BATCH NO:	23.8.96
INSPECTED BY:	VJ

PL302
MACHINE ANALYSER
OPERATING MANUAL
(ANALYSER MODE)

Revision 1.1

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CHAPTER 1 - INTRODUCTION

1.1 USING THE MANUAL

This manual has been organised so that it can provide an easy and quick reference for the functionality of the PL302 in Analyser Mode. The first part of the manual deals with the major features of the instrument and details how external connections are made to signal sources, printers, and host computers. The main part of the manual is arranged as an alphabetical reference for all features of the instrument.

It will be found that the instrument's operator interface is quick and easy to master yet contains features normally only available on far more complex instruments. This manual provides details of the functionality of the PL302 Analyser Mode together with background information on many of its powerful features.

1.2 POWERING THE INSTRUMENT

1.2.1 ON/OFF Switching

The PL302 can be powered from its own internal NiCd battery pack or by a mains adapter plugged into the rear panel of the instrument. The instrument switched ON by pressing the ON/OFF key on the front keypad. The instrument is powered OFF by pressing the same key again.

At power-up, the internal processors are reset and a self-test is carried out to ensure that the internal circuitry is functioning correctly and that the integrity of the stored data in the memory has been maintained. It should be noted that the instrument will always power-up in the same state as it was when it was last powered-down. Therefore, if the instrument is accidentally switched off, the user will find that his settings have been maintained when he applies power again.

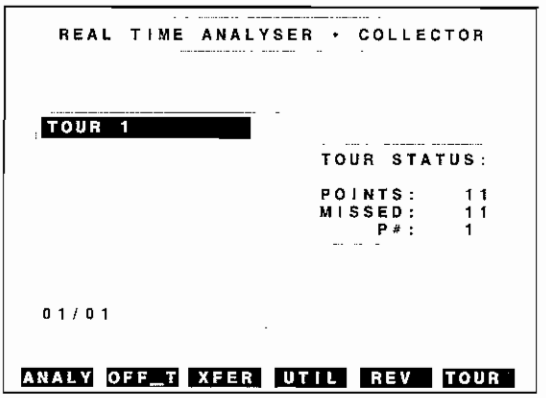
If the charge on the internal battery is very low the instrument will turn itself off shortly after power-up in order to prevent the battery becoming deeply discharged. This is discussed further in the next section.

1.2.2. Entering ANALYSER MODE

When the PL302 is swtiched on, the screen shown in figure 1.1. will appear. This normally allows TOUR operations to be carried out on Data Collector Mode.

To enter Analyser Mode, the *[ANALY]* softkey should be pressed. The PL302 will now remain in Analyser Mode i.e. acting as a dual-channel FFT analyser until the exit operation is carried out.

Figure 1.1
Entering Analyser Mode



1.2.3 Exiting from ANALYSER MODE

Exiting from Analyser Mode is carried out via the SETUP MENUS screen as shown in figure 1.2. Pressing the **[SETUP]** hardkey returns to Data Collector Mode while pressing the **[START]** hardkey remains in Analyser Mode and enables the Analyser Mode display screen.

Figure 1.2
Exiting from Analyser Mode

1.2.4 Battery/Mains Usage

The PL302 can be powered from one of two sources, either its own internal NiCd battery pack (5.7 Ah capacity) or a mains adapter plugged into the rear input connector panel. The internal rechargeable battery pack is housed in a compartment on the underside of the instrument. The battery pack can be accessed by turning the large screw and removing the battery cover.
The battery pack can be recharged outside the instrument (at a rate of 570 mA) or it will recharge when the mains adapter is connected to the rear input connector panel.

When the mains adapter is connected, the instrument draws its power from this source. More specifically, when the instrument is switched on with the mains adapter connected the power for the instrument is drawn from the mains adapter, and in addition the internal battery pack is charged at its trickle rate. When the mains adapter is connected with the PL302 switched off, the battery pack will recharge at its full recharge rate. The battery pack will then take between 14 and 16 hours to fully recharge from its discharged state.

The PL302 can accept a DC voltage of 10.5V of either polarity. The instrument is supplied with a DC adapter and it is recommended that this unit is used at all times for powering and recharging the instrument. Power sources of greater than 10.5V should not be used as this will cause heating of the internal regulation circuitry. The instrument should not be powered from the Mains Adaptor without a battery being fitted.

DC adapters are available for different mains voltage levels as found throughout the world.

The instrument monitors battery condition and will put a low battery indication BAT on the display screen when the battery pack is approaching a low charge level. When the remaining charge level is so low that permanent damage might result to the battery pack, the instrument will automatically power down.

Under normal operating conditions, a fully charged battery pack will supply the instrument for between 6 and 8 hours.

Notes: To maximise available battery life, it is recommended that the battery pack is charged and discharged fully in a cyclic manner.

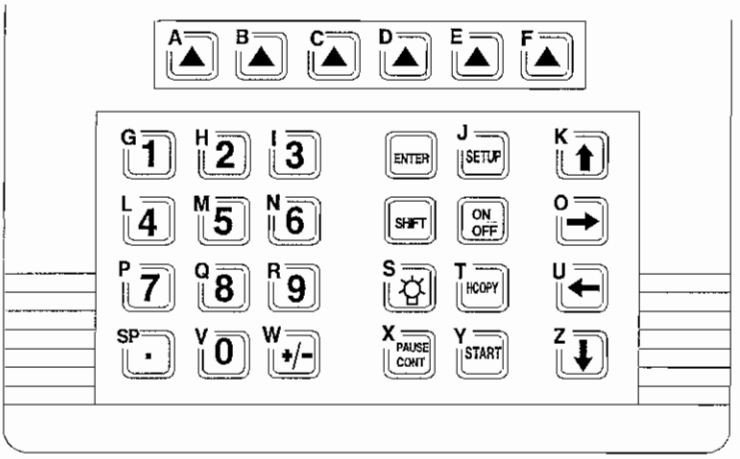
Do not attempt to power the analyser from dry alkaline batteries as the internal impedance of this battery type is too high and damge to the instrument may occur.

1.3 KEYBOARD OVERVIEW

The keypad of the PL302 is a highly durable silicon rubber type with positive tactile response. The keypad is totally waterproof and the individual keys are large enough to be operated with a gloved hand.

Keys are of two types, namely dedicated keys which are found on the lower section of the keypad, and six function keys (or softkeys) which are found on the upper section. Dedicated keys (hardkeys) carry out the function specified on the key legend, while function keys vary according to the prompt displayed on the LCD screen. The keypad also contains the complete alphabet, the letters being printed on the top left hand corner of the individual keys. Using the SHIFT hardkey, labels can be added to hard copy displays and data stored under filenames. Figure 1.3 shows the overall keypad.

Figure 1.3
Keypad Arrangement



The lower keypad contains three groups of hardkeys. On the left is a calculator style numeric keypad. This is used for a variety of numeric entry functions. In the centre are the main control keys for the instrument. On the right are four cursor arrow keys which enable menu selections to be made and the vertical cursor to be moved on the screen displays. The left cursor arrow also acts as a BACK SPACE or DELETE function in alpha or numeric entry mode.

The six softkeys on the upper section of the keypad are always prompted by labels at the bottom of the display. Prompts always correspond to a particular screen display and are explained in detail in chapter 3.

The functions of the analyser's hardkeys are as follows:

SETUP — This exits from the main display screen and enables the user to select one of the analyser setup screens.

ENTER — This key has several functions. It terminates alpha or numeric entry similar to the ENTER or RETURN key on a computer keyboard. It also initiates certain actions when prompted on the display screen. It allows the user to cycle through the available options in various fields of the setup screens.

SHIFT — This enables alpha entry using the alphabet characters on the top left hand corners of the keys, this is similar to the SHIFT function of a computer keyboard. In addition, SHIFT can be used to lock the cursors for the upper and lower displays.

ON / OFF — This toggle action key allows the instrument to be turned ON and OFF.

This toggle action key allows the backlight illumination on the display screen to be increased.

HCOPY — This allows the contents of the display screen to be downloaded via the RS232 interface to a graphics printer or plotter.

PAUSE CONT — This toggle action key allows data acquisition to be paused and then resumed.

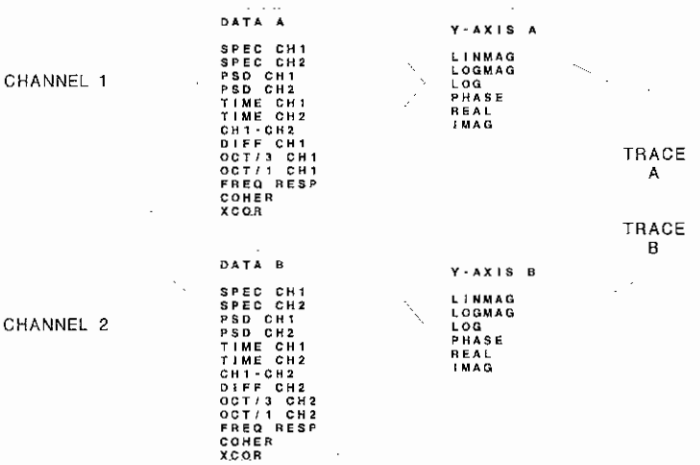
START — The main function of this key is to initiate data acquisition and processing. However, the key is also used to exit the setup screens and return to main display without restarting data acquisition. (See section 1.7 for more details)

1.4 INPUT CHANNEL AND DISPLAY RELATIONSHIP

The PL302 can operate in two different modes. First, the instrument can act as a digital storage oscilloscope whereby input data is gathered and displayed in the time domain. Secondly, mathematical functions can be performed on the time domain data to convert the time records to the frequency or process domain. These mathematical processes can be performed on either of the input channels individually, or as a cross-channel function on both channels. AUTOSPECTRUM is an example of the single channel process whereas the FREQUENCY RESPONSE FUNCTION (TRANSFER FUNCTION) is a cross-channel process.

Time domain and process domain outputs can be displayed as a single , dual or waterfall trace. Figure 1.4 shows how data from the input channels can be routed through the various process options in the instrument and passed on to the display traces.

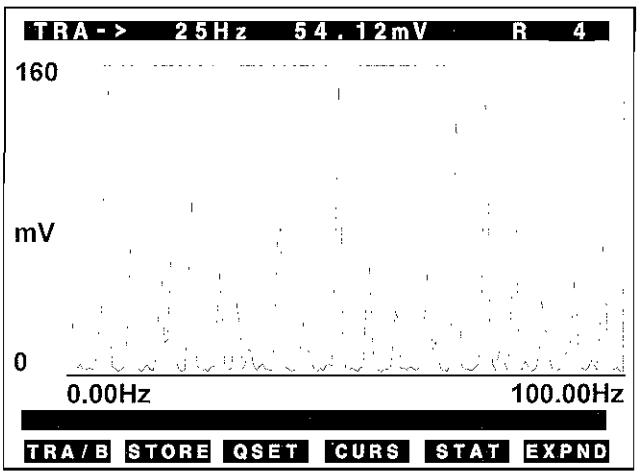
Figure 1.4
Display /Traces relationship



1.5 MAIN DISPLAY SCREEN

Figure 1.5 shows the main display screen with a typical trace data display. The screen contains banners at the top and bottom, which provide information about the trace and the status of the instrument.

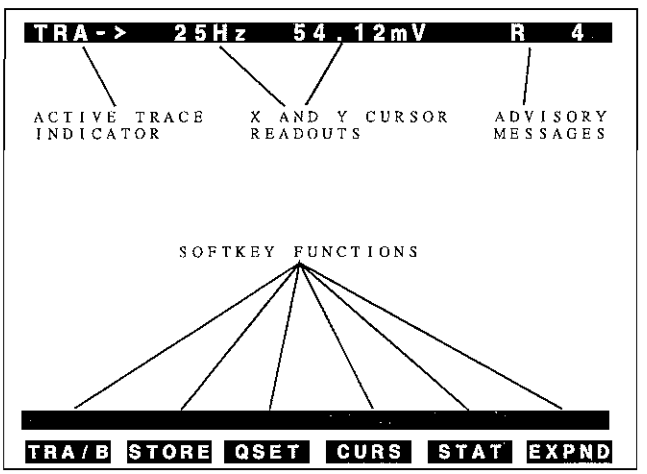
Figure 1.5
Main Display Screen



In the above example a single trace is displayed therefore only the upper banner contains information. If a dual trace were displayed then the lower banner would also be annotated.

Figure 1.6 illustrates the layout of information on the screen.

Figure 1.6
On-Screen Information



Each trace (A or B) has a cursor associated with it to enable readout on the corresponding banner. The cursor is moved by operating the right/left arrow keys on the keypad. The amplitude range shown on the y-axis of the display can be increased and decreased using the up and down arrow keys respectively.

Only one trace is active at any one time. Cursor movement operations using the right/left arrow keys will therefore operate on the active trace only, unless the SHIFT hardkey is pressed (indicated by a small arrow in the lower right hand side of the display) to lock the cursor movements together.

To switch between trace A and trace B, the left hand SOFTKEY (TRA/B) is pressed. The active trace is indicated by a '->' symbol on the appropriate banner.
At the very bottom of the screen are the softkey labels. These vary with operation of the instrument. However, in the Main Display Screen, the softkey functions are as follows:

[*TRA/B*] or [*TRB/A*] - Active trace selection (toggle)

[*STORE*] - Store data currently on screen (a file name is assigned automatically)

[*QSET*] - Access the Quick set-up option

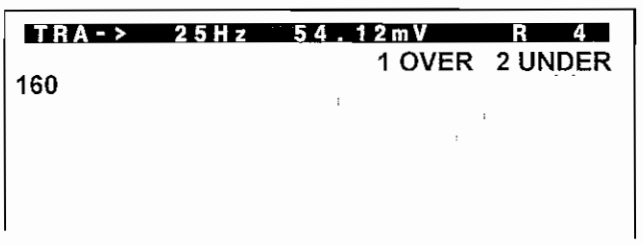
[*CURS*] - Access the Cursor options

[*STAT*] - Access the Status screen

[*EXPND*] or [*COMPR*] - Expand or Compress the x-axis display range

In addition to the banners and SOFTKEYS, various warning messages can appear on the display screen to alert the operator to certain operational conditions. For example on the display shown in figure 1.7, 1 OVER indicates that the input signal to Channel 1 has overloaded the specified input voltage range. In contrast, the 2 UNDER message indicates that the input data supplied to Channel 2 is under range i.e the signal is very small relative to the specified input voltage range.

Figure 1.7
Display Screen Warning Messages



Note: In the PL302, overload detection is performed after A to D conversion (see description of 1OVER in Chapter 3 of this manual for more details.)

1.6 MEMORY CARD

A powerful feature of the PL302 is the ability to store and retrieve data using a PCMCIA memory card which is inserted into the card slot on the rear panel of the analyser. Memory cards up to 2 megabytes can be used for data storage. Data is stored in DOS file format and can be read directly by any IBM-PC or compatible computer equipped with a PCMCIA card reader. The card appears as a normal drive volume (e.g. E:)

Data records, in both the time and process domains, can be stored in the internal (battery backed) memory of the PL302 or directed to the memory card. Data records can be retrieved from either the internal memory or from memory card. The destination/source of data to be stored/recalled is selected by the user.

Note: The PCMCIA card slot can also be used to load application-specific programs into the analyser from Application DI-CARDS.

1.7 REPROCESSING AND POST-PROCESSING OF DATA

The instrument incorporates two powerful methods of processing data which has already been acquired. These methods are know as reprocessing and post-processing.

Reprocessing can be performed on newly acquired data but not on data that has been recalled from memory. At any time during data acquisition and processing, the user can pause the instrument by using the PAUSE/CONT key, modify the process or other parameters, and upon pressing START, the data will be reprocessed and displayed according to the new selection made.

An example of reprocessing is where a time trace is initially specified for display, data is acquired and then the acquisition is paused. If the time process is then changed to a spectrum process in the PROCessing screen and START is pressed, the frequency domain equivalent of the time signal will be computed and displayed (Note that if process averaging is enabled, the frequency domain function will be computed from the averaged spectral data in active memory rather than from the instantanuous time function shown on the display). This feature can be useful to ensure that a time signal is as expected for a particular measurement, before viewing the resulting frequency domain functions.

The following parameters can be changed during reprocessing:

INTEGR1
INTEGR2
A-WEIGHT
X-AXIS SCALE
X-AXIS FREQ

All process shown in DATA A and DATA B
All parameters available in YAXIS A and YAXIS B
FAST AVG
PREVIEW

All options in MEM screen
All parameters in DISP screen

Post-processing allows the user to modify data in a similar fashion to reprocessing except that post-processing is performed on data that has previously been stored to function memory or memory card and subsequently recalled into the display (trace) memory. Post-processing has a dedicated screen PPROC which is accessed via the UTIL screen. When it is desired to post-process a particular piece of display data and the PPROC screen has been accessed, all available options for post-processing that particular type of data are displayed on the screen.

2. EXTERNAL CONNECTIONS

2.1. VOLTAGE INPUTS

Signal inputs to the PL302 are made via the BNC connectors marked CH1 and CH2 on the rear panel of the instrument. The maximum input voltage range is +/-10V and the minimum full-scale range is +/- 10 mV. The inputs are protected against high voltage transients but prolonged over-voltage input should be avoided. The voltage inputs can be DC coupled or AC coupled. These settings are selected in the INPUT screen.

2.2 ACCELEROMETER INPUT

The accelerometer (ICP) interface is selected as a further coupling option in the INPUT menu screen. When accelerometer coupling is selected, the instrument provides a constant 4 milliamp current from the BNC connector at a voltage up to 24 Volts. This enables most standard ICP accelerometers to be powered directly from the instrument. The accelerometer interface is AC coupled with a -3dB cut off at approximately 1Hz. The interface is over-voltage protected but once again excessive or prolonged over-voltages should be avoided.

2.3 EXTERNAL TRIGGER

An external trigger signal can be applied to the EXT TRIG BNC connector on the rear panel of the analyser. This enables synchronisation of the data acquisition process to external events without using up a data channel and can also be used for speed measurement/order normalisation.

The instrument is capable of handling external trigger signals of a variety of types as selected in the TRIG menu screen. (See the relevant external trigger sections in Chapter 3 for further details: EXT ANALG, EXT TTL, EXT + PLL).

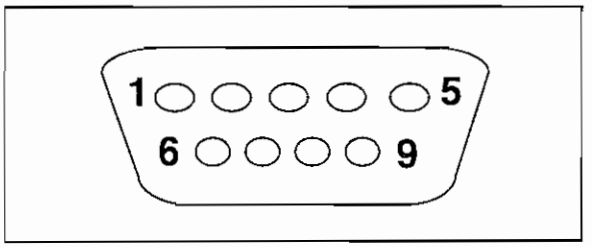
2.4 EXTERNAL CLOCK

An external sample clock signal can be applied to the EXT CLK BNC on the rear panel of the analyser. This enables the sample rate of the instrument to be synchronised with external sampling events. Any duty cycle can be accepted provided that the input level is at logic high for at least 2 microseconds. Care should be taken not to exceed the maximum sampling rate of 102.4kHz on EXT CLK, otherwise indeterminate data will result. This clock can be driven by a TTL, CMOS or open-collector drive. (see CLOCK in Chapter 3 for further details)

2.5 RS232 INTERFACE

The RS232 interface is implemented via a 9-way D-Connector on the rear panel of the analyser. The pin assignment is shown in figure 2.1. This interface operates with a hardware handshake, and does not support XON/XOFF.

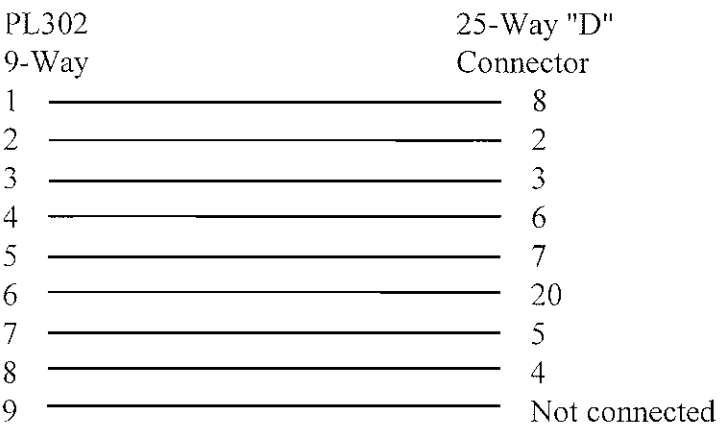
Figure 2.1
RS232 Pin Assignment



PIN	TYPE	I/O
1	CD carrier detect	Output
2	RD receive data	Input
3	TD transmit data	Output
4	DTR data terminal ready	Output
5	GND ground	
6	DSR data set ready	Input
7	RTS request to send	Output
8	CTS clear to send	Input
9	RI ring indicator	Not Connected

To facilitate connection to a printer / plotter or an IBM or compatible PC, a cable wired per figure 2.2 is recommended. This ensures correct enabling and handshaking between the devices.

Figure 2.2
RS232 Cabling



2.6 Power Socket

Power for supplying the instrument and recharging the battery pack is supplied via the DC input socket on the rear panel of the analyser. When external power is being supplied to the instrument, the red LED will illuminate. Care should be taken always to use the power adapter supplied with the instrument. The power input is protected against misuse, but excessive voltage may result in the internal fuse in the instrument blowing.

The NiCd battery pack supplied with the instrument has a capacity of 4.5 Ah. this pack can be charged outside the instrument at a rate of 450 milliamps.From a completelydischarged state, the battery will fully recharge in approximately 14 hours at this charge rate. The instrument should not be powered from its power adapter without a battery pack being inserted. To maximise battery life, it is recommended that the battery pack is charged and discharged fully in a cyclic manner. Battery life will be shortened if the pack is continually kept fully charged from the power adapter.

It should not be attempted to supply the instrument from dry alcaline cells as the internal impedance of the battery type is too high.

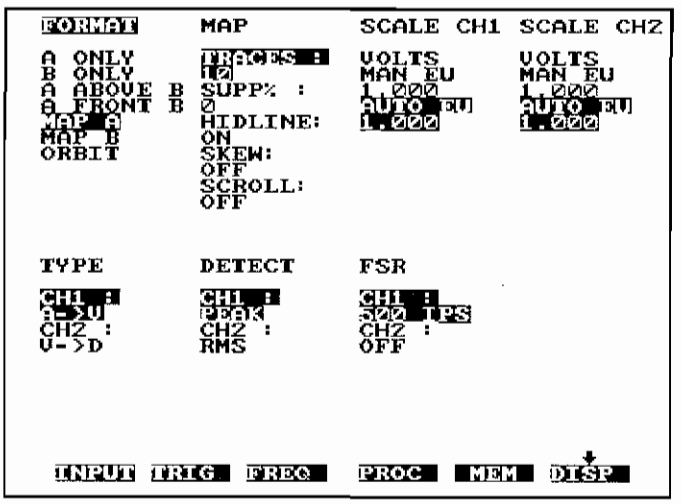
3. OPERATOR REFERENCE

A ABOVE B

Type: Menu Item

Description: A ABOVE B column, as selected in the format column, defines that both traces A and B are shown on the main display screen. The Active Trace is toggled between Trace A and Trace B using the TRA/B function key.
Trace A is automatically shown above trace B.

The cursor readouts for trace A are shown above trace A and the cursor readouts for trace B are shown below trace B.

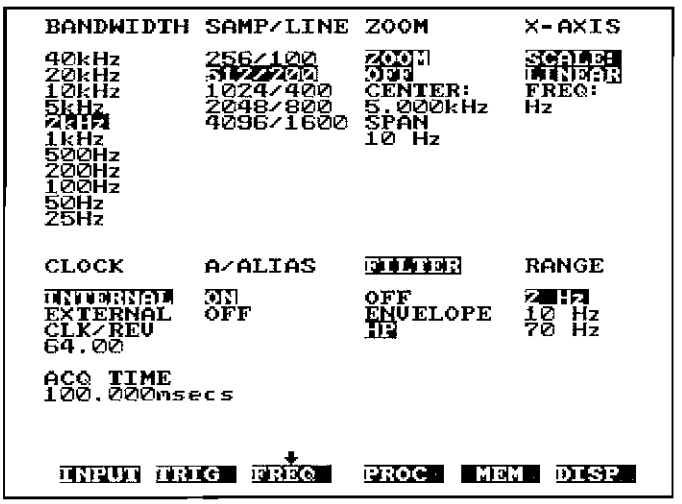


A/ALIAS

Type: Menu Column Heading

Description: A/ALIAS is found in the FREQuency menu screen. A/ALIAS defines whether the anti aliasing filters for both channels are ON or OFF. For all processes other than time domain data it is recommended that the anti-aliasing filters are kept on. This prevents higher frequencies in the signal being sampled at less than twice their frequency and being folded back into the frequency range of interest.

The anti-aliasing filters on both channels are automatically set to the analysis bandwidth selected.



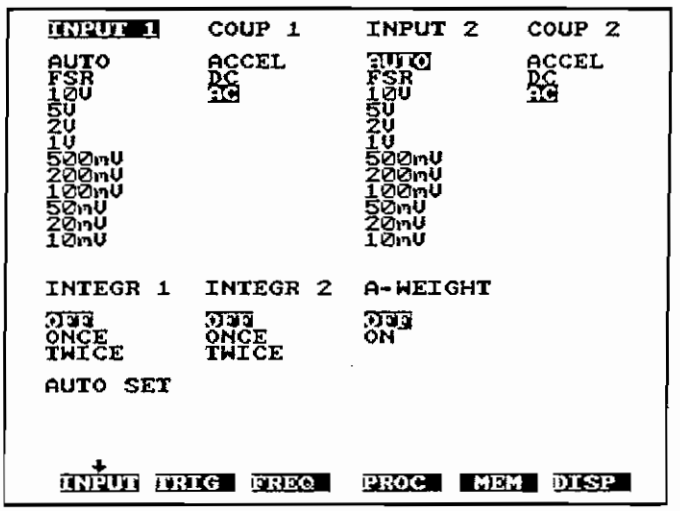
AC (AC Coupling)

Type: Menu Item

Description: AC Coupling for either channel is selected in the INPUT menu screen. When selected. the input voltage will be AC coupled to the input amplifiers of the instrument. The -3dB point is at approximately 1Hz.

Use this setting to remove unwanted DC components from the input signal.

See also: **ACCEL, DC**

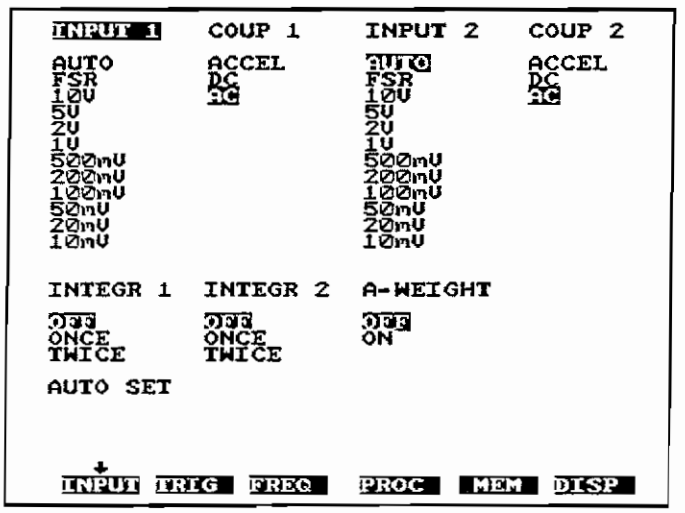


ACCEL (ICP)

Type: Menu item

Description: Accelerometer (ICP) Coupling can be selected for either or both channels in the input menu screen. When selected, an internal power supply and signal conditioning circuit is switched into the corresponding channel input. The power supply is a 4mA constant current source with an open circuit voltage of 24V. This is used to power typical ICP transducers without any external signal conditioning. The accelerometer input is AC coupled with a -3dB point at approximately 1Hz.

See Also : **AC, DC**



ACTIVE MEM

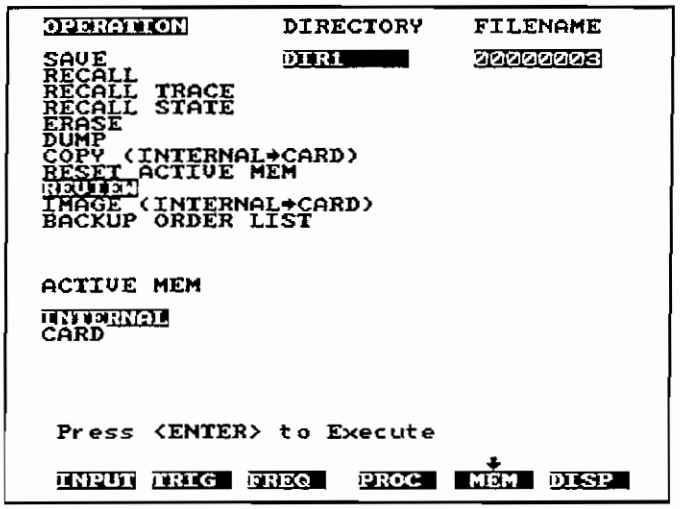
Type: Menu Column Heading

Description: The ACTIVE MEM column is found in the MEM screen. the ACTIVE MEM selection defines the currently active memory device for all memory operations.

The memory devices available are INTERNAL (i.e. the unit's internal battery backed function storage) and CARD (i.e. an SRAM memory card inserted in the PCMCIA card socket on the rear panel of the analyser)

Internal memory or the memory card can be reset (i.e. cleared) using the RESET option in the OPERATION column. Alternatively, single records can be erased using the ERASE function. Data can be transferred from internal memory to memory card and vice-versa using the COPY (INTERNAL->CARD) option.

See also: **RESET, ERASE, COPY**



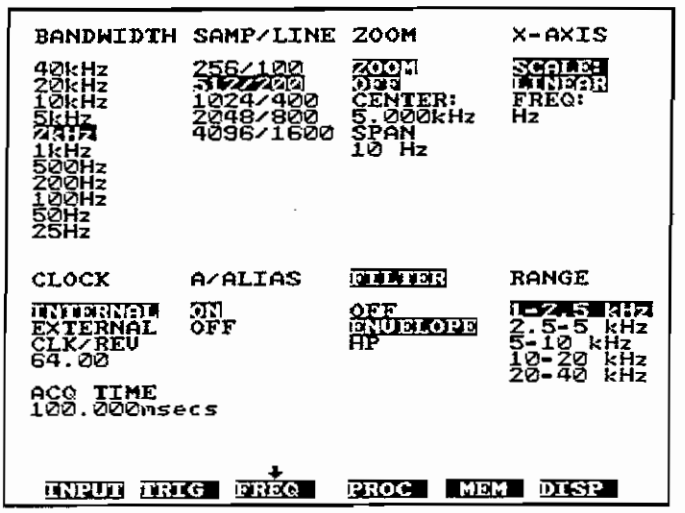
ACQ Time (Acquisition Time)

Type: Menu Column Heading

Description: ACQ TIME (Acquisition Time) is found in the FREQ (Frequency) menu screen. This parameter is not selectable but indicates the time that will be required for a record to acquire the number of samples at the bandwidth defined. For example, 512 samples (or 200 lines) with a bandwidth of 1kHz will result in an acquisition time of 200mS. This information is most useful when large record lengths and low frequency bandwidths are being used since the acquisition time can be significant.

Acquisition Time (T) is calculated by the following expression:

$$T = \frac{1}{\Delta f} = \frac{\#\text{lines}}{\text{bandwidth}} = \frac{\#\text{ samples}}{2.56 \times \text{bandwidth}}$$

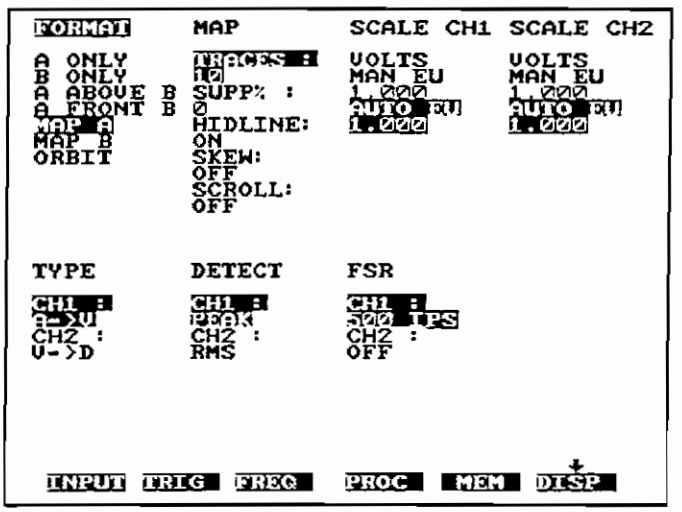


A FRONT B

Type: Menu Item

Description: A Front B, as selected in the FORMAT column, defines that trace A and trace B are both shown on the main display screen, and that one trace is superimposed on top of the other. This display format is useful when making comparative measurements. Data can be recalled from function memory and overlaid on newly acquired data.

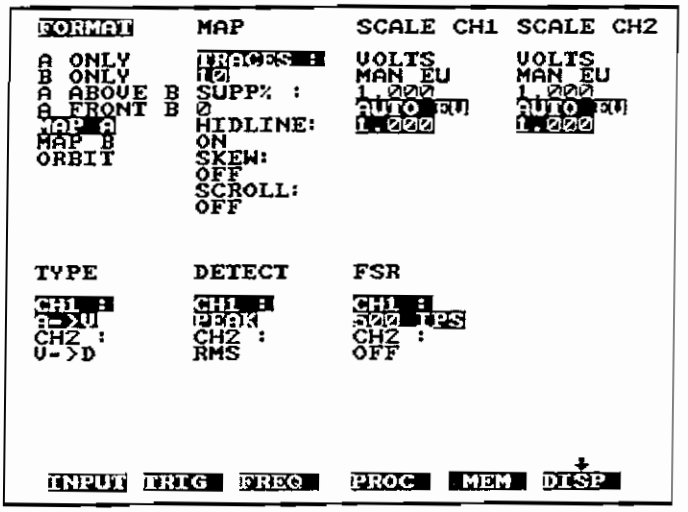
The active trace is toggled between trace A and trace B using the TRA/B function key.



A ONLY, B ONLY

Type: Menu Item

Description: A ONLY (or B ONLY), when selected in the FORMAT column. defines that only trace A (or B) is shown on the main display screen. Trace A (or B) is therefore. automatically the active trace.



AUTO EU

Type: Menu Item

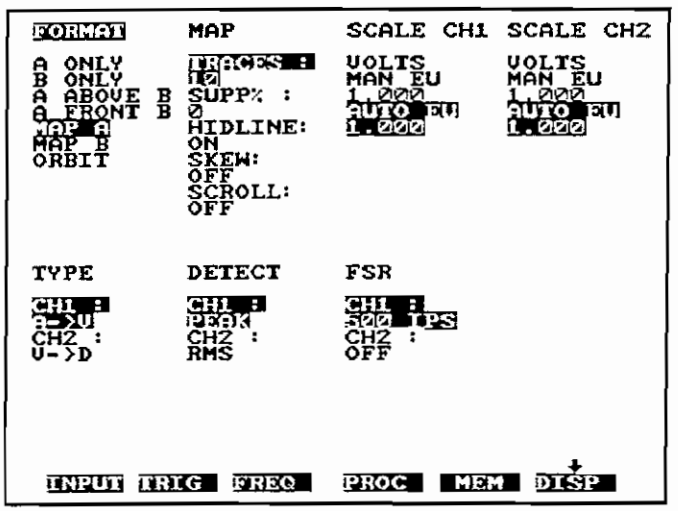
Description: AUTO EU as selected in the SCALE CH1 (or CH2) columns. defines the transducer calibration value for channel 1 (or 2). This value is defined in mV/unit where the unit is dependant on the type of transducer that is used.
The table below defines the units that are used in the PL302 for each supported transducer type and depending upon the system of units selected in the UTILities screen. These units are those commonly used by the transducer manufacturers worldwide.

When AUTO EU is selected, other parameters appear on the lower half of the screen. These parameters are, TYPE (numbers of levels of integration), DETECT (RMS. PEAK. PEAK-TO-PEAK), EU UNIT (English or Metric) and FSR.

For example. if an accelerometer with calibration factor of 100 mV/g is used then a value of 100 (1.00 e + 2) is entered below AUTO EU. If velocity is to be viewed then selecting A-V in the TYPE column automatically integrates the signal while preserving the correct system of units.

See also: **FSR, TYPE, DETECT**

Transducer Type	Metric	English
Acceleration	mV/g	mV/g
Velocity	mV/mm/sec	mV/ips
Displacement	mV/ mm	mV/mil ($inch^{-3}$)



AUTO (Autorange)

Type: Menu Item

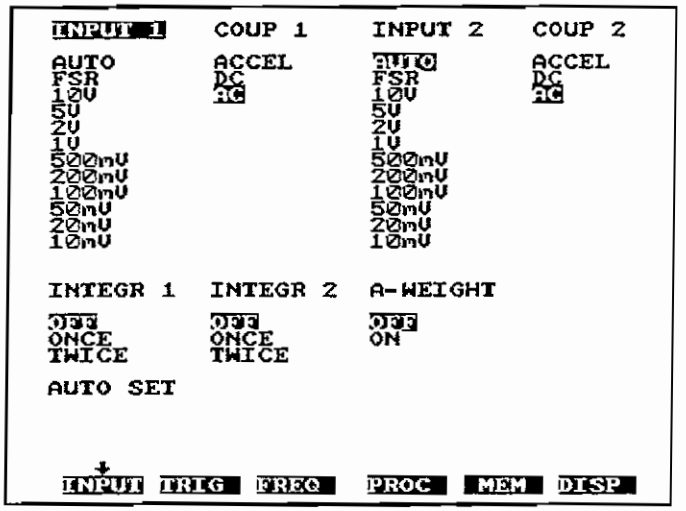
Description: The AUTO function enables the instrument to automatically select the optimum voltage input range prior to acquisition. AUTO (Autorange Function) can be selected in the input menu screen or by the quick set softkey QSET.

Note that as the Autorange circuit determines the best range prior to acquisition. there will be a time delay before the data capture begins.

Autoranging is performed whenever the START button is pushed. However the input range is not adjusted during acquisition.

Typically Autorange is not suitable for short duration transient signals which change rapidly as a function of time.

See also: **QSET**



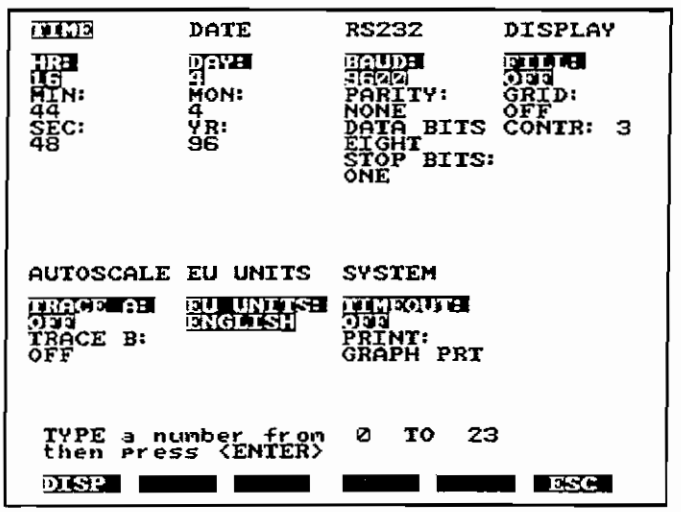
AUTOSC (Auto Scale)

Type: Menu Column Heading

Description: AUTOSC automatically selects a y-axis scale for both traces to suit the amplitude of the signals detected when acquisition begins. AUTOSC can be turned ON or OFF in the UTIL (UTILITIES) menu screen.

Autoscale has nothing to do with the Autorange function which sets the input full-scale voltage range. Autoscale is simple a method of setting the amplitude (y-axis) range of the display.

Note that Display Autoscaling is perfomed whenever the START button is pushed. However, the scale is not reajusted during acquisition.



AVERAGE

Type: Menu Column Heading

Description: The AVERAGE column in the PROCessing screen controls the number of time and process averages that the instrument will perform. It also selects the type of average that will be carried out.

Both the time and process averaging are available separately or sequentially.

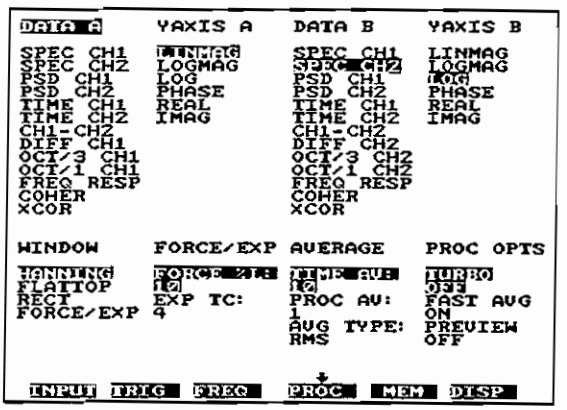
For example, setting the number of time averages to three and the number of process averages to four will result in a total of twelve frames of time data being acquired. The incoming time data frames are first time averaged in groups of three before the resulting intermediate averaged time data frame is FFT processed into the frequency domain and the resulting spectrum is added to the process average. This is repeated a total of four times until all four "time averaged" frames have been included in the process average.

(Remember that for time averaging to provide meaningful results. the signal being averaged must be periodic in nature and a reliable trigger must be available to synchronise the data frames).

During the averaging process the user can elect to view or not to view the intermediate average results by using FAST AVeraGing controls under the PROCessing OPTions in the PROCessing menu. Depending upon the the display options slected here, indicators are provided in the display status bar to show the progress of the averaging operation where "Tn" (n is a number) shows the current time average count and "Rn" shows the total process average count.

The acquisition and averaging process can be temporarily interrupted using PAUSE/CONT key. Pressing this key once will freeze the screen so that the data can be inspected using the cursors. Pressing the key a second time will allow the acquisition and averaging process to continue at the point where the averaging was paused. Pressing the START key at any time will reset the average count and restart acquisition and processing.

See Also: **TIME AV, PROC AV, AVG TYPE, FAST AVG**



AVG TYPE (Average Type)

Type: Menu Item

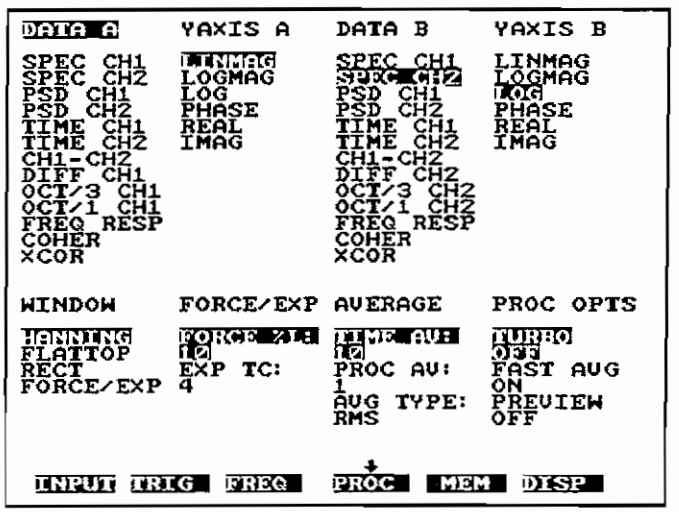
Description: AVG TYPE (Average Type), as selected in the AVERAGE column, defines the type of average which will be performed when carrying out the process average as selected. The options are RMS, EXPONENTIAL, and PEAKHOLD.

RMS provides the root-mean-square average function for the appropriate process. For example, if PROC AV is set to 10, then 10 RMS averages will result. RMS averaging is sometimes known as linear averaging.

EXPONENTIAL averaging provides the moving average with each record being weighted according to the time at which it was acquired. The earlier the record, the less significance it has in the resulting average. A record will have zero significance when the number of records collected subsequent to it exceeds the number defined in the PROC AV menu.

PEAKHOLD is not an average as such, but latches the highest value of process data until the number of average equals that selected in the PROC AV menu item. The number of processes specified is acquired and the peak at each point is held.

See also: **TIME AV, PROC AV, FAST AVG**

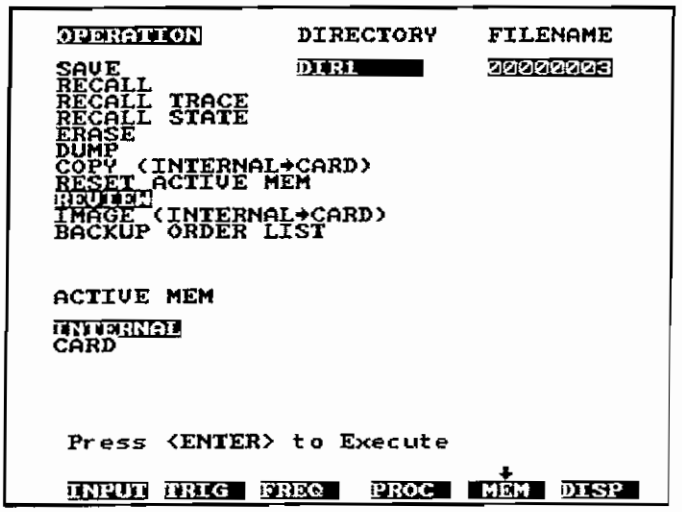


BACKUP ORDER LIST

Type: Menu item

Description: The Backup order list memory operation is listed in the OPERATION column of the MEMory screen.
Backup order list copies the stored order sequences either from interal memory to card or from card to internal memory. This is dependent on the active memory device as specified in the ACTIVE MEM column.
The operation copies the LASTUSED.DAT file.

See also: For more information on using order sequences, see description of FTMS™ in the data collector manual

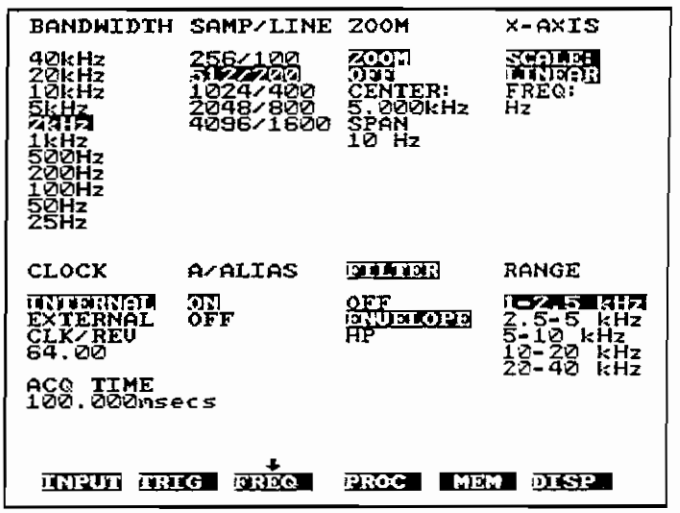


BANDWIDTH

Type: Menu Column Heading

Description: BANDWIDTH options are found on the FREQ (Frequency) menu screen. There are 11 bandwidth options available from DC - 25Hz to DC - 40kHz. This column defines the baseband frequency range. ie. from DC to the bandwidth specified. It is therefore only valid when ZOOM is OFF. When ZOOM is ON. the BANDWIDTH selection is ignored.

It is important to understand the significance of the frequency selected. The cut-off frequency of the anti-aliasing filters is set to the frequency selected in the FREQ column. provided that the anti-aliasing filters are switched ON. The sample clock however. runs 2.56 times faster. For example a frequency setting of 20kHz will set the filters to 20kHz cut-off but the sampling rate would be 51.2kHz per channel. If the record length as set to 4096 in this example the total time for the record would be 80mS. Total acquisition time is indicated on the FREQuency menu screen.



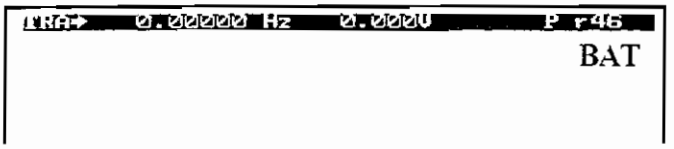
BAT (Low Battery Warning)

Type: Warning Message

Description: BAT will appear on the main display screen when the battery pack is approaching a low state of charge. This will vary according to the age of the battery pack but the message will typically appear when the instrument has approximately two hours before charging is required.

The battery cannot be damaged by running the instrument long after the BAT warning has appeared. as the instrument will automatically power down when the battery has reached such a low level of charge that damage may result.

The internal circuitry which controls the BAT warning message monitors the voltage of the NiCd battery pack. The actual voltage on the battery can be raised if the adapter (which charges the battery) was connected shortly before the instrument was turned on. In this case, the BAT warning would not appear for several minutes even if there was a very low charge on the battery. The non-appearance of the BAT warning message should not be interpreted as meaning that the battery is well charged in these circumstances.



CALIBRATION

Type: Specific Process

Description: When the SETUP hardkey is pressed the user can enter a special process to calibrate the instrument for a particular measurement.

Before making use of this function it is necessary to set the scaling mode (SCALE CHn) in the DISPlay screen to MANEU for the channel or channels to be calibrated

The analyser should be set up for the desired measurement using the setup menus.

Pressing SETUP hardkey, SHIFT hardkey then START hardkey enters the Calibrate Mode.

The softkeys available are:

TRA/B	-	Toggles between two traces if required
CAL	-	enables a value to be entered for a peak
PEAK	-	finds the highest peak.
ESC	-	escapes to the main display.

After having selected the peak, and entered the calibration value, the instrument computes the appropriate scaling value which is automatically entered under MAN EU in the DISPlay screen.

See also: **SCALE, MANEU**

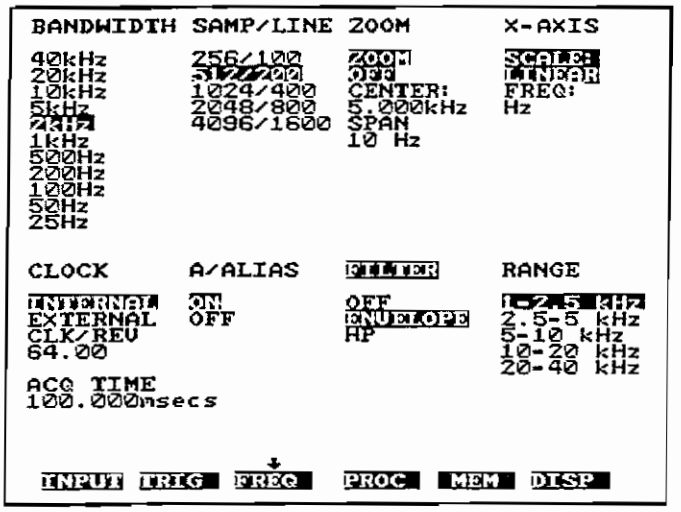
CENTER

Type: Menu Item

Description: CENTER defines the centre frequency of the ZOOM function. It is only valid when ZOOM is turned ON. The centre frequency is entered via the numeric keypad and entry is confirmed using the ENTER key. Entry is floating point format.

The bandwidth displayed when ZOOM is ON is the
(CENTRE frequency ±SPAN÷2).
For example, a centre frequency of 5kHz and a span of 2kHz will display a frequency range from 4kHz to 6kHz.

See Also: **ZOOM, SPAN**

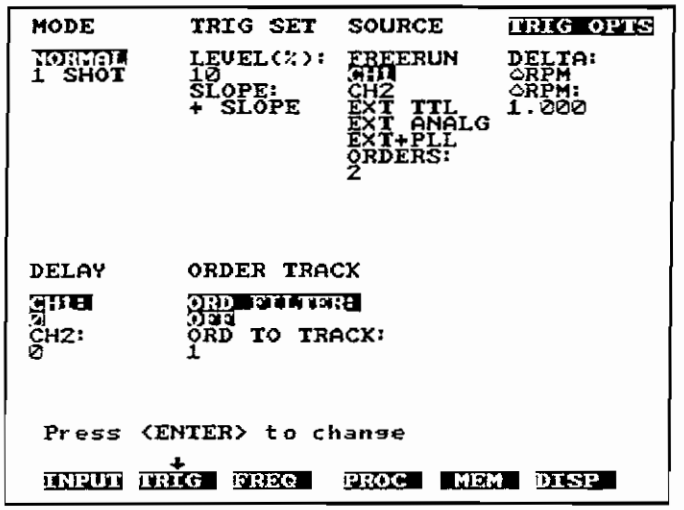


CH1. CH2

Type: Menu Item

Description: CH1 (or CH2) appears as a menu item in the SOURCE column of the TRIG (Trigger) menu screen. When selected, a measurement will start when the input level and slope of the signal on channel 1 meets the trigger conditions defined in the LEVEL and SLOPE parameters.

See also: **LEVEL,SLOPE**



CH1-CH2

Type: Menu Item

Description: CH1-CH2 provides the arithmetic subtraction of channel 2 time data from channel 1 time data. This enables the time domain difference between the two channels to be displayed. All options as for standard time domain data gathering apply to CH1-CH2.

CLOCK

Type: Menu Column Heading

Description: The selections under the CLOCK heading determine how data sampling will be controlled. The two choices are INTERNAL and EXTERNAL. If EXTERNAL is selected this must be qualified by a CLK/REV value which determines the relationship between the frequency of the external clock signal and the number of orders shown in any spectral domain displays.

Selecting INTERNAL clock generation specifies that data sampling will be controlled by an internal timer chip. In this case the analogue input signal will be sampled at a fixed time interval (Dt). The sample rate that is used is determined by the analysis frequency bandwidth (specified in the BANDWIDTH column of the FREQuency menu) according to the following relationship:

Sample Rate (Hz) = Sampling Multiplier (=2.56) x Frequency Bandwidth (Hz)

When EXTERNAL clock is selected the data sampling process can be controlled directly by an external clock signal connected to the external clock (EXT CLK) connector on the rear panel of the analyser. Data is then sampled at the external clock frequency.

Note that when EXTERNAL clock is selected data is not sampled at fixed time intervals. For this reason 'time domain' processes are annotated in points (PTS) rather than seconds and 'frequency domain' processes are annotated in orders. The number of orders is directly proportional to the number of clock signals per cycle (CLK/REV) according to the following expression:

Orders = Clock Signals per Cycle (CLK/REV) , Sampling Multiplier (=2.56)

Externally controlled data sampling is used when it is desired to synchronise data sampling to some external process. However, it should be noted that when the analyser is operating in this mode the sampling frequency itself is not measured and so can not be used to annotate displays or to control data acquisition (Eg DRPM) triggering.

P.T.O.

Notes:

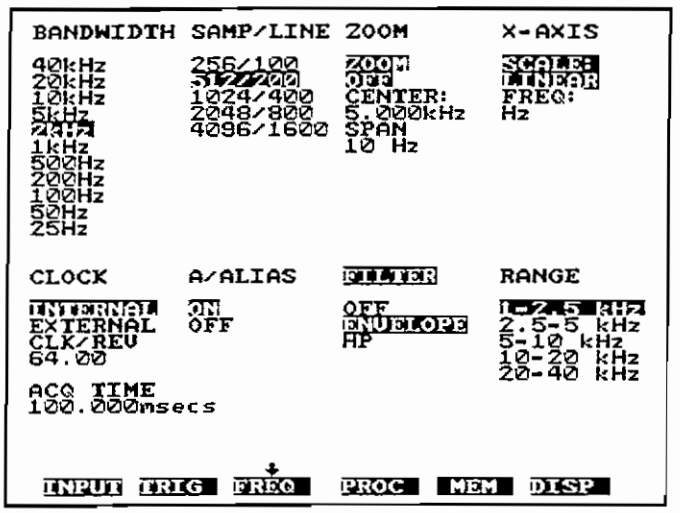
i. Selecting external clock overrides all processes governed by the internal sample clock. For this reason the BANDWIDTH setting in the FREQuency menu is ignored.

ii. External clock operation is not compatible with EXT+PLL triggering since EXTernal trigger with Phase Locked Loop operation requires the internal clock to control data sampling.

iii. The external clock circuitry can be driven either by a TTL signal or an open-collector drive

Application: An example of the use of externally clocked data acquisition might be to perform order analysis on a rotating shaft. In this case the clock signal could be derived either from an optical encoder or from a magnetic pickup observing a gear or toothed wheel. As the shaft rotates clock signals are generated which cause data to be sampled at fixed angular positions regardless of the speed of the machine. The resulting spectra have an order normalised frequency axis where the number of orders is determined by the number of clock pulses per revolution (number of orders = CLK/REV ¸ 2.56).

See also: EXT+PLL



COHER (Coherence)

Type: Menu Item

Description: The COHER (COHERENCE) process is the standard coherence function for measuring the interaction between the signal input on channel 1 and channel 2. It is a normalised measure of the coefficient of correlation of two signals, but output in the frequency domain. The output is dimensionless in the range 0 to 1. Two fully coherent signals will give an output of unity across all frequencies, implying that they are related by a linear transfer function. A coherence of 0 means that the signals have nothing to do with each other. Note that a large number of average (typically 20 to 100) is required for the coherence function to provide a representative output. Coherence of 1 average is always unity.

The coherence function can be displayed on either trace A or trace B.
Coherence is a very useful check for the validity of data in the Frequency Response process. In this case the frequency response will be displayed on trace B in A ABOVE B display mode.

COMPR (Compress of Main Display)

Type: Softkey Prompt

Description: COMPR is the reverse operation to EXPND (expand) and enables the display of a data record which is greater than 280 points to be compressed into the main display screen. For example, a four hundred line spectrum will be represented by 280 pixels on the main display when it has been compressed. This means that some pixels represent more than one spectral line. In some cases, when the left and right cursor keys are used to move the main cursor, the cursor will not in fact move but the read out on the upper or lower banners will change to reflect the fact that a new spectral line has been accessed for cursor read out.

See Also: **EXPND**

COPY (Memory Operation)

Type: Menu Item

Description: The copy memory operations are listed in the OPERATION column of the MEM screen. COPY selectively copies stored memory items from the active memory device to the other memory device. The direction of copying is indicated alongside the COPY legend. If the ACTIVE MEM setting is INTERNAL the COPY (INTERNAL CARD) is displayed ie. copy from the internal memory to a memory card. otherwise if the ACTIVE MEM is setting is CARD the legend COPY (CARD INTERNAL) is displayed ie. copy from a memory card to the internal memory.

When COPY is executed a pop up menu appears giving COPY options.

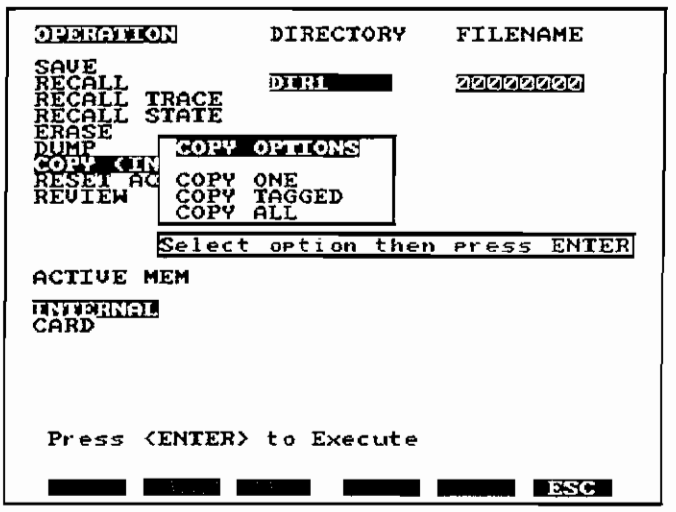
COPY ONE copies the single memory item specified by the current DIRECTORY and FILENAME settings.

COPY TAGGED copies all the tagged items in the current directory.

COPY ALL copies all the items in the current directory.

To select the option required move the cursor to the appropriate legend and press the ENTER key. The COPY operation can be aborted by pressing the ESC softkey.

See also: **ERASE, DUMP, TAG**

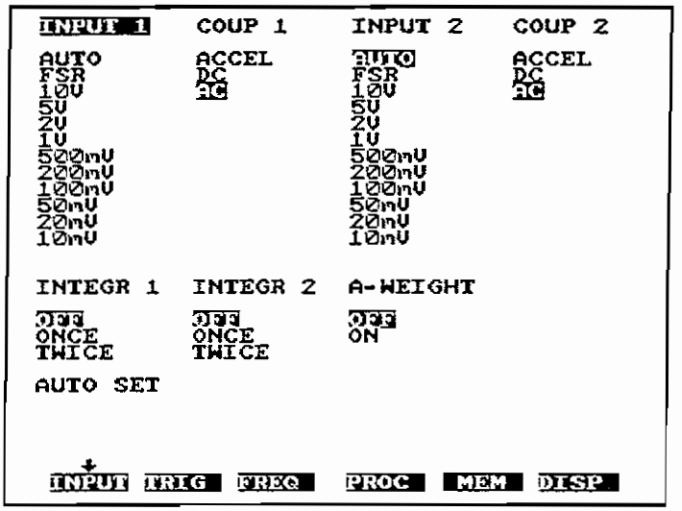


COUP 1, COUP 2 (Coupling channel 1 or Coupling channel 2)

Type: Menu Column Heading

Description: COUP 1 selects the input coupling for channel 1. The options are DC or AC coupling for voltage inputs or ACCEL (accelerometer) when the internal power supply is required to drive an ICP type transducer.

See Also: **ACCEL, DC, AC**



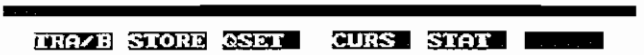
CURS

Type: Softkey Prompt

Description: Pressing the CURS key in the main display screen enables display cursors to be used. Four cursor types are available. namely power (PWR). sideband (SIDE). harmonic (HARM) and (PEAK). Pressing the CURS softkey enables these softkey prompts onto the main display screen.

Note that a Cursor Lock function is available to tie both cursors together. This is invoked by pressing the SHIFT lock key then the right (or left) arrow.

See Also: **PWR,SIDE,HARM,PEAK**

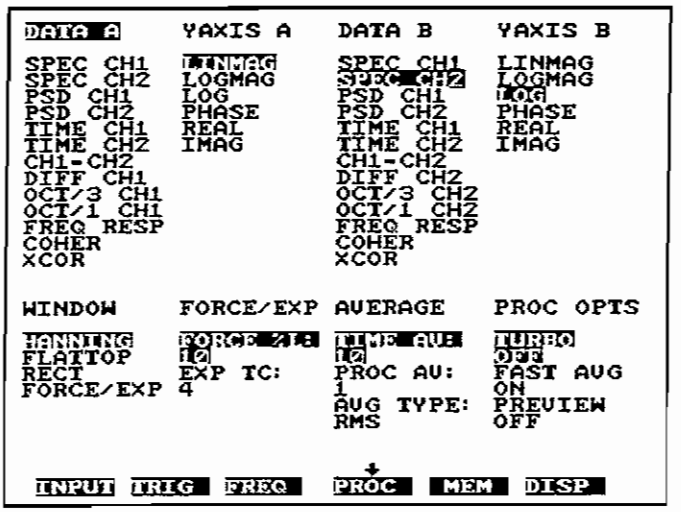


DATA A, DATA B

Type: Menu Column Heading

Description: The DATA A (or DATA B) column in the PROC (PROCESS) menu screen enables the various processes which can be displayed on trace A (or B) to be selected. Incoming data will be processed according to the process and channel indication selected in this column.

See also: **Y AXIS A, Y AXIS B**

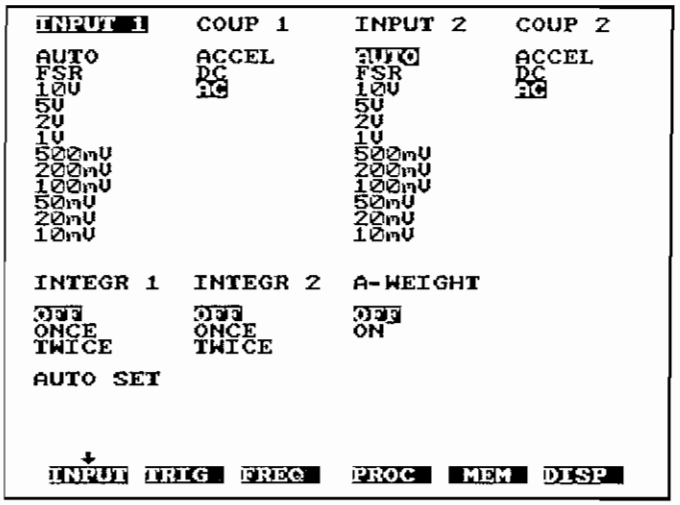


DC (DC COUPLING)

Type: Menu Item

Description: DC Coupling for either channel is selected in the input menu screen. When selected, the input voltage will be directly coupled to the input amplifiers of the instrument. This means that any constant DC offset voltage will be measured by the instrument and displayed in the corresponding process.

See Also: **ACCEL, AC**



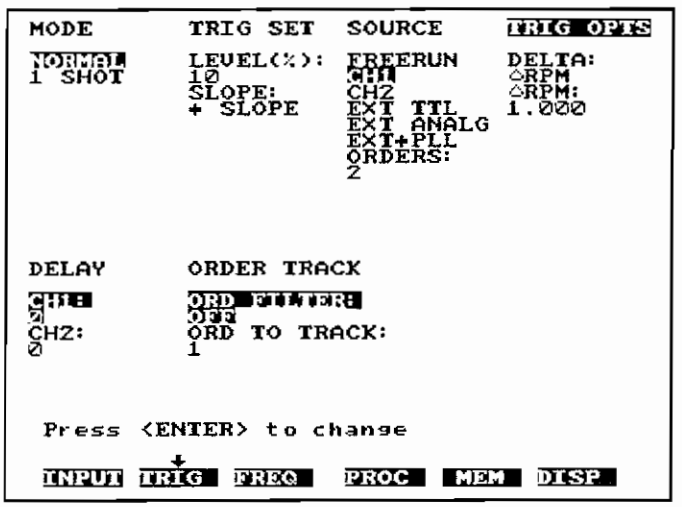
DELAY

Type: Menu Column Heading

Description: DELAY is found in the TRIGger menu and defines the pre-trigger and post-trigger delay between the trigger event and the commencement of data acquisition on channel 1 and on channel 2. A pre-trigger delay is entered as a negative number and a post trigger delay is entered as a positive number. For example by entering -50 under channel 1 delay, the instrument will display on the screen 50 sample points prior to the trigger point. Delays can be set independently for channel 1 & channel 2.

The DELAY column enables the acquired data to either precede, be synchronised with or come after the selected trigger point. In pre-trigger, data is being continually captured and the record can be set up to 4096 points before the trigger position. If the pre-trigger value is greater than the record length, the trigger point will not be included in the acquired record. If the pre-trigger setting is less than the record length the data record will include the trigger point. This mechanism is particularly useful when encountering transients in 1-SHOT mode.

In post-trigger, the record is always captured following a delay after the trigger point. This mechanism is useful when the signal of interest occurs sometime after a suitable trigger. Any post-trigger delay can be set up to 4096 points.

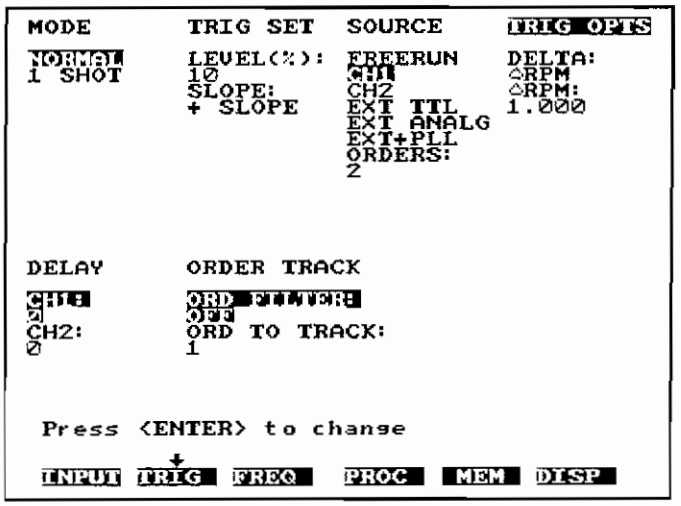


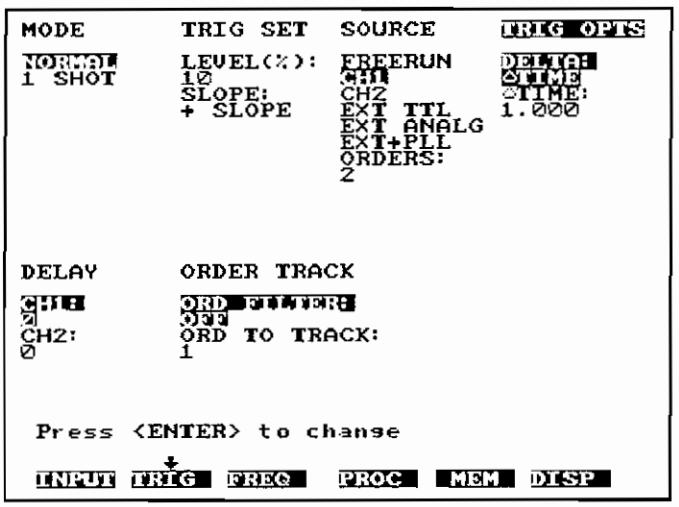
DELTA

Type: Menu Item

Description: DELTA, is found in the TRIG (Trigger) screen and allows selection of a 'delta' trigger mode. This is particularly useful for map displays. DELTA can be set to OFF, Δ TIME or Δ RPM. When DELTA is OFF the instrument uses the normal trigger modes to initiate data acquisition. The trigger source can be internal or external as in normal operation. Pressing the ENTER key allows selection of TIME or RPM. The Δ RPM or Δ TIME interval can then be defined by entering the appropriate parameter underneath. The units of RPM are revolutions per minute, and the units of time are seconds.

See also: **Δ RPM, Δ TIME (Set alphabetically under R and T)**





DETECT

Type: Menu Column Heading

Description: The DETECT column is located in the DISPlay menu. This feature is used in conjunction with AUTO EU mode to control the amplitude representation of spectral functions.

The default amplitude representation for spectral functions is RMS (Root Mean Square) units. This is a consequence of the spectral averaging process where the phase relationship between individual frequency components is not preserved and so it is necessary to express the resulting average in terms of its RMS energy content. For example with a RMS scaling a 1 volt peak sine wave appears as a single line in the frequency domain with an amplitude of 0.707 volts RMS (the RMS value of a sine wave is $\sqrt{2}$ x its peak value).

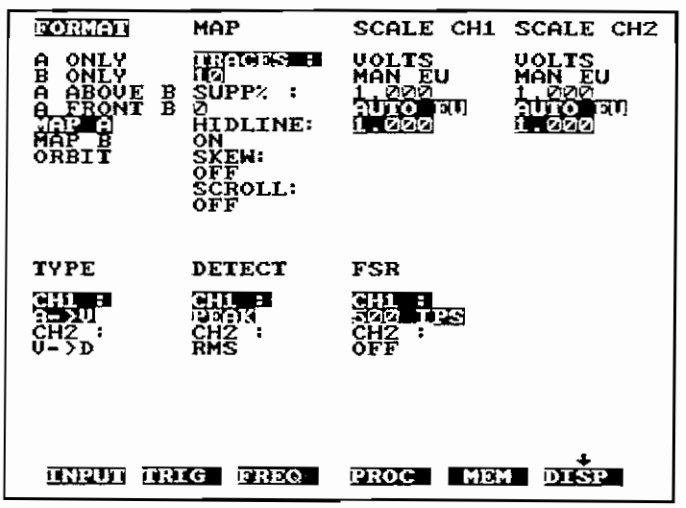
In some applications it is common practice to express spectral functions in pseudo 'peak' or 'peak-to-peak' units. This is done by rescaling the RMS values according to the relationships outlined below. However, it should be noted that this is only strictly valid with single frequency (sinusoidal) signals and may not be representative of the peak or peak-to-peak levels observed in the time domain waveform, particularly if significant levels of noise or other frequency components are present within the spectrum.

The settings available for DETECT are;

Setting	Definition
RMS	Root Mean Square (Default)
PEAK	Pseudo 'peak' units (= RMS x $1/\sqrt{2}$)
PK-PK	Pseudo 'peak to peak' units (= 2 x RMS x $1/\sqrt{2}$)

Notes:
i. DETECT is only active in AUTO EU mode.
ii. The operations performed on each channel are independent.

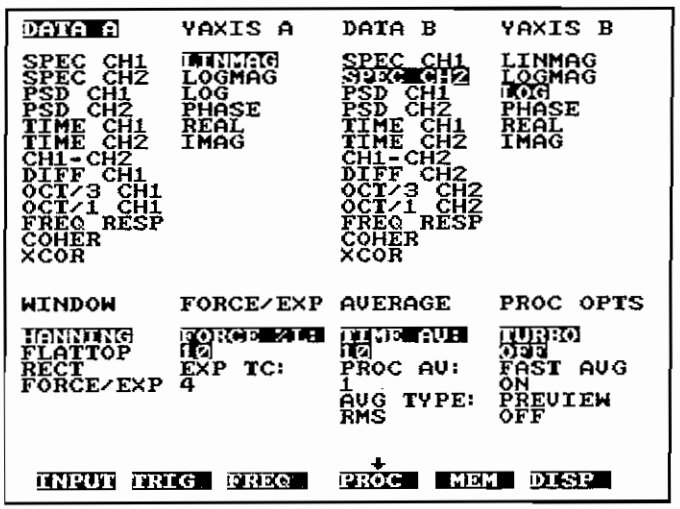
See also: **AUTO EU, TYPE**



DIFF CH1, DIFF CH2

Type: Menu Item

Description: DIFF CH1 and DIFF CH2 are selected in the PROC (Process) screen and differentiate the raw input data record with respect to time for channel 1 and channel 2 respectively. The resulting amplitude is measured in volts/second. The calculation is such that the differential of Vsinwt is w Vcoswt.



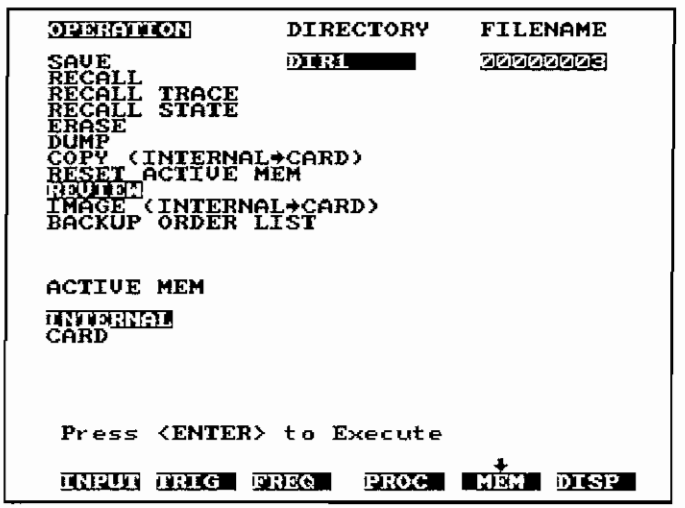
DIRECTORY

Type: Menu Column Heading

Description: The DIRECTORY column is found in the MEM screen. The entry in this column is an eight character alphanumeric string representing the currently active directory for all memory operations. To enter a directory name, the user types the appropriate character string then presses ENTER. Alpha characters are entered using SHIFT control key which enables letters to be typed accordingly to key markings. Numeric characters are entered via the keypad. Spaces can be entered using the SP - Space Key.

To facilitate alpha character entry a "shift lock" feature is used when entering letters in the field. When the SHIFT button is pressed SHIFT remains on until either SHIFT is pressed again or ENTER is pressed. A small arrow can be seen beside the rightmost softkey when shift is locked.

SEE also: **FILENAME**



DUMP (Memory Operations)

Type: Menu Item

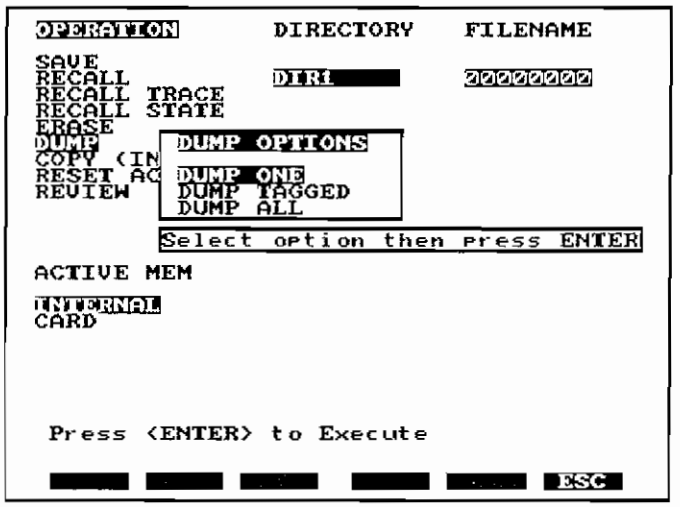
Description: The DUMP Memory Operations is listed in the OPERATION column in the MEM screen. DUMP selectively outputs stored memory items on the RS232 output of the PL302. When executed a pop up menu appears giving the DUMP options. All the DUMP options are carried out on the active memory device as specified in the ACTIVE MEM column.

DUMP ONE dumps the single memory item specified by the current DIRECTORY and FILENAME setting.

DUMP TAGGED dumps all the tagged items in the current directory.

To select the option required move the cursor to the appropriate legend and press the ENTER key. The DUMP operation can be aborted by pressing the ESC softkey. Once the ENTER key is pressed the RS232 transfer is started and the softkeys change. The RS232 transfer can be aborted by pressing the ABORT softkey.

See also: **ERASE, COPY, TAG**



ENTER

Type: Control Key

Description: The ENTER control key is situated on the key pad at the front of the instrument. It has the same action as the ENTER or CARRIAGE RETURN function of a computer keyboard. That is to say, it initiates certain actions which have been set-up using the cursor keys of the instrument or terminates numeric or alpha data entry via the keyboard.

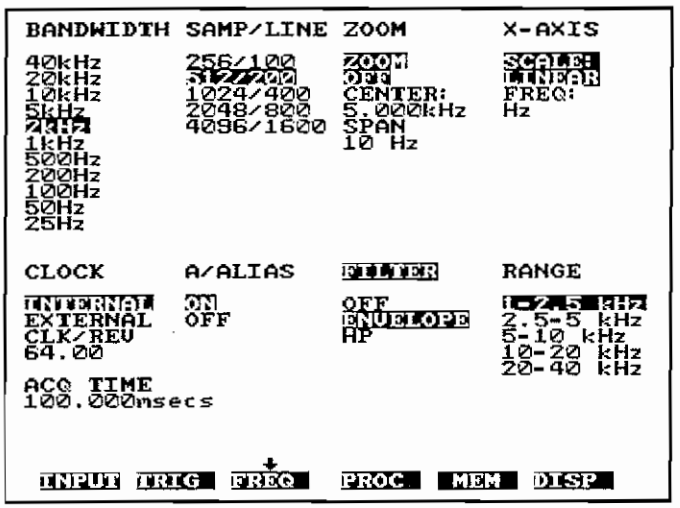
ENVELOPE

Type: Menu Item

Description: When ENVELOPE is selected in the FILTER menu column of the FREQuency menu, the internal enveloping filters in channel 1 are enabled. One of four band pass filter selections are available in the RANGE column.

The envelope function is a special filter section which provides a demodulated version of the input signal. The carrier frequency which is demodulated is selected as one of the four bands. Enveloping is particularly useful for bearing condition analysis.

See also: **FILTER, RANGE**



ERASE (Function Operation)

Type: Menu Item

Description: The ERASE function operation is listed in the OPERATION column in the MEMory screen. ERASE selectively deletes functions from memory. When executed, a pop up menu appears giving the ERASE options. All of the ERASE options are carried out on the active memory device as specified in the ACTIVE MEM column.

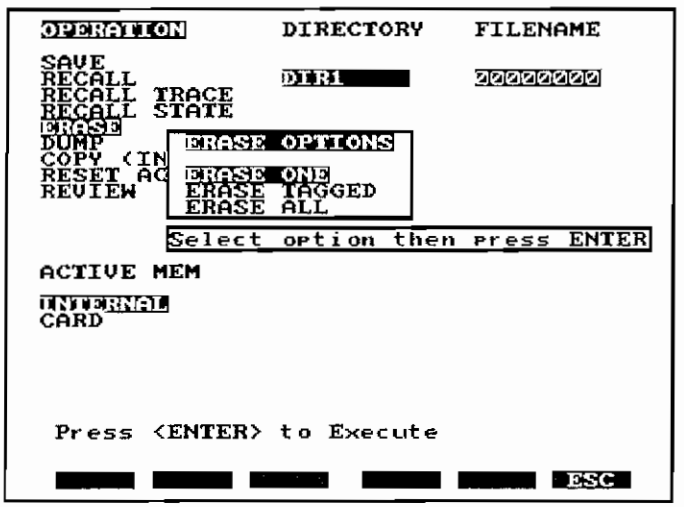
ERASE ONE erases the single specified by the current DIRECTORY and FILENAME settings.

ERASE TAGGED erases all the tagged items in the current directory.

ERASE ALL erases all the items in the current directory.

To select the option required move the cursor to the appropriate legend and press the ENTER key. The ERASE operation can be aborted by pressing the ESC softkey.

See also: **DUMP, COPY, TAG**



EXPND (Expand x-axis of Main Display)

Type: Softkey Prompt

Description: Pressing the EXPAND softkey in the main display screen expands the display so that one measurement point or spectral line is displayed per display line (pixel) on the screen. This only applies when the number of data points to be displayed exceeds the number of pixels available horinzontally on the screen. The maximum number of pixels available along the x-axis is 280.

For example, a two hundred line spectrum display will be automatically expanded by the instrument to occupy 280 lines on the main display screen. No further expansion is therefore required. However, for a four hundred line spectrum, the option to expand and compress the spectrum is required as the display is unable to accommodate the four hundred lines at one time.

When a display is expanded using the EXPAND function key, the prompt on this key changes to COMPR (Compress) which is the reverse process. It is therefore possible to expand and compress a display of more than 280 data points by toggling this softkey.

To examine features in displays with a large number of time points or spectral lines, a useful technique is to select the area of interest in the overall spectrum by moving the cursor to that area with the spectrum compressed. Pressing EXPAND will then expand the display around the cursor position. Moving the cursor to the edge of the display then causes displayed range to scroll (step) to the adjacent set of data points.

See Also: **COMPR**

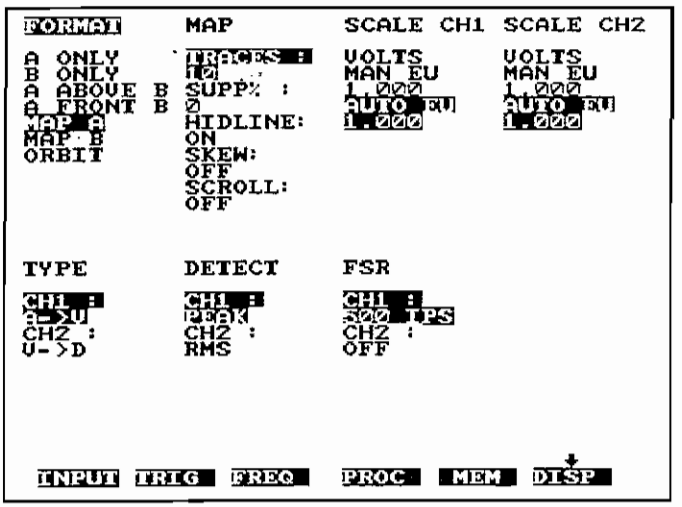
EUNITS

Type: Menu Column Heading

Description: EUNITS appears in the DISPLAY setup screen. The user can enter a four character string using the keypad. Note to use the Alphabet keys the SHIFT key should be pressed - Pressing again disengages the function.

User defined units will only appear on the screen if MAN EU's are set in the Scale CH1 (or CH2) column of the Display Screen.

See also: **MAN EU**



EU UNITS

Type: Menu Column Heading

Description: The EU UNITS column is located in the UTILities menu. This feature is used in conjunction with AUTO EU mode to define the active engineering unit system. The choices are ENGLISH or METRIC.

This setting is used to control data scaling and axis labelling operations performed in AUTO EU mode, this is particularly important when auto-integration (A->V, A->D or V->D) is specified.

If ENGLISH units are selected the following units are assumed;

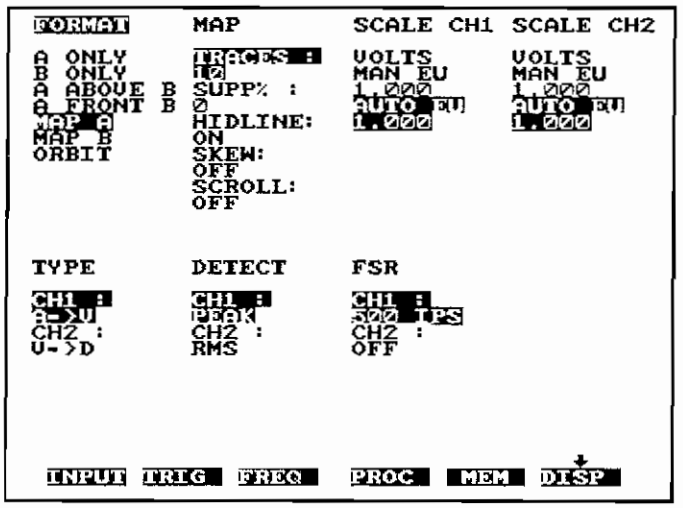
Parameter	Unit	
Acceleration	g	g's (1g = 386.088 in/s^2)
Velocity	ips	inches per second
Displacement	in	inches

If METRIC units are selected the following units are assumed;

Parameter	Unit	
Acceleration	g	g's (1g = 9.80665 m/s^2)
Velocity	m/s	metres per second
Displacement	m	metres

Notes: The EU UNITS selection is only available in AUTO EU mode.

See also: **AUTO EU, TYPE**

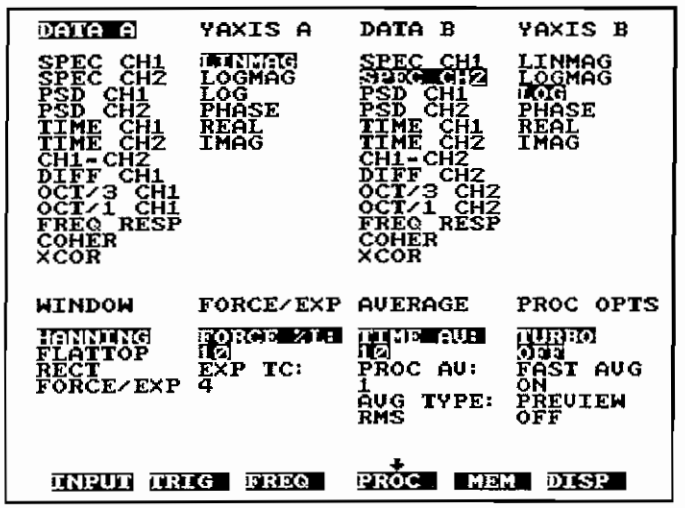


EXP TC

Type: Menu Item

Description: EXP TC defines the time constant of the exponential decay in the force exponential window function. A value from 0-10 can be selected. A value of 0 will apply no exponential decay.

See also: **FORCE/EXP, FORCE, %L:, WIN TIME**



EXT TTL

Type: Menu Item

Description: EXT TTL switches the trigger source from internal to external. In order to trigger, a +5Volt TTL signal is expected at the EXTernal TRigger input on the rear of the analyser.

Note that EXT TTL does not require the setup of LEVEL or SLOPE.

Triggering occurs on the rising edge of the pulse and is protected against overload voltage using an internal pull-up resistor.

External trigger is useful when using Time Averaging for extracting a signal from noise. In addition, most phase measurements need a good trigger.

See also: **EXT + PLL, EXT ANALG**

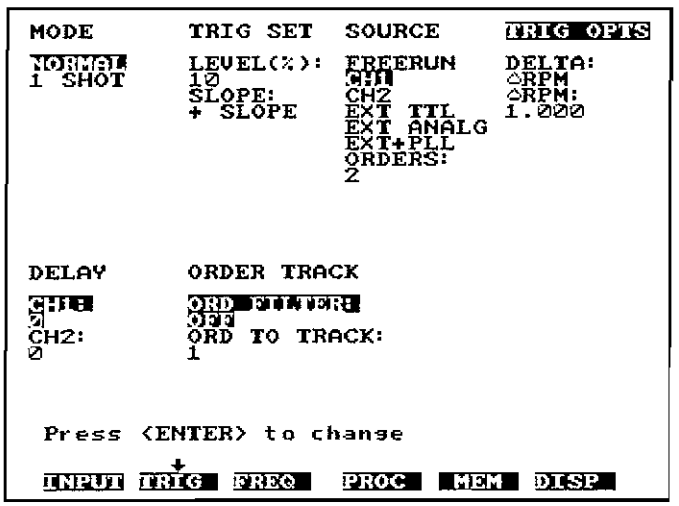
EXT ANALG

Type: Menu Item

Description: External Analog (EXT ANALG) is similar in function to EXT TTL. The main difference is an analog voltage may be used to trigger. This voltage may be set up to +/-10 volts with diode clamping occurring at +/- 15 volts.

EXT ANALG must also have the level and slope conditions set. Here +/- 10 Volts is equal to +/-100%, therefore setting a level of 20% will require the input voltage to reach at least 2V before triggering will occur.

See also: **Level, Slope, EXT TTL, EXT + PLL**



EXT+PLL (EXTernal trigger + Phase Locked Loop)

Type: Menu item

Description: This setting is used to select a mode of analyser operation where the data sampling rate is adjusted in relation to the period of an external trigger (tachometer) signal. This feature is useful to 'lock' the analysis bandwidth to the frequency of an external event, resulting in a spectrum with a frequency axis that is normalised relative to the frequency of that event, and is referred to as 'order normalisation'.

When performing order normalisation the actual data sampling rate is determined by a combination of the current order bandwidth and the tachometer frequency as follows:

Samples per Revolution = Sampling Multiplier (=2.56) x Order Bandwidth

Sample Rate (Hz) = Samples per Rev. x Tachometer Frequency (Hz)

= Samples per Rev. x [Pulses per rev (=1) x Rotational Speed (RPM) ¸ 60]

The ORDERS field below the EXT+PLL selection is provided to allow the user to specify the maximum order number of interest. Based upon this the next available order bandwidth above the specified value is selected automatically by the analyser.

To use this feature a suitable tachometer signal (±10 volts max.) must be connected to the external trigger connector (EXT TRIG) on the rear panel of the analyser. The trigger events (tachometer pulses) are detected using the analyser's analogue trigger circuit following which a Phase Locked Loop is used to determine the period between those events and hence the fundamental frequency of the trigger (tachometer) signal. Based upon this a data sampling rate is selected to produce the required order normalisation. The sample rate is selected immediately prior to the acquisition of each frame of data and remains fixed for the duration of that frame.

When using EXT+PLL the external trigger conditions (LEVEL and SLOPE under the TRIG SET heading) must also be defined. The definition of these parameters is the same as for the analogue external trigger (EXT ANALG) and is based upon an external trigger range of ±10 volts.

Notes:

i. Since EXT+PLL automatically selects the data sampling rate immediately prior to the acquisition of each frame of data **the BANDWIDTH setting in the FREQuency menu is ignored.**

ii. Although the data sampling rate can vary from one data frame to another the INTERNAL sample clock is still used to control the data sampling within each frame. For this reason **the CLOCK item in the FREQuency menu must be set to INTERNAL.**

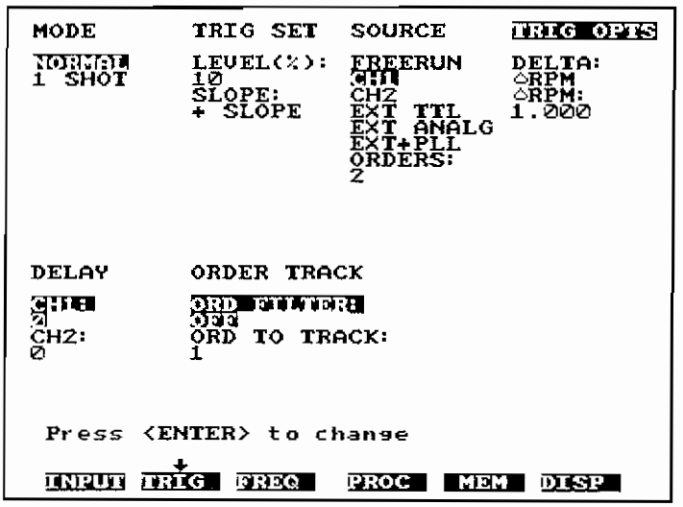
Application: Most typically this feature is used in rotating machinery analysis to generate 'order normalised' spectra where the spectral components are displayed as a function of the machine's rotational speed. The frequency axis is expressed in 'orders' with the signal component at the rotational frequency being displayed at '1.0 orders' independent of the rotational speed.

In an order normalised spectrum signal components that are multiples of the machine's rotational speed remain at fixed locations on the order axis as speed varies whereas fixed frequency components, such as those due to resonance effects, change location with speed. This is in contrast to a normal frequency spectrum where 'constant frequency' components remain at fixed locations and components which relate to the rotational speed move around as speed changes.

To order normalise the spectrum of a rotating machine a tachometer signal with a single pulse per revolution is required. Please note that tachometer signals with multiple pulses per revolution are not currently supported within the analyser. The tachometer signal must be connected to the external trigger input and is required to provide a consistent (triggered) phase reference and to ensure correct scaling of the order axis.

Note that the Sample Rate may not exceed the maximum sample rate of the analyser (102.4 kHz max. 51.2 kHz with full anti-alias protection).

See also: **LEVEL, SLOPE, EXT ANALG.**



FAST AVG (Fast Averaging)

Type: Menu Item.

Description: FAST AVG (Fast Averaging) has three modes of operation namely OFF, TIME and TIME + PROC.

If set OFF, each interim calculated average is displayed on the screen.

If set to TIME, then only the Time domain display is Fast Averaged (i.e. processed but not displayed), and only the Process Average results are displayed.

If set to TIME + PROC (Time and Process) then the display will only be updated when the specified combination of time and process averages has been completed. This enables a faster real-time processing rate to be achieved.

This option is also useful for loading averaged spectral results into a map display. In this case, the averaging specified by AVERAGE & AVG TYPE is completed before the result is loaded into the map.

See also: **TIME AV, PROC AV**

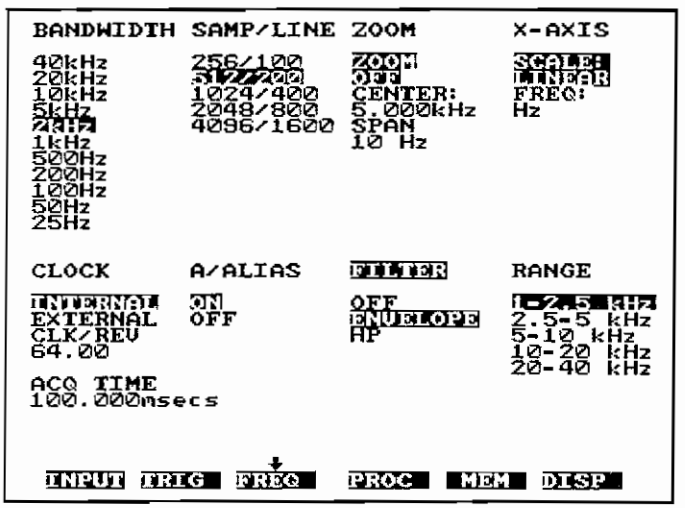
FILTER

Type: Menu Column Heading

Description: The FILTER selection in the FREQuency menu screen enables the internal enveloping filters to be selected. Note that enveloping filters are only available on channel 1.

The OFF selection in the FILTER column means that no enveloping filter has been selected. When ENVELOPE is on, an additional column appears to right of the FILTER column. This column is headed RANGE, and indicates 4 available pass band filter selections. These are 2.5-5kHz, 5-10kHz,10-20kHz and 20-40kHz. The incoming signal on channel 1 will be filtered according to the range selected, before the signal is passed to the internal active enveloping circuit.

See also: **ENVELOPE, RANGE.**



FILENAME

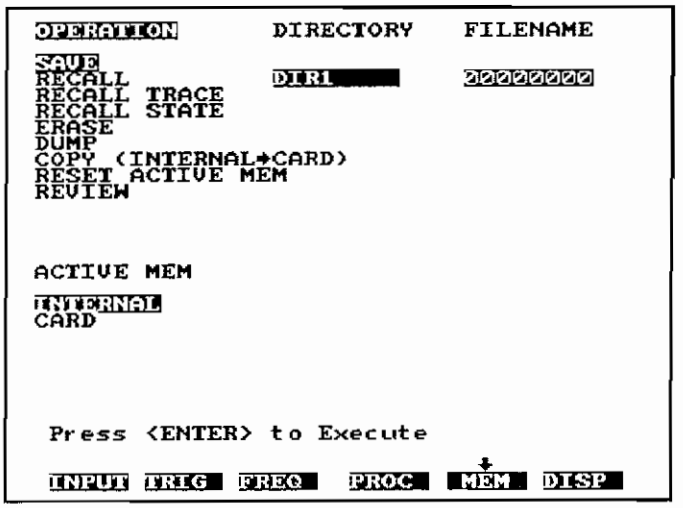
Type: Menu Column Heading

Description: The FILENAME column is found in the MEM screen. The entry in this column is an eight character alphanumeric string and represents the currently active filename for all memory operations. To enter a filename the user types the appropriate character entry.

Alpha characters are entered using the SHIFT control key which enables letters to be typed according to key markings. Numeric characters are entered via the keypad. As with DOS filenames spaces should not be used.

A "shift lock" feature is used when entering alpha characters in this field. When the SHIFT button is pressed SHIFT remains on until SHIFT is pressed again or ENTER is pressed.

See also: **DIRECTORY**



FLATTOP

Type: Menu Item

Description: FLATTOP. as selected in the WINDOW column, applies the flattop window function to spectral processes.

This window provides the best amplitude accuracy of the window types available. However, this is at the expense of spectral resolution since energy is spread across several spectral lines, thus broadening the peak.

If accurate frequency determination or separation fo closely spaced spectral lines is required. a HANNING window is preferred.

The weighting function applied by the flattop window is 0.215-(0.416 Cos wt) + (0.278 Cos 4 wt) - (0.0836 Cos 6wt) + (0.0069 Cos 8wt).

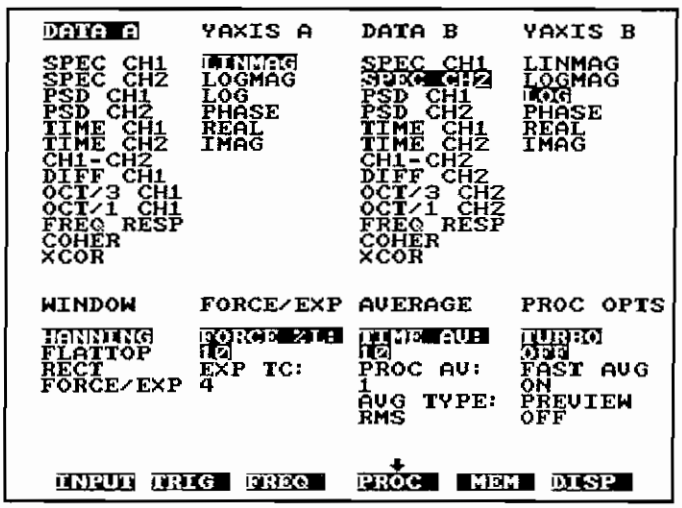
FORCE %L:

Type: Menu Item

Description: FORCE %L: defines the length (duration) of the force window as a percentage of total data frame length. This is used in the FORCE/EXPONENTIAL window combination.

See the FORCE/EXP description for details of the force/exponential window operation.

See also: **FORCE/EXP, EXP TC:, WIN TIME**



FORCE/EXP

Type: Menu Column Heading

Description: The Force/Exponential window selection specifies a combination of windows that are used primarily for frequency response function measurements using impact testing techniques in structural testing applications. This window combination is suitable for use where an impulsive force signal is connected to Channel 1 and a corresponding transient response signal is connected to Channel 2.

This window combination may be used to reduce the effects of "noise" on the force signal and "spectral leakage" which can occur if the response transient does not decay completely within the frame measurement time.

To reduce the effects of spectral leakage, an exponential decay window is applied to the response signal. This window causes the time response to decay more quickly - effectively adding "artificial damping" to the true characteristics of the system under test. The amount of damping added is controlled by the user through the time constant of the exponential decay... the larger the number the more "damping" that is added and the faster the decay!

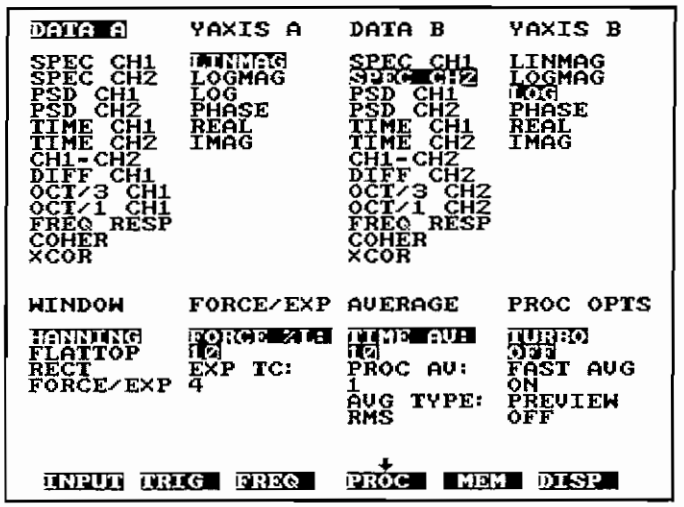
To ensure that the resulting transfer function is scaled correctly, this exponential window is applied to both the force and the response channels (Channel 1 and Channel 2 respectively).

Unlike the response, the force signal applied is generally a single impulse (normal or inverted peak in the time trace) with a relatively short duration with respect to the measurement period. With this in mind, an additional window can be applied to the force signal (Channel 1) which effectively averages out any signals detected after the main excitation event. Most typically, these result either from noise or from extraneous signals generated by the hammer but not transmitted to the structure under test... such as those caused by putting the hammer down on a bench/ table!

In the PL302, the force window is applied to Channel 1 only and is a rectangular window which preserves all data values within the window (multiplying them by unity) and eliminates all values outside of it (multiplying them by zero).
The force window starts at the beginning of the time data frame and its length [FORCE %L] is expressed as a percentage of the time period. The time constant [EXP TC] for the exponential part of the window combination is set directly.

Note: When setting up the parameters for the Force/Exponential windows. it can be helpful to view the resultant "windowed time" functions for the force and response channels in the upper and lower displays respectively.
The Windowed time option may be activated in the FORCE/EXP column of the PROCessing setup window.

See Also: **FORCE, EXP TC, WIN TIME**



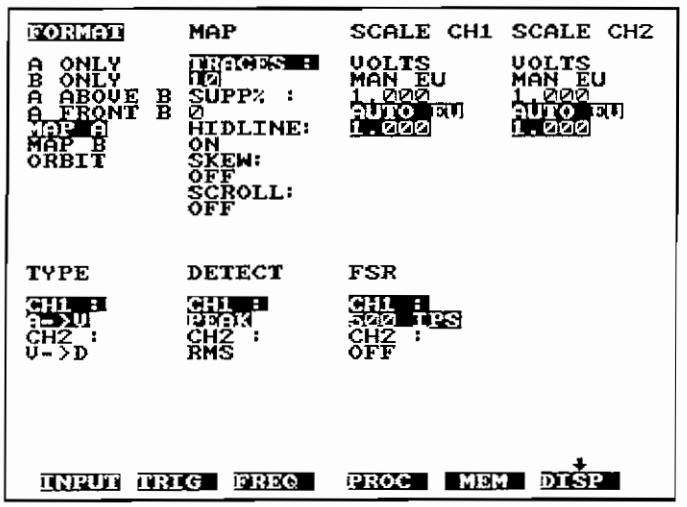
FORMAT

Type: Menu Column Heading

Description: The FORMAT column is situated in the DISP (Display) menu screen. This selects whether a single trace (Trace A or Trace B) or a dual trace (Trace A and Trace B) is displayed on the main screen. It also decides the type of display namely standard, map (or waterfall), orbit, Table A or Table B.

When two displays are selected simultaneously, only one trace is active at one time. The active trace is toggled using the TRA/B function key. Cursor movements , Y-axis boost and attenuation, and hard copy facilities are available on the active screen.

See Also: **A ONLY, B ONLY, A ABOVE B, A FRONT B, MAP A, MAP B, ORBIT, TABLE A, TABLE B**



FREE RUN

Type: Menu Item

Description: FREE RUN is found in the TRIG (trigger) menu screen. This defines a continuous mode of operation where the analyser gathers and processes frames of data without waiting for a specific trigger event between frames.

See also: **NORMAL, 1 SHOT**

FREQ RESP

Type: Menu Item

Description: FREQ RESP (Frequency Response), sometimes known as Transfer Function, is a two channel process in which the input signal to a system is applied to channel 1 and the output to channel 2. The output of the process, which can be displayed on Trace A or Trace B, is a dimensionless amplitude trace (Vout/Vin) versus frequency. The number of lines in the output is the same as other spectral processes. All window types and averaging can be applied to the Frequency Response process. Linear and logarithmic amplitude displays are available in addition to the phase difference between the two channels.

The frequency axis of the Frequency Response function can be displayed both linearly and logarithmicaly.

FSR (Full Scale Range)

Type: Menu Column Heading (DISP Screen)
Menu Item (INPUT Screen)

Description: FSR (Full Scale Range) is a method of defining the range in engineering units that will be displayed on the screen of the instrument.

The primary control of FSR is carried out in the DISP (Display) screen. FSR is only valid when AUTO EU has been selected.

FSR in the DISP screen can be set to OFF or to a fixed value of engineering units (eg. 2g, 10mm/s etc), according to the type of unit selected in the TYPE column. When FSR is OFF, the displayed range will be set by the current full scale input voltage range and the transducer sensitivity specified for that channel. When FSR is set to a value, the displayed range is "clamped" to that value and will not vary regardless of input voltage range or sensitivity factor. This is useful when making comparative readings.

FSR in the INPUT1 and INPUT2 columns of the INPUT screen is only valid when FSR is selected in the DISP screen. If FSR is selected in the INPUT screen with FSR not selected (i.e. OFF) in the DISP screen, then the instrument will operate as if AUTO has been selected in the INPUT1 and INPUT2 columns.

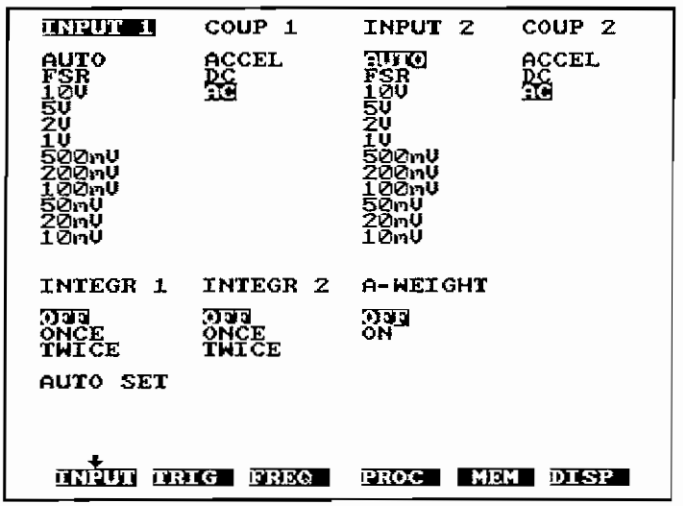
With FSR set to a value in the DISP screen, there are three possible operating modes:

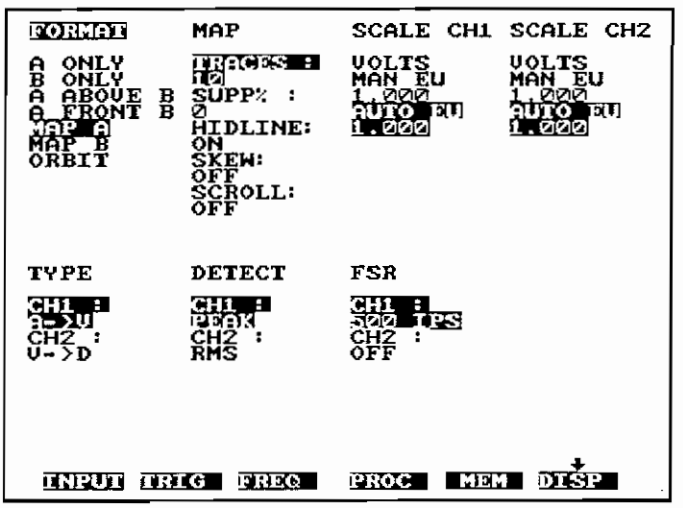
1. When FSR is specified for either channel in the INPUT screen, the analyser automatically selects that Full Scale (input voltage) Range which locks the available measurement range to the Full Scale (display) Range selected in the DISP screen. The input voltage range that is selected is determined by the transducer sensitivity factor specified for AUTO EU and the FSR selected for the display, both of which are specified in the DISP screen. The input range selected by the instrument can be determined by viewing the PL302 Status Screen.

Note: If integration is selected in the TYPE field of the DISP screen, it is not possible for FSR to set the input range directly. In this case, the input is 'autoranged' as in (2) below. This feature may be useful where the maximum level of the input signal is known in calibrated engineering units and it is desired to set the input range accordingly. However, for measurement quality to be maintained, care must be taken to ensure that the level of the incoming signal is suitable for the input range selected (i.e. that it is neither overloading the input, nor is it under range, as shown the the UNDER and OVER indicators on the main display screen.)

2. When AUTORANGE is specified for either channel in the INPUT screen, the analyser automatically selects an appropriate Full Scale (input voltage/ measurement) Range for the signal level detected during autorange. However, the display range remains clamped at that specified in the FSR field of the DISPlay screen. This feature is useful for making comparisons between measurements made at different times while maintaining the optimum measurement dynamic range. However, if the signals being measured are transient in nature, it may be appropriate to set the input range explicitly as in (3) below.

3. When a Full Scale input voltage Range is set explicitly for either channel in the INPUT screen (e.g. 100mV), then that range is used for the measurement. However, the display range remains clamped at that specified in the FSR field of the DISPlay screen. The feature is useful for comparative measurements where the voltage level of the input signal is known if the signal is transient in nature.





HANNING (Hanning Window)

Type: Menu Item

Description: The HANNING selection, in the WINDOW column of the PROCessing screen. specifies that a Hanning weighting function should be used in the computation of all spectral functions.

The window is most useful for general broadband signals where it limits "spectral leakage" to just a few spectral lines. However, this is at the expense of amplitude accuracy.

For these reasons, the Hanning window is useful for identifying specific frequencies or for separating closely spaced spectral components. However, where amplitude accuracy is required, a Flattop window is preferred.

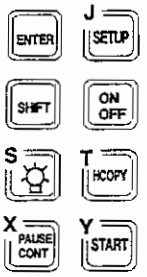
The weighting function applied by the hanning window is 0.5-(0.5 Cos wt.).

HCOPY

Type: Control Key

Description: The HCOPY control key enables hard copy dumps of graphic and alpha numeric data to be made to printers and plotters. When this key is pressed, the contents of the display are transmitted via the RS232 interface to the printer or plotter type defined in the UTIL (Utilities) screen.

When HCOPY is pressed, two options appear on the softkeys. These are SCRN (Screen Contents) and REC (Complete Record). SCRN activates printing of the portion of the signal displayed on the screen, REC activates printing of the complete record.

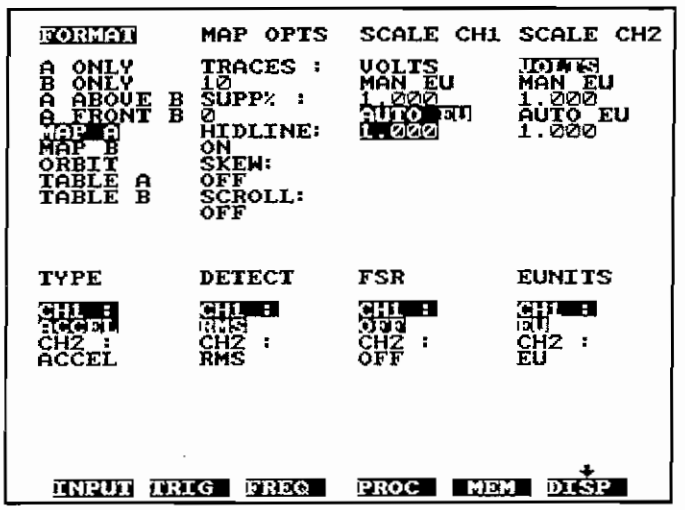


HIDLINE

Type: Menu Item

Description: HIDLINE, as selected in the MAP column, defines whether a new trace on the map (waterfall) display hides those parts of the previous trace which are overlayed by the new trace. This function can be turned ON or OFF by pressing the ENTER key.

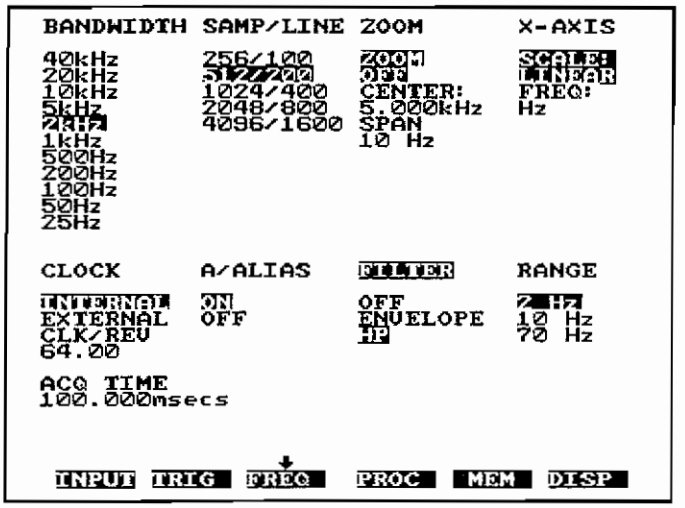
See also: **TRACES, SUPPL%**



HP FILTER

Type: Menu item

Description: When HP is selected in the FILTER menu column of the FREQuency menu, the internal high-pass filters on Channel 1 are enabled. One of three high-pass filters are available in the Range Column: 2 Hz, 10 Hz and 70 Hz.
The high pass filter allows energy pass above the value of the filter. Then energy below the value of the high-pass filter is removed. Therefore if you have to remove a 50 Hz mains frequency from the signal, you should use the 70 Hz high-pass filter.

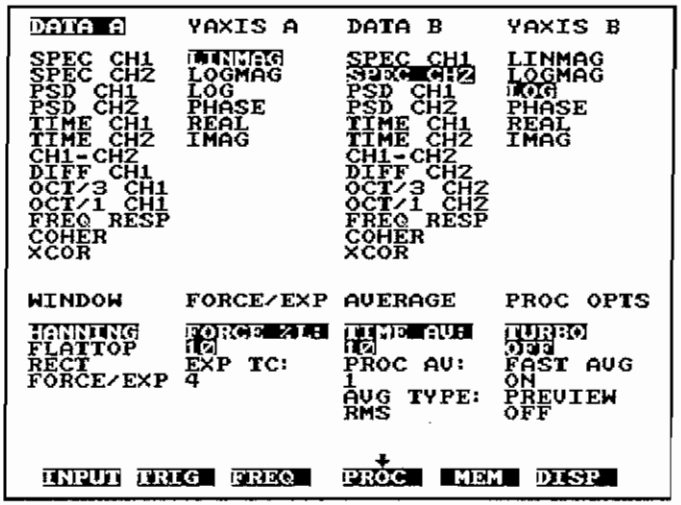


IMAG (imaginary Part)

Type: Menu Item

Description: IMAG, as selected in the YAXIS A or YAXIS B columns, displays the imaginary part of the appropriate process. This is the complement of the real part.

It should be noted that the imaginary part of raw time data is always zero.



INPUT 1, INPUT 2

Type: Menu Column Heading

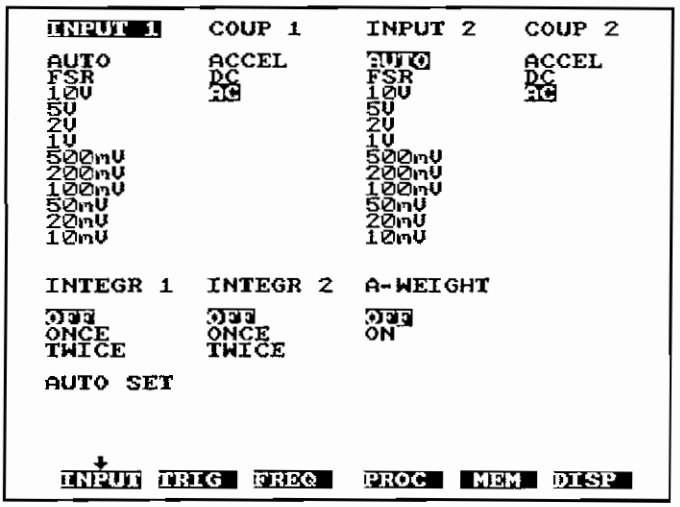
Description: The INPUT 1 column is found in the INPUT menu screen. INPUT1 selects the input full scale voltage range for channel 1. Ten fixed input ranges are available from ± 10v to ± 10mV. Operations for channel 2 are equivalent to those described here for channel 1.

A pre-acquisition autorange feature is also available where the analyser automatically selects an input range based upon the level of the signal detected immediately prior to data acquisition. This feature is enabled by selecting AUTO.

Notes:

i. When AUTO ranging is selected for either channel, a delay will occur between pressing the START key and the beginning of data acquisition while the autorange is performed.
ii. The autoranging process is only effective for signals up to 5 KHz analysis bandwidth.
iii. The input range selected by autoranging can be viewed by pressing the STATus softkey in the DISPlay screen. Another option in the INPUT 1 colunm is FSR. This is a means of tying an input range to a specified display range. Operation of this feature is described in detail in the FSR section of this manual.

See also: **AUTO, FSR**



INTEGR 1, INTEGR 2

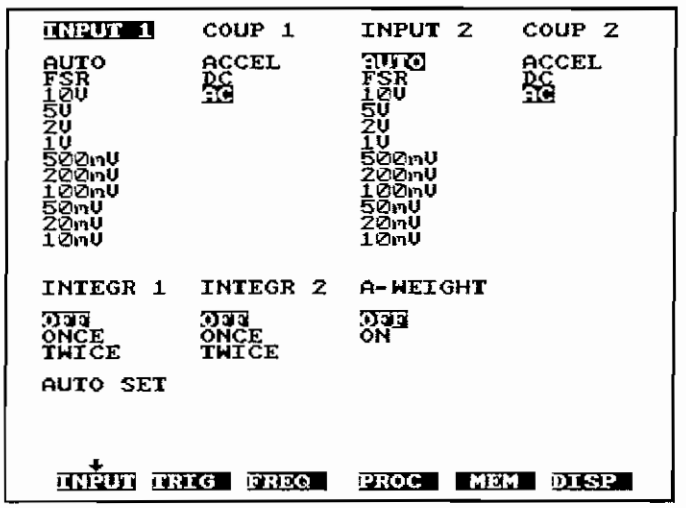
Type: Menu Column Heading

Description: INTEGR 1 defines the number of frequency domain integrations to be performed on channel 1 data. Note that time domain data is not affected by this integration. Operations for channel 2 are equivalent to those described here for channel 1.

Note that integration can be set-up automatically using AUTO EU's in the DISPlay menu. In this case, the words AUTO SET appear below the INTEGR 1 column in the INPUT menu and the integration level set cannot be modified until the automatic integration has been disabled.

Application: An example of the use of the integration feature is to convert acceleration spectra measured using an accelerometer into velocity or displacement units. Setting integration to ONCE will convert acceleration to velocity, while setting TWICE will convert acceleration direct to displacement. OFF disables the integration process for the relevant channel.

See also: **AUTO EU**



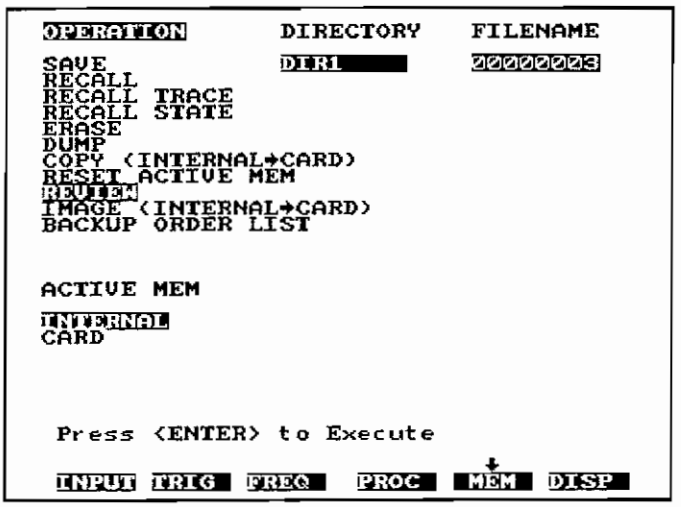
INTERNAL (Memory)

Type: Menu item

Description: INTERNAL is found in the MEM (Memory) screen in the ACTIVE MEMORY column. INTERNAL refers to the internal static RAM of the PL302 of which approximately 0.5 Megabytes is available for data storage. When selected, data storage/retrieval is to/from the INTERNAL memory.

For external data storage, CARD may be selected. This allows data to be stored to/ retrieved from a PCMCIA SRAM Memory Card.

Note that either memory (internal or card) can be reset independently using the RESET ACTIVE MEM selection. In the case of SRAM cards, this is equivalent to a FORMAT operation performed on a PC.



LEVEL (%), LEVEL (V)

Type: Menu Item

Description: LEVEL (%) and LEVEL (V) are found in the TRIGger menu and define the level of the signal required to trigger data acquisition. This is used when the trigger source is set to channel 1, channel 2, external analogue or external + PLL. The setting is ignored for the external TTL and freerun modes.

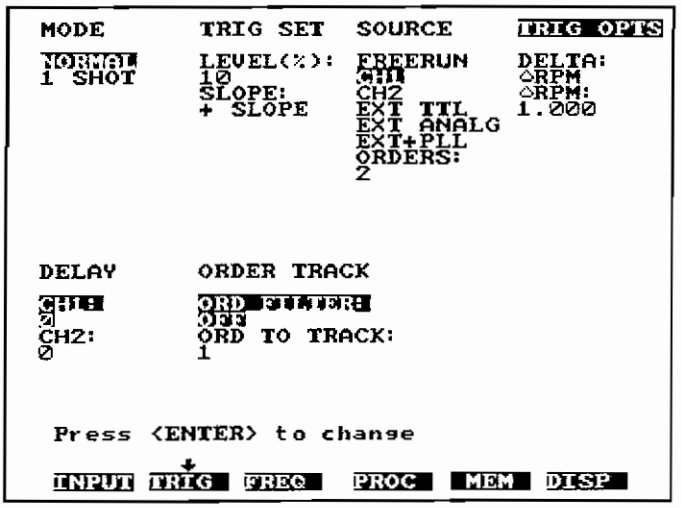
LEVEL (%) is defined as the percentage level of the relevant input voltage range. For channel triggering this is the current input full scale voltage range as defined in the INPUT menu. In contrast the voltage range for the external trigger circuit is fixed at ±10 volts.

LEVEL (V) allows the trigger voltage level to be entered directly. The LEVEL (%) and LEVEL (V) fields are complimentary and when one is set the other is adjusted accordingly.

Note: When channel triggering is selected and the input range for the specified channel is set to AUTO, the input voltage range is not known until acquisition is initiated. In this case. it is assumed that the 100% level is equal to 10 volts for setup purposes. The actual trigger voltage used once autoranging has been completed may differ from this as the trigger level is set as a percentage of the final input voltage range selected.

See also: **SLOPE, INPUT 1, EXT ANALG, EXT+PLL**

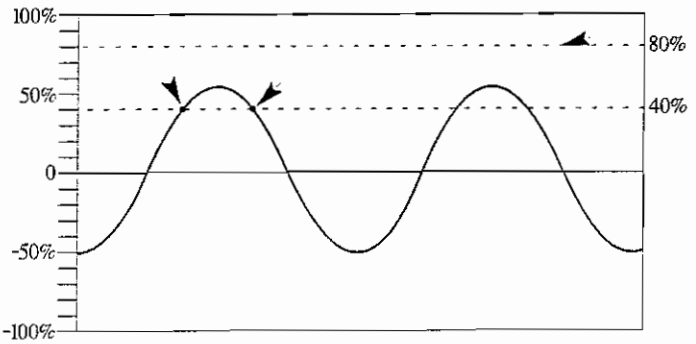
P.T.O.



Trigger at 40% level
with positive (+) slope

Trigger at 40% level
with negative (-) slope

No trigger events detected
at 80% level



LINMAG (Linear Magnitude)

Type: Menu Item

Description: Selects a LINear MAGnitude scale for the y-axis of the specified display (A or B).

Note: When time data is viewed in LINMAG format the modulus of the data is shown, i.e. both positive and negative values are shown as positive values. For normal display of time data use the REAL y-axis format option.

LOG (dB)

Type: Menu Item

Description: Selects a LOGarithmic scale for the y-axis of the specified display (A or B) annotated in decibles (dB)

Note: For functions expressed in linear units the number of decibels is defined as follows;

number of dB = $20\log_{10}(y/y_{ref})$, where...

...'y' is the data amplitude and
...'y_{ref}' is a reference data amplitude (= 1 volt RMS for voltage measurements).

LOGMAG (Logarithmic Magnitude)

Type: Menu Item

Description: Selects a LOGarithmic MAGnitude scale for the y-axis of the specified display (A or B).

MAN EU

Type: Menu Item

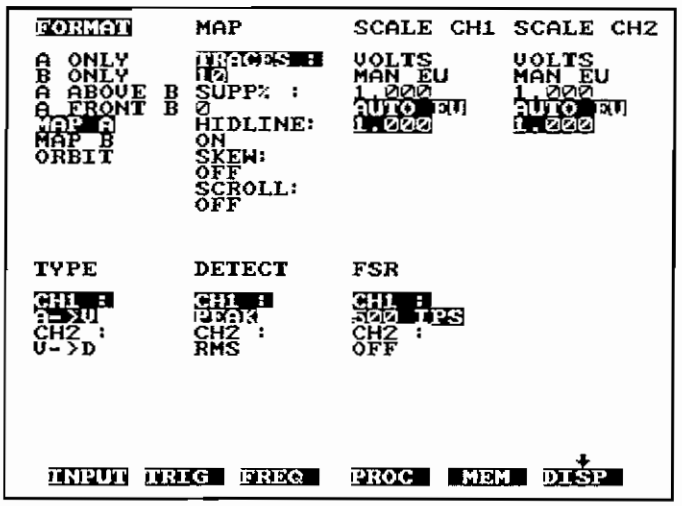
Description: MAN EU allows an arbitrary scale factor and system of units to be applied to the data from the specified channel (1 or 2). Each channel can be scaled independently.

The scale factor for each channel is entered via the keypad using floating point number notation. Measured voltage values are multiplied by the specified scale factor to obtain the scaled engineering unit values. Scale factors are tagged to their corresponding traces when saved and recalled from memory. In addition, a unit label corresponding to the specified scale factor can be entered in the EUNITS field.

Example: For example, an accelerometer of sensitivity 100mV/g entering a value of 10 would give an appropriately scaled measurement [100 mV/g = 0.1 V/g ° 10 g/V]

Note: Care must be taken when entering numerical values in the MAN EU and AUTO EU fields to ensure correct data scaling as the methodologies used in each case are different. In MAN EU, the number entered is a scale factor in EU per volt while in AUTO EU, the number entered is a sensitivity factor in mV per EU.

See also: **AUTO EU, EUNITS**



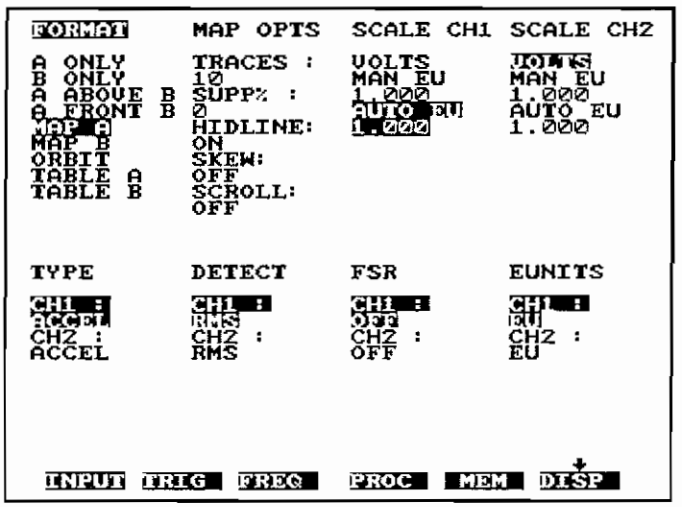
MAP OPTS

Type: Menu Column Heading

Description: The MAP OPTionS column in the DISP (Display) menu screen, controls five attributes of a map display, as follows:

TRACES: the total number of traces to be shown in the display (max. 99)
SUPP%: a percentage of the amplitude axis range below which trace drawing is suppressed. This feature can be used to reduce clutter in the display caused by low-level signal or noise components.
HIDLINE: enables or disables hidden-line suppression
SKEW: determines whether the map is viewed square-on or from an angle.
SCROLL: determines whether the map is refreshed (clears then starts again) or scrolls when the specified number of traces has been reached.

See also: **TRACES, SUPPL%, HIDLINE, SCROLL, SKEW**

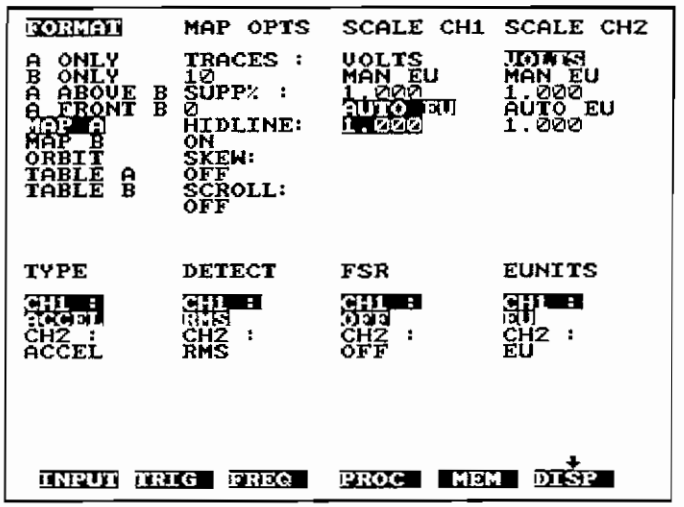


MAP A, MAP B

Type: Menu Item

Description: Specifies that the display will be in the form of a 3-D map (waterfall) display. Map displays are available for either Trace A or Trace B. The parameters for the map display are defined in the MAP OPTionS column.

See Also: **MAP OPTS**

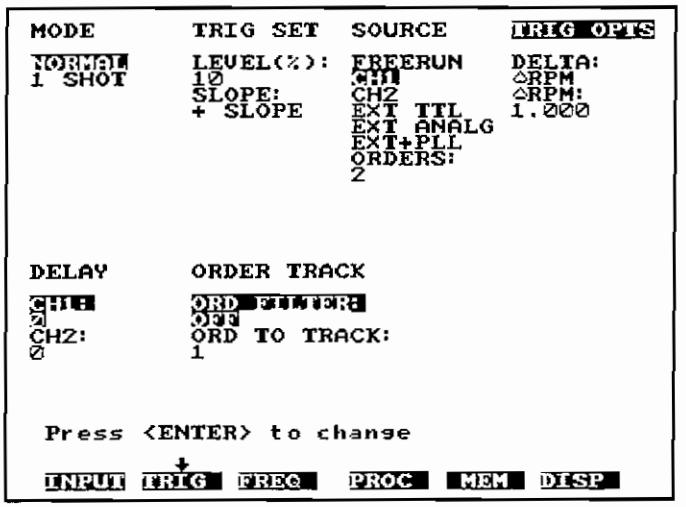


MODE

Type: Menu Column Heading

Description: MODE is found in the TRIG (Trigger) menu screen and defines the current trigger mode. Two modes are available, namely: NORMAL and 1 SHOT.

See also: **NORMAL, 1 SHOT**



NORMAL

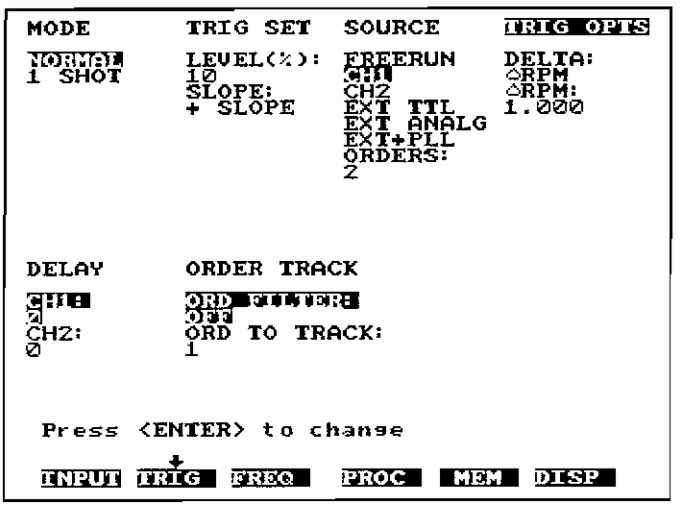
Type: Menu Item

Description: This specifies a continuous mode of data capture where acquisition restarts automatically each time a set of time and process averages has been completed. The number of time and process averages, within each set, are specified in the PROCessing menu.

During normal mode of operation, data acquisition may be paused/resumed using the PAUSE/CONTinue hardkey. Acquisition can be restarted at any time by pressing the START hardkey.

The complement to NORMAL mode is 1 SHOT where acquisition is automatically halted after one set of time and process averages have been completed.

See also: **1 SHOT**



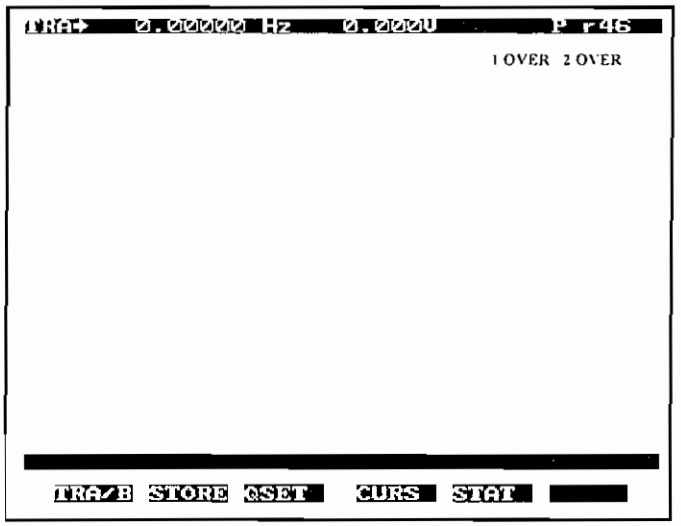
1 OVER, 2 OVER

Type: Warning Message

Description: The message 1 OVER (or 2 OVER) appears in the main display screen when the level of the signal connected to channel 1 (or channel 2) exceeds the input full scale voltage range defined for that channel. If this occurs, the input voltage range for the relevant channel should be increased to avoid clipping of the time domain waveform and corresponding distortion of the frequency domain data.

Note: Overload detection is performed after anti-alias filtering and A/D conversion. As a consequence, frequency components in the signal above the analysis cut-off frequency can cause saturation of the input amplifiers/filters without being detected. If this is suspected (for example due to distortion being observed in the frequency domain), it is recommended that the analysis bandwidth is increased (e.g. to 20 kHz) to determine whether such high frequency components are present. If they are then the input voltage range should be increased or an external filter applied before analysis is performed at the original analysis frequency bandwidth.

See also: **1 UNDER, 2 UNDER**



1 UNDER , 2 UNDER

Type: Warning Message

Description: The message 1 UNDER (or 2 UNDER) appears on the main display screen when the signal level of channel 1 (or channel 2) is less than one quarter of the input full scale voltage range selected for that channel (equivalent to -12 dB). In this case, the input voltage range for the relevant channel should be reduced to optimise the dynamic range of the measurement.

See also: **1 OVER, 2 OVER**

1 SHOT

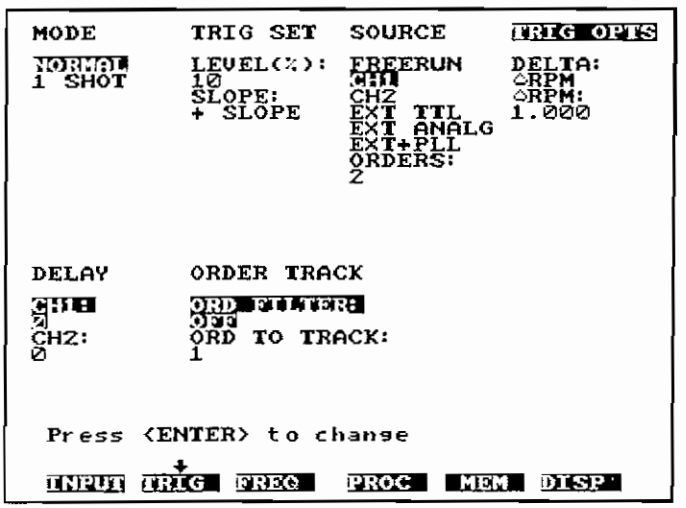
Type: Menu Item

Description: This specifies a 'single-shot' mode of data capture where acquisition is halted automatically after one complete set of time and process averages have been performed. The time and process average counts are specified in the PROCessing menu. Once acquisition is complete a 'P' character is shown next to the number of averages performed on the right-hand side of the banner at the top of the display.

During one-shot operation data acquisition may be paused/resumed using the PAUSE/CONTinue hardkey. Acquisition can be restarted at any time by pressing the START hardkey.

The complement to 1 SHOT mode is NORMAL data capture mode where acquisition restarts automatically each time a sequence of time and process averages is completed.

See Also: **NORMAL**



OCTAVE

Type: Menu Item

Description: The OCT/3 and OCT/1 items are located in the DATA A and DATA B columns of the PROCessing menu. These specify the computation and display of third and full octave functions respectively.

In this analyser octave functions are synthesised from narrowband spectra. To ensure that accuracy is preserved for all octave bands the octave function is computed from two narrowband spectral measurements performed in sequence.

The octave bandwidth is set using the BANDWIDTH column in the FREQuency menu. The available selections are 20 kHz, 10 kHz and 5 kHz. these are nominal frequency bandwidths. Spectral measurements are made at the nominal bandwidth and at one tenth of that bandwidth from which the specified octave functions are computed. In both cases a 2048 point / 800 line measurement is used. The resulting octave bands are outlined in the tables below.

OCT/1 - full octave - 10 bands

Bandwidth	*Octave Band Centre Frequency (Hz)*									
20 kHz	31.5	63	125	250	500	1k	2k	4k	8k	16k
10 kHz	16	31.5	63	125	250	500	1k	2k	4k	8k
5 kHz	8	16	31.5	63	125	250	500	1k	2k	4k

OCT/3 - third octave - 31 bands

Bandwidth	*Octave Band Centre Frequency (Hz)*									
20 kHz	20	25	31.5	40	50	63	80	100	125	160
	200	250	315	400	500	630	800	1k	1.25k	1.6k
	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	12.5k	16k
	20k									
10 kHz	10	12.5	16	20	25	31.5	40	50	63	80
	100	125	160	200	250	315	400	500	630	800
	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k
	10k									
5 kHz	5	6.3	8	10	12.5	16	20	25	31.5	40
	50	63	80	100	125	160	200	250	315	400
	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k
	5k									

Notes: The following restrictions apply to octave processing mode;

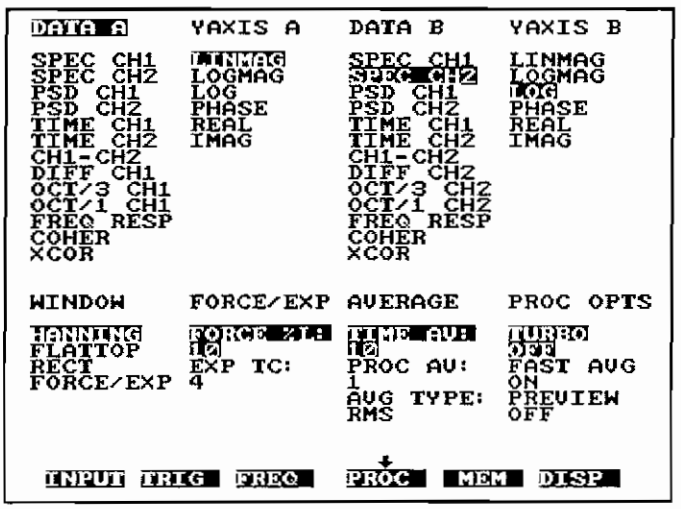
i. Octave functions (full or third) must be specified for both data traces (A and B).

ii. Only those functions specified for display are available once acquisition has completed, ie. reprocessing facilities are not available.

iii. The nominal octave function bandwidths available are 20 kHz, 10 kHz and 5 kHz. if any other selection is made a warning message is output to the display when the START hardkey is pressed.

iv. The number of samples/lines is fixed at 2048/800 during octave processing and the setting of the SAMP/LINE column in the FREQuency menu is ignored.

See also: **BANDWIDTH.**



ON/OFF

Type: Control Key

Description: The ON/OFF control key powers the instrument by a toggle action. When the instrument is turned off, the settings are remembered so that when the instrument is next powered up the user can continue from where he left off.

The instrument will power-off automatically under two circumstances:

i. When the battery level is so low that internal damage to the battery could occur.

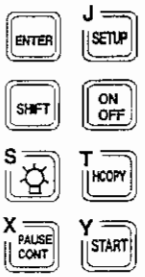
ii. When the TIMEOUT feature is enabled in the UTILity menu and a key has not been pressed for a pre-defined period of time. Two timeout periods are defined in the analyser:

   a. Two minutes... if no keys are pressed after the analyser is switched ON (protects against inadvertant switch ON)

   b. Ten minutes... if no keys are pressed for approximately ten minutes the analyser will switch off to preserve battery life.

The Timeout facility can be diabled in the UTILity menu.

See also: **UTIL**

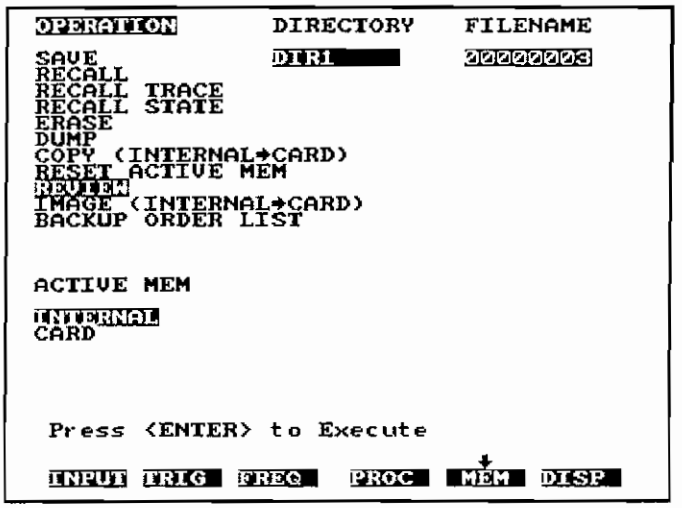


OPERATION (Memory Operation)

Type: Menu Column Heading

Description: The OPERATION column is found in the MEM screen. The memory operations which the user can execute are listed in this column. To execute an operation, the cursor is moved to the appropriate legend and the ENTER key is pressed.

See also: **SAVE, RECALL, ERASE, DUMP, COPY, RESET ACTIVE MEM, REVIEW**



ORBIT

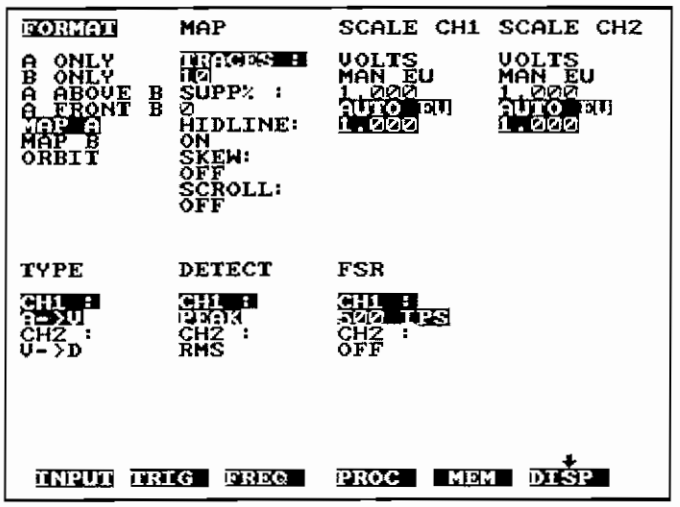
Type: Menu Item

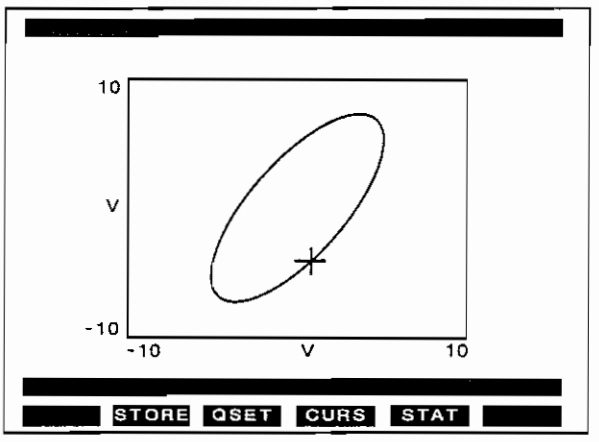
Description: ORBIT, as selected in the FORMAT column, specifies that an X-Y plot of trace A versus trace B will be shown on the main display screen. This is most useful for time domain plots where channel 1 data is displayed on trace A and channel 2 data is displayed on trace B.

Cursor readout of the amplitudes of both traces is available, except that the cursor is a cross-hair type moving in two dimensions round the orbit display. Both cursor readouts are updated simultaneously.

A typical orbit is shown below. Any process can be plotted against another, but the most useful is time versus time.

Note that the signal can be boosted by pressing the UP arrow but this only applies to one of the channels. Here the TRA/B softkey should be pressed to boost the other channel





ORDER TRACK

Type: Menu Column Heading

Description: The ORDER TRACK column is located within the TRIGger menu. This feature is used to extract a single integer order component from the input data and to display just the contribution of that component in any requested time or order spectrum displays, including filtered orbits.

ORDER TRACKing is enabled by setting the ORD FILTER field to ON and by specifying the order component of interest in the ORD TO TRACK field.

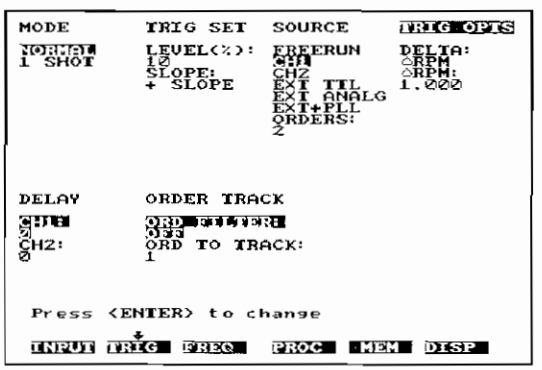
When ORDER FILTERing is switched ON both time and order spectrum displays show just one frequency component. For example if a square wave is input to the system (both to an input channel and to the external trigger input) and the ORD TO TRACK is set to '1' the time display shows a sinusoidal waveform and the order spectrum display shows a single peak at the fundamental frequency of that square wave. Similarly when the ORD TO TRACK is set to '2' the components corresponding to the second harmonic are shown, and so on for any component up to the 100^{th} order.

Notes:
i. ORDER TRACK operation is only valid in conjunction with EXT+PLL (External + Phase Locked Loop) data acquisition triggering. A warning message is issued when the START hardkey is pressed if any other trigger source is selected.
ii. ORDER TRACK operation is not compatible with octave or zoom analysis

Application: An example of the use of order filtering is in the display of filtered orbits. An orbit is a cross-plot of two time functions, typically measured using an 'x/y' pair of proximity probes mounted orthogonal (at 90°) to one another observing the motion of a shaft within a rotating machine. This plot enables the motion of the surface of the shaft to be observed from which the motion of the shaft centre-line may be inferred.

When the unfiltered time waveforms are displayed in an orbit format the total contribution from all frequency components are viewed. However, these displays can be difficult to interpret, particularly if scratches or other electrical defects cause high frequency components to occur in the time domain waveform. In such cases ORDER FILTERing can be used to isolate the contribution to the orbit made by a single spectral component. This enables the contribution from each order component (1x, 2x etc.) to be studied independently, aiding interpretation of the information contained within the plot.

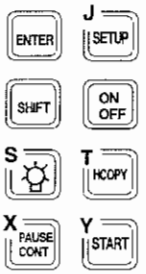
See also: **EXT+PLL**



PAUSE/CONT

Type: Control Key

Description: The PAUSE/CONT control key operates by toggle action and is used to interrupt data acquisition and processing. Pressing the key causes machine operation to pause to enable inspection of data and movement of cursors across the screens. Machine operation is resumed by pressing the key again. If averaging is being used, the instrument will continue from the last average when allowed to continue. To reset the averages to zero the START hardkey should be pressed.



PEAK (Peak Cursor Position)

Type: Softkey Prompt

Description: Pressing the PEAK soft cursor function key enables the peak of a signal to be identified. On pressing the key the main cursor will move immediately to the highest value identified in the display. The main cursor will remain in this position until the PEAK key is pressed again or the cursor is moved using the right and left cursor keys.

Note that the cursor will move to the highest amplitude shown on the display, even if the display is showing only a part of a long record.

PPROC

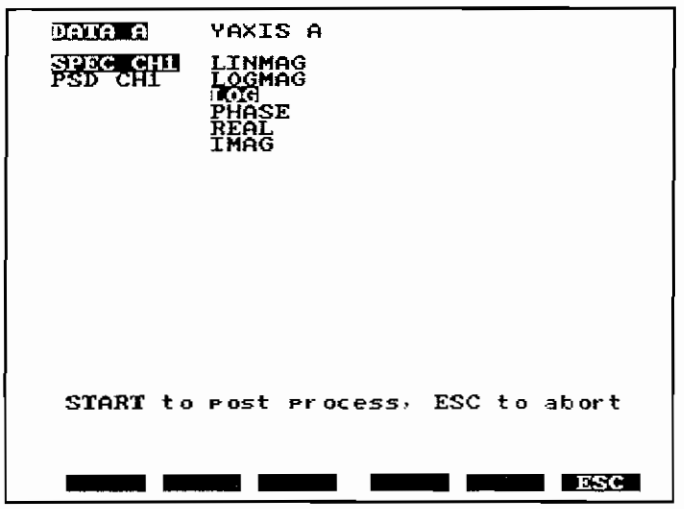
Type: Softkey Prompt

Description: PPROC softkey option is available in the STATus screen. This enables post-processing to be carried out on data stored to and subsequently recalled from memory. The procedure is to first recall data from memory using the operations available in the MEM screen. Entering the post-processing screen by pressing the PPROC softkey in the STAT screen enables the user to select the particular process which he wants to carry out on the recalled data.

The post-process screen is CONTEXT SENSITIVE, that is to say, the contents of the screen depend on the type of signal recalled from memory and only the relevant post-processing options are available.

Note that when this screen is first entered, the set-ups shown relate to the recalled data.

Advanced post processing can be performed where two signals are recalled from memory together and, provided they are compatible, cross-channel post-processing can be performed (eg. two time signals post-processed into a transfer function). It is also worth noting that to post-process into cross-channel format, the original signals used must be derived from different channels (i.e. channel 1 & channel 2).



PRESET

Type: Hidden Function

Description: The PRESET operation allows the analyser to be reset from its current user-defined setup condition to a default state that is 'preset' at the factory. This feature can be useful to return the analyser to a known setup state before beginning a new series if tests.

Note that performing a PRESET does not erase the functions or setup states stored in the analyser's internal static memory.

To initiate the PRESET operation press the following hardkeys in sequence;

SHIFT then ENTER then A (the top left hand key)

The following messages are then shown on the screen;

Press [ENTER] to Preset
Other key to abort

Pressing ENTER causes the analyser to be reset to it's factory default conditions.

Pressing any other key aborts the PRESET operation leaving the analyser setup state unchanged.

PREVIEW

Type: Menu Item

Description: PREVIEW can be used with all functions but is most often used in conjunction with the FORCE/EXP window. It can be turned to OFF, MANUAL or AUTO in the PROC OPTS (Process options) column.

When PREVIEW is on manual, the raw time data is displayed on the screen, and the operator has the option whether to accept or reject this data. This is particularly useful when carrying out transient capture analysis as it ensures that good data is accumulated in the average. The operator is prompted on the main display screen such that pressing the 0 key will reject data and pressing the 1 key will accept the data.

When PREVIEW is on AUTO, the overloaded data is automatically rejected and so is not used as part of the Average. Here a reject message appears on the screen.

It is recommended that 1-SHOT trigger mode is used when PREVIEW is enabled. This means that each average is held for display without another trigger immediately initiating further data acquisition and overwriting the interim result.

When PREVIEW is OFF, data is automatically accumulated into the average without interruption.

See also: **FORCE/EXP**

PROC AV (process Averages)

Type: Menu Item

Description: PROC AV (Process Average), as selected in the AVERAGE column, defines the number of frequency domain averages to be performed. Process averaging can run sequentially in conjunction with time averaging.

Process averaging improves the statistical accuracy of the process being measured, but does not improve the signal-to-noise ratio.

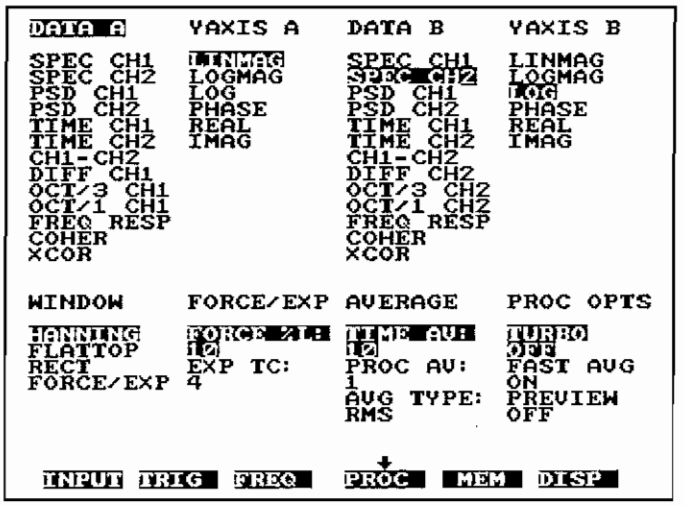
See also: **TIME AV, AVG TYPE**

PROC OPTS

Type: Menu Column Heading

Description: PROC OPTS defines the processing options available on the instrument. Three options are available namely TURBO MODE ON or OFF. FAST AVG (Fast Average) and PREVIEW. TURBO and FAST AVG control the speed at which the instrument will process and display data. PREVIEW enables the operator to decide whether incoming time data should be accumulated into an averaged process. This is particularly useful when transient analysis using hammer pulses is being carried out. The operator can decide whether to accept or reject the raw channel signal.

See also: **TURBO, FAST AVG, PREVIEW**



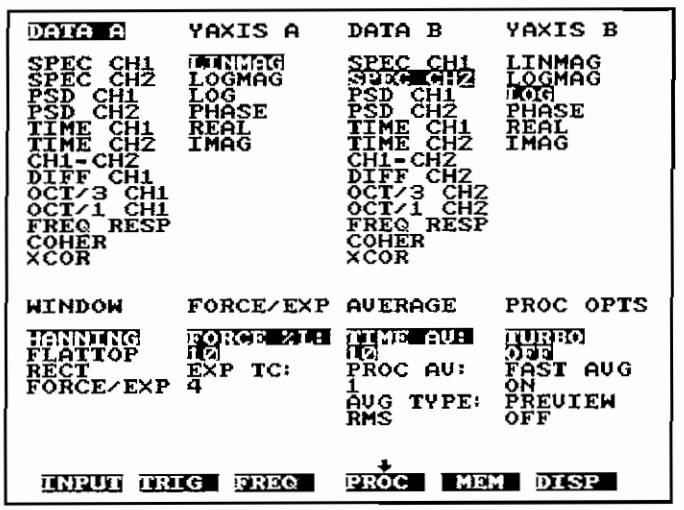
PSD CH1, PSD CH2

Type: Menu Item

Description: PSD CH1 and PSD CH2 compute and display the power spectral density for channel 1 and channel 2 respectively. PSD is similar to the SPEC process except that the amplitude is normalised with respect to frequency resolution. In linear display mode, the amplitude is given as V/(Square root Hz) and in logarithmic mode is given as dB/(Square root Hz).

Power spectral density is especially useful when making broadband noise measurements. The process ensures that the amplitude value is always the same for a given frequency, regardless of the frequency resolution of the spectrum. eg. in logarithmic display, the amplitude of a signal in dB's would be the same, regardless of whether a 200 or 400 line spectrum has been selected. In the standard spectrum display, the value in dB's would be reduced if the line resolution was decreased (ie. the number of lines in the spectrum was increased) because the total amount of energy is shared between the lines reducing the level of each one accordingly.

The same display formats as for standard spectrum are available for Power Spectral Density.



PWR (Band-Cursor Measurement of Spectrum Overall)

Type: Softkey Prompt

Description: The PWR cursor feature is used to compute the 'spectral overall' content contained within a user-defined frequency band. The band is defined using a pair of data cursors which may be positioned either using the arrow keys or by direct numeric entry. The resulting 'overall' value is displayed in a box on the upper right-hand side of the display.

The PWR cursor can be removed by setting both the upper and lower band values to zero.

Note: The 'spectral overall' is equivalent to the power contained within the signal converted to linear units, ie. √(power).

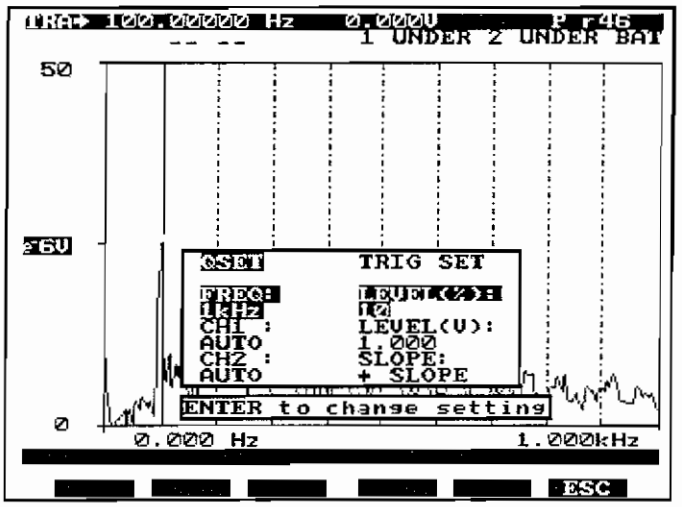
See also: **CURS**

QSET

Type: Softkey Prompt

Description: QSET, available in the main display screen, enables frequently used settings to be changed quickly. These are frequency, channel 1 and 2 input voltage ranges and trigger level settings. The parameter to be changed is selected by using the up and down cursor keys, and the parameter setting is selected using ENTER key. Note that to change the trigger setting, the right (or left arrow) is pressed to move to that column. Here, the main display behind the pop up window will not change but the trigger warning level will change from W (waiting) to T (triggering) when the user selects an appropriate level. The W or T message is displayed in the banner at the top right hand corner. Pressing the ESC softkey or the START control key removes the QSET display and resumes data acquisition.

When a parameter is modified using the QSET function, the appropriate parameter is updated in the INPUT or FREQ screens.

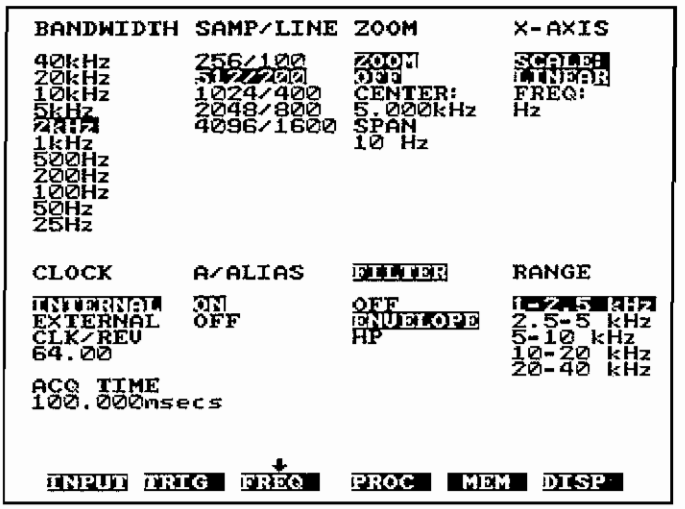


RANGE

Type: Menu Item

Description: The RANGE column only appears in the FREQ (Frequency) menu screen where ENVELOPE has been selected in the FILTER column. Four band pass filters are available when the ENVELOPE selection has been made. These are 2.5-5kHz, 5-10kHz, 10-20kHzand 20-40kHz Enveloping is only available on channel 1, and the incoming signal is filtered according to the range selected before being passed on to the active enveloping circuit.

See also: **FILTER, ENVELOPE**

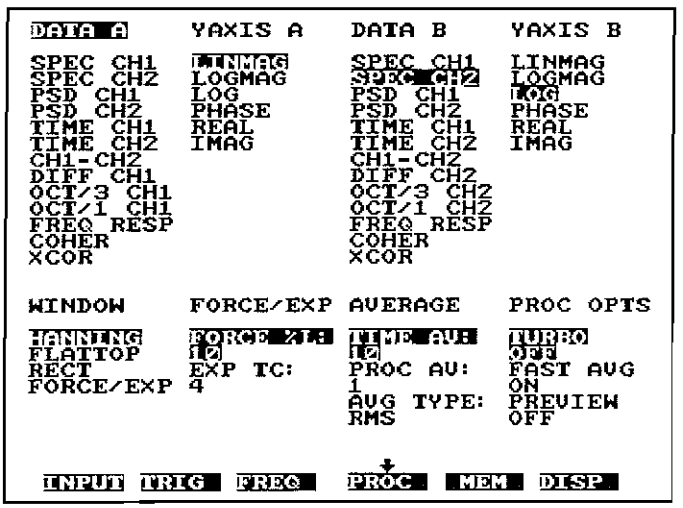


REAL (Real Part)

Type: Menu Item

Description: REAL, as selected in the YAXIS A or YAXIS B columns, displays the real part of the signal being processed. This is the complement to the IMAG (Imaginary) part of a complex function.

Note that raw channel (time) data should always be displayed as REAL since, except in zoom processing, the imaginary part of time data is always zero, and the LINMAG option displays a rectified (modulus) waveform.



REC (print complete record)

Type: Softkey Prompt

Description: The REC softkey prompt appears after the HCOPY control key has been pressed. REC enables printing of a complete data record to be made even though the whole record may not displayed on the screen.

This feature can be useful to print an entire data record after the x-axis EXPAND facility has been used to examine a particular feature of the data.

See also: **HCOPY, SCRN**

REC ->

Type: Menu Item

Description: REC -> appears in the list of available processes in the PROC (Process) screen when a trace has been recalled from memory.

For example, if a trace was recalled from function memory which was the spectrum of channel 1 then the label REC-> SPEC CH1 would appear at the bottom of the process list. If the trace were recalled to trace A then the message would appear at the bottom of DATA A list and similarly for a function recalled to trace B. This is to indicate to the user that the trace is a recalled display and not a live process currently active within the instrument.

Pressing the START key will return to the main display screen. The user is reminded that the display is recalled by the message REC-> appearing in the appropriate banner. To remove a recalled function from the display and to return to live processing, the cursor in the PROCessing menu must be moved from the REC-> field to the required function.

RECALL (memory operation)

RECALL TRACE

RECALL STATE

Type: Menu Item

Description: The RECALL, RECALL TRACE and RECALL STATE memory operations are listed in the OPERATION column in the MEMory screen. When executed RECALL loads setup state and trace data from the active memory device as specified in the ACTIVE MEM column. The directory and file name of the data recalled is specified by the current DIRECTORY and FILENAME settings.

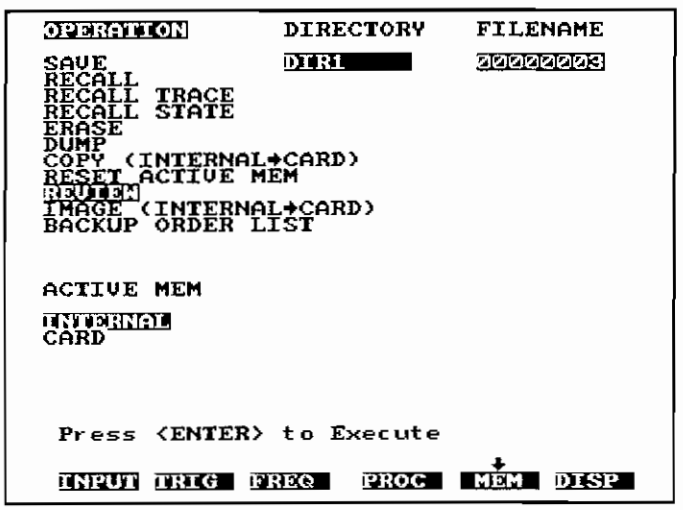
Note that if trace A and trace B data exists for the specified memory item, both will be recalled.

If the setup state and/or traces are recalled successfully, the functions are shown in the main display screen.

For recalled trace data the selected item in the DATA column in the PROC screen is set to REC followed by the data type of the recalled trace.

The RECALL TRACE operations works as for RECALL except that only the trace data is recalled.

The RECALL STATE operations works as for RECALL except that only the setup state is recalled.



RECT (Rectangular Window)

Type: Menu Item

Description: The RECTangular window selection in the WINDOW column of the PROCessing screen specifies that a uniform unity weighting function will be applied to the time data frame before it is processed into the frequency domain.

This window does not modify the original time data and so does not provide any protection against spectral leakage. However, the window is useful for the analysis of transient signals which are completely contained (are initiated and decay completely) within the data frame. Such signals are sometimes referred to as 'self windowing'.

RESET ACTIVE MEM

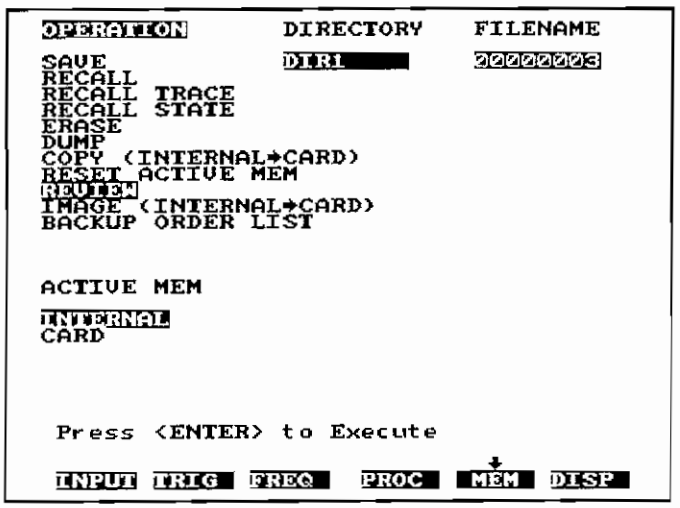
Type: Menu Item

Description: The RESET ACTIVE MEM memory operation is listed in the OPERATION column in the MEM screen.

RESET ACTIVE MEM reformats and resets the active memory device as specified in the ACTIVE MEM column. Reformatting and resetting deletes all the stored items in the active memory device.

The RESET ACTIVE MEM operation requires confirmation. When executed the message (ENTER) resets. To carry out the reset, the ENTER key must be pressed again. Any other will abort the operation.

When RESET ACTIVE MEM is carried out on a memory card, a test is carried out to determine the size of the card. A message is displayed at the end of this test indicating the card size e.g. CARD SIZE 512 kbytes.



REVIEW (Memory Operation)

Type: Menu Item

Description: The REVIEW memory operation is listed in the OPERATION column in the MEMory screen. When executed REVIEW displays the REVIEW screen. This displays the contents of the active memory device and has function softkeys which allow the user to carry out various operations on the stored memory items.

The REVIEW screen displays two lists:

The left hand list contains directories with the cursor position on the current directory. The right hand list contains the files in the current directory with the cursor positioned on the current file.

The file list displays the file name, the function contained within the file (or the first function where two data traces have been stored) and the file type. The file type can be 'A' or 'B' for a single trace, '2' for a pair of traces (A & B) or MAP A or MAP B for a complete waterfall function of either trace.

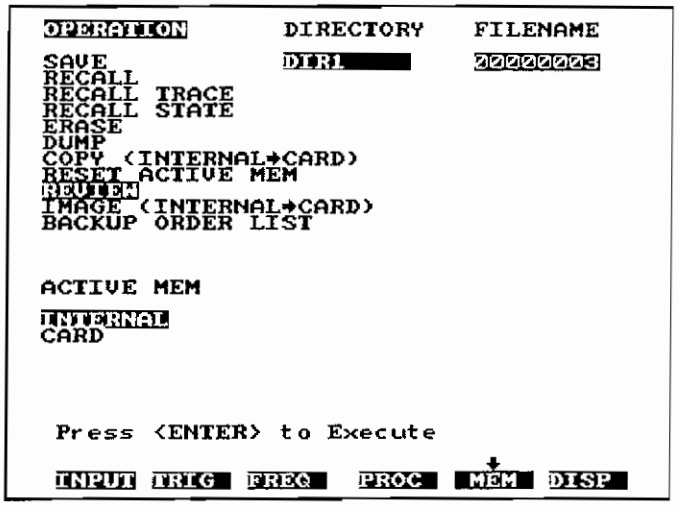
The active list is indicated by a thicker border around it. The ENTER key changes which list is active. The entries in each list are displayed a page at a time with an indicator of the current page and total number of pages displayed at the bottom. For example, 02/03 indicates that there exists three pages of entries in total with the second page currently displayed.

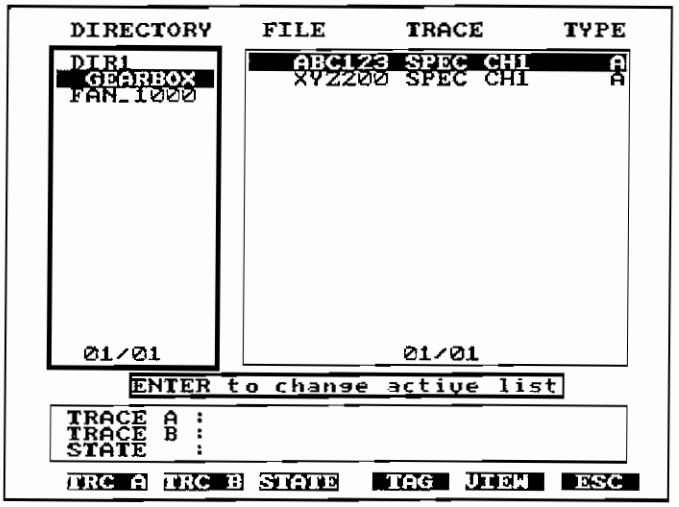
The cursor in the active list is moved by using the four cursor hardkeys. The up and down cursor keys move the cursor up and down the list. The left and right cursor keys move the cursor a page at a time backwards and forwards through the list entries.

The softkeys below the REVIEW screen allows various data tagging recall and display operations to be performed. see the relevant sections of this chapter for more details.

To exit the REVIEW screen press the ESC function. This returns to the MEM screen.

See also: **TRC A, TRC B, STATE. VIEW, TAG.**


OPERATION
DIRECTORY
FILENAME
SAVE
DIR1
00000003
RECALL
RECALL TRACE
RECALL STATE
ERASE
DUMP
COPY <INTERNAL→CARD>
RESET ACTIVE MEM
REVIEW
IMAGE <INTERNAL→CARD>
BACKUP ORDER LIST
ACTIVE MEM
INTERNAL
CARD
Press <ENTER> to Execute
INPUT
TRIG
FREQ
PROC
MEM
DISP


DIRECTORY
FILE
TRACE
TYPE
DIR1
GEARBOX
FAN_1000
ABC123 SPEC CH1 A
XYZ200 SPEC CH1 A
01/01
01/01
ENTER to change active list
TRACE A :
TRACE B :
STATE :
TRC A
TRC B
STATE
TAG
VIEW
ESC

Δ RPM

Type: Menu Item

Description: The Δ RPM item is located in the TRIGger OPTionS column of the TRIGger menu and specifies a form of data acquisition control where data frames are captured at specified RPM (speed) intervals.

The RPM interval is set by entering a positive speed value (between 0 and 500,000 rpm) in the Δ RPM field.

In this mode of operation data acquisition is initiated when the START hardkey is pressed. Subsequent data frames are then captured at integer multiples of the specified trigger delta regardless of whether speed is increasing or decreasing.

Notes:

i. Δ RPM data capture is only valid in conjunction with externally triggered operation. The current RPM value is measured from a once per revolution (tachometer) signal connected to the EXTernal TRIGger connector on the rear panel of the analyser and is displayed in the banner at the top of the screen during acquisition.

   When EXTernal TTL or EXTernal ANALoG triggering is selected data is sampled using the internal sample clock, based upon the BANDWIDTH setting defined in the FREQuency menu, resulting in a normal frequency spectrum annotated with RPM values.

   Alternatively when EXTernal + Phase Locked Loop triggering (EXT+PLL) is selected the sample rate is automatically adjusted in relation to the current speed to produce an order spectrum containing the number of orders specified in the ORDERS field within the SOURCE column of the TRIGger menu.

ii. In cases where the next trigger speed is reached before the acquisition and processing of the previous data frame has been completed that trigger condition is skipped and the next data frame is captured at the next available condition

Application: This feature is commonly used when monitoring a run-up or a run-down of a rotating machine and is particularly powerful when used in conjunction with a 3-D MAP (waterfall) display.

See also: **DELTA, TIME, Δ TIME, EXT TLL, EXT ANALG, EXT+PLL**

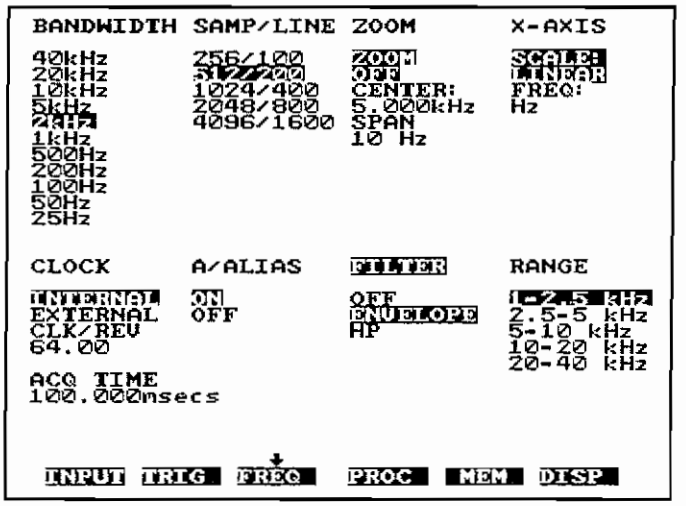

MODE
TRIG SET
SOURCE
TRIG OPTS
NORMAL
1 SHOT
LEVEL(%):
10
SLOPE:
+ SLOPE
FREERUN
CH1
CH2
EXT TTL
EXT ANALG
EXT+PLL
ORDERS:
2
DELTA:
ΔRPM
ΔRPM:
1.000
DELAY
ORDER TRACK
CH1:
0
CH2:
0
ORD TO TRACK:
1
Press <ENTER> to change
INPUT
TRIG
FREQ
PROC
MEM
DISP

SAMP/LINE

Type: Menu Column Heading

Description: The SAMP/LINE column is used to select the data acquisition frame size and the corresponding number of spectral lines. The data acquisition frame size is specified in terms of the number of time data SAMPles. The number of spectral LINEs is equal to the number of samples ÷ 2.56.

The data acquisition frame size can vary in powers of two from 256 to 4096 points with the corresponding number of lines varying from 100 to 1600.



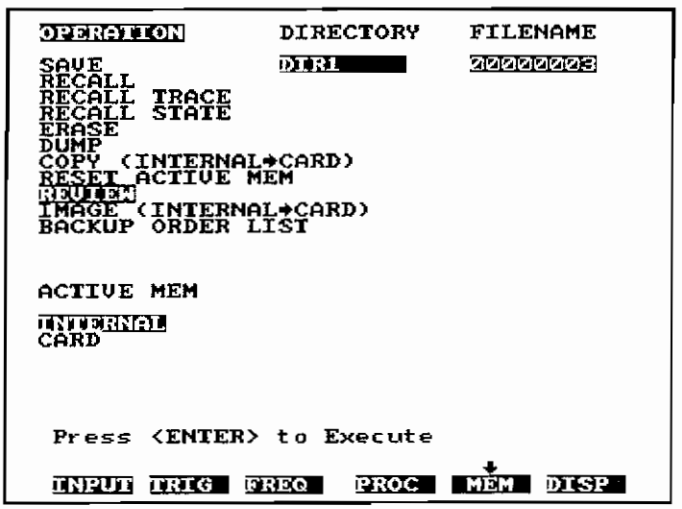
SAVE (Memory Operation)

Type: Menu Item

Description: The SAVE memory operation is listed in the OPERATION column of the MEMory screen. SAVE stores the current setup state and displayed data trace(s) in the active memory device as specified in the ACTIVE MEM column. The directory in which the state and trace(s) are stored is that specified in the DIRECTORY field.

The filename for the stored setup state and trace(s) is specified in the FILENAME field with the extension .STA used for setup states. .TRA used for trace A data and .TRB used for trace B data.

If, when the SAVE operation is executed, data already exists in the active memory device with the same directory and filename as specified in the MEMory screen the user is prompted as to whether the previous data should be overwritten.



SCALE CH1, SCALE CH2

Type: Menu Column Heading

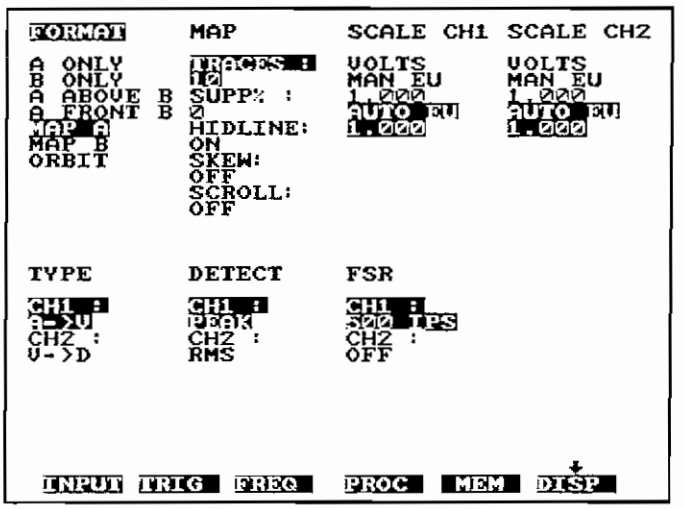
Descriptions: SCALE CH1 and SCALE CH2 define the data amplitude scaling mode for channels 1 and 2 respectively. The options available are:

VOLTS 'Volt mode'
data is displayed directly in measured volts without any Engineering Unit scaling applied.

MAN EU 'MANual Engineering Units' mode
data measured in volts is multiplied by an arbitrary scale factor to convert it to Engineering Units for display.

AUTO EU 'AUTOmatic Enginering Units' mode
data measured in volts is scaled in relation to a transducer sensitivity factor specified in mV/EU. Acceleration , velocity and displacement transducers and conversion between those formats are supported for MEtric and English unit systems.

See also: **VOLTS, MAN EU, AUTO EU, EU UNITS**



SCROLL

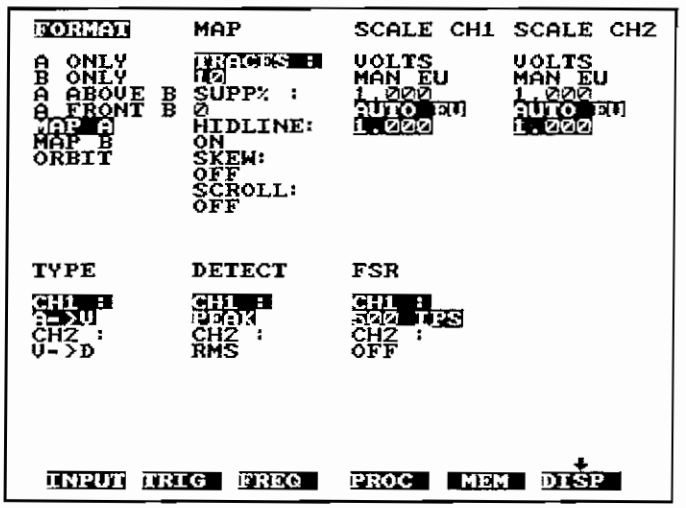
Type: Menu Item

Description: SCROLL is found in the DISPlay screen when MAP is selected and defines whether the traces of a map display are scrolled or refreshed when the specified number of traces is reached.

When SCROLL is OFF, the display will fill up to the number of traces defined in the MAP column. On receipt of the next trace, the display is cleared and the map will start to build up again from the bottom of the display.

With SCROLL on, traces scroll through display. In other words, the display will fill with the number of traces defined and then, when each new trace is received, the trace at the bottom of the screen will drop off.

See also: **MAP**



SCRN (Print Screen Contents)

Type: Softkey Prompt

Description: SCRN is an option which will appear as a softkey prompt when the HCOPY control key is pressed.

The SCReeN option specifies that only the portion of the data trace that is currently on the screen will be printed.

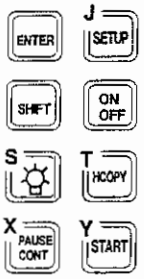
See also: **HCOPY, REC**

SETUP

Type: Control Key

Description: Pressing the SETUP key provides a series of softkey prompts which give access to each of the main setup menu screens, namely INPUT, TRIGger, FREQuency, PROCessing, MEMory and DISPlay.

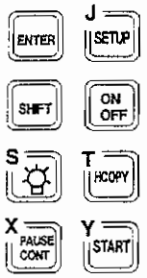
Selecting one of these options enters that screen while pressing the START key returns the analyser to the main display screen.



SHIFT

Type: Control Key

Description: The SHIFT hardkey enables alphabetic data (ie. non-numeric) to be entered. This is required when a directory name or file name is being defined for data storage. The SHIFT key operates as a shift lock ie. after pressing the SHIFT once. alpha entry will continue until SHIFT is pressed a second time.



SIDE (Positioning of Side-band Cursors)

Type: Softkey Prompt

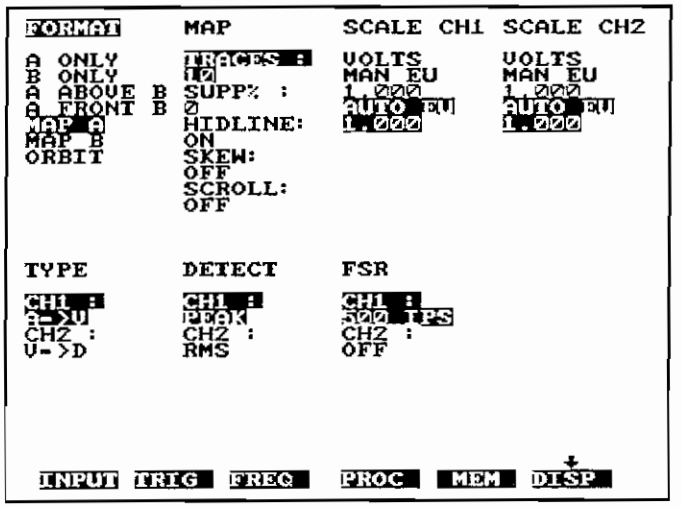
Description: The SIDE softkey cursor function enables side-band cursors to be displayed at predetermined distances from the main cursor. Side band spacing can be selected by typing the required spacing on the numeric key pad or by using the left and right cursor (arrow) keys which automatically increment the side band spacing.

Side-band cursors can be removed by setting the spacing value to zero.

SKEW

Type: Menu Item

Description: SKEW is found in the DISP (Display) screen when MAP is selected and applies to map (waterfall) displays. SKEW defines whether the map is viewed straight-on (SKEW OFF) or from an oblique angle (SKEW ON)



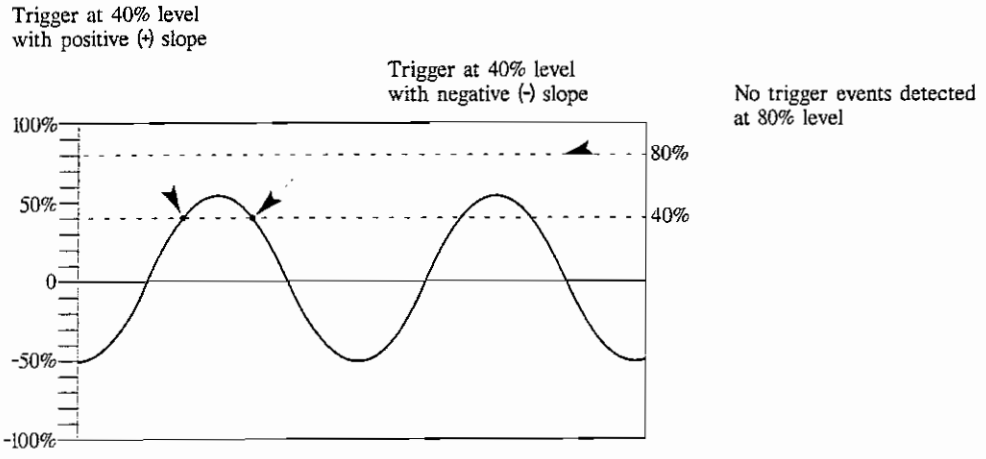
SLOPE

Type: Menu Item

Description: SLOPE is found in the TRIG (trigger) menu screen and defines the slope of the signal for a trigger to be initiated. The slope can be either positive indicated by '+' or negative indicated by '-'. The slope applies to both the EXTernal ANALoG and the CHannel triggered operation.

The example below shows the level and slope trigger points for a signal.

See also: **LEVEL**



SPEC CH1, SPEC CH2

Type: Menu Item

Description: SPEC CH1 and SPEC CH2 specify the computation and display of the spectrum for channel one and channel two respectively. The spectra can be displayed on trace A or trace B as selected in the DATA A or DATA B columns.

A variety of display formats are available for spectrum displays. The Y-axis can be displayed as linear magnitude, log magnitude (logarithmic scaling), log magnitude (dB), phase (in degrees), and real and imaginary parts. These options are selectable in the PROCessing menu. The X-axis can have linear or logarithmic scaling. Units on the x-axis can be Hertz, CPM or orders (EXT + PLL mode only).

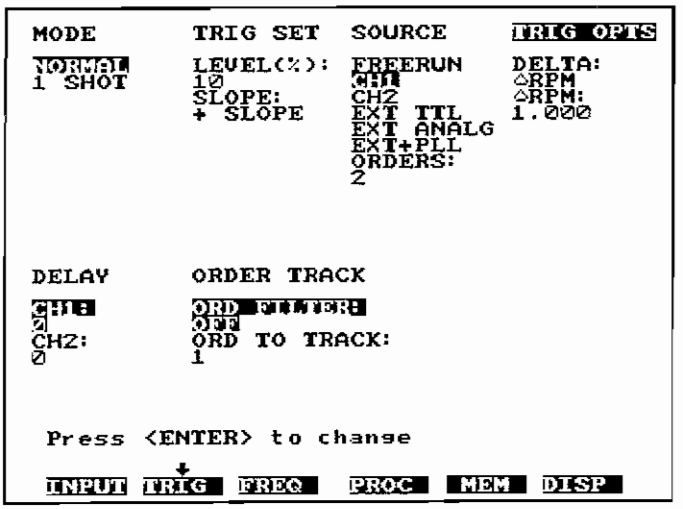
See also: **Y-AXIS A, Y-AXIS B.**

SOURCE

Type: Menu Column Heading

Description: SOURCE is found in the TRIG (trigger) menu screen and defines the source of the signal which will control data acquisition triggering. Five possible options are available namely Freerun, channel 1 (CH1), channel 2 (CH2), External TTL, External Analog and External +PLL.

See also: **CH1, CH2, EXT TTL, EXT ANALG, EXT + PLL**



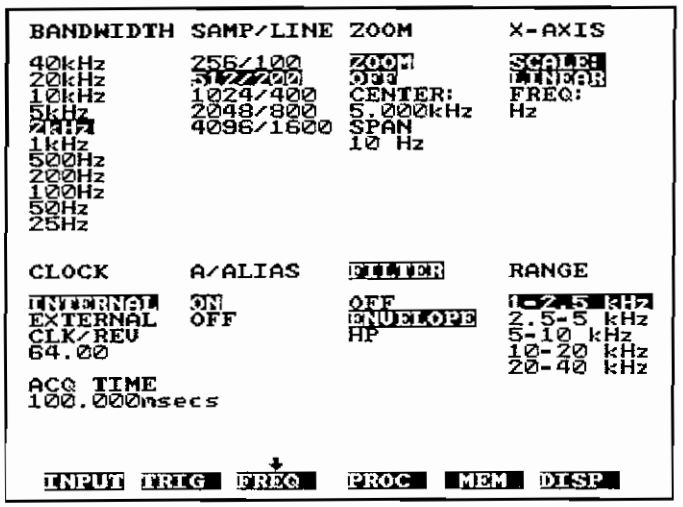
SPAN

Type: Menu Item

Description: SPAN defines the range of the ZOOM function around the centre frequency. Span ranges are predefined and are selected by pressing the ENTER key until the desired span is shown. SPAN is only valid when the ZOOM function is turned ON.

For example, a centre frequency of 5kHz with a span of 2 kHz will display a bandwidth from 4kHz to 6kHz.

See also: **ZOOM, CENTRE**

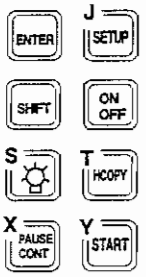


START

Type: Control Key

Description: The START hardkey returns to the main display screen and initiates data acquisition and processing. If averaging is being used, the average count is reset before acquisition is commenced.

When START is pressed during reprocessing, the analyser returns to the main display screen to display the reprocessed data. However, in this case, data acquisition is not restarted.



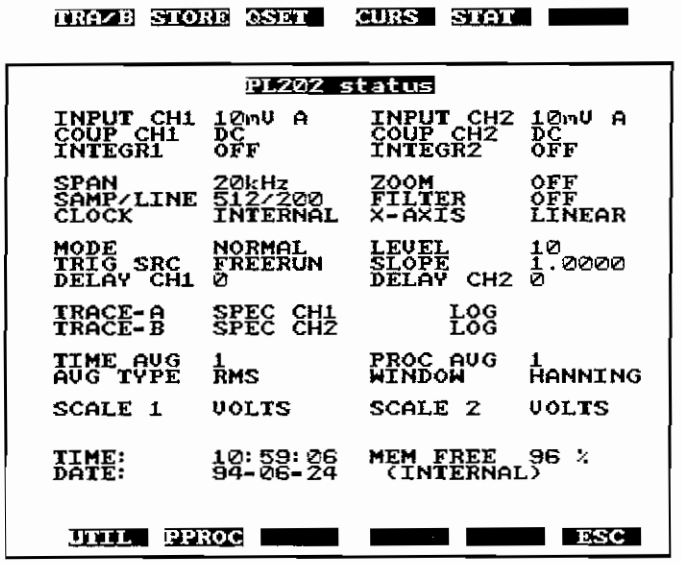
STAT (Instrument Status)

Type: Softkey Prompt

Description: Pressing the STAT softkey in the main display screen enables the status of the instrument to be shown. All setting of the instruments are displayed including time and date. One particularly useful parameter is the MEMFREE number which indicates the percentage of memory which is still available for storing of data in either internal memory or on the memory card currently selected.

Pressing the STAT softkey also provide access to the UTILities screen and the Post PRocessing menu

See also: **PPROC, UTIL**



STATE (Review screen function key)

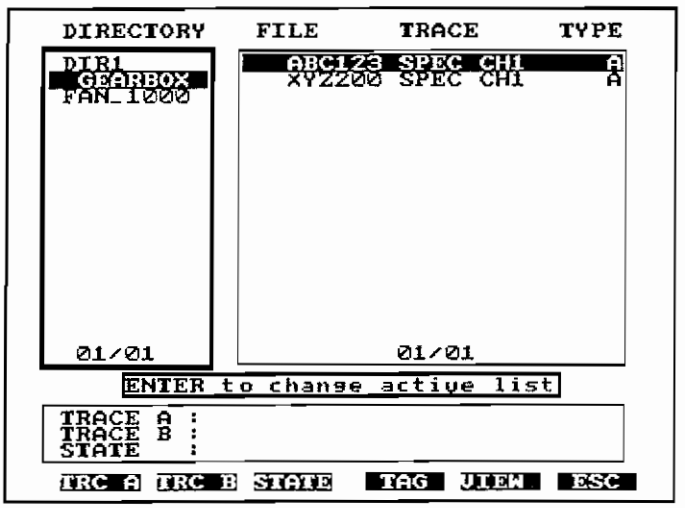
Type: Softkey prompt.

Description: The STATE softkey is displayed in the REVIEW screen. This key is used to select a memory item listed in the REVIEW screen as the state setup to be recalled.

When STATE is pressed the memory item indicated by the current positions of the cursors in the directory and file lists in the REVIEW screen is selected and its directory and file name are displayed alongside the "STATE" legend. When the VIEW softkey is pressed the memory item selected as "STATE" will be recalled as the setup state of the instrument.

NOTE that the STATE function key works as a toggle so pressing it twice will disable the STATE: selection.

See also: **REVIEW, TRC A, TRC B, VIEW**



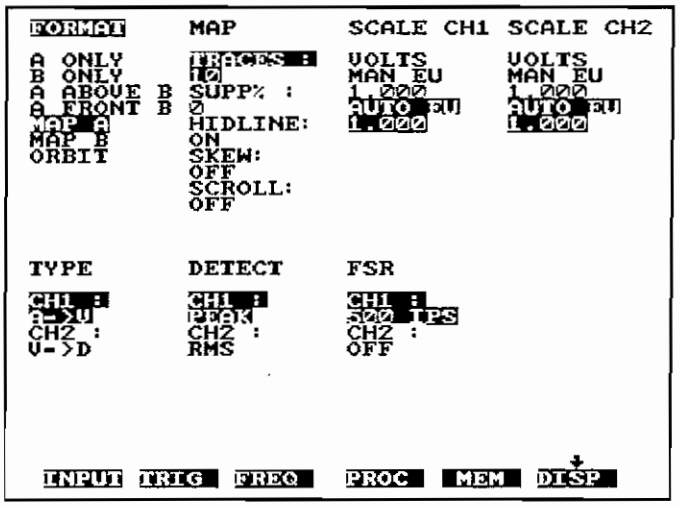
SUPP%

Type: Menu Item

Description: SUPP%, as selected in the MAP column, defines the percentage amplitude of a trace which is not displayed in the MAP or waterfall display format. For example, if SUPP% is set to 10%, the bottom 10% of the amplitude of the trace will not be displayed. This is useful when it is desired to see peaks of a particular process without low level noise detracting from the clarity of the display.

Setting SUPP% to 0 disables the suppression.

See also: **TRACES, HIDLINE**



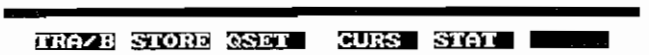
STORE

Type: Softkey Prompt.

Description: Pressing STORE in the main display screen saves the current display data and setup state to function memory. This can be either INTERNAL or MEMORY CARD as selected in the MEM screen. The action of pressing STORE is exactly the same as implementing the SAVE function in the MEM screen, except that STORE increments the FILE NAME. Data is stored in the directory and file name specified in the MEM screen. Pressing the STORE button again will increment the file name (either numerically or to the next letter of the alphabet) automatically.

When STORE is pressed, the message "SAVE in progress" is displayed followed by the directory and file name in which the data was stored. If an attempt is made to store data in a file name which already exists, the message "ENTER to overwrite" is displayed. The action of pressing any other key will abort the attempted store sequence and the message "NOT saved" will be displayed.

See also:



TAG (Review screen function)

Type: Softkey prompt

Description: The TAG softkey is displayed in the REVIEW screen. This key is used to select memory items in the current directory for subsequent functions. When pressed, TAG marks the memory item indicated by the current positions of the cursor in the directory and file lists as tagged. Tagged items are indicated by the tick character alongside their entry in the file list. TAG works as a toggle i.e. pressing TAG on already tagged items untags them. Tagging is used to select items which the DUMP, COPY, and ERASE memory items are to be carried out on.

The procedure is to enter the REVIEW screen, move to the required directory, TAG the required memory items, exit the REVIEW screen using the ESC function key, and select the appropriate memory operation.

Note that tagging only works in one directory at any one time so changing directories untags all files.

See also: **DUMP, COPY, ERASE, REVIEW**

TIME AV (time Averages)

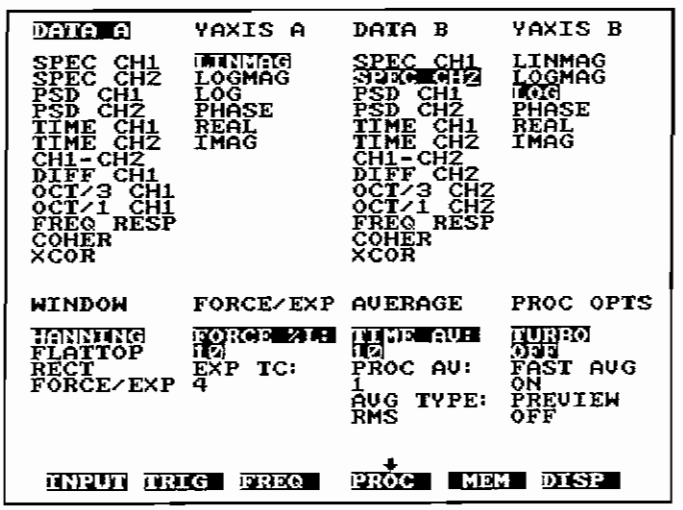
Type: Menu Item

Description: The TIME AVerages item is located in the AVERAGE column of the PROCessing menu. This defines the number of time averages that will be performed before the time averaged result is passed to the process averager. The number of time averages can range from 1 - no time averaging - to 4096.

Time averaging is an effective method of enhancing 'periodic' signal components that repeat in synchronisation with some trigger event while all other components (those that are not synchronous with the trigger), including noise. average to zero. However for time averaging to be effective a reliable trigger (either a channel trigger or an external trigger) is essential to ensure that successive frames of time data are synchronised correctly.

If no suitable trigger is available time averaging can result in meanlingless data. To avoid this the time averaging process must be disabled by setting the TIME AVerages field to '1'. This is also essential when the trigger source is set to FREERUN.

Note: In the PL302 analyser time averaging and process averaging are performed in series. As each time averaging sequence is completed (i.e. the specified number of sequential time averages has been completed) the result is included in the process average. A new time averaging sequence is then initiated and the operation is repeated until the process average count is satisfied.



TIME CH1, TIME CH2

Type: Menu Item

Description: The TIME CH1 and TIME CH2 items are located in the PROCessing menu. These allow time series data from channel 1 and channel 2 respectively to be assigned to either display trace, A or B.

When display of time series data is specified the y-axis format should be set to REAL (the default) to ensure a normal display. Note that for baseband (non-zoom) analysis the IMAGinary part of time series data is zero.

Note: The relationship between the time data sample rate and the analysis bandwidth is defined by the following relationship;

Sample rate (Hz) = Sampling Multiplier (=2.56) x Analysis Bandwidth (Hz)

See also: **PROC, DATA A, Y AXIS A**

Δ TIME

Type: Menu Item

Description: The Δ TIME item is located in the TRIGger OPTionS column of the TRIGger menu and specifies a form of data acquisition control where data frames are captured at fixed time intervals.

The time interval is set by entering a positive number (between 0.01 and 500,000 seconds) in the Δ RPM field.

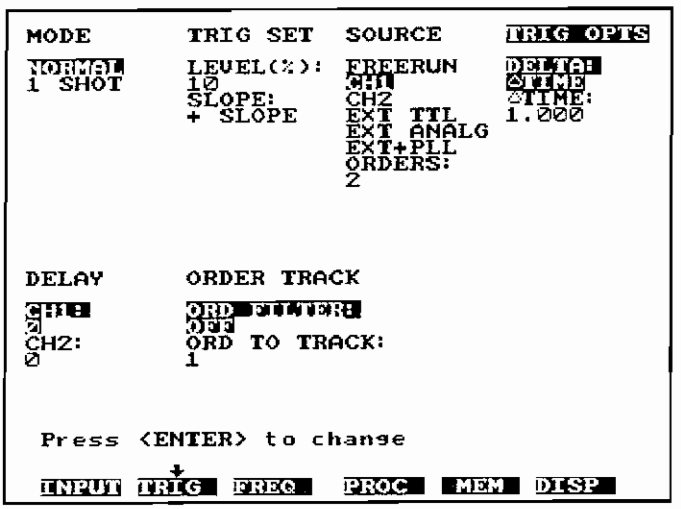
In this mode of operation data acquisition is initiated when the START hardkey is pressed. Subsequent data frames are then captured at times separated by the specified time interval.

Notes:

i. Δ TIME data capture is only valid when the trigger source in the TRIGger menu is set to FREERUN. Δ TIME data capture is not compatible with channel triggered, externally triggered or zoom data acquisition.

ii. The time trigger only rearms once acquisition and processing of each data frame has been completed. In cases where the trigger interval is set less than or equal to the acquisition/processing time some time trigger events may be missed.

See also: DELTA, TIME



TRA/B

Type: Softkey Prompt

Description: TRA/B toggles which trace is active between trace A and trace B. This function is valid in the main display screen and when cursor options are being selected.

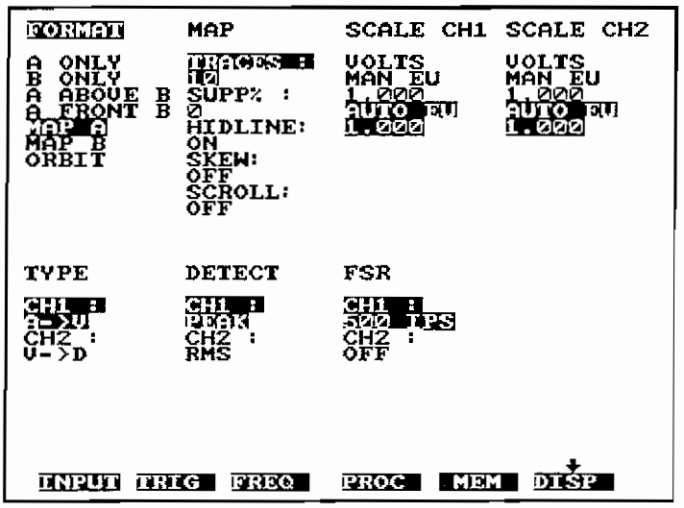
See also:

TRACES

Type: Menu Item

Description: TRACES, when selected in the MAP column, defines the number of traces shown on the MAP (or waterfall) display. The number of traces available is variable between 1 and 99. Entry is made via the numeric keypad and terminated by ENTER.

See also: **SUPP%, HIDLINE.**



TRC A, TRC B (Review screen function key)

Type: Softkey Prompt

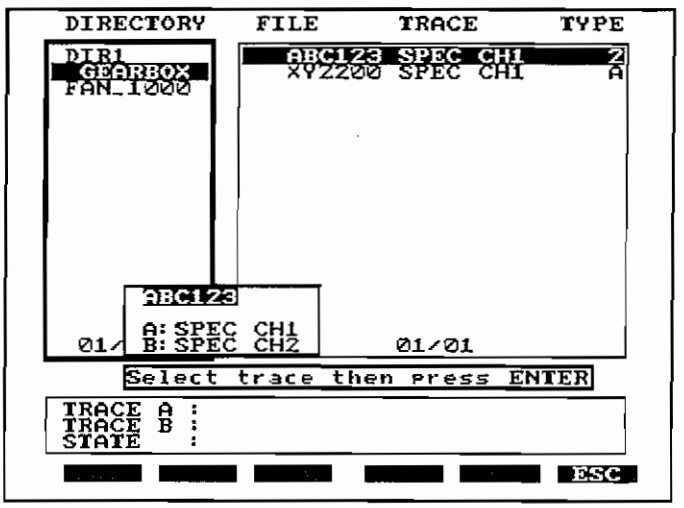
Description: The TRC A softkey is displayed in the REVIEW screen. This key is used to select a memory item listed in the REVIEW screen for recall to trace A in the main display screen.

When TRC A is pressed the memory item indicated by the current positions of the cursors in the directory and file lists in the REVIEW screen is selected and its directory and file name are displayed alongside the "TRACE A" legend.

When the VIEW function key is pressed the memory item selected as TRACE A: will be recalled to trace A. Note that the TRC A function key works as a toggle so pressing it twice will disable the TRACE A: selection.

If the current memory item has two traces stored with it, when TRC A is pressed a pop up menu appears prompting the user as to which of the two traces stored in the memory item should be selected for TRACE A: The user moves the cursor in the pop up menu to the desired trace using the up and down cursor hard key and presses ENTER to select, The ESC function key is used to abort the operation.

See also: **REVIEW, TRC B, STATE, VIW.**



TRIG OPTS (Trigger Options)

Type: Menu Column Heading

Description: The TRIGger OPTionS column is located in the TRIGger menu and provides two forms of 'delta' triggering options, namely ΔRPM and ΔTIME.

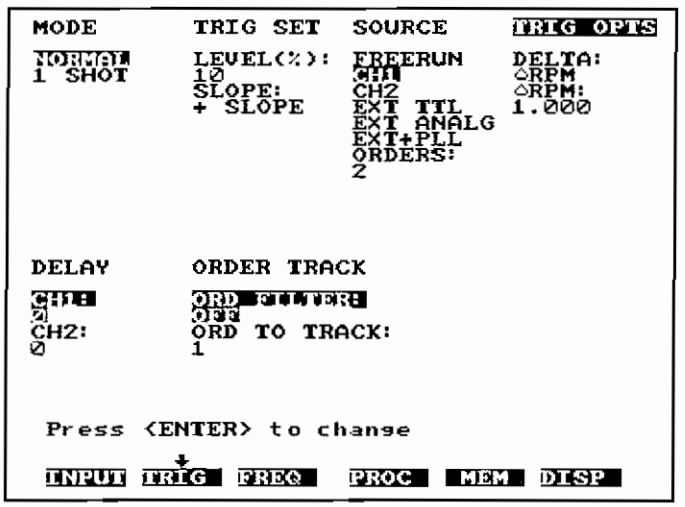
Delta triggering can be switched to OFF (default), ΔRPM or ΔTIME by pressing the ENTER hardkey with the cursor over the DELTA field.

When delta triggering options are switched OFF data acquisition control is determined by the setting in the trigger SOURCE column. Options include freerunning, channel triggered and external triggered.

When ΔRPM triggering is enabled frames of data are taken at specified speed (RPM) intervals. This mode of operation requires an external trigger signal to provide the speed information required to trigger the data acquisition.

When ΔTIME triggering is enabled frames of data are acquired at specified time intervals. This mode of operation requires that the trigger SOURCE be set to FREERUN.

See also: **DELTA, ΔRPM, ΔTIME**

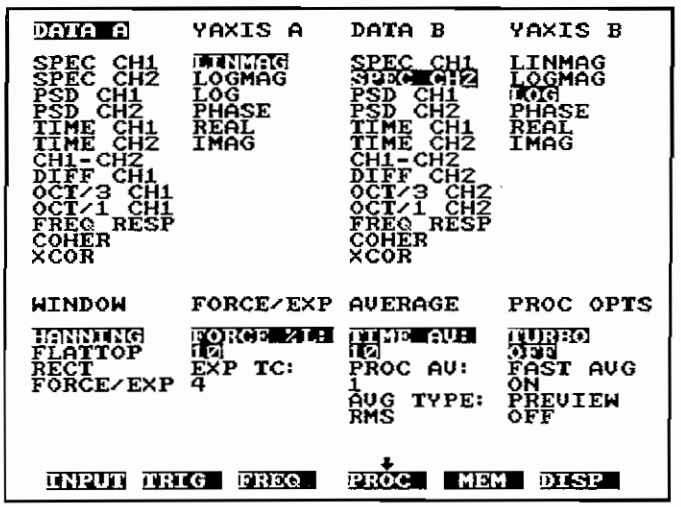


TURBO

Type: Menu Item.

Description: TURBO can be turned ON or OFF in the PROC OPTS (Process Options) column. When TURBO is ON, the interim results of any process are not stored in the instrument. This means that processes can execute faster, so that real-time rates can be improved. It is therefore possible to achieve 20kHz for a spectrum on a single channel when TURBO and fast averaging are both ON.

When TURBO is OFF , interim results are stored which means that data can be reprocessed if desired.



TYPE

Type: Menu Column Heading

Description: The TYPE column is located in the DISPlay menu. This feature is used in conjunction with AUTO EU mode to allow data to be converted from one response format to another while preserving the proper scaling with respect to the current system of engineering units, as defined in the EU UNITS field of the UTILities menu.

The combinations available are:

Setting	Input Data Format	Display Format
ACCEL	Acceleration	Acceleration
A->V	Acceleration	Velocity
A->D	Acceleration	Displacement
VEL	Velocity	Velocity
V->D	Velocity	Displacement
DISP	Displacement	Displacement.

Notes:

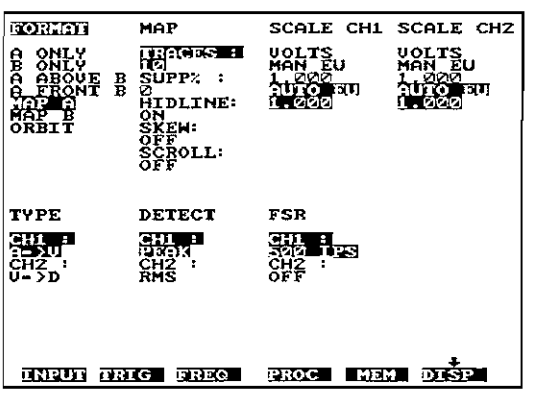
i. TYPE is only active in AUTO EU mode. When VOLTS or MAN EU modes are selected for a given channel any settings in the TYPE field are ignored.

ii. The operations performed on each channel are independent.

iii. Depending upon the conversion selected the system automatically performs the required number of integration on the incoming data signal. When this happens the number of integrations is automatically set in the INTEGR fields of the INPUT menu and the wording 'AUTO SET' is displayed below the column for the particular channel. In this case the number of integrations for that channel can not be changed manually unless the conversion TYPE is changed or AUTO EU mode is disabled.

Application: An example of the use of this feature is to convert acceleration measured in 'g' to velocity measured in 'ips' (inches per second). In this case the system of units in the UTILitites menu must be set to ENGLISH. The scaling mode for the particular channel must then be set to AUTO EU and the transducer sensitivity factor must be set in 'mV/g'. Finally the TYPE field is set to A->V to produce the required display format and scaling. Note that in this case the item in the INTEGR column of the INPUT menu is set to ONCE and the words AUTO SET appear.

See also: **AUTO EU, DETECT, INTEGR 1**



UTIL (Utilities)

Type: Softkey Prompt

Description: The UTIL (utilities) softkey function is available after pressing the STAT softkey in the main display screen. UTIL enables the system parameters of the instrument to be set up. These are: time and date, RS232 settings. display settings, auto scale on or off. engineering units to be metric or English. timeout on or off, the format for hard copy printout, and certain Offsets.

Time and date are set using the numeric key pad. Note that time is according to a 24- hour clock. For exact synchronisation, time starts to increment when the ESC softkey is pressed.

RS232 settings are selected using the ENTER key. Baud rates from 1200 up to 38400 are available. Parity can be set to odd, even or none; data bits can be seven or eight ; stop bits can be one or two.

FILL can be turned ON or OFF in the DISPLAY column by using the ENTER key. When FILL is ON, vertical lines are drawn for each data point. effectively "filling" the area of the plot between the zero or base-line and the data. When FILL is OFF, consecutive data points are joined together with straight lines.

Display grids are turned ON or OFF via the GRID parameter in the DISPLAY column. Grids will be either linear or logarithmic depending on y-axis selections made in the PROC menu screen and X-axis selection made in the FREQ screen.

The screen can be changed from Black on White to White on Black using the VIDEO selection.

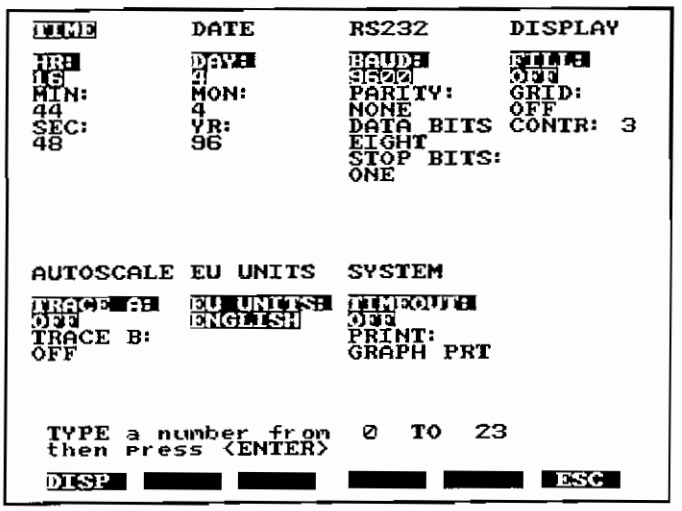
Screen contrast is adjusted via the CONTR parameter in the DISPLAY column. Contrast is changed by pressing the ENTER key to select the desired contract in the range 0 to 7 (7 being the darkest.) AUTOSCALE can be turned ON or OFF using the ENTER key. With this function ON, a signal display is adjusted in signal amplitude and Y-axis scaling for optimum viewing.This is a display function only and carries out no mathematical adjustment of data. AUTOSCALE can be applied to trace A and trace B independently .

ENGLISH or METRIC engineering units can be selected in the EU UNITS column.

To preserve battery life, the instrument has a TIMEOUT function which will power down the instrument after a predetermined time if no key has been pressed. This function can be turned ON or OFF in the TIMEOUT parameter in the SYSTEM column. With TIMEOUT switched ON, the instrument will switch itself off 2 minutes after power-up if no key has been pressed ie. it is assumed that the ON/OFF key was pressed inadvertently. The instrument will switch off after 10 minutes after the last key press (which was not the ON/OFF key). Care should be taken when operating with TIMEOUT switched OFF as, if the instrument is left on inadvertently, it will run until the battery has completely discharged. The instrument will then switch off automatically to protect the battery.

The format of the hard copy (HCOPY) printer output is set via the PRINT parameter in the SYSTEM column. Pressing the ENTER key will select between either LASER PRT (Laser printer format), GRAPH PRT (Epson or compatible graphics printer) or PLOT (HPLG Plotter format).

See also: **HCOPY, SCRN, REC, OFFSETS , VIDEO**



VIEW (Review Screen function key)

Type: Softkey Prompt

Description: The VIEW softkey is displayed in the REVIEW screen. This key is used to recall memory items selected in the REVIEW screen.

If any or all of TRACE A, TRACE B or STATE selections displayed in the REVIEW screen have been set up. then these determine what is recalled e.g.

TRACE A: DIR1/FILE0001.TRA
TRACE B: DIR2/FILE0002.TRB
STATE:

Here when VIEW is pressed

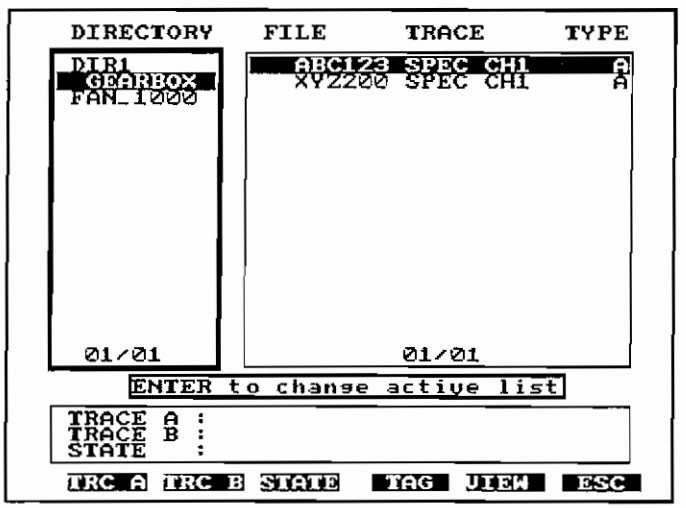
DIR1/FILE0001.TRA is recalled to trace A and
DIR2/FILE0002.TRA is recalled to trace B.

No state is recalled.

TRACE A:
TRACE B:
STATE: DIR3/FILE0004.STA

Here when view is pressed no traces are recalled. Setup state DIR3/FILE0004.STA is recalled. If none of the TRACE A, TRACE B, or STATE selections have been made ie. all the entries alongside these legends are blank, then the memory item indicated by the current positions of the cursors in the directory and file lists is recalled. In this case all of the traces and the state for this item are recalled.

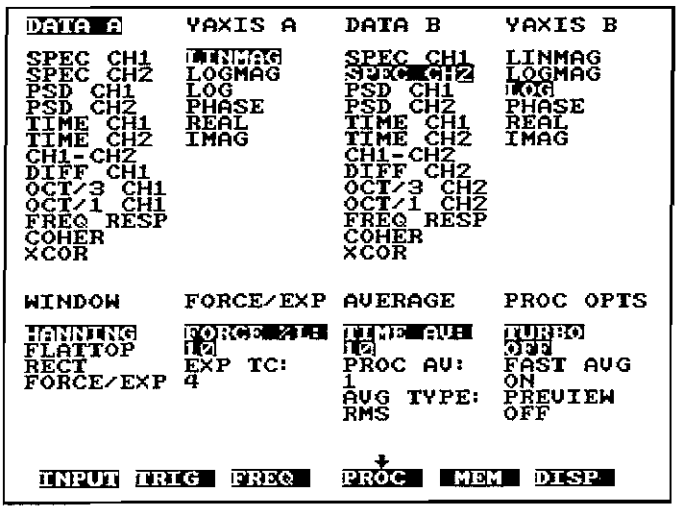
See also: **REVIEW, TRC A, TRC B, STATE.**



WINDOW

Type: Menu Column Heading

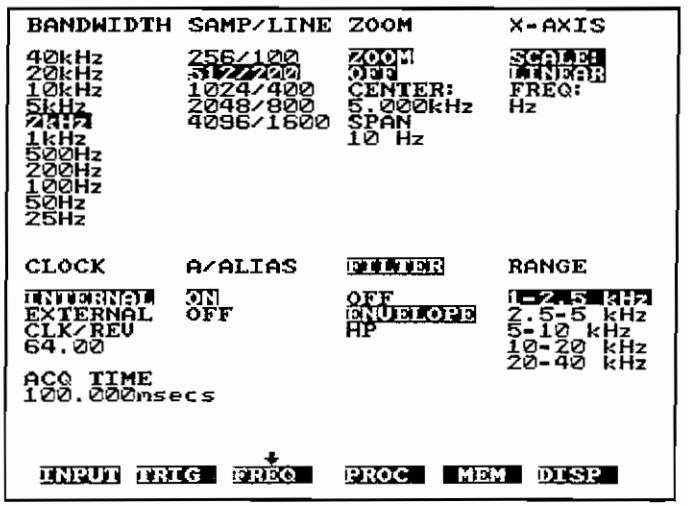
Description: The WINDOW selection in the PROC (Process) menu screen sets the window weighting function applied to the incoming data in non time domain processes. The options are HANNING, FLAT TOP, RECT (Rectangular) and FORCE/EXP (Force/Exponential). The window selected is applied to both Trace A and Trace B processes.



X-AXIS

Type: Menu Column Heading

Description: X-AXIS is found in the FREQ (Frequency) menu screen. The options in this column are linear or log and enable linear or logarithmic x-axis display to be selected. When using the log x-axis display, it is suggested that grids are turned on to enable better viewing of the non-linear axis.

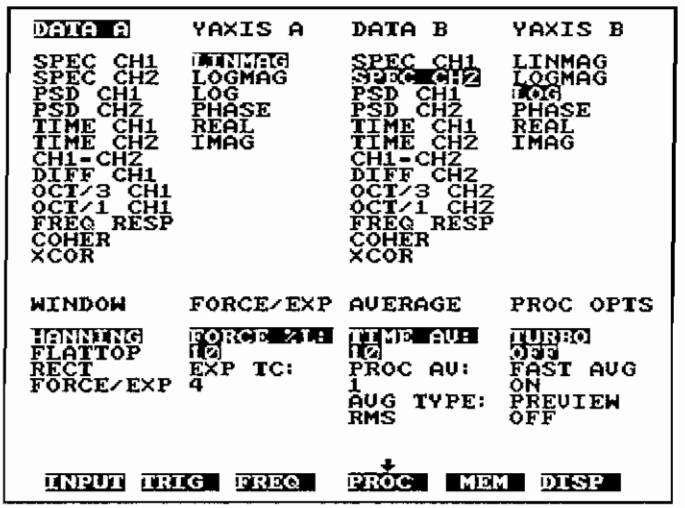


XCOR (Cross correlation)

Type: Menu Item

Description: XCOR is the cross correlation process of input data from channel 1 and channel 2. Its output gives units proportional to input squared in the vertical axis and time in the horizontal axis.

In keeping with recognised cross correlation techniques, both negative and positive time results are displayed by this process. This ensures that meaningful results can be obtained regardless of which signal is applied to which channel. If the input signals are swapped between channel 1 and channel 2, then the results of the cross correlation will be mirrored about the zero time axis.

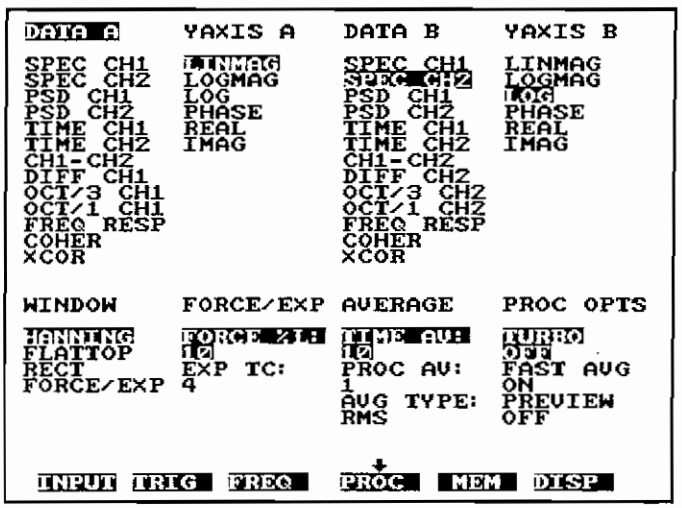


Y AXIS A, Y AXIS B

Type: Menu Column Heading

Description: Y AXIS A (or Y AXIS B) and the PROC (Process) menu screen selects the type of Y-Axis scaling for Trace A (or B). The options are Linear or logarithmic amplitude, real or imaginary parts, or the phase output (in degrees) of the process selected.

See also: **DATA A, DATA B**



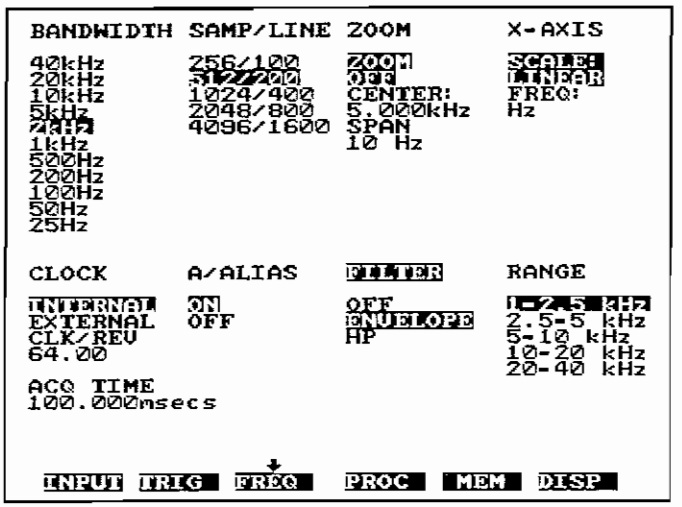
ZOOM

Type: Menu Column Heading

Description: ZOOM is found in the FREQuency menu. ZOOM enables more detailed examination of process domain displays to be carried out.

ZOOM can be turned ON or OFF. When ZOOM is off, the base band spectral range is defined in the bandwidth column. When ZOOM is on, the displayed section of the spectrum is defined by a centre frequency and a span around that centre frequency. Centre frequency and span are defined in the same ZOOM column. Any centre frequency can be selected by typing in the desired frequency using the numeric keypad. Span ranges are pre-set and are selected by incrementing through the possible ranges by pressing the ENTER key. The equivalent zoom magnification available is up to x80.

See also: **CENTRE, SPAN.**



A.1. ADVISORY MESSAGES

The format of message description in this Appendix is:

"Message text as it appears in the unit."
Screen message appears in or action being carried out which causes message to appear.
Description of what message means.
Error. if any indicated by message.

%d = decimal value
%x = hexadecimal value (4 chars)
%lx = hexadecimal value (8 chars)

A.2. OPERATIONAL ADVISORY MESSAGES

"Enter <1> to accept, <0> to reject"
In PREVIEW mode.
Prompts user to accept or reject acquired data.

"Transfer in progress"
When data sent ot RS232.
Inform user that data transfer is taking place.

"Press [ENTER] to Preset Other key to abort"
PRESET.
Promtp user for ENTER key to PRESET. ANY other key aborts.

"Must choose OCTAVE processes on both traces Press key to continue"
User info message

"Select Zoom Range with Centre + Span\2 <= 10kHz Press key to continue"
User info message

"OCTAVE processes - use bandwidth 5kHz, 10kHz or 20kHz Note available with ZOOM Press key to continue"
User info message

"XCOR process not available with ZOOM Press key to continue"
User info message

"PLL & \x096RPM not available with Zoom Press key to continue"
User info message

"Peak hold not available with \n FREQ RESP. COHER and XCORR processes\n Press key to continue"

User info message

A.3. MEMORY STORAGE ADVISORY MESSAGES

"Reading files. Please wait"

REVIEW Screen.
Always displayed when entering REVIEW.

"No files"

REVIEW Screen.
Indicates no files stored in current directory.

"No stored data - Press any key"

REVIEW Screen
No directories or files exist in memory device.

"DIRECTORY ERROR: directory full press kry to continue"

Storing record in memory.
If ROOT then root directory full, otherwise memory full and cannot allocate space for new directory entries.

"device not formatted. Press key to continue"

Accessing memory.
Mem device not formatted.
Memory device error.

"Card not present. Press key to continue"

Accesing memory.
No memory card found.
Memory device error.

"filename exists! ENTER to overwrite, other to abort"

Storing record.
File with this name already exists.

"SAVE in progress"

Storing record.
Save being carried out.

"RECALL in progess"
Recalling record.
Recall being carried out.

"dir\filename NOT found"
Accessing record.
COPY\ERASE\DUMP.

"Transfer aborted"
DUMPing record.
DUMP aborted.

"dir\filename copied"
COPYing record.
COPY carried out.

"dir\filename erased"
ERASing record.
ERASE carried out.

"TESTING CARD"
Testing RAM card.
Memory test on RMA card being carried out.

"CARD SIZE n kbytes"
Testing RAM card.
Size of RAM card found by test.

"ERROR: memory full. Press key to continue"
Storing record.
Store not carried out, Memory device full.

"Erase in progress..."
ERASE
ERASE being carried out.

"Transfer in progress..."
DUMP.
DUMP being carried out.

"Copy in progress..."
COPY.
COPY being carried out.

A.4. APPLICATION LOADER ADVISORY MESSAGES

"Starting RS232 loader"
"Loading Application from RS232"
"nnn kbytes remaining"
Loading sequence from RS232
Advisory message sequence to user
No error found

"BIN loader error n - Hit any key"
Error message while loading application
Valid error values of n:
1: RS232 error loading application header
2: RS232 error loading application area
3: Checksum error within application
4: Error in application format

"Card Detected"
Loader checks for card present
Card is detected but no application found

"Checksum Error on Application Card"
Loader checks application on card. if present
Application has been detected, but is corrupted.

"Application Detect on Card"
"Name: APPLICATION"
"Press 1 to load new application
2 to continue"
Loading sequence from application card.
Advisory message sequence to user
No error found

"Loading Application from Card"
"Name: APPLICATION"
Loading application from card.
Message appears when key is pressed to load application

"Corrupt Application Detected"
"No Firmware detected in memory"
"Switch off unit"
"Then insert Application Card"

Attempt to find and run non-exitent or corrupt application
Advisory message to user to load application. The leader will not attempt to run a non-existent or corrupt application.

A.5 SELF-TEST WARNING MESSAGES

"page %d %1x r %1x"

Power up tests.
DSP RAM test failed. Gives address and data where test failed.
Hardware error.

"KEY_DOWN. Code = %d"

Power up tests
When waiting for ENTER to continue, if other keys are pressed this message displays code for key currently held down.
No error.

"ROM CHECKSUM ERROR"

Power up tests
ROM test failed
Hardware error

"ROM TEST OK"

Power up tests
ROM test passed

"SYSTEM RAM ERROR"

Power up tests
RAM test failed
Hardware error

"SYSTEM RAM TEST OK"

Power up tests
RAM test passed.

"LCD CONTROLLER ERROR"
Power up tests
LCD controller test failed
Hardware error

"NO DSP BUS GRANT"
Full power up tests.
Bus nott granted by DSP.
Hardware error.

"DSP RAM ERROR"
Full power up tests.
DSP RAM failed.
Hardware error.

"DSP RAM TEST OK"
Full power up tests.
DSP RAM test passed.

"ANALOGUE BOARD ERROR 1"
Full power up tests.
Analogue board test 1 passed. This tests 82C54 counter.
Harware error.

"ANALOGUE BOARD TEST 1 OK"
Full power up tests.
Analogue board test 1 passed. This tests 82C54 counter.

"ANALOGUE BOARD ERROR 2"
Full power up tests.
Analogue board test 2 failed. This test is commented out in V1.11 so should never fail.

"ANALOGUE BOARD TEST 2 OK", 1,6):
Full power up tests.
Analogue board test 2 failed. This test is commented out in V1.11 so should never fail.

"DSP BOARD ERROR"
Full power up tests.
DSP run test failed. This test is commented out in V1.11 so should never fail.

"DSP BOARD TEST OK"
Full power up tests.
DSP run test passed. This test is commented out in V1.11 so should never fail.

"Press [ENTER] to continue..."
Full power up tests or power up if a test fails.
Waits for ENTER key to be pressed.

A.6. MEMORY STORAGE WARNING MESSAGES

"Warning: Record stored under different software version"
Recalling stored record.
All stored records have version string tuple. Stored version number does not agree with current version number.
No error. Tuple warning.

"Stored under version %s"
Recalling stored record.
All stored records have version string tuple. Displays this version number.
No error. Tuple information, not normally displayed.

"Checksum error in filename.ext press key"
Recalling stored record.
All stored records have checksum tuple. Does not agree with calculated checksum.
Data corruption error.

"data checksum error - press key"
Recalling stored record.
All stored records have checksum tuple. Does not agree with calculated checksum.
Data corruption error.

"INTERNAL ERROR: no checksum to create"
Storing record.
All records should be stored with a checksum tuple. This has not been created for this record.
Software error.

"NULL source - ignoring data"
Storing record.
Attempting to create a non menu tuple with NULL pointer.
Software error.

"Making non menu tuple"
Storing record.
Creating a non menu tuple.
No error. Tuple info. Not normally displayed.

"Unknown Non-Menu item"

Attempting to create a menu tuple with an unknown type.
Software error.

"Unknown menu type"

Storing record.
Attempting to create a menu tuple with an unknown menu type.
Software error.

"ERROR: filename.ext in wrong format \npress key"

Recalling record.
All records should be stored with a checksum tuple. This has not been found for this record.
Software error.

"ERROR: data in wrong format - press key"

Recalling record.
All records should be stored with a checksum tuple. This has not been found for this record.
Software error.

"Loading Tuple n"

Recalling stored data.
Loading tuple.
No error. Tuple info. Not normally displayed.

"NULL test. ignoring data"

Recalling record.
Attempting to create a non menu tuple with NULL pointer.
Software error.

"Loading Non Menu type n"

Recalling stored record.
Loading a non menu tuple.
No error. Tuple info. Not normally displayed.

"Unknown Non-Menu type"

Recalling record.
Attempting to load a non menu tuple with an unknown type.
Software error.

"Tuple n unknown"

Recalling record.
Attempting to load a non and unknown tuple.
Software error.

"No end type found"

Recalling record.
All records should be terminated with end tuple. This has not been found.
Software error.

"mem device ERROR: clust %d out of range press key to continue, ENTER to reset."

Accessing memory.
Cluster number out of range.
Data corruption error.

"INTERNAL DISK not formatted\nPress 1 to attempt repair, 2 to reset, \nother to continue."

Accessing memory.
Memory device not formatted.
Memory deivce error.

"DMA channel 0 Interrupt"

Invalid DMA interrupt.
Software error.

"NO CARD FITTED"

Testing RAM card.
Memory test in RAM card failed.
Mem device error.

"DMA channel 1 Interrupt"

Invalid DMA interrupt.
Software error.

"H/W Interrupt 1"

Invalid DSP interrupt.
Software error.

"H/W Interrupt 3"

Invalid RS232 interrupt.
Sofware error.

"Timer 2 Spurious Interrupt"
Invalid Timer 2 interrupt"
Software error.

All messages here are generated by invalid interrupts or error interrrupt traps. Thses are all caused by software errors.

"Spurious Interrupt Exception"
"PANIC: Divide by Zero Trapped"
"Single Step"
"Non-Maskable Interrupt Trapped":
"Breakpoint Interrupt":
"Overflow Interrupt":
"Array Bond Interrupt":
"Illegal Op-Code $%x":

"Cannot figure SPACE out!"
Programming DSP.
DSP code structure in invalid.
Software error.

"1 0x%1x-0x%1x be 0x%1x\n"
Programming DSP.
Code written to DSP does not verify.
Hardware error.

"Limits Exceeded. Press any key"
Entering numeric fileds in menus.
Value entered exceeds range.

"mlist_proc (): Error"
In menus.
Menu structure invalid.
Software error.