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## 1.0 INTRODUCTION

The DIGI\_GALV is a second generation instrument designed for industry use as a tool for the measurement and prediction of inhibitor performance in metalworking, hydraulic water based fluids and lubricants.

The equipment consists of: -

- a) A Multi - Metal test probe.
- b) A digitally controlled DUAL RANGE precision electrochemical ZRA instrument unit.
- c) A desktop P.C, fitted with an A/D, I/O card running VB6 WINDOWS compiled executable analysis software (DIGI\_Win).

## 2.0 OVERVIEW

The purpose of the instrument is to visually display the effectiveness of chemical compounds as corrosion inhibitors. Once installed the equipment will display the corrosion of up to seven individual metal couples in real time. Each bar on the screen represents the value of corrosion current flowing in/out of the respective metal. The effects of corrosion inhibitor addition on individual metals can be immediately visualised. This allows the evaluation of water soluble inhibitors directly, and oil phase inhibitors when emulsified or solubilised by a co-solvent. The main application areas for the equipment are water based machining coolants, rolling lubricants, H<sub>2</sub>O/WF hydraulic fluids, antifreeze/water/glycol mixtures.

## 3.0 INSTALLATION

### 3.1 *Installing the Hardware*

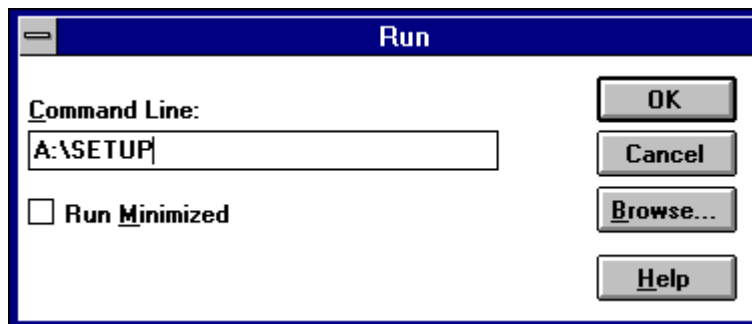
- a) MAKESURETHATTHECOMPUTERISSWITCHEDOFFATTHEMAINS,  
BUTHASIT'SMAINSLEADCONNECTEDATTHE REAR.  
(i.e.THECASEISEARTHED)
- b) (PC30ATInstallation)  
MAKESURETHATYOU TOUCHTHEMETALCASINGINSIDETHECOMPUTER  
BEFOREREMOVINGTHEAMPLICONCARDFROMIT'SSTATICPROTECTION  
PACKAGING.(THISEARTHSTHESTATICONYOU).
- c) SLIDETHECARDINTOANEMPTYEXPANSIONSLOT.
- d) THECARDIS SUPPLIEDALREADYCALIBRATED&SETUPFORTHIS  
APPLICATION.
- e) \*\*THEONBOARDWAITSTATEGENERATORONTHEPC30ATCARDCANBE  
VARIEDTOSUITTHEI/OBUSSSPEEDOFOURCOMPUTER.\*\*  
  
WEHAVESETTHECARD(JUMPERJ17TOPOSITION3,CORRESPONDING TO  
8-10MHzASSUMINGYOURCOMPUTERISADELLWITHASTANDARD BUSS  
SPEEDSEEP7PC30ATMANUAL.IFYOUAREOPERATINGADX2MACHINE  
(CLOCK SPEED66MHz,I/OBUSSSPEED33MHz)SELECTPOSITION1
- f) THISJUMPERJ17ISTHEONLYSETTINGONTHECARDTHATMA YNEEDTO  
BECHANGEDTOOPTIMISESOFTWARESPEED.  
  
\*\*PLEASEDONOTTOUCHANYOTHERCARDSETTING\*\*
- g) LOCATETHE DIGITALV,37/50WAYLEADTOCONNECTTHEINSTRUMENTTO  
THECOMPUTER.
- h) LOCATEEUROMAINSLEADINTOCONNECTORINTHEREAROF THE  
INSTRUMENT.
- i) TURNONTHEINSTRUMENTVIATHESWITCHONTHEEURO -MAINSSOCKET  
ATTHE REAROF THE  
(POWERLED(RED)SHOULDLIGHT)
- j) SWITCHONCOMPUTERANDMONITOR

### 3.2 Installing the Software

To install DIGI\_Win for the first time you must first copy the executable file to your hard drive, together with three OCX control files. The "SETUP" program supplied on the disc is designed to install DIGI\_Win from the Windows \RUN prompt. The SETUP program will create a directory C:\DIGI GALV on your hard drive and will automatically copy files into this directory and the Windows system directory.

To install this software follow the steps: -

a) From within Windows Program Manager click on File \Run..., in the Run Command Box type A:\setup as below, insert SETU P disc 1 into drive A and press Return.



b) After SETUP has checked the system for available disc space, you are prompted for an installation directory. Change the installation directory to C:\DIGI GALV.

c) Insert discs 2 & 3 as directed.

d) Select "Windows Setup" icon in MAIN and double click

e) From "Options" menu select Setup Applications

f) In Set Up Applications select "Ask to specify an application" Click OK

g) At the flashing cursor type "C:\DIGI GALV\Win1v\*.EXE" click OK and close window set up box

h) You should now have an icon named DIGI GALV in the Applications group box in Windows

i) Double click this icon to start DIGI\_Win

### 3.3 Probe-Cell Preparation

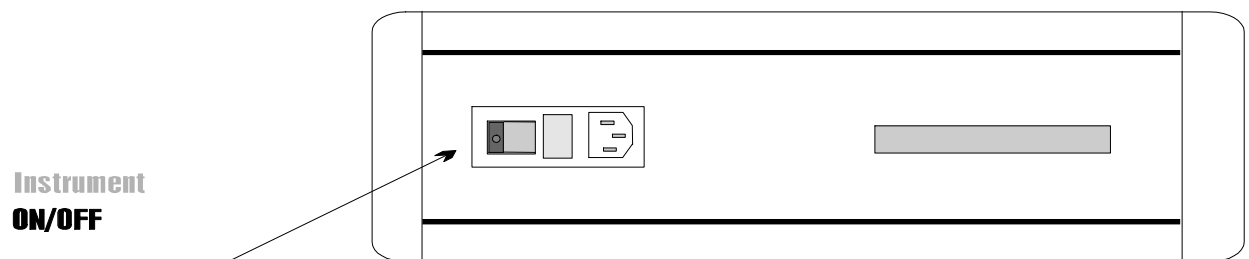


Before testing the performance of a fluid, the surfaces of the test probe electrodes need to be cleaned. Removal of all oxide layers and traces of corrosion inhibitors is essential for good test reproducibility. Prepare the electrode surfaces by first removing heavy oxidation with wet P600/800 carborundum (wet/dry) paper, and inspect for pitted surfaces. Final clean to a semi-polished surface with P1200 wet/dry paper, cleaning each electrode with a fresh square of paper (approx 25mm Sq) to avoid cross contamination of metals. It is recommended to polish in the sequence central electrode first, followed by the outer circle in rotation. Rinse with Deionised water and proceed with the test immediately. If the probe is left for longer than five minutes without immersion in a fluid, then repolish with P1200 before testing. Do not use solvent e.g. Acetone, or Isopropyl alcohol to dry the electrode surfaces, as this causes poor wetting out of the surfaces when immersing in a fluid and can cause erroneous test results.

## 4.0 USING THE INSTRUMENT

(A QUICK GUIDE TO RUNNING A TEST)

### 4.1 Turning On and Off

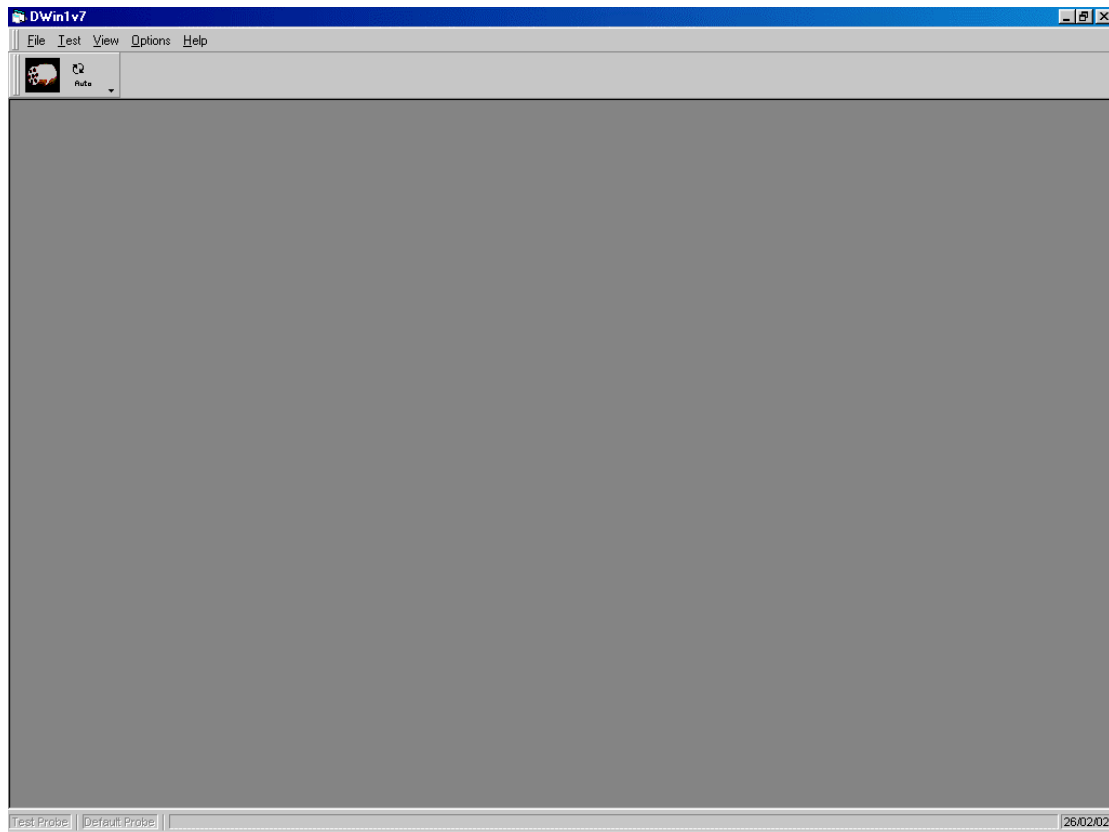


When switching on the DIGI -GALV System it is recommended good practice to switch **ON** the equipment in the sequence DIGI -GALV instrument unit first, followed by the Dell System Unit and Monitor.

Turn the instrument **OFF** by reverse sequence i.e. instrument unit last.

## 4.2 RunningDIGI\_Win

DoubleclickontheDIGI\_WiniconintheApplicationsgroupboxinWindowstoopen DIGI\_Win.



TheDwin1v7mainMDIMenuscreenisshownabove.Tobeginamu select **TEST**and **Standard** fromthemenu bar.Tobeginamulti lti-metalscreeningtest theDEFAULTprobesetupselect.... -metalscreeningtestusing



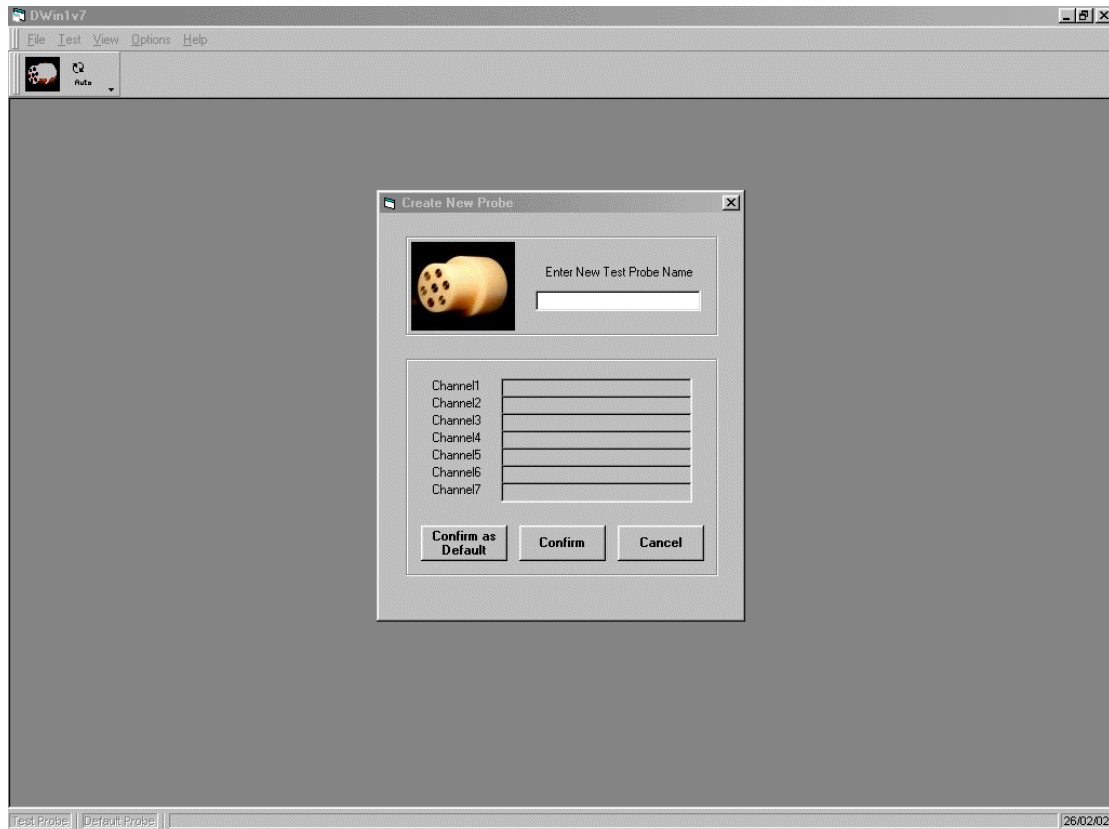
AUTOTESTfromthemenutoolbar.



### 4.3 Create a Probe Device



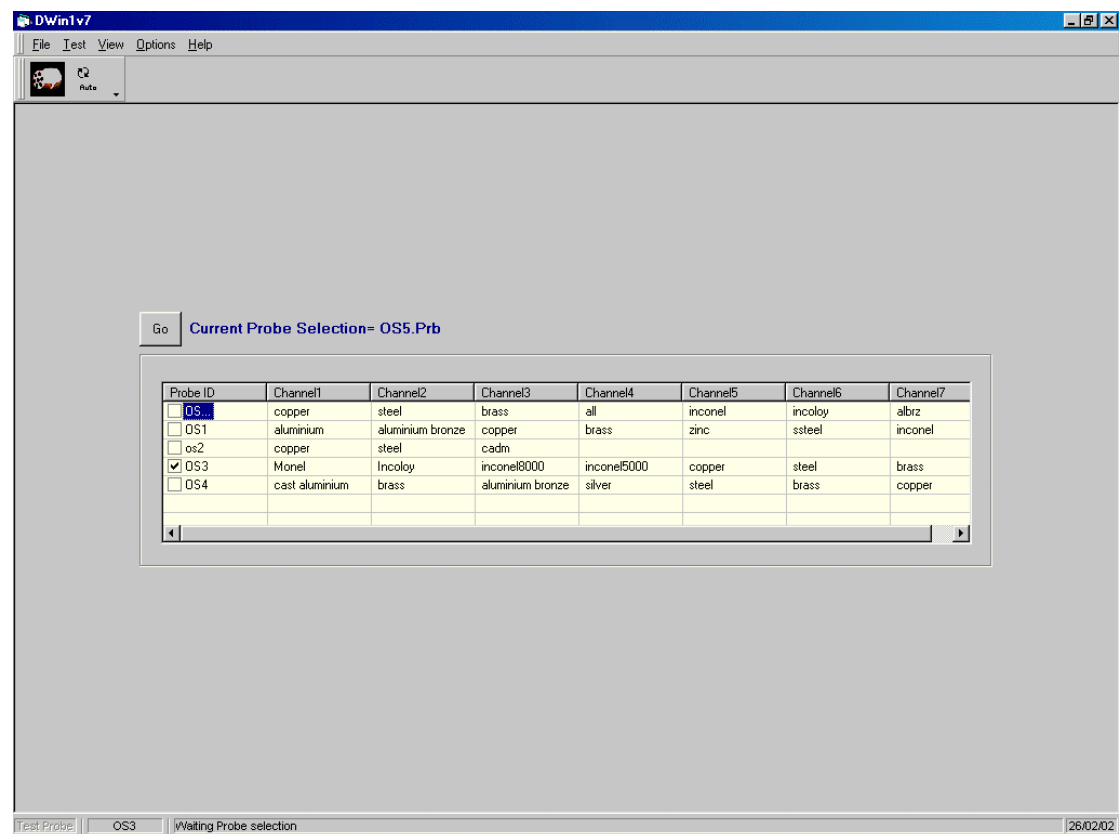
To create a probe device either select the icon in the menu toolbar or select menu **FILE** and **Create Probe Device**. Probe devices are stored as \*.Prb files in a directory \PROBES under the AppPath directory.



Enter a probe device name into the 'TestProbeName' text box then press the **Return** key. The Channel1 -7 description boxes will become enabled sequentially to allow a mapping of a probe test metal to an instrument channel. Select the **Confirm** button to write the new probe device to disc.

## 4.4 StartaStandardtest

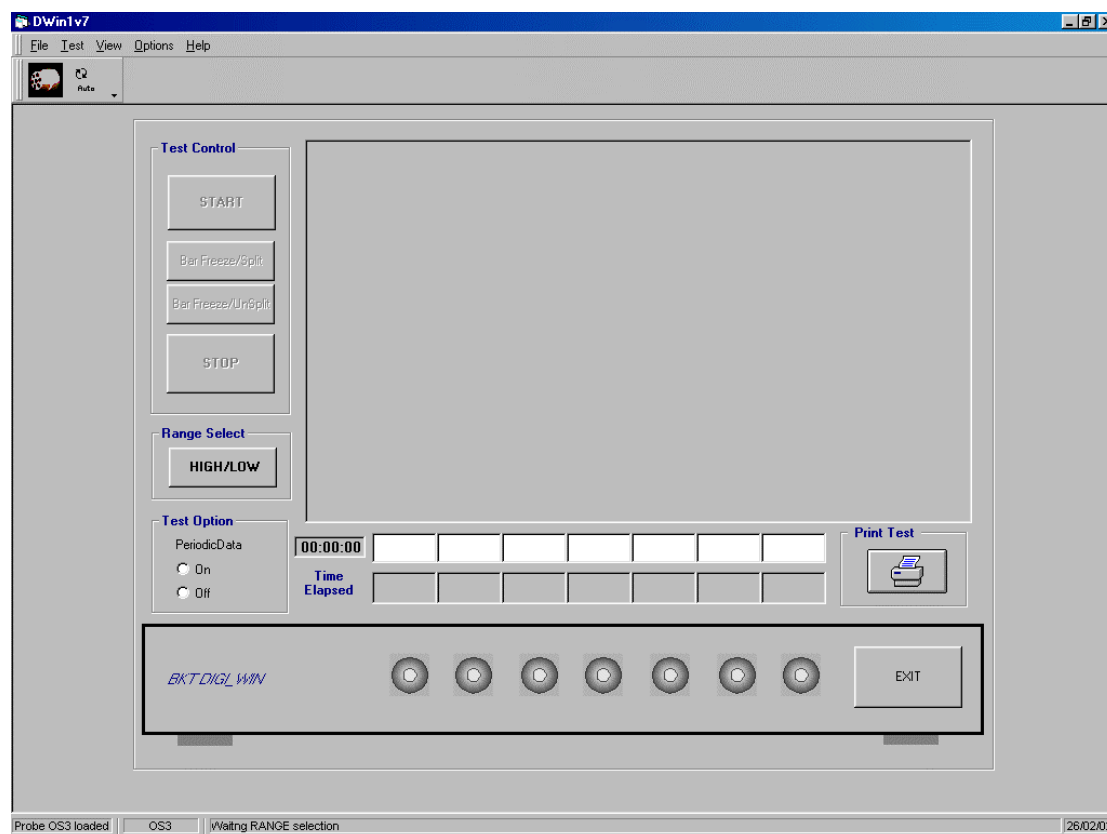
To begin a Standard multi-metal logging test, select **Standard** from the **TEST** menu. Before the main logging screen is displayed the probe device for the test must be selected from the list of available probe devices (\*.Prbin... \Probes).



Select a probe device from the column 'ProbeID' and click the

**Go** button to proceed to the

main logging screen.



Before you can begin running a test in the picture window of the logging screen, the DIGI - GALV instrument range must be selected. Select the **HIGH/LOW** button in the Range Select frame, by either clicking on the button or pressing the ( **+key** ), and choose LOW option, followed by 100  $\mu$ A. The DIGI\_Win software automatically sets the instrument range to LOW and the 100  $\mu$ A test axes appear in the logging window.

Once you have selected a range the **START** button in the Test Control frame is enabled. Connect the cleaned test probe to the front panel of the DIGI - GALV instrument, immerse in the test fluid, and click on **START** to initiate data logging. The test duration is displayed in the **Time Elapsed** label box in the format (hh:mm:ss) and is updated every second. The test bar values are displayed below the logging window in the format (00.0  $\mu$ A). Once a test is in progress, the **HIGH/LOW** Range Select button automatically has focus.

Channels can be returned **ON/OFF** by either toggling the **F1-F7** keys, or by selecting and clicking on the **LED'S** on the virtual instrument panel.

## 5.0 DIGI\_WinSOFTWAREINDETAIL

### 5.1 Probe-Devices

A probe device is a (\*.Prb) file that represents the physical makeup of a test probe. The metals on a test probe are physically mapped to a DIGI GALV instrument channel by their connection pin out on the 9 way D probe connector. (See Appendix 1)

Each test probe requires a (\*.Prb) file for software mapping of the probe's test metal to an instrument channel. The (\*.Prb) files are located in a directory (... \Probes) which is one level below the Dwin1v7 application path.

Probe devices require a minimum of 2 test metals and a Probe Device name. To create a probe device see section 4.3.

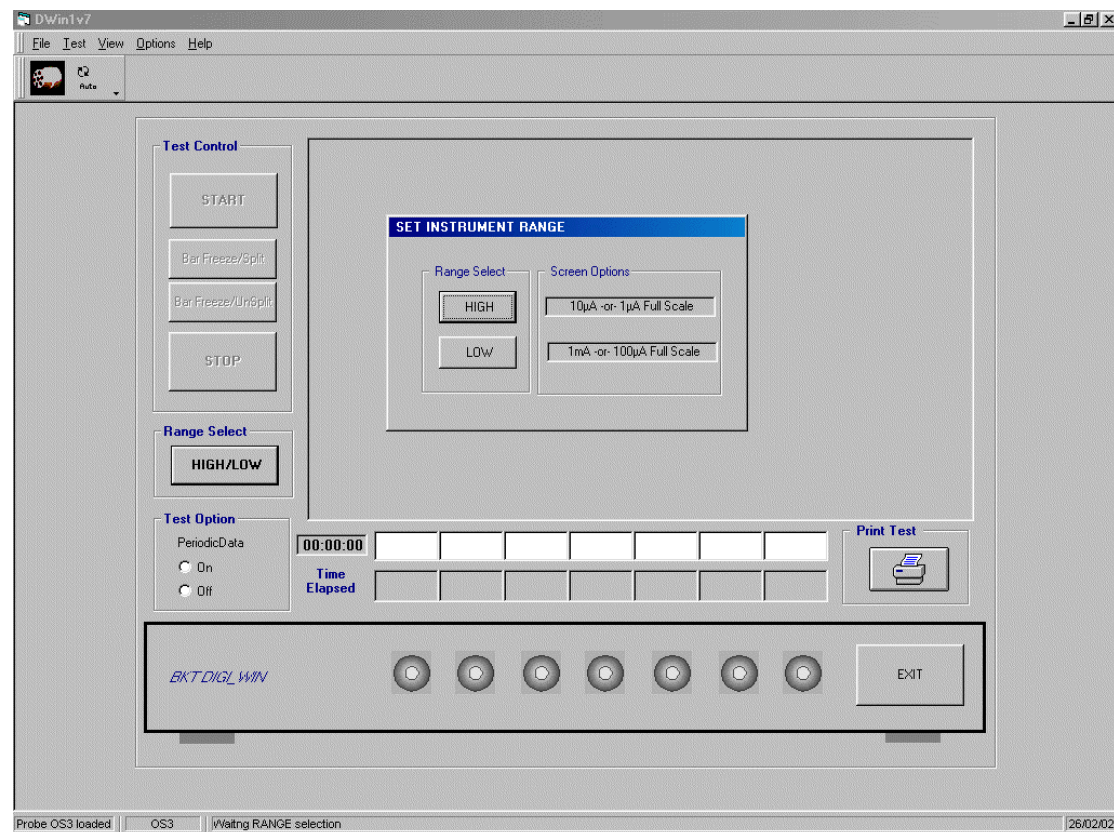
### 5.2 LoggingScreen

Before you can perform data logging with the DIGI GALV instrument the instrument range has to be selected. If you are in doubt as to the magnitude of the expected corrosion currents, select the LOW range and 1000  $\mu$ A screen scale as the lowest sensitivity and work upwards.

#### 5.2.1 Range Selection

Select the **HIGH/LOW** button in the Range Select frame to display the **SET INSTRUMENT RANGE** dialogue box. The **LOW** option allows a maximum current measurement of 1000  $\mu$ A, use the **HIGH** option only if you expect all the channel currents to be below 10  $\mu$ A. The maximum current measurement capability of the instrument set in **HIGH** range mode is 10  $\mu$ A, channel currents exceeding 10  $\mu$ A will appear off screen in the logging picture box and the instrument will return a current of 10  $\mu$ A.

For example, if you are testing a highly dosed fluid that has properties which inhibit metal currents to below 1  $\mu$ A on the 1  $\mu$ A screen scale, and a single channel exceeds 1  $\mu$ A the channel currents will continue to be displayed within the range 0 - 10  $\mu$ A.

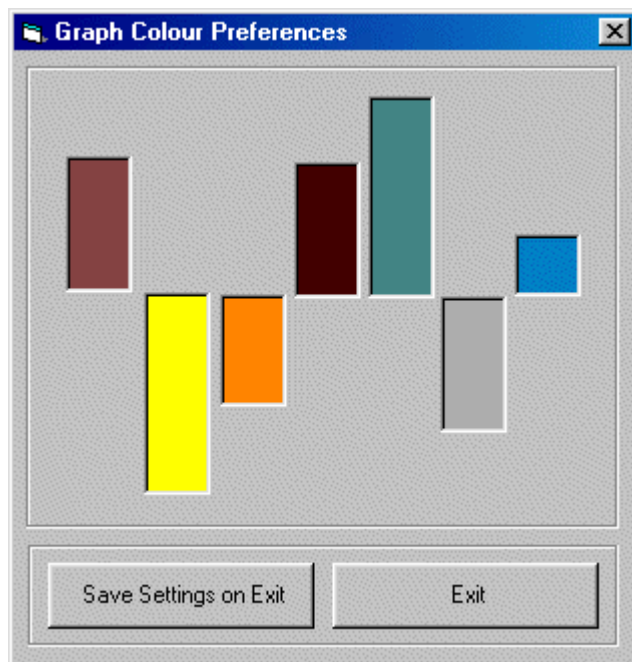


## 5.3 TestOptions

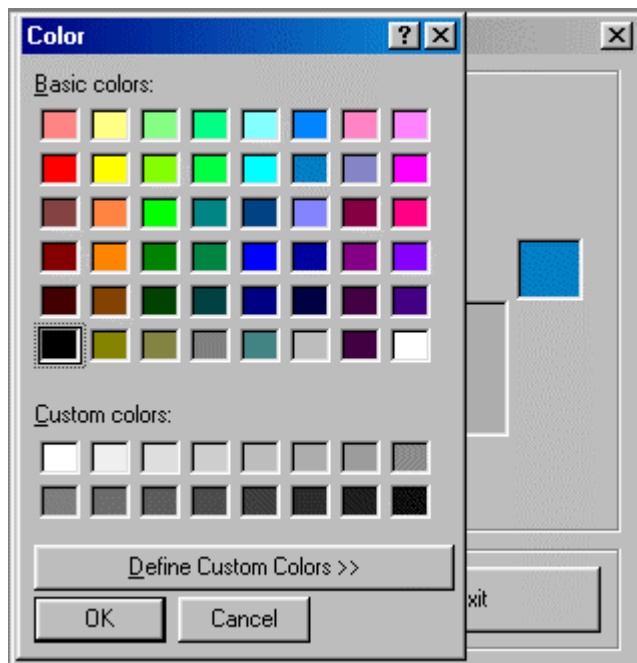
The test bar colours can be set independently through the menu **Options and Preferences**

### 5.3.1 Preferences

Select the menu **Options and Preferences** to preselect the channel bar colours.



Select a graph channel by clicking on a bar's coloured area to display the standard colour palette.



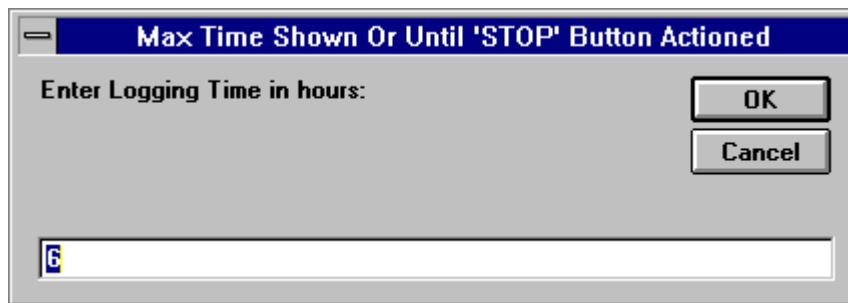
Set the graph channel to the required colours and save these settings by selecting the button 'Save Settings on Exit'.

### 5.3.2 PeriodicDataStorage

Use this option to read the bar current values repeatedly at a specified time interval to disc.

Bar values can be read and stored into memory during a test and written to disc in a named \*.dat format. The data acquisition time interval is entered in **seconds** into the **ENTER TIME INTERVAL** dialogue box. Minimum value 5 seconds, maximum value 30 seconds, the program then displays the maximum number of logging hours available for the specified time interval entered, as displayed in the dialogue box below. The box below displays 6 hours available logging for a time interval of 5 seconds.

Enter a logging time in hours (for example 0.1, for 6 minutes) and select OK or press return.



PeriodicDataStorage will initiate on the test **START** button and will terminate when the logging time has expired, unless the test **STOP** button is actioned.

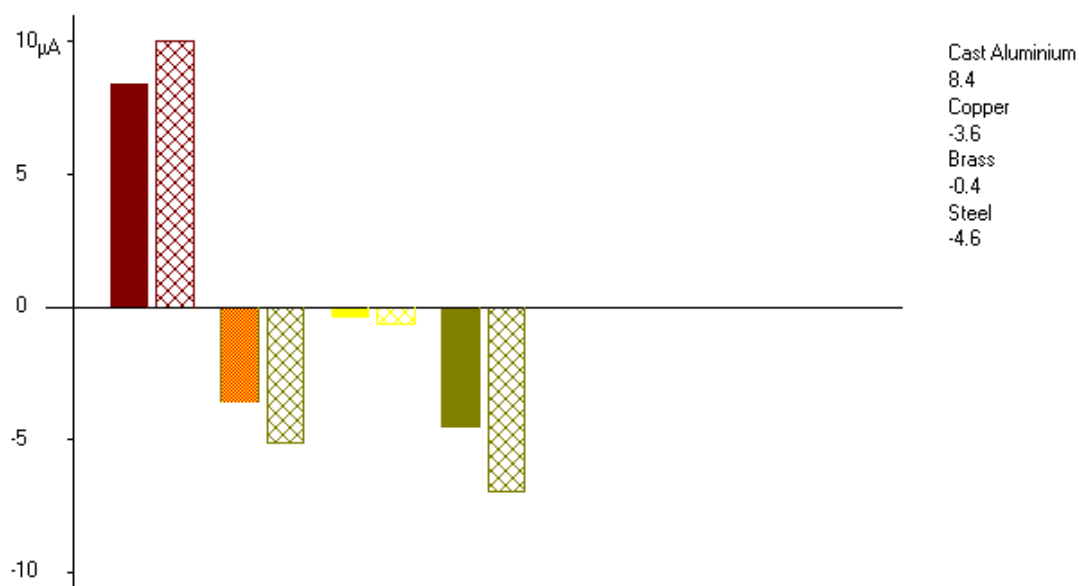
At the end of a logging session the File\_Save Dialog box will appear. Save the current PeriodicDataStorage data as a (\*.DAT) file to disc.

### 5.3.3 BarFreeze/Split

The BarFreeze/Split option is used to visualise the magnitude of change, in terms of inhibition effected after addition of a water soluble additive.

The bar values are frozen at the point in time that the option is actioned. A bar -split records the frozen values and displays continuous values in the left portion of the original bar width.

Use this option to test modifications to formulations, and formulating in **real-time**.



### 5.3.4 BarFreeze/UnSplit

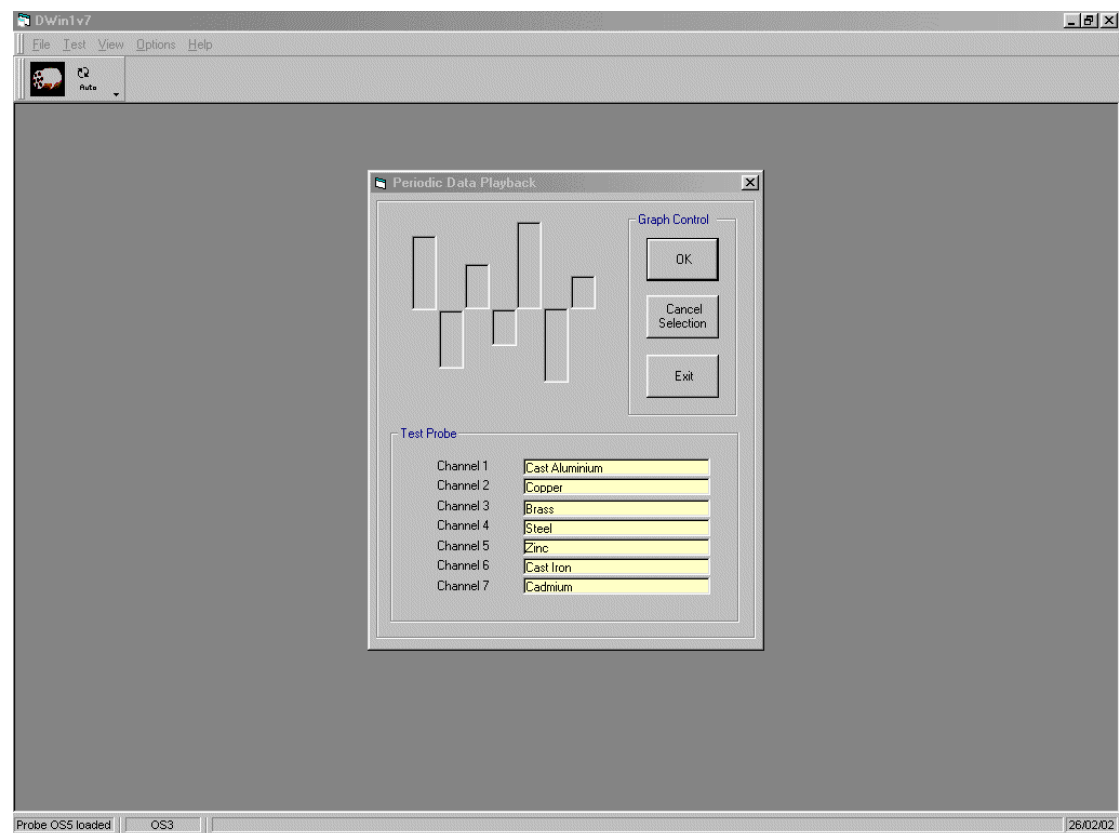
Use this option to reverse the BarFreeze/Split Option.



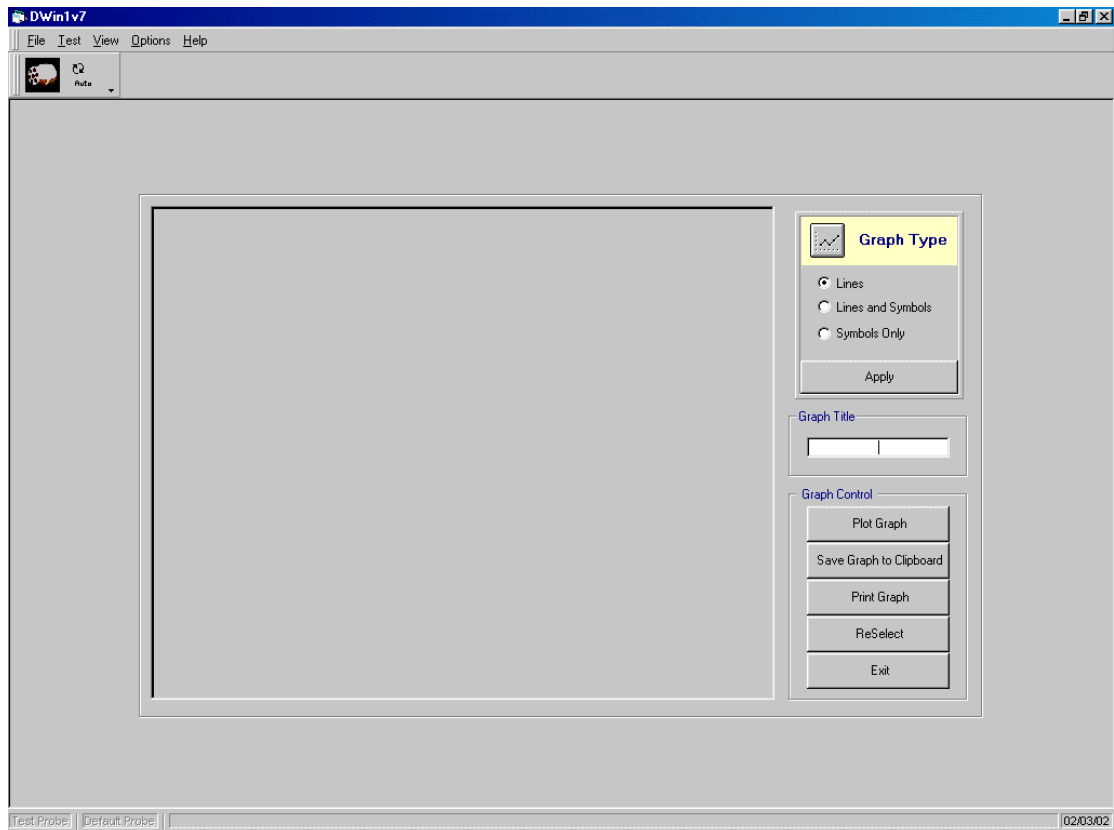
### 5.3.5 GraphPeriodicData

Use this option to display up to seven channels of current vs time plots from a previously stored file. The Periodic Stored data is held in the format of .Dat files on disc. To access a previously stored (\*.Dat) file go to menu **File\_Open** and select the (\*.Dat) file from the Open Dialog box.

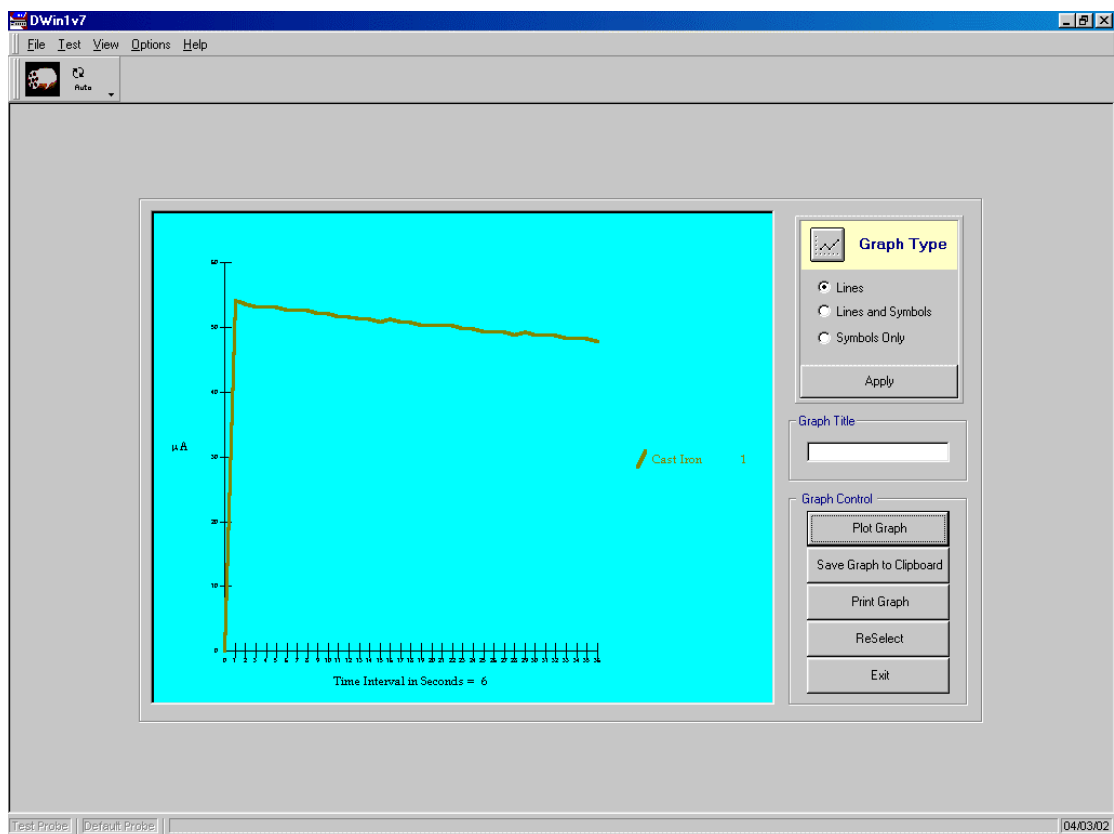
The Periodic Data Playback form is displayed with the associated Probe Device metals opposite each instrument channel.



Choose the number of channels to plot by selecting a channel bar from the picture box and mouse\_click inside the bar are to select. After selection of channels to plot click on the OK button to proceed to the graph display form.



Enter a Graph Title (optional) in the Graph Title text box and select Graph Type. Select the **PLOTGRAPH** button to produce a Periodic Data plot.



Choose the **ReSelect** button to return to the previous Periodic Data Playback screen.

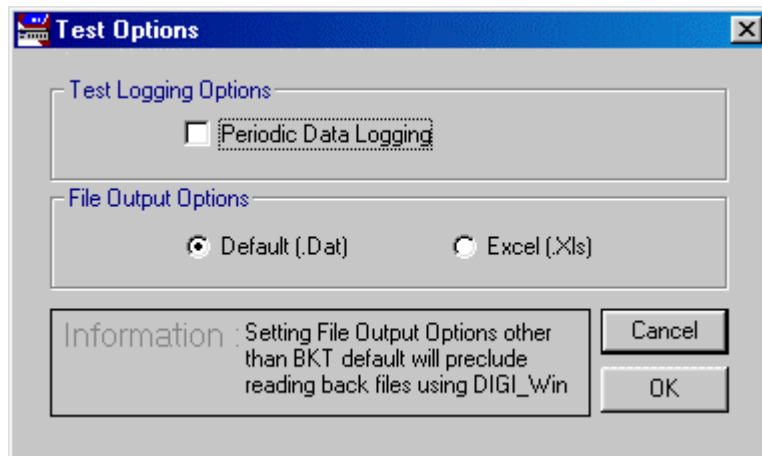
Choose **PrintGraph** button to send a bitmap image of the picture box to the default printer.

Choose **SaveGraphtoClipboard** button to send a bitmap image of the picture box to the Windows Clipboard.

Choose the **EXIT** button to return to the main MDI Menu screen.

### 5.3.6 Setting Test Options

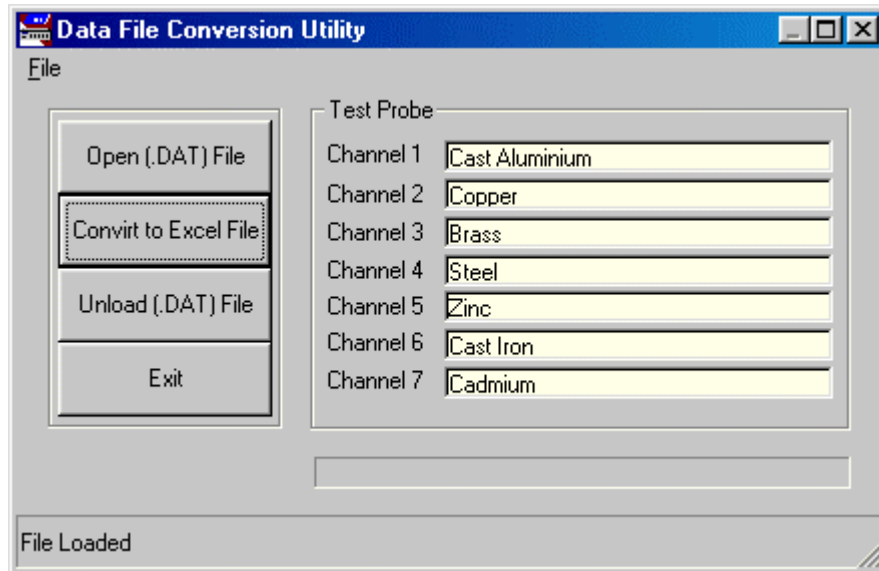
The default test options can be set globally through the Test Options dialog box, select Menu\_Options and Test Options.



Note: Selecting Excel as the default Periodic Data file output will automatically produce a (.xls) file output as opposed to the default (.Dat) file output. To view the output data in a graphical format from a (.xls) file requires the user to manipulate the data separately in Excel.

### 5.3.7 Converting Periodic Data (.Dat) files to Excel (.xls)

Periodic Data files can be converted to Excel format by opening them through the BKT data conversion utility program Data Convert, select menu \_Options and Excel Data Export.



## 5.4 PRINTING TESTS

DIGI\_Win requires a Windows printer driver to be installed prior to loading the program.

Clicking on the **PRINTTEST** button during a test sends a bitmap image of the logging window to Windows Print Manager.

Note: The Dwin1v7 programme is not multi-threaded and its execution therefore reacting to **PRINTTEST** during a logging session may freeze the logging screen for several seconds. To avoid this... use the **COPYTOCLIPBOARD** method section 5.5.1.

## 5.5 MENUPOPUP

### 5.5.1 CopytoClipboard

To capture the screen at any time during a test, right-click the mouse button inside the test window area. Select **CopytoClipboard** from the test menu popup.

