDAQ web interface.

The information bar located across the top of the web interface provides the eDAQ's IP address and the date and time that the page was loaded in addition to test specific information. When a test is initialized but not running, the name of the initialized test, the next run number, and a green light labeled Go (click to start a test run) are displayed. When a test run is in progress, the current run number, a red stop sign labeled Stop (click to stop a test run), and the elapsed test run time are displayed. This display is not automatically updated. The page must be refreshed/reloaded to update the run timer.

Just below the information bar is the tab menu bar which provides access to categories of available operations. Each category has its own page which is opened by clicking on the appropriate tab. The available operations are described in subsequent sections of this chapter.



eDAQ Web Interface

System

System Setup

The System Setup group of pages provide methods to modify the network configuration parameters, RS-232 communication parameters, remote username and password, and the timezone in which the eDAQ resides.

Network Setup

Network Setup is used to set the network configuration parameters within the eDAQ.

To make changes to the setup, modify the Hostname, IP number, Netmask, and Gateway as required. Click Reconfigure Network to save the changes. Click Cancel to abandon the changes.

- Hostname
- IP number
- Netmask
- Gateway (leave blank for none)

Network Setup

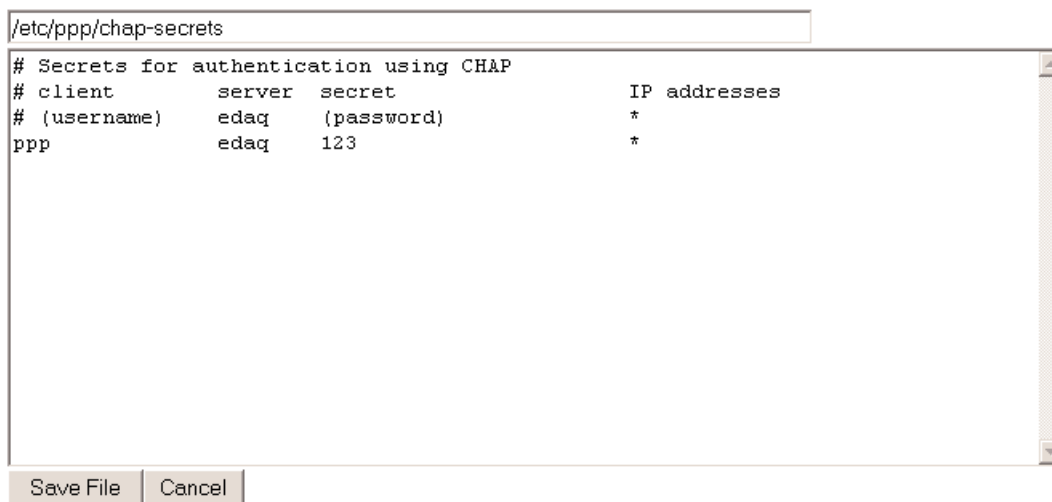
RS-232 Setup

RS-232 Setup is used to set the serial communication parameters within the eDAQ. This operation will open a text area which contains the file `pgetty.conf`, the file containing all configuration information for serial communication. Errors within `pgetty.conf` can cause all serial communication to cease to function. It is therefore advised that **extreme caution** be exercised when modifying this file.

Remote Username and Password Setup

Remote Username and Password Setup is used to set the username(s) and password(s) that are allowed remote access to the eDAQ. This information is used when the eDAQ has been set up for and is accessed through a dial-up connection.

To make changes to this setup, modify the file as needed. Click Save File to save any changes. Click Cancel to discard changes. In the default configuration shown below, "PPP" is the remote username, and "123" is the password for that user.

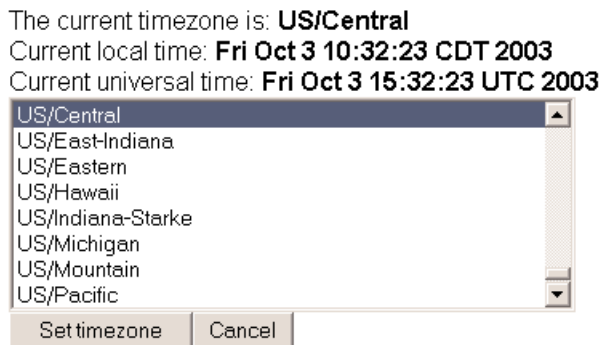


Remote Username and Password Setup

Timezone Setup

Timezone Setup is used to set the timezone in which the eDAQ resides. The current timezone, local time, and universal time (Universal Coordinated Time - UTC: the time as set by the World Time Standard) are provided.

To make changes to the setup, select a new timezone from the list. Click Set timezone to save the changes. Click Cancel to abandon the operation.



Timezone Setup

System Status

The System Status group of operations provide access to information about the current state of the eDAQ system.

Show Ethernet TCP/IP Configuration

Show Ethernet TCP/IP Configuration will display information about the current configuration of the Ethernet TCP/IP communication system setup.

Ethernet TCP/IP Configuration

```
eth0      Link encap:Ethernet  HWaddr 00:D0:56:00:22:11
          inet addr:192.168.0.16  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:496288  errors:0  dropped:1  overruns:0  frame:0
          TX packets:384  errors:0  dropped:0  overruns:0  carrier:0
          collisions:1  txqueuelen:100
          RX bytes:26312249 (25.0 Mb)  TX bytes:0 (0.0 b)
          Interrupt:10  Base address:0x300
```

OK

Show Ethernet TCP/IP Configuration

Show Running Processes

Show Running Processes will display information about the currently running processes on the eDAQ.

System Maintenance

Explore eDAQ Files

Explore eDAQ Files will open the eDAQ filesystem and allow the user to browse its contents.

All file lists will contain the entry "Copy new file to eDAQ". Selection of this entry will open the interface which allows the copying of a file from the PC to the eDAQ. The current location within the filesystem is automatically entered as the destination path in the copy interface.

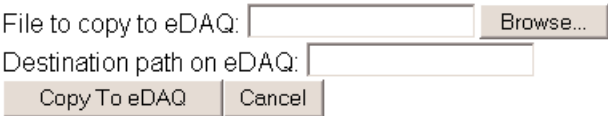


Explore eDAQ Files

Transfer a file to the eDAQ

Transfer a file to the eDAQ will open the interface which allows the copying of a file from the PC to the eDAQ.

Enter the path and filename of the file to be copied, or click the Browse button to open a standard Windows file selection dialog box to locate and select the file to be copied. Enter the destination path (location within the eDAQ filesystem). Click Copy To eDAQ to complete the file copy. Click Cancel to abandon the operation.



Transfer a file to the eDAQ

Command Prompt

Command Prompt will open an interface that allows direct entry of Linux shell commands to the eDAQ operating system. This operation is provided for *Expert Use Only*. Serious damage to the system can occur through the use of system commands (it is possible to render the system inoperable). Therefore, **extreme caution** should be exercised when using this operation.

Reset eDAQ

Reset eDAQ performs a reset of the eDAQ system.

eDAQ Reset

- Now resetting eDAQ...
Wait for the LEDs: Green ON, Red ON, Yellow OFF.

[Back to the eDAQ web page](#)

Reset eDAQ

Hardware

The Hardware page contains information about the hardware contained in the eDAQ. Displayed information includes the network node associated with the hardware, the type of board and its serial number, the version number of the code contained in the flash memory, completed ECNs, and information about the PC Card (if installed).

Node	Connector	Card Type	Serial #	Code	Hardware Specifics
192.168.0.16	MPB	Main Processor	MSMPB.06-2211	V3_7_2 (v3.2)	13 ECNs PC Card
192.168.0.16	MPBSer	MPB Serial Bus			
192.168.0.16	HiLev_1	High Level	MSHLB.03-2140		3 ECNs
192.168.0.16	VBus_1	Vehicle Bus		v3.5	
192.168.0.16	LoLev_1	Low Level	MSLLB.05-2364		4 ECNs

Hardware Tab

Card Type

Certain eDAQ layers allow for additional configuration such as enabling message logging and editing of parameter databases. When this additional configuration is available, the Card Type (i.e., layer) listed will be enabled as a hyperlink (underlined) and, when selected, will open additional pages where the configuration options are presented.

Vehicle Bus

The additional configuration available for the Vehicle Bus layer includes editing parameter databases, importing a vector CANdb database, logging messages, viewing status, and resetting the vehicle bus hardware.

Vehicle Bus

- [Edit Parameter Databases](#)
- [Import Vector CANdb Database](#)

VBus_1

- @
- [VBus_1 Hardware Status](#)
- [Reset VBus_1 Hardware](#)

Additional Vehicle Bus Card Type Configuration Options

Edit Parameter Databases opens an interface that allows for browsing of the eDAQ filesystem to locate the database, then provides options for opening the database file in a text area or in a spreadsheet within the web interface. Files can also be copied back and forth between the eDAQ and the support PC and deleted from the eDAQ.

Import Vector CANdb Database opens an interface that allows for the import of a new database file to the eDAQ. The database filename can be entered manually with the keyboard or the Browse button can be used to open a standard file selection dialog box. Once the file is located, enter the name for the converted database in the text box, and click Import File. Click Cancel to abandon the operation.

Select the .dbc file:

Enter a name for the converted eDAQ database:

Import Vector CANdb Database

Log Messages will open a new page and display the messages received from the Vehicle Bus.

Code

The version of the code (i.e., firmware) that controls the layer is displayed in the Code column. This code can be updated from within the web interface. For layers that place more than one entry in the hardware list, only one of the entries will allow the update to the firmware. To open the interface that controls this update, click the hyperlink.

A new page will open that displays the Connector name and serial number for the layer that has been selected. It also provides basic instructions for the process.

The MPB and the Vehicle Bus provide a “Just testing...” option to test the process and ensure that no errors occur. It is advised that this option be used if there is any possibility of an interruption in network communications or power supply or if this is the first attempt to upgrade a specific eDAQ. Failures during a critical point in any upgrade/reflash can cause the hardware to malfunction requiring its return to SoMat for repair by a qualified SoMat Technician.

Hardware Specifics

ECNs

An ECN is an “Engineering Change Notice” signifying a physical modification made to the hardware of a layer to correct or improve its performance. When these changes are made to the hardware layers, the change is recorded in non-volatile memory within the layer itself so that changes can be tracked.

The number of ECNs performed on the layer is displayed in the Hardware Specifics column. Clicking the link will display a list of ECN number and the corresponding date that the change was made.

PC Card

If a PC Card is installed in the eDAQ, a link will be available within the Hardware Specifics column. Clicking the link will open a list of operations specific to the PC Card. These operations include showing information, showing detailed information, showing resources used, ejecting, and formatting the card.

To remove the PC Card from the eDAQ, either the eDAQ must be powered down or the Eject PC Card operation must be selected. Removing the PC Card while the eDAQ is powered-up without performing this step will almost certainly result in data loss.

There are two filesystem formats available for use on a PC Card within the eDAQ. Using the Linux ext2 filesystem will provide higher data throughput. Using the DOSVFAT filesystem will allow a PC running Microsoft Windows with a PC Card reader to read the data directly from the PC Card.

NOTE: TCE software version (and therefore MPB firmware version) 3.5.1 or greater must be installed to use the Linux ext2 filesystem format.

Channels

The Channels tab provides information about the defined Transducer, Message, and Computed Channels in the currently initialized test. The information displayed for transducer and message channels includes the unique ID, the connector, the transducer type, the sample rate, the calibration date, and other information pertinent to the channel. The information displayed for computed channels includes the network node associated with the channel, the unique ID, the prefix, a description, and other information pertinent to the channel.

Transducer Channels

ID	Connector	Transducer	Rate	Cal Date	Transducer Specifics
mpbpc_1	192.168.0.16:MPB.c01	Main Processor	1000	09/18/03	
bit2	192.168.0.16:MPB.bwi	Main Processor	1000		
bit3	192.168.0.16:MPB.bwi	Main Processor	1000		
bit4	192.168.0.16:MPB.bwi	Main Processor	1000		
bit5	192.168.0.16:MPB.bwi	Main Processor	1000		
vb_mes	192.168.0.16:VBus_1	Vehicle Bus	0		
lolev_1	192.168.0.16:LoLev_1.c01	Low Level	1000	09/17/03	
hilev_1	192.168.0.16:HiLev_1.c01	High Level	1000	09/11/03	

Computed Channels

Node	ID	Prefix	Description	Specifics
192.168.0.16	pc_computed	PULSE		
192.168.0.16	hilev_1_up10	USAMPLE	Voltage Input [10000 mv range]	

Channels Tab

Test

The Test tab provides information about the current test. If a test is initialized, it displays the name of setup file, the current or next run number, and the elapsed time (for a running test). This display is updated only upon a refresh of the page (therefore the elapsed time will not automatically update).

Current Test: mytest

Next Run: 2

Start Test Run Description:

Test Status

[View eDAQ logbook](#)
[Get TCE setup file \(mytest.tce\)](#)

Test Tab - With a Test Initialized

Test runs can be started and stopped and test status can be viewed using the buttons. There are also links provided to view the eDAQ logbook and to get (and save to the PC) the setup file in use on the eDAQ.

Data

The Data tab provides access to test data. There is a link to Get SIF file that can be used to save the SIF file to the support PC.

[Get SIF File](#)

Run	Date
Run 1	2003-10-06 15:53:47

Data Tab

This tab also provides a method to view individual test run data. When test run data is present in the eDAQ, a list is generated of the individual test runs along with the date and time that the test run was performed. To view test run data, click on the hyperlink for the test run to be viewed. A new page will open displaying the channels contained in the test run, the test run number, the channel number, the DataMode type, the sample rate for the channel, and the number of data points gathered for the channel during the test run.

ChanName	RunNum	ChanNum	DataModeType	SampleRate	NumPoints
th_hilev1@hilev_1.RN_2	2	3	TIMHIS	1000	58640
th_lolev1@lolev_1.RN_2	2	4	TIMHIS	1000	58640

Test Run Data Detail Display

Currently Time History and Message Channels are the only data types viewable via the web interface. To view basic information about the channel along with the actual data collected during the test run, click on the channel name.

Custom

The Custom tab can be used to install custom modules into the eDAQ system. The Serial GPS and Cubic TC modules are currently the only distributed custom module. It can be found within the TCE installation in the eDAQ directory.

To install a custom module, click the Install New Module hyperlink. Type the path and filename in the text box or use the Browse button to open a standard file selection dialog box to locate and select the module to install. Click Install Custom Module to complete the installation, or click Cancel to abandon the operation.

- [Install New Module](#)

Module	Status	Action
/usr/custom/SerialGPS	Disabled	Enable Remove

Custom Tab

When custom modules are installed in the eDAQ, a table is displayed on the Custom page. The information this table contains includes the name and installation path of the module, the current status (enabled or disabled), and a list of operations that can be performed on the module (enable/disable and remove).

To discuss a custom module created specifically for your company's needs, contact your SoMat Sales Representative.

Help

The Help tab contains links to the electronic help system for the web interface.

Appendix - Using Networked eDAQs

Multiple eDAQ FCSs can be configured to acquire data synchronously using a single Master Sample Rate (MSR) clock source. TCE supports defining test setup configurations for networked eDAQs in a single TCE setup file. TCE also coordinates most test control tasks for networked eDAQs; this includes test initializations and ends, test run previews, starts, and stops, and SIF data file uploads.

Setting Up the Hardware

Hardware Required

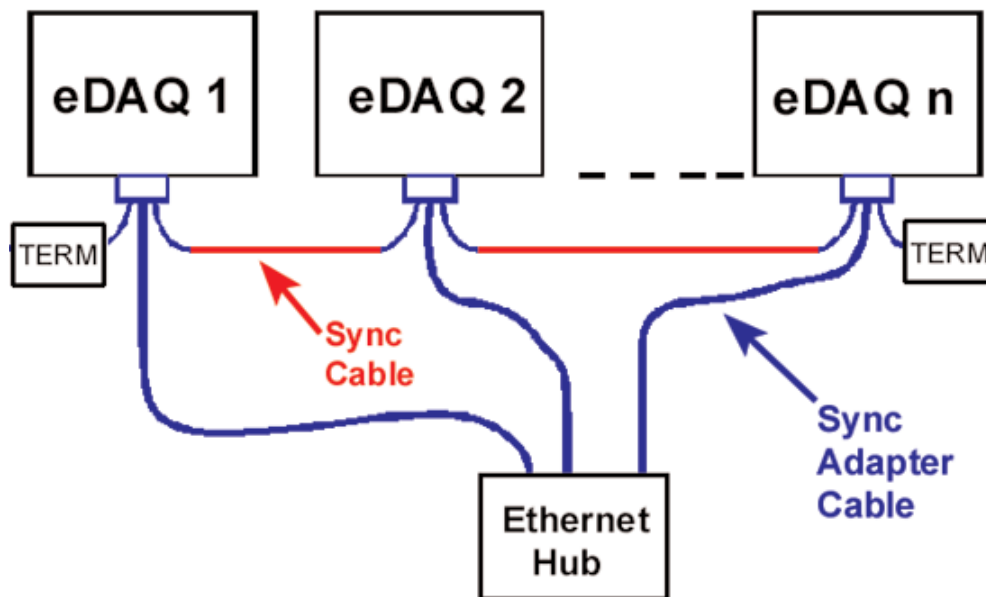
There are specific cables and adapters required to set up a network of eDAQs. They are:

- the eDAQ Synchronization Adapter Cable (SAC-ESYNCADAPT) — 1 per eDAQ in the network
- the eDAQ Data Sync Clock Cable (SAC-ESYNC) — 1 for each eDAQ to eDAQ connection
- the Data Sync Cable Terminations (SAC-ESYNCTERM) — 2 per network of eDAQs

It is assumed that Ethernet communication will be used for the eDAQ network. Therefore, an Ethernet hub with enough connections for each of the eDAQs and the support PC is also required.

Hardware Connections

Referring to the diagram below, the eDAQ Synchronization Adapter Cable is simply a normal communication cable with the addition of 2 cable stubs which provide a “tee” connection to the data synchronization clock. The clock is supplied by the Master FCS and distributed to each Slave FCS via the eDAQ Data Sync Clock Cables. One side of this “tee” will be left unconnected at each of the end eDAQs and should be terminated using the Data Sync Cable Terminators.



NOTE: There is currently a 10 to 20 microsecond hardware delay imposed in routing the Master clock signal to the Slaves.

Setting Up the Test

TCE communicates with each eDAQ and coordinates test control tasks. It is assumed that all eDAQs and the PC are connected to a hub and that the Remote Control option is disabled (see [Remote Control Operation](#) for details about enabling the Remote Control option within networked eDAQs).

1. Define the set of eDAQs to be used in the test. This is done within the Test ID/Network Setup window in TCE. Use the Add button to add each network node (eDAQ). In general one of the eDAQs will be designated as the Master (i.e., the eDAQ that generates the MSR clock source) and the rest will be designated to be Slaves. The choice of which eDAQ is the Master network node is largely arbitrary.
2. Set the current communications preference to any one of the networked eDAQs (see [Setting up the eDAQ - Setting Up eDAQ-PC Communications](#)), and perform a hardware query (see [TCE for eDAQ - Setup Windows - Hardware Setup](#)). TCE will coordinate the hardware queries for all of the networked eDAQs. The Hardware Setup window will display the list of hardware modules on each eDAQ partitioned by the network nodes.

NOTE: All eDAQs in a network configuration must have the Master Sample Rate option set to the same value (i.e., either 100,000 or 98,304 Hz).

3. Define the Transducer and Message channels (see [Transducer and Message Channels - Defining a Channel](#)), Computed channels (see [Computed Channels - Defining a Computed Channel](#)), and DataModes (see [DataModes - Defining a SoMat DataMode](#)) for the test. For multiple channel eDAQ interactive setup tasks such as the group DVM display and parallel transducer calibrations, TCE currently limits the channel set to those residing on a single network node. However, most non-interactive features (e.g., group edits and group deletions) are supported across multiple network nodes.

Running the Test

With the test setup complete and all transducer channels calibrated, the test can be initialized with the current communications preference set to any one of the networked eDAQs. TCE will coordinate the test initialization of all networked eDAQs. Test run starts and stops are also coordinated by TCE.

The details of starting (or previewing) and stopping tests are largely transparent to the user but occur as follows. TCE prepares each Slave eDAQ for a test run start (or preview) in a serial manner. After each Slave is prepared, it is waiting only for the Master to assert the MSR clock source for the test run to actually begin on the Slave. During this waiting period, the green and amber LEDs on the Slave will blink in unison at a fairly slow rate. TCE then starts the test run (or preview) on the Master, which starts all test runs (or previews) synchronously when the Master asserts the MSR clock source. To stop a test run (or preview), TCE stops the test run (or preview) on the Master eDAQ, which results in the MSR clock source being de-asserted. When this occurs, each Slave detects the loss of the MSR clock source and stops the test run (or preview) synchronously.

NOTE: When an eDAQ is configured as either a Master or Slave and a power failure or an error reset occurs, the eDAQ will not attempt to start a new test run.

Checking Test Status

The TCE Get Test Status function will first check and report the status of the eDAQ using the current communications preference. It will then ask for confirmation about proceeding with reporting the test status on the other eDAQs in the networked test configuration.

Other Test Control and Monitoring Tasks

Test control and monitoring tasks (including TCE Control Panel, Run Time Display, and all Prerun Options) not specifically mentioned in this appendix are performed using the current communications preference. As an example consequence of this, Run Time Display can only display channels from one network node (eDAQ) at a time.

Uploading the Data

Each eDAQ resident SIF file is uploaded in a serial manner. TCE appends a qualifier string to the default PC file name to distinguish SIF files. For example, if the TCE setup file name is MyTest.tce, and there are 3 eDAQs networked, the default SIF data file names will be MyTest(1 of 3).sif, MyTest(2 of 3).sif, and MyTest(3 of 3).sif. If the user chooses to remove the PC Card and perform a SIF file consolidation on the PC (instead of using the TCE upload option), TCE will provide the same default SIF file naming convention.

Remote Control Operation

The remote control hardware (i.e., the digital I/O interface hardware) is used only on the eDAQ that is designated as the Master. This currently applies to both the test run control input and the optional test monitoring output hardware lines.

The Slave eDAQs automatically start a new test run immediately after test initialization and after each test run is stopped, as long as the remote control is not suspended by the user. **Because of this the user must be very careful to not start the Master until all of the Slaves are running** (i.e., waiting for the Master to assert the MSR clock source; the green and amber front panel LEDs blink in unison when the Slave is in this ready state). Failure to do this will result in the Slave data being out of synchronization with the Master data.

One consequence of the Slaves automatically starting a new run after each run is stopped is that the user generally cannot remove the PC Card or end the test after a test run is stopped. One way around this is to suspend the remote control, then stop the test. This should be done with the run control switch on the Master set in the off position. When this is done, each Slave will have incremented the test run number and will have created a new set of DataMode channels in the SIF file

The remote control can be suspended/resumed using the TCE interface in the same manner (by selecting Remote Control... from the Test Control menu) as it is done for a stand-alone eDAQ test using the remote control option. See the TCE online help system for more information about Remote Control Operation.

The user is advised to experiment with the remote control of a networked set of eDAQs and become thoroughly familiar with the details involved prior to using it in the field.

NOTE: The Preview Run option is not supported in Remote Control mode.

Appendix - Technical Specifications

Digital I/O Device Wiring

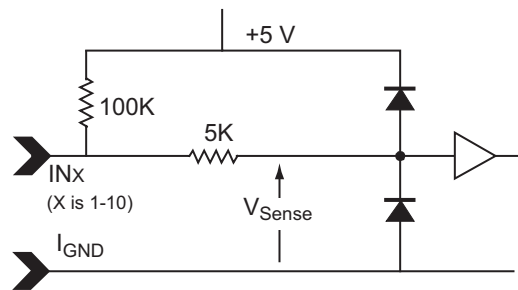
The following information is applicable to the eDAQ main processor board (MPB), eDAQ-plus main processor board (MPB), and the Digital I/O expansion layer board.

Digital Inputs

The wiring diagrams for various digital input devices are provided below. An equivalent circuit as well as diagrams showing use of a switch closure, encoder, and magnetic pickup device is included.

Equivalent Circuit

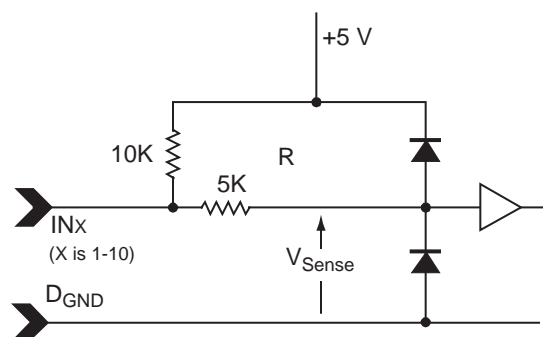
The equivalent circuit for a digital input line is shown below.



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).

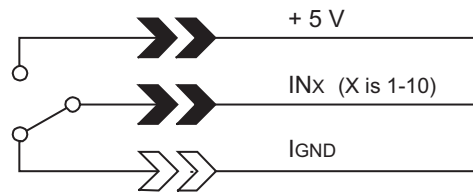
Pulse Counter



Equivalent Circuit for Pulse Counter Input Line

Preferred Switch Digital Input

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



Preferred Switch Digital Input

This circuit solidly switches the input line to either ground (DGND) 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: When this input is used in conjunction with the eDAQ-Classic or the eDAQ-Plus main processor boards, the +5 Volts must be supplied externally for this circuit to work correctly. The Digital I/O expansion layer board provides this directly from the board.

Alternate Switch Digital Input

The circuit wiring for an alternate digital input involving a switch closure function is shown below. An open switch as shown is logic one (true); a closed switch is logic zero (false).



Alternate Switch Digital Input

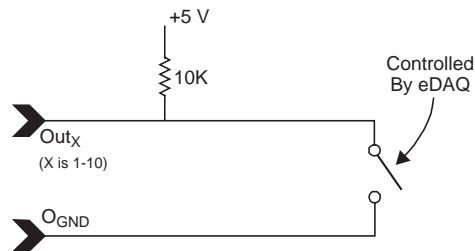
This circuit is adequate for most applications. Contact SoMat for a special cable to eliminate coupling if you observe coupling from another input line.

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

The equivalent circuit for a digital output line is shown below. An output of logic zero closes the switch; a logic one output opens the switch.

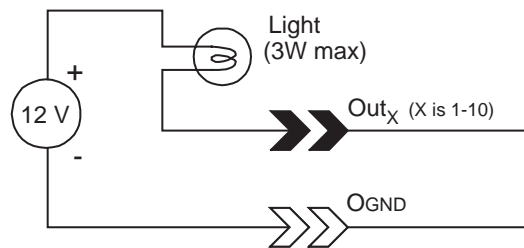


Equivalent Circuit for Digital Output Line

The maximum switching voltage of the switch and the cumulative current of which the output lines are capable is determined by the board (eDAQ MPB, eDAQ-plus MPB, or DIO). This information is provided in the section of this appendix specific to the board type.

Use of an Incandescent Bulb

An incandescent bulb (3 watts maximum) used as an indicator in the digital output circuit is shown below.

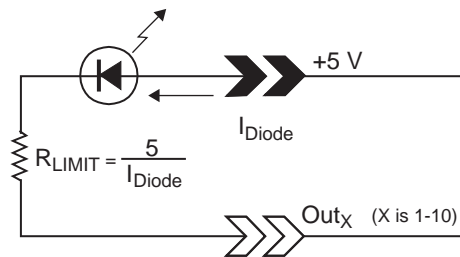


Operating a 12-volt Incandescent Bulb

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

The use of a light-emitting diode (LED) as an indicator in the digital output circuit is shown below. A logic zero causes the diode to light.



Operating an Externally Powered LED

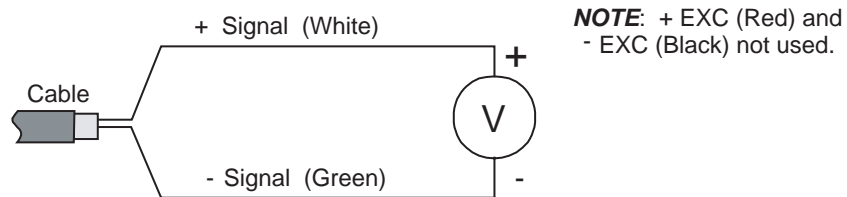
The total of all diode currents must be less than 250 mA.

NOTE: When this LED is used in conjunction with the eDAQ-Classic or the eDAQ-Plus main processor boards, the +5Volts must be supplied externally for this circuit to work correctly. The Digital I/O expansion layer board provides this directly from the board.

High Level SS Analog Transducer Wiring

The wiring diagram for a High Level SS channel analog voltage input is shown below.

The shield drain wire in the transducer cable should not be connected to circuit ground at the eDAQ end of the cable.

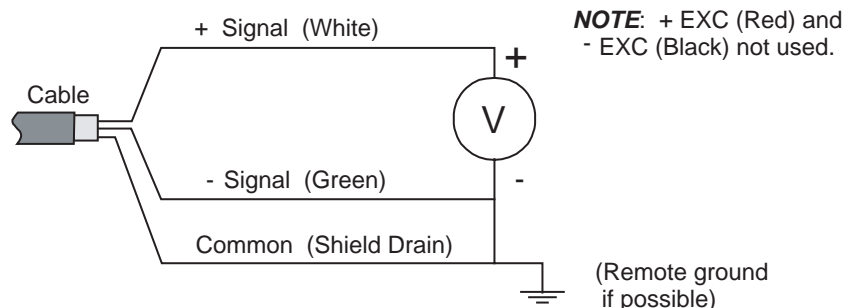


High Level SS Voltage Input Wiring

Low Level and High Level Analog Transducer Wiring

The wiring diagram for either a Low Level or a High Level channel analog voltage input is shown below. Although the wire colors shown are specific to the Low Level cables, the diagram is applicable for Low Level and High Level transducer channels.

The shield drain wire in the transducer cable should be connected to circuit ground at the eDAQ end of the cable.



Low Level and High Level Voltage Input Wiring

Layer Expansion Options

The basic eDAQ configuration can be expanded to suit individual needs. The following layers can be added to the base layer in quantities and combinations limited primarily by available board addresses and power supply. A secondary consequence of adding more layers is increased internal temperatures in the eDAQ in relation to ambient temperature.

Low Level

Features

Each Low Level layer 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, or differential amplifier mode
- Either 120 Ω or 350 Ω internal quarter-bridge completion (determined when the board is built)
- Programmable digital filters
- Regulated excitation options of 5, 10, and 20V

Specifications

The specifications for each Low Level layer 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
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
Analog Output:	Nominal ± 10 V of actual Full Scale values Can be nulled to less than 1 mV offset for completely reversed user-defined Full Scale values

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

Accuracy at room temperature for room temperature factory calibration:

- $\pm 0.1\%$ for Full Scale Amplitude $\geq \pm 100$ mV
- $\pm 0.2\%$ for ± 20 mV \leq Full Scale Amplitude $< \pm 100$ mV
- $\pm 0.2\%$ for Full Scale Amplitude $< \pm 20$ mV, with zero suppression

Connectors

There are two 37-pin D-Sub female 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.

Cables

Each of these cable options has a 37-pin D-Sub male plug for connection to the eDAQ. There are two cable assemblies available for use with the Low Level Board, SAC-EXDUC and SAC-EXDUC-6-V.

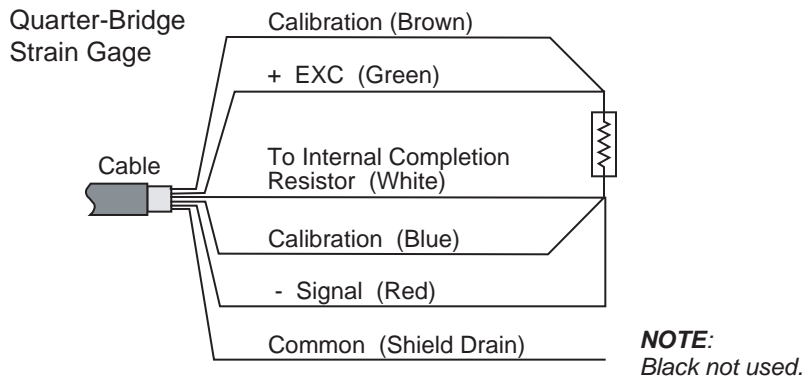
The SAC-EXDUC consists of four 6-wire cables which are 2 meters in length and end in pigtails. The SAC-EXDUC-6-V consists of four 6-wire cables, which are 11 meters in length and end in pigtails, and four voltage out cables (labeled VOUT), which end in BNC connectors. The voltage out cables provide the analog signal outputs.

Each Low Level Board is shipped with a set of two of these cables, SAC-EXDUC unless SAC-EXDUC-6-V specified when ordered.

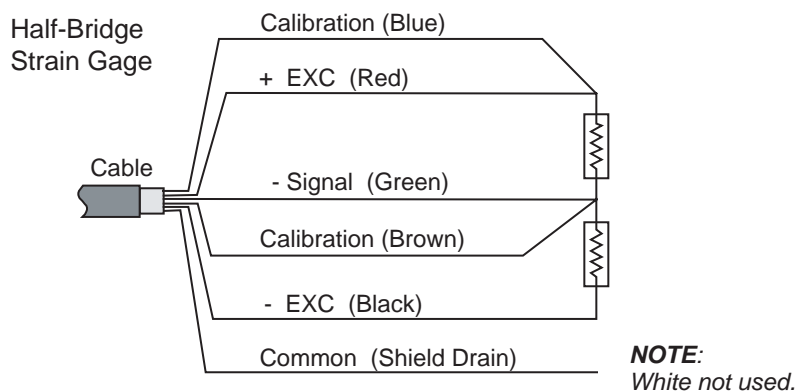
Low Level Strain Transducer Wiring

The following illustrations show examples of wiring for quarter-, half-, and full-bridge strain gages. Note that with the half- and full-bridges, where the blue and brown calibration wire is attached is user selectable; they are arbitrarily set in the illustrations for a downscale shunt.

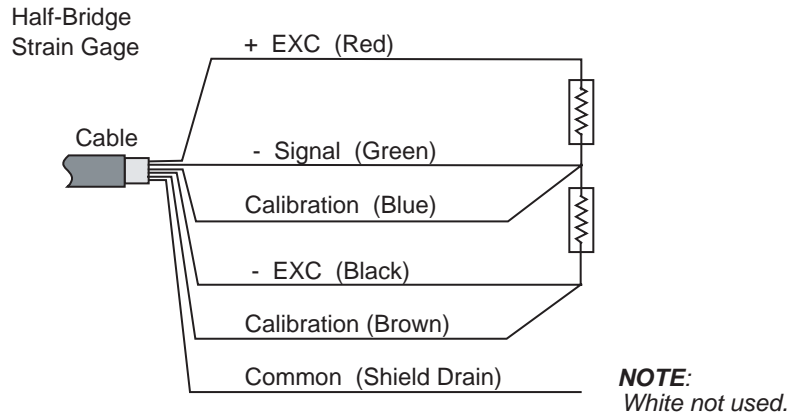
The shield drain wire in transducer cables should be connected to circuit ground at the eDAQ end of the cable.



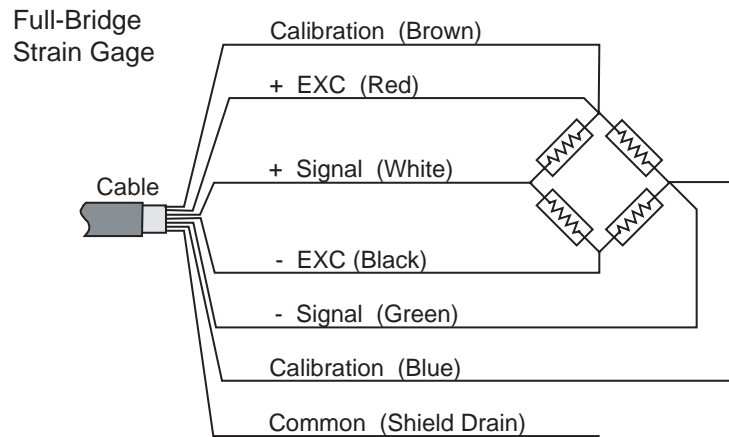
Quarter-Bridge Strain Gage, Downscale Calibration



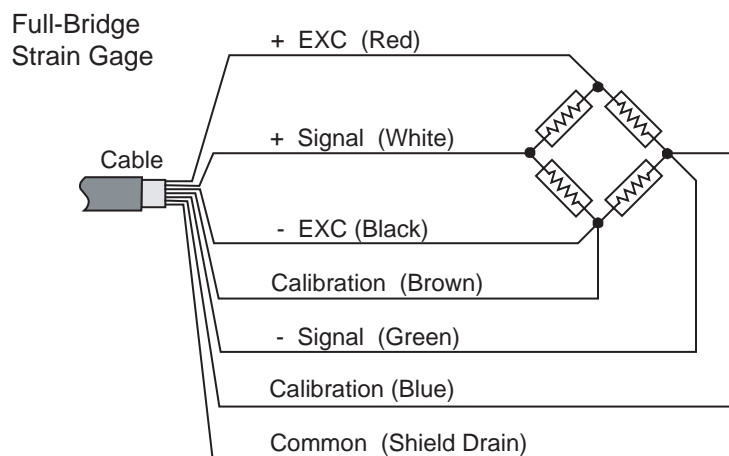
Half-Bridge Strain Gage, Downscale Calibration



Half-Bridge Strain Gage, Upscale Calibration



Full-Bridge Strain Gage, Downscale Calibration

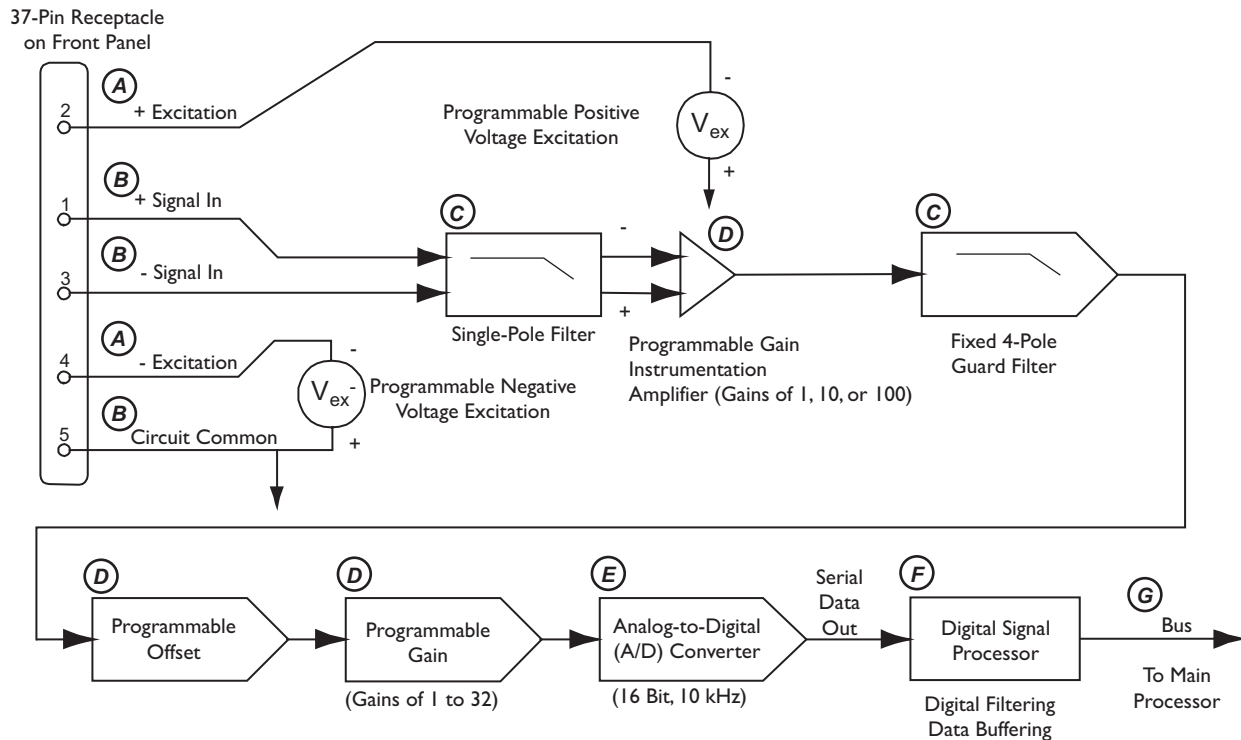


Full-Bridge Strain Gage, Upscale Calibration

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 diagram illustrates the flow of an analog input signal through a Low Level channel. The lettered steps match circled numbers from the signal flow diagram.



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. Connect this to - Signal In for single-ended inputs.
 - b. 120 Ω or 350 Ω completion resistors are available.
- 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.

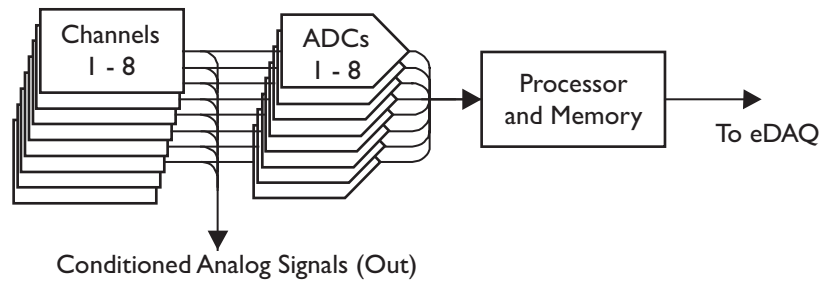
F The digital samples pass through a digital filter (selected by the user via TCE) and are downsampled based on the sample rate specified by the user. The maximum sample rate at the output of the digital filter is 2,500 Hz.

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 data samples are stored temporarily in a FIFO buffer and are then routed to the main processor for further processing and/or storage.

Outputs

Shown below is a block diagram of the outputs from a Low Level Board unit.



Low Level Board Signal Flow with ADC

High Level

Features

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

Connectors

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

Cables

A high-level analog transducer cable is provided when a High Level Analog layer is installed in the eDAQ. It has a 62-Pin HDD-sub male plug. The cable ends in pigtailed.

The SAC-EHLB1 is provided for a High Level layer without Vehicle Bus Interface. A single cable extends from the plug.

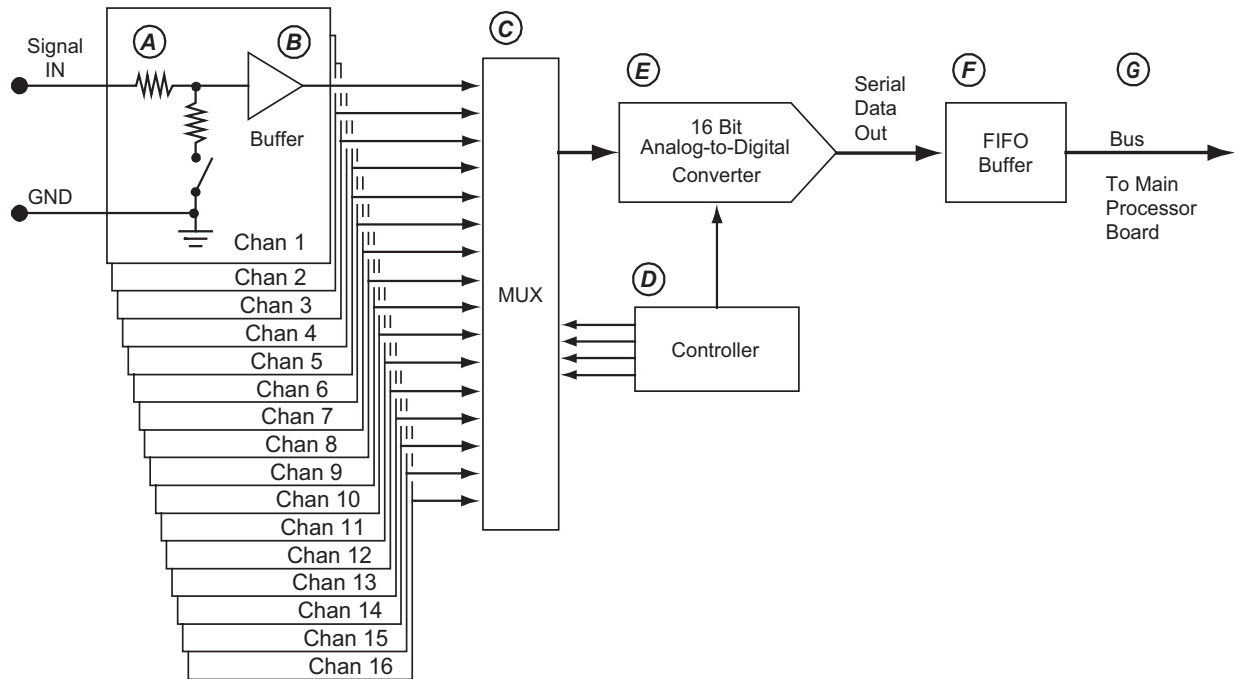
The SAC-EHLBI-VB is provided for a High Level layer with Vehicle Bus Interface. Two cables extend from the plug for this cable assembly.

There are two versions of this cable that have the same SoMat part number but have different wire color coding. The newer version of the cable assembly has outer PVC shielding labeled E74020-C. The wiring diagrams for each of these cable assemblies is provided in [Wire Color Coding and Cable Pin Outs - High Level](#) and [Wire Color Coding and Cable Pin Outs - Vehicle Bus Sub-board](#).

High Level Signal Flow through eDAQ

The eDAQ is connected to transducers or sensors producing analog signals via the High Level Analog layer. 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 layer. The numbered steps match circled numbers from the signal flow diagram.



High Level Signal Flow

- A The high-level signals can be attenuated by selecting to double the signal range to $\pm 20V$ (an option within TCE).
- B The signals are buffered.
- C All 16 data channels are multiplexed resulting in approximately 25 microseconds skew between channels.
- D The Controller sequences the MUX and ADC.
- E Each signal is processed through the A/D converter at up to 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.

Vehicle Bus Interface

The optional Vehicle Bus Interface 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:

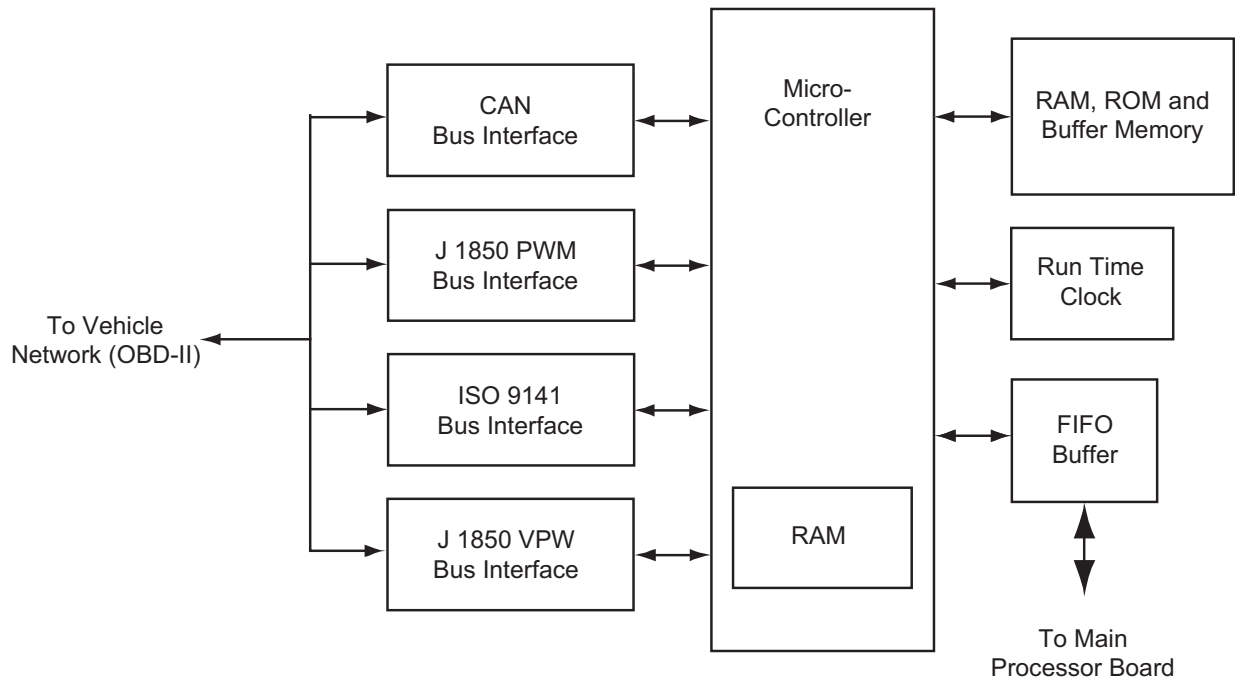
CAN J1850 PWM ISO 9141 J1850 VPW

The Vehicle Bus Interface 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



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 and forwards those packets to the main processor board via a FIFO buffer.

High Level Simultaneous Sampling

The High Level Simultaneous Sampling layer offers 16 channels of differential input signal conditioners with a full scale range of $\pm 64\text{mV}$ to $\pm 80\text{V}$.

Features

- Simultaneous sample for all HLS channels
- 16-bit resolution ADC
- Individual 6-pin TURCK picofast[®] connectors for each channel
- Analog anti-aliasing filters – 8-pole Butterworth filtering at 20 KHz
- Programmable digital filters

Specifications

The specifications for each High Level Simultaneous Sample layer are as follows:

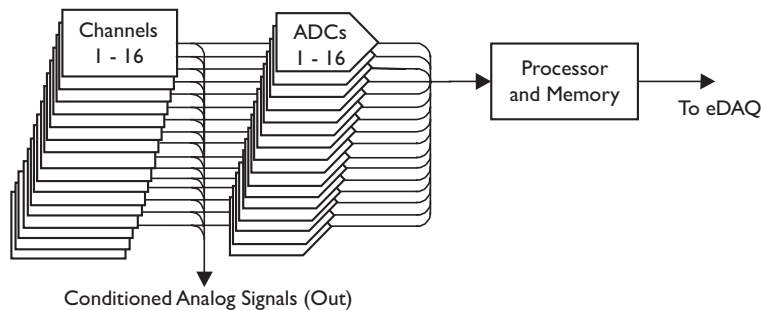
Sample Rate:	0.1–100,000Hz
ADC Resolution:	16 bit
Operating Temp.:	
Temperature Drift (Worst Case):	
Input Resistance:	
Dynamic Range:	
Common Mode Rejection:	
Full-Scale Voltage Range:	$\pm 64\text{mV}$ to $\pm 80\text{V}$
Analog Output:	

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

Accuracy at room temperature for room temperature calibration:

$\pm 0.1\%$ of Full Scale Amplitude with the following exception,

$\pm 0.5\%$ of Full Scale Amplitude if and only if the low impedance voltage divider is used with single-ended inputs



High Level SS Board Signal Flow with ADC

Isolated Thermocouple

Offers eight channels of isolated thermocouple signal conditioning per layer. Each channel is independently isolated to 500 volts. Multiple layers can be added to an existing eDAQ configuration. Each layer is specific to a thermocouple type.

Features

- T, J, K, and E type thermocouple support
- Guard filters are used before the ADC, followed by digital filtering
- All eight channels are independently isolated to 500 volts
- One cold junction sensor per channel
- 3 watts of power required from the eDAQ power supply

Specifications

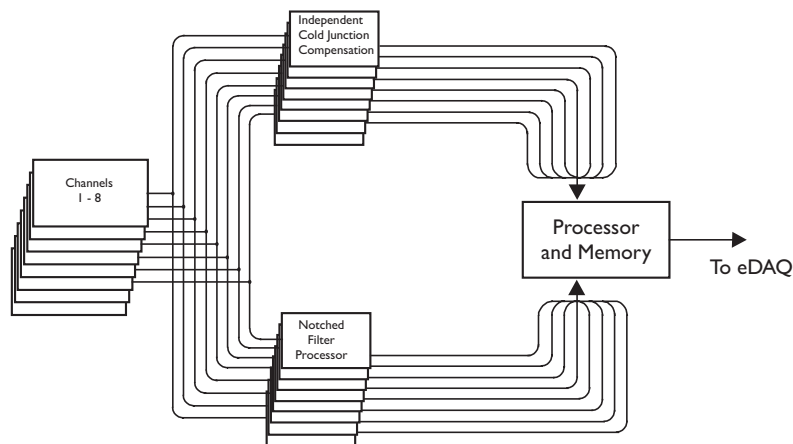
The specifications for each Isolated Thermocouple layer are as follows:

Sample Rate:	0.1–5Hz	
Temperature Range:	Type T	-200°C to 400°C
	Type J	-200°C to 1200°C
	Type K	-200°C to 1372°C
	Type E	-200°C to 1000°C

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

Accuracy at room temperature for room temperature calibration:

$\pm 0.5^\circ\text{C}$ absolute accuracy for an ideal Thermocouple input in the range of 0°C to the maximum temperature allowed for the particular type of thermocouple.



Isolated Thermocouple Board Signal Flow with CJC and Filter

Non-Isolated Thermocouple

Offers 16 channels of non-isolated thermocouple signal conditioning per layer. Multiple layers (typically, at least 4) can be added to an existing eDAQ configuration. Any channel can be configured to any of the four thermocouple types.

Features

- T, J, K, and E type thermocouple support
- Guard filters are used before the ADC, followed by digital filtering
- One cold junction sensor per bank of 16 channels

Specifications

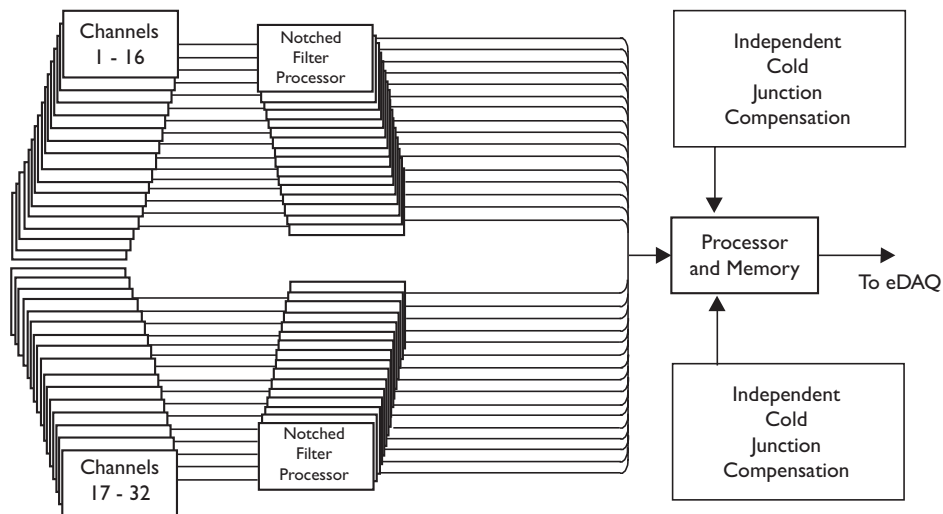
The specifications for each Thermocouple layer are as follows:

Sample Rate:	0.1–5Hz	
Temperature Range:	Type T	-200°C to 400°C
	Type J	-200°C to 1200°C
	Type K	-200°C to 1372°C
	Type E	-200°C to 1000°C

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

Accuracy at room temperature for room temperature calibration:

$\pm 0.5^\circ\text{C}$ absolute accuracy for an ideal Thermocouple input in the range of 0°C to the maximum temperature allowed for the particular type of thermocouple.



Thermocouple Board Signal Flow with CJC and Filter

Digital Input/Output (GPS)

Features

- 12 fixed input channels support an input value range of $\pm 45V$
- 24 user-configurable input/output channels support input values from 0 to 45V
- Boolean state threshold values are user programmable
- 6-pin TURCK picofast[®] connectors located on front panel

Wire Color Coding and Cable Pin Outs

Main Processor Board (MPB)

SAC-EDIO

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
PC Signal 1	2	White	PC Return 1	1	Black
PC Signal 2	4	Red	PC Return 2	3	Green
PC Signal 3	6	Orange	PC Return 3	5	Blue
PC Signal 4	8	White/Black	PC Return 4	7	Red/Black
PC Signal 5	10	Orange/Black	PC Return 5	9	Green/Black
PC Signal 6	12	Blue/Black	PC Return 6	11	Black/White
PC Signal 7	14	Red/White	PC Return 7	13	Green/White
PC Signal 8	16	Orange/Red	PC Return 8	17	Blue/White
I/O Signal 1	24	White	I/O Return 1	23	Black
I/O Signal 2	26	Red	I/O Return 2	25	Green
I/O Signal 3	28	Orange	I/O Return 3	27	Blue
I/O Signal 4	30	White/Black	I/O Return 4	29	Red/Black
I/O Signal 5	32	Orange/Black	I/O Return 5	31	Green/Black
I/O Signal 6	34	Blue/Black	I/O Return 6	33	Black/White
I/O Signal 7	36	Red/White	I/O Return 7	35	Green/White
I/O Signal 8	38	Blue/White	I/O Return 8	37	Orange/Red
I/O Signal 9	40	Black/Red	I/O Return 9	39	White/Red
I/O Signal 10	42	Blue/Red	I/O Return 10	41	Red/Green

SAC-EDIGIO

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
PC Signal 1	2	Green	PC Return 1	1	Black
PC Signal 2	4	Red	PC Return 2	3	Gray
PC Signal 3	6	Blue/White	PC Return 3	5	Red/White
PC Signal 4	8	Orange	PC Return 4	7	Brown
PC Signal 5	10	Pink	PC Return 5	9	Orange/White
PC Signal 6	12	White	PC Return 6	11	Purple
PC Signal 7	14	Red/Black	PC Return 7	13	Green/White
PC Signal 8	16	Purple/White	PC Return 8	17	Light Green
<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
I/O Signal 1	24	Green	I/O Return 1	23	Black
I/O Signal 2	26	Red	I/O Return 2	25	Gray
I/O Signal 3	28	Blue/White	I/O Return 3	27	Red/White
I/O Signal 4	30	Orange	I/O Return 4	29	Brown
I/O Signal 5	32	Pink	I/O Return 5	31	Orange/White
I/O Signal 6	34	White	I/O Return 6	33	Purple
I/O Signal 7	36	Red/Black	I/O Return 7	35	Green/White
I/O Signal 8	38	Light Green	I/O Return 8	37	Purple/White
I/O Signal 9	40	Yellow	I/O Return 9	39	Brown/White
I/O Signal 10	42	Black/White	I/O Return 10	41	Blue

SAC-ESR9/XO and SAC-ESR9/HUB

The following information is for the current, fully molded cable assembly.

<u>Function</u>	<u>RJ-45 Pin</u>	<u>Wire Color (X/O)</u>	<u>Wire Color (HUB)</u>
Receive +	3	Orange/White*	Green/White*
Receive -	4	Orange	Green
Transmit +	2	Green/White*	Orange/White*
Transmit -	1	Green	Orange

<u>Function</u>	<u>eDAQ 26 Pin</u>	<u>PC 9 Pin</u>	<u>Wire Color</u>
CTS	17	7	Yellow
DCD	10	4	Red
DSR	15	1	Violet
DTR	13	6	Orange
RX (Receive)	11	3	Brown
RI (Rec Intr)	18	9	Blue
RTS	16	8	Green
TX (Transmit)	12	2	Black
Ground	14	5	Gray*

* differs from original, non-molded cable assembly

The original communications cable was not a molded assembly and the wire color codings for Ground, Receive+ and Transmit+ differ as follows:

<u>Function</u>	<u>RJ-45 Pin</u>	<u>Wire Color (X/O)</u>	<u>Wire Color (HUB)</u>
Receive +	3	White/Orange*	White/Green*
Receive -	4	Orange	Green
Transmit +	2	White/Green*	White/Orange*
Transmit -	1	Green	Orange

<u>Function</u>	<u>eDAQ 26 Pin</u>	<u>PC 9 Pin</u>	<u>Wire Color</u>
CTS	17	7	Yellow
DCD	10	4	Red
DSR	15	1	Violet
DTR	13	6	Orange
RX (Receive)	11	3	Brown
RI (Rec Intr)	18	9	Blue
RTS	16	8	Green
TX (Transmit)	12	2	Black
Ground	14	5	White*

* differs from current, fully molded cable assembly

SAC-EPWR15

NOTE: Pin 3 is jumpered to Pin 4.

Power

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Main Power	1	Red	-Main Power	8	Black

Remote Power

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Remote Power	6	Red	-Power Power	14	Black

Low Level**SAC-EXDUC and SAC-EXDUC-6V**

The only difference between the two SAC-EXDUC cables is the presence of 4 voltage out cables with dedicated BNC connectors on the SAC-EXDUC-6V.

Channel 1 / Channel 5 Cable

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	35	Red (see Note)	-Excitation	15	Black
+Signal	16	White	-Signal	33	Green (see Note)
+Calibration	34	Blue	-Calibration	14	Brown
Ground	17	(Shield)			

Channel 2 / Channel 6 Cable

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	13	Red (see Note)	-Excitation	30	Black
+Signal	31	White	-Signal	11	Green (see Note)
+Calibration	12	Blue	-Calibration	29	Brown
Ground	32	(Shield)			

Channel 3 / Channel 7 Cable

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	28	Red (see Note)	-Excitation	8	Black
+Signal	9	White	-Signal	26	Green (see Note)
+Calibration	27	Blue	-Calibration	7	Brown
Ground	10	(Shield)			

Channel 4 / Channel 8 Cable

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	6	Red (see Note)	-Excitation	23	Black
+Signal	24	White	-Signal	4	Green (see Note)
+Calibration	5	Blue	-Calibration	22	Brown
Ground	25	(Shield)			

NOTE: For a Quarter Bridge configuration only, wire colors for +Excitation and -Signal are reversed (i.e., +Excitation is Green, and -Signal is Red).

SAC-SLXDUC-6

The wire color coding for this cable is identical to the SAC-EXDUC.

SAC-SLXDUC-6-V

The wire color coding of the 4 channel cables for this cable is identical to the SAC-EXDUC.

Analog Out

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
Volt Out 1/5	19	Brown	Ground 1/5	18	Black
Volt Out 2/6	37	Red	Ground 2/6	36	Green
Volt Out 3/7	2	Orange	Ground 3/7	3	White
Volt Out 4/8	20	Yellow	Ground 4/8	21	Blue
Ground	1	(Shield)			

SAC-SLXDUC-4, SAC-SLXDUC-4-V

High Level**SAC-EHLB1**

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	61	Red	-Excitation	59	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

SAC-EHLB1 [E74020-C] (labeled HLB I/O)

See [SAC-EHLB1-VB \[E74020-C\] \(labeled VEH BUS\)](#) for color coding and pin outs of the cable labeled VEH BUS.

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+Excitation	61	Gray/Red	-Excitation	59	Light Blue/Black
Analog 1 In	29	Black	Analog 1 Gnd	49	Brown
Analog 2 In	8	Red	Analog 2 Gnd	7	Orange
Analog 3 In	31	Yellow	Analog 3 Gnd	51	Green
Analog 4 In	10	Blue	Analog 4 Gnd	9	Purple
Analog 5 In	33	Gray	Analog 5 Gnd	53	White
Analog 6 In	12	Pink	Analog 6 Gnd	11	Light Green
Analog 7 In	55	Black/White	Analog 7 Gnd	34	Brown/White
Analog 8 In	35	Red/White	Analog 8 Gnd	56	Orange/White
Analog 9 In	14	Green/White	Analog 9 Gnd	13	Blue/White
Analog 10 In	57	Purple/White	Analog 10 Gnd	36	Red/Black
Analog 11 In	37	Orange/Black	Analog 11 Gnd	58	Yellow/Black
Analog 12 In	16	Green/Black	Analog 12 Gnd	15	Gray/Black
Analog 13 In	39	Pink/Black	Analog 13 Gnd	60	Pink/Green
Analog 14 In	18	Pink/Red	Analog 14 Gnd	17	Pink/Purple
Analog 15 In	41	Light Blue	Analog 15 Gnd	62	Light Blue/Brown
Analog 16 In	20	Light Blue/Red	Analog 16 Gnd	19	Light Blue/Purple

Vehicle Bus Sub-board

SAC-EHLB1-VB [Alpha 3470/37C]

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
CANL	1	Black	K-Line	4	Black/White
CANH	23	White	L-Line	44	Blue/Black
AGnd	26	Green	AGnd	48	Green/White
SWC_bus	24	Red	+12v	45	Red/White
AGnd	46	Blue	CCD+	5	Orange/Red
VPW_bus	2	Orange	CCD-	25	Blue/White
AGnd	47	Red/Black	AGnd	30	White/Red
AGnd	27	White/Black	PWM_bus+	22	Black/Red
ALDL_bus	3	Green/Black	PWM_bus-	43	Red/Green
AGnd	28	Orange/Black	AGnd	32	Blue/Red

SAC-EHLB1-VB [E74020-C] (labeled VEH BUS)

See [SAC-EHLB1 \[E74020-C\] \(labeled HLB I/O\)](#) for color coding and pin outs of the cable labeled HLB I/O.

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
CANL	1	Black	K-Line	4	Red
CANH	23	Brown	L-Line	44	Light Green
AGnd	26	Pink	AGnd	48	Black/White
SWC_bus	24	Orange	+12v	45	Brown/White
AGnd	46	Yellow	CCD+	5	Red/White
VPW_bus	2	Green	CCD-	25	Orange/White
AGnd	47	Blue	AGnd	30	Green/White
AGnd	27	Purple	PWM_bus+	22	Blue/White
ALDL_bus	3	Gray	PWM_bus-	43	Purple/White
AGnd	28	White	AGnd	32	Red/Black

High Level Simultaneous Sampling

SAC-EHLS

High Level SS board transducer input cable:

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
(Reserved)	1	Brown
+Signal Input	2	White
Shield	3	N/A
Ground	4	Black
Power	5	Red
-Signal Input	6	Green

High Level SS board transducer analog output cable:

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>	<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
Analog Ground	P	White	Analog Ground	R	Red
Analog 1 Out	B	White/Green	Analog 9 Out	K	Grey/Brown
Analog 2 Out	M	Brown	Analog 10 Out	U	Blue
Analog 3 Out	A	Red/Blue	Analog 11 Out	L	Grey/Pink
Analog 4 Out	E	Green	Analog 12 Out	G	Black
Analog 5 Out	N	Pink	Analog 13 Out	T	Yellow/Brown
Analog 6 Out	C	Grey	Analog 14 Out	I	White/Grey
Analog 7 Out	O	Yellow	Analog 15 Out	S	Violet
Analog 8 Out	D	Brown/Green	Analog 16 Out	H	White/Yellow
Shield	F	N/A			

DIO**SAC-EHLS**

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
I/O 4, 8, or 12	1	Brown
I/O 3, 7, or 11	2	White
GND / Shield	3	N/A
I/O 1, 5, or 9	4	Black
Power	5	Red
I/O 2, 6, or 10	6	Green

SAC-ESYNC CABLE

<u>Function</u>	<u>Pin</u>	<u>Wire Color</u>
+AUX	1	Brown
-AUX	2	White
Shield	3	N/A
SYNC GND	4	Black
+SYNC	5	Red
-SYNC	6	Green

Appendix - eDAQ-lite

CPU

The eDAQ-Lite CPU is a National/AMD Geode SC3200 (266 MHz) processor with embedded Floating Point Processor.

Internal Memory

Flash memory can be configured with 32 MB to 2 GB. 32 MB of Flash memory is currently reserved for OS usage. The remainder can be used for test data storage.

DRAM can be configured with 64 MB to 256 MB. 32 MB of DRAM memory is currently reserved for OS usage. The remainder can be used for test data storage.

NOTE Flash and DRAM memory modules are factory replaceable.

Ethernet Communications

The eDAQ-lite provides 100BaseT Ethernet communications.

Serial Communications

All eDAQs support an RS232 communications option. The default baud rate for the eDAQ-lite is 115200, configurable to lower baud rates to support serial bus modules.

MPB Digital Inputs, Outputs, and Pulse Counters

The eDAQ-lite MPB board does not support any Digital I/O functionality; however, the ELDIO board is available and provides enhanced Digital I/O functionality.

Operating Temperature

All eDAQs are operational with nominal internal temperatures ranging from -20 to 65C. Note that the eDAQ internal temperature will always be somewhat higher than ambient (steady state) air temperature.

Power Supply and Battery Backup Considerations

The eDAQ-lite was designed with the understanding that it would always be connected to an adequate power supply for the durations of all test runs (e.g., a charged nominal 12 volt vehicle battery system that reliably supplies around 13.5 volts).

1) The eDAQ-lite was designed to support nominal 12 volt vehicle battery systems only. The maximum input power voltage is 18 volts (exceeding this will cause a programmed shutdown).

A minimum of 10 volts is required for boot up, and a minimum of 9 volts required for continuous operation once booted. Once booted and running, the eDAQ-lite will continue to operate for a limited time at an input voltage down to 6 volts (as discussed in the note below).

2) When the input power voltage drops below 9 volts, as will occur during normal vehicle engine cranking, eDAQ-Lite will switch in the internal backup battery as the power source. Power will continue to source from the internal battery until the input voltage drops below 6 volts or until it detects that the internal battery has

limited life left. In either of these cases it will then do an orderly power shut down. When input power voltage is restored to 10 volts (or more), the eDAQ-lite will reboot and continue operation. A fully charged internal backup battery contains enough reserve capacity to power an eDAQ stack drawing 50 watts in this mode of operation for more than one minute.

NOTE The voltages above are the voltages at the eDAQ power connector, which are always less than the voltages at the power source because there is always some voltage drop in the wires used to route the power supply voltage to and through the eDAQ power connector. These voltage losses are dependent on the length and gauge of the connection wiring assembly.

NOTE The eDAQ-lite fuses are 10 amp, 42 volt rated automotive mini-blade fuses. The base plate must be carefully removed to gain access to the fuses.

3) When a power fail shut down initiates with a test run in progress, the eDAQ-lite proceeds to immediately stop the test run and then flush all data in temporary buffers to the PC Card. This can take several seconds. It is imperative that the backup battery is sufficiently charged to keep the eDAQ running during this time; if this is not the case, the SIF file data will be corrupted!

4) A fully charged eDAQ-lite backup battery will have at least 100 watt-minutes of reserve power. It takes about 4 hours for a completely discharged backup battery to be fully recharged. The battery charging circuit draws 4 watts maximum while it's being charged. The backup battery charger operates on an as needed basis. An intelligent charge controller monitors current into and out of the backup battery. In so doing, it tracks the current charge state of the battery. When the battery has discharged to about 92% of rated capacity and the eDAQ is connected to a power supply at more than 10 volts, the charger will turn on and will run until a full charge state is detected (normally after about 20 to 30 minutes), and then shut off.

An eDAQ-lite that is turned off and connected to a power supply (such as vehicle battery), will run one of these 20 minute charge cycles about once every 2 days, or an average power drain of about 30 milliwatts (i.e., 2.5 milliamps at 12 volts).

If the battery should be disconnected and then reconnected or changed, this is also detected and the new battery is assumed to be dead. A charge cycle will then initiate upon connection to a power supply and will run until full charge is detected.

NOTE There is a status indicator provided in the eDAQ web browser interface that shows the level of battery charge as either Low, Medium, or High, and also indicates if the recharging circuit is currently on or off.

5) The auxiliary power switch cable that comes out of the eDAQ-lite power connector acts as a "3 way switch" in conjunction with the front panel on-off push button switch. If this is not in use, be sure that the red and black wires are either fully insulated from each other or solidly connected to each other to prevent accidentally turning the power off. If the wires are connected to each other and there is any chance of magnetic induction, do not coil the cable in a loop.

NOTE New test runs can be started on the eDAQ by forcing a reboot when a test is running. Many customers use this feature to start new test runs. The auxiliary power switch can be used to accomplish this in a way that does not drain the backup battery (since the main power supply is still on during the duration of the power down operations). However, turning off the power supply or disconnecting the power supply from the eDAQ will drain the backup battery and should be avoided as it can result in SIF file data corruption!

NOTE Do not apply any voltage sources to the auxiliary power switch cable! It is designed to be used with a single pole single throw (open/close) contact switch.

NOTE The “3 way switch” reference above means that there are 2 physical switches (i.e., the front panel switch and the [user installed] auxiliary power cable switch) that invert each other's switching logic. This means that the user can choose to have the eDAQ power up on either an opening or a closing of the auxiliary power cable switch - by simply toggling the front panel switch.

Data Storage

RAM Disk Data Storage Option

The RAM Disk storage option has quite limited use in most test applications. On the eDAQ-Classic, the size is limited to 3.5 MB, and as such is usually much too small for sequential data storage, or even histogram data storage if many test runs are required. While the RAM Disk can be resized on the eDAQ-plus and the eDAQ-lite, this is currently recommended only to support the following kind of test.

If the user defines a test that uses the Burst History data mode, and accumulates a large number of burst data records (e.g., by either having many channels, or using small burst record sizes, or both), the (3.5 MB) RAM Disk memory can fill up with header records long before the PC Card fills up with the raw data records. In this test scenario, increasing the RAM Disk size is required to allow the test to run longer.

PC Card Data Storage Option

The term PC Card as used here refers to the original (full sized) PCMCIA cards and the CompactFlash (CF) cards that can be used with a PC Card extender.

Storage Media Options

There are two PC Card storage media options.

- A disk partition on the Internal Flash (CF card)
- DRAM memory

The size of the Internal Flash partition available for data storage is dependent on the size of the Internal CompactFlash card. As of the V3.8.5 release, about 32 MB of the Internal Flash memory is reserved for the eDAQ Linux OS usage. The remainder of the Internal Flash memory is available for data storage. Likewise, the amount of DRAM memory available for data storage is dependent on the size of the socketed DRAM. As of the V3.8.5 release, about 32 MB of the DRAM memory is reserved for the eDAQ Linux OS usage.

Selecting the Storage Media

Use the eDAQ web browser to select the actual media (i.e., DRAM, or Internal Flash). To do this, first ensure that there is no test initialized on the eDAQ. Then select the Hardware page of the eDAQ web browser main menu. Use the Select Storage Device drop down list box to select the desired storage media, and click on the Change storage device button.

Following are some guidelines for selecting the PC Card storage media.

- The DRAM storage media option is applicable for limited testing scenarios only. While it provides the maximum throughput compared to all other storage modes, the DRAM memory is volatile. This means that the test data will be lost if the eDAQ is powered down, or if the eDAQ resets for any reason.

- The Internal Flash storage media option provides much better data throughput than an external PC card storage media option assuming the Internal Flash CF card uses DMA (as is the case for the SoMat supplied CF cards). Data throughput can be up to 5 times better using the Internal Flash. As such, this is the preferred storage media for test applications where the user can Upload the test data.

NOTE For all storage media options, the eDAQ stores raw test data and related information in a set of individual SIF component files referred to as SIC files. There is a fixed naming convention for these files (i.e., sif00000.sic, sif00001.sic, sif00002.sic, and so on). These files reside in the eDAQ file system directory hd/eDAQ and can be viewed using the eDAQ web browser option Explore eDAQ Files (under the System menu option).

USB LCD Display

An optional USB driven LCD Display module is available for monitoring test status and/or displaying a small number of selected channels in real time.

Hardware Setup

Simply connect the SoMat supplied cable to the HSS (high speed serial) connector located in the center of the front panel of the ELMPB / ELPWR layer.

NOTE The HSS connector is not a general purpose USB connector. It is currently available to support the LCD Display only!

USB LCD configuration

The eDAQ web interface for configuring the USB display on an eDAQ-lite can be reached by clicking the USB Display Setup link from the Test tab on the eDAQ's web page. The current web interface for setting up the USB LCD Display has three separate modes - Basic, Advanced, and Expert.

General points to remember are as follows.

- Display specifications are stored inside the eDAQ according to the setup name of the test.
- The default (no test initialized) display cannot be changed through the web interface.
- The Basic, Advanced, and Expert web interface modes all manipulate the same per-test display specification inside the eDAQ; only the user interfaces are different.
- The interface allows the display of real test channels (transducer or computed) as well as pseudo channels that include such information as the current run number, free PC-Card memory, and other similar metadata.
- Since each interface operates on the same underlying data, it can be easy to set up a simple display using the basic interface, and then tweak it as desired using the advanced or expert interfaces.

Basic Interface

- Allows the setup of one displayed channel (real or pseudo) per LCD display line using extremely simple controls. The format of each line on the LCD is ChannelName: value.

Advanced Interface

- Allows precise formatting and positioning of static text intermixed with channel (real and pseudo) displays.
- Allows copying of setup information from one saved test name to another.

- Allows precise formatting of numerical and string data, either via a simplified ###.## style format, or using printf() -style format strings.
- Channel names can either be typed in by hand in the edit column, or chosen from a list in the select column.
- The channel placeholder token * is user-modifiable.

Expert interface

- A simple text edit box of the actual display specification used by the process that actually manages the LCD display.
- Channel specifications are of the form %[name], or %[name | format] when an explicit format is desired.
- Format strings can be in the simplified ###.## style, or in printf() percent style.
- %% is used to display a literal % in static text
- printf() format documentation can be found in any standard ANSI C programming language manual.

Appendix - eDAQ-plus

CPU

The eDAQ-plus CPU is a National/AMD Geode SC3200 (266 MHz) processor with embedded Floating Point Processor.

Internal Memory

Flash memory can be configured with 32 MB to 2 GB. 32 MB of Flash memory is currently reserved for OS usage. The remainder of the Flash memory can be used for test data storage.

DRAM can be configured with 64 MB to 256 MB. 32 MB of DRAM memory is currently reserved for OS usage. The remainder of the DRAM memory can be used for test data storage.

NOTE The Flash and DRAM memory modules are factory replaceable.

PC Cards

There is a dual PC card slot (but only one slot can be used at a time). PC Cards or CompactFlash (CF) cards (with a PC Card adapter) up to 2 GB in size can be used.

Ethernet Communications

The eDAQ-plus provides 100BaseT Ethernet communications.

Serial Communications

All eDAQs support an RS232 communications option. The default baud rate for the eDAQ-plus is 115200, configurable to lower baud rates to support serial bus modules.

MPB Digital Inputs, Outputs, and Pulse Counters

The eDAQ-Plus MPB board provides essentially the same functional support as the eDAQ-Classic MPB, with improved data handling to support sample rates of up to 2500 Hz (without generating MissedInterrupt error resets in most test scenarios).

Operating Temperature

All eDAQs are operational with nominal internal temperatures ranging from -20 to 65C. Note that the eDAQ internal temperature will always be somewhat higher than ambient (steady state) air temperature.

Power Supply and Battery Backup Considerations

The eDAQ-plus was designed with the understanding that it would always be connected to an adequate power supply for the durations of all test runs (e.g., a charged nominal 12 volt vehicle battery system that reliably supplies around 13.5 volts).

- 1) The eDAQ-plus was designed to support nominal 12, 24 and 42 volt vehicle battery systems. The maximum input power voltage is 60 volts (exceeding this for more than a few milliseconds will blow user replaceable fuses).

A minimum of 10 volts is required for boot up, and a minimum of 9 volts required for continuous operation once booted. Once booted and running, the eDAQ-plus will continue to operate for a limited time at an input voltage down to 6 volts (as discussed in the note below).

- 2) When the input power voltage drops below 9 volts, as will occur during normal vehicle engine cranking, the eDAQ-plus will switch in the internal backup battery as the power source. Power will continue to source from the internal battery until the input voltage drops below 6 volts or until it detects that the internal battery has limited life left. In either of these cases it will then do an orderly power shut down. When input power voltage is restored to 10 volts (or more), the eDAQ-plus will reboot and continue operation. A fully charged internal backup battery contains enough reserve capacity to power an eDAQ stack drawing 50 watts in this mode of operation for more than one minute.

NOTE The voltages above are the voltages at the eDAQ power connector, which are always less than the voltages at the power source because there is always some voltage drop in the wires used to route the power supply voltage to and through the eDAQ power connector. These voltage losses are dependent on the length and gauge of the connection wiring assembly.

NOTE The eDAQ-Plus and eDAQ-Lite fuses are 10 amp, 42 volt rated automotive mini-blade fuses. For the eDAQ-Plus only, spare fuses may be stored in a compartment under the bottom panel fuse access plate (new units are shipped with 6 spares in this compartment). For the eDAQ-Lite only, the base plate must be carefully removed to gain access to the fuses.

- 3) When a power fail shut down initiates with a test run in progress, the eDAQ-plus proceeds to immediately stop the test run and then flush all data in temporary buffers to the PC Card. This can take several seconds. It is imperative that the backup battery is sufficiently charged to keep the eDAQ running during this time; if this is not the case, the SIF file data will be corrupted!
- 4) A fully charged backup battery will have at least 100 watt-minutes of reserve power. It takes about 4 hours for a completely discharged backup battery to be fully recharged. The battery charging circuit draws 4 watts maximum while it's being charged. The backup battery charger operates on an as needed basis. An intelligent charge controller monitors current into and out of the backup battery. In so doing, it tracks the current charge state of the battery. When the battery has discharged to about 92% of rated capacity and the eDAQ is connected to a power supply at more than 10 volts, the charger will turn on and will run until a full charge state is detected (normally after about 20 to 30 minutes), and then shut off.

An eDAQ-plus that is turned off and connected to a power supply (such as vehicle battery), will run one of these 20 minute charge cycles about once every 2 days, or an average power drain of about 30 milliwatts (i.e., 2.5 milliamps at 12 volts).

If the battery should be disconnected and then reconnected or changed, this is also detected and the new battery is assumed to be dead. A charge cycle will then initiate upon connection to a power supply and will run until full charge is detected.

NOTE There is a status indicator provided in the eDAQ web browser interface that shows the level of battery charge as either Low, Medium, or High, and also indicates if the recharging circuit is currently on or off.

- 5) The auxiliary power switch cable that comes out of the eDAQ-plus power connector acts as a "3 way switch" in conjunction with the front panel on-off push button switch. If this is not in use, be sure that the red and black wires are either fully insulated from each other or solidly connected to each other to prevent accidentally turning the power off. If the wires are connected to each other and there is any chance of magnetic induction, do not coil the cable in a loop.

NOTE New test runs can be started on the eDAQ by forcing a reboot when a test is running. Many customers use this feature to start new test runs. The auxiliary power switch can be used to

accomplish this in a way that does not drain the backup battery (since the main power supply is still on during the duration of the power down operations). However, turning off the power supply or disconnecting the power supply from the eDAQ will drain the backup battery and should be avoided as it can result in SIF file data corruption!

NOTE Do not apply any voltage sources to the auxiliary power switch cable! It is designed to be used with a single pole single throw (open/close) contact switch.

NOTE The “3 way switch” reference above means that there are 2 physical switches (i.e., the front panel switch and the [user installed] auxiliary power cable switch) that invert each other’s switching logic. This means that the user can choose to have the eDAQ power up on either an opening or a closing of the auxiliary power cable switch - by simply toggling the front panel switch.

Data Storage

RAM Disk Data Storage Option

The RAM Disk storage option has quite limited use in most test applications. On the eDAQ-Classic, the size is limited to 3.5 MB, and as such is usually much too small for sequential data storage, or even histogram data storage if many test runs are required. While the RAM Disk can be resized on the eDAQ-plus and the eDAQ-lite, this is currently recommended only to support the following kind of test.

If the user defines a test that uses the Burst History data mode, and accumulates a large number of burst data records (e.g., by either having many channels, or using small burst record sizes, or both), the (3.5 MB) RAM Disk memory can fill up with header records long before the PC Card fills up with the raw data records. In this test scenario, increasing the RAM Disk size is required to allow the test to run longer.

PC Card Data Storage Option

The term PC Card as used here refers to the original (full sized) PCMCIA cards and the CompactFlash (CF) cards that can be used with a PC Card extender.

Storage Media Options

There is a dual external PC Card slot available on the MPB. Note that only one of the two PC slots can be used for data storage at any time. Either of the two slots can be used for this purpose.

- There is a disk partition on the Internal Flash (CF card) that can be used as the data storage media.
- DRAM memory can be used as the data storage media.

The size of the Internal Flash partition available for data storage is dependent on the size of the Internal CompactFlash card. As of the V3.8.5 release, about 32 MB of the Internal Flash memory is reserved for the eDAQ Linux OS usage. The remainder of the Internal Flash memory is available for data storage. Likewise, the amount of DRAM memory available for data storage is dependent on the size of the socketed DRAM. As of the V3.8.5 release, about 32 MB of the DRAM memory is reserved for the eDAQ Linux OS usage.

Selecting the Storage Media

Use the eDAQ web browser to select the actual media (i.e., [the external] PC Card, DRAM, or Internal Flash). To do this, first ensure that there is no test initialized on the eDAQ. Select the Hardware page of the eDAQ web browser main menu. Use the Select Storage Device drop down list box to select the desired storage media, and click on the Change storage device button.

Guidelines for selecting the PC Card storage media.

The DRAM storage media option is applicable for limited testing scenarios only. While it provides the maximum throughput compared to all other storage modes, the DRAM memory is volatile. This means that the test data will be lost if the eDAQ is powered down, or if the eDAQ resets for any reason.

The Internal Flash storage media option provides much better data throughput than the external PC card storage media option assuming the Internal Flash CF card uses DMA (as is the case for the SoMat supplied CF cards). Data throughput can be up to 5 times better using the Internal Flash. As such, this is the preferred storage media for test applications where the user can Upload the test data.

NOTE For all storage media options, the eDAQ stores raw test data and related information in a set of individual SIF component files referred to as SIC files. There is a fixed naming convention for these files (i.e., sif00000.sic, sif00001.sic, sif00002.sic, and so on). These files reside in the eDAQ file system directory hd/eDAQ and can be viewed using the eDAQ web browser option Explore eDAQ Files (under the System menu option).

External PC Card Format Options

For the external PC Cards, the user can select either a Windows compatible MSDOS format, or a Linux format. The eDAQ web browser interface is used to format the PC Cards (by clicking on the Storage: PC Card link in the Hardware page spreadsheet, and then selecting the Initialize/Format ATA PC Card option).

NOTE There is a link to the eDAQ web browser main menu via the TCE PC Card Configuration Options (accessed by highlighting the MPB card in the TCE Hardware Setup window and clicking on the Config button).

NOTE It is generally recommended that PC Cards be formatted in the eDAQ. However, the cards can also be formatted in Windows 2000 PCs using either the FAT or the FAT32 format options provided under Windows 2000.

The Linux format will provide somewhat higher data throughput performance and is recommended if the user plans to always use the TCE Upload task to upload the SIF file from the eDAQ to the PC over a communications line.

If the user wants to remove the external PC Card after stopping a test run and insert it in the PC Card slot of a PC running Windows, the MSDOS format is required. With the PC Card inserted in the Windows PC Card slot, the user can create a SIF file from the set of SIF component files (i.e., SIC files) by using the TCE File menu option Consolidate SIC Files. The card can be reinserted in the eDAQ and another test run can be started.

External PC Card Removal

After a test run is stopped, the external PC Card is removable from the eDAQ - but only after it has been logically unmounted. Currently, the only way to do this is to power down the eDAQ, wait for all LEDs to be turned off by the eDAQ, and then manually eject the PC Card.

WARNING If the user ejects the external PC Card without going through the above procedure, the SIF data file will most likely be corrupted!

NOTE The eDAQ also supports the capability to swap in a new PC Card and re-initialize a test that was previously initialized. This allows users to effectively store test runs across multiple PC Cards.

Procuring PC Cards

While many types of PC Cards will work with the eDAQ, some will not work at all. Furthermore, different brands/models of PC cards can have significantly different data throughput characteristics. For reasons beyond the scope of this topic, older PC cards will often perform better than newer PC cards from the same manufacturer. As such, it is recommended that customers use the same type(s) of PC Card(s) that SoMat provides for current production shipments since these are selected to optimize data throughput and have been thoroughly tested at SoMat.

eDAQ USB LCD Display

An optional USB driven LCD Display module is available for monitoring test status and/or displaying a small number of selected channels in real time.

Hardware Setup

The USB LCD Display cable pigtails need to be connected to the MSMPB board digital cable pins as follows. (The required information is not currently available!) Note that only the new split cable (i.e., SAC-EDIGIO) can be used with the USB LCD Display module.

NOTE The HSS connector is not a general purpose USB connector. It is currently available to support the LCD Display only!

eDAQ Plus/Lite USB Display User Interface Setup Basics

The eDAQ web interface for configuring the USB display can be reached by clicking the USB Display Setup link from the Test tab on the eDAQ's web page. The current web interface for setting up the USB LCD Display has three separate modes - Basic, Advanced, and Expert.

General points to remember about the USB LCD configuration are as follows.

- Display specifications are stored inside the eDAQ according to the setup name of the test.
- The default (no test initialized) display cannot be changed through the web interface.
- The Basic, Advanced, and Expert web interface modes all manipulate the same per-test display specification inside the eDAQ; only the user interfaces are different.
- The interface allows the display of real test channels (transducer or computed) as well as pseudo channels that include such information as the current run number, free PC-Card memory, and other similar metadata.
- Since each interface operates on the same underlying data, it can be easy to set up a simple display using the basic interface, and then tweak it as desired using the advanced or expert interfaces.

Basic Interface

- Allows the setup of one displayed channel (real or pseudo) per LCD display line using extremely simple controls. The format of each line on the LCD is ChannelName: value.

Advanced Interface

- Allows precise formatting and positioning of static text intermixed with channel (real and pseudo) displays.
- Allows copying of setup information from one saved test name to another.

- Allows precise formatting of numerical and string data, either via a simplified ###.## style format, or using printf() -style format strings.
- Channel names can either be typed in by hand in the edit column, or chosen from a list in the select column.
- The channel placeholder token * is user-modifiable.

Expert interface

- A simple text edit box of the actual display specification used by the process that actually manages the LCD display.
- Channel specifications are of the form %[name], or %[name | format] when an explicit format is desired.
- Format strings can be in the simplified ###.## style, or in printf() percent style.
- %% is used to display a literal % in static text
- printf() format documentation can be found in any standard ANSI C programming language manual.

Appendix - CAT Layer Expansion Board

Information found in this appendix is specific to the CAT layer expansion board made specifically for Caterpillar® Inc.

Available Channel Types

Cat PCM – Cat PCM channels are sourced from the serial data stream of the Caterpillar Metraplex® signal conditioning system. Up to 128 channels of PCM data channels can be acquired. PCM set files are imported into eDAQ database files via the Hardware Interface configuration options.

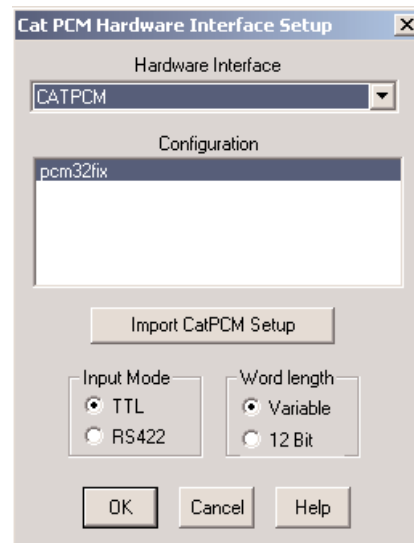
Cat ECM – Cat ECM channels are sourced from the serial data stream of the Caterpillar SuperComm module that interfaces to Caterpillar engine control modules. Up to 64 channels of SuperComm defined data channels can be acquired. SuperComm set files are imported into eDAQ database files via the Hardware Interface configuration options.

Cat ECM Message – Cat ECM message channels are specialized SuperComm channels that generate text information.

Cat PCM Channel

Before Defining a Channel - Hardware Configuration

The Caterpillar PCM board must be configured prior to the addition of any Cat PCM input channels. To perform this configuration, open the TCE Hardware Setup page by pressing F1 or selecting the window with the mouse. Highlight the Caterpillar PCM board, then click Config. This will open the Cat PCM Hardware Interface Setup dialog.



Cat PCM Hardware Interface Setup

Parameters

Hardware Interface – The desired Cat PCM hardware interface. Currently Cat PCM is the only interface that can be selected.

Configuration – The database from which to load configuration information.

NOTE: TCE assumes that the database file selected matches the current PCM encoding. The user is responsible for ensuring that this is the case.

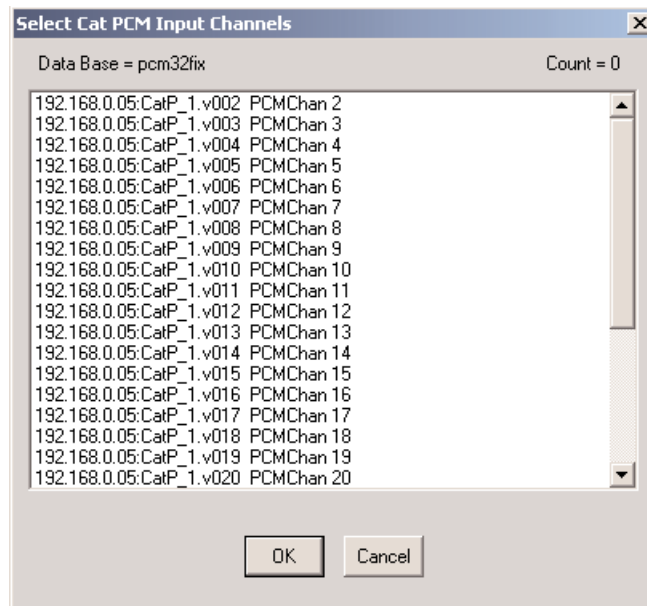
Import CatPCM Setup – A method for creating a database file from a user created CatPCM file

Input Mode – The desired input mode.

Word length – The appropriate word length mode to match the PCM data stream encoding.

Selecting Channels from a Database

Once the hardware configuration is complete, a Cat PCM channel can be added as described in [Transducer and Message Channels - Defining a Channel](#). The Cat PCM input channel setups are always loaded from a database file; therefore, no parameter definition dialog boxes will appear upon creation of the channel(s).



Select Cat PCM Input Channels Dialog Box

To edit the definition parameters for a Cat PCM input channel, double-click on the definition line within the Transducer and Message Channel Setup window or highlight the line then click Edit. The channel definition dialog box will appear.

Cat PCM Input Channel Definition Dialog Box (Page 1)

Parameters

The following parameters are specific to the Cat PCM input channel type. See also [Transducer and Message Channels - Common Input Channel Parameters](#).

Data Base Info – Open a read-only dialog containing a summary of database parameters.

Data Flow Control

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

NOTE: The same sample rate must be specified for all PCM input channels for any given Cat PCM board or sub-board.

Stale and Invalid Data Handling

Stale Data Expiration (secs) – The time period for which data received will remain valid and will be used as the output data value. When the Stale Data Expiration time period elapses before new data is received, the Invalid Data Output Value will be used as the output data value.

NOTE: The Stale Data Expiration time period must be specified uniformly for all PCM channels for good throughput performance. Having even one channel that has a different value for this field than all other PCM channels will drastically reduce throughput performance.

Invalid Data Output Value – The value that will be substituted for all data that is flagged as invalid.

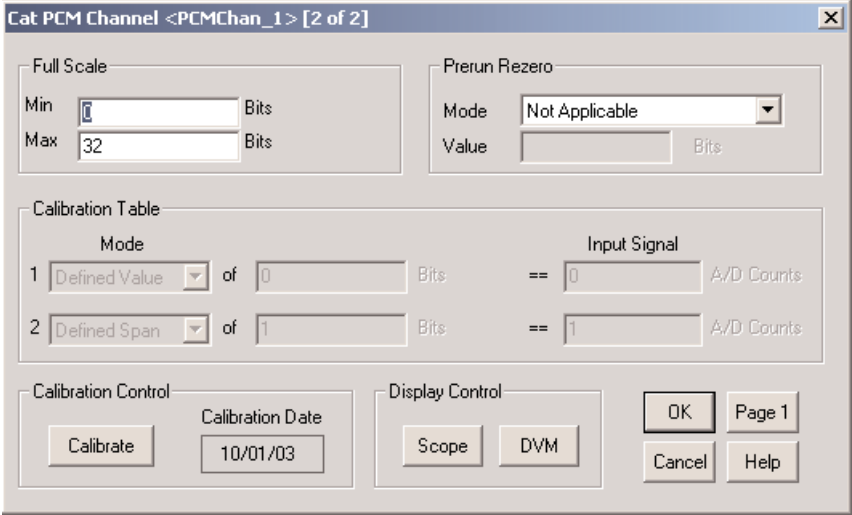
Output Data Type

Raw Data Type – Typically, the data type defined in the database (i.e., 8-bit unsigned, 16-bit unsigned, or 32-bit unsigned); however, for database bit sizes other than 8, 16, or 32, the raw data type is promoted to one of

these 3 bit lengths (e.g., a 1-bit unsigned is promoted to 8-bit unsigned, a 24-bit unsigned is promoted to 32-bit unsigned, etc.)

Convert New Data to 32 Bit Float – Optionally set the output data type to 32-bit float.

NOTE: Utilizing 32-bit float conversion for even one PCM channel will add computational overhead and drastically reduce throughput performance.

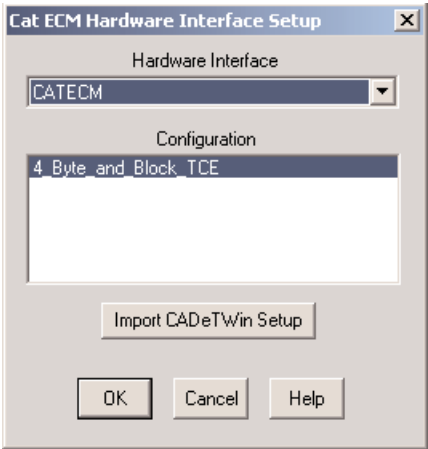


Cat PCM Input Channel Definition Dialog Box (Page 2)

Cat ECM Channel

Before Defining a Channel - Hardware Configuration

The Caterpillar ECM board must be configured prior to the addition of any Cat ECM input channels. To perform this configuration, open the TCE Hardware Setup page by pressing F1 or selecting the window with the mouse. Highlight the Caterpillar ECM board, then click Config. This will open the Cat ECM Hardware Interface Setup dialog.



Cat ECM Hardware Interface Setup

Parameters

Hardware Interface – The desired Cat ECM hardware interface. Currently Cat ECM is the only interface that can be selected.

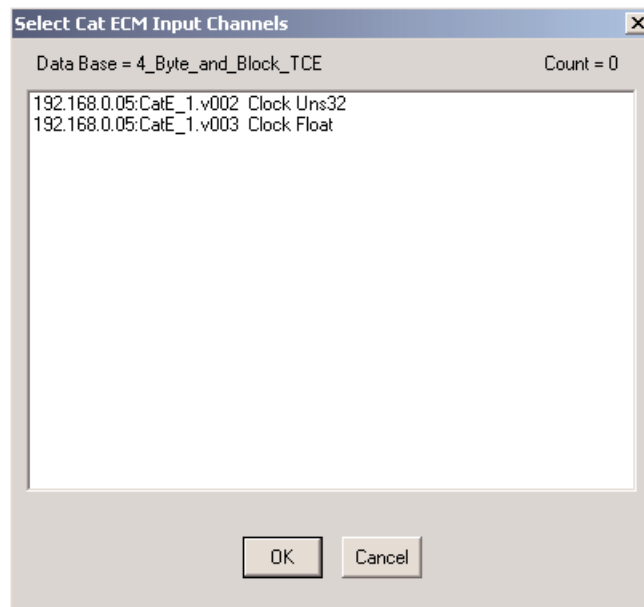
Configuration – The database from which to load configuration information.

NOTE: TCE assumes that the database file selected matches the current ECM encoding. The user is responsible for ensuring that this is the case.

Import CADeTWin Setup – A method allowing the user to create a database file from a CADeTWin file.

Selecting Channels from a Database

Once the hardware configuration is complete, a Cat ECM channel can be added as described in [Transducer and Message Channels - Defining a Channel](#). The Cat ECM input channel setups are always loaded from a database file; therefore, no parameter definition dialog boxes will appear upon creation of the channel(s).



Select Cat ECM Input Channels Dialog Box

To edit the definition parameters for a Cat ECM input channel, double-click on the definition line within the Transducer and Message Channel Setup window or highlight the line then click Edit. The channel definition dialog box will appear.

Cat ECM Input Channel Definition Dialog Box (Page 1)

Parameters

The following parameters are specific to the Cat ECM input channel type. See also [Transducer and Message Channels - Common Input Channel Parameters](#).

Data Base Info – Open a read-only dialog containing a summary of database parameters.

Data Flow Control

Output Sample Rate – The rate at which data is passed to computed channels or DataModes. Select the rate from the drop-down list.

NOTE: The same sample rate must be specified for all ECM input channels for any given Cat ECM board or sub-board.

Stale and Invalid Data Handling

Stale Data Expiration (secs) – The time period for which data received will remain valid and will be used as the output data value. When the Stale Data Expiration time period elapses before new data is received, the Invalid Data Output Value will be used as the output data value.

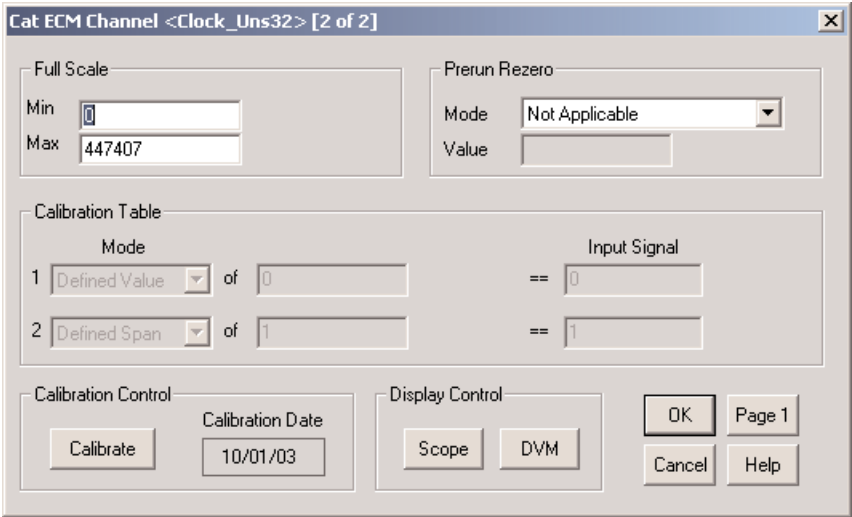
Invalid Data Output Value – The value that will be substituted for all data that is flagged as invalid.

Output Data Type

Raw Data Type – Typically, the data type defined in the database (i.e., 8-bit unsigned, 16-bit unsigned, or 32-bit unsigned); however, for database bit sizes other than 8, 16, or 32, the raw data type is promoted to one of these 3 bit lengths (e.g., a 1-bit unsigned is promoted to 8-bit unsigned, a 24-bit unsigned is promoted to 32-bit unsigned, etc.)

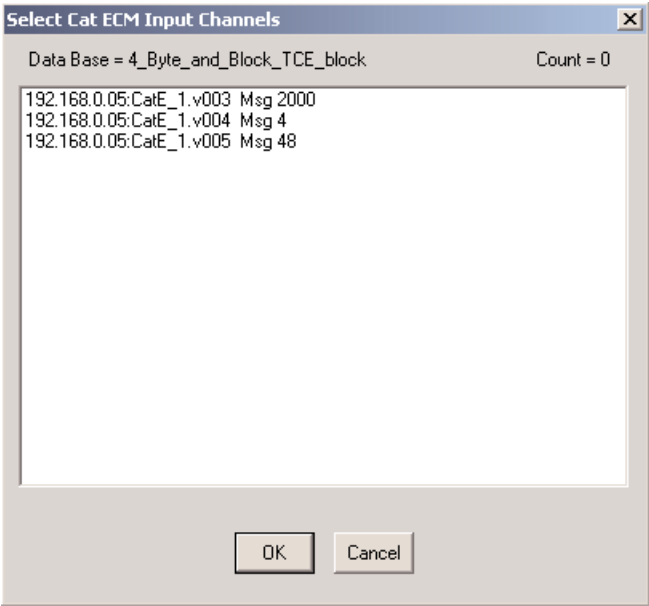
Convert New Data to 32 Bit Float – Optionally set the output data type to 32-bit float.

NOTE: The 32-bit float conversion will add some computational overhead; and this is significant to overall eDAQ performance in the situation where there are a larger number of ECM input channels defined at high sample rates.

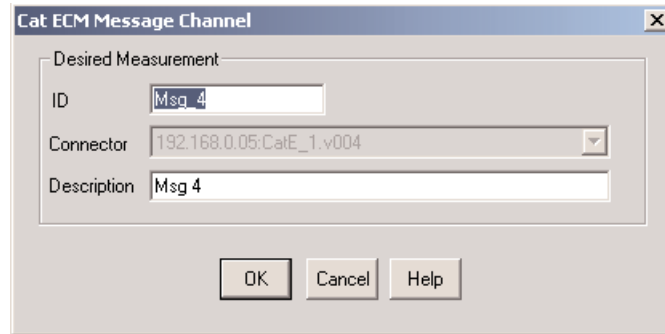


Cat ECM Input Channel Definition Dialog Box (Page 2)

Cat ECM Message Channel



Select Cat ECM Input Channels



Cat ECM Message Input Channel Setup Dialog Box

Parameters

There are no parameters specific to the Cat ECM Message input channel type. See [Transducer and Message Channels - Common Input Channel Parameters](#).

eDAQ Web Interface

When a CAT expansion layer is present in the eDAQ stack, log messages are viewable via the eDAQ web interface. These messages are accessible from the hyperlink present in the Card Type column of the Hardware page. The interface for viewing the messages is identical to the interface used for viewing Vehicle Bus messages.