FLUKE®
Calibration

9500B

High Performance Oscilloscope Calibrator

Users Guide

November 2019

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Introduction

The Model 9500B is a state-of-the-art calibrator offering oscilloscope test and calibration capabilities from a single source, providing wide functionality (shown in Figure 1). (Variant 9500B/1100 is described—for other variants, refer to the *9500B Extended Specifations*. See *Specifications*.)

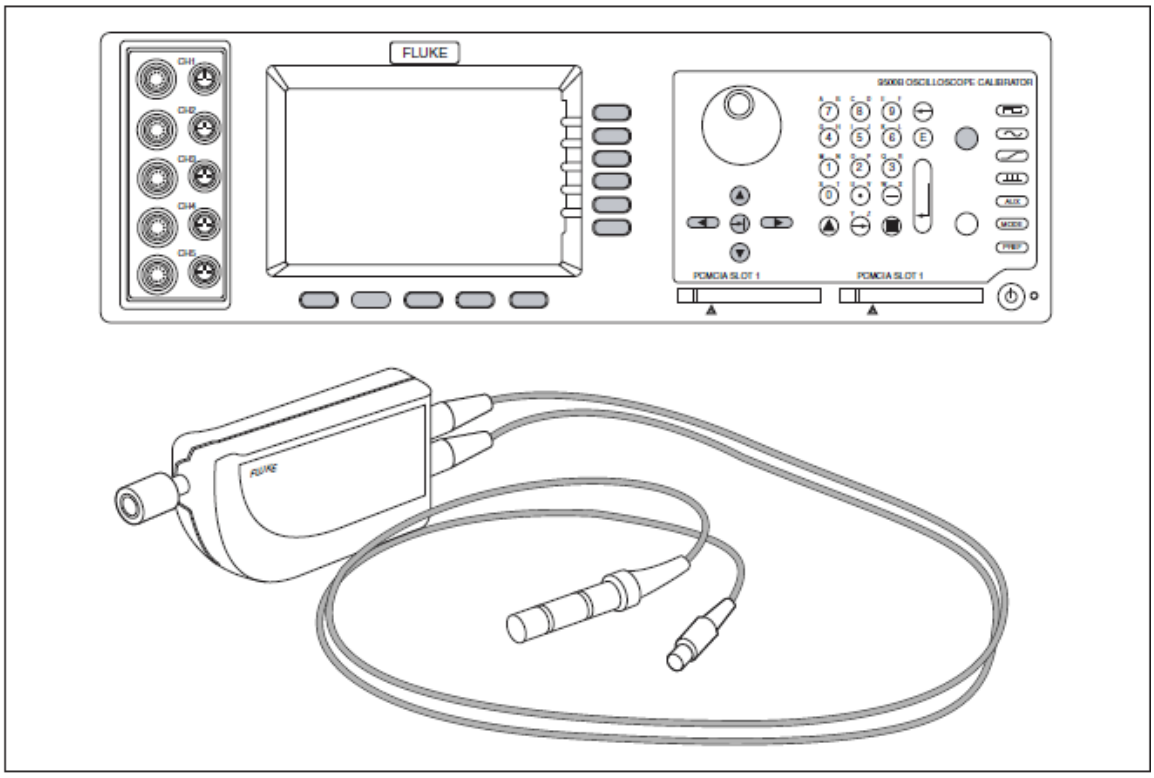


Figure 1. General View of Model 9500B with an Active Head

This sections introduces the Model 9500B High Performance Oscilloscope Calibrator. The following topics are covered:

- Functions
- Operating Modes
- System Operation
- Associated Products and Options

Functions

The functions listed below are not necessarily available via every model of Active Head.

- DC Function:

Output Voltage:	(into 50 Ω):	±(888 V to 5.56 V)
Output Voltage:	(into 1 MΩ):	±(888 µV to 222.4 V)

- Square Function:

Frequencies:	10 Hz to 100 kHz	
Output Voltage:	(pk-pk into 50 Ω):	35.52 µ V to 5.56 V
Output Voltage:	(pk-pk into 1 MΩ Load):	35.52 µ V to 222.4 V

- Sine Function (Variant 9500B/1100 quoted below); (see *Specifications*):

Frequencies:	100 mHz to 550 MHz	
Output Voltage:	(pk-pk into 50 Ω and 1 M Ω):	4.44 mV to 5.56 V
Frequencies:	550 MHz to 1.1 GHz	
Output Voltage:	(pk-pk into 50 Ω and 1 M):	4.44 mV to 3.35 V

Dual Channel

- Edge Function: Selectable Rising/Falling Edge

Low Edge:	500 ps: Active Head Model 9510 or 9530	
Periods:	500 ns to 100 ms	
Output Voltage:	(pk-pk into 50 Ω and 1 M Ω):	4.44 mV to 3.1 V
High Edge:	100 ns: Active Head Model 9510 or 9530	
Periods:	10 µ s to 100 ms	
Output Voltage:	(pk-pk into 50 Ω):	888 mV to 5.56 V
	(pk-pk into 1 MΩ):	888 mV to 222.4 V
Fast Edge:	150 ps: Active Head Model or 9530	
Periods:	500 ns to 100 ms	
Output Voltage:	(pk-pk into 50 Ω and 1 MΩ):	4.44 mV to 3.1 V

- Time Markers Function (Output Voltage pk-pk into 50 Ω and 1 M)

  Square/Sine Waveforms (Variant 9500B/1100 quoted below)

  (see *Specifications*):

Squarewave Periods:	9.0091 ns to 55 s	(111 MHz to 18.181 mHz)
(Highlighted style):	20 ns to 55 s	(50 MHz to 18.181 mHz)
Output Voltage:	100 mV to 1.0 V	
Sinewave Periods:	450.5 ps to 9.009 ns	(2.22 GHz to 111 MHz)
Output Voltage:	100 mV to 500 mV	
Sinewave Periods:	909.1 ps to 9.009 ns	(1.1 GHz to 111 MHz)
Output Voltage:	1.0 V	

  Pulse and Triangle Waveforms:

Periods:	900.91 ns to 55 s	(1.11 MHz to 18.181 mHz)
(Highlighted style):	20 ns to 55 s	(50 MHz to 18.181 mHz)
Output Voltage:	100 mV to 1.0 V	

- Pulse Width Function:

Amplitude:	1 Vpk-pk into 50 W
Pulse Width:	1 ns to 100 ns
Rise/Fall Time:	<500 ps
Frequency:	1 kHz to 1 MHz

- Current Function:

  DC:

Output Current:	±(88.8 μA to 111.2 mA)

  Square:

Frequencies:	10Hz to 100kHz
Output Current:	88.8 μA pk-pk to 111.2 mA pk-pk

- Composite Video Function:

Polarity:	Positive and Negative sync
Patterns:	Full Raster Selectable: White, Mid Grey or Black
Amplitude Levels p-p:	White: 1 V, mid-grey: 0.7 V, black: 0.3 V. No deviation
Frame Standards:	625 lines/50 Hz, 525 lines/60 Hz
Trigger:	Calibrator trigger output selectable to Odd Field Start, or Composite Sync

- Linear Ramp Function:

Period:	3 s, 300 ms, 30 ms, 3 ms
Ramps:	Equal Rise, Fall and Flat divisions per cycle
Amplitude:	1 V pk-pk
Bias:	Symmetrical about ground
Trigger Alignment:	Start of rising or falling ramp

- Overload Pulse Function:

Pulse Amplitude:	5.0 V to 20.0 V (0.1 V resolution)
Pulse Energy:	1.6 J to 50.0 J (0.1 J resolution)
Polarity:	Positive or negative from ground
Pulse Duration:	At 20 V: 200 ms to 6.25 s; at 5 V: 3.2 s to 100 s (Internally calculated from Amplitude and Energy)
Power into 50 Ω:	0.5 W to 8 W (Internally calculated from Amplitude)
Repetition Rate:	Single manually-triggered event, max repetition rate 0.3 Hz.
UUT Scope Trigger:	With energy pulse, or Auto trigger at 100 Hz

- Zero Skew Function:

Frequencies:	10 Hz to 100 MHz.
Default Alignment:	9500B output channel skew = ≤50 ps
Align 9500B Channel Output Timing:	Using a single oscilloscope channel
Measure UUT Scope Channel Skew:	Using aligned 9500B channels

- Auxiliary Input:

Signal Path:	Automated, passive, relay-switched routing of user's external calibration waveforms to any Active Head's BNC connector via the output multiplexer
Impedance:	Input and Output: 50 Ω
3 dB Bandwidth:	Approx. 400 MHz
Trigger:	No trigger pickoff provided, internal trigger not available

- Load Resistance and Capacitance Measurement:

Resistance Range:	
Input:	10 kΩ to 20 MΩ
Termination:	10 Ω to 150 Ω
Capacitance:	
Range:	1 pF to 120 pF

- Reference Frequency Input:

Frequency Range:	1 MHz to 20 MHz in 1 MHz integer steps
Amplitude Range:	70 mV pk-pk to 1 V pk-pk

- Reference Frequency Output:

Frequency Range:	1 MHz or 10 MHz
Level into 50 Ω:	>1.15 V
Level into 1 MΩ:	>2.3 V

- Input Leakage Function

Short/Open Circuit Outputs:	Allows testing of UUT oscilloscope input leakage current.
UUT Scope Trigger:	Auto trigger at 100 Hz

Contact Fluke Calibration

To contact Fluke Calibration, call one of the following telephone numbers:

- Technical Support USA: 1-877-355-3225
- Calibration/Repair USA: 1-877-355-3225
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31-40-2675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- China: +86-400-810-3435
- Brazil: +55-11-3759-7600
- Anywhere in the world: +1-425-446-6110

To see product information and download the latest manual supplements, visit Fluke Calibration's website at www.flukecal.com.

To register your product, visit http://flukecal.com/register-product.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

General Safety Information is located in the printed Safety Information document that ships with the Product. It can also be found online at www.flukecal.com. More specific safety information is listed where applicable.

Safety Issues

Read this entire section thoroughly before attempting to install, operate or service the model 9500B.

General Safety Summary

This instrument has been designed and tested in accordance with IEC/EN 61010-1, and has been supplied in a safe condition.

This manual contains information and warnings that must be observed to keep the instrument in a safe condition and ensure safe operation. Operation or service in conditions or in a manner other than specified could compromise safety. For the correct and safe use of this instrument, operating and service personnel must follow generally accepted safety procedures, in addition to the safety precautions specified.

To avoid injury or fire hazard, do not switch on the instrument if it is damaged or suspected to be faulty. Do not use the instrument in damp, wet, condensing, dusty, or explosive gas environments.

Whenever it is likely that safety protection has been impaired, make the instrument inoperative and secure it against any unintended operation. Inform qualified maintenance or repair personnel. Safety protection is likely to be impaired if, for example, the instrument shows visible damage, or fails to operate normally.

⚠⚠ Warning

This instrument can deliver a lethal electric shock. Never touch any lead or terminal unless you are absolutely certain that no dangerous voltage is present.

Protective Earth (Ground)

Protection Class I:

The instrument must be operated with a Protective Earth/Ground connected via the power cable's protective earth/ground conductor. The Protective Earth/Ground connects to the instrument before the line and neutral connections when the supply plug is inserted into the power socket on the back of the instrument.

⚠⚠ Warning

Any interruption of the protective ground conductor inside or outside the instrument is likely to make the instrument dangerous.

To avoid electric shock hazard, make signal connections to the instrument after making the protective ground connection. Remove signal connections before removing the protective ground connection, i.e. the power cable must be connected whenever signal leads are connected.

Do Not Operate Without Covers

⚠⚠ Warning

Removing the covers may expose voltages in excess of 1.5 kV peak (more under fault conditions).

To avoid electric shock or fire hazard, do not operate the instrument with its covers removed. The covers protect users from live parts, and unless otherwise stated, must only be removed by qualified service personnel for maintenance and repair purposes.

Safe Operating Conditions

Only operate the instrument within the manufacturer's specified operating conditions. Specification examples that must be considered include:

- Ambient temperature
- Ambient humidity
- Power supply voltage and frequency
- Maximum terminal voltages or currents
- Altitude
- Ambient pollution level
- Exposure to shock and vibration

⚠⚠ Warning

To avoid electric shock or fire hazard, do not apply to or subject the instrument to any condition that is outside specified range. See *9500B Extended Specifications* available at http://www.flukecalibration.com for detailed instrument specifications and the remainder of this manual for operating instructions.

⚠ Caution

Consider direct sunlight, radiators and other heat sources when assessing ambient temperature.

⚠ Caution

Before connecting the instrument to the supply, make sure that the rear panel ac supply voltage connector is set to the correct voltage and that the correct fuses are fitted.

The Power Cable and Power Supply Disconnection

The intended power supply disconnect device is the ON/OFF switch that is located on the instrument's rear panel. The ON/OFF switch must be readily accessible while the instrument is operating. If this operating condition cannot be met, the power cable plug or other power disconnecting device must be readily accessible to the operator.

⚠⚠ Warning

To avoid electric shock and fire hazard, make sure that the power cable is not damaged, and that it is adequately rated against power supply network fusing. If the power cable plug is to be the accessible disconnect device, the power cable must not be longer than 3 meters.

Power Input and Fuse Requirements

⚠ Warning

To avoid fire hazard, use only the fuse arrangements that appear in the fuse specification table below. Additionally, the supply network must be over-current protected at a maximum of 20 A, and in the UK, a 10 A fuse must be fitted in the power cable plug. See *Preparation for Operation* for details of setting line input voltage and changing the line input fuse.

⚠⚠ Warning

Measurement and/or guard terminals are designed for connection at Installation (Overvoltage) Category I. To avoid electric shock or fire hazard, the instrument terminals must not be directly connected to the AC line power supply, or to any other voltage or current source that may (even temporarily) exceed the instrument's peak ratings.

⚠⚠ Warning

To avoid injury or death, do not connect or disconnect signal leads while they are connected to a hazardous voltage or current source. Make sure that all leads are in a safe condition before you handle them in any way.

Make sure that the instrument is correctly protectively earthed (safety grounded) via the power cable before and while any other connection is made.

Power Input Fuse

Line Voltage Selection	Line Voltage	FUSE 5 x 20 mm
100 V	95 V – 115 V	T10.0AH 250 V
120 V	115 V – 132 V	T10.0AH 250 V
220 V	209 V - 230 V	T5.0AH 250 V
240 V	230 V – 264 V	T5.0AH 250 V

Maintenance and Repair

Observe all applicable local and/or national safety regulations and rules while performing any work. First disconnect the instrument from all signal sources, then from the AC line supply before removing any cover. Any adjustment, parts replacement, maintenance or repair should be carried out only by the manufacturer's authorized technical personnel. See the *9500B Calibration Manual.*

⚠ Warning

For protection against injury and fire hazard, use only manufacturer supplied parts that are relevant to safety. Perform safety tests after replacing any part that is relevant to safety.

Moving and Cleaning

First disconnect the instrument from all signal sources, then from the AC line supply before moving or cleaning. See the *9500B Calibration Manual.*

Specifications

Safety Specifications are located in the Safety Specifications section of the *9500B Safety Sheet*. Complete specifications are at www.flukecal.com. See the *9500B Extended Specifications.*

Operating Modes

In order to be able to calibrate a wide range of different oscilloscope parameters, flexibility is built into the design of the 9500B. Of the five major modes only two: 'Manual' and 'Procedure', determine the everyday front-panel use of the instrument. The other three are concerned with system configuration, 9500B calibration and 9500B selftest.

Manual Mode

In 'Manual' Mode the 9500B is operated entirely from the front panel. The operator is in complete charge of the calibration procedure, usually interpreted locally from the UUT oscilloscope manufacturer's calibration data. Refer to *Controls and Features* and *Manual Mode*.

Procedure Mode

'Procedure' Mode involves the use of a memorized calibration procedure. The manufacturer's data for the UUT oscilloscope will have been interpreted into a series of calibration operations, which are programmed on to a memory card. When the card is inserted into an available PCMCIA slot in the front panel, the 9500B will move from operation to operation,

switching the 9500B controls automatically, and issuing a series of requests for the operator to change UUT switching and connections.

Refer to *Procedure Mode*.

Portocal II v 1.7 can be used to generate calibration sequences on procedure cards to calibrate UUT oscilloscopes using the Model 9500B.

Configuration Mode

This mode, requiring a password, provides access for the user-selectable configuration options. These include:

- Set the internal reference frequency.
- Adjust the threshold for high voltage warning.
- Change the IEEE-488 bus addresses.
- Select or deselect remote emulation (SG5030 or CG5010/5011).
- Enable or disable use of an external printer (Procedure mode only).
- Set the instrument to power-up in either Manual or Procedure mode.
- Alter the passwords required for entry to Configuration and Calibration modes.
- Select the frequency for External Reference Input.
- Set the frequency of, or disable, External Reference Output.
- Alter the memorized date and time, and its format of presentation.
- Set User language (for Procedure mode only).
- Determine the percentage of UUT measurement tolerance beyond which a 'Borderline' result is called (in Procedure mode only).
- Enable or disable the use of a data card for 'RESULTS' (Procedure mode only).
- Enable or disable fields in certificates to accommodate Engineer's note (Procedure mode only).
- Select the type of certificate required to be printed, alter some of the certificate details, and re-format its pages (Procedure mode only).
- Clear the displayed list of Procedure mode users.

Calibration Mode

Calibration of the 9500B cannot proceed until two security measures have been satisfied:

1. The rear panel 'CAL' switch must be set to its 'ENABLE' position.

Note

The switch is recessed behind a small hole—at shipment this hole is covered by a paper seal which should not be broken except for an authorized recalibration.

A broken seal is regarded as invalidating the previous calibration.

2. An acceptable password must be entered on the screen.

Once into Calibration mode, there are three types of calibration available. These should be used only under supervision—if it is suspected that calibration may be required, contact your Fluke Service Center.

- 'Special' calibration, enabling automatic calibration of the main A-D converter.
- 'Factory use only' is an initial calibration which is not available to users, requiring a second password.
- 'Standard Calibration' will initiate manual calibration procedures for those functions requiring recalibration.

Calibration of the 9500B is detailed in the *9500B Calibration Manual.* Those 9500B calibration sequences which are user-accessible are detailed in *9500B Calibration Manual*. If it is suspected that some other calibration may be required, contact your Fluke Service Center.

Test Mode

Three main variants of self test are available for user initiation:

- 'Base' Test: Tests the base unit only. No head data is tested.
- 'Heads' Test: Tests the fitted Active Heads only, assuming that base tests have been passed.
- 'All' Test: Tests both the base unit and active heads fitted.

Note

In the above three tests, the 9500B will keep a list of all test failures, including the number of the test and its result. Any failures can then be recalled using screen keys.

- 'Fast' Test: This is the same as the confidence test carried out at power-on, checking power supplies, basic operation, etc.
- 'Interface' Test: This can be used to check the operation of the display and its memory, the keyboard and/or printer connected to the instrument. On models that have two PCMCIA slots, a blank memory card can be tested in either slot. (IMPORTANT: the stored contents of any memory card subjected to this test will be overwritten.).

⚠ Caution

The stored contents of any memory card subjected to this test will be overwritten.

It is possible to print out a set of results of selftests. A printer can be connected directly to the 25-way Centronics™ printer port on the rear panel. The printer can be enabled from within Configuration mode.

Test procedures and error-code descriptions are given in the *9500B Calibration Manual* In the case of a reported or suspected failure, consult your Fluke Service Center.

System Operation

Remote Interface

The instrument can form part of an automated system by means of the IEEE-488 standard digital interface. The interface has been included both for automatic calibration of UUT oscilloscopes, and for automatic calibration of the 9500B itself. The method of connecting to the system controller and the IEEE-488.2 SCPI command codes are described in the *9500B Remote Command Manual*.

Emulation of the SG5030 and CG5010/5011 is available only via the remote IEEE-488 interface, as detailed in *Model 9500B — Emulation of Tektronix SG5030 and CG5010/5011*.

Met/Cal

The 9500B is included in the number of calibrators accessible through Met/Cal which can be used to calibrate UUT oscilloscopes remotely.

Associated Products and Options

1. Active Head™

   At least one unit of the following products is necessary to complete the output connection from the 9500B output channel to one channel of the UUT oscilloscope.

Model 9510	1.1 GHz Output Module (Active Head™) with 500 ps pulse edge capability.
Model 9530	3.2 GHz Output Module (Active Head™) with 150 ps and 500 ps pulse edge capabilities.
Model 9550	25 ps Fast Edge Output Module (Active Head™) with 25 ps pulse edge capability only.
Model 9560	6.4 GHz Output Module (Active Head™) with 70 ps pulse edge capability. Requires 9500-3200 or 9500B-3200 base with issue 3.0 firmware or greater.

Check the last section of this manual for an Addendum that describes any additional Active Head models.

Any one of the fitted heads can be used to provide triggers for the UUT oscilloscope instead of signals. However, a Trigger Cable (SMC-to-BNC) is shipped with the 9500B to provide triggers to a separate trigger input on the UUT oscilloscope, with a mix of up to four active heads.

2. The following accessories are shipped with the instrument:

Pt. No.	Description
630477	Trigger Cable for trigger purposes only, in place of an Active Head™

3. The available options for the 9500B are as follows:

9500B/CASE	Carry Case
9500-90 FLK	Rack Mounting Kit
Line Voltage:	The 9500B is configured for use at the correct voltage at the shipment point. The 9500B can be reconfigured for a different line voltage, requiring a different power fuse (Refer to *Power Fuse and Line Voltage*)

Installation

This section contains information and instructions for unpacking and installing the Model 9500B Universal Calibration System.

Lifting and Carrying the 9500B

⚠ Warning

To avoid injury take special care when lifting and carrying the 9500B because it weighs in excess of 12 kg.

Lifting and Carrying from Bench Height

1. Disconnect and remove any cables from the rear panel.
2. The 9500B center of gravity is concentrated at the rear. Tilt the unit so that it is standing vertically on its rear panel, with the feet towards you, at the edge of the bench.
3. Grasp the instrument at the bottom (rear panel) corner furthest away from you, and tilt it slightly to rest against you. Take the weight and carry it vertically at the same height, making sure that it remains resting against you.
4. Place the 9500B down at the same level by setting it vertically onto the surface, and then swivel it so that it can be tilted back on to its feet.

Lifting and Putting Down at Low Level

1. Always bend your knees, not your back, when going down. Keep your back as straight and as vertical as possible.
2. Use the same technique (as described above) to hold the instrument's center of gravity close to you.

Unpacking and Inspection

Every care is taken in the choice of packing materials to ensure that your equipment will reach you in perfect condition.

If the equipment has been subject to excessive mishandling in transit, the fact will probably be visible as external damage to the shipping container and inner carton. In the event of damage, the shipping container, inner carton and cushioning material should be kept for the carrier's inspection.

Carefully unpack the equipment and check for external damage to the case, sockets, controls, etc. If the shipping container and cushioning material are undamaged, they should be retained for use in subsequent shipments. If damage is found notify the carrier and your sales representative immediately.

Standard accessories supplied with the instrument should be as described in *Associated Products and Options* and on your delivery note.

Storage

The instrument should be stored under cover. The shipping container provides the most suitable receptacle for storage, as it provides the necessary shock isolation for normal handling operations.

Place the instrument with an active desiccant sachet inside a sealed bag. Fit the bag into the cushioning material inside the inner carton, place this within the corner cushioning blocks inside the outer shipping container, and locate the whole package within the specified storage environment.

Preparation for Shipment

If the 9500B is to be transported, please consider using the carry case, 9500/CASE.

The instrument should be transported under cover. The original (double) shipping container should be used to provide shock isolation for normal handling operations. Any other container should be double-cushioned, providing similar shock isolation to the following approximate internal packing dimensions:

	Length	**Width**	**Depth**
Outer Box	785 mm	675 mm	440 mm
Inner Box	675 mm	565 mm	315 mm
Cushioned to	460 mm	430 mm	145 mm

Place the instrument with an active desiccant sachet inside a sealed bag. Fit the bag into the cushioning material inside the inner carton, place this within the corner cushioning blocks inside the outer shipping container, and secure the whole package.

Calibration Enable Switch

Note

This two-position, 'CAL' switch on the rear panel protects the instrument calibration memory. The instrument was initially calibrated at the factory, so under no circumstances should the switch be operated, until immediate recalibration is intended.

For Recalibration:

If Calibration Mode is entered while the switch is in the 'DISABLE' position, the following warning message is placed on the screen:

Calibration switch not enabled!

Preparation for Operation

Note

Refer to the Safety Issues section at the front of this manual, together with additional information in the Model 9500B General Specifications, including Environmental Conditions. See Specifications.

Before preparing the Model 9500B calibrator for operation, note the danger warning.

⚠⚠ Warning

This instrument is capable of delivering an electric shock. Under no circumstances touch any instrument terminal unless you are first satisfied that no dangerous voltage is present.

Other than the main output active head connectors, the connections to the 9500B are via the rear panel, see Figure 2.

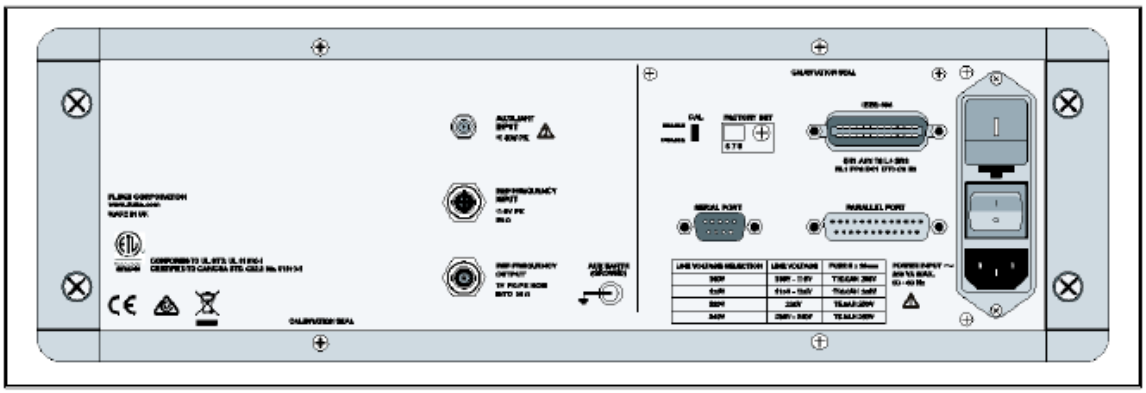


Figure 2. 9500B Rear Panel

Mounting

Bench Mounting

The instrument is fitted with four plastic feet and a tilt stand. It can stand flat on a bench, positioned so that the cooling-air inlet on the right side and exhaust apertures on the left side are not obstructed.

9500-90 FLK—Rack Mounting

9500-90 FLK permits the instrument to be mounted in a standard 19 inch rack. The method of fitting this option is described below, the locations being shown in Figure 3.

1. Provision of 9500-90 FLK
   a. 9500-90 FLK is provided with all necessary attachments and fixings.
   b. The 9500B is fitted with side extrusions with holes to accommodate rack mounting fixing screws.
2. Fitting the Mountings to the 9500B
   a. Fit left and right front rack mounting ears (these are interchangeable) to the 9500B:
      1) Assemble the handles to the front ears as shown in the diagram, and secure using the four M4 x 12 POZICSK screws provided.
      2) Secure the front ears through the side extrusions to the chassis, with the brackets at the front as shown. Use two M5 x 20 POZIPAN screws, plain and shake proof washers provided, through the lower holes of each ear.
   b. Fit left and right rear rack sliders (these are interchangeable) to the 9500B:

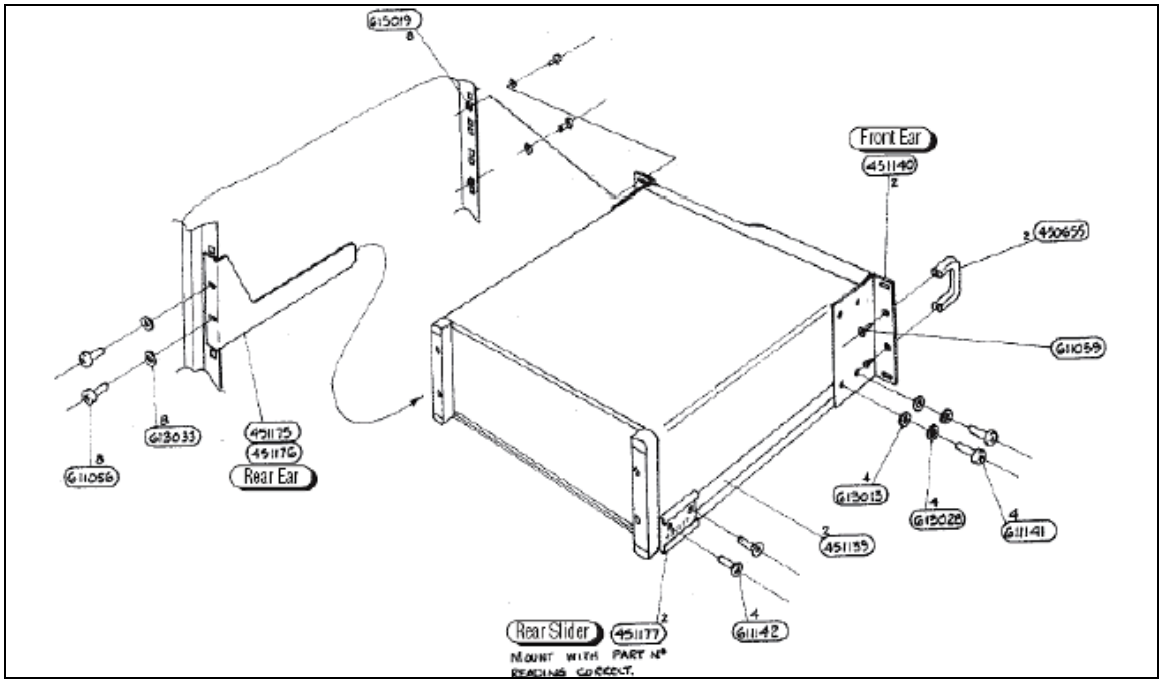
      Secure both sliders through the side extrusions to the chassis, at the rear as shown. Use the four M5 x 20 POZICSK screws provided.
3. Removing the 9500B Feet and Tilt Stand (if required)

   Remove the feet and tilt stand:
   a. Prize off the rubber pads from the four feet.
   b. Undo the two securing screws from each foot. This releases the feet, washers and tilt stand so that they can be detached and stored safely for possible future use.
4. Fitting the Rear Ears to the Rack

   Fit the left and right rear ears (not interchangeable) to the rack:
   a. Fit the eight M6 cage nuts into the correct cutouts at front and rear of the rack (see Figure 3). Squeeze the cage on each nut and insert from the inside of the rack.
   b. Offer up each appropriate ear to the outside of the back of the rack, with the tongue facing forward as shown in the diagram. Secure the ears using four of the eight M6 x 16 chromium-plated POZIPAN screws and four M6 washers.

5. Fitting the 9500B into the Rack

   With assistance, slide the instrument into the rack, locating the rear ears in the sliders on the side extrusions. Push the instrument home, and secure the front ears to the rack using the other four M6 x 16 chromium-plated POZIPAN screws and four M6 washers.

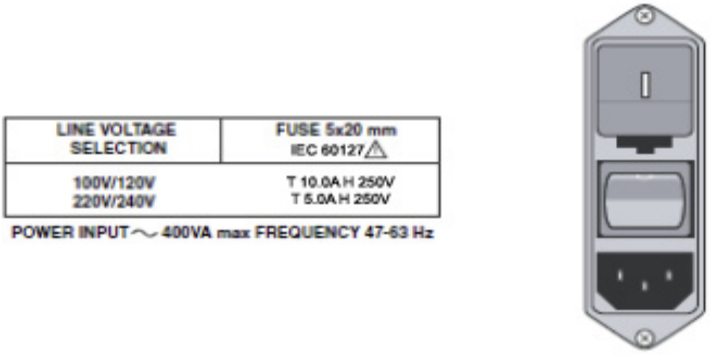


Erw003

Figure 3. 9500-90 FLK — Rack Mounting Kit — Fitting

Power Input

The recessed POWER INPUT plug, POWER FUSE, POWER SWITCH and LINE VOLTAGE SELECTOR are contained in an integral filtered module on the right of the rear panel (looking from behind the unit).



erw004

A window in the fuse drawer allows the line voltage selection to be inspected. To inspect the fuse rating the fuse drawer must be taken out (Refer to *Power Fuse*. First switch off and remove the power cable).

Power Cable

The detachable supply cable, comprising two meters of 3-core PVC sheath cable permanently molded to a fully-shrouded 3-pin socket, fits in the POWER INPUT plug recess.

⚠ Warning

The supply lead must be connected to a grounded outlet ensuring that the ground lead is connected.

See the safety issues section at the front of this manual.

Power Fuse

The fuse rating is:

- T 5.0A H 250V for 220/240 V line voltage selection.
- T 10.0A H 250V for 100/120 V line voltage selection.

It is fitted into the reverse side of the Fuse Drawer, in the Power Input module on the rear panel, and must be of High Breaking Capacity, as shown in Figure 4.

⚠ Warning

Make sure that only fuses with the required rated current and of the specified type are used for replacement.

See the safety issues section at the front of this manual.

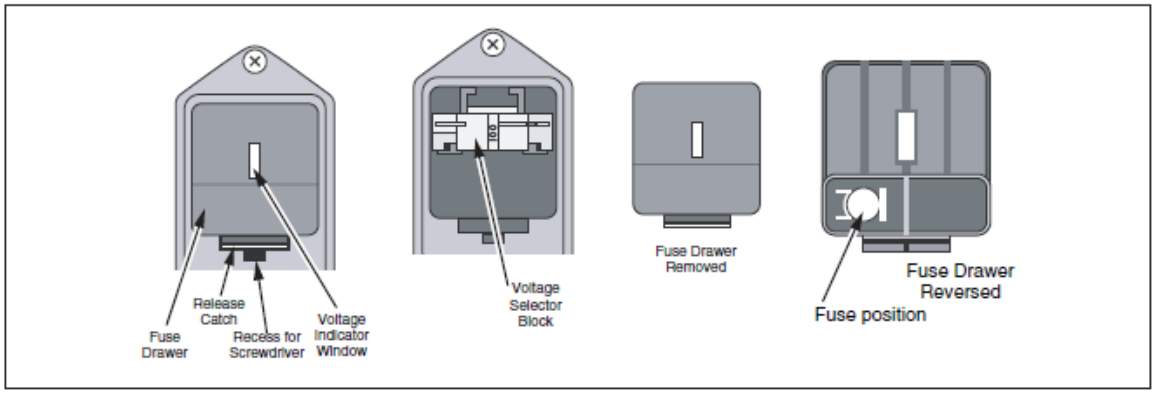


Figure 4. Fuse Locations

Power Fuse Replacement

When the power fuse is to be replaced, proceed as follows:

1. Ensure that the POWER CABLE is removed. Insert a small screwdriver blade in the narrow recess beneath the catch under the fuse drawer; lever gently downwards until the catch releases. Pull the drawer out, and reverse it to see the fuse.
2. Check the fuse and replace if required.
3. Check that the desired voltage is visible at the front of the voltage selector block inside the power module cavity.
4. Insert the fuse drawer into the module and press until the catch is heard to click into place.

Line Voltage

The 9500B is operative for nominal line voltage selections: 100/120/220/240 V, 50 Hz to 60Hz.

To accommodate these ranges, a small voltage selector block is housed behind the POWER FUSE drawer.

Selection of Operating Line Voltage

⚠ Warning

Ensure that the POWER CABLE is removed.

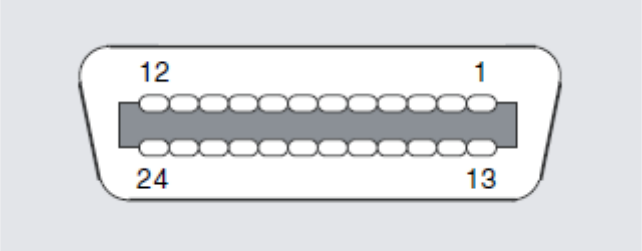
1. Insert a small screwdriver blade in the narrow recess beneath the catch under the fuse drawer; lever gently downwards until the catch releases. Pull the drawer out to reveal the grey voltage selector block.
2. Hook a small finger into the block in the square recess in its base; pull to disengage its contacts, and remove from the module cavity.
3. Rotate the voltage selector board until the desired voltage faces outward.
4. Ensure that the block is upright. Re-insert the block firmly into its cavity in the module.
5. Check the fuse if required (see Power Fuse), then insert the fuse drawer into the module and press until the catch is heard to click into place.
6. Check that the desired voltage is visible in the cutout in the fuse drawer.

Connectors and Pin Designations

IEEE-488 Input/Output (Rear Panel)

This 24-way input/output connector on the rear panel, which is labeled IEEE-488, is directly compatible with the IEEE-488 and IEC-625 Interface Bus standards.

Pin Layout



Erw006

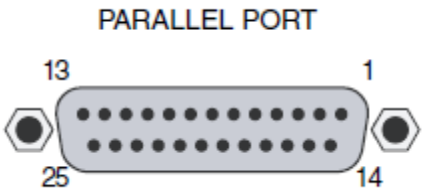
Pin Designations

Pin no.	Name	Description
1	DIO 1	Data Input Output Line 1
2	DIO 2	Data Input Output Line 2
3	DIO 3	Data Input Output Line 3
4	DIO 4	Data Input Output Line 4
5	EOI	End or Identify
6	DAV	Data Valid
7	NRFD	Not ready for Data
8	NDAC	Not Data Accepted
9	IFC	Interface Clear
10	SRQ	Service Request
11	ATN	Attention
12	SHIELD	Screening on cable (connected to Safety Ground)
13	DIO 5	Data Input Output Line 5
14	DIO 6	Data Input Output Line 6
15	DIO 7	Data Input Output Line 7
16	DIO 8	Data Input Output Line 8
17	REN	Remote Enable
18	GND 6	Ground wire of twisted pair with DAV
19	GND 7	Ground wire of twisted pair with NRFD
20	GND 8	Ground wire of twisted pair with NDAC
21	GND 9	Ground wire of twisted pair with IFC
22	GND 10	Ground wire of twisted pair with SRQ
23	GND 11	Ground wire of twisted pair with ATN
24	0V_F	Logic Ground (Internally associated with Safety Ground)

Parallel Port (Rear Panel)

This 25 way D-Type socket is located beneath the IEEE-488 connector on the rear panel. Its connections are similar to the 25-way printer port on PCs, carrying control and data for an external printer as designated in the table.

Pin Layout



Erw007

Pin Designations

9500B Pin No.	9500B Signal Name	9500B I/O	Description or Common Meaning
1	STROBE_L	Output	1 µs pulse to cause printer to read one byte of data from data bus DO1—DO8
2	DO1	Output	Data bit 1
3	DO2	Output	Data bit 2
4	DO3	Output	Data bit 3
5	DO4	Output	Data bit 4
6	DO5	Output	Data bit 5
7	DO6	Output	Data bit 6
8	DO7	Output	Data bit 7
9	DO8	Output	Data bit 8
10	ACKNLG_L	Input	Pulse to indicate that the printer has accepted a data byte, and is ready for more data
11	BUSY_H	Input	Printer is temporarily busy and cannot receive data
12	P_END_H	Input	Printer is out of paper
13	SLCT_H	Input	Printer is in on-line state, or connected
14	AUTO_FEED_L	Output	Paper is automatically fed 1 line after printing. This line is fixed _H (high) by the 9500B to disable auto feed
15	ERROR_L	Input	Printer is in 'Paper End', 'Off-line' or 'Error' state
16	INIT_L	Output	Commands printer to reset to power-up state, and in most printers to clear its print buffer
17	SLCT_IN_L	Output	Commands some printers to accept data. This line is fixed _L (low) by the 9500B
18-25	0V_F	Output	Digital Common
H ≡ Logic-1 active; L ≡ Logic-Ø active			

Serial Port (Rear Panel)

This 9-way D-Type socket is located to the left of the Parallel port connector on the rear panel. Its connections are RS232-compatible; carrying control and power supplies for, and receiving data from, an external tracker ball.

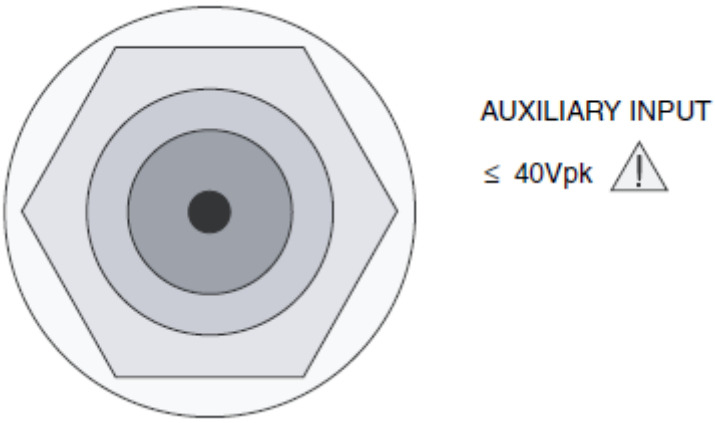
Pin Layout

Erw008

Pin Designations

Pin No.	Name	Description
1	- - -	Not used
2	RXD0_L	Serial Data: Tracker Ball → 9500B
3	TXD0_L	Serial Data: 9500B → Tracker Ball
4	DTR0_H	Data Terminal Ready
5	0V_F	Digital Common
6	DSR0_H	Data Set Ready
7	RTS0_H	Request to Send
8	CTS0_H	Clear to Send
9	- - -	Not used
_H ≡ Logic-1 active; _L ≡ Logic-Ø active		

Auxiliary Input (Rear Panel)

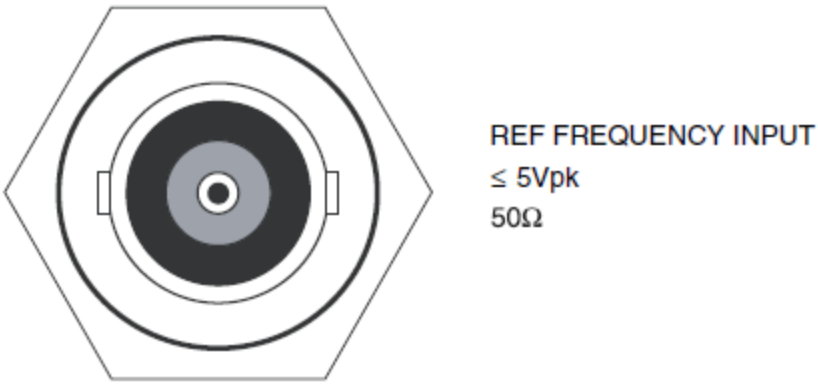


Erw009

This SMC connector is located at the upper center of the rear panel, providing an internal, passive, relay switched route for a user's external calibration signal, via any one of five output channels to an Active Head's BNC or PC3.5 connector.

Internal controls are provided (via front-panel keys or via the IEEE-488/SCPI interface) to switch the signal between channels. For further details see *Auxiliary Input Operation*.

Ref Frequency Input (Rear Panel)

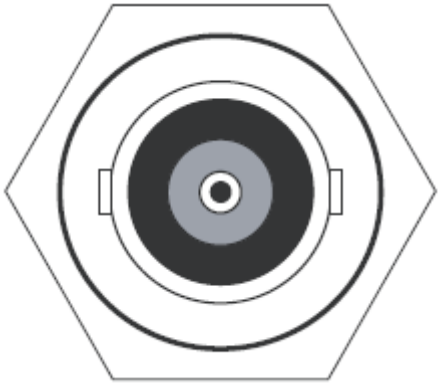


Erw010

This BNC connector is located at the middle center of the rear panel, providing an input for a signal of good frequency accuracy, for use as a frequency reference in the 9500B.

Internal controls are provided (via front-panel keys in Configuration mode) to select the signal as reference. For further details see *'Ext ref in'*.

Ref Frequency Output (Rear Panel)



Erw011

This BNC connector is located at the lower center of the rear panel, providing an output reference signal of the same frequency accuracy as the 9500B.

Internal controls are provided (via front-panel keys in Configuration mode) to select the signal as reference. For further details see *'Ext ref out'*.

Care of Microwave Connectors

It is necessary to observe certain basic precautions when using microwave connectors, in order to achieve accurate and repeatable calibration and measurement results. This will also help to extend connector life.

Good practice includes:

- When not in use, ensure that connectors are kept clean. This is best done by using a plastic end cap. Avoid touching components whose function is to make electrical contact.
- Visually inspect all connectors, looking for dents, scratches and metal particles. Never use damaged connectors.
- Clean connectors properly, particularly connector threads and dielectric faces. Try compressed air first, and if this is insufficient, use isopropyl alcohol. Avoid spillage, and never use abrasives.

When making connections, be careful to align connectors carefully, avoiding bending forces. Always make the initial connection lightly to avoid cross-threading, and use a correctly-set torque wrench for final tightening

Controls and Features

This section is a detailed description of the 9500B operating controls; starting with a general description of the front panel. The user preferences 'Pref' key and screen is described, followed by a brief description of Mode selection.

Introduction to the Front Panel

Local and Remote Operation

Remote, Semi-Automatic and Manual Calibration of UUT Oscilloscopes

The 9500B has been designed to present three main user interfaces for control of UUT calibration:

- Fully-automatic operation for UUT oscilloscopes which are remotely controllable on the IEEE-488 Instrumentation Control Interface, employing IEEE-488.2/SCPI protocols. The 9500B also includes emulation modes which minimize the software effort required for integration into existing calibration systems designed around Tektronix CG5011 and SG5030 calibrators. Refer to the *9500B Remote Command Manual*.
- Semi-automatic operation using procedure memory cards to drive the 9500B, with control of the subject UUT being implemented by a form of the UUT manufacturer's procedure through a series of user prompts. Refer to *Procedure Mode*.
- Manual operation from the front panel, again with control of the subject UUT being implemented by the UUT manufacturer's procedure. Refer to *Manual Mode*.

Use of Procedure Memory Cards

This is a form of assisted (semi-automatic) calibration, in which a memory card for a specific UUT oscilloscope is inserted into PCMCIA SLOT 1. Running Procedure Mode will generate instructions to the operator, while setting output values on the 9500B. The sequence of these instructions and outputs, the output specifications and the pass/fail limits conform the UUT manufacturer's calibration procedure.

Manual and Remote Calibration of the 9500B Itself

The 9500B itself must periodically be verified or calibrated against suitable traceable standards. The calibration processes for the mainframe and Active Heads are available manually, but to gain the advantages of simplicity and throughput provided by automated procedures, these process commands are also available via the remote interface (IEEE-488.2/SCPI protocols – *9500B Remote Command Manual*). The 9500B communicates with programmable standards under the direction of external Control Software.

General Arrangement of Front Panel Controls

The front panel is divided into three main areas, as shown in Figure 5.

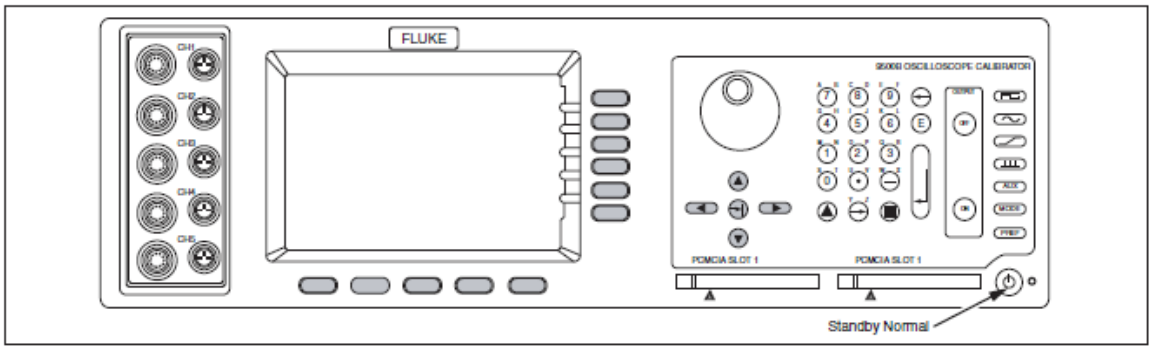


Figure 5. 9500B Front Panel

Center: A 'Menu' and 'Output Display' LCD screen, with grouped soft keys.

Right: A control panel, used to select and adjust operational Functions and Modes, with two slots to accept memory cards. Some models are equipped with only one slot that can be used to run procedures or firmware updates.

Left: Output Connectors, used for connection of the active heads.

These features are described in the following paragraphs.

Front Panel Features

Liquid Crystal Display and Screen Keys

The 9500B communicates with the operator by presenting essential information on the LCD screen. For example: the output value generally appears in large characters below the center of the screen, accompanied by its units. An operator can move through a series of menu screens, choosing options from those presented on the screen.

Eleven soft keys ('screen' keys) are grouped below and to the right of the screen. These are labelled by characters or symbols representing menu choices, which appear in reserved display areas on the screen next to the keys. Main functions are selected by buttons on the 'Oscilloscope Calibrator' panel.

'Oscilloscope Calibrator' Panel

This panel carries the main controls used to select the operational functions and modes of the calibrator:

1. Major Function keys are used mainly in Manual mode (*Manual Mode*) and Calibration mode (*9500B Calibration Manual*). They are arranged down the right edge:

   Waveform (select Square with direction, or ±DCV using screen keys).

   Sinewave (select amplitudes and frequency using screen keys and cursor controls).

   Edge (select polarity using screen keys).

   Timing Markers (select Waveform and Frequency/Period using screen keys — including Line Frequency).

Aux: Auxiliary Functions (select Current, Composite Video, Linear Ramp, Overload Pulse, UUT Input Leakage Test, Auxiliary Input, Channel Skew, and Load Resistance or Load Capacitance measurement using screen keys).

2. Mode Key, under the Function keys. The modes are: 'Procedure', 'Manual', 'Configuration', 'Calibration' and 'Test' (refer to *Modes of Operation*).
3. Preferences Key, the bottom key. The user-preferences provided are display adjustments of: 'Screen Contrast', 'Amplitude step' factor sequence, 'Time step' factor sequence and Deviation/UUT Error toggle (refer to Preferences).
4. OUTPUT OFF and ON keys, with an 'ON' state indicator LED, in a separate column due to their importance.
5. Alpha-numeric keypad, used for various purposes, to be described later.
6. The ⊕ (Tab) key, Cursor keys and Spinwheel: These select and increment or decrement displayed quantities.

Output Connections

The ten output connectors are located on the left of the panel. Use of these connectors is described in *Manual Mode*.

PCMCIA SLOT 1 and PCMCIA SLOT 2

These slots are included mainly for Procedure mode (*Procedure Mode*), although there are secondary uses. Some models are equipped with only one slot that can be used to run procedures or firmware updates.

'Standby' Push-Button

Pressing this button, in the bottom right corner of the front panel, will toggle between normal operation (LED green) and 'standby' (LED red). The instrument will transfer automatically from normal operation to standby some 15 minutes after the most recent operation, then pressing the button will immediately restore normal operation.

Power On/Off Switch

Line power to the 9500B is switched On and Off using a switch at the left of the instrument, on the rear panel. Up is On; Down is Off.

Output Controls

The aim of this discussion is to become familiar with the 9500B interactive display, and the manipulation of front-panel controls.

We have chosen DC/Square as a typical function for manipulation (it is also likely to be the most familiar to most new operators).

Full details of the DC/Square function are not given here, they appear in *DC/Square Function*.

Front Panel Control Sets

We have already seen that there are two sets of front-panel controls which manipulate the output configuration, but briefly, to establish a base-line, here they are again:

1. Controls positioned in the right half of the front panel. They are:
   a. Major Function keys, arranged in a column down the right edge.
   b. Moving left, the OUTPUT OFF and ON keys, arranged in a separate column because of their importance.
   c. Alpha-numeric Keypad.
   d. Cursor Controls:

      See section Editing on the Screen.
2. Screen Soft Keys, around the display itself, are used to select subfunctions and individual parameters (identified in the areas used as screen key labels).

Before we proceed, we need to identify the components present on a typical menu screen. A representation of a DC/Square display in Manual mode is given as Figure 5.

Entry to Manual Mode

This discussion is conducted in Manual mode, which you may not recognize at present. Refer to Mode Selection. To enter MANUAL mode:

1. Press the front panel Mode key.
2. Press the MANUAL screen key beneath the display.

Manual Mode—Typical Menu Screen

Ensure that the 9500B is installed and switched on as in *Installation*. If, after selecting Manual mode, the display does not correspond to Figure 5, press the ⊓⊔ key in the top right corner of the front panel.

Familiarize yourself with Figure 5. This is the default version of the menu screen which will appear when you enter DC/Square function for the first time (unless the default has been changed in Config Mode).

Note

Contrast inversions of symbols and fields indicate those elements which have been selected, 'Scope Mode' (1-2-5) only in this case.

Editing on the Screen

We have already mentioned 'Scope Mode'. This is not a major mode of the same importance as Manual mode, but identifies a specific means of making selections or entering changes on the screen.

In all editing, the Tab key ⇥ is used to select the required variable for adjustment.

There are two modes, selected by the right-most soft key on the bottom row beneath the screen, which toggles between 'Direct' mode 1.0 and 'Scope' mode 1.0 encompassing three main ways of adjusting values presented on the screen:

1. Direct Mode

   Once the ⇥ key has selected the required variable, two triangular markers presented above and below a digit in the selected numeric value form a cursor, and two methods of value adjustment are available:

   a. Digit Edit

      Cursor keys: ⟨ and ⟩ control the screen cursor to select a digit for adjustment, then ⌃ increments and ⌄ decrements the digit selected by the cursor.

      Spinwheel: Increments or decrements the selected digit, in place of the ⌃ and ⌄ keys.

   b. Numeric-Entry Edit

      Key Pad: Typing any character on the numeric keypad will set up a 'box' beneath a smaller version of the selected numeric value, and place the typed character in the box. The right side key labels change to give a choice of units.

      Units: After the new value has been typed on the keypad, the required units can be chosen from the right side soft keys. Pressing one of these keys will cause the display to revert to the 'Digit Edit' format, with the same numeric value remaining selected by the two triangles.

      'Enter': The keypad 'Enter' (ø) key can be used instead of one of the units keys to revert to 'Digit Edit' format. In this case the 9500B firmware will always impose the basic units (not multiples or sub-multiples).

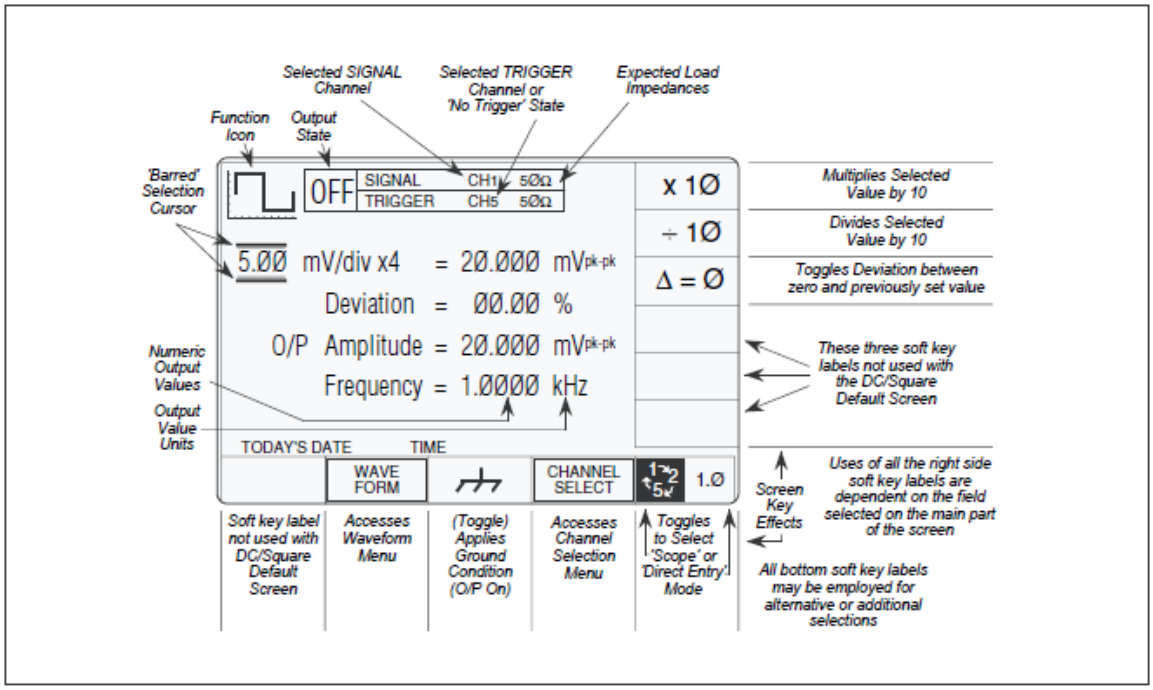
      Further Use: Either Digit Edit or Numeric-Entry Edit can be used for all selectable variables on the screen.

2. Scope Mode

   This mode differs from Direct Mode only in that adjustment of many screen variables is constrained to a series of 'Stepped Values', which run in a sequence of 1:2:5 factor steps (The 'Pref' facility, described overleaf, can be used to change the factor sequence to match certain oscilloscopes with 1:2:2.5:4:5 steps). Selecting one of these variables places a 'barred' cursor above and below the whole numeric value (shown in Figure 5), and only one method of value adjustment is available:

      Cursor keys: ⟨ and ⟩ are not used. Adjustment is carried out using the ⌃ and ⌄ keys (or spinwheel) to increment or decrement the whole value through the pre-defined factor steps.

   These forms of editing are also described in greater detail, with illustrations, in *Edit Facilities*.



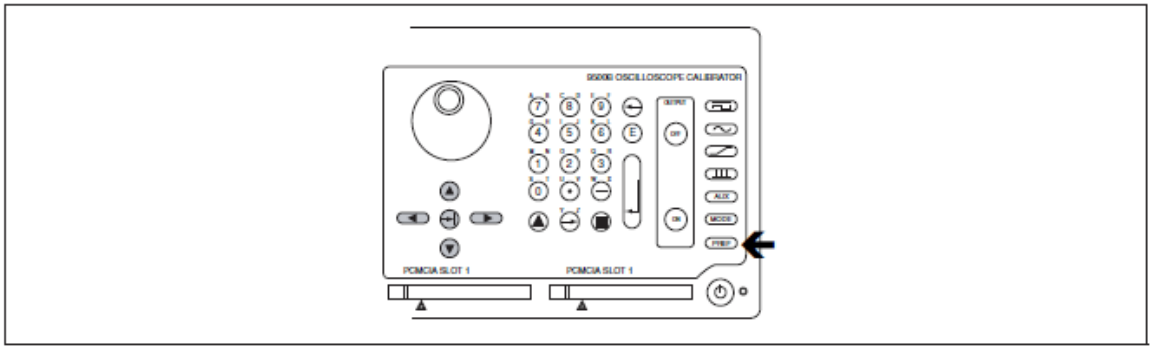
erw013

Figure 6. Manual Mode — Startup Default Settings

Preferences

Pref Selection

The Pref key is highlighted in Figure 7.



erw014

Figure 7. 'Pref' Key

Pref Overview

The Pref key sets up a special display which offers adjustment of four parameters, shown in Figure 8. This menu can be exited only by pressing EXIT, or re-pressing the Pref key.

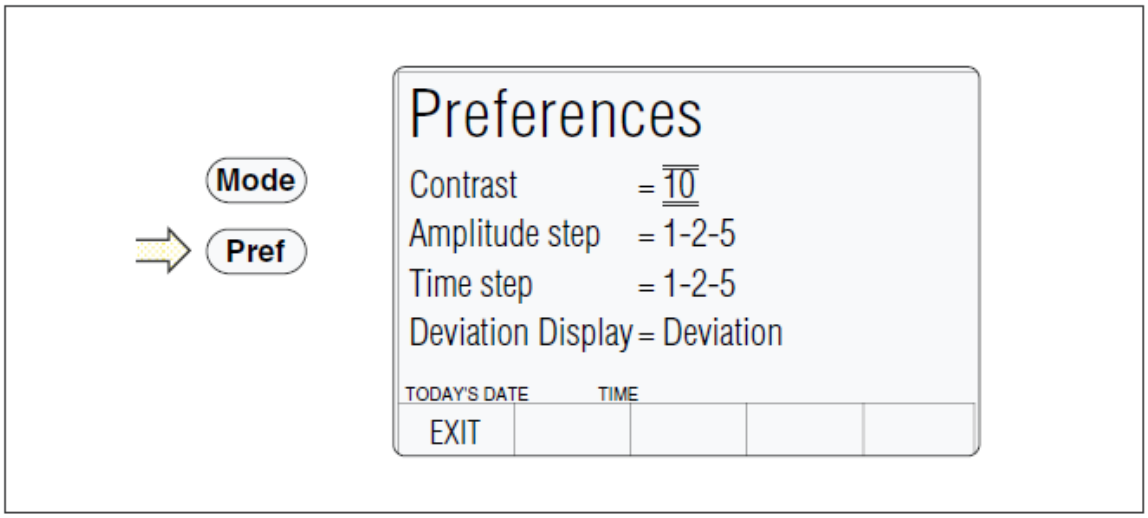


Figure 8. 'Pref' Parameters

The Preference screen can be displayed in all modes and functions without disturbing the function setup (except that under certain conditions with OUTPUT ON, the output will be turned off).

Preference selections are non-volatile. Once a parameter has been set up as required, it will be remembered by the 9500B through changes of mode and function, also being restored after Power down/Power up.

Changing the Parameters

The mechanism for adjusting parameters is known as 'Digit Edit'. A Cursor of horizontal lines enclosing screen characters indicate the parameter selected for adjustment. This can be moved from one parameter to another using the ⇥ (Tab) key.

Once the cursor has been moved to the required parameter, the adjustment is carried out using either the spinwheel or the ⌃ (Up)/⌄ (Down) cursor keys. The Left and Right cursor keys have no effect.

Screen Contrast

The front panel screen is viewable from a wide range of vertical and horizontal angles. For best contrast at a fixed angular sight line in the vertical plane, the 'Contrast' parameter on the screen can set the sight line to one of twenty-seven different angles, represented by the numbers 1-27. The range from numbers 10-12 will provide good contrast from head-on viewing positions.

To change the contrast:

1. Use the tab key to position the cursor on the contrast number.
2. Use the spinwheel or up/down cursor keys to adjust for your best display contrast, by increasing or decreasing the contrast number.

Scope Mode Amplitude Steps

For most UUT oscilloscopes, amplitude sensitivity can be increased or decreased at values which run in a sequence of 1:2:5 factor steps. The Scope Mode 'Amplitude step' parameter can change the sequence to match certain oscilloscopes with 1:2:2.5:4:5 factor steps.

To change the Amplitude steps parameter:

1. Use the tab key to position the cursor on the Amplitude steps sequence.
2. Use the spinwheel or up/down cursor keys to toggle between:

   1—2—5 and 1—2—2.5—4—5 factor steps.

Scope Mode Time Steps

This operates on the same basis as Amplitude steps, but the result is a change in output period (and frequency) in the chosen factor steps.

To change the Time steps parameter:

1. Use the tab key to position the cursor on the Time steps sequence.
2. Use the spinwheel or up/down cursor keys to toggle between:

   1—2—5 and 1—2—2.5—4—5 factor steps.

Deviation Display

The deviation of an output signal amplitude from the factored output step value is controllable, within ±11.2 %, from the function screen. So a signal of 1 V DC can be adjusted from 0.8880 V to 1.1120 V using the deviation control.

To extend the usefulness of this facility, the deviation display value can be expressed as 'UUT Error'. This permits use of the deviation control to adjust the 9500B output until the UUT oscilloscope presentation itself shows the required value. The 9500B output value can be read off, but in addition, the UUT's error is presented on the 9500B screen.

Note that both the UUT error and the deviation are expressed as a percentage (ratios). This means that if the deviation has to be adjusted to +10.00 %, the UUT error is -9.091 %. An example will show why:

Example of 'UUT Error':

1. Assume a 1 V UUT nominal cal point.
2. 9500B set to 1 V: UUT reading is low.
3. 9500B 'Deviation' increased until UUT reading is 1 V nominal—Deviation value is +10 % and 9500B output is 1.1 V.
4. A UUT reading of '1 V' represents 1.1 x 1 V, so UUT original reading for 1 V input was 1 V ÷ 1.1 = 0.909091 V.
5. The UUT Error is therefore 0.909091 V – 1 V = -0.09091 V.
6. The UUT percentage Error is (0.09091 V ÷ 1 V) x 100 %, = -9.09091 %.

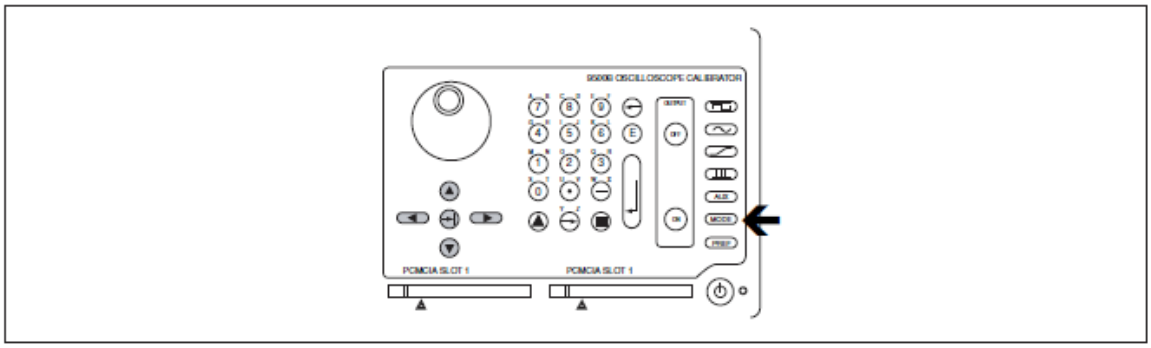
To change the Deviation parameter:

1. Use the tab key to position the cursor on the Deviation display parameter.
2. Use the spinwheel or up/down cursor keys to toggle between 'Deviation' and 'UUT Error'.

Modes of Operation

Mode Selection

The Mode key is highlighted in Figure 9.

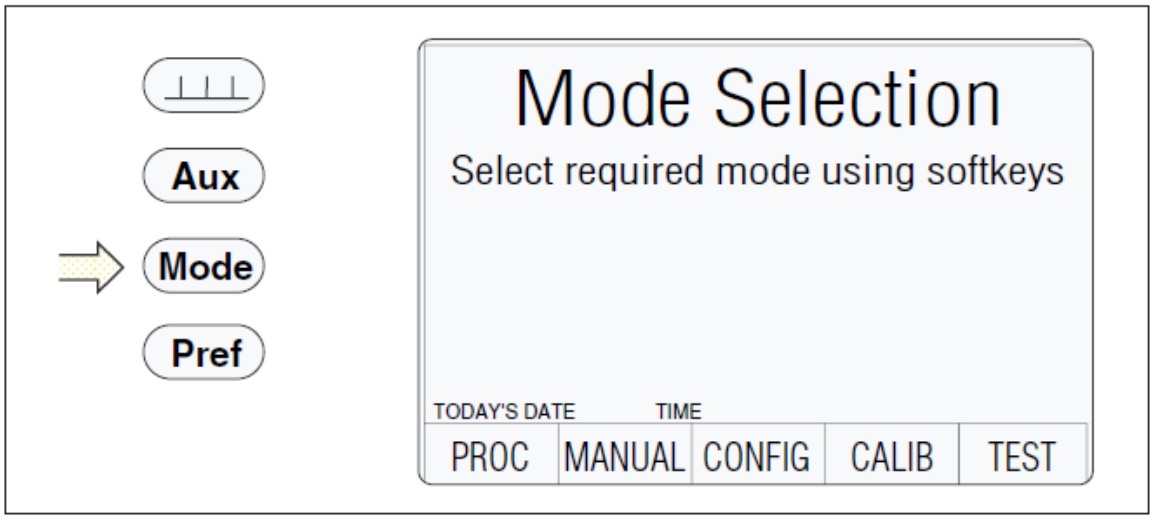


erw016

Figure 9. 'Mode' Key

Mode Overview

The Mode key sets up a special menu display, offering selection from five primary modes. This menu can be exited only by pressing one of the five screen keys. See Figure 10.



erw0

Figure 10. Mode Selection Menu

Four of the modes are described in later sections, but because of its wide-ranging effects, Configuration Mode is dealt with in this section. The five modes are:

PROC = Procedure Mode:

For calibration of a specific type of UUT, the sequence of 9500B output selections is determined by a 'Procedure' memory card, placed in the left-hand PCMCIA SLOT 1 beneath the panel outline. Results can be printed, or recorded in a second 'Data' card, placed in the right-hand PCMCIA SLOT 2. Refer to *Procedure Mode*.

MANUAL = Manual Mode:

The output is selected and adjusted entirely from the front panel. Refer to *Manual Mode*.

CONFIG = Configuration Mode:

On entry to Configuration mode, parameters are protected by password. These include: Power-On default mode (Manual or Procedure modes); Present Time and Date; Enable Printing; Reformat Printed Certificates, etc. Refer to Passwords and Access.

CALIB = Calibration Mode:

This mode is protected by switch and password. On entry to Calibration mode, the operator can process the calibration of the 9500B itself. Calibration can be controlled from the front panel, or via the IEEE-488 Interface. Refer to the *9500B Calibration Manual*.

TEST = Test Mode:

This mode permits an operator to initiate and interact with any of a series of tests as follows: 'Base'; 'Heads'; 'All'; 'Fast' or 'Interface'. Refer to the *9500B Calibration Manual*.

Passwords and Access

1. All Configuration mode selections require a password. When the 9500B is shipped from new, the password requirement is enabled to avoid unauthorized access.
2. It is recommended that both passwords be changed, for security purposes, at the earliest opportunity.
3. The shipment 'Configuration' password is 12321 (as typed on the front panel keypad when the Password Entry screen for Configuration mode is showing). It is stated here to allow entry to Configuration mode by personnel authorized by local management, and permit subsequent access to the means of altering the password itself. The necessary process is detailed later in this section.
4. A second (different) password will be required to allow entry to Calibration mode as authorized by local management. The shipment version of the Calibration mode password is 2→3→5→7 (as typed on the front panel keypad when the Password Entry screen for Calibration mode is showing). The necessary process for changing this password is also detailed later in this section.

Configuration Mode

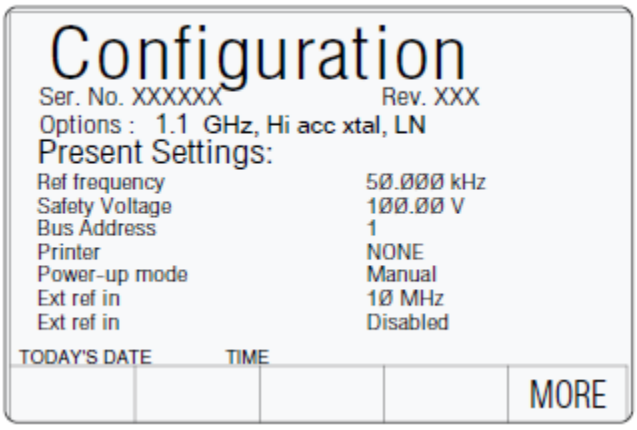
Configuration Mode is used to change the settings of those parameters which have been placed under user control.

Note

A password is required for access to change settings.

When changing configuration, start as follows:

1. Press the Mode key to obtain the 'Mode Selection' menu screen.
2. Press the CONFIG screen key at the center of the bottom row to progress into 'Configuration' mode. The 9500B will transfer to the 'Configuration' menu screen:



erw018

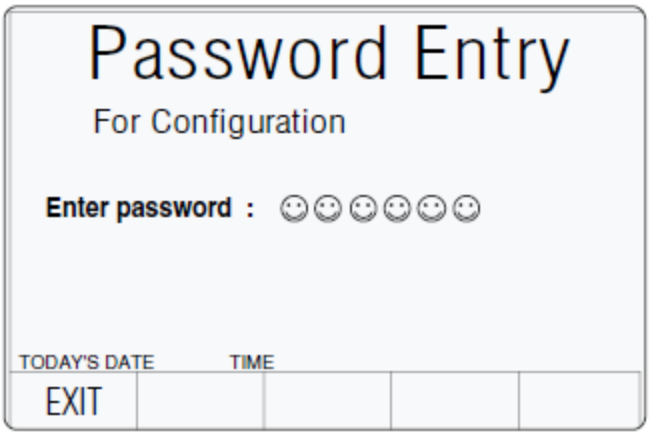
3. The screen shows the present settings of some of the parameters which can be changed in Configuration mode.
4. The screen also indicates which hardware Option 9500B/600, 9500B/1100 or 9500B/3200 is fitted. These cannot be changed in Configuration mode.

'MORE' Configuration

1. To gain access to alter Configuration mode options, a password will be required. (Refer to the arrangements made for 'shipment' passwords described in Passwords and Access).
2. The password requirement will be invoked by pressing the MORE screen key on the right of the bottom row. The 9500B will transfer to the 'Password Entry' screen.
3. When you enter your password using the alpha-numeric keypad, security icons will appear on the screen as you type. Finally press the ↵ key.

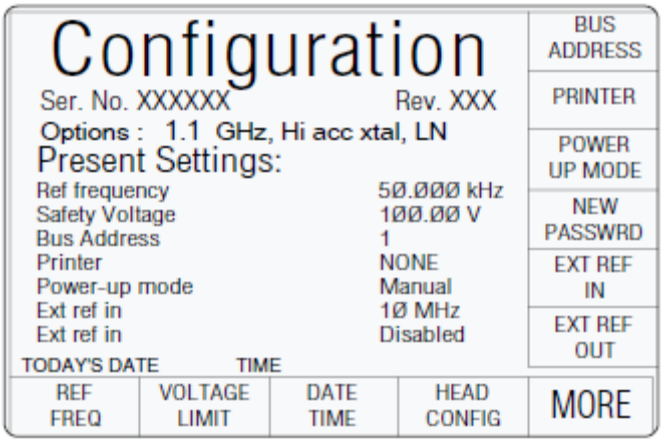
   If the password is incorrect: an error message will be given and the security icons will be removed, enabling a new attempt to enter the password.

The 'EXIT' screen key acts to escape, back to the previous screen.



erw019

4. The correct password, followed by ↵, will provide entry to the main 'Configuration' menu screen, showing the present settings of the parameters which now can be changed using screen keys whose labels appear on the display.
5. Pressing the 'MORE' key again will provide entry to a second 'Configuration' menu screen, showing the present settings of other parameters. Refer to *'MORE' Configuration*.



erw020

'Ref Frequency'

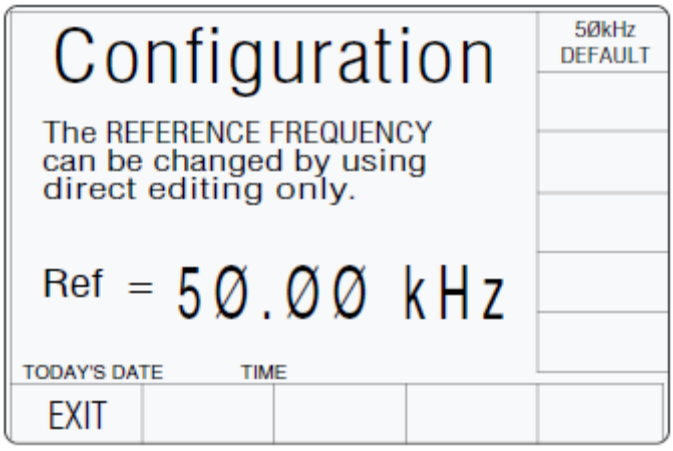
Use of Reference Frequency

The reference frequency is used mainly in assessments of UUT oscilloscope bandwidth, a commonly used frequency for this purpose being 50 kHz. In the 9500B, for ease of operation in certain functions, the output can be changed from the selected frequency to the reference frequency and back by a simple toggle switching action.

In the 9500B, the default reference frequency is set at 50 kHz, but users can change this in Configuration mode to match the frequency used in procedures for individual oscilloscopes.

1. For access to alter the reference frequency, press the REF FREQ screen key at the bottom left of the 'Present Settings' screen.
2. This transfers to a configuration screen designed for changing the 'Ref Frequency'.

   The default value is shown:



erw021

3. Use Direct edit to set the required reference frequency. After typing the value press the ↵ key on the keypad (the Direct edit 'V' screen key in the right-hand column will perform the same action).
4. The '50 kHz DEFAULT' screen key on the right can be used if 50 kHz is required.
5. Press the EXIT screen key to return to the 'Present settings' menu screen. The new reference frequency appears on the 'Present Settings' list.

'Safety voltage'

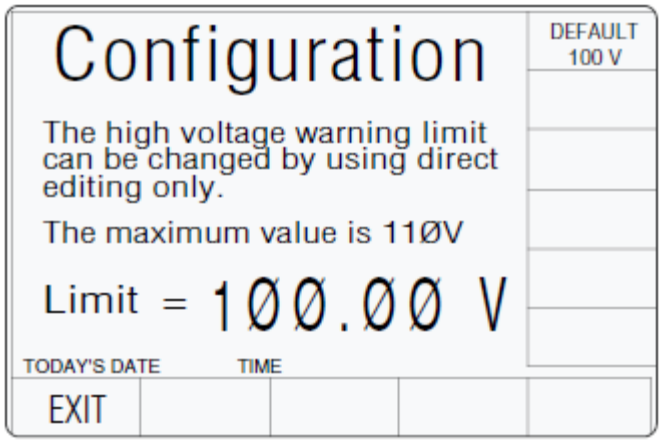
High Voltage Warnings—Warning and Interlock

In the interests of safety, to avoid electric shock, the 9500B incorporates a high-voltage warning and interlock system for both DC and Square Voltage functions. The limit can be set to any voltage from 10 V to 110 V. The default warning threshold value (100 V) can be changed in Configuration mode. The active threshold value is stored in non-volatile memory.

When the output is on in DC/Square or High Edge function, the warning will sound when the output voltage setting is raised to or above the threshold value. The output will stay at its previous value until the user confirms the new voltage by re-pressing the OUTPUT ON button.

1. For access to allow the high voltage warning threshold to be altered, press the VOLTAGE LIMIT screen key on the 'Present Settings' screen.
2. This transfers to a configuration screen designed for changing the 'Voltage Limit'.

The default value is shown:



erw022

3. Use Direct edit to set the required high voltage warning limit. After typing the value press the ↵ key on the keypad (the Direct edit 'V' screen key in the right-hand column will perform the same action).
4. The 'DEFAULT 100 V' screen key on the right can be used if 100 V is the required level.
5. Press the EXIT screen key to return to the 'Present settings' menu screen. The new high voltage threshold value appears on the 'Present Settings' list.

Note

The valid range of limit values is from 10 V to 110 V. When values outside this range are entered, an error message will appear on the screen, and the 'EXIT' screen key label will be replaced by 'OK'. By pressing 'OK' the original value is reinstated and the message disappears, for a second attempt.

'Bus address'

Remote Operation via the IEEE-488 interface—Addressing the 9500B

When the 9500B is set for remote operation, control is removed from the front panel and given to an external controller.

Communication is set up between the 9500B and its controller via the IEEE-488 bus, connected into an interface within the 9500B.

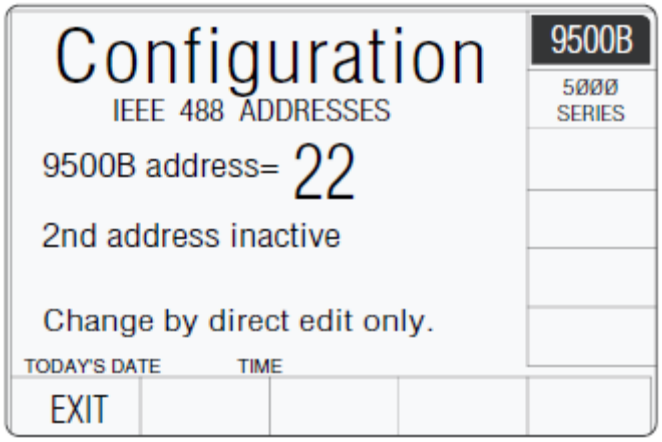
Commands from the controller are addressed to the 9500B using an address code, which can be a number in the range 0-30. For the 9500B to respond, this number must be matched by the same number programmed into the 9500B using the procedure given below.

Remote operation of the 9500B via the IEEE-488 interface is described in the *9500B Remote Command Manual*.

Note

The correct bus address is necessary to use remote commands, but remote operation is available only when the instrument is in MANUAL or CALIBRATION mode.

1. The 9500B IEEE-488 bus address can be set to any number within the range 0 to 30. For access from the 'Present Settings' screen, press the BUS ADDRESS screen key at the top right.
2. The 9500B transfers to the 'IEEE 488 ADDRESSES' screen:



erw023

3. Use numeric entry to set the required bus address number. Type the number on the keypad, then press the ↵ key.
4. Press EXIT to return to the 'Present Settings' screen.

   For second address (5000-series emulation), refer to *Model 9500B — Emulation of Tektronix SG5030 and CG5010/5011*.

'Printer'

Printer Operation (Procedure Mode and Test Mode only)

Using the Procedure mode print facility, the 9500B can deliver a printed certificate, whose style is also determined in Configuration mode.

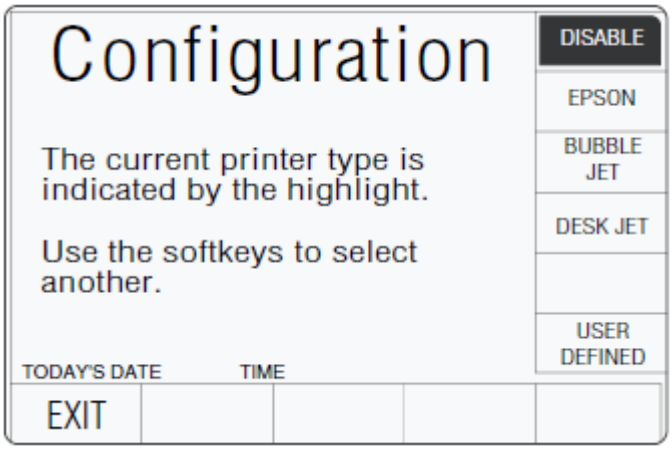
In Test mode, test results can also be printed—in a pre-determined format. The results are stored until the print command is given after the test is over. The printer does not need to be selected in Configuration mode, unless the results print is required to conform to the layout of a particular type of printer.

The printer is set up only when an attempt is made to print, following two types of occasion:

1. Printer type is changed in Config mode
2. 9500B is powered on

Printer Type Selection:

1. For access to select and enable a particular printer type (or one using the same formatting), press the PRINTER screen key on the 'Present Settings' screen.
2. This transfers to a 'Configuration' screen to change 'The current printer type':

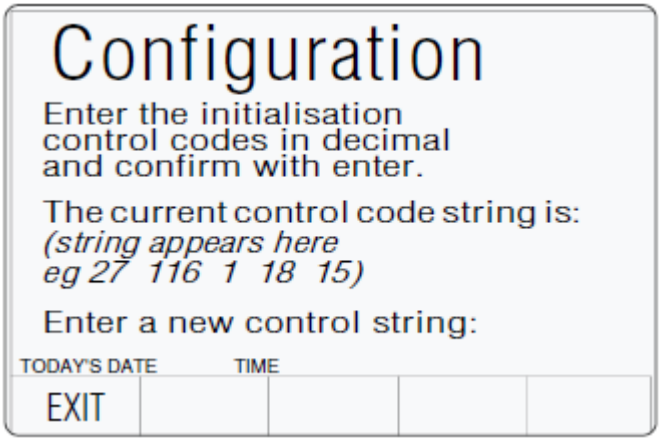


erw024

3. Power-on default is DISABLE. Use the screen keys to select the type of printer on the interface, or to disable direct printing.
4. EXIT returns to the 'Present Settings' menu screen.

User Defined Printer Type

5. If the type of printer you are using does not conform to one of those listed, press the USER DEFINED screen key. This transfers to a 'Configuration' screen designed to enter the initialization control codes for your printer:



Erw025

6. Obtain the initialization control codes from your printer's operating manual. If necessary, convert the codes to decimal. Use the 9500B keypad to type the decimal codes, separated by spaces (→): the new string replaces the old. Press the ↵ key.
7. EXIT returns to the 'current printer type' screen.

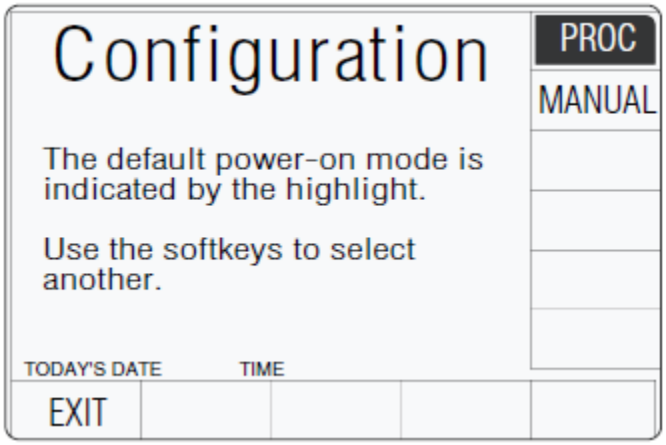
'Power-up mode'

Mode Selection at Power-on

Users can determine which mode will be selected automatically at power-on, choosing between Procedure mode and Manual mode. The 9500B cannot be made to power-up in any other mode.

To set the power-up default mode use the procedure in the column on the right:

1. For access to change the default mode, press the POWER UP MODE screen key on the 'Present Settings' screen.
2. This transfers to a 'Configuration' screen to change 'The default power-on mode':



erw026

3. To change the default, press the required screen key on the right.
4. Press EXIT to return to the 'Present Settings' screen.

The new default will be incorporated into the list. Next time the line power is turned from OFF to ON, the 9500B will power-up in the selected mode.

'NEW PASSWORD'

Changing the Passwords

Two passwords are required (they can be the same or different):

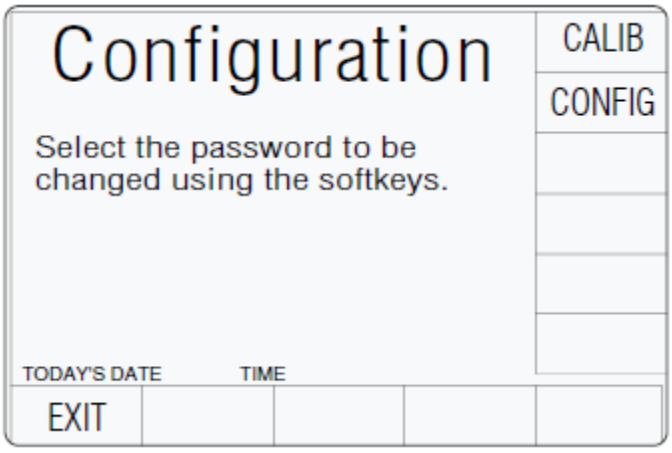
- For entry to Configuration mode
- To enter Calibration mode (for calibration of the 9500B itself)

Refer to *Passwords and Access*. When the 9500B is shipped from new, the password requirement is enabled to avoid unauthorized access (refer to *Passwords and Access*). The shipment Configuration and Calibration passwords allow initial access to the two modes, but should be changed as soon as entry has been gained into Configuration mode.

The passwords are changed using the following:

To change either the CALIB or CONFIG password:

1. On the 'Present Settings' menu screen, press the NEW PASSWORD screen key on the right. This transfers to the 'Select the Password' screen:
2. Select the password to be changed, via one of the two screen keys on the right.



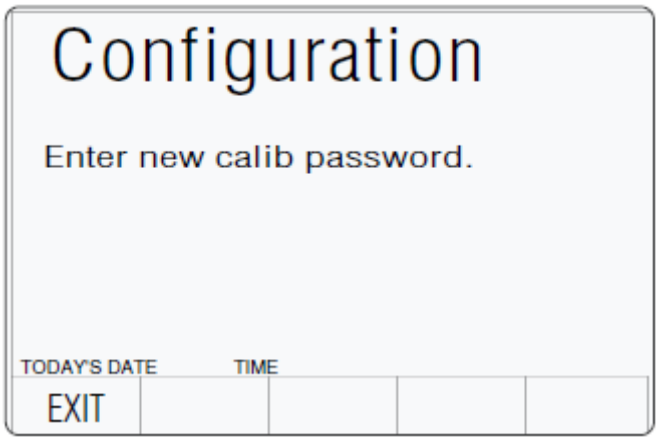
erw027

3. The EXIT screen key reverts to the Present Settings' screen.

'CALIB' Password

To Change the Calibration Mode Password

1. On the 'Select the password' screen, press the CALIB screen key on the right. This transfers to the 'Enter new calib password' screen:



erw028

(To cancel an attempt, press the EXIT key. This will revert to the 'Select the password' screen).

2. Type the new password using the alphanumeric keyboard, and finish with ↵. The 9500B will ask for the password to be entered again, to confirm it.
3. Retype the same password; finish with ↵. If the second password is different from the first, the 9500B will reject both, and the process must be repeated. If both passwords are the same, the 9500B will accept the new password, and revert to the 'Select the password' screen.

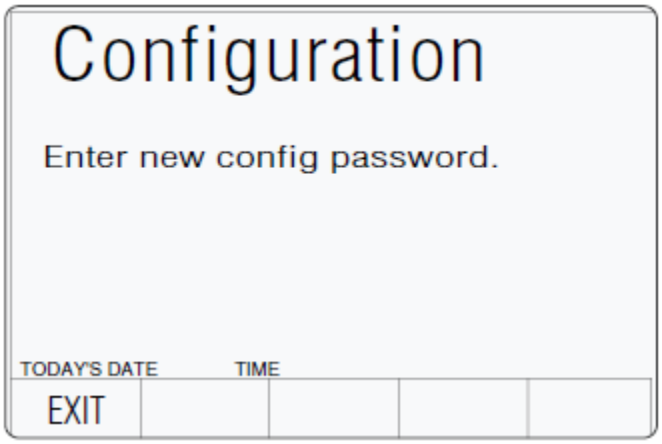
Note

The shipment version of the 'Calibration' password is 2→3→5→7.

'CONFIG' Password

To Change the Configuration Mode Password

1. On the 'Select the password' screen, press the CONFIG screen key on the right. This transfers to the 'Enter new config password' screen:



Erw029

(To cancel an attempt, press the EXIT key. This will revert to the 'Select the password' screen.)

2. Type the new password using the alphanumeric keyboard, and finish with ↵. The 9500B will ask for the password to be entered again, to confirm it.
3. Retype the same password; finish with ↵. If the second password is different from the first, the 9500B will reject both, and the process must be repeated. If both passwords are the same, the 9500B will accept the new password, and revert to the 'Select the password' screen.

Note

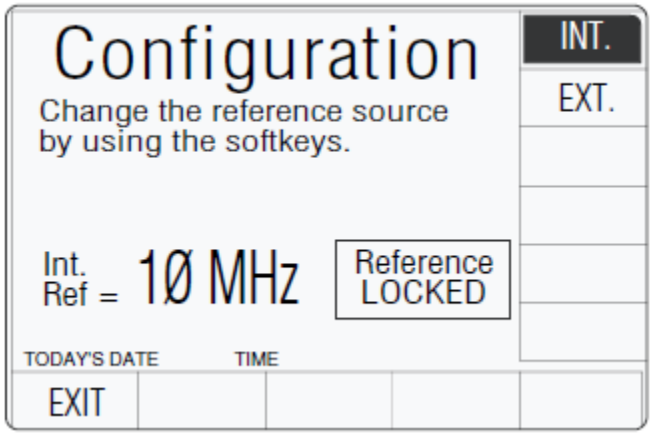
The shipment version of the 'Configuration' password is 12321.

'Ext ref in'

Reference Frequency Input

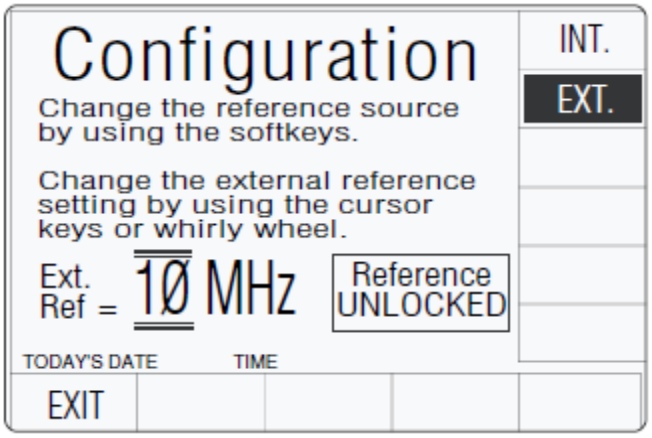
A BNC connector on the 9500B rear panel accepts reference frequency inputs from 1 MHz to 20 MHz in 1 MHz steps, from a TTL source.

1. On the 'Present Settings' screen, press the EXT REF IN screen key to transfer to the 'Change the reference source' screen (default shown).
2. To change the reference source, press the required screen key on the right:



Erw030

3. When switched to 'EXT.', use the up/down cursor control or spinwheel to inform the 9500B of the source frequency. Ensure that the required source is connected and operating.



Erw031

4. Press EXIT to return to the 'Present Settings' screen. The new external reference frequency is available to enhance the 9500B internal clock.

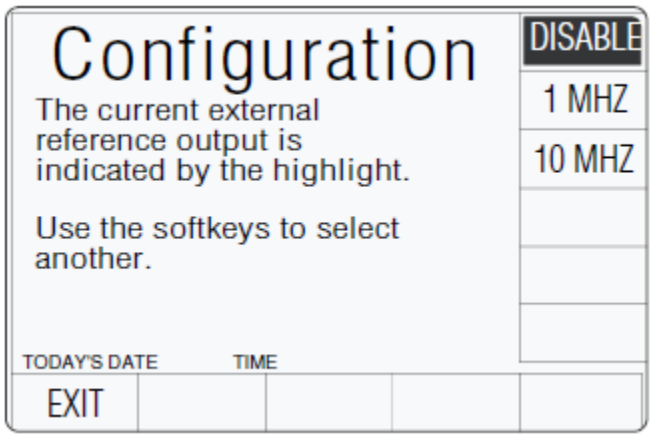
   The new external reference frequency is available to enhance the 9500B internal clock.

'Ext ref out'

Reference Frequency Output

A BNC connector on the 9500B rear panel provides a reference frequency output at either 1 MHz or 10 MHz, from a 50 Ω source (VSWR < 1.2 to 100 MHz). This can use the 9500B internal clock to enhance the frequency accuracy of other devices.

1. On the 'Present Settings' screen, press the EXT REF OUT screen key to transfer to the current external reference output' screen (default shown):



erw032

2. To change the external reference output, press the required screen key on the right.
3. Press EXIT to return to the 'Present Settings' screen.

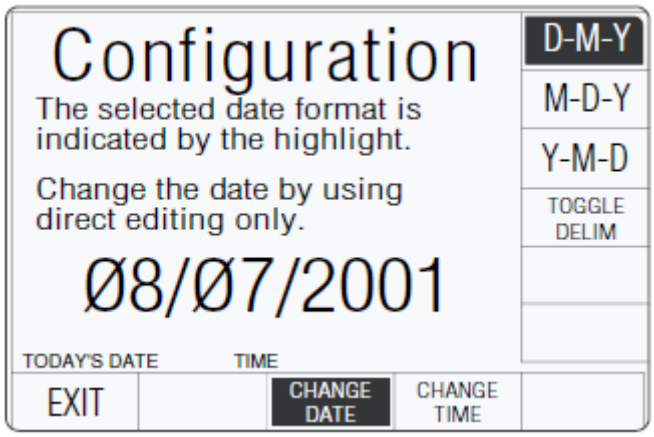
   The selected external reference frequency is either disabled, or applied to the 'REF FREQUENCY OUTPUT' BNC connector on the rear panel.

'DATE TIME'

Date and Time Settings

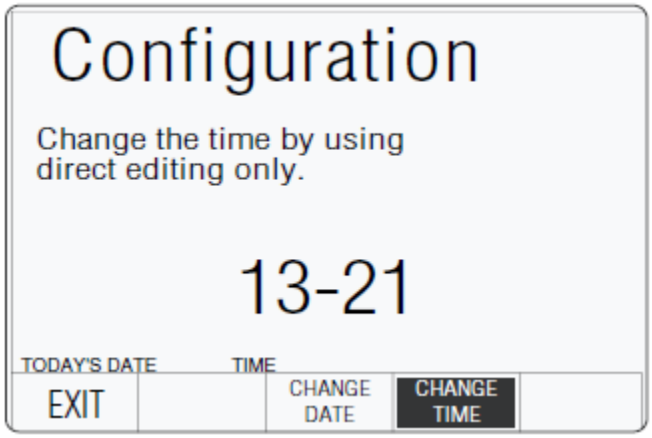
A real-time clock, supported by an internal battery, presents the date and time at the bottom of many screens. It is also used to generate the date to appear on direct-printing certificates in Procedure mode. Users have access via Configuration mode to correct the date and time (for instance: to accommodate daylight saving changes, and crossing time zones).

1. Press the DATE TIME screen key on the 'Present Settings' screen, for access to allow the date and time to be altered.
2. This transfers to a configuration screen designed for changing the date and time. Our representation shows the current date from a previous setting:



Erw033

3. Press the appropriate right screen key to set the required date format, and use the keypad to correct the date, (using non-alphanumeric characters as delimiters), followed by ↵. The new date will appear with delimiters as set by the 'TOGGLE DELIM' key, which merely switches between 'slash' (/) and 'period' (.) only.
4. To correct the time, press the CHANGE TIME screen key to transfer to the 'Change the time' screen, then use the alpha-numeric keypad to enter the present time:



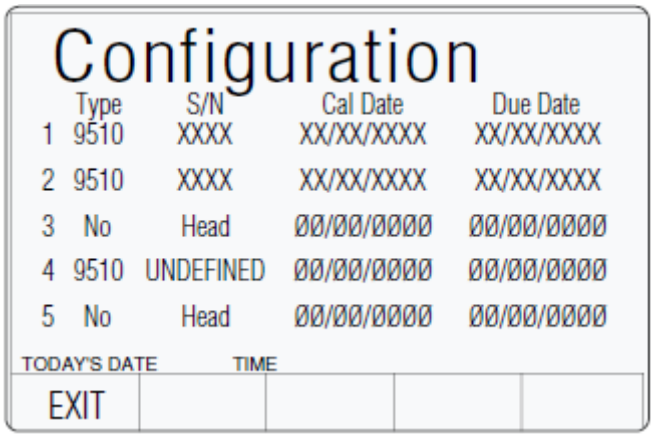
erw034

5. Press the EXIT screen key to return to the 'Present settings' menu screen. The updated corrected date and time, will appear wherever they are used.

'HEAD CONFIG'

Information only

Pressing the 'HEAD CONFIG' key provides a screen which indicates the type, serial no., cal date and cal due date for each head fitted:

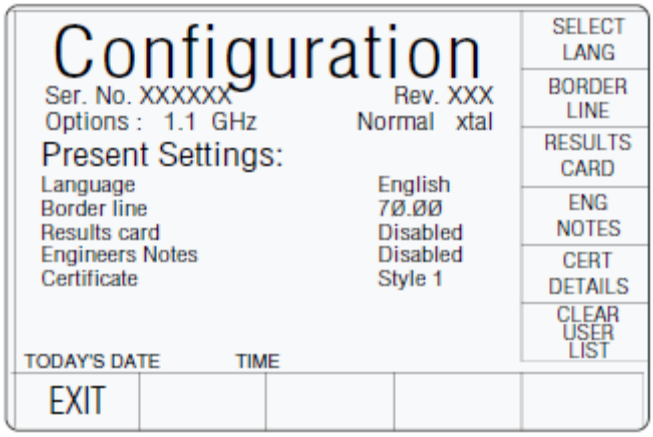


erw035

Head calibration stores head details and calibration corrections, specific to that head, regardless of the base unit to which it is fitted. The above screen presents the stored details derived from the fitted heads.

'MORE' Configuration

After exiting to the 'Present Settings' screen, pressing the 'MORE' key will provide entry to a second 'Configuration' menu screen, showing the present settings of other parameters (generally associated with Procedure mode) which can be changed using screen keys whose new labels appear on the display:



erw036

The 'EXIT' screen key acts to escape, back to the first Configuration menu screen.

If it desired to revert to the Mode Selection display, press the front panel 'Mode' key.

'Language'

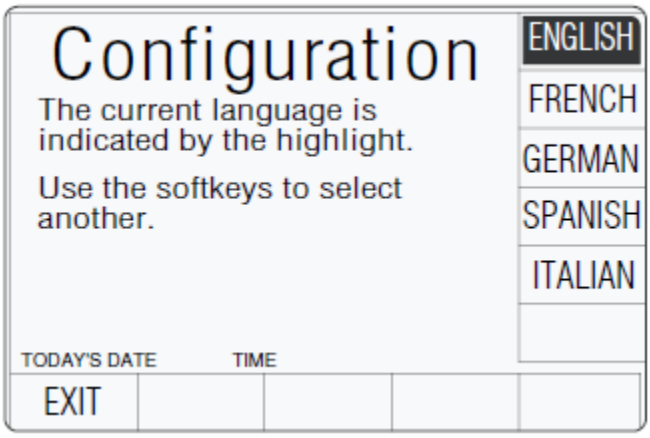
Language Considerations

The 9500B default language is English. It is possible to change the language used in Procedure mode, but not in any of the other modes.

For Procedure mode the language of the introductory screens can be changed (these are stored within the 9500B itself).

The language used in a procedure card is determined and registered on the card, within the procedure header, at the time that the procedure is created (Portocal II can perform this function). When the procedure card is being used in the Model 9500B, the language cannot be changed.

This facility allows users to alter the language used in the introductory screens of Procedure mode:



erw037

1. On the 'Present Settings' screen, to transfer to the 'Current language' screen, press the SELECT LANG screen key.
2. To change the Procedure mode language, press the required language screen key on the right.
3. Press EXIT to return to the second 'Present Settings' menu screen.

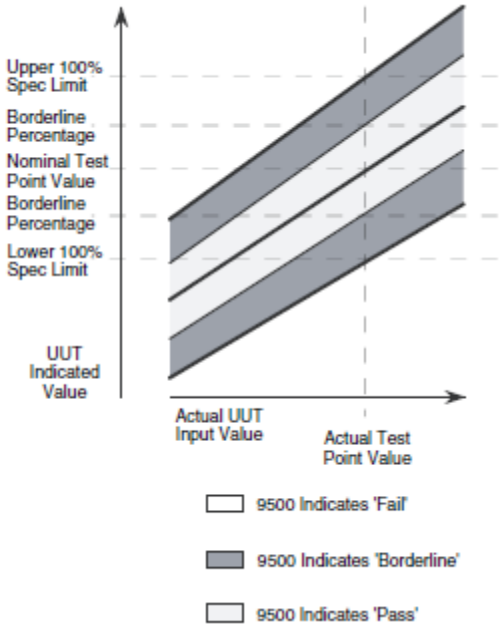
The new language will be used the next time that Procedure mode is entered.

'Border line'

Test Point Specifications—'Borderline' Reporting

For users who wish to know when a UUT is drifting towards the limits of (while still within) the manufacturer's specification, it is useful to provide some 'borderline' indication. This can be expressed as a percentage of the manufacturer's specification for each test point, beyond which the indication will be given.

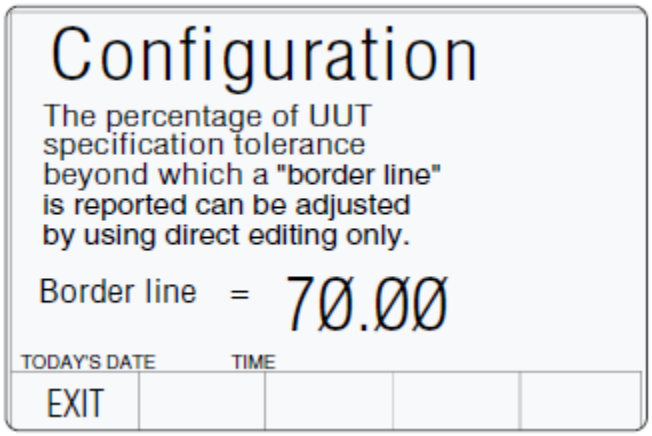
In the figure, the pass, borderline and fail regions of the specification tolerance are indicated at the test point.



erw038

When in Procedure mode, the direct-printing certificate (Style 1), and the data on the 'Results' card, will report 'Borderline' test results. Users have access via Configuration mode to set the percentage for borderline reporting.

1. For access to allow the borderline reporting threshold to be altered, press the BORDER LINE screen key on the 'Present Settings' screen. This transfers to a configuration screen designed for changing the threshold (default value shown):



erw039

2. Use Direct edit to set the required percentage of specification tolerance. Results which lie between this percentage and 100 % of tolerance will be reported as 'BORDER LINE '.
3. Press the EXIT screen key to return to the second 'Present settings' menu screen.

Subsequently, during each verification in Procedure mode, the 9500B will detect its own slewed output and place the UUT measurement error into the 'Pass', 'Border line' or 'Fail' category. When a (Style 1) certificate is printed, and on any active results card, each test point will indicate a 'Pass', 'Borderline' or 'Fail' result.

'Results card'

Note

This section is only applicable for products that are equipped with a PCMCIA SLOT 2.

Formatting Results Memory Cards (Procedure Mode only)

In Procedure mode, the 9500B can deliver the results of a 'Calibrate' or 'Verify' procedure to a memory card inserted into PCMCIA SLOT 2 in the front panel (refer to *Procedure Mode*). Note that only SRAM cards can be used in the PCMCIA SLOT 2 drive.

New SRAM cards must first be formatted for the purpose. This can be carried out in Test mode, as part of the 'Card Slot Test' procedure (refer to the *9500B Calibration Manual*), or within Portocal II software.

⚠ Caution

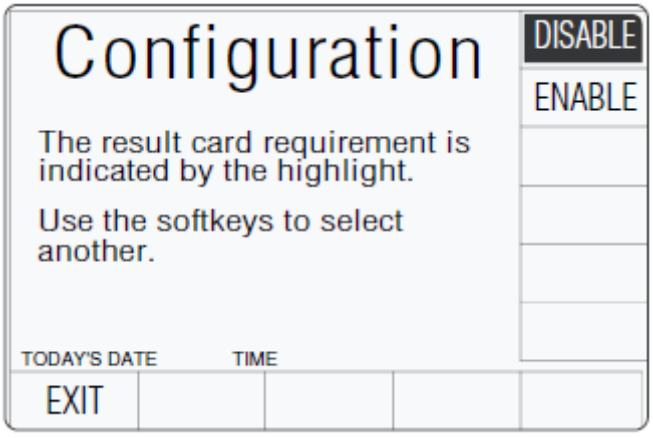
During the formatting process, the Card Slot Test over-writes all data stored on the card in the slot, and sets up a new 'Results card header'.

Note

It is not necessary to re-format a used card, with results already stored, for it to accept new data. New results data from Procedure mode runs will be concatenated with existing data until the card memory is full. Erasure of card contents should be done using Portocal II.

1. For access to enable Procedure mode results to be downloaded to a SRAM memory card in the front panel PCMCIA SLOT 2, press the RESULTS CARD screen key on the 'Present Settings' screen.
2. The 'RESULTS CARD' screen key transfers to 'The result card requirement' menu screen.

   The power-on default is DISABLE.



erw040

3. To enable or disable the facility, press the required screen key on the right of the screen. If enabled without a results card inserted in PCMCIA SLOT 2, the selected procedure will not run.
4. EXIT returns to the second 'Present Settings' menu screen.

'Engineers Notes'

Engineer's Notes

When a certificate is being prepared in Procedure mode, sometimes it will be desirable to insert additional information about special conditions, pertinent to the procedure which was carried out.

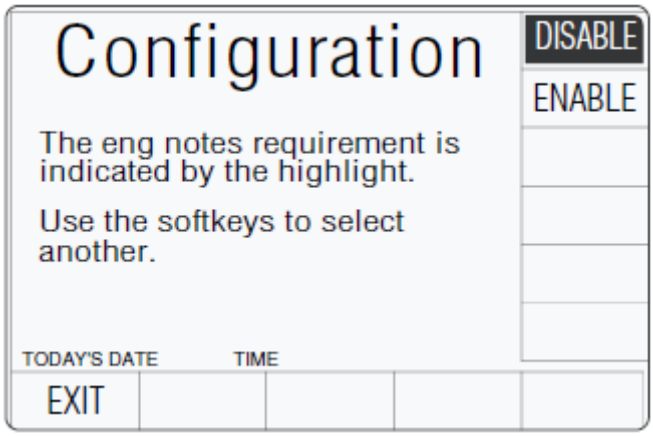
For instance: if the procedure was performed on a plug-in module of an oscilloscope, it may be desired to add the serial number of the oscilloscope mainframe, as well as the module's serial number.

If, in CONFIG mode, the 'Engineers Notes' are enabled, then an extra field will be added to the certificate entitled 'Additional Notes' in which any engineer's information can be entered. It will appear between the 'Calibration Standard' and 'Measurement Type' blocks.

The additional notes can be added on a screen which will be shown in Procedure mode when 'Engineers Notes' are enabled.

To Enable Engineers Notes

1. On the second 'Present Settings' menu screen, press the ENG NOTES screen key on the right. This transfers to the 'Eng notes requirement' screen:



erw041

2. Press the ENABLE screen key on the right. The DISABLE key reverses the process.
3. The EXIT screen key reverts to the second 'Present Settings' screen.

'Certificate'

Results Certificates

In Procedure mode, three styles of printed certificate are available:

Style 1

This provides full information about each point tested, including applied and target values, spec limits and UUT error, % error pass/fail and test uncertainty ratio between 9500B and UUT.

Style 2

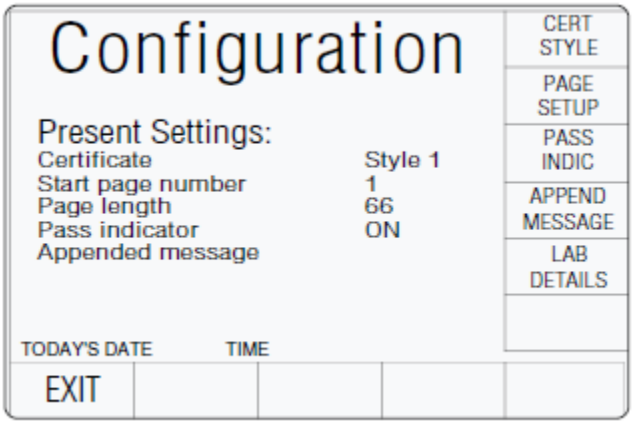
This is a shorter form of certificate, showing only the applied and target values, and the 9500B absolute uncertainty.

Style 3

This certificate is similar to Style 1, and has been added to accommodate the wider spec limits encountered during oscilloscope calibration, expressed in percentages rather than ppm.

Users are given the facility, in Configuration mode, to change the style of certificate to be printed.

1. For access to allow the certificate formatting to be altered, press the CERT DETAILS screen key on the second 'Present Settings' screen.
2. This transfers to what we shall refer to as a 'CERT DETAILS' screen:



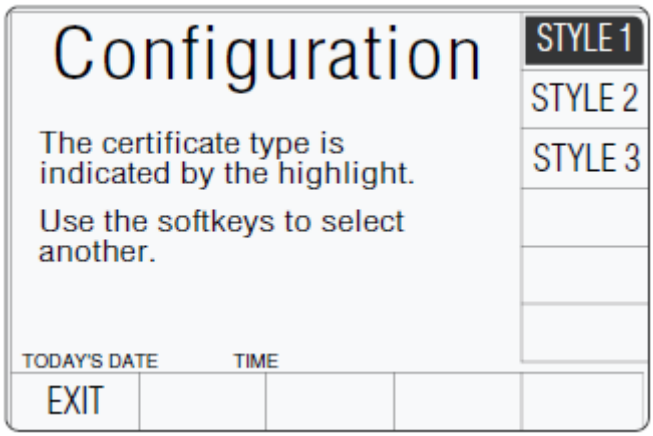
CERT DETAILS Screen Layout

erw042

3. The 'CERT DETAILS' screen allows users to design a certificate by adjusting or selecting characteristics via screen keys on the right (refer to 'CERT STYLE' to Laboratory Temperature and Humidity).
4. The EXIT screen key reverts to the second 'Present Settings' screen.

'CERT STYLE'

1. For access to select the certificate style, press the CERT STYLE screen key on the 'CERT DETAILS' screen. This transfers to 'The certificate type' screen, which allows the style of certificate to be selected:

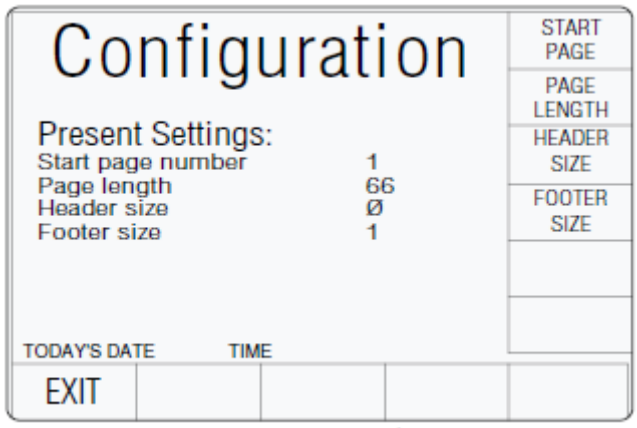


erw043

2. Press the key on the right which represents the required style of certificate.
3. Press the EXIT screen key to revert to the CERT DETAILS screen.

'PAGE SETUP'

1. To set up the certificate page, press the PAGE SETUP screen key on the 'CERT DETAILS' screen. This transfers to what we shall refer to as a 'PAGE SETUP' screen, which allows users to design the certificate page, using the keys on the right:



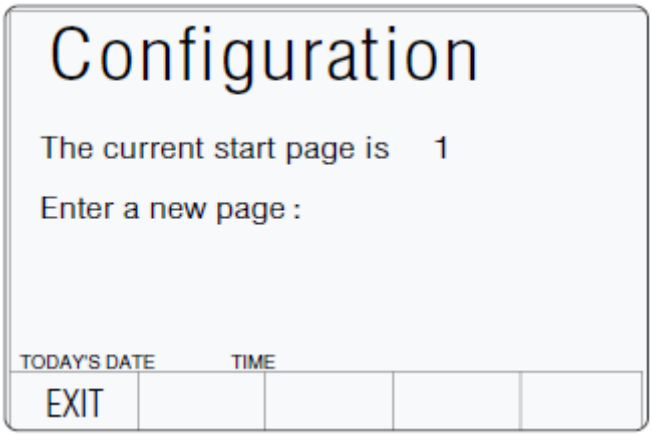
PAGE SETUP Screen Layout

erw044

2. Press the key on the right which describes the attribute to be changed.
3. The EXIT screen key to revert to the CERT DETAILS screen.

'Start Page Number'

1. To change the certificate start page number, press the START PAGE screen key on the 'PAGE SETUP' screen. This transfers to the 'Current start page' screen:



erw045

2. Use Direct edit to enter the new start page number.
3. Press the ↵ screen key to confirm the new page number and return to the 'PAGE SETUP' menu screen. The new page number will appear on the 'Present settings' list.
4. The EXIT screen key reverts to the PAGE SETUP screen without changing the start page number.

Page Length, Header and Footer Sizes

'Page length', 'Header size' and 'Footer size' are changed by similar operations as for the 'Start page number' change. No further explanation is necessary.

After all the page setup characteristics are satisfactory, press EXIT on the 'PAGE SETUP' screen to return to the 'CERT DETAILS' screen.

'Pass Indicator'

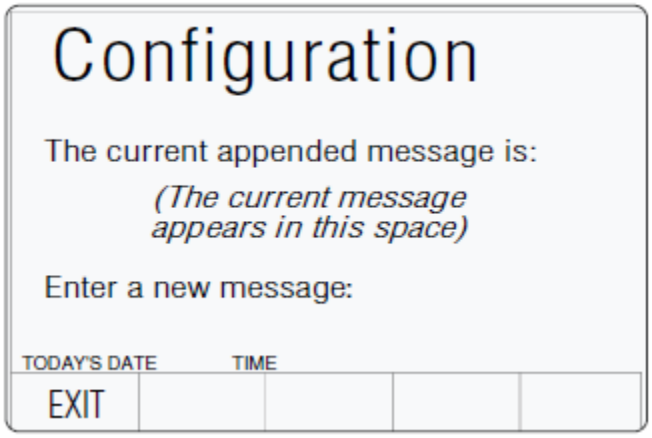
On the 'CERT DETAILS' screen, the 'PASS INDIC' soft key acts as a toggle to turn the pass indicator facility off and on. There is no transfer to another screen, the state of the pass indicator on the 'CERT DETAILS' screen merely toggles between off and on as the facility is altered.

'Appended Message'

Message required for the Certificate

For the printed results certificates, users may wish to add a descriptive message:

1. To access the message screen, press the APPEND MESSAGE screen key on the 'CERT DETAILS' screen. This transfers to the 'Current appended message' screen:
2. Use Direct edit to enter the new message.



erw046

3. Press the ↵ screen key to return to the 'CERT DETAILS' screen. The message appears on the 'Present settings' list.
4. The EXIT screen key reverts to the CERT DETAILS screen without changing the appended message.

'LAB DETAILS'

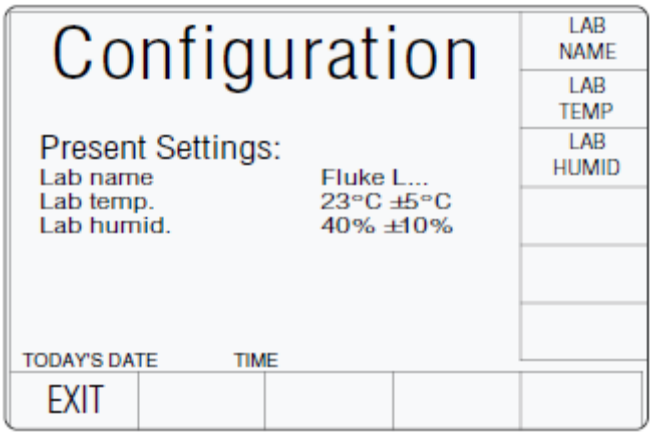
Laboratory Details required for the Certificate

For the printed results certificates, it is required to enter details of the laboratory at which the results were obtained.

Users should enter the name, temperature and relative humidity of their laboratory for the printed certificates:

1. To set up the Laboratory details, press the LAB DETAILS screen key on the 'CERT DETAILS' screen. This transfers to what we shall refer to as a 'LAB DETAILS' screen.

2. The lab name, temperature and humidity can be entered via the three screen keys on the right.



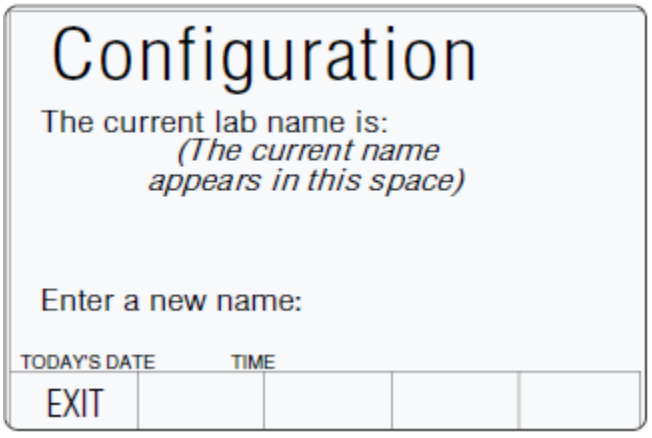
LAB DETAILS Screen Layout

erw047

3. The EXIT key reverts to the CERT DETAILS screen.

'LAB NAME'

1. To enter the Laboratory name, press the LAB NAME screen key on the 'LAB DETAILS' screen. This transfers to the 'Current lab name' screen:



erw048

2. Use Direct edit to enter the new laboratory name.
3. Press the ↵ screen key to return to the 'LAB DETAILS' screen: The new lab name will appear on the 'Present settings' list.
4. The EXIT screen key reverts to the LAB DETAILS screen without changing the lab name.

Laboratory Temperature and Humidity

'Lab temp' and 'Lab humid' are changed by similar operations as for the 'Lab name' change. No further explanation is necessary.

After all the laboratory details are satisfactory, press EXIT on the 'LAB DETAILS' screen to return to the 'CERT DETAILS' screen.

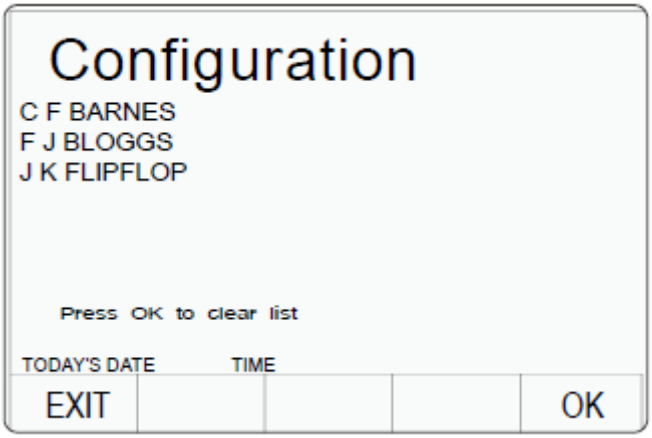
'CLEAR USER LIST'

Procedure Mode User List

A list of users is presented on the opening menu screen of Procedure mode, where the user's name can be selected to appear on the certificate. New names can be added to the screen at the same time.

Names cannot be removed from the list without knowing the Config mode password, which must be used to access the 'Clear user list' facility.

1. For access to allow the Procedure mode user list to be cleared, press the CLEAR USER LIST screen key on the second 'Present Settings' screen. This transfers to the confirmation screen:



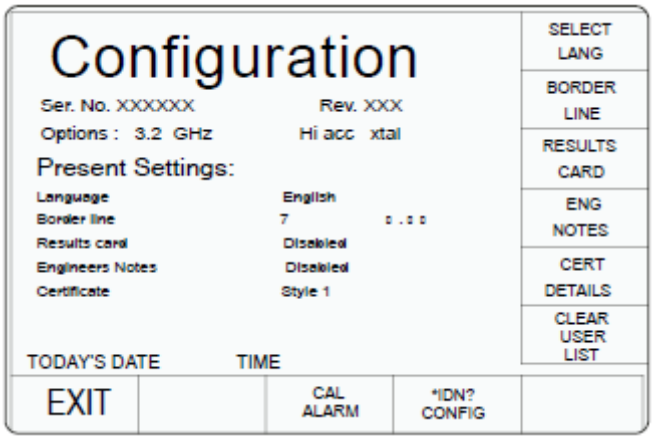
erw049

2. OK removes all names from the list and returns to the second 'Present Settings' menu screen.
3. EXIT returns to the second 'Present Settings' menu screen without removing the names.

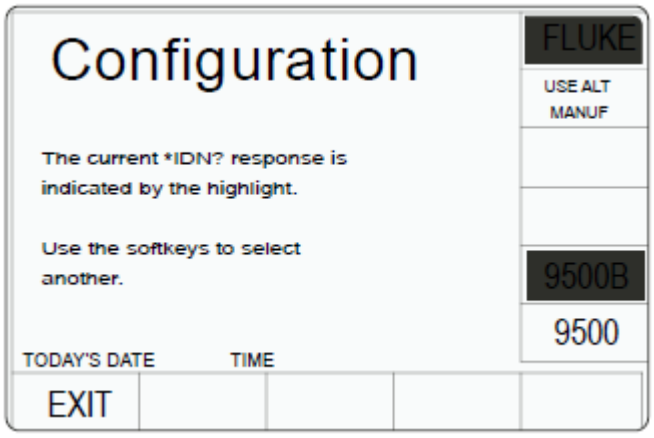
*IDN? CONFIG

To retain compatibility with software applications that depend upon instrument response to the IEEE 488.2 common command *IDN? it may be necessary to configure your "Fluke 9500B" to respond as a previous model "9500" from a previous manufacturer, for example, "Wavetek".

1. On the second "Present Settings" menu screen, press the IDN screen key on the bottom row of Softkeys. This transfers to the "*IDN? Config" screen:



erw050



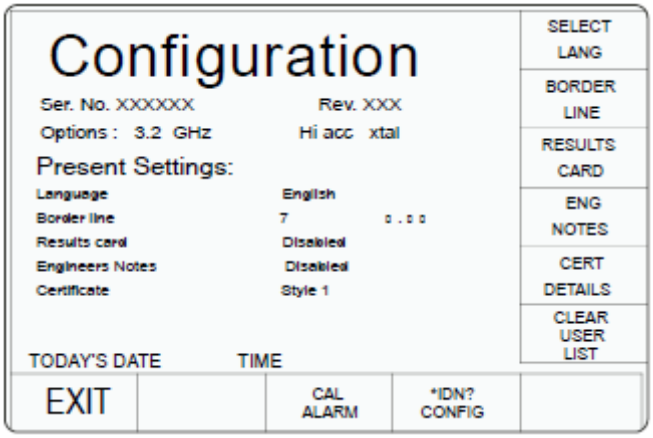
erw051

2. The EXIT screen key reverts to the second "Present Settings" menu screen.

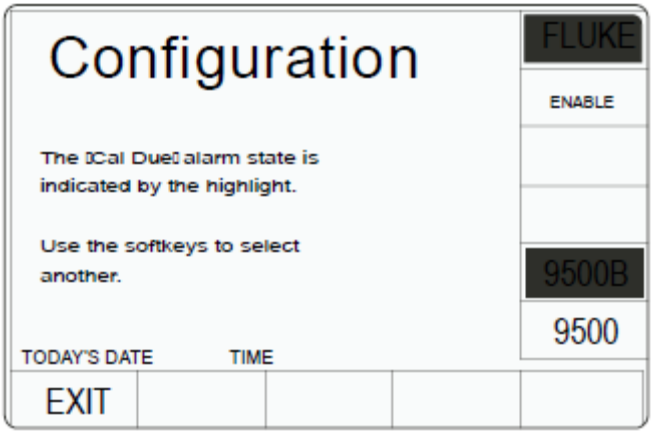
'CAL Alarms'

The default setting for calibration alarms is enabled. This configuration allows these alarms to be disabled.

1. On the second “Present Settings” menu screen, press the CAL Alarm key on the bottom row of Softkeys. This transfers to the “CAL Alarm” screen:



erw052



erw053

2. The EXIT screen key reverts to the second “Present Settings” menu screen.

Manual Mode

The following topics are covered in this section:

- Interconnections
- Manual Mode - Function Selection
- Edit Facilities
- DC/Square Operation
- Sine Function
- Edge Function
- Time Markers Function
- Auxiliary Functions
- Current Function
- Composite Video Function
- Linear Ramp Function
- Overload Pulse Function
- Zero Skew Function
- Auxiliary Input
- Load Resistance and Capacitance Measurement
- Input Leakage Function
- Pulse Width Function

Interconnections

This section deals with the Active Head Technology™ used to connect the 9500B to a UUT oscilloscope, and rear-panel signal inputs and outputs.

Active Head Technology

The main function of a head is to route the 9500B's output to the UUT oscilloscope input channel without intervening cables that could degrade the signal.

Each head contains output circuitry that generates and supports the transmission of pulses of very short rise and fall times with low distortion, and amplitude variable from ±5 mV to ±3 V, and good 50 Ω matching. This is achieved by the use of low-loss substrate dielectrics, with wide-band components, attenuators and relays. The heads also perform the function of sinewave levelling.

Available head modules include:

- Model 9510: 1.1 GHz Output Module with 500 ps pulse edge capability.
- Model 9530: 3.2 GHz Output Module with 150 ps and 500 ps pulse edge capability.
- Model 9550: Output Module with 25 ps pulse edge capability only.
- Model 9560: 6.4 GHz Output Module with 70 ps pulse edge capability.

Electrical specifications apart, modules are interchangeable. The 9500B accepts any mix of types, up to five modules.

Connections to the 9500B and UUT Oscilloscope

Two connections are used for each head. An 18-way connector and cable provides power supplies, control and sense signals, whereas a separate coaxial connector and cable carries the signal or clock. The output signal is delivered directly to the UUT oscilloscope's input channel through the single BNC or PC3.5 connection.

⚠Caution

The ⚠ symbol, shown on the 9500B front panel and heads, draws attention to information contained in this manual regarding maximum output voltages and currents.

For details, see *Specifications*.

Head Signal Processing

Signal processing in the head modules can be summarized by considering the 9500B functions:

- DC/Square: The signal is routed directly via switched attenuators to the output BNC or PC3.5 socket. Sensing from the output is passed back to the mainframe, effectively providing a 4-wire delivery.
- ∿ Sine: The sinewave at its final frequency is passed through the input SMA coaxial cable. Sinewave amplitude is set in the mainframe, but sensing for sinewave levelling takes place in the head itself, returning the levelling control signal to the mainframe. The levelled signal is routed via attenuators to the output BNC or PC3.5 socket.
- Edge: Pulse levels and timing originate in the mainframe and pass to the head for control of the edge generating circuitry. Pulses with 500 ps edge are routed via the LF/DC attenuators to the output BNC or PC3.5 socket (Models 9510/9530). Special attenuators in Model 9530/9560 are used for the 150 ps or 70 ps edge pulses.
- Markers. Marker types: (Square/Sine, Pulses or Narrow Triangle waveform), timing and levels originate in the mainframe and pass directly via switched attenuators to the output BNC or PC3.5 socket. Line frequency markers are also included.
- Aux:
  a. DC/Square Current Source. Current outputs between 100 μA and 100 mA are derived from the DC/Square voltage source.

  Note

  Not compatible with 9550 or 9560.

  b. Composite Video. Video voltage outputs are passed directly via the output BNC or PC3.5 to test TV sync separator functions.

  c. Linear Ramp. Symmetrical triangular 1Vp-p waveforms of period 3 ms to 3 s are passed via the DC/Square voltage route to the output BNC or PC3.5. These calibrate trigger level markers and check DSOs for missing ADC codes.

d. Overload Pulse. High energy pulses between 5 V and 20 V of limited duration are passed via the DC/Square voltage route to the output BNC or PC3.5, to test 50 Ω terminator protection.

e. Zero Skew. Permits 9500B channels/heads transit times to be harmonized, in order to test UUT input channel trigger synchronization.

f. AUX IN AUX IN Routes external calibration waveforms to an active head's BNC or PC3.5 output.

g. Load Resistance. Measures load resistance in the active head's output circuit.

h. Load Capacitance. Measures load capacitance in the active head's output circuit.

i. UUT Input Leakage Tests. Short/ Open-circuit outputs directly to the output BNC or PC3.5 allow testing of oscilloscope input leakage current.

AUX IN (Rear Panel)

Despite the huge flexibility if the 9500B, it is sometimes desirable to apply signals from user's equipment to the inputs of a UUT oscilloscope, for specific calibration or test purposes.

With the 9500B Auxiliary Input selected, wideband passive routing is available from a rear-panel 50 Ω SMA input through to the selected 9500B channel output, using 9500B front panel controls.

No trigger pickoff is provided, and internal triggers are not available.

REF Frequency Input

A BNC connector on the 9500B rear panel accepts reference frequency inputs from 1 MHz to 20 MHz in 1 MHz steps, from a TTL source, to enhance the 9500B internal clock.

REF Frequency Output

A BNC connector on the 9500B rear panel provides a reference frequency output at either 1 MHz or 10 MHz, from a 50 Ω source (VSWR < 1.2 to 100 MHz). This can use the 9500B internal clock to enhance the frequency accuracy of other devices.

Manual Mode—Function Selection

This section is a guide to selecting the functions in Manual mode.

Selection of Manual Mode

Whenever the 9500B is in another mode, Manual mode can be selected by pressing the front panel Mode key, followed by the Manual screen key at the left of the bottom row.

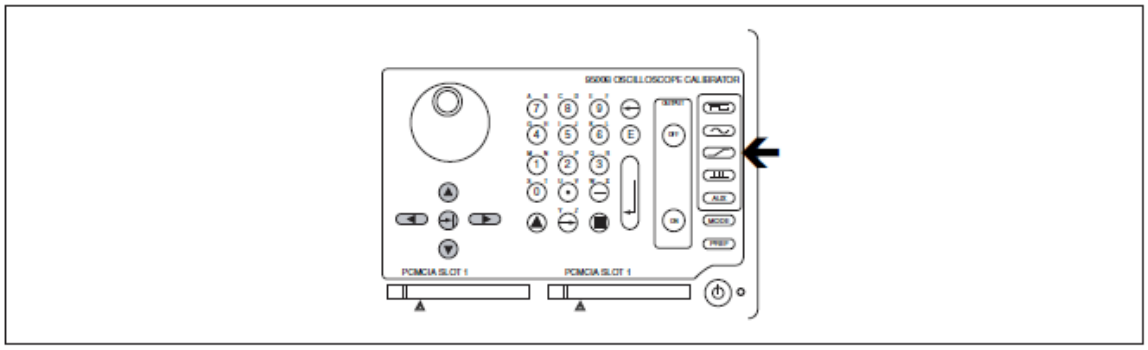
Note

The 9500B can be made to default to either Manual or Procedure mode at power-up (refer to 'Power-up mode').

Front Panel Function Keys

Note

This description assumes that the 9500B is powered-up and that Manual mode is active.



erw054

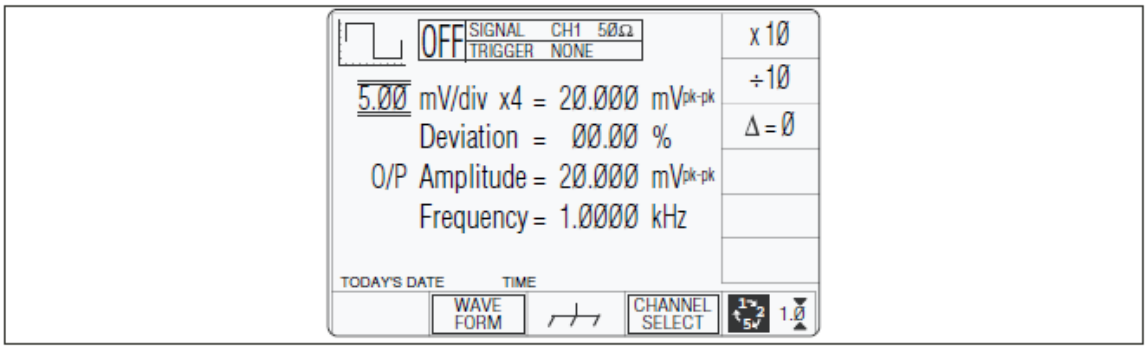
Figure 11. 9500B Function Keys

'Function' Keys

A function is accessed by pressing one of five keys at the right of the 'OSCILLOSCOPE CALIBRATOR' panel, as highlighted in Figure 11.

Default Settings

When entering Manual mode, the system selects DC/Square function. The system defaults to show the DC/Square menu screen:



erw055

Figure 12. Manual Mode Power-Up Screen — Multi-Channel

OSCILLOSCOPE CALIBRATOR' Panel—Right Side Function Keys

This panel carries the main controls used to select the operational functions and modes of the calibrator.

Manual and Calibration Mode Function keys are arranged down the right edge:

 DC/Square function. Select Square with direction, or ±DCV using screen keys. Select output channel, amplitudes and frequency using screen keys and cursor controls.

 Levelled Sinewave function. Select output channel, amplitude and frequency using screen keys and cursor controls.

 Edge. Select polarity, amplitude and frequency using screen keys.

 Timing Markers. Select Waveform, Amplitude and Frequency/Period, using screen keys.

Aux Auxiliary Functions. Select from:

- Current
- Composite Video
- Linear Ramp
- Overload Pulse
- Zero Skew
- Auxiliary Input
- Load Resistance or Load Capacitance measurement
- UUT Input Leakage Test using screen keys
- Pulse Width

As soon as a right-side screen key is pressed (other than ), the default menu screen will disappear, to be replaced by the default screen of the selected oscilloscope function.

For further details refer to subjects later in this section.

Edit Facilities

Introduction

Methods of Adjustment

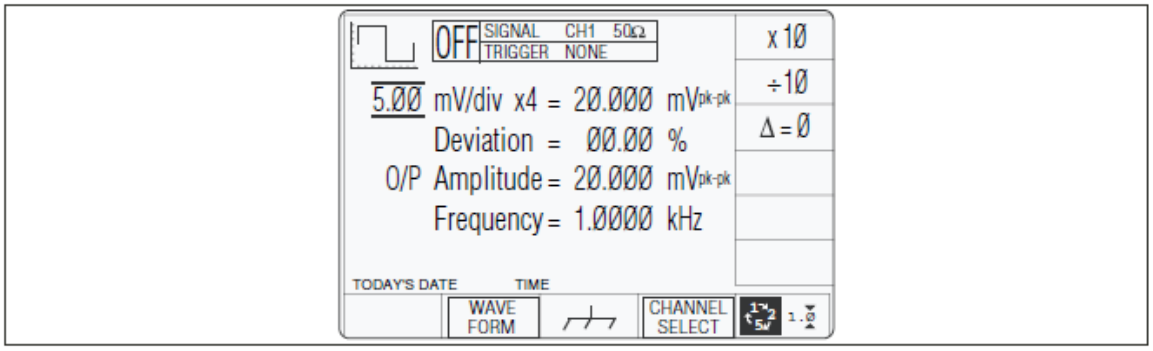
Before looking at displays for the functions, we need to know how to alter the values displayed on the screen. There are three main methods used to change values:

- 'Digit Edit'; in which values can be scrolled digit by digit, using a 'triangular' cursor and associated controls.
- 'Sequence Scroll'; in which values can only be changed by scrolling through a sequence of values, using a 'barred' cursor and associated controls. One of two common sequences can be selected using the 'Pref' facility.
- 'Numeric Entry Edit'; where a complete new value is written in place of the existing selected value, using the 'triangular' cursor and the numeric keypad.

Adjustment Modes

In addition to the three methods, there are two modes, selected by the right-most soft key on the bottom row beneath the screen, which toggles between 'Scope' mode and 'Direct' mode . These are not major modes of the same magnitude as Manual mode, but identify specific means of making selections or entering changes on the screen.

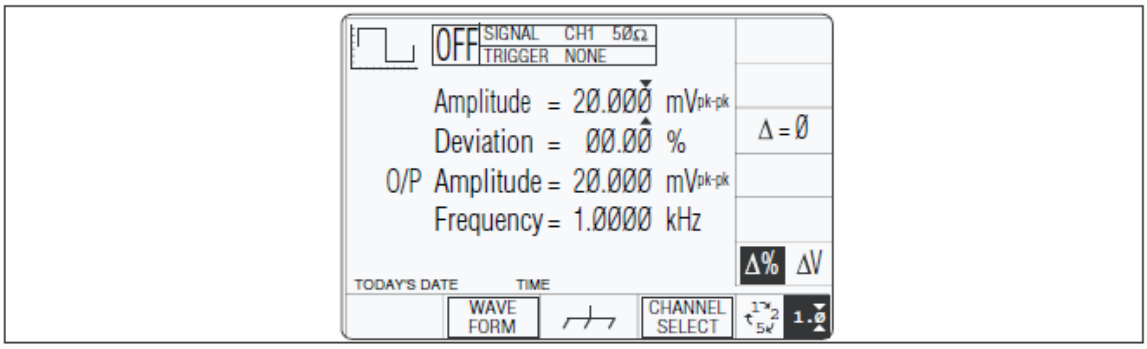
1. 'Scope Mode'; which relates to the way that oscilloscopes are ranged in sequences. Scope mode mainly uses Sequence Scroll, but also includes limited use of Digit Edit and Numeric Entry Edit. This is indicated by the bottom right corner key label:



erw056

Figure 13. Typical Screen in Scope Mode

2. 'Direct Mode'; which permits access to all contributing parameters using only Digit Edit and Numeric Entry Edit, indicated by the bottom right corner key label:



erw057

Figure 14. Typical Screen in Direct Mode

Use of the Tab Key

In all editing, the Tab key ⇥ is used to select the required variable for adjustment.

Scope Mode is the Default

Scope Mode is the default mode, which will always be forced at power-on and when changing modes. However, we shall discuss Direct mode first because Sequence Scroll is excluded.

In order to enter Direct mode, the bottom rightmost soft key must be toggled so that its label changes to:

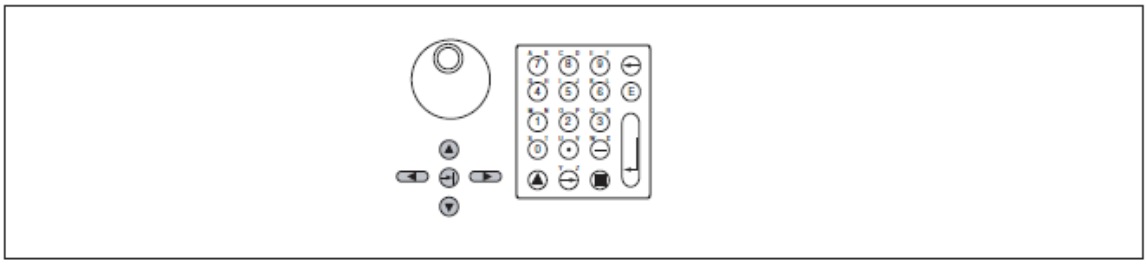
Direct Mode

In Direct mode, once the ⇥ key has selected the required variable, the cursor can take only one form: 'triangular'. A pair of triangles, pointing at a single digit, indicate that the digit's value can be scrolled continuously in integer increments.

Note that the Units/division and multiplier fields are not used, and the 'barred' cursor seen on the default screen is missing.

Cursor Control

The cursor controls used in Direct mode are shown highlighted in Figure 4-5.



erw058

Figure 15. Cursor Control in Direct Mode

Direct Mode—Digit Edit

With the triangular cursor attached to a digit, the ⌃/⌄ keys and the spinwheel are used to increase or decrease the digit's value. The 〈 and 〉 keys move the cursor along the number to select the digit to be scrolled. Except for Deviation, where the resolution cannot be changed, movement of the cursor off the end of the number will cause the resolution to change to accommodate an extra digit, until no further resolution change is possible.

The two shift keys ▲ or ■ can be used as a short cut to change the number's resolution. Pressing either of the shift keys before a 〈 or 〉 key will effect the change, even if the digit may not be at the end of the number. The cursor will remain with its selected digit.

Note that after pressing a shift key, its image appears and remains on the bottom right of the screen until the 〈 or 〉 key is pressed. (for Deviation, the resolution cannot be changed, so use of a shift key is ineffective).

Direct Mode—Numeric Entry

Introduction

Numeric Entry is not a default state. Digit Edit will always be forced at power-on, and when changing modes and functions.

Each method has its own advantages, which will become apparent with experience of using the front panel controls.

Numeric Entry facility employs the numeric keypad to enter whole values, where this is more convenient than operating on individual digits in 'Digit Edit' facility.

Cursor Control

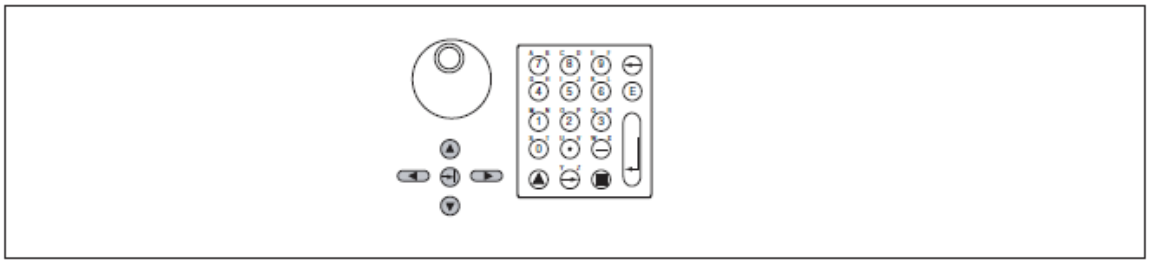
The tab ⇥ key is used to pass the cursor from one parameter to another, but the ⌃, ⌄, ⌃, ⌃ keys and spinwheel play no part in setting the value.

Form of Cursor

Numeric Entry can be used to alter only those parameter values which are accessed by the triangular form of cursor. The cursor can sit on any digit in the number, and Numeric Entry will have the same effect.

Value Editing

The controls for Numeric Entry to alter the value are the numeric keys of the alpha numeric keypad, highlighted in Figure 16.



erw059

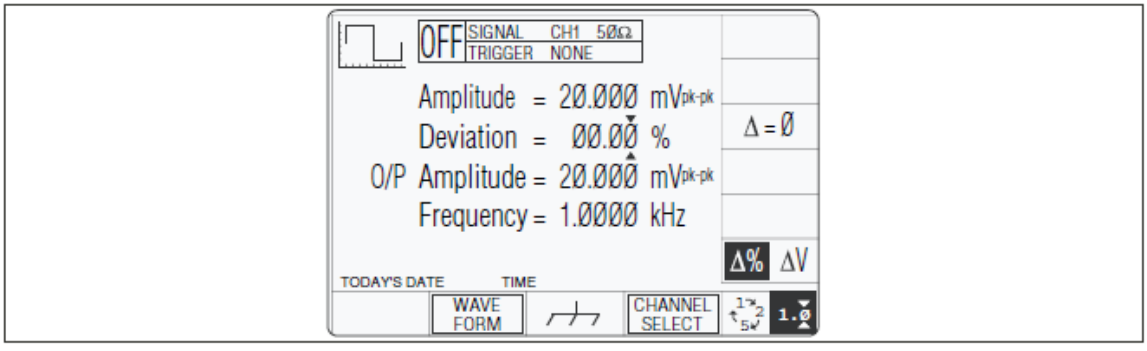
Figure 16. Controls for Numeric Entry

Value Entry Box

Once a numeric key is pressed, an enclosed area (box) will be provided on the screen, below a reduced-size version of the value to be changed. The box can be seen in Figure 18.

Numeric Entry Action

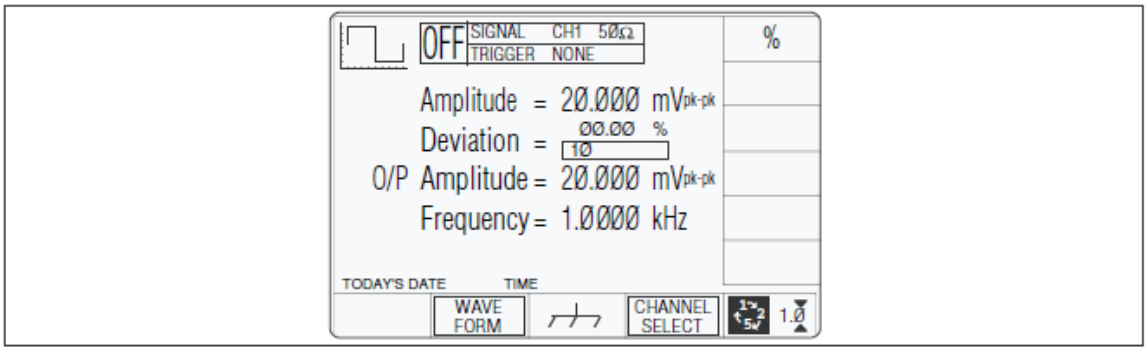
Assume that the tab key has placed the cursor on the Deviation value, in this case ØØ.ØØ %. The cursor can be seen in Figure 17.



erw060

Figure 17. Numeric Entry Starting Point

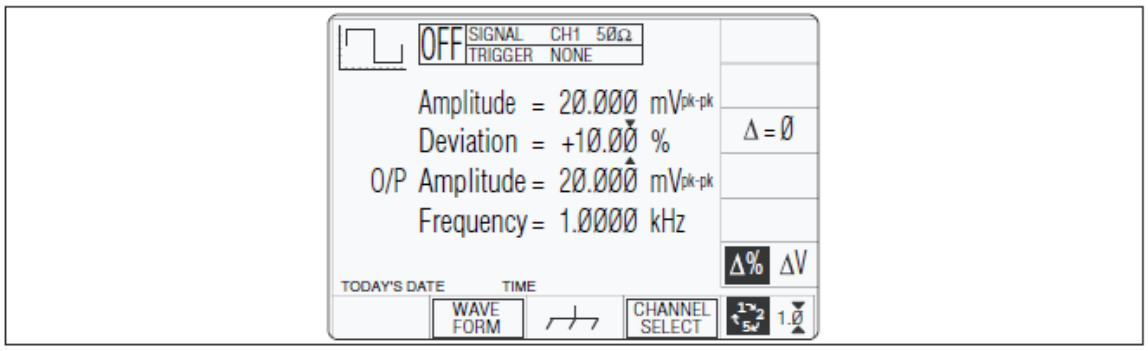
By typing the number '10' (for +10 %) on the numeric keypad, the value entry box appears on the display as shown in Figure 18.



erw061

Figure 18. Numeric Entry — Effect on Deviation Value and Screen Key Labels

The new value is implemented by pressing the ↵ (Enter) key on the keypad, or '%' at the top of the right screen keys. The display then changes to that shown in Figure 19.



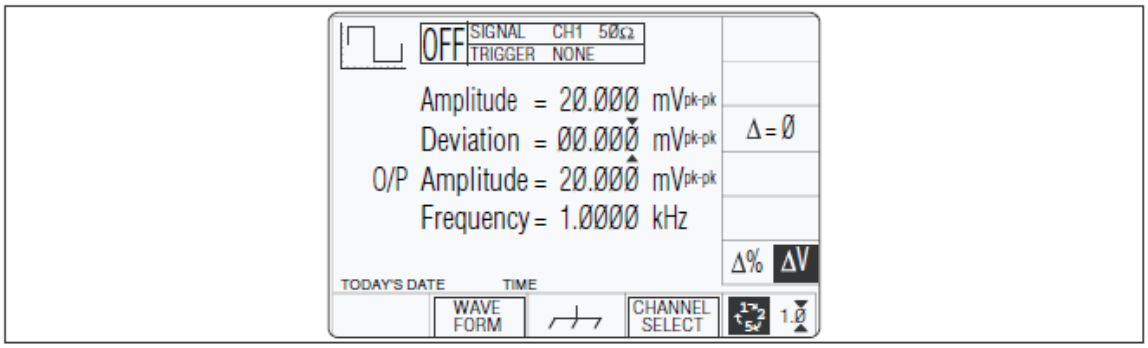
erw062

Figure 15. Result of Pressing ↵ (Enter)

Note that the 9500B has assumed that the typed characters '10' represent a deviation of +10.00 % in this context. For a deviation of -10.00 %, type the characters '-10' using the keypad hyphen as a negative symbol.

Parameter Context

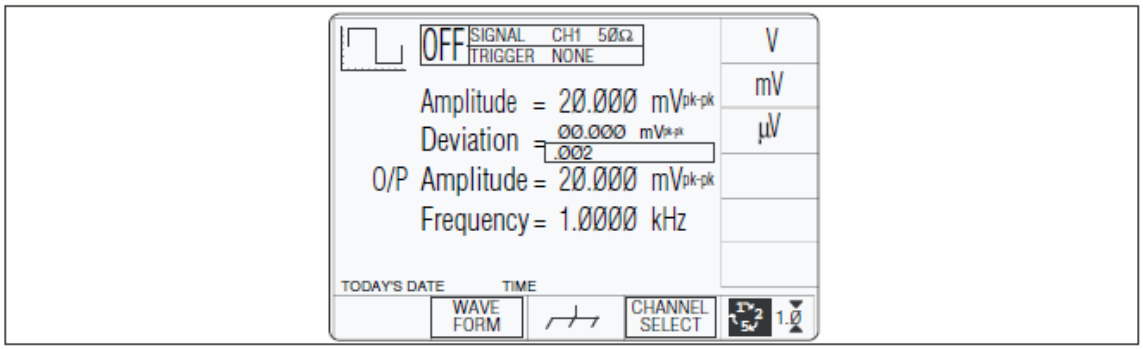
If the Deviation units had been changed to ΔV (absolute voltage) instead of the relative Δ%, then instead of Figure 17, this would be indicated as shown in Figure 20.



erw063.eps

Figure 20. Deviation Selected as ΔV

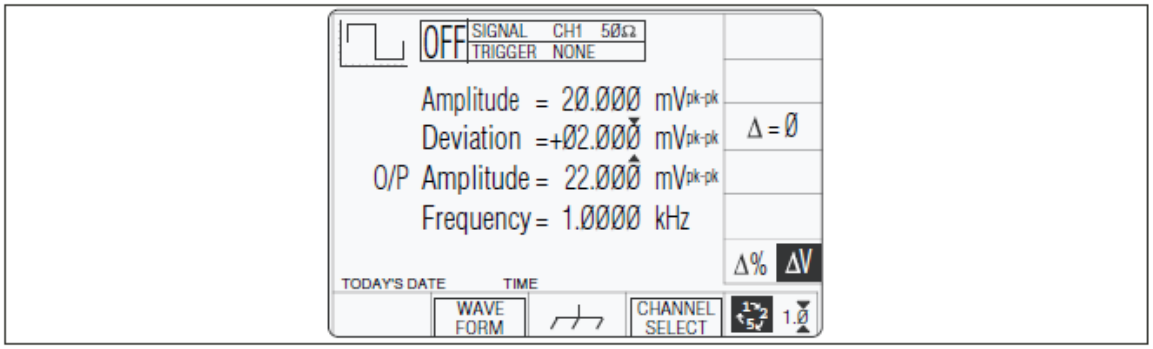
In this case by typing the number '.002', the 9500B respects this change of units. The result is shown in Figure 21, also changing the available unit labels on the right screen keys to reflect the change.



erw064

Figure 21. Option to Choose Units for Deviation Value

Note that if the new value is implemented by pressing the ↵ (Enter) key on the keypad, then (in this case) the units will be Volts. If the number '2' had been typed followed by ↵, an error message would have appeared, as 2 V is obviously outside the deviation range of ±10 % for the set value of 20 mV. This could have been avoided by typing '2', then pressing the 'mV' screen key to obtain the correct result (Figure 22):



erw065

Figure 26. Voltage Deviation Applied

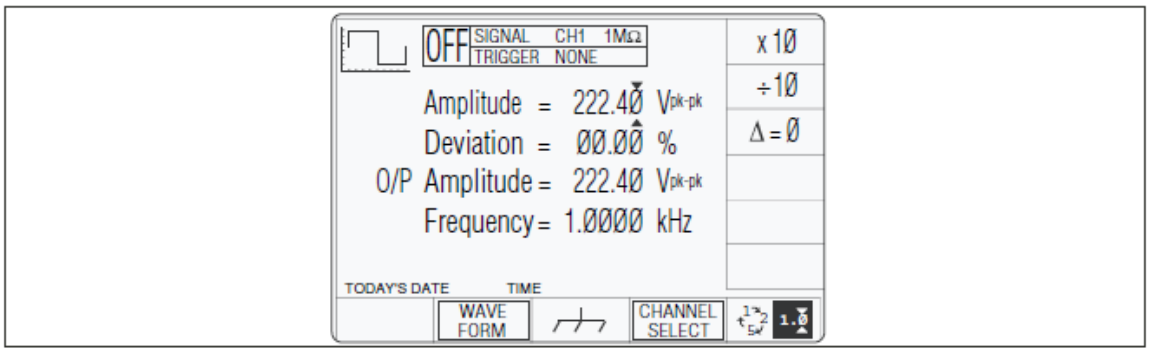
The new deviation of +2 mV is equivalent to +10 % of the set value, which can be seen by pressing the right side key Δ%/ΔV.

Numeric Entry Result

The 9500B will comply with the instructions given in Numeric Entry, using the displayed value to set the output deviation, in the same way as for Digit Edit. This applies wherever it is possible to use Numeric Entry.

Return to Scope Mode

The 9500B will always permit return from Direct mode to Scope mode, even if the values on the screen cannot be attained in Scope mode. The values will default to extremes if necessary. For example:

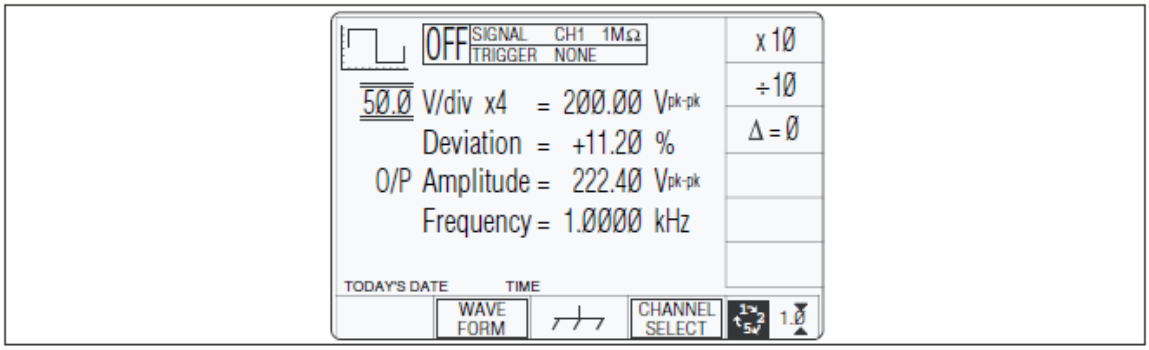


erw066

Figure 23. Direct Mode Starting Point

In Figure 23, the (maximum) O/P Amplitude has been set using Direct mode (as shown). An error message will result for any attempt to increase the Amplitude value or any positive Deviation percentage.

If the bottom right screen key (Editing Mode key) is pressed to return to Scope mode, the two contributors (Units/Div and Deviation) will be adjusted to achieve the same O/P Amplitude, as shown in Figure 24:



erw067

Figure 7. Transfer to Scope Mode

For simplicity, the remainder of Manual mode is described in this manual in terms of Scope mode, Digit Edit.

Scope Mode

Introduction

In Scope mode, once the ⊕ key has selected the required variable, the cursor can take one of two forms: 'triangular' and 'barred'. The triangular form operates in the same way as in Direct mode, and permits editing using Numeric Entry as well as Digit Edit.

Note that the Units/Division and Multiplier fields are used in Scope mode, corresponding to similar arrangements in UUT oscilloscopes.

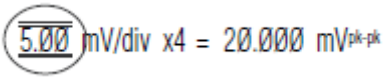
Cursor Controls

Triangular Cursor

For the triangular cursor, the main controls used to manipulate the cursor are the same as for Direct mode, except that the two keypad shift keys have no effect, as the only variable which uses the triangular cursor is 'Deviation', whose resolution is constant.

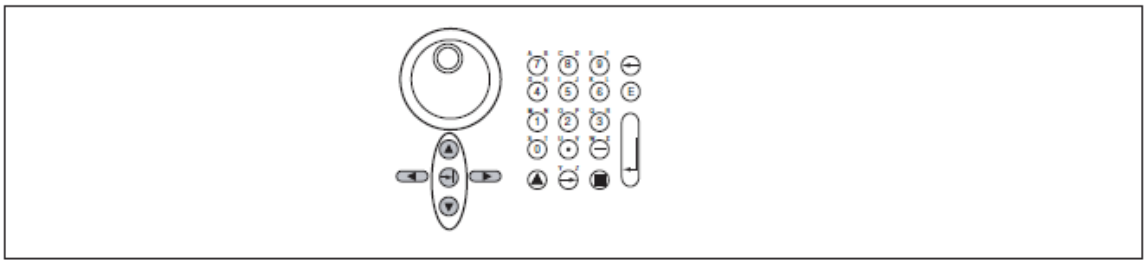
'Barred' Cursor

Two pairs of horizontal lines, enclosing a value, indicate that for that value, neither Digit Edit nor Numeric Entry is available. The value can be adjusted only within a preferred step sequence. Numeric Entry editing is not available for numbers with a 'Barred' cursor:



erw068

With this form of cursor, the ⟨ and ⟩ keys are inactive. The ⌃/⌄ keys and the spinwheel increase or decrease the whole value, using the preferred sequence for that parameter (refer to *Preferences*). The controls used for the barred cursor are highlighted in Figure 25:

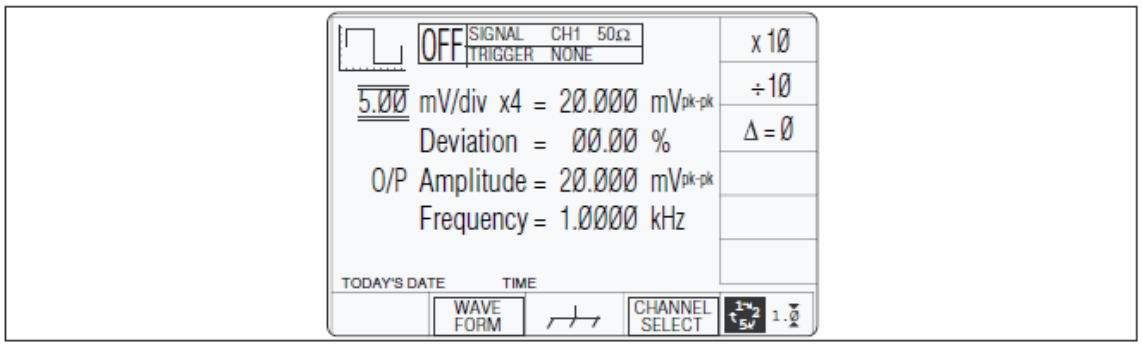


erw069

Figure 8. Barred Cursor Control Keys

Use of Sequence Scroll

Having already dealt with Digit Edit, Sequence Scroll is easy to understand. The default DC/Square screen of Figure 23 is repeated in Figure 26 as an example:



erw070

Figure 9. DC/Square Default Screen

Using the Tab ⇥ key to transfer through the four available fields in turn, it can be seen that the 'mV/div', the Multiplier and the Frequency fields use barred cursors, with the Deviation field using a triangular cursor.

Returning to the mV/div field, pressing the ⌃ key will increase the whole value to 10.0 mV, or pressing the ⌄ key will reduce the whole value to 2.00 mV (always assuming that the sequence 1→2→5 has been selected in 'Pref' facility). All other values with barred cursors will also be incremented in the preferred sequence.

DC/Square Function

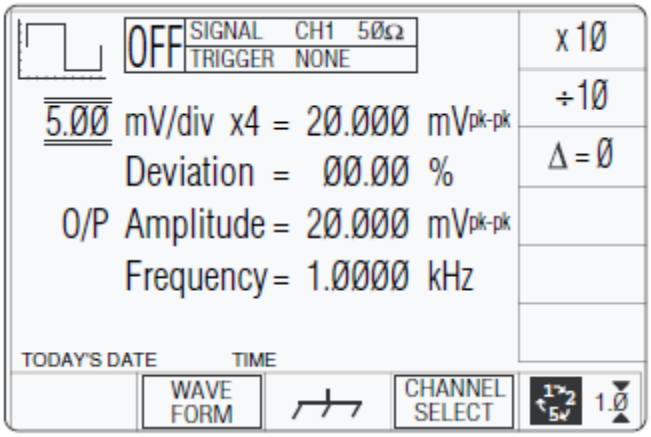
This section is a guide to the use of the 9500B for generating square waves and DC voltages for use for amplitude calibration of oscilloscopes.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to Interconnections, Manual Mode – Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. Otherwise, the function is accessed by pressing the ⊓⊔ function key at the top right of the 'OSCILLOSCOPE CALIBRATOR' panel.

Whenever the DC/Square menu screen is opened, except on recovery from a standby period, it may appear with the following default settings, although some settings may have been made non-volatile (refer to Retained Channel Memory):



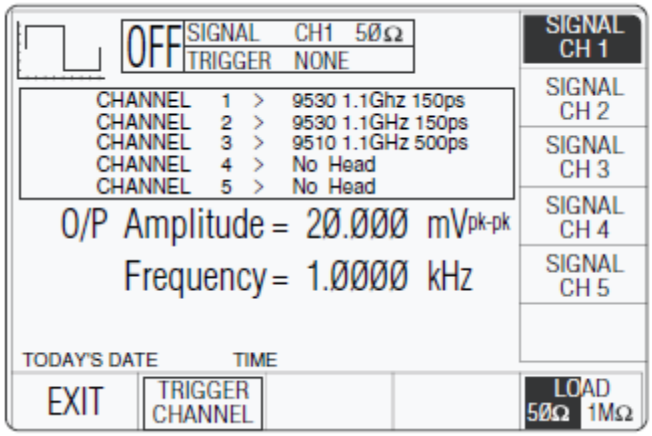
erw071

The above default screen has auto-selected the positive square waveform, as indicated by the icon in the top left corner. Frequency is variable between 10.000Hz and 100.00 kHz. Frequency has defaulted to 1 kHz, deviation 'Δ' to zero, and output voltage to 20.000 mVp-p. The Duty Cycle is fixed at a nominal 50 %.

Menu Selections

Signal Channels

Each channel leads to specified pair of active head connectors, and a head (if fitted). The required channel can be selected on a second menu screen. This is activated by pressing the 'CHANNEL SELECT' screen key on the bottom row. The screen changes to show the available channels (the presence of a head is detected when fitted):



erw072

As can be seen from the screen, Model 9530 heads are fitted to channels 1 and 2, a Model 9510 head is fitted to channel 3, and no heads are fitted to channels 4 and 5.

The highlight on channel 1 indicates that this channel is selected for signal output, (confirmed by the legend in the top central box). Pressing any one of the right side soft keys selects that channel for the signal output.

Expected load is confirmed as 50 Ω (once selected, the selection applies to all signal channels). The right-most key on the bottom row toggles between expected loads of 50 Ω and 1 MΩ. The presence of 'TRIGGER NONE' in the top central box indicates that no trigger channel has been nominated.

Pressing the 'EXIT' key will revert back to the standard DC/Square screen of Default Settings.

Note

When a channel's head is finally connected to the UUT oscilloscope, and the 9500B output is turned on, the 9500B will measure the UUT load. If the measured load is outside the specification for the expected load, then an error message will appear on the screen:

'Load Mismatch Detected UUT >150 Ω' for 50 Ω selected;

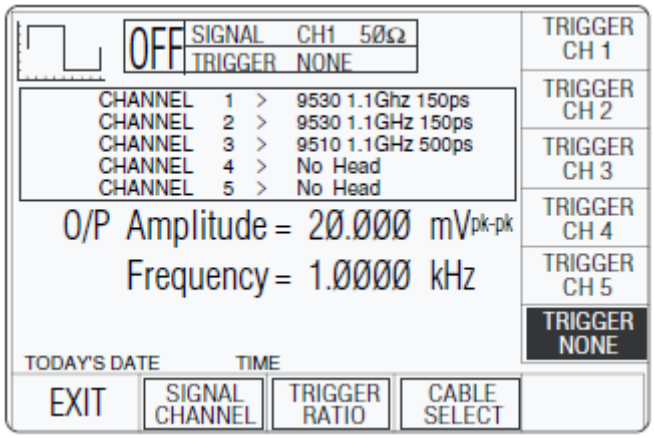
'Load Mismatch Detected UUT <50k Ω' for 1 MΩ selected.

UUT Triggers

The trigger can be routed via any head (except 9550), but a standard SMA to BNC coaxial cable can be used instead, to save the cost of an extra head. The reason for establishing five channels is to permit use of four signal heads to carry a full range of signals, plus an extra channel to accommodate the trigger input, if necessary. When a cable is fitted instead of a head, it cannot carry the full range of signals.

Pressing the 'TRIGGER CHANNEL' soft key provides a screen which permits a user to assign a channel to trigger outputs.

As the screen shows, as yet no channel has been allocated to triggers. This is confirmed by the legend in the top central box and the right side screen keys.



erw073

On the screen, the 'TRIGGER CHANNEL' label has changed to 'SIGNAL CHANNEL', and pressing this will revert to the previous screen of Signal Channels so this key toggles between the signal and trigger selection screens.

Pressing the 'EXIT' key will revert back to the standard DC/Square screen of Default Settings.

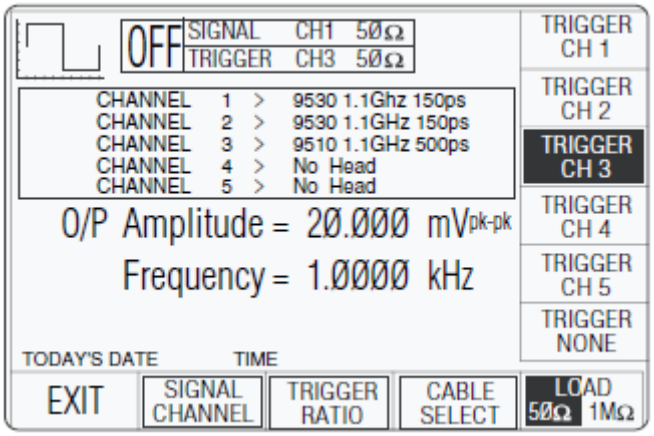
Note that in the bottom right corner of the screen, the expected load selection label has disappeared, because as yet no trigger channel has been selected. The label will be reinstated if an active head is chosen to carry the trigger, but if a cable is used a trigger load of 50 Ω will always be expected.

Trigger Channel Selection

Any of the channels can be selected for trigger, so long as it is not already allocated as a signal channel. In the screen UUT Triggers the top central box shows Channel 1 as the signal channel, and unavailable for trigger. Attempting to use an occupied channel will result in a 'bleep' and an error message.

If it is necessary to use an occupied channel for triggers, its allocation as a signal channel must be de-selected. Similarly, a channel already occupied as a trigger channel cannot also be used as a signal channel. The first use to be allocated to a channel is dominant, and must be first de-selected to change its use.

Pressing an unoccupied channel key will highlight the key's label and change the legend in the top central box. For instance, pressing the 'TRIGGER CH 3' key has the following effect:

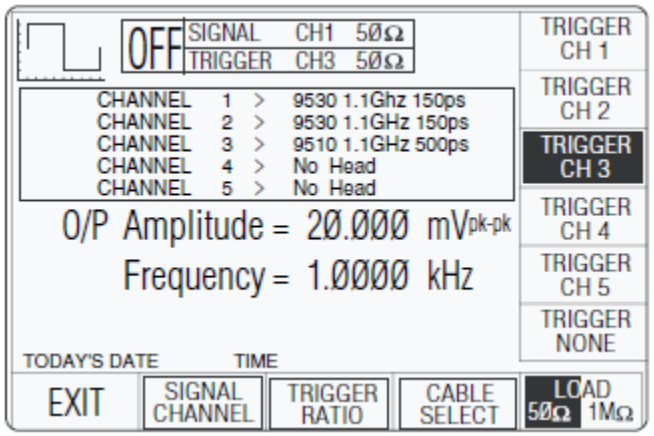


erw074

The expected load value can be changed from 50 Ω to 1 MΩ using the bottom left corner toggle key.

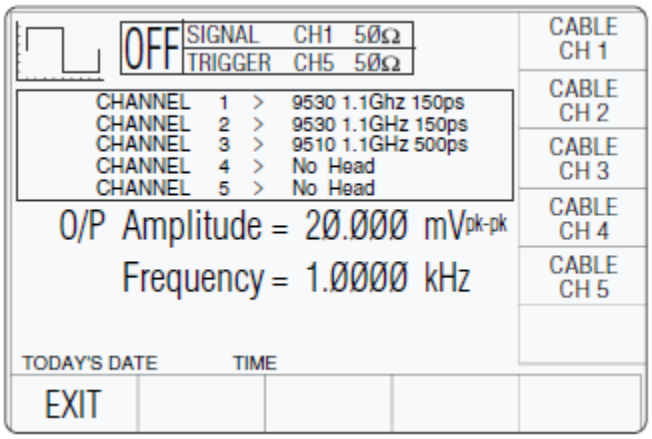
Cable Selection

If it is intended to use a cable instead of a full head to convey the trigger, then a channel with no head fitted must be selected. In this case, for example, pressing the 'TRIGGER CH 5' key has the following effect:



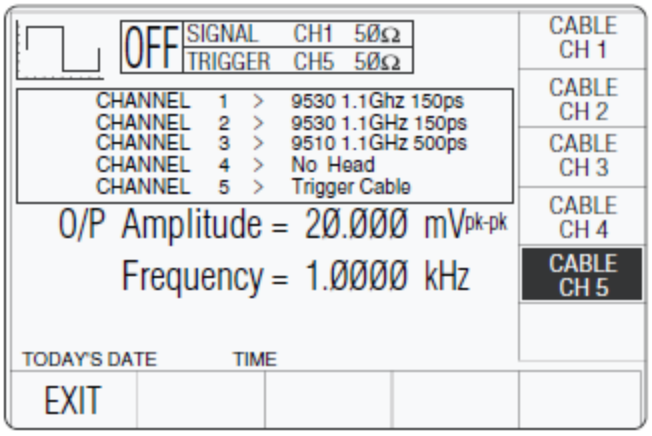
erw075

This channel must be allocated as a 'cable' channel; accessed by pressing the 'CABLE SELECT' key. A new screen is presented:



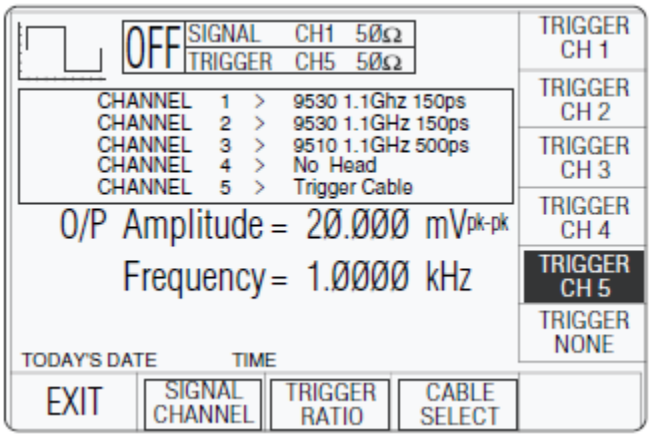
erw076

Pressing the 'CABLE CH 5' key has the following effect:



erw077

Having made the selection, pressing 'EXIT' returns to the trigger selection screen:

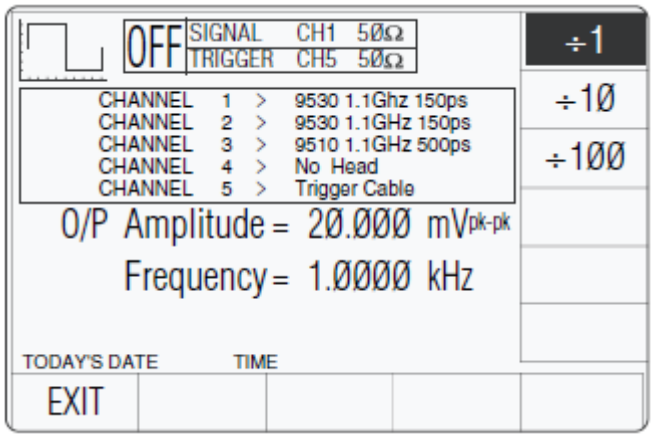


erw078

Note that the expected load key in the bottom right corner is now de-activated, and the trigger state legend in the top central box is fixed on 50 Ω. A further selection is available, to choose the trigger ratio.

Trigger Ratio

The 'Trigger Ratio' is the ratio of the trigger frequency to that of the waveform itself. Three ratios are available: '÷1', '÷10' and '÷100'. Pressing the 'TRIGGER RATIO' key presents the following screen:



erw079

Pressing first the required ratio, then 'EXIT' returns to the trigger selection screen. On this screen, no indication of the trigger ratio is given.

Note

Beware that a low frequency subdivided in this way could lead to a very long delay before a trigger occurs.

Retained Channel Memory

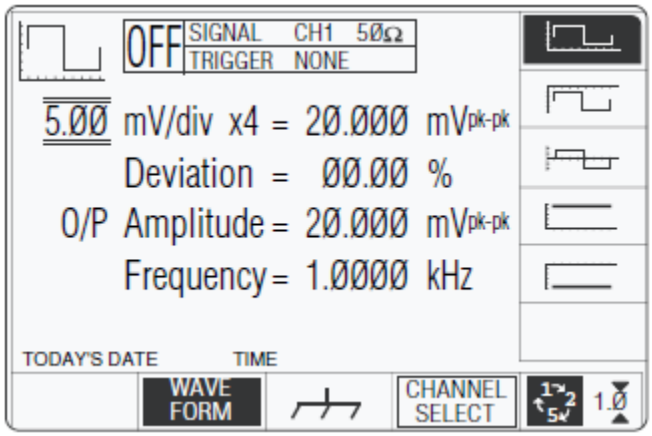
Channel, Cable Select and Trigger Ratio are retained in non-volatile memory within the 9500B. Changing modes and functions; and powering the instrument on and off will not alter these selections.

For this reason, there are no true defaults for these parameters, although on receipt from manufacture you should find the following selections are already made:

Signal Channel:	1
Trigger Channel:	NONE
Cable Select:	Not selected
Trigger Ratio:	÷1

Choosing a Waveshape

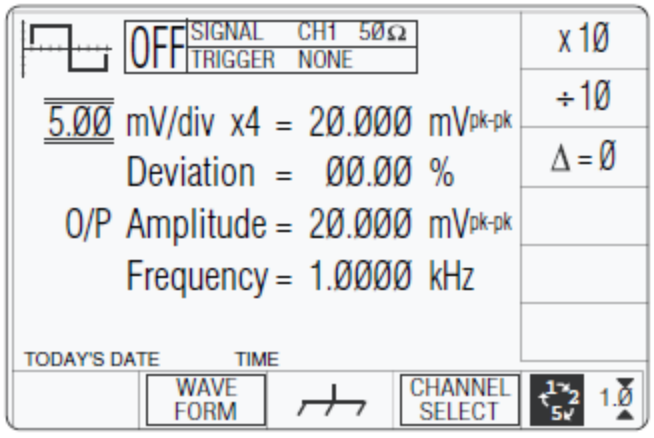
All waveshapes in this function can be selected on a second menu screen. This is activated by pressing the 'WAVEFORM' screen key on the bottom row. The screen changes to show the available waveforms:



erw080

The WAVEFORM key label is highlighted to indicate that waveform selection is available, as is the presently-selected waveform icon.

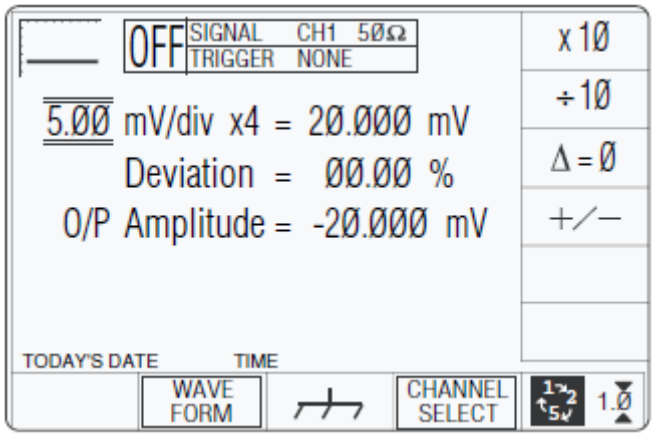
Pressing one of the waveform keys (for example: the key) to select a different waveform will return to the previous screen, with the icon of the selected waveform showing in the top left corner:



erw081

DC Selection

Pressing one of the two DC keys, for example: the ⎓ (DC Negative) key, will return to the previous screen, with the DC Negative icon showing in the top left corner. The parameters listed on the screen will be changed to reflect DC instead of Square:



erw082

DC/Square Selection Summary

'DC' and 'Square' can be regarded as a combined dual function, as each has a similar purpose, and switching between the two is accomplished by selection in a common 'Waveform' menu.

The parametric differences are evident once the appropriate waveform soft key has been pressed.

DC/Square Operation

Right Side Screen Keys—Digit Edit/Sequence Scroll

Keys operate on the value marked by the cursor. The key labels will change depending on the cursor position, as indicated:

1. **Cursor on Units/div:**

X10 Multiplies the Units/div by ten

÷10 Divides the Units/div by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

Ø Toggles the value between positive and negative (DC only)

2. **Cursor on Multiplier:**

Δ = Ø Toggles the Deviation value between the marked value and zero

Ø Toggles the value between positive and negative (DC only)

3. **Cursor on Deviation:**

Δ = Ø Toggles the Deviation value between the marked value and zero

Δ% ΔV Press to set Deviation value in absolute units

Δ% ΔV Press to set Deviation value in percent of set value

4. **Cursor on Frequency/Period:**

X10 Multiplies the marked value by ten

÷10 Divides the marked value by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

Press to change display from Frequency to Period (not DC)

Press to change display from Period to Frequency (not DC)

Right Side Screen Keys—Numeric Entry

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Numeric Entry back to Digit Edit/Sequence Scroll; then set the value as evaluated in the box:

Cursor on Deviation:

% Evaluates the number in the box in Deviation Percentage

V Evaluates the number in the box in Volts

mV Evaluates the number in the box in Millivolts

μ V Evaluates the number in the box in Microvolts

Bottom Screen Keys—Digit Edit, Sequence Scroll and Numeric Entry

WAVE FORM Provides a second menu screen for selection between three Square waveshapes or ±DC. (Choosing Waveshape, DC Selection and DC/Square Selection Summary.

With output on, the output to the UUT is grounded, for any waveform or DC selection.

CHANNEL SELECT Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel (Menu Selections).

Press to select Direct Mode (Scope Mode).

Press to select Scope Mode (setting the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Square Operation

Value Editing

Amplitude

At maximum and minimum output voltages, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output voltage itself.

For example:

Contributor	Ω LOAD = 1 MΩ		Ω LOAD = 50 Ω	
	Minimum	Maximum	Minimum	Maximum
Output Voltage Limit	35.52 µV p-p	222.4 V p-p	35.52 µV p-p	5.56 V p-p
Units/Division	10 µV/div	50 V/div	10 µV/div	2 V/div
Scaling Multiplier	1	10	1	10
Deviation	-11.20 %	+11.20 %	-11.20 %	+11.20 %

Provided they do not exceed the output voltage limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Volts/division (adjustable sequence: 1-2-5 or 1-2-2.5-4-5; default 5 mV).
2. Scaling Multiplier (adjustable through integers 1 to 10; default 4).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit Edit or Numeric Entry can be used.
4. Output Voltage (adjustable only by manipulation of (1), (2) and (3); default 20.000 mV).

Output Voltage Editing

The editing processes follow the same general rules as for editing voltages described in Edit facilities.

Tab ⇥ Key and Cursors (Scope Mode)

Repeatedly pressing this key moves the cursor from the default units/division to the Multiplier, then to the Deviation and back to the units/division. The type of cursor at each position indicates the type of adjustment possible.

Units/Division (Scope Mode)

The type of cursor (barred) used for the units/division signifies that the value can be adjusted only as a step-sequence value using the ⌃ and ⌄ keys. The 〈 and 〉 keys are inactive.

From the default '5 mV/div', the value can be raised using the ⌃ key by increments through 10 mV/div, 20 mV/div, 50 mV/div and so on up to 50 V/div, providing that the other contributors will not take the output voltage value above 5.56 V p-p (50 Ω load) or 222.40 V p-p (1 MΩ load). Similarly, the ⌄ key will reduce the Units/Division down to 10 µ V/div, unless the output voltage would fall below 35.52 µ V p-p (both 50 Ω and 1 MΩ loads).

Multiplier (Scope Mode)

Again the 〈 and 〉 keys are inactive. From the default 'x 4', the value can be changed using the ⌃ and ⌄ keys, by single integer increments to values between 1 and 10, providing that the other contributors do not take the output voltage value out of its limits. The product of the units/division and multiplier are shown on the right side of the '=' sign.

Deviation (Scope and Direct Mode)

The triangular type of cursor indicates that all the cursor keys can be used.

From the default 00.00 %, the deviation percentage can be changed to any value within its resolution between -11.20 % and +11.20 %, providing that the other contributors do not take the output voltage value out of its limits. The result of combining the units/division, multiplier and deviation are shown as the value of 'O/P Volts p-p'.

Output Voltage (Scope and Direct Mode)

The O/P Amplitude is only adjustable by means of its contributors.

From the default 20.000 mV p-p, the output voltage can be changed to any value within its resolution between 35.52 μ V p-p (both 50 Ω and 1 MΩ loads) and 5.56 V p-p (50 Ω load) or 222.40 V p-p (1 MΩ load).

Frequency (Scope and Direct Mode)

From the default 1 kHz, the output frequency can be changed to any value within its resolution between 10 Hz and 100 kHz.

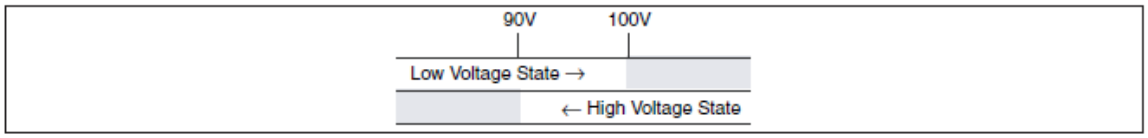
Low Voltage (LV) and High Voltage (HV) States

In the interests of safety, to avoid electric shock, the 9500B incorporates a high-voltage interlock system for DC/Square and High Edge functions. The interlock threshold voltage can be chosen by the user between 10 V and 110 V, otherwise a default threshold value of 100 V is set. The active threshold value is stored in non-volatile memory.

Any voltage below the threshold can be output without hindrance, but voltages on or above the threshold cannot be output without deliberate action being taken to enter the high voltage (HV) state. Once entered, a continuous audible signal acts as a reminder that HV state is active.

The system exits from HV state when the output voltage is brought down below HV state's lower limit. This is always 10 % less than the active threshold value, allowing some adjustment of output without the irritation of having to change states.

Each threshold value is related to the output value set on the screen, including Deviation. The default state boundaries are shown in Figure 27. The values given in the figure translate to DC volts in DCV function, and pk-pk volts in Square and High Edge functions.



erw083.eps

Figure 10. Default Settings of Low and High Voltage States

Increasing Output Voltage into High Voltage State

When increasing output value using any method; if the new value will be at or greater than the upper threshold and OUTPUT is OFF, HV state will be activated but no effect will be observed. If OUTPUT is ON, it will remain ON at its latest value. The operator will be prompted, by audible warning, and error message: 'Confirm with ON', that HV State is required. This is done by pressing the OUTPUT ON key again; then, after a short delay, the output voltage will be raised to the new voltage in HV state.

While OUTPUT is ON in HV state, a distinctive, pulsing tone is emitted. Once in HV state, OUTPUT can be turned ON and OFF with no need to confirm.

Decreasing Output Voltage out of High Voltage State

When decreasing output value using any method; if the new value will be less than the lower limit of HV State, then the LV state will be activated. No warning will be given, except that the pulsing tone will cease. This rule applies whether OUTPUT is OFF or ON.

Applicability to Square Function

In Square Function, the output voltage can only rise above the minimum threshold setting of 10 V, when the expected load setting is 1 MΩ. High Voltage State cannot be entered when the expected load setting is 50 Ω.

Using the 9500B Square Function to Calibrate the Amplitude Response of a UUT Oscilloscope

Two types of procedures for amplitude calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use the appropriate active head to connect from the required 9500B channel output to the input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger for the Channel to be calibrated.

UUT Scope—Amplitude Calibration using the 9500B as a Fixed Source

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for amplitude calibration.
3. 9500B: Ensure that the 9500B is in Square Function with Output OFF. If in any other function, press the ⎍ soft key at the top right of the screen.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required square wave p-p voltage, polarity, frequency and load impedance for the UUT 'Scope amplitude cal point.

2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the amplitude response.
5. Calibration:
   a. If a calibration adjustment is provided, adjust the UUT's response to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. If no adjustment is provided on the UUT 'Scope, record its response at the calibration point as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

UUT Oscilloscope—Amplitude Calibration using the 9500B as an Adjustable Source

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for amplitude calibration.
3. 9500B: Ensure that the 9500B is in Square Function with Output OFF. If in any other function, press the ⊓⊔ soft key at the top right of the screen.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage:

1. 9500B: Use the front panel controls to set the 9500B Output to the required square wave p-p voltage, polarity, frequency and load impedance for the UUT 'Scope amplitude cal point.
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.

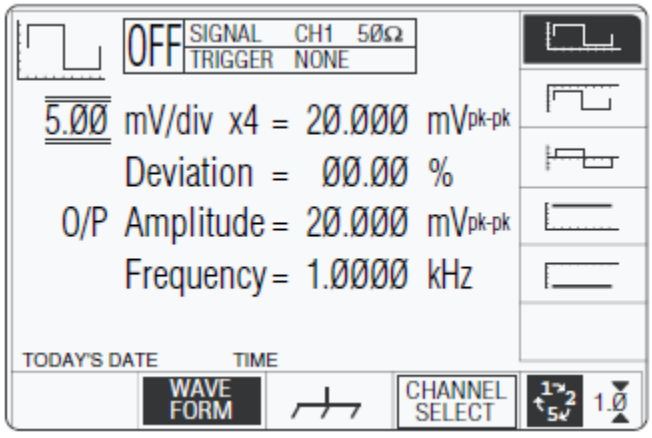
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the amplitude response.
5. Calibration:
   a. Use the 9500B Deviation control to slew the 9500B Output voltage until the UUT's response is appropriate to the 9500B settings, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. Record the 9500B screen output voltage as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

DC Operation

Polarity

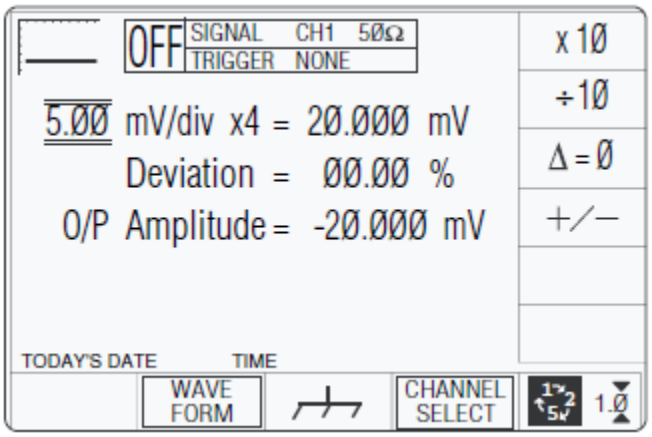
Waveform Selection Screen

From the power-on default, pressing the WAVEFORM screen key transfers to the waveform menu screen:



erw084

Both polarities of DC Voltage output are listed merely as different waveforms. As an example, pressing the ⎓ key from the setup shown above will present the DC function screen, showing negative values selected (of course, the frequency parameter has disappeared from the screen):



erw085

Once into DC function, it is not necessary to change the waveform to change polarity. Pressing the +/- screen key toggles between positive and negative DC Voltage. The polarity selection is shown by the function icon in the top left corner, confirmed by the + or - sign on the O/P Amplitude value.

Value Editing

Amplitude

At maximum and minimum output voltages, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output voltage itself. For example:

Contributor	Ω LOAD = 1 MΩ		Ω LOAD = 50 Ω	
	Minimum	Maximum	Minimum	Maximum
Output Voltage Limit	±888.00 µVDC	±222.4 V p-p	±888.00 µVDC	±5.56 V
Units/Division	0.20 mV/div	50 V/div	0.20 mV/div	2 V/div
Scaling Multiplier	1	10	1	10
Deviation	-11.20 %	+11.20 %	-11.20 %	+11.20 %

Provided they do not exceed the output voltage limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Volts/division (adjustable sequence: 1-2-5 or 1-2-2.5-4-5; default 5 mV).
2. Scaling Multiplier (adjustable through integers 1 to 10; default 4).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit or Numeric Entry can be used.
4. Output Voltage (adjustable in Digit Edit/Sequence Scroll only, by manipulation of (1), (2) and (3); default 20.000 mV).

Output Voltage Editing

The editing processes follow the same rules as for editing square waves Output Voltage Editing. Obviously no frequency adjustment is present, and polarity is changed.

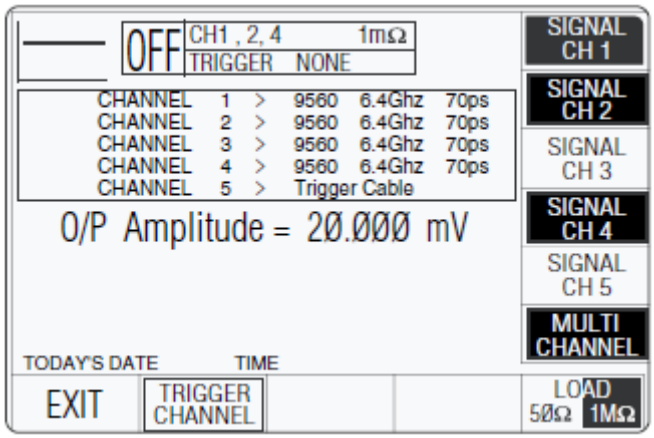
Low Voltage (LV) and High Voltage (HV) States

Entering and leaving High Voltage state in DC Function is governed by the same rules as for Square function (refer to Low Voltage (LV) and High Voltage (HV) States0 In this case the threshold-setting limits are ±10 VDC and ±110 VDC, not pk-pk.

Multi Channel DC Operation

The 9500B is capable of simultaneous DC Output from all channels that have a 9510, 9520, 9530 or 9560 Active Head fitted.

Primarily to accelerate the Calibration of voltage linearity under automated remote control, the feature is also available to manual operators via the 9500B front panel controls and display.



erw086

Whenever the DC waveform is selected within the DC/Square function an extra Soft Key is available in the CHANNEL SELECT sub menu.

Please note that Multi Channel DC Output may only be configured to drive a UUT input impedance of 1 MΩ.

This key toggles Multi Channel capability ON and OFF. Whilst OFF, the operation of Channel Selection is unchanged and is as previously described. Refer to Signal Channels Whilst ON (highlighted) each of the above Softkeys may be toggled ON or OFF, to select Output from any or all channels.

Using the 9500B DC Function to Calibrate the Amplitude Response of a UUT Oscilloscope

Two types of procedures for amplitude calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use the appropriate active head to connect from the required 9500B channel output to the input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use the appropriate active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger for the Channel to be calibrated.

UUT Scope: Amplitude Calibration using the 9500B as a Fixed Source of DC Voltage

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read earlier paragraphs.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for amplitude calibration.
3. 9500B: Ensure that the 9500B is in DC Function with Output OFF. If in any other function, press the ⊓⊔ soft key at the top right of the screen, then press the WAVEFORM screen key. Select ⎍ or ⎓ as required.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (8) at each stage:

1. 9500B: Use the front panel controls to set the 9500B Output to the required DC voltage, polarity and load impedance for the UUT 'Scope amplitude cal point:
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select 'DC-Coupled', if required.
   c. Select the correct range for the cal point.
3. 9500B:
   a. Press the ⏚ screen key on the bottom row to provide a zero reference.
   b. Set Output ON.
4. UUT 'Scope: Set the Y controls to place the trace ongraticule zero.
5. 9500B: Repress the ⏚ screen key on the bottom row to remove a zero reference.
6. UUT 'Scope:
   a. Auto-trigger the oscilloscope or use the 100Hz Trigger from the 9500B. Adjust the UUT for a stable display.
   b. Observe and note the DC level change from graticule zero.
7. Calibration:
   a. If a calibration adjustment is provided, adjust the UUT's response to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. If no adjustment is provided on the UUT 'Scope, record its response at the calibration point as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
8. 9500B: Set Output OFF.

UUT Scope—Amplitude Calibration using the 9500B as an Adjustable Source of DC Voltage

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for amplitude calibration.
3. 9500B: Ensure that the 9500B is in DC Function with Output OFF. If in any other function, press the ⎍ soft key at the top right of the screen, then press the WAVEFORM screen key. Select ⎓ or ⎓ as required.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (8) at each stage:

1. 9500B: Use the front panel controls to set the 9500B Output to the required DC voltage, polarity and load impedance for the UUT 'Scope amplitude cal point:
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select 'DC-Coupled', if required.
   c. Select the correct range for the cal point.
3. 9500B:
   a. Press the ⌐‾¬ screen key on the bottom row to provide a zero reference.
   b. Set Output ON.
4. UUT 'Scope: Set the Y controls to place the trace on graticule zero.
5. 9500B: Repress the ⌐‾¬ screen key on the bottom row to remove a zero reference.
6. UUT 'Scope:
   a. Auto-trigger the oscilloscope or use the 100 Hz Trigger from the 9500B. Adjust the UUT for a stable display.
   b. Observe and note the DC level change from graticule zero.
7. Calibration:
   a. Use the 9500B Deviation control to slew the 9500B Output voltage until the UUT's response is appropriate to the 9500B settings, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. Record the 9500B screen output voltage as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
8. 9500B: Set Output OFF.

Sine Function

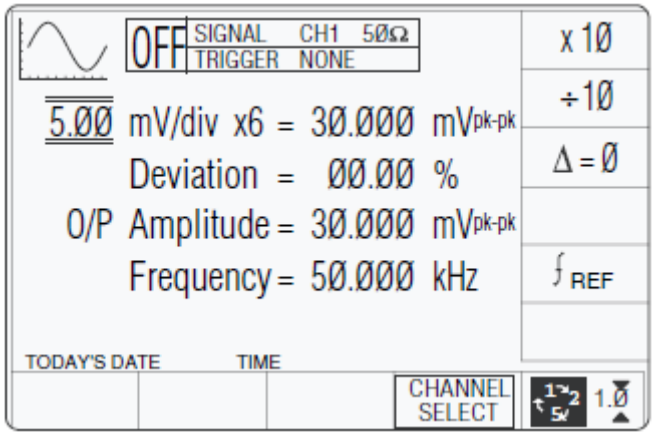
This section is a guide to the use of the 9500B to generate sine waves for flatness and bandwidth calibration of oscilloscopes.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. Sine function can be accessed by pressing the ∿ function key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel.

Whenever the menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw087

The above default screen has auto-selected the frequency of 50 kHz. Deviation has defaulted to zero, and output voltage to 30.000 mVp-p. Frequency is variable between 0.1 Hz and 1.1 GHz (variant 9500B/1100—for other variants refer to *Specifications*.

Menu Selections

Except for Dual Channel operation Dual Channle Operation, all Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio operate in the same way as in DC/Square function. Refer to Menu Selections.

Retained Channel Memory

Refer to Retained Channel Memory.

Right Side Screen Keys—Digit Edit/Sequence Scroll

Keys operate on the value marked by the cursor. The key labels will change depending on the cursor position, as indicated in the next column:

1. **Cursor on Units/div:**

X10 Multiplies the Units/div by ten

÷10 Divides the Units/div by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

f_{REF} Toggles between the marked frequency and the reference frequency

2. **Cursor on Multiplier:**

Δ = Ø Toggles the Deviation value between the marked value and zero

f_{REF} Toggles between the marked frequency and the reference frequency

3. **Cursor on Deviation:**

Δ = Ø Toggles the Deviation value between the marked value and zero

Δ% ΔV Press to set Deviation value in absolute units

Δ% ΔV Press to set Deviation value in percent of set value

f_{REF} Toggles between the marked frequency and the reference frequency

4. **Cursor on Frequency/Period:**

X10 Multiplies the marked value by ten

÷10 Divides the marked value by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

f_{REF} Toggles between the marked frequency and the reference frequency

f $\frac{1}{f}$ Press to change display from Frequency to Period

f $\frac{1}{f}$ Press to change display from Period to Frequency

Right Side Screen Keys—Numeric Entry

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Numeric Entry back to Digit Edit/Sequence Scroll; then set the value as evaluated in the box:

Cursor on Deviation:

% Evaluates the number in the box in Deviation Percentage.

V Evaluates the number in the box in Volts.

mV Evaluates the number in the box in Millivolts.

Cursor on Frequency:

Hz Evaluates the number in the box in Hertz.

kHz Evaluates the number in the box in Kilohertz.

MHz Evaluates the number in the box in Megahertz.

GHz Evaluates the number in the box in Gigahertz.

Bottom Screen Keys—Digit Edit/Sequence Scroll and Numeric Entry

CHANNEL SELECT Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel Menu Selections.

Currently in Scope mode. Press to select Direct Mode (Scope Mode).

Currently in Direct mode. Press to select Scope Mode (setting the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Sine Function Operation

Value Editing

Amplitude

At maximum and minimum output voltages, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output voltage itself (refer to Table 1).

Table 1. Sine Function—Output Voltage Limits and Contributors Limits

	Frequency: 100 mHz - 550.00 MHz		Frequency: 550.01 MHz - 1.1 GHz	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Output Voltage Limit	4.44 mV p-p	5.56 V p-p	4.44 mV p-p	3.336 V p-p
Units/Division	1 mV/div	2 V/div	1 mV/div	2 V/div
Scaling Multiplier	1	10	1	10
Deviation	-11.20 %	+11.20 %	-11.20 %	+11.20 %

Provided they do not exceed the output voltage limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Volts/division in the adjustable sequence: 1 - 2 - 5 or (using 'Pref') 1 - 2 - 2.5 - 4 - 5; default 5 mV/div.
2. Scaling Multiplier (adjustable through integers 1 to 10; default 6).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit Edit, Sequence Scroll or Numeric Entry can be used.
4. Output Voltage (adjustable in Digit Edit/ Sequence Scroll only, by manipulation of (1), (2) and (3); default 30.000 mV).

Output Voltage Editing

Editing follows the same general rules as for editing voltages described in Edit Facilities.

Tab ⇥ Key and Cursors (Scope Mode)

Repeatedly pressing this key moves the cursor from the default Units/Division to the Multiplier, then Deviation, finally to the Frequency and back to the Units/Division. The type of cursor at each position indicates the type of adjustment possible to that value.

Units/Division (Scope Mode)

The type of cursor (barred) used for the units/ division signifies that the value can be adjusted only as a step-sequence value using the ⌃ and ⌄ keys. The 〈 and 〉 keys are inactive.

From the default '5 mV/div', the value can be raised using the ⌃ key by increments through 10 mV/div, 20 mV/div, 50 mV/div and so on up to 2 V/div, providing that the other contributors will not take the output voltage value above 5.56 Vp-p (≤550 MHz) or 3.336 Vp-p (>550 MHz). Similarly, the ⌄ key will reduce the Units/Division down to 1 mV/div, unless the output voltage would fall below 4.44 mVpp (all frequencies).

Multiplier (Scope Mode)

Again the 〈 and 〉 keys are inactive. From the default 'x 6', the value can be changed using the ⌃ and ⌄ keys, by single integer increments to values between 1 and 10, providing that the other contributors do not take the output voltage value out of its limits. The product of the units/division and multiplier are shown on the right side of the '=' sign.

Deviation (Scope and Direct Mode)

The triangular type of cursor indicates that all the cursor keys can be used as in other functions. From the default 00.00 %, the deviation percentage can be changed to any value within its resolution between -11.20 % and +11.20 %. The result of combining the units/division, multiplier and deviation are shown as the p-p value of 'O/P Amplitude'.

Output Voltage (Scope and Direct Mode)

The O/P Amplitude is only adjustable by means of its contributors.

Frequency (Scope and Direct Mode).

The triangular type of cursor indicates that all the cursor keys can be used.

From the default 50 kHz, the output frequency can be changed to any value within its resolution between 100 mHz and 1.1 GHz (O/P Amplitude ≤3.336 Vp-p) or between 100 mHz and 550 MHz (any valid O/P Amplitude).

Limitations for UUT Scope Input Impedance of 1 MΩ

The selection of UUT Oscilloscope input impedance of 50 Ω is strongly recommended when using the Sine Function at high frequency (e.g. >100 MHz). This ensures that the 9500B output signal is correctly terminated within the UUT.

There are however many Oscilloscopes that do not feature an input 50 Ω terminator. To address these instruments the 9500B, when configured to drive 1 MW, applies its own 50 Ω terminator within the Active Head (9510, 9520, 9530 only). However the effectiveness of this approach is limited by short but finite signal path length to the UUT input amplifiers and their input capacitance. Substantial Sine amplitude errors may result from this unterminated transmission line.

Error magnitude and the frequency at which it becomes significant may vary as UUT input attenuators are selected (V/div adjustment) and are highly dependent upon UUT design and construction.

Errors due to signal path length may be reduced slightly by using a BNC 50 W through termination between the 9500 output and the UUT input. Again effectiveness will be limited by remaining path length and capacitance within the UUT.

In all cases frequencies above 500 MHz are not recommended for use into UUT input.

Dual Channel Operation

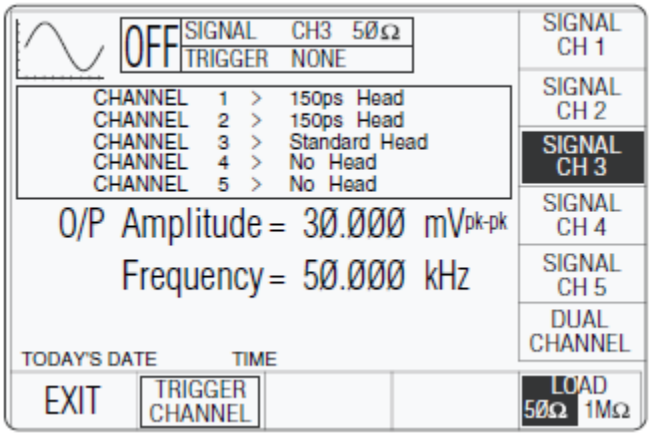
Dual Channel Selection (Two channels/heads activated)

For certain oscilloscope test and calibration procedures, such as 'channel trigger sensitivity' and 'X/Y test', it is necessary to provide the oscilloscope with two identical sinewave signals. Dual Channel Sine function allows the 9500B and UUT oscilloscope to remain connected, without the need to insert physical cable couplers. This is particularly useful during automated calibration and test.

Note

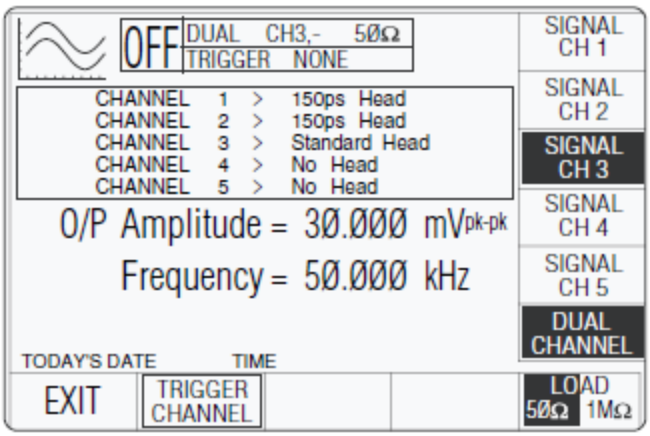
For this function two heads must be connected and activated.

When two channels are used, it is necessary to choose one of the channels as 'Master', and one as 'Slave'. The Master channel controls the feedback, whereas the Slave repeats the signal. To select two channels, press the CHANNEL SELECT soft key to select the Master channel, in this case Signal Channel 3:



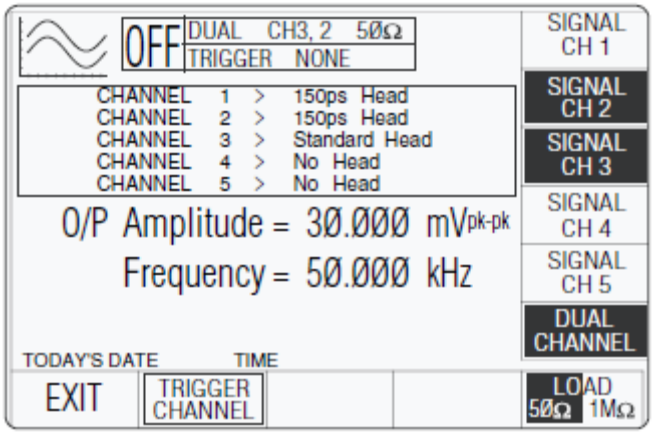
erw088

Now press the DUAL CHANNEL soft key, and the Dual Channel screen icon will appear.



erw089

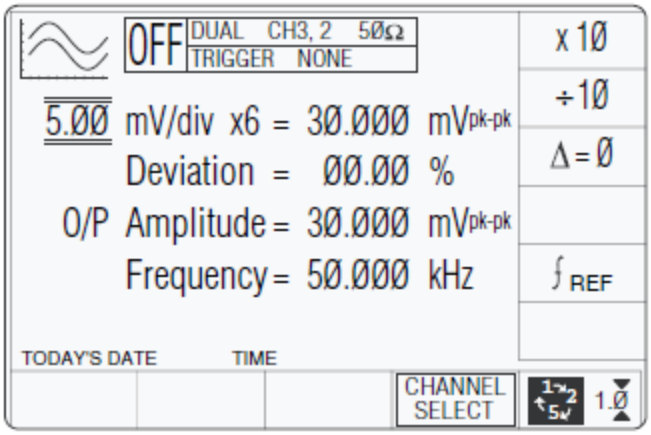
Next select the Slave channel, in this case Signal Channel 2:



erw090

Both channel key labels and the Dual channel label are highlighted, and the legend in the box at the top of the screen shows the two channels selected, the Master written first.

Pressing EXIT will return to the main Dual Channel Sine screen, so that other parameters can be set:



erw091

Note that the upper sinewave amplitude range limits are halved by invoking Dual Channel Sine function.

Using the 9500B Levelled Sine Function to Calibrate the Flatness/Bandwidth Response of a UUT Oscilloscope

Two types of procedures for flatness and bandwidth calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use an active head to connect from the required 9500B channel output to the input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger.

Common Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope Select the required function for flatness calibration.
3. 9500B: Ensure that the 9500B is in Sine Function with Output OFF. If in any other function, press the ∿ key at the right of the front panel.

UUT Scope—Flatness Calibration using the 9500B as a Fixed Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope flatness calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required sine wave p-p voltage, frequency and load impedance for the UUT 'Scope flatness cal point:
2. UUT 'Scope:
    a. Select the correct channel for the cal point.
    b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
    a. Adjust the sweep speed and trigger level for a stable display.
    b. Observe and note the amplitude response.
5. Calibration:
    a. If a calibration adjustment is provided, adjust the UUT's response to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
    b. If no adjustment is provided on the UUT 'Scope, record its response at the calibration point as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

UUT Oscilloscope—Flatness Calibration using the 9500B as an Adjustable Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required sine wave p-p voltage, frequency and load impedance for the UUT 'Scope flatness cal point:
2. UUT 'Scope:
    a. Select the correct channel for the cal point.
    b. Select the correct range for the cal point.

3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the amplitude response.
5. Calibration:
   a. Use the 9500B Deviation control to slew the 9500B Output voltage until the UUT's response is appropriate to the 9500B settings, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. Record the 9500B screen output voltage as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

Edge Function

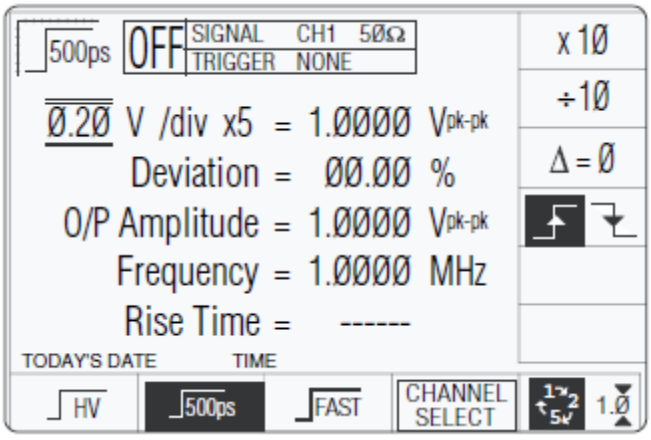
This section is a guide to the use of the 9500B for generating defined pulse edges to examine oscilloscope pulse response.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. Edge function can be accessed by pressing the ⌐‾ function key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel.

Whenever the Edge menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw092

The above default screen has auto-selected a frequency of 1 MHz, a rise time of 500 ps, zero deviation and an output level of 1 Vpk-pk.

Menu Selections

Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Retained Channel Memory

Refer to Retained Channel Memory.

Right Side Screen Keys—Digit Edit

Keys operate on the value marked by the cursor. The key labels will change depending on the cursor position, as indicated:

1. **Cursor on Units/div:**

X10 Multiplies the Units/div by ten

÷10 Divides the Units/div by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

Press to select falling edge (Function icon follows)

Press to select rising edge(Function icon follows

2. **Cursor on Multiplier:**

Δ = Ø Toggles the Deviation value between the marked value and zer

Press to select falling edge (Function icon follows)

Press to select rising edge (Function icon follows)

3. **Cursor on Deviation:**

Δ = Ø Toggles the Deviation value between the marked value and zero

Press to select falling edge (Function icon follows)

Press to select rising edge (Function icon follows)

Δ% ΔV Press to set Deviation value in absolute units

Δ% ΔV Press to set Deviation value in percent of set value

4. **Cursor on Frequency/Period:**

X10 Multiplies the marked value by ten

÷10 Divides the marked value by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

Press to select falling edge (Function icon follows)

Press to select rising edge (Function icon follows)

f $\frac{1}{f}$ Press to change display from Frequency to Period

f $\frac{1}{f}$ Press to change display from Period to Frequency

5. **Cursor on Fast:**

150ps Press to select 150 ps pulse function. (Function icon follows)

70ps Press to select 70 ps pulse function. (Function icon follows)

25ps Press to select 25 ps pulse function. (Function icon follows)

Right Side Screen Keys—Direct Edit

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Direct Edit back to Digit Edit; then set the value as evaluated in the box:

Cursor on Deviation:

%	Evaluates the number in the box in Deviation Percentage
V	Evaluates the number in the box in Volts
mV	Evaluates the number in the box in Millivolts

Bottom Screen Keys—Digit and Direct Edit

HV	Selects High-Edge pulse (highlighted when selected).
500ps	Selects 500 ps-Edge pulse (highlighted when selected).
Fast	Selects Fast Edge pulse (highlighted when selected).
CHANNEL SELECT	Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel (Menu Selections).
1,2,5 1.0	Press to select Direct Mode (Scope Mode).
1,2,5 1.0	Press to select Scope Mode (setting the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Edge Function Operation

Value Editing

The section below assumes the use of a 9510 or 9530 Active Head. Operating output level and frequency boundaries vary for other Head types, Refer to Edge Function.

Amplitude

At maximum and minimum output voltages, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output voltage itself (refer to Table 2).

Table 2. Edge Function—Output Voltage Limits and Contributors Limits

	9510 or 9530 Heads (High Edge) Frequency: 10 Hz – 100 kHz		500ps Edge and Fast Edge Frequency: 10 Hz – 2 MHz	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Output Voltage Limit	888 mV p-p	5.56 V p-p	4.44 mV p-p	3.10 V p-p
Units/Division	0.2 V/div	2 V/div	1 mV/div	1 V/div
Scaling Multiplier	1	5	1	10
Deviation	-11.20 %	+11.20 %	-11.20 %	+11.20 %

Provided they do not exceed the output voltage limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Volts/division (adjustable sequence: 1-2-5 or 1-2-2.5-4- 5; defaults: High Edge: 1 V, others: 0.2 V).
2. Scaling Multiplier (adjustable through integers - High Edge: 1 to 5; default 5, others 1 to 10; default 5).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit or direct edit can be used.
4. Output Voltage (adjustable in digit edit only, by manipulation of (1), (2) and (3); defaults: High Edge: 5 V, others: 1 V).

Output Voltage Editing

The 'Digit' and 'Direct' editing processes follow the same general rules as for editing voltages described in Edit Facilities.

Tab ⇥Key and Cursors (Scope Mode)

Repeatedly pressing this key moves the cursor from the default Units/Division to the Multiplier, then Deviation, finally to the Frequency and back to the Units/Division. The type of cursor at each position indicates the type of adjustment possible to that value.

Units/Division (Scope Mode)

The type of cursor (barred) used for the units/ division signifies that the value can be adjusted only as a step-sequence value using the ⌃ and ⌄ keys. The 〈 and 〉 keys are inactive.

500 ps Edge and Fast Edge:

From the default '0.2 V/div', the value can be raised using the ⌃ key up through 0.5 V/div and so on to 1 V/div, providing that the other contributors will not take the output voltage value above 3.00 Vp-p. Similarly, the ⌄ key will reduce the Units/Division down through 0.1 V/div and so on to 1 mV/div, unless the output voltage would fall below 4.44 mVp-p (all frequencies).

High Edge:

For High Edge the default is '1 V/div', the upper limit is 2V/div (O/P Ampl. limit for 1 MΩload 5.56 Vp-p). The lower limit is 0.2 V/div to 1 mV/div, (O/P Ampl. limit 888 mVp-p).

Multiplier (Scope Mode)

500 ps Edge, Fast Edge and High Edge:

Again the 〈 and 〉 keys are inactive. From the default 'x 5', the value can be changed using the ⌃ and ⌄ keys, by single integer increments to values between 1 and 10, within output voltage value limits. The product of the units/division and multiplier are shown on the right side of the '=' sign.

Deviation (Scope and Direct Mode)

The triangular type of cursor indicates that all the cursor keys can be used as in other functions. From the default 00.00 %, the deviation percentage can be changed to any value within its resolution between -11.20 % and +11.20 %, within output voltage value limits. The result of combining the units/division, multiplier and deviation are shown as the p-p value of 'O/P Amplitude'.

Output Voltage (Scope and Direct Mode)

The O/P Amplitude is only adjustable by means of its contributors.

500 ps Edge and Fast:

Edge From the default 1.0000 V p-p, the output voltage can be changed to any value within its resolution between 4.44 mVp-p and 3.0000 Vp-p. The software ensures that the contributors' values remain within their limits.

High Edge:

From the default 5.0000 V p-p, the output voltage can be changed to any value within its resolution between 888 mVp-p and 5.56 Vp-p (1 MΩ expected load only). The software ensures that the contributors' values remain within their limits.

Frequency (Scope and Direct Mode)

500 ps Edge and Fast Edge:

From the default 1 MHz, the output frequency can be changed to any value within its resolution between 10 Hz and 2 MHz.

High Edge:

From the default 1 kHz, the output frequency can be changed to any value within its resolution between 10 Hz and 100 kHz.

Rise (Fall) Time (Scope and Direct Mode)

When each head is calibrated, its measured (10 % to 90 %) transition times for each type of edge are stored in non-volatile memory. During normal use, this figure is recalled and presented on the 'Rise Time' field for the selected head (channel) and selected type of edge.

Low Voltage (LV) and High Voltage (HV) States

Entering and leaving High Voltage state in High Edge Function is governed by the same rules as for Square function (refer to Low Voltage (LV) and High Voltage (HV) States). The threshold-setting limits are ±10 Vpk-pk and ±110 Vpk-pk.

Using Active Heads

Active heads are introduced briefly in Active Head Technology (Interconnections).

The front panel operations of Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio are described earlier in Menu Selection (DC/Square Function).

Using the 9500B Edge Function to Calibrate the Pulse Response of a UUT Oscilloscope

Two types of procedures for pulse response calibration use the 9500B as a fixed source, where the oscilloscope can or cannot be adjusted.

Interconnections

1. Use the appropriate active head to connect from the required 9500B channel output to the input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use the appropriate active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger for the Channel to be calibrated.

Common Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for pulse response calibration.
3. 9500B: Ensure that the 9500B is in Edge Function with Output OFF. If in any other function, press the ⌒ key at the right of the front panel.

UUT Scope—Pulse Response Calibration using the 9500B as a Fixed Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope flatness calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required edge p-p voltage, frequency and load impedance for the UUT 'Scope pulse response cal point:
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the pulse shape response.

5. Calibration:
   a. If a calibration adjustment is provided, adjust the UUT's pulse shape. Note rise time and aberration, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. If no adjustment is provided on the UUT 'Scope, note rise time and aberration, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

Time Markers Function

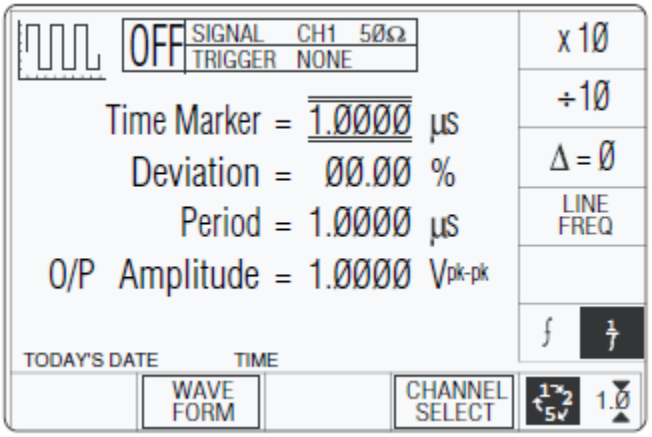
This section is a guide to the use of the 9500B for generating square waves and DC voltages for use for amplitude calibration of oscilloscopes.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. Time Markers function can be accessed by pressing the ⊥⊥⊥ function key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel.

Whenever the ⊓⊓⊓ menu screen is opened, except on recovery from a standby period, it will appear with the following default settings, although some settings may have been made non-volatile (refer to Retained Channel Memory).



erw093

The above default screen has auto-selected the square waveform, as indicated by the icon in the top left corner. Square waveform Period is variable between 10 ns and 50 s (sine waveform is used above approx. 100 MHz). Sine waveform Period is variable between 500 ps and 10 ns (variant 9500B/1100—for other variants refer to *Specifications*. Period has defaulted to 1 μ s (square), deviation 'Δ' to zero, and output voltage to 1.0000 Vp-p. The Duty Cycle is fixed at a nominal 50 %.

Menu Selections

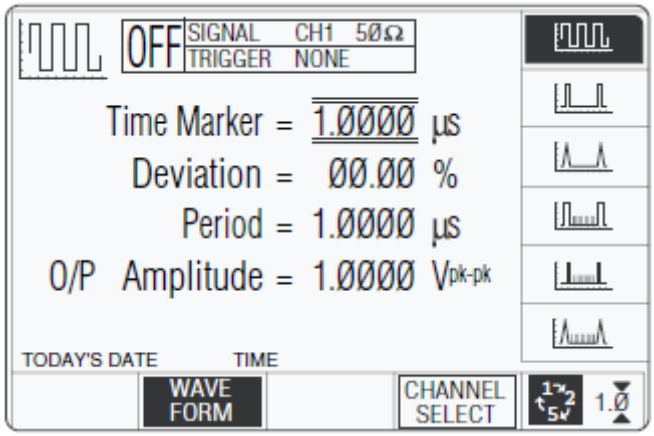
Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Retained Channel Memory

Refer to Retained Channel Memory.

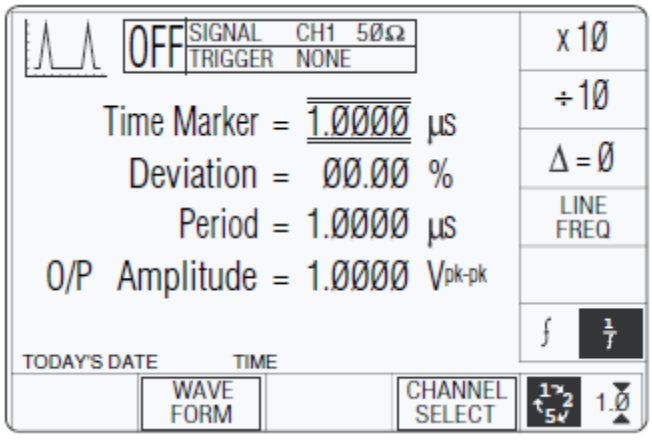
Choosing a Waveshape

All waveshapes (Marker Styles) in this function can be selected on a second menu screen. This is activated by pressing the 'WAVEFORM' screen key on the bottom row. The screen changes to show the available waveforms:



erw094

The WAVEFORM key label is highlighted to indicate that waveform selection is available, as is the presently-selected waveform icon. Pressing one of the waveform keys (for example: the  key) to select a different waveform will return to the previous screen (providing that the frequency is appropriate), with the icon of the selected waveform showing in the top left corner:



erw095

Right Side Screen Keys—Digit Edit

Keys operate on the value marked by the cursor. The key labels will change depending on the cursor position, as indicated:

1. **Cursor on any parameter:**

Δ = Ø — Toggles the Deviation value between the marked value and zero

LINE FREQ — Line frequency output is available only for 'Square' waveform selection. The key toggles between internal Period/Frequency and the Line input Frequency

2. **Cursor on Time Marker:**

X10 — Multiplies the displayed value by ten

÷10 — Divides the displayed value by ten

f $\frac{1}{f}$ — Press to change display from Period to Frequency

f $\frac{1}{f}$ — Press to change display from Frequency to Period

3. **Cursor on Deviation:**

Δ% ΔV — Press to set Time Marker Deviation value in absolute units

Δ% ΔV — Press to set Time Marker Period Deviation value in percent of Time Marker Period value

4. **Cursor on O/P Amplitude:**

See (1) above

Right Side Screen Keys—Direct Edit

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Direct Edit back to Digit Edit; then set the value as evaluated in the box:

Cursor on Deviation:

% — Evaluates the number in the box in Period Deviation Percentage

s — Evaluates the number in the box in Seconds

ms — Evaluates the number in the box in Milliseconds

μ s — Evaluates the number in the box in Microseconds

ns — Evaluates the number in the box in Nanoseconds

Bottom Screen Keys—Digit and Direct Edit

WAVE FORM — Provides a second menu screen for selection between three Time Marker waveshapes or their highlighted versions. (Highlighted Marker Styles).

With output on, the output to the UUT is grounded, for any waveform or DC selection.

CHANNEL SELECT — Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel (Menu Selections).

Press to select Direct Mode (Scope Mode).

Press to select Scope Mode (setting the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Time Markers Operation

Value Editing

Output Period/Frequency

At maximum and minimum output period, the screen settings of the contributors' values (Time Marker and Deviation) are limited by both the output period/frequency and the output voltage. For example:

Marker Style	O/P Amplitude	Time Marker Period		Deviation		O/P Period	
		Min	Max	Min		Min	Max
	100 mV - 500mV	450.46 ps	50 s	-45 %	+45 %	450.46 ps	55 s
	1V	626.96 ps	50 s	-45 %	+45 %	909.10 ps	55 s
	100 mV – 1 V	621.32 ns	50 s	-45 %	+45 %	900.91 ns	55 s
	100 mV – 1 V	621.32 ns	50 s	-45 %	+45 %	900.91 ns	55 s
	100 mV – 1 V	13.794 ns	50 s	-45 %	+45 %	20.000 ns	55 s
	100 mV – 1 V	621.32 ns	50 s	-45 %	+45 %	20.000 ns	55 s
	100 mV – 1 V	621.32 ns	50 s	-45 %	+45 %	20.000 ns	55 s

Provided they do not exceed the O/P Period limits shown, the contributors have the following adjustments (Scope mode):

1. Time Marker Period (adjustable sequence: 1-2-5 or 1-2-2.5-4-5; default 1.0000 μ s).
2. Percentage Deviation (a maximum range of ±45.00 % about the value of (1), at resolution of four significant digits, with two decimal places; default zero). Digit or direct edit can be used.
3. Output Voltage (directly adjustable only by preferred sequence between 100 mV and 1 V; default 1.0000 V).

Output Period Editing

The 'Digit' and 'Direct' editing processes follow the same general rules as for editing voltages described in Edit Facilities.

Tab ⇥ Key and Cursors (Scope Mode)

Repeatedly pressing this key moves the cursor from the default 'Time Marker' (period) to the Deviation, then to the O/P Amplitude and back to the 'Time Marker' position. The type of cursor at each position indicates the type of adjustment possible.

Time Marker (Scope Mode)

The type of cursor (barred) used for the 'Time Marker' signifies that the value can be adjusted only as a step-sequence value using the ^ and v keys. The < and > keys are inactive.

From the default '1 μs', the 'Time Marker' period can be raised using the ⌃ key by increments through 2 μs, 5 μs, 10 μs and so on up to 50 s, providing that the other contributors will not make the output period longer than 55 s. Similarly, the ⌄ key will reduce the 'Time Marker' period down to 500 ps, unless the output voltage is greater than 500 mV.

Square/Sine Waveform Changeover

The changeover from square to sine occurs at a frequency of 111.101 MHz (Period = 9.000819 ns), chosen to avoid normal calibration points.

Frequency Parameter Resolution Conflict

Due to resolution and the step sequence, some periods cannot be converted exactly into frequencies. In order to direct attention towards period at any point at which its reciprocal cannot be defined exactly, the 'Frequency' parameter display is given an 'approximately equal to' symbol (≃).

Deviation (Scope and Direct Mode)

Note

In Time Markers function, the Deviation operates on the Time Marker interval, to modify the output 'Period' or 'Frequency', and not modify the O/P Amplitude, as in the other functions.

The triangular type of cursor indicates that all the cursor keys can be used.

The result of combining the Time Marker interval and Deviation are shown as the value of the output 'Period' or 'Frequency'. From the default 00.00 %, the deviation percentage can be changed to any value within its resolution between -45 % and +45 %, providing that the Time Marker interval does not take the output 'Period' or 'Frequency' value out of its limits.

Output Voltage Amplitude (Scope and Direct Mode)

The O/P Amplitude is directly adjustable, but only in the step sequence defined by the preferences (Pref) facility. For this reason the O/P Amplitude has a 'barred' cursor in both Scope and Direct modes.

The default 1.0000 Vp-p is the maximum output available. The output voltage can be changed to any step value between 100 mV p-p and 1 V p-p. With Marker Style ⊓⊓, for sinewave periods less than 909.09 ps, the maximum output voltage available is 500 mVp-p.

Output Period/Frequency

From the default 1 μs/1 MHz, the output period/frequency can be changed to any value within its limits as shown in the table for the Marker Styles.

Highlighted Marker Styles

Each marker style is available in a version where each tenth marker is raised to higher amplitude (highlighted) for Output Periods of 1 μ s and longer:

1. Square/Sine: symbol for highlighted style is (does not extend into Sine frequency band).
2. Pulse: symbol for highlighted style is .
3. Narrow Triangle: symbol for highlighted style is .

Limits for these highlighted versions are shown in the table.

Using the 9500B Time Markers Function to Calibrate the Time Base of a UUT Oscilloscope

Two types of procedures for time base calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted or a measurement can be taken.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use an active head to connect from the required 9500B channel output to the input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger for the Channel to be calibrated.

Common Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for time base calibration.
3. 9500B: Ensure that the 9500B is in Time Markers Function with Output OFF. If in any other function, press the key at the right of the front panel.

UUT Scope — Time Base Calibration using the 9500B as a Fixed Source

Sequence of Operations

Refer to the table or list of UUT Scope time base calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B output to the required channel, expected load impedance, trigger channel, waveshape, period and p-p voltage for the UUT 'Scope time base cal point:
2. UUT 'Scope:
    a. Select the correct channel for the cal point.
    b. Select the correct time base speed for the cal point.
    c. Select the correct amplitude range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
    a. Adjust the sweep speed and trigger level for a stated display.
    b. Observe and note the accuracy of marker alignment, indicating any misadjustment in the UUT's time base speed or linearity.
5. Calibration:
    a. If calibration adjustments for time base speed and linearity are provided, adjust the UUT's time base to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
    b. If no adjustment is provided on the UUT 'Scope, record the timebase condition at the calibration point as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

UUT Scope — Time Base Calibration, the 9500B as an Adjustable Source

Sequence of Operations

Refer to the table or list of UUT Scope time base calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B output to the required channel, expected load impedance, trigger channel, waveshape, period and p-p voltage for the UUT 'Scope time base cal point:
2. UUT 'Scope:
    a. Select the correct channel for the cal point.
    b. Select the correct time base speed for the cal point.
    c. Select the correct amplitude range for the cal point.
3. 9500B: Set Output ON.

4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stated display.
   b. Observe and note the accuracy of marker alignment, indicating any misadjustment in the UUT's time base speed or linearity.
5. Calibration:
   a. Use the 9500B Deviation control to slew the 9500B Output period/frequency until the UUT's alignment is appropriate to the 9500B settings, as detailed in the UUT Scope Manufacturer's Calibration Guide.
   b. Record the 9500B screen output voltage and period/frequency as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

Auxiliary Functions

This section is a guide to selecting the Auxiliary Functions. Eight functions are available.

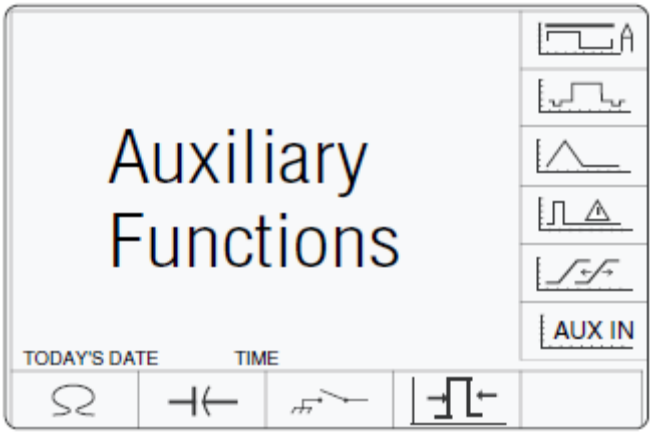
Selection of Auxiliary Functions

'Aux' Key

Auxiliary functions are accessed by pressing the 'Aux' key at the right of the 'OSCILLOSCOPE CALIBRATOR' panel.

Default Settings

At power-on, the system defaults into DC/Square function and shows the DC/Square function initial menu screen. Each time the 'Aux' key is pressed, the system defaults to show the Auxiliary menu screen:



erw096

Function Icons

The following icons are used to access the functions listed:

 Current

 Composite Video

 LF Linear Ramp

 Overload Pulse

 Zero Skew;

(Without Option 5, only one signal channel and one trigger channel is available, so Zero Skew operation is not possible.)

 Auxiliary Input

 Input Resistance Measurement;

 Input Capacitance Measurement

 Short/Open Output.

 Pulse Width

Current Function

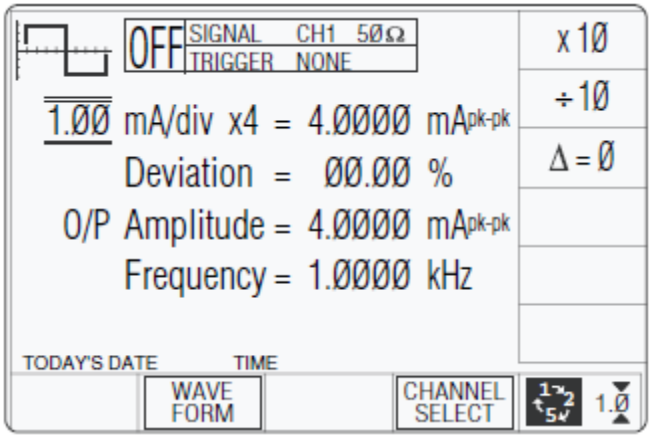
This section is a guide to the use of the 9500B for generating square waves and DC currents for use in calibrating oscilloscope current probes.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Current function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the  soft key on the top right of the screen.

Whenever the Current menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw098

The above default screen has auto-selected the symmetrical square waveform, as indicated by the icon in the top left corner. Frequency is variable between 10.000 Hz and 100.00 kHz. Frequency has defaulted to 1 kHz, deviation 'Δ' to zero, and output current to 4.0000 mAp-p. The Duty Cycle is fixed at a nominal 50 %.

Menu Selections

Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Note

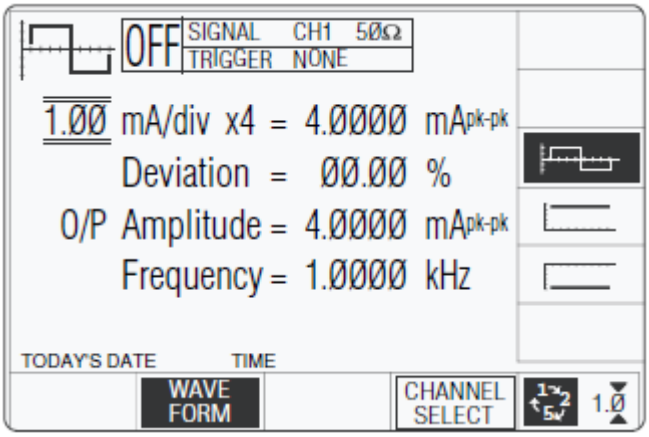
Without Option 5, only one signal channel and one trigger channel is available.

Retained Channel Memory

Refer to Retained Channel Memory.

Choosing a Waveshape

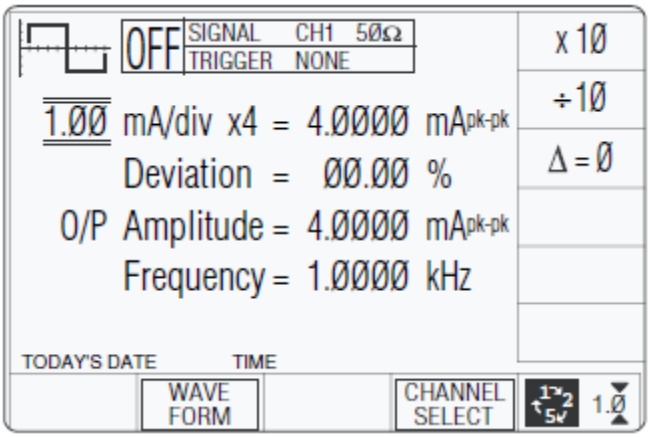
All waveshapes in this function can be selected on a second menu screen. This is activated by pressing the 'WAVEFORM' screen key on the bottom row. The screen changes to show the available waveforms:



erw099

The WAVEFORM key label is highlighted to indicate that waveform selection is available, as is the presently-selected waveform icon.

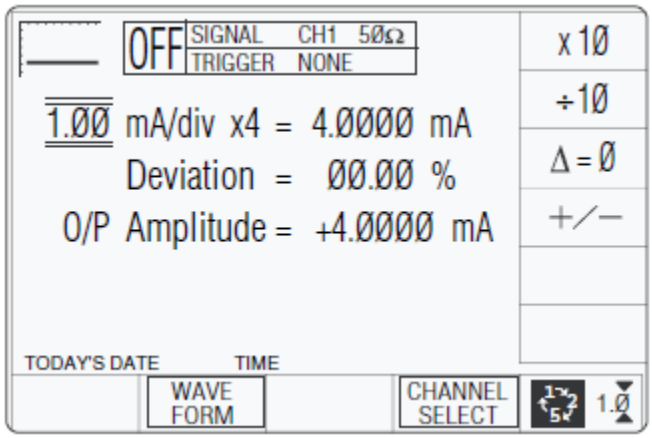
The only square current waveform available is the symmetrical version, so the others shown on this screen are for DC current. Selecting any of these three will return to the previous screen, with the icon of the selected waveform showing in the top left corner:



erw100

DCI Selection

Pressing one of the two DC keys, for example: the ⎓ (DC Negative) key, will return to the previous screen, with the DC Negative icon showing in the top left corner. The parameters listed on the screen will be changed to reflect DC instead of Square:



erw101

Current Selection Summary

'DC' and 'Square' can be regarded as a combined dual function, as each has a similar purpose, and switching between the two is accomplished by selection in a common 'Waveform' menu. The parametric differences are evident once the appropriate waveform soft key has been pressed.

Current Operation

Right Side Screen Keys—Digit Edit

Keys operate on the value marked by the cursor. The key labels will change depending on the cursor position, as indicated:

1. **Cursor on Units/div:**

X10 Multiplies the Units/div by ten

÷10 Divides the Units/div by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

+/- Toggles the value between positive and negative (DC only)

2. **Cursor on Multiplier:**

Δ = Ø Toggles the Deviation value between the marked value and zero

+/- Toggles the value between positive and negative (DC only)

3. **Cursor on Deviation:**

Δ = Ø Toggles the Deviation value between the marked value and zero

Δ% ΔV Press to set Deviation value in absolute units

Δ% ΔV Press to set Deviation value in percent of set value

4. **Cursor on Frequency/Period:**

X10 Multiplies the marked value by ten

÷10 Divides the marked value by ten

Δ = Ø Toggles the Deviation value between the marked value and zero

f $\frac{1}{f}$ Press to change display from Frequency to Period (not DC)

f $\frac{1}{f}$ Press to change display from Period to Frequency (not DC)

Right Side Screen Keys—Direct Edit

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Direct Edit back to Digit Edit; then set the value as evaluated in the box:

Cursor on Deviation:

% Evaluates the number in the box in Deviation Percentage

A Evaluates the number in the box in Amps

mA Evaluates the number in the box in Milliamps

μ A Evaluates the number in the box in Microamps

Bottom Screen Keys—Digit and Direct Edit

WAVE FORM Provides a second menu screen for selection between three Square waveshapes or ±DC. (Choosing a Waveshape).

CHANNEL SELECT Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel (Menu Selections).

Press to select Direct Mode (DC/Square Operation and Square Operation).

Press to select Scope Mode (setting the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Square Operation

Value Editing

Amplitude

At maximum and minimum output currents, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output current itself. For example:

Contributor	Limits	
	Minimum	Maximum
Output Current Limit	88.8 μA p-p	111.2 mA p-p
Units/Division	20 μA/div	50 mA/div
Scaling Multiplier	1	10
Deviation	-11.20 %	+11.20 %

Provided they do not exceed the output current limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Amps/division (adjustable sequence: 1-2-5 or 1-2-2.5-4- 5; default 1 mA).
2. Scaling Multiplier (adjustable through integers 1 to 10; default 4).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit or direct edit can be used.
4. Output Current (adjustable only by manipulation of (1), (2) and (3); default 4.0000 mA).

Output Current Editing

The 'Digit' and 'Direct' editing processes follow the same general rules as for editing currents described in Edit Facilities.

Tab ⇥ Key and Cursors (Scope Mode)

Repeatedly pressing this key moves the cursor from the default units/division to the Multiplier, then to the Deviation and back to the units/division. The type of cursor at each position indicates the type of adjustment possible.

Units/Division (Scope Mode)

The type of cursor (barred) used for the units/division signifies that the value can be adjusted only as a step-sequence value using the ⌃ and ⌄ keys. The 〈 and 〉 keys are inactive.

From the default '1 mA/div', the value can be raised using the ⌃ key by increments through 2 mA/div, 5 mA/div, 10 mA/div and so on up to 50 mA/div, providing that the other contributors will not take the output current value above 111.2 mA p-p. Similarly, the ⌄ key will reduce the Units/Division down to 20 μA/div, unless the output current would fall below 88.8 μA p-p.

Multiplier (Scope Mode)

Again the 〈 and 〉 keys are inactive. From the default 'x 4', the value can be changed using the ⌃ and ⌄ keys, by single integer increments to values between 1 and 10, providing that the other contributors do not take the output current value out of its limits. The product of the units/division and multiplier are shown on the right side of the '=' sign.

Deviation (Scope and Direct Mode)

The triangular type of cursor indicates that all the cursor keys can be used.

From the default 00.00 %, the deviation percentage can be changed to any value within its resolution between -11.20 % and +11.20 %, providing that the other contributors do not take the output current value out of its limits. The result of combining the units/division, multiplier and deviation are shown as the value of 'O/P Amplitude p-p'.

Output Current (Scope and Direct Mode)

The O/P Amplitude is only adjustable by means of its contributors.

From the default 4.0000mA p-p, the output current can be changed to any value within its resolution from 88.8 μA p-p to 111.2 mA p-p.

Frequency (Scope and Direct Mode)

From the default 1 kHz, the output frequency can be changed to any value within its resolution between 10 Hz and 100 kHz.

Using the 9500B Current (Square) Function to Calibrate the Pulse Response of a UUT Oscilloscope Current Probe

Introduction

Two types of procedures for amplitude calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use the appropriate active head and current probe accessory to connect from the required 9500B signal output channel to the UUT current probe.
2. If a trigger is required, use the appropriate active head (or trigger cable) to connect from the required 9500B channel output to the scope input.

Common Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT Probe: Select the required function for probe pulse response calibration.
3. 9500B: Ensure that the 9500B is in Current Function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the top right of the screen.

UUT Current Probe — Pulse Response Calibration using the 9500B as a Fixed Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required square wave p-p current and frequency for the UUT 'Scope amplitude cal point.
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the amplitude response.
5. Calibration:
   a. If a calibration adjustment is provided, adjust the probe's response to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. If no adjustment is provided, record the probe's response at the calibration point as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

UUT Current Probe — Pulse Response Calibration using the 9500B as an Adjustable Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage.

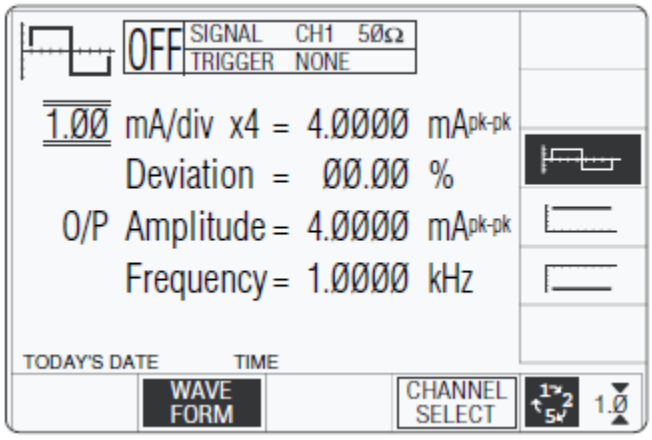
1. 9500B: Use the front panel controls to set the 9500B Output to the required square wave p-p current and frequency for the UUT 'Scope amplitude cal point:
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and note the amplitude response.

5. Calibration:
   a. Use the 9500B Deviation control to slew the 9500B Output current until the UUT's response is appropriate to the 9500B settings, as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
   b. Record the 9500B screen output current as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
6. 9500B: Set Output OFF.

DCI Operation

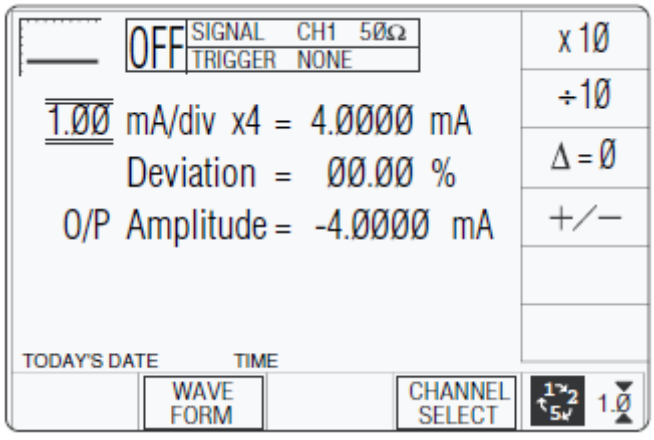
Polarity Waveform Selection Screen

From the power-on default, pressing the WAVEFORM screen key transfers to the waveform menu screen:



erw102

Both polarities of DC Current output are listed merely as different waveforms. As an example, pressing the ⎓ key from the setup shown above will present the DC function screen, showing negative values selected (of course, the frequency parameter has disappeared from the screen):



erw103

Once into DC function, it is not necessary to change the waveform to change polarity. Pressing the +/- screen key toggles between positive and negative DC Current. The polarity selection is shown by the function icon in the top left corner, confirmed by the + or - sign on the O/P Amplitude value.

Value Editing

Amplitude

At maximum and minimum output currents, the screen settings of the contributors' values (units/division, scaling multiplier and deviation) are limited by the output current itself. For example:

Contributor	Limits	
	Minimum	Maximum
Output Current Limit	±88.8 µA p-p	±111.2 mA p-p
Units/Division	20 µA/div	50 mA/div
Scaling Multiplier	1	10
Deviation	-11.20 %	+11.20 %

Provided they do not exceed the output current limits shown, the contributors have the following adjustments (Scope mode):

1. Units/Division in Volts/division (adjustable sequence: 1-2-5 or 1-2-2.5-4- 5; default 1 mA).
2. Scaling Multiplier (adjustable through integers 1 to 10; default 4).
3. Percentage Deviation (a maximum range of ±11.20 % about the value of (1) x (2), at a resolution of four significant digits, with two decimal places; default zero). Digit or direct edit can be used.
4. Output Current (adjustable in digit edit only, by manipulation of (1), (2) and (3); default 4.0000 mA).

Output Current Editing

The 'Digit' and 'Direct' editing processes follow the same rules as for editing square waves (refer Output Current Editing). Obviously no frequency adjustment is present, and polarity is changed as described in Polarity.

Using the 9500B DCI Function to Calibrate the Amplitude Response of a UUT Oscilloscope Current Probe

Two types of procedures for amplitude calibration are given:

1. Using the 9500B as a fixed source, where the oscilloscope can be adjusted.
2. Using the 9500B as an adjustable source, reading oscilloscope deviations via the 9500B screen.

Interconnections

1. Use the appropriate active head and current probe accessory to connect from the required 9500B signal output channel to the current probe at the UUT input.
2. If a trigger is required, use the appropriate active head (or trigger cable) to connect from the required 9500B channel output to the UUT Trigger input.

Common Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT Probe: Select the required function for pulse response calibration.
3. 9500B: Ensure that the 9500B is in Current Function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the top right of the screen. Select or as required.

UUT Current Probe — Amplitude Calibration using the 9500B as a Fixed Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Scope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (8) at each stage.

1. 9500B: Use the front panel controls to set the 9500B Output to the required DC current and polarity for the UUT Probe amplitude cal point:
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select 'DC-Coupled', if required.
   c. Select the correct range for the cal point.
3. 9500B: Ensure that Output is OFF.
4. UUT 'Scope: Set the Y controls to place the trace on graticule zero.
5. 9500B: Set Output ON.
6. UUT 'Scope:
   a. Auto-trigger the oscilloscope or use the 100Hz Trigger from the 9500B. Adjust the UUT for a stable display.
   b. Observe and note the DC level change from graticule zero.

7. Calibration:
    a. If a calibration adjustment is provided, adjust the UUT probe's amplitude response to be appropriate to the settings on the 9500B screen, as detailed in the UUT Scope Manufacturer's Calibration Guide.
    b. If no adjustment is provided, record the probe's amplitude response at the calibration point as detailed in the UUT Scope Manufacturer's Calibration Guide.
8. 9500B: Set Output OFF.

UUT Current Probe—Amplitude Calibration using the 9500B as an Adjustable Source

Sequence of Operations

Refer to the table or list of UUT Oscilloscope amplitude calibration points in the UUT Scope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (8) at each stage:

1. 9500B: Use the front panel controls to set the 9500B Output to the required DC current and polarity for the UUT Probe amplitude cal point:
2. UUT 'Scope:
    a. Select the correct channel for the cal point.
    b. Select 'DC-Coupled', if required.
    c. Select the correct range for the cal point.
3. 9500B: Ensure that Output is OFF.
4. UUT 'Scope: Set the Y controls to place the trace on graticule zero.
5. 9500B: Set Output ON.
6. UUT 'Scope:
    a. Auto-trigger the oscilloscope or use the 100 Hz Trigger from the 9500B. Adjust the UUT for a stable display.
    b. Observe and note the DC level change from graticule zero.
7. Calibration:
    a. Use the 9500B Deviation control to slew the 9500B Output current until the UUT probe's response is appropriate to the 9500B settings, as detailed in the UUT Scope Manufacturer's Calibration Guide.
    b. Record the 9500B screen output current as detailed in the UUT Scope Manufacturer's Calibration Guide.
8. 9500B: Set Output OFF.

Composite Video Function

This section is a guide to the use of the 9500B to generate composite video for video trigger sensitivity calibration of oscilloscopes.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Signals and Triggers

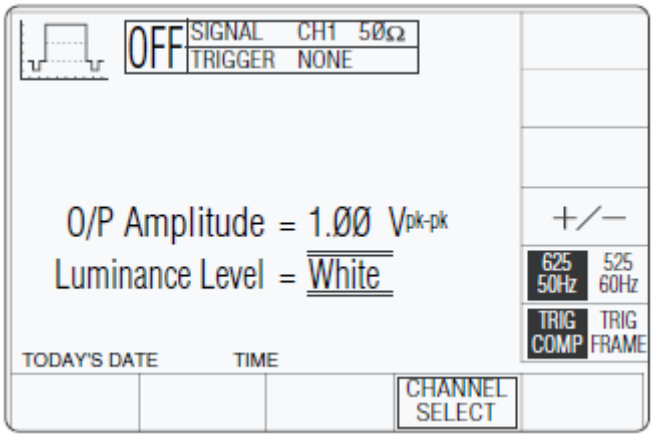
The composite video signal generated by the 9500B is standard 625 line or 525 line video with both frame and composite synch pulses, and an inverted version of the composite waveform is available. As shown by the screen icon, three luminance levels are available.

The 9500B trigger channel can output either composite or frame synchronizing pulses, without the video. All variants can be selected from the front panel.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Composite Video function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the soft key on the right of the screen.

Whenever the menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw104

The above default screen has auto-selected 625 lines/50 Hz and triggers will be from composite video. Amplitude has defaulted to a luminance level of 'White' at 1.0 V p-p.

Menu Selections

Signal Channel selection, Trigger Channel selection and Cable selection all operate in the same way as in DC/Square function. Trigger Ratio is not available in Composite Video function. Refer to Menu Selections.

Note

Without Option 5, only one signal channel and one trigger channel is available.

Retained Channel Memory

Refer to Retained Channel Memory.

Right Side Screen Keys

The cursor is available only on the Luminance Level parameter (Scope mode). Three luminance levels are defined (Value Editing). The key labels will change depending on other key selections.

Default Screen:

+/-	Toggles between upright and inverted composite video.
	Currently 50 Hz line supply with 625 raster lines. Press to select for 60 Hz line supply with 525 raster lines.
	Currently 60 Hz line supply with 525 raster lines. Press to select for 50 Hz line supply with 625 raster lines.
	Currently Composite synch pulses on the Trigger channel. Press to output Frame synch pulses on the Trigger channel.
	Currently Frame synch pulses on the Trigger channel. Press to output Composite synch pulses on the Trigger channel.

Bottom Screen Keys

CHANNEL SELECT	Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel and cable channel (Menu Selections).

Composite Video Function Operation

Value Editing

Amplitude:

The three luminance levels give amplitudes as follows:

White:	(1.0 Vp-p)
Mid-grey:	(0.7 Vp-p)
Black:	(0.3 Vp-p)

Video Inversion

Composite Video can be toggled between upright and inverse, using the +/- screen key. No further adjustment is available.

Video Standards

Composite Video can be switched between 625 lines/50 Hz and 525 lines/60 Hz, using the 625 50Hz 525 60Hz screen key.

Trigger Interval Selection

Either composite or frame synch can be selected as trigger on the assigned trigger channel, using the TRIG COMP TRIG FRAME screen key. The +/- key toggles the synch polarity as part of the composite video.

Using the 9500B Levelled Composite Video Function to Calibrate Video Trigger Sensitivity of a UUT Oscilloscope

As the 9500B composite video amplitude variation is limited, and trigger outputs are not variable, except as described in Value Editing for operating the 9500B are essentially simple.

Interconnections

1. Use an active head to connect from the required 9500B channel output to the video input of the UUT Signal Channel to be calibrated.
2. If a trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the input of the UUT Trigger for the Channel to be calibrated.

Calibration Procedure

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of using front panel controls. In the case of difficulty, re-read the paragraphs earlier in this section.

9500B and UUT Oscilloscope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for video and trigger calibration.
3. 9500B: Ensure that the 9500B is in Composite Video Function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the right of the screen.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (6) at each stage:

1. 9500B: Use the front panel controls to set the 9500B to output the required Luminance level, Composite Video and line standard for the UUT 'Scope cal point.
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
   c. Select the correct presentation setup for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope: Verify stable display from TV trigger in accordance with the UUT Oscilloscope Manufacturer's Calibration Guide.
5. 9500B: Set Output OFF.

Linear Ramp Function

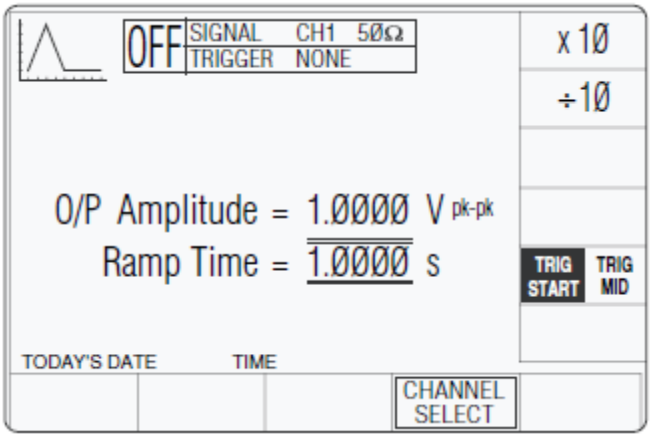
This section is a guide to the use of the 9500B for generating Linear Ramps for error code detection and trigger level marker calibrations.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Linear Ramp function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the soft key on the right of the screen.

Whenever the Linear Ramp menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw105

The 9500B has auto-selected a Ramp Time of 1.0000 s. Trigger is auto-selected: 'TRIG START', not 'TRIG MID'. O/P Amplitude is fixed at 1.0000 V.

Menu Selections

Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Note

Without Option 5, only one signal channel and one trigger channel is available.

Retained Channel Memory

Refer to Retained Channel Memory.

Scope Mode Only

The function operates only in Scope mode. Ramp Time is the only signal variable, operating on a step sequence as selected in 'Pref'. Refer to *Preferences*.

Right Side Screen Keys

x 1Ø	Increases Ramp Time by a factor of 10 within max. and min. limits
÷ 1Ø	Decreases Ramp Time by a factor of 10 within max. and min. limits
TRIG START / TRIG MID	UUT Scope trigger currently at start code. Press to provide trigger at center code
TRIG START / TRIG MID	UUT Scope trigger currently at center code. Press to provide trigger at start code

Bottom Screen Keys

CHANNEL SELECT	Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio, cable channel and expected load (Menu Selections).

Linear Ramp Operation

Value Editing

Amplitude:

Amplitude is fixed at 1.0000 V pk-pk and cannot be edited.

Bias:

The waveform is symmetrical about ground.

Ramp Time:

From the default 1 s, the ramp time can be changed in decades from 1 ms to 1 s.

Waveform Period:

The ramp times are part of waveforms with the following periods:

Ramp Time	Waveform Period
1 s	3 s
100 ms	300 ms
10 ms	30 ms
1 ms	3 ms

Using the 9500B Linear Ramp Function for Error Code Detection and Trigger Level Marker Checks

The type of procedure, for generating Linear Ramps for error code detection and trigger level marker calibrations, uses the 9500B as a fixed source.

Interconnections

1. Use an active head to connect from the required 9500B signal output channel to the UUT signal input channel.
2. If a trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the UUT Trigger input.

9500B and UUT Oscilloscope Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for pulse response calibration.
3. 9500B: Ensure that the 9500B is in Linear Ramp function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the right of the screen.

Error Code Detection—Sequence of Operations

Refer to the table or list of UUT Oscilloscope test points in the UUT Oscilloscope Manufacturer's Test Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (6) at each stage:

1. 9500B: Select the required channel and use the front panel controls to set the 9500B Output to the required trigger point, ramp time and expected load for the UUT 'Scope test point.
2. UUT 'Scope:
   a. Select the correct channel for the test point.
   b. Select the correct range for the test point.

3. 9500B: Set Output ON.
4. UUT 'Scope: Adjust the sweep speed and trigger level for a stable display.
5. Error Code Check: Observe and record the UUT response to the codes at the test point, as detailed in the UUT Oscilloscope Manufacturer's Test/Calibration Guide.
6. 9500B: Set Output OFF.

Trigger Level—Sequence of Operations

Refer to the table or list of UUT Oscilloscope test/calibration points in the UUT Oscilloscope Manufacturer's Test Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (6) at each stage:

1. 9500B: Select the required channel and use the front panel controls to set the 9500B Output to the required trigger point, ramp time and expected load for the UUT 'Scope test point.
2. UUT 'Scope:
   a. Select the correct channel for the test point.
   b. Select the correct range for the test point.
3. 9500B: Set Output ON.
4. UUT 'Scope: Adjust the sweep speed and trigger level for a stable display.
5. Trigger Level Marker Check
   a. If a trigger level calibration is provided, adjust the UUT's trigger response to the ramp to be appropriate to the settings on the 9500B screen, as detailed in the UUT Oscilloscope Manufacturer's Test Guide.
   b. If no adjustment is provided on the UUT 'Scope, record its trigger response at the test point as detailed in the UUT Oscilloscope Manufacturer's Test Guide.
6. 9500B: Set Output OFF.

Overload Pulse Function

This section is a guide to the use of the 9500B for generating Overload Pulses for use in testing oscilloscope 50 Ω terminator Protection.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Overload Protection Test

Some oscilloscope manufacturers protect the internal 50 Ω terminator with a voltage or thermal detector.

Verification of the protection function requires limited-duration application of overload, during which the protection should react and open circuit the 50 Ω terminator.

With the 9500B 'Auxiliary' Overload Pulse function selected, the Overload Pulse can be set to the UUT oscilloscope's overload test requirements, using 9500B front panel controls.

The pulse is triggered as a single event, and cannot be repeated at intervals less than 3 seconds. Sync or 100 Hz triggers are provided if required.

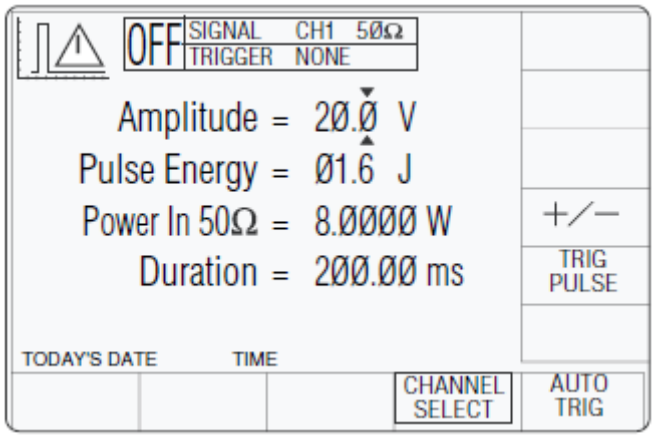
Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Overload Pulse function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing ⎍⚠ the soft key on the right of the screen.

⚠ Caution

The ⚠ symbol indicates that care must be taken when applying the overload pulse to UUT oscilloscope inputs.

Whenever the Overload Pulse menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



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The above default screen has auto-selected the positive pulse waveform, as indicated by the icon in the top left corner. Amplitude is variable between 5-Volts and 20-Volts (default). Pulse Energy is variable between 1.6-Joules (default) and 50-Joules. Power into 50 Ω and Pulse Duration are calculated from the voltage and energy settings.

Menu Selections

Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Note

Without Option 5, only one signal channel and one trigger channel is available.

Retained Channel Memory

Refer to Retained Channel Memory.

Overload Pulse Operation

Right Side Screen Keys—Digit Edit

Keys operate on the value marked by the cursor. The key labels do not change, regardless of the cursor position:

+/-	Toggles the value between positive and negative pulses.
TRIG PULSE	Press to trigger a single shot of the specified pulse output. No further pulse can be triggered within three seconds, otherwise a screen message will appear.

Right Side Screen Keys—Direct Edit

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Direct Edit back to Digit Edit; then set the value as evaluated in the box:

1. **Cursor on Amplitude:**

V:	Evaluates the number in the box in Volts

2. **Cursor on Pulse Energy:**

J:	Evaluates the number in the box in Joules

Bottom Screen Keys—Digit and Direct Edit

CHANNEL SELECT	Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel, trigger ratio and cable channel (Menu Selections).
AUTO TRIG	Produces a train of triggers at 100 Hz to trigger the UUT oscilloscope continuously.

Value Editing

Overload Protection

Different oscilloscope manufacturers have different ways of defining the overload which will activate their protection system.

For example, into 50 Ω, the two specifications ±20 V for 200 ms and 1.6 J at a power of 8 W are equivalent.

Normally, where voltage and time are specified, the voltage will be set and the energy adjusted to achieve the specified time.

The 9500B can output single pulses whose two adjustable constituents are Amplitude and Pulse Energy. The limits on these parameters are:

Amplitude:	±5 V to ±20 V
Pulse Energy:	1.6 J to 50 J

For a fixed Pulse Amplitude the power into 50 Ω will remain constant, regardless of pulse duration. Adjusting the Pulse Energy operates on the pulse duration at fixed amplitude. Controlling these two parameters can adapt to all specifications between the above limits.

Maximum and minimum power values into 50 Ω are:

Power:	0.5 W to 8 W
Amplitude	±5 V to ±20 V

Maximum and minimum pulse durations, with corresponding parameters, are:

Duration	200 ms to 100 s
Amplitude	±20 V to 5 V
Pulse Energy	1.6 J to 50 J
Power	8 W to 0.5 W

Overload Pulse Editing

The 'Digit' and 'Direct' editing processes follow the same general rules as for editing DC/Square described in Edit Facilities.

Using the 9500B to Test the Overload Response of a UUT Oscilloscope

The test procedure consists of inputting a single pulse as specified in the oscilloscope manufacturer's overload protection test, and checking that the protection reacts to open circuit the 50 Ω input termination.

The form of input overload indication will vary between oscilloscopes.

Interconnections

1. Use an active head to connect from the required 9500B signal output channel to the UUT input channel.
2. If a UUT trigger is required, use an active head (or trigger cable) to connect from the required 9500B channel output to the UUT Trigger input.

9500B and UUT Scope Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with the methods of editing screen values. In the case of difficulty, re-read the paragraphs earlier in this section.

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for overload pulse protection test.
3. 9500B: Ensure that the 9500B is in Overload Pulse Function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the right of the screen.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope Overload Test points in the UUT Oscilloscope Manufacturer's Test Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (5) at each stage:

1. 9500B:
   a. Use the front panel controls to set the 9500B Output to the required Overload Pulse and polarity for the UUT 'Scope test point.
   b. If the scope requires a repetitive trigger, press the 'AUTO TRIG' soft key at the bottom right corner of the screen.
2. UUT 'Scope:
   a. Select the correct channel for the test point.
   b. Select the correct range for the test point.
   c. If required, adjust the sweep speed and trigger level for a stable display.
3. 9500B:
   a. Set Output ON.
   b. Press the 'TRIG PULSE' screen key once; observe and note the UUT scope response.
   c. If required, repeat pressing the 'TRIG PULSE' screen key as detailed in the UUT Oscilloscope Manufacturer's Test Guide; observe and note the UUT scope responses.
4. UUT Response: Record the UUT 'Scope response at the test point as detailed in the UUT Oscilloscope Manufacturer's Test Guide. If required, reset the scope protection circuit.
5. 9500B: Set Output OFF.

Zero Skew Function

'Skew' is defined as the relative delay between two or more selected channels. If the channel delays are equalized, then the condition is known as 'Zero Skew'. This section is a guide to using the 9500B Zero Skew function to:

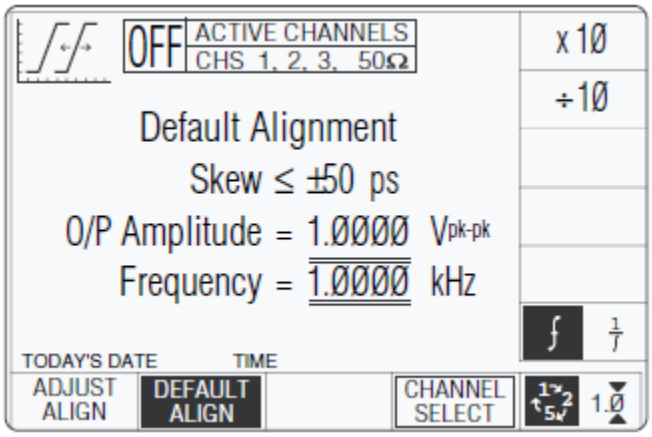
1. Adjust selected 9500B channels to equalize their delays.
2. Use the same channels as sources for measuring the skew between input channels of a UUT oscilloscope.
3. Also, two cable channels can be precision aligned.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to Interconnections, Manual Mode-Function Selection and Edit Facilities.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Zero Skew function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the soft key on the right of the screen.

Whenever the Zero Skew menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



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The above default screen has auto-selected 'Default Alignment', as indicated by the top line of text and the highlighted screen key on the bottom row. The unequallized (default) alignment has a maximum skew of ±50 ps between channels. The amplitude and default frequency are also shown on the screen.

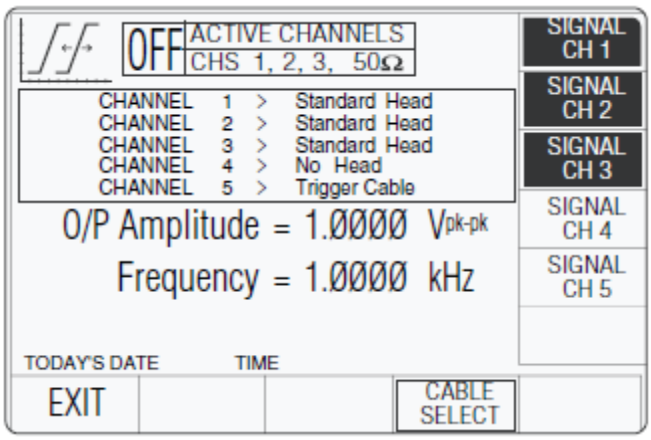
The selected output channels are listed in the central box at the top of the screen.

Menu Selections

Signal Channel Selection

Signal Channel selection differs from other functions in that all channels fitted with an active head will be selected on entering the function. In the unit used for this description, channels 1, 2 and 3 had heads attached, nothing was fitted to channel 4, and a trigger cable was fitted to channel 5.

The required channels can be selected on a second menu screen. This is activated by pressing the 'CHANNEL SELECT' screen key on the bottom row. The screen changes to show the available channels, which are already selected:



erw108

Neither channel 4 nor 5 has an active head fitted. The highlights on channels 1, 2 and 3 indicate that only these channels have heads active (confirmed by the legend in the top central box), and for these zero skew can be used. Toggling any one of these soft keys deselects and reselects that channel. Note that the function cannot operate with only one channel selected, which will cause an error message to appear on the screen.

In Zero Skew function, expected load is fixed at 50 Ω on all signal channels, so the 50 Ω/1 MΩ switching soft key is absent.

In this function, the 'trigger channel' soft key is absent.

When the Channel Select screen is presented, adjustment of Frequency/Period is inhibited. Pressing the 'EXIT' key will revert back to the standard Zero Skew screen of Default Settings, the top central box showing the channels which have been selected.

Right Side Screen Keys—Digit Edit/Sequence Scroll

Keys operate only on the value of Frequency/Period:

X10	Multiplies the marked value by ten
÷10	Divides the marked value by ten
f $\frac{1}{f}$	Press to change display from Frequency to Period
f $\frac{1}{f}$	Press to change display from Period to Frequency

Right Side Screen Keys—Numeric Entry

Right side screen keys operate on the value in the edit box, and acting in place of the ↵ key, exit from Numeric Entry back to Digit Edit/Sequence Scroll; then set the value as evaluated in the box:

Keys operate only on the value of Frequency/Period:

X10	Multiplies the marked value by ten
÷10	Divides the marked value by ten
Hz	Evaluates the number in the box in Hertz
kHz	Evaluates the number in the box in Kilohertz
MHz	Evaluates the number in the box in Megahertz
GHz	Evaluates the number in the box in Gigahertz

Bottom Screen Keys

ADJUST ALIGN	Press to select Precision Alignment ALIGN to adjust the alignment on each active channel, and store the result.
DEFAULT ALIGN	After Precision Alignment has been stored, toggles between Default and Precision Alignment.
CHANNEL SELECT	Permits Zero Skew to be selected for any two or more of the five channels, providing that active heads are fitted to those channels (9500B and UUT 'Scope Setup).
1.0	Press to select Direct Mode (Scope Mode).
1.0	Press to select Scope Mode (sets the step sequence to '1, 2, 5' or '1, 2, 2.5, 4, 5' as chosen using the Preferences key) (Introduction and Direct Mode).

Zero Skew Operation

Precision Alignment of 9500B Channel Outputs

The 9500B is set into Zero Skew function. Two or more channel heads are aligned, in turn, on the same input channel of an oscilloscope (can be the UUT oscilloscope), while triggering from another channel or external trigger.

Precision Alignment

Using Zero Skew function, 'CHANNEL SELECT' is used to select the channels for adjustment.

With output off, a channel active head is connected into the scope input channel to be used. At the required frequency, with output on, the channel delay at half-amplitude is marked using a cursor (also, by pressing the 'ADJUST ALIGN' soft key, the channel delay can be adjusted, for a particular screen alignment).

With output off, the first active head is removed and a second channel's head is connected into the same scope input channel. With output on, 'ADJUST ALIGN' allows the second channel delay to be adjusted to the same cursor mark.

Repeating the adjustment for all other channels achieves accurate common alignment. Having aligned the selected output channels, they can be used to apply signals simultaneously to measure the relative delays between the input channels of a UUT oscilloscope.

Preservation of Alignment

The 9500B Zero Skew function will allow only the aligned channels to be used together with their aligned heads. Unless channels have been reconfigured, merely selecting another function will not destroy the alignment when Zero Skew function is again entered. Deselecting a channel allows the other aligned channels to be used. Reselecting the deselected channel restores the alignment if the same head is fitted.

If one of the heads is removed from its output channel, and another substituted, the 9500B will recognize the new head as being unaligned, and will not allow it to be used until another precision alignment has been carried out.

Measurement of UUT Oscilloscope Channel Skew

Introduction

The procedure depends on pre-alignment of the requisite number of active heads (if better than ±50 ps calibrator alignment is required—when UUT specification is <200 ps or better), as broadly described in Precision Alignment of 9500B Channel Outputs.

Interconnections

Connect the required active heads to the UUT oscilloscope input channels.

9500B and UUT 'Scope Setup

The following procedure assumes that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with front panel operation. In case of difficulty, read the paragraphs earlier in this section.

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for input channel skew test.
3. 9500B: Ensure that the 9500B is in Zero Skew function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the soft key on the right of the screen.

Ensure that the required channels are selected and, if necessary, have been 'Precision Aligned'.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope Input delay measurement points in the UUT Oscilloscope Manufacturer's Test Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (5) at each stage:

1. UUT 'Scope:
   a. Select the correct signal test channels.
   b. Select trigger for the test from the correct channel.
   c. Select the correct Y sensitivity range.
   d. Select the correct time base speed for the test.
   e. If required, adjust the sweep speed and trigger level for a stable display.
2. 9500B: Set Output ON.
3. UUT 'Scope:
   a. Adjust each channel Y position control to superimpose the waveforms, equally disposed across the X axis.
   b. Use the UUT oscilloscope controls to measure the relative delays on each channel (at half amplitude).
4. UUT Response: Record the UUT input channels' relative delays as detailed in the UUT Oscilloscope Manufacturer's Test Guide.
5. 9500B: Set Output OFF.

Auxiliary Input

This section is a guide to the use of the 9500B to generate variable width pulses for the testing trigger timing circuitry within an Oscilloscope.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Automated Routing

Despite the huge flexibility if the 9500B, it is sometimes required to apply signals from user's equipment to the inputs of a UUT oscilloscope, for specific calibration or test purposes.

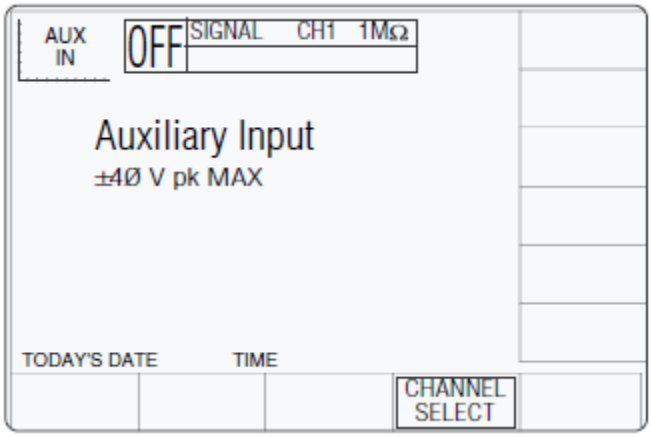
With the 9500B Auxiliary Input selected, wideband passive routing is available from a rear-panel 50 Ω SMA input through to the selected 9500B channel output, using 9500B front panel controls.

No trigger pickoff is provided, and internal triggers are not available.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen. The Auxiliary Input function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the AUX IN soft key on the right of the screen.

Whenever the Auxiliary Input screen is opened, except on recovery from a standby period, it will appear as follows (for details of nonvolatility, refer also to Retained Channel Memory).



erw109

Menu Selections

Signal Channel selection, Trigger Channel selection, Cable selection and Trigger Ratio all operate in the same way as in DC/Square function. Refer to Menu Selections.

Note

Without Option 5, only one signal channel and one trigger channel is available.

Retained Channel Memory

Refer to Retained Channel Memory.

Auxiliary Input Operation

Bottom Screen Keys

CHANNEL Permits the AUX INPUT signal to SELECT be routed to any of the five heads, allowing selection of signal channel and expected load only (Menu Selections).

Using the 9500B for Automated Routing of User-Specific Calibration Signals to UUT Oscilloscope Input Channels

The calibration procedure consists of routing a signal from a user's source to a specified channel input, as required by the oscilloscope manufacturer's calibration procedure.

Interconnections

1. Use the appropriate active head to connect from the required 9500B signal output channel to the UUT input channel.
2. Connect the user's source to the 'AUXILIARY INPUT' SMA connector on the 9500B rear panel.

User's Signal Source, 9500B and UUT Scope Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with front panel operation. In case of difficulty, reread the paragraphs earlier in this section.

1. Preparation: Ensure that all instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function requiring the user's specific signal.
3. 9500B: Ensure that the 9500B is in Auxiliary Input with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the AUX IN soft key on the right of the screen.
4. User's Signal Source: Set up the signal source to provide the required signal to the 9500B rear panel 'Auxiliary Input' (refer to the Auxiliary Input Routing Specification in Interconnections).

Sequence of Operations

Refer to the table or list of UUT Oscilloscope calibration points in the UUT Oscilloscope Manufacturer's Calibration Guide.

Follow the sequence of calibration stages as directed by the guide, and carry out the following operations (1) to (5) at each stage.

1. User's Signal Source: Ensure that the correct signal is being output.
2. UUT 'Scope:
   a. Select the correct channel for the cal point.
   b. Select the correct range for the cal point.
3. 9500B: Set Output ON.
4. UUT 'Scope:
   a. Adjust the sweep speed and trigger level for a stable display.
   b. Observe and record the UUT's response to the user-specific signal as detailed in the UUT Oscilloscope Manufacturer's Calibration Guide.
5. 9500B: Set Output OFF.

Load Resistance and Capacitance Measurement

This section is a guide to using the 9500B to measure the resistive or capacitive load presented by the channel inputs of a UUT oscilloscope.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Measurement Method

UUT Oscilloscope input load resistance or capacitance can be measured directly via any active head.

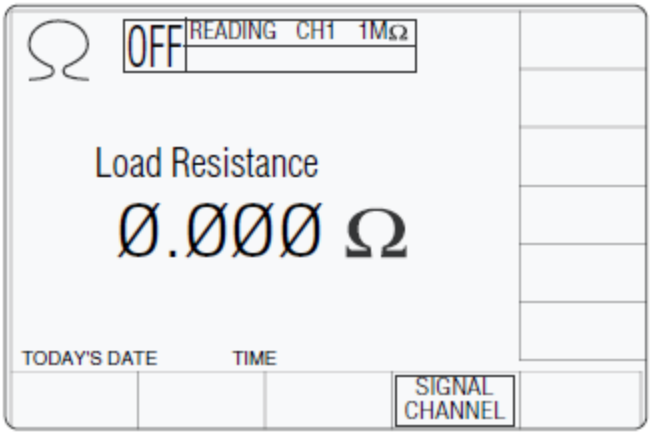
With the 9500B 'Auxiliary' functions, and 'Ω' or ' ' function selected, the load resistance or ⊣⊢ capacitance presented by the UUT oscilloscope input to the active head will be shown on the screen. No triggers are provided.

Default Settings

Load Resistance Defaults

The Load Resistance Measurement is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the Ω soft key at the bottom of the screen.

Whenever the Load Resistance screen is opened, except on recovery from a standby period, it will appear as follows (but also refer to Retained Channel Memory).

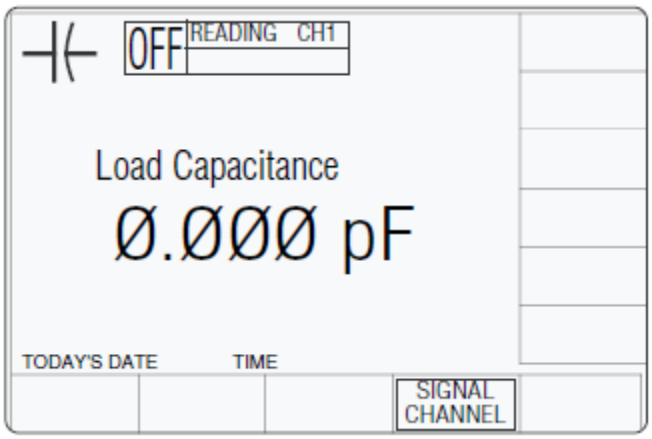


erw110

Load Capacitance Defaults

The Load Capacitance Measurement is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the ⊣⊢ soft key at the bottom of the screen.

Whenever the Load Capacitance screen is opened, except on recovery from a standby period, it will appear as follows (but also refer to Retained Channel Memory).



erw111

Menu Selections

Load Resistance Menus

Only Signal Channel and Expected Load selections operate in the same way as in DC/Square function. Refer to Menu Selections.

Note

Measurement is available only when OUTPUT is ON.

Load Capacitance Menus

Only Signal Channel selection operates in the same way as in DC/Square function. Refer to Menu Selections.

Note

Measurement is available only when OUTPUT is ON.

Retained Channel Memory

Refer to Retained Channel Memory.

Measurement Operation

Bottom Screen Keys (Resistance)

SIGNAL CHANNEL — Permits the measurement setup to be routed via any of the five heads, also allowing selection of expected load (Menu Selections).

Bottom Screen Keys (Capacitance)

SIGNAL CHANNEL — Permits the measurement setup to be routed via any of the five heads (Menu Selections).

Use the 9500B to Measure Load Resistance or Load Capacitance

Introduction

Both measurement procedures consists of connecting an active head to each channel input in turn, and checking that the resulting resistance or capacitance reading is within specification limits.

Interconnections

Use the appropriate active head to connect from the required 9500B signal output channel to the UUT input channel. No triggers are required or available.

9500B and UUT Scope Setup

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for Load Resistance or Load Capacitance measurement as required.
3. 9500B: Ensure that the 9500B is in Load Resistance or Load Capacitance Measurement function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the Ω or ⊣⊢ soft key at the bottom of the screen.

Sequence of Operations (Load Resistance)

Refer to the table or list of UUT Oscilloscope Load Resistance measurement points in the UUT Oscilloscope Manufacturer's Test/ Calibration Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (5) at each stage:

1. 9500B:
   a. Press the 'SIGNAL CHANNEL' screen key on the bottom row.
   b. Select the required signal channel.
   c. Select the appropriate load (50 Ω or 1 MΩ) using the toggle screen key in the bottom right corner.
   d. Press 'EXIT'.

2. UUT 'Scope:
    a. Select the correct channel for the test point.
    b. Select DC Coupling if required.
3. 9500B:
    a. Set Output ON.
    b. Read the Load Resistance value from the screen.
4. UUT Response: Record the UUT channel load resistance at the test point as detailed in the UUT Oscilloscope Manufacturer's Test/Calibration Guide.
5. 9500B: Set Output OFF.

Sequence of Operations (Load Capacitance)

Refer to the table or list of UUT Oscilloscope Load Capacitance measurement points in the UUT Oscilloscope Manufacturer's Test/Calibration Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (4) at each stage:

1. 9500B:
    a. Press the 'SIGNAL CHANNEL' screen key on the bottom row.
    b. Select the required signal channel.
    c. Press 'EXIT'.
2. UUT 'Scope:
    a. Select the correct channel for the test point.
    b. Select DC Coupling if required.
3. 9500B:
    a. Set Output ON.
    b. Read the Load Capacitance value from the screen.
4. UUT Response: Record the UUT channel Load Capacitance at the test point as detailed in the UUT Oscilloscope Manufacturer's Test/Calibration Guide.
5. 9500B: Set Output OFF.

Input Leakage Function

Introduction

This section is a guide to using the 9500B to short-circuit and open-circuit channel inputs of a UUT oscilloscope to test for input leakage.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Input Leakage Test

UUT Oscilloscope input leakage current can be tested by noting the difference in deflection when a channel's input is open-circuited and when it is short-circuited.

With the 9500B 'Auxiliary' Input Leakage function selected, open and short circuits can be imposed on the selected channel input, using 9500B front panel controls.

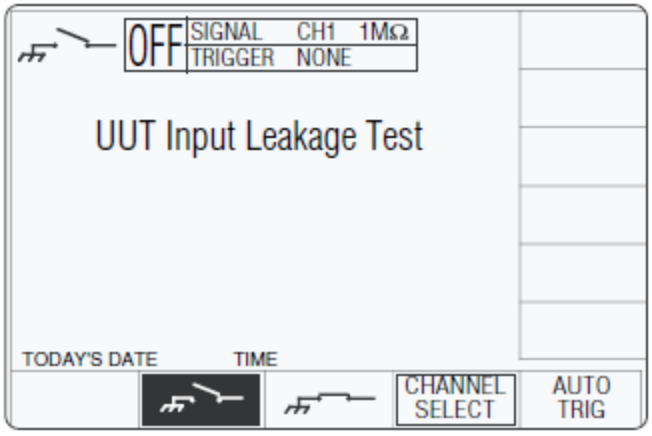
Scope triggers at 100 Hz are provided if required.

Default Settings

When Manual mode is selected the system defaults into DC/Square function and shows the DC/Square function initial menu screen.

The Input Leakage function is accessed by first pressing the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then pressing the soft key on the bottom of the screen.

Whenever the Input Leakage menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw112

The above default screen has auto-selected the open-circuit output, as indicated by the icon in the top left corner, and the highlighted screen key on the bottom row.

Menu Selections

Signal Channel selection, Trigger Channel selection and Cable selection all operate in the same way as in DC/Square function. Refer to Menu Selections.

Retained Channel Memory

Refer to Retained Channel Memory.

Input Leakage Operation

Bottom Screen Keys

	Press to select short-circuit output, and provide a one-shot trigger to the UUT.
	Press to select open-circuit output, and provide a one-shot trigger to the UUT.
CHANNEL SELECT	Permits the screen signal setup to be routed to any of the five heads, allowing selection of trigger channel and cable channel (Menu Selections).
AUTO TRIG	Produces a train of triggers at 100 Hz to trigger the UUT oscilloscope.

Open Circuit Output Leakage Specification

Output Leakage Current

The 9500B output leakage current in any channel output is less than ±50 pA.

Using the 9500B to Test the Input Leakage Current of a UUT Oscilloscope

The test procedure consists of applying an open-circuit and short-circuit to each channel input in turn, as specified in the oscilloscope manufacturer's input leakage test, and checking that the resulting deflection is within specification limits.

Interconnections

1. Use the appropriate active head to connect from the required 9500B signal output channel to the UUT input channel.
2. If a UUT trigger is required, use the appropriate active head (or trigger cable) to connect from the required 9500B channel output to the UUT Trigger input.

9500B and UUT Scope Setup

The following procedures assume that the 9500B instrument is in Manual Mode. It is also assumed that the user will be familiar with front panel operation. In case of difficulty, reread the paragraphs earlier in this section.

1. Preparation: Ensure that both instruments are powered ON and warmed up.
2. UUT 'Scope: Select the required function for Input Leakage test.
3. 9500B: Ensure that the 9500B is in Input Leakage Function with Output OFF. If in any other function, press the 'Aux' key on the right of the 'OSCILLOSCOPE CALIBRATOR' panel, then the  soft key on the bottom of the screen.

Sequence of Operations

Refer to the table or list of UUT Oscilloscope Input Leakage Test points in the UUT Oscilloscope Manufacturer's Test Guide.

Follow the sequence of test stages as directed by the guide, and carry out the following operations (1) to (7) at each stage:

1. 9500B: If the scope requires a repetitive trigger, press the 'AUTO TRIG' soft key at the bottom right corner of the screen.
2. UUT 'Scope:
   a. Select the correct channel for the test point.
   b. Select the correct range for the test point.
   c. If required, adjust the sweep speed and trigger level.
3. 9500B:
   a. Set Output ON.
   b. Press the  screen key to select short circuit output, and provide a one-shot trigger to the UUT.
4. UUT 'Scope: Adjust the 'Y' position control to place the display on the zero axis.
5. 9500B: Press the  screen key to select open circuit output, and provide a one-shot trigger to the UUT.
6. UUT Response: Record the UUT 'Scope 'Y' deflection at the test point as detailed in the UUT Oscilloscope Manufacturer's Test Guide.
7. 9500B: Set Output OFF.

Pulse Width Function

This section is a guide to the use of the 9500B to generate variable width pulses for the testing trigger timing circuitry within an Oscilloscope.

For those users who require more detailed instructions for interconnections, and manipulating the front panel controls, refer to sections Interconnections, Manual Mode-Function Selection and Edit Facilities.

Trigger Qualification Timer Tests

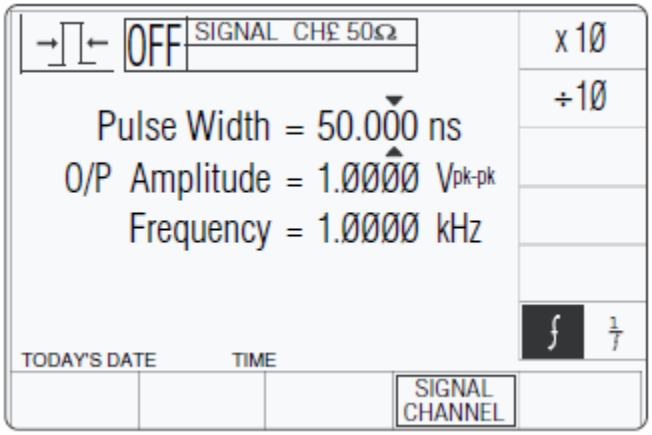
Modern digital Oscilloscopes often feature sophisticated trigger circuitry capable of distinguishing events within a time window, e.g. detection of a pulse narrower (or wider) than a user determined time. The Oscilloscope will use its internal (sampling) clock to measure the time between, in this case rising and falling edges of the trigger waveform. However, in many cases the resolution of this measurement is extended by a short duration analogue timer. It is this timer that demands independent verification, and sometimes adjustment, using a short duration pulse of known width.

With the 9500B “Auxiliary” Pulse Width function selected a narrow pulse of suitable and known width can be set up using the front panel controls and applied to the UUT input.

Default Settings

When Manual mode is selected the system defaults into the DC/Square function and shows the DC/Square function initial menu screen. The Pulse Width function is accessed by first pressing the “Aux” key on the right of the “OSCILLOSCOPE CALIBRATOR” panel, then pressing the soft key on the lower right of the screen.

Whenever the Pulse Width menu screen is opened, except on recovery from a standby period, it will appear with the following default settings:



erw113

The above default screen has selected a 50 ns Pulse Width at a frequency of 1 MHz. Output amplitude is fixed at 1 Vpk-pk into 50 Ω.

Menu Selections

Signal Channel selection operates in the same way as in DC/Square function, Refer to Menu Selections. There is no Trigger Output or selection associated with this function.

Retained Channel Memory

Refer to Retained Channel Memory.

Direct Mode Only

This function supports Digit Edit, Numeric Entry within Direct Mode only; Scope Mode entry is not available. Refer to Direct Mode.

Pulse Width Operation

Right Side Screen Keys

x 10 Increases Pulse Width or Frequency by a factor of 10 within max. and min. limits

÷ 10 Decreases Pulse Width or Frequency by a factor of 10 within max. and min. limits

f $\frac{1}{f}$ Press to toggle the display waveform Frequency or Period

Bottom Screen Keys

SIGNAL CHANNEL Permits the screen signal set-up to be routed to any of the five heads

Procedure Mode

This section is a guide to using procedure card in the 9500B, to calibrate manually-operated oscilloscopes (UUTs). For a guide to using front panel controls in Manual Mode, please turn to *Manual Mode*.

Because the actual procedures are contained within the cards, this section is limited to general points, and access to the programs on the cards.

Procedure Mode — Safety and General Notes

Safety Features

The Model 9500B incorporates safety mechanisms in all its internal programming.

For example: a user must make an extra confirming key-press in order to raise a voltage at the terminals above a pre-determined value.

⚠⚠Warning

After pressing OK or REPEAT PREV. keys: If the procedure writer has not conformed strictly to the procedure-writing guidelines, high voltages may appear without warning at any point in the procedure. Any warning beeps should be taken very seriously.

⚠Warning

Emergency Action—Use of OUTPUT OFF Button

In emergency, the most effective way of turning output off (other than pulling the line-power plug) is to press the OUTPUT OFF button on the right of the front panel. This may sound obvious, but a special feature of the OFF button operation is that as well as sending the appropriate message to the operating system, it also has a hardware link which bypasses the software. Even if the program has locked up, this button is effective in cutting off the output.

General Notes

Output Slewing

In the '1 Year Verification' procedure within Procedure mode, there is a need for the 9500B output to be adjusted ('slewed') around the nominal test point value. This enables the 'slew error' to be registered in the 9500B internal memory, to appear on printed certificates.

Front Panel Controls — Fine Slewing Adjustments

To provide slewing in single-digit increments, there is an 'ENABLE CURSOR' screen key on the bottom row of all 'READ—SLEW SOURCE' screens. The effect of pressing this key is to place the cursors on the least significant digit of the 'Applied Value', enabling all the cursor keys, shift keys and spinwheel to operate as in the Digit Edit facility (refer to *Direct Mode*).

Front Panel Controls — Coarse Slewing Adjustments

Most initial slewing operations will require steps of adjustment larger than a single digit. These coarser adjustments are available with the 'ENABLE CURSOR' key cancelled. Of the front panel keys, only the spinwheel and the ⌃ and ⌄ keys are enabled. The size of their increments and decrements are calculated internally.

Printing Setup

The results of adjustment and verification operations on UUTs can be printed on one of two forms of certificate. A suitable printer must be connected and switched on-line, and the required certificate style, format and data must be entered into the 9500B memory. Then with the correct printer type enabled, the 9500B internal program will generate the required certificate.

Printer Type

The printer to be used should be capable of printing 120 characters per line, and must be able to print the Code Page 437 character set. Most printers compatible with Epson FX, Canon Bubble-Jet or Hewlett-Packard Desk-Jet are suitable. The printer is connected to the 25-way D-type port on the 9500B rear panel.

Certificate Formatting and Data Presentation

Config mode is used to select the style of certificate to be printed, and to set the format of page length, headers, footers, etc. In addition, such certificate entries as laboratory identification, temperature and humidity can be added. Details of these elements of Config mode can be found in *Configuration Mode*.

Note

If the Procedure Card used to run the procedure was originally written for the Model 9100 Option 250 or 600, then the procedure and certificate will incorporate the relevant 9100 (not 9500B) uncertainties.

Enable Printing

Printing must be enabled, using the Config mode screen keys 'PRINTER' and the appropriate selection of printer type (refer to *Printer*).

Saving Results on Memory Cards

Front Panel PCMCIA Slots

In Procedure mode, the procedures for adjustment and verification operations for UUTs are controlled from a pre-programmed

memory card, inserted in the left PCMCIA SLOT 1 on the 9500B front panel. The results of these operations can be saved on Static RAM memory cards, inserted in the right PCMCIA SLOT 2, if equipped. The 9500B 'Test' mode of operation can be used to erase SRAM cards containing old results, and initialize them as blank results cards (refer to the *9500B Calibration Manual*).

Although 'FLASH' cards are used to store procedures, they cannot be used for storing results.

Results Card Enabling and Insertion

Use of Config Mode

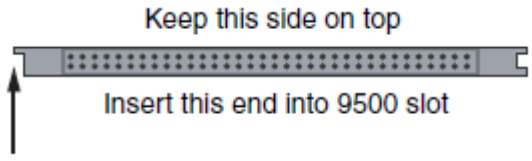
Config mode is used to enable results to be saved on memory cards. Details can be found in *Results Cards*.

Inserting the Card

Before the results can be saved, a memory card must be inserted into PCMCIA SLOT 2 and pressed firmly home. If a card is not present, a reminder will be given on the screen when the internal program attempts to write results.

Examine the Memory Card

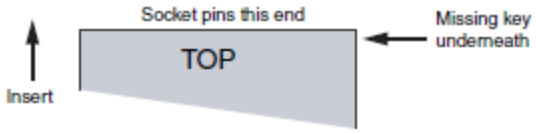
The 68-way socket pins can be seen on the end of the card to be inserted:



erw114

Insert the Card

When inserting, the missing key must be located underneath the card on the right front:



erw115

Write-Protect Switch

The Static RAM cards can be write-protected by means of a small switch on the opposite end to the contact pins. Obviously this protection must be switched off before the 9500B can write results. If a card is write protected, a warning message will appear on the screen.

Do Not Remove in Mid-Procedure

It is not necessary to insert a card before enabling, but once the card is inserted, it must not be removed until the procedure is ended or aborted. Such removal will corrupt data.

Stage-by-Stage Results Saving

The 9500B internal program will generate and save results at the conclusion of each stage in the UUT adjustment or verification procedure. The end of each stage is marked by the use of the 'OK', 'PASS' or 'FAIL' screen key on the front panel (or, of course, by the equivalent use of the tracker unit buttons).

Results Memory Space

After a 'Procedure' memory card is created, an estimate of the results memory requirement for each procedure is calculated and written on to the card.

When in use, before the first results for a procedure are written into the 'Results' card, the 9500B system will review the free memory space on the card. If this is less than 150 % of the procedure's estimated results requirement, the user will be warned to insert a different card.

Static RAM Card—Non-Rechargeable Battery Condition

Battery Voltage Monitoring

Each Static RAM card is powered by its own battery which maintains the non-volatile status of its RAM. While a results card is present in PCMCIA SLOT 2, if equipped the 9500B continuously monitors the battery voltage state. When the voltage falls to approach a failure condition, a warning is given on the 9500B screen.

Changing the Battery

With the card present in PCMCIA SLOT 2, if equipped the RAM is powered from 9500B power supplies, so it is possible to pull out the battery module from the card and insert a new module without losing the stored data.

Static RAM Card—Rechargeable Battery

Battery Charging

Each Static RAM card is powered by its own battery which maintains the non-volatile status of its RAM. While a results card is present in PCMCIA SLOT 2, if equipped with the 9500B powered ON, the battery will be recharged. The specified recharge times are 8 hours to 60 % capacity, and 40 Hours to 100% capacity. If the card battery charge is low when the card is inserted into PCMCIA SLOT 2, if equipped a low battery warning may be given on the 9500B screen, during the initial charge period of up to 40 seconds.

Procedure Mode—Access Guide

Mode Selection

A flow chart summarizing the access to Procedures is given in Common Operations in Procedure Mode — Summary of Actions.

'Mode' Key

The five 'Modes' are accessed by pressing the 'Mode' key at the right of the front panel.

'Mode Selection' Display

At power-on, the system defaults into either Procedure mode or Manual mode as previously programmed in 'Configure' mode. When 'Procedure' mode is required and the Configure default is 'Manual' mode, it will be necessary to transfer via the 'Mode' display.

By pressing the 'Mode' key, the system will present the Mode Selection menu screen for selection from the five modes (Figure 28).

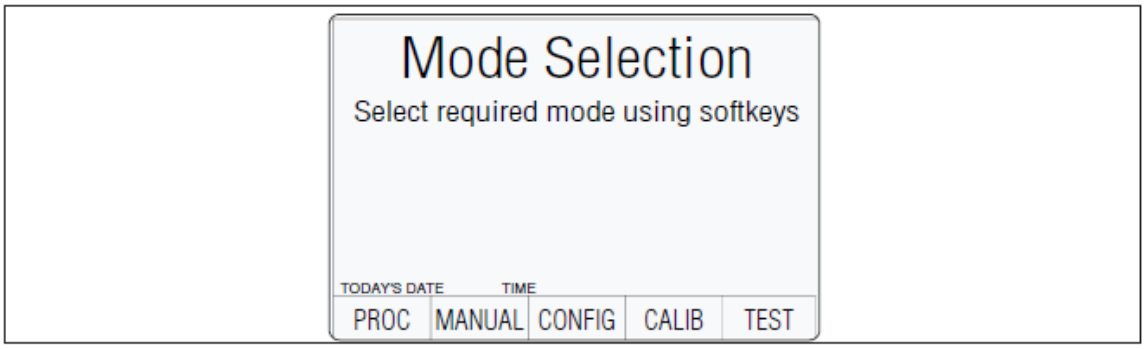


Figure 28. Mode Selection Menu

The required mode is selected by pressing its appropriate screen key on the bottom row; then the 'Mode Selection' screen will be replaced by the mode's first menu screen (or in the case of Configure or Calibration mode, the password entry screen).

Press the Mode key on the right of the front panel to obtain the 'Mode Selection' menu screen

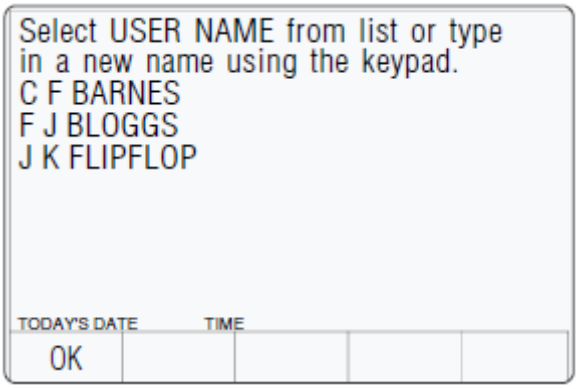
Selection of Procedure Mode—Entry Menus Common to All Procedures

PROC Key

Procedure mode is entered by pressing the 'PROC' screen key on the bottom row of the Mode Selection menu screen (or after Power On when the Procedure mode is set as the power-on default in Configuration mode).

Procedure Mode Display at Entry

When Procedure mode has been successfully entered, the 9500B starts by presenting the 'Select USER NAME ...' display:



erw117

Is Your Name on the List?

If you are on the list, use cursor keys to select your name, then press the 'OK' screen key.

If Your Name is NOT on the List:

Use the alpha-numeric keypad to write your name (12 characters max.) on the screen*. It will appear at the bottom of the screen as you type, together with a shift key icon. Then press the '↵' key or the 'OK' screen key, after which the screen will change to select the manufacturer or model to be tested, except that further progress will require a procedure card to be inserted into PCMCIA SLOT 1 (refer to Select and Insert the Procedure Card which contains the Procedure for the Subject UUT Model).

The list can be cleared only by entering CONFIG Mode, using the password and pressing the 'MORE' screen key, then using the 'CLEAR USER LIST' facility.

Note

**Writing Alphabetical Characters: For alphabetical characters, there are two shift keys: '◢' (blue—left) and '◤' (red—right) on the bottom row of the keypad. The numeric keys have color-coded alphabetical characters printed on left and right. Press and release the appropriate shift key then the alphabetic character key in order to spell out the words. Only UPPER CASE characters are available from the keypad.*

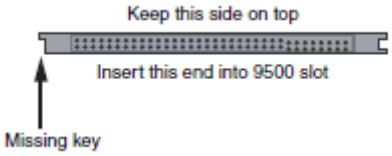
Select and Insert the Procedure Card which contains the Procedure for the Subject UUT Model

1. No Procedure Card in Slot, and no Procedures Downloaded:

   Up to now, there has been no need to use the Procedure memory card. After this point, the 9500B needs to extract information from the card, so the card required for the UUT must be inserted into PCMCIA SLOT 1, and pushed firmly home. But first:

   Examine the Memory Card:

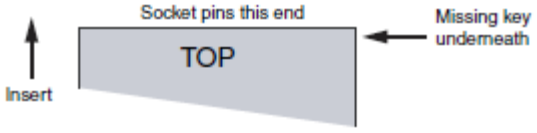
   The 68-way socket pins can be seen on the end of the card to be inserted:



erw118

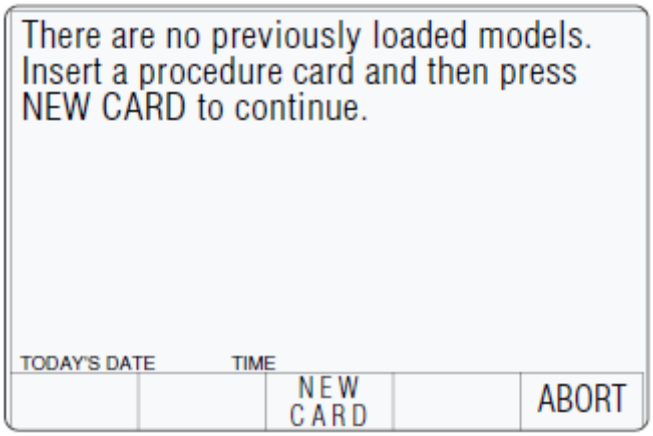
Insert the Card:

When inserting, the missing key must be located underneath the card on the right front:



erw119

If no Procedure Card has yet been inserted into the slot, and no procedure is at present resident in the RAM, (see Select the Subject UUT Model), then the following message will appear on the screen:



erw120

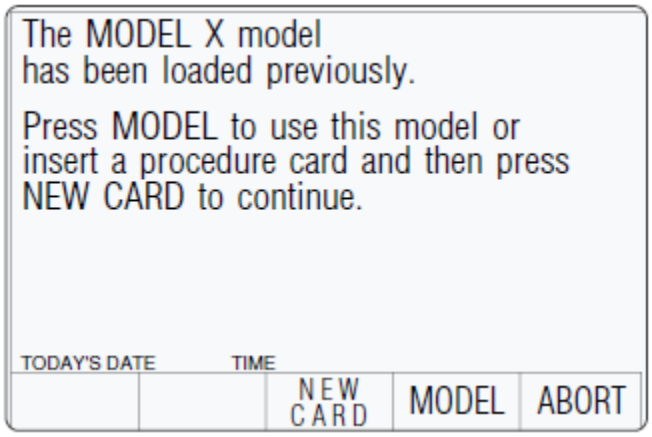
In this case, insert the card required for the UUT into PCMCIA SLOT 1, push gently home, and press the 'NEW CARD' screen key for the sequence to continue.

The 9500B will transfer to the 'Select MANUFACTURER' menu screen if more than one manufacturer is listed in the procedure card, or to 'Select MODEL' screen if only one manufacturer is listed.

2. No Procedure Card in Slot, but a UUT Model's Procedures Resident in RAM:

   If, on a previous occasion since the most recent power-on, a UUT model was selected from the Select Model screen menu, the 9500B will have downloaded all the procedures for the selected model into internal RAM.

   If, on this occasion, no Procedure memory card has yet been inserted into the slot, and procedures are still resident in the RAM, (see Select the Subject UUT Model), then a message similar to the following will appear on the screen:



erw121

   A choice is given: whether to use the loaded procedures, or to insert a new card to load a different model's procedures.

   For the same model, merely press the 'MODEL' screen key and the 9500B will transfer to the 'Enter the SERIAL NUMBER...' screen.

   For a different model, insert the card required for the UUT into PCMCIA SLOT 1, push firmly home, and press the 'NEW CARD' screen key for the sequence to continue.

   After pressing 'NEW CARD', the 9500B will transfer to the 'Select MANUFACTURER' menu screen if more than one manufacturer is listed in the procedure card, or to 'Select MODEL' screen if only one manufacturer is listed.

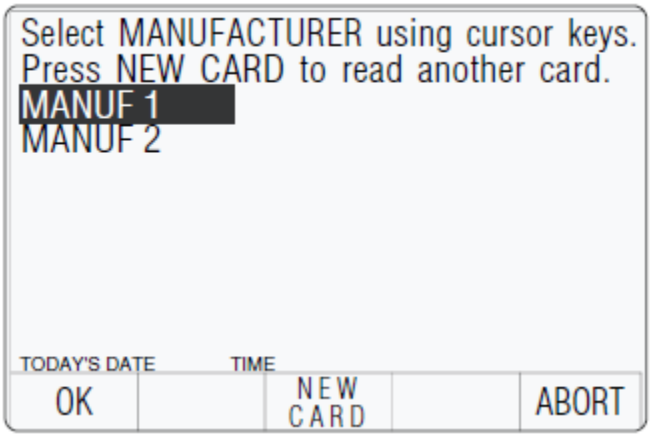
   ABORT returns to the 'Select USER NAME ...' screen.

   Refer to Common Operations in Procedure Mode — Summary of Actions, Figure 29.

Select the Subject UUT Manufacturer

(Only available if more than one manufacturer is listed in the Procedure Card)

By the time the 'Select MANUFACTURER' screen has been successfully opened, the 9500B will have extracted a list of the manufacturers whose models' procedures are contained in the Procedure card memory. These it displays on the screen for the user to choose. For example:



erw122

If the wrong card has been inserted:

Remove that card, insert another, then press the NEW CARD screen key to tell the 9500B that a different card has been inserted.

More than one manufacturer listed in the new card: The 9500B lists the manufacturers whose models' procedures are resident in the new card

Only one manufacturer listed in the new card: The 9500B transfers to the 'Select MODEL' screen if only one manufacturer is listed.

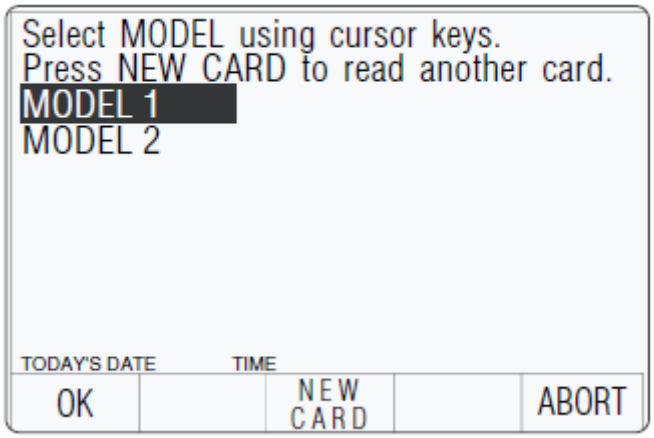
Correct manufacturer selected:

After selecting the required manufacturer, pressing the OK screen key will cause the 9500B to transfer to the 'Select MODEL' menu screen.

ABORT returns to the 'Select USER NAME ...' screen. Refer to Common Operations in Procedure Mode — Summary of Actions, Figure 29.

Select the Subject UUT Model

By the time the 'Select MODEL' screen has been successfully opened, the 9500B will have extracted a list of the models whose procedure is contained in the Procedure card memory. These it displays on the screen for the user to choose. For example:



erw123

If the wrong card has been inserted:

Remove that card, insert another, then press the NEW CARD screen key to tell the 9500B that a different card has been inserted.

More than one manufacturer listed in the new card:

The 9500B lists the manufacturers whose models' procedures are resident in the new card. After selecting the required manufacturer using the cursor keys, pressing the OK screen key will cause the 9500B to transfer to the 'Select MODEL' menu screen.

Only one manufacturer listed in the new card:

The 9500B transfers to the 'Select MODEL' screen if only one manufacturer is listed.

Correct Model selected:

After selecting the required model, pressing the OK screen key will cause the 9500B to download all the procedures for that model into internal RAM. The card can then be removed and used to load another instrument.

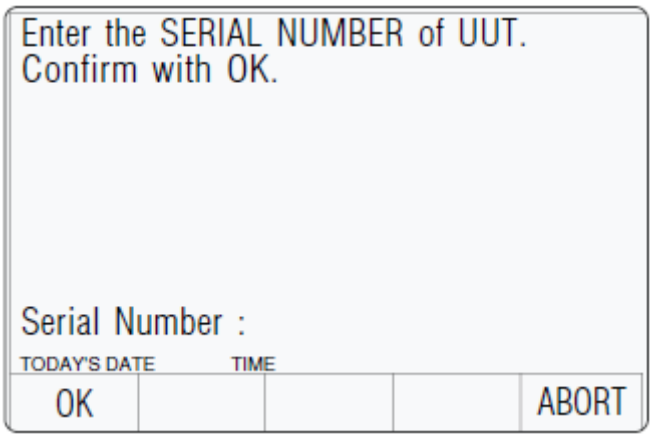
After choosing the model, the next stage is to enter the UUT serial number. Pressing the 'OK' screen key will cause the 9500B to transfer to the 'Serial Number' screen.

ABORT returns to the 'Select USER NAME ...' screen.

Refer to Common Operations in Procedure Mode — Summary of Actions, Figure 29.

Enter the Serial Number of the Subject UUT

Having selected the UUT model, the 9500B asks for the serial number to be entered so that any results can be identified. This is done on the following screen:



erw124

Enter the UUT's Serial Number:

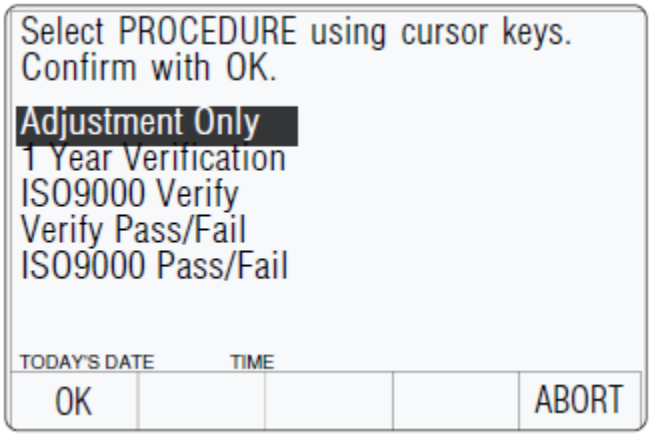
Use the alpha-numeric keypad to write the serial number (20 characters max.) on the screen. It will appear at the bottom of the screen as you type. Then press the '↵ ' key or the 'OK' screen key, after which the screen will change to select the type of procedure required.

ABORT returns to the 'Select USER NAME ...' screen.

Refer to Common Operations in Procedure Mode — Summary of Actions, Figure 29.

Select the Procedure for the Subject UUT Model

When the 'Select PROCEDURE' screen is opened, the 9500B will have already downloaded all the procedures for the selected model from the Procedure card memory into internal RAM. The 9500B displays a list of these on the screen for the user to choose:



erw125

Types of Procedure

(Procedure Cards supplied from the Procedure Library).

Adjustment Only

The procedure will cause the 9500B to provide the correct outputs for each of the Manufacturer's recommended test points for adjustment of the subject UUT model. The identity of adjustment controls, target values and limits are presented on the screen for the convenience of the user, who will also decide whether the adjustment was successful, and record pass/fail status.

1 Year Verification

The 9500B provides the correct outputs for each of the Manufacturer's recommended test points used to verify the full performance of the subject UUT model. Users can slew the output to determine the UUT error. 'Style 1' printed results will list these errors.

ISO9000 Verify

This is a variant of 1 Year Verification, different in that the 9500B provides a wider range of test points to verify performance in greater detail than is recommended by the Manufacturer.

Verify Pass/Fail

The 9500B provides the correct outputs at each of the test points, for the user to check whether the UUT verifies within its specification. Pass/Fail only is printed on the report.

ISO9000 Pass/Fail

This is a variant of Verify Pass/Fail, different in that the 9500B provides a wider range of test points to check the specification in greater detail than is recommended by the Manufacturer.

To Select a Procedure

Use the ⌃ and ⌄ cursor keys, or the spinwheel to highlight the required procedure, then press 'OK'. The 9500B will transfer to the appropriate menu screen. Refer to the procedure description.

ABORT returns to the 'Select USER NAME ...' screen.

Refer to Common Operations in Procedure Mode — Summary of Actions, Figure 5-2.

Procedures — Card-Based Operating Instructions

Selection of UUT Model

When the model of UUT has been chosen from the menu (derived from the procedure card), all procedures for the selected model are automatically downloaded into the 9500B's internal memory, and the selected procedure no longer requires the card, as it will be programmed from the internal memory. Once the procedure has progressed this far, the procedure card can be removed and used to program other Model 9500B units.

Procedure Activation

Once the type of procedure has been selected, the downloaded user-interactive program will be run by the 9500B. Subsequent instructions appearing on the screen will be derived from the programmed sequences.

Single-Channel Variants - Procedures

This description assumes that the variant 9500B/1100 is being used.

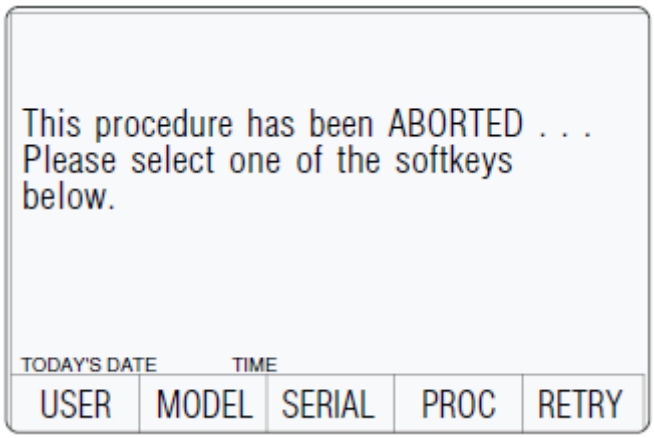
Conclusion

No further routine instructions are given here, as they may vary from model to model and are developed within the programmed sequences. However, the 9500B is programmed also to interrupt procedures and communicate with the user when certain events occur. Among these, the two most important are those of 'Abort' and 'End'.

'ABORT'

Up to this point of choosing a procedure, when an 'ABORT' screen key is pressed, the system will revert to the first Procedure-mode screen 'Select USER NAME'.

After the choice of procedure has been confirmed by 'OK', the procedure itself is controlled from the card sequence, and when an 'ABORT' screen key is pressed, the system will generate a special 'ABORT' message which also ends the procedure, overwriting the currently-displayed screen:



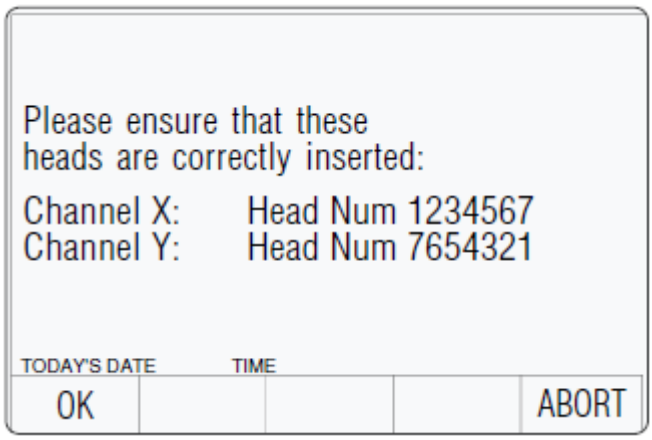
erw126

The procedure can be aborted by the 9500B itself for other reasons. This will also invoke the 'ABORT' screen.

For the choices obtained from the five screen keys, refer to User Options Following 'ABORT' or 'END'.

Removal of Active Head

If the 'in use' Active Head is removed during a procedure, this will be detected and a message will appear on the screen:



erw127

The head serial numbers are given.

'Channel X' refers to the selected signal channel, and 'Channel Y' is the selected trigger channel.

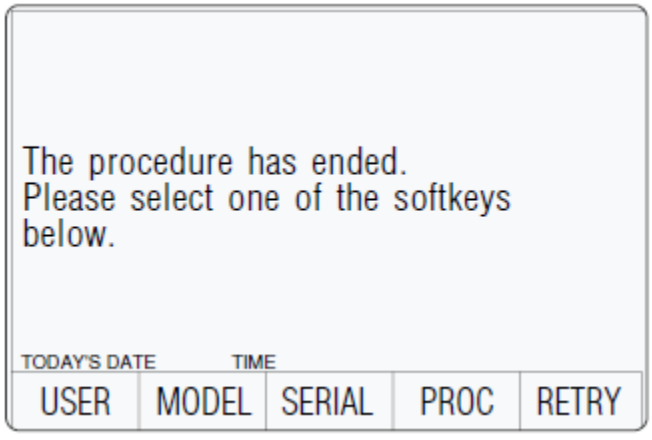
If no head was fitted, then the words 'Any Head' will appear in place of the head number.

If the procedure card was produced for use with the Model 9100 Option 250 or 600, then no channels will have been nominated in the procedure. In this case the 9500B will choose the channel which was most-recently used, and it will be this which appears on the screen.

Pressing OK will cause the 9500B to pass on to the next operation in sequence, only after the appropriate heads have been connected to the selected channels. Otherwise the operator can choose ABORT, which will return to the previous start point.

'END'

When all stages of the procedure have been completed, the system will end the procedure, also generating a special 'END' message which overwrites the currently-displayed screen:



erw128

For the choices obtained from the five screen keys, refer to User Options Following 'ABORT' or 'END'.

User Options Following 'ABORT' or 'END'

Once the procedure has ended or been aborted, the user can return to one of five points in the sequence. The point numbers refer to Figure 29:

USER (Point 1)

The 'Select USER NAME' screen is the first to appear after selecting Procedure mode. All setup parameter variables can be changed, and a new procedure card can be inserted.

MODEL (Point 2)

The 'Select MODEL' screen offers users-election from all the UUT models (for the previously-selected manufacturer) on the currently-loaded procedure card; or a new procedure card can be inserted.

Note

For those cards containing procedures for UUTs from more than one manufacturer: then in order to change manufacturer, return to the 'Select USER NAME' screen by pressing the 'USER' screen key.

SERIAL (Point 3)

This choice assumes a wish to select a different unit of the same model. The system therefore returns to the 'Enter SERIAL NUMBER' screen.

PROC (Point 4)

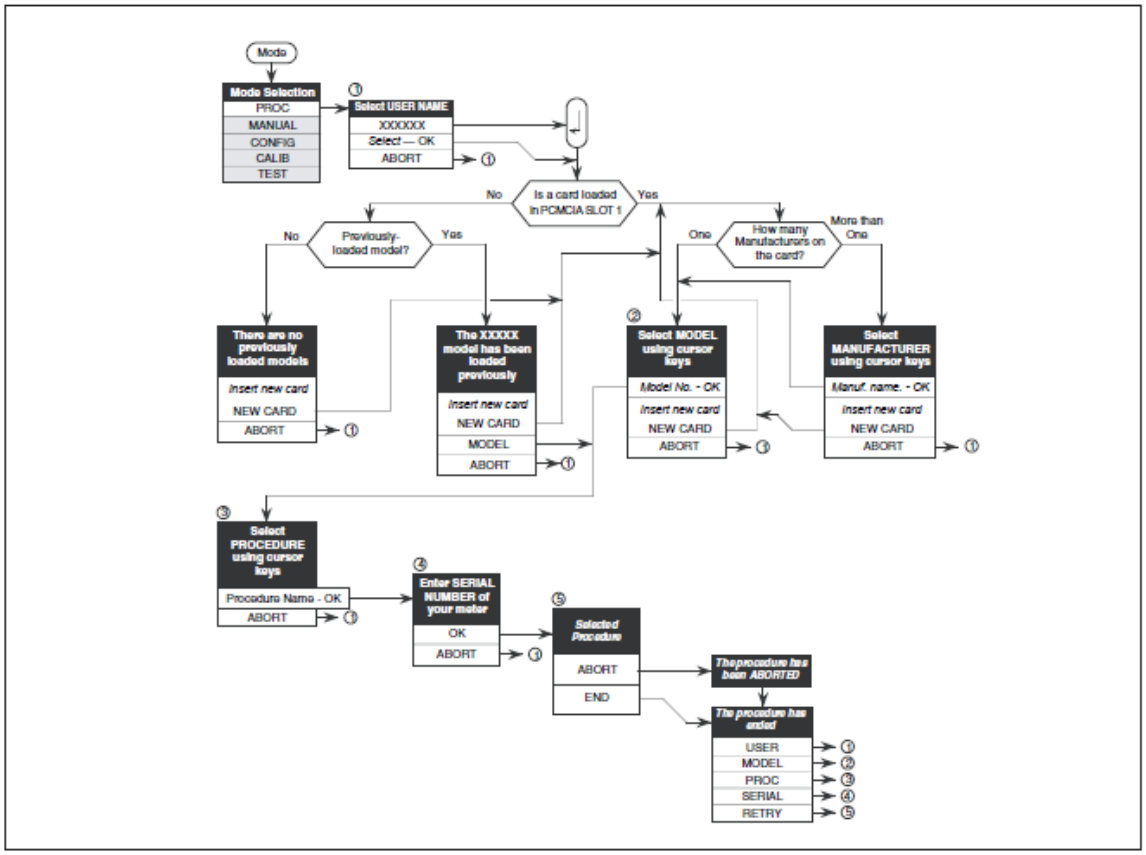
This choice assumes a wish to select a different procedure for the same model and serial number. The system therefore returns to the 'Select PROCEDURE' screen.

RETRY (Point 5)

This selection re-runs the same procedure which has just ended or been aborted. It is assumed that the same unit is being tested, so the same serial number will appear on any results printout.

Common Operations in Procedure Mode — Summary of Actions

The flow chart in Figure 29 summarizes the user actions needed to enter Procedure mode and load the procedure card; then select the UUT model and its pre-programmed procedures:



erw129

Figure 29. Procedure Mode — Access to Procedures