

OPERATING INSTRUCTIONS

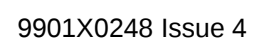
Digital Direct/Residual Shear Apparatus

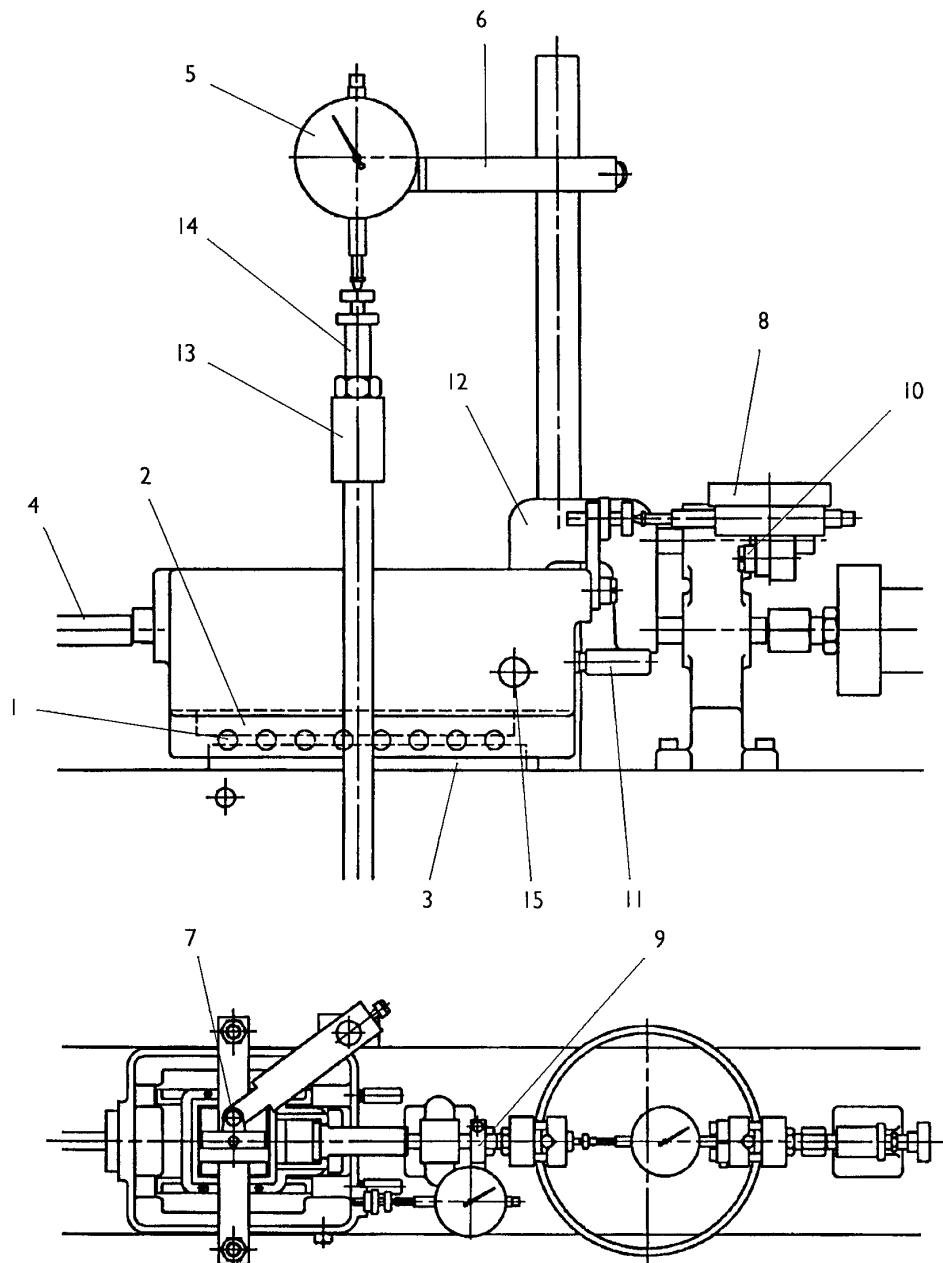
26-2114

ELE International Chartmoor Road, Chartwell Business Park Leighton Buzzard, Bedfordshire, LU7 4WG England phone: +44 (0) 1525 249200 fax: +44 (0) 1525 249249 email: ele@eleint.co.uk http://www.ele.com ELE International, a division of Hach Lange Ltd.	Distributor:	ELE International Soiltest Product Division PO Box 389, Loveland, CO 80539 USA phone: +1 (800) 323 1242 fax: +1 (970) 663 9781 email: soiltest@eleusa.com http://www.eleusa.com
<i>In the interests of improving and updating its equipment, ELE reserves the right to alter specifications to equipment at any time.</i> ELE International 2015 ©		

Contents

	Section	Page
	Figures 1 to 10	3-9
1	Safety	10
1.1	Symbols	10
1.2	Use of Hazards information	10
2	Introduction	11
2.1	List of Contents	11
3	Specifications	12
4	Installation	12
4.1	Mechanical	12
4.2	Electrical- Power Supply	14
5	Portable Appliance Tests	15
6	Controls/Description	15
7	Operation	20
8	References	22
9	Maintenance	22
10	Spares	23
11	Accessories	24
	Appendix A: RS232	25
	Declaration of Conformity	
	WEEE Directive	

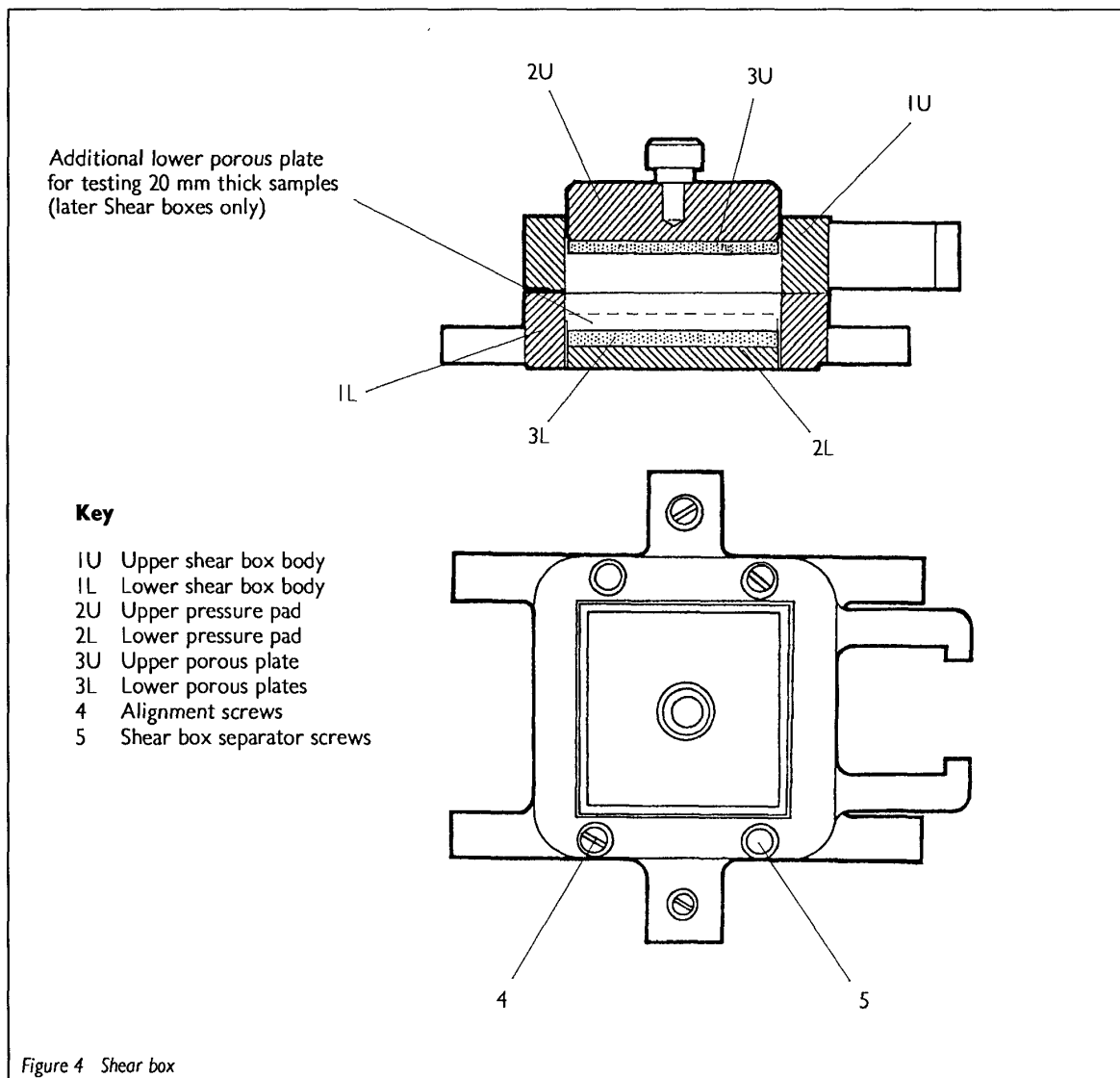
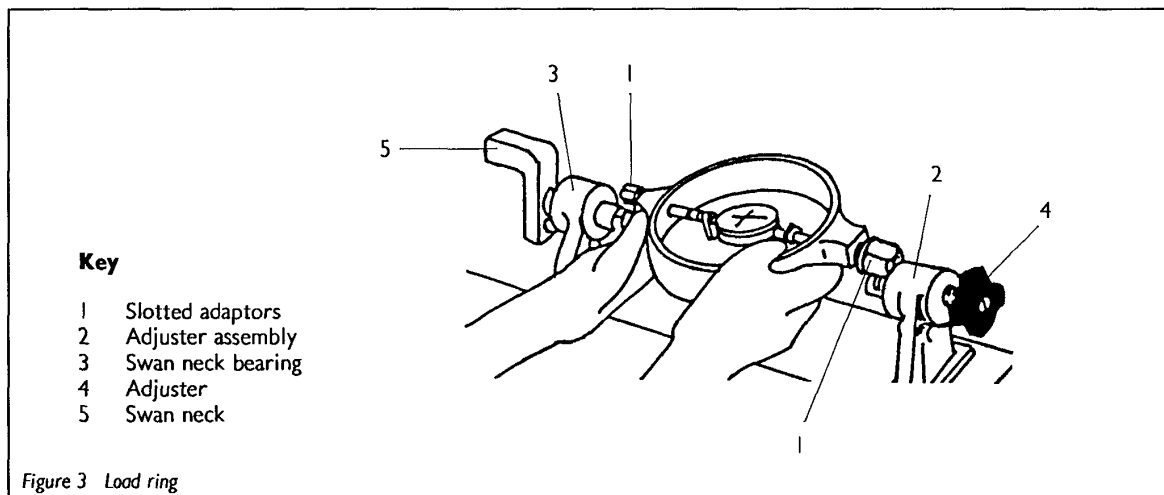


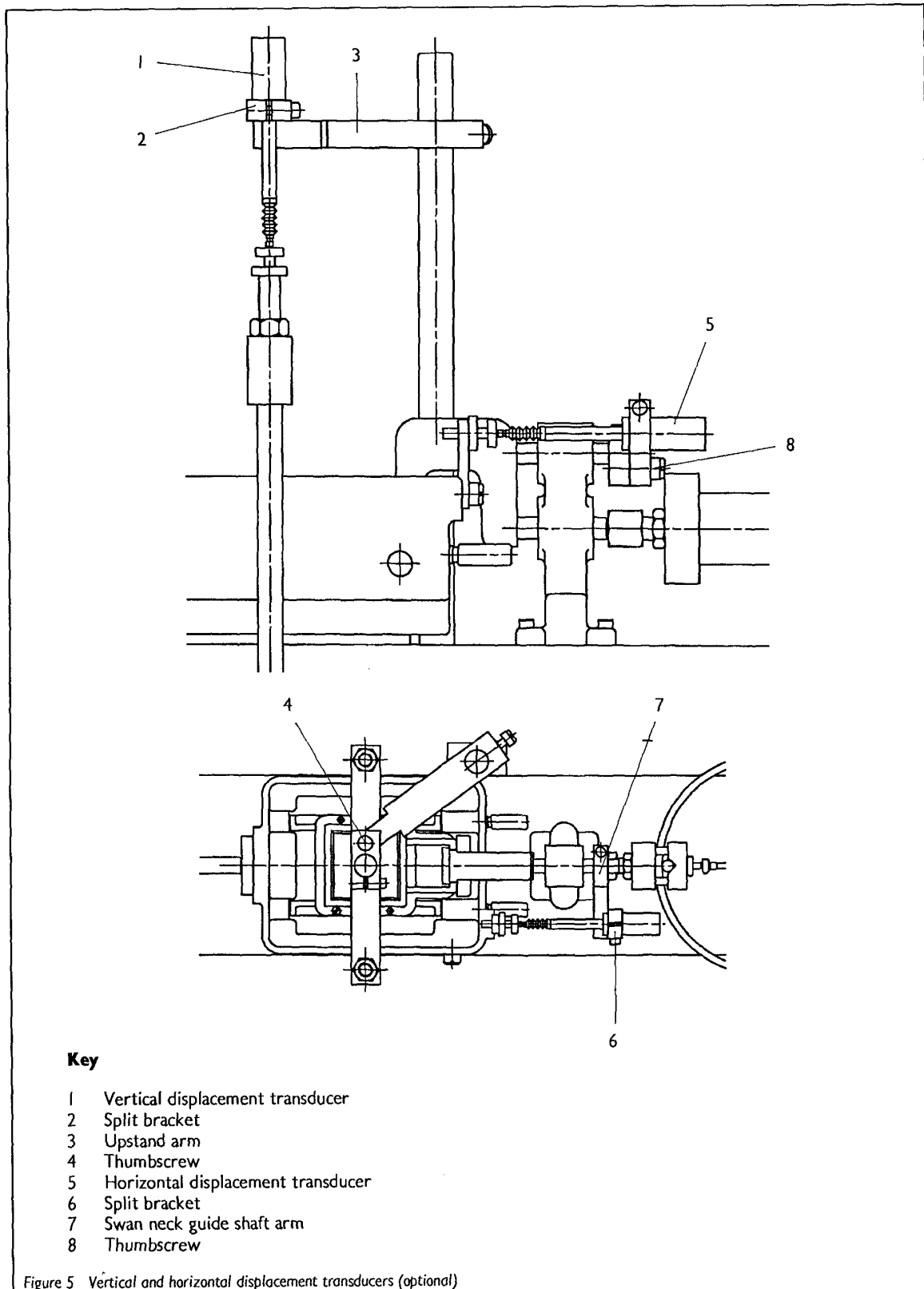


Key

- | | |
|--------------------------------------|-----------------------------|
| 1 Ball races | 9 Swan neck guide shaft arm |
| 2 Upper carriage track | 10 Thumbscrew |
| 3 Lower main frame track | 11 Locking screw |
| 4 Loading shaft | 12 Swan neck |
| 5 Vertical displacement dial gauge | 13 Loading yoke |
| 6 Upstand arm | 14 Load pin |
| 7 Thumbscrew | 15 Drain plug |
| 8 Horizontal displacement dial gauge | |

Figure 2 Shear carriage and dial gauge arrangement





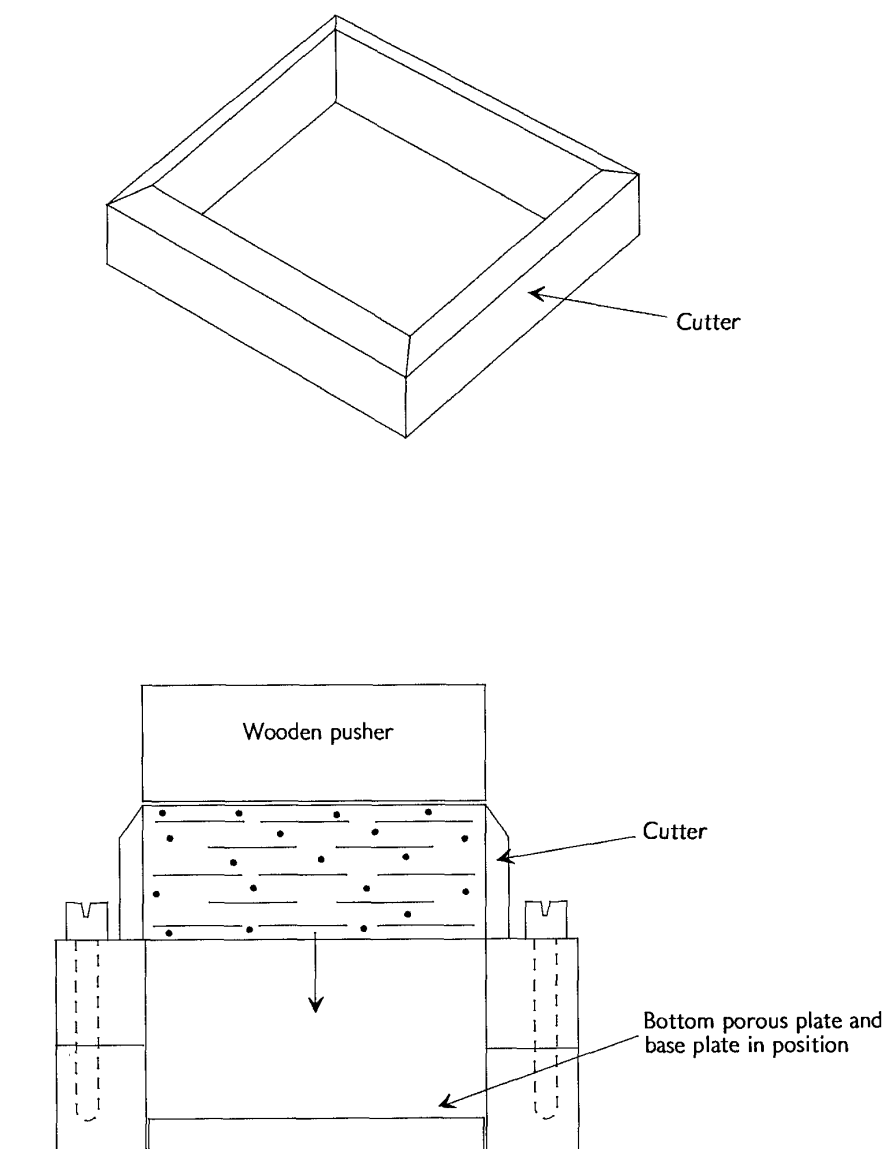
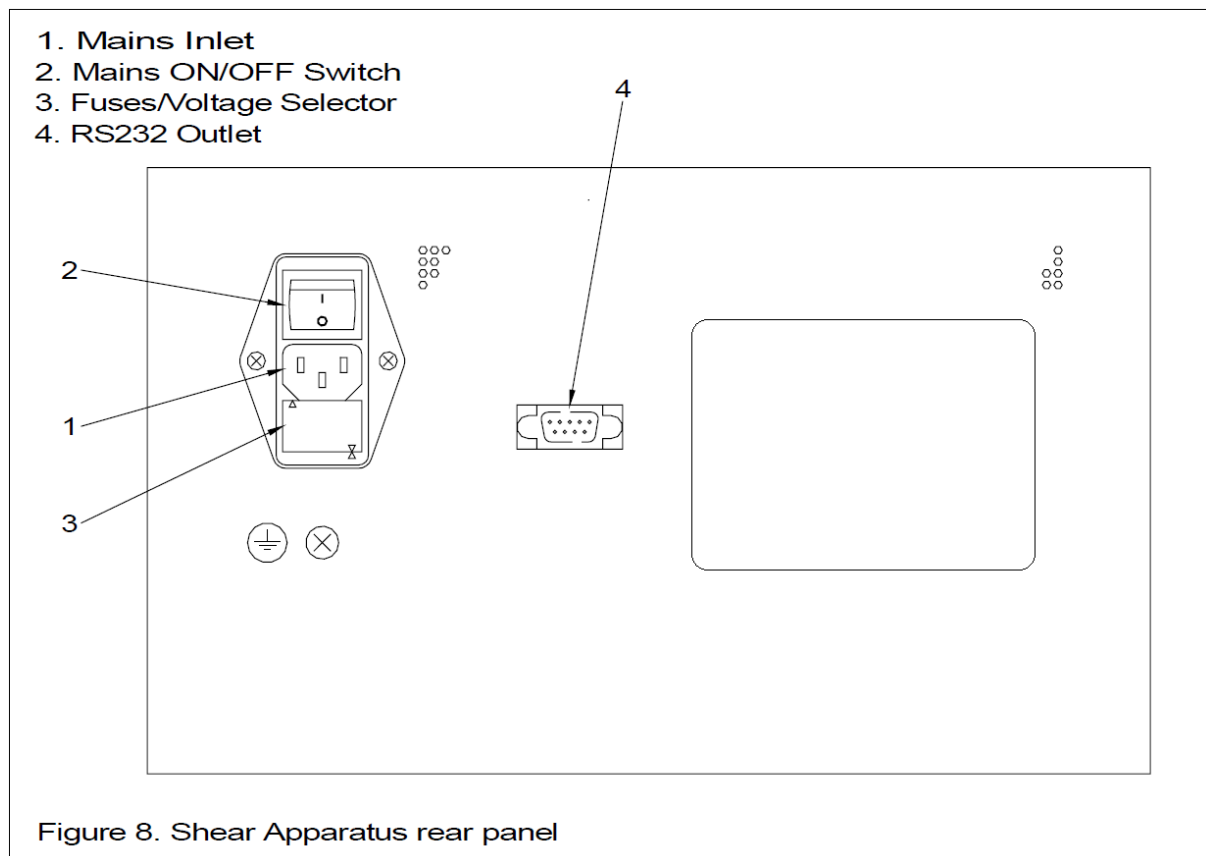
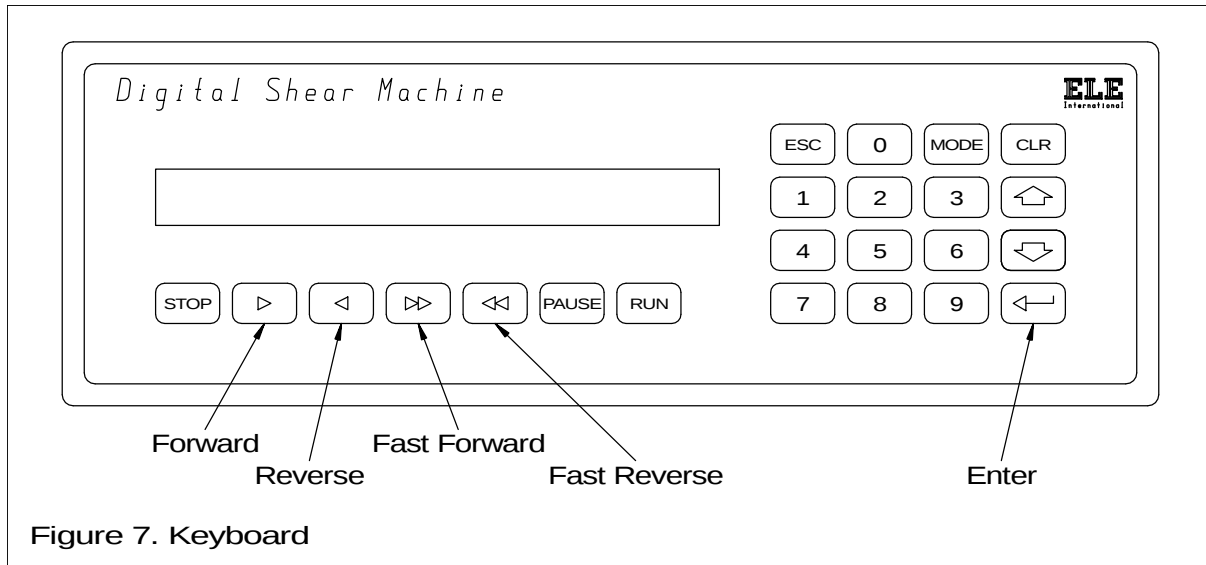


Figure 6 Specimen cutter



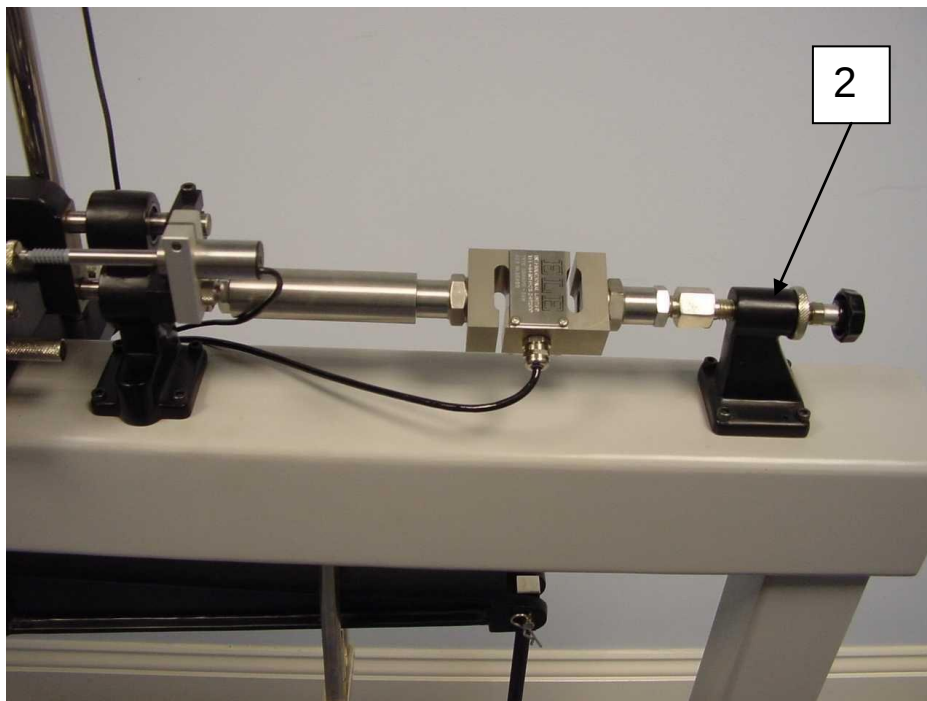
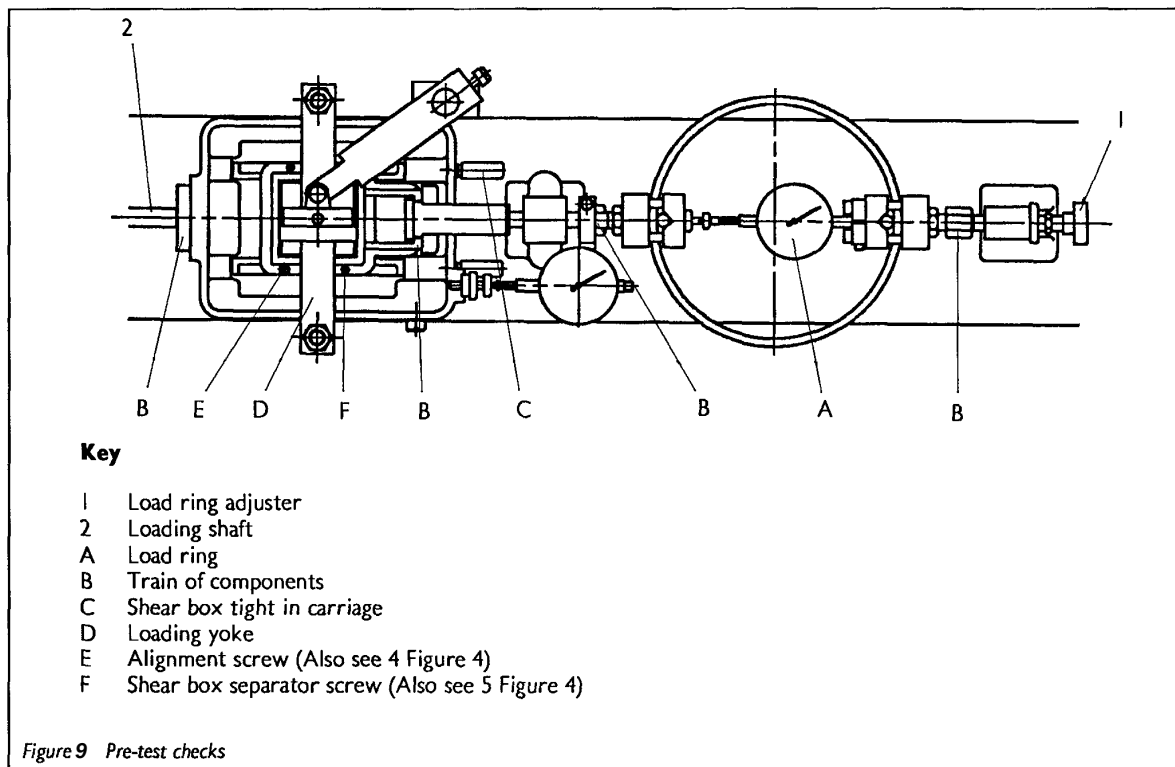


Figure 10

1 Safety

This equipment has been tested by ELE International and is safe to use providing that the proper safety precautions are observed:

Do not use this equipment in any manner, other than as specified in this user manual; misuse may result in serious injury to personnel.

Do not attempt to operate the equipment with covers removed.

Only connect to the correct electrical supply. Equipment voltage setting is stated on the fuse cover of the appliance inlet module.

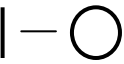
Refer to Installation section before installing machine

Do not operate machine with wet hands

Please read this entire manual before unpacking, setting up or operating this equipment. Pay particular attention to all **DANGER** and **CAUTION** statements. Failure to do so could result in serious injury to the operator, or other personnel, or damage to the equipment.

Ensure all moving parts are thoroughly secured before attempting any maintenance.

1.1 Symbols

	Green or Black	PROTECTIVE CONDUCTOR TERMINAL Equipment safety earthing point
	Any contrasting Color	"I" = SUPPLY SWITCHED "ON" "O" = SUPPLY SWITCHED "OFF"
	Any contrasting Color	FUSE, FOR SAFE OPERATION OF THE EQUIPMENT, USE ONLY FUSES WITH RATINGS SPECIFIED
	Green or Black	Earth (ground) TERMINAL Not for safety earthing purposes but provide an earth reference point.
	Background Yellow; symbol and outline – Black	Caution, risk of electric shock
	Background Yellow; symbol and outline – Black	Caution – refer to accompanying documents
	Any contrasting Color	Equipment conforms to the requirements of European CE Directives, as stated on the Declaration of Conformity

1.2 Use of Hazard Information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury

Important Note: Information that requires special emphasis

Note: Information that supplements points in the main text.

2 Introduction

These instructions cover machines with serial numbers beginning with 1885.

Microprocessor control

LCD screen display

Direct entry via touch sensitive keyboard

Rapid approach and return to start datum

Fully variable speed, 0.00001 to 9.99999 mm/minute

Accepts specimens up to 100 mm square

The use of a microprocessor controlled drive system and keyboard entry provides the apparatus with a wide range of features which includes pause and speed change during test, RS232C interface for computer control, operator programming of speed and control functions self test diagnostics and many other features. A return to start datum provides a positive means of reversing the shear box when either preparing for a new test or continuing with residual testing procedures.

Safety forward/reverse travel limit switches are fitted as standard.

Supplied complete with carriage, load hanger and 10:1 lever loading device.

2.1 List of Contents

Item	Quantity
Shear machine	1
Load hanger	1
Jack screw assembly	1
Carriage	1
Ball race	2
Load connector and lock nuts	2
Mains lead	1

3 Specifications

Max specimen size	100 mm
Max design normal load	1000 kg
Specimen 60 mm square 10:1 ratio max stress	100 kg 2.8 N/mm ² (272.5 kPa)
Max design shear force	5.0 kN
Weight (approximate)	70 kg (155 lbs)
Approximate dimensions (L x W x H)	320 x 1135 x 1260 mm
Enclosure	Metal casing with painted finish
Temperature	5° C to 40° C
Relative Humidity	Up to 80% for temperatures up to 31° C, decreasing linearly to 50% RH at 40° C
Supply voltage(s)	115 VAC, 50/60Hz 230 VAC, 50/60Hz
Power consumption	26W – 1.6A fuse rating
Pollution category	II
Installation category	II
Serial interface	RS232 (Standard) Programmable baud rate and protocol
Certifications	CE & to UL/CSA Safety by ETL (cETLus mark)

4 Installation

Ensure all moving parts are thoroughly secured before attempting any installation or maintenance activities.

Ensure all appropriate measures are taken to protect the operator from excessive noise. See noise certificate (when supplied).

DANGER: The Direct/Residual Shear is very heavy; it weighs more than 70 kg (155 lbs.) Do not attempt to unpack, carry or move without proper equipment and sufficient people to do so safely. Remember, always lift with your legs, not with your back. If you have a history of back problems or cardiovascular problems, do not attempt to unpack or lift the Direct/Residual Shear.

4.1 Mechanical

4.1.1 Location

CAUTION: Once the feet extensions are removed great care must be exercised when handling the machine, as the stability will be greatly reduced.

The machine is supplied with wooden extensions bolted to the feet for increased stability.

It is suggested that the machine be moved as near as possible to its final location before removing the extensions.

The machine must be bolted down to a solid base (preferably a concrete floor) see Figure 1.

4.1.2 Lever Loading Arm (Figure 1)

Attach the Load Hanger to the Lever Loading Arm using the pin and clips supplied see Figure 1

The shear machine is designed to operate with the lever arm assembly arranged to multiply a given normal load by 10. i.e. 1 kg on the load hanger applies a load of 10 kg to the sample.

Balance the lever arm in the horizontal position by adjusting the position of the balance weight on the arm.

4.1.3 Shear carriage (Figure 2)

The carriage runs on two ball races (1) running between the upper carriage track (2) and the lower main frame track (3).

If supplied separately, position the ball races and the carriage centrally on the tracks and check for free running.

Connect the carriage to the loading shaft (4).

4.1.4 Load ring and "S" type load cells (Figures 3 & 10)

A selection of load rings are available for use with the equipment ranging in capacity from 2.0 kN to 4.5 kN. Also available is a 5 kN "S" load cell.

Two special slotted adaptors (1) are provided, to connect the load ring to the adjuster assembly (2) and the shear box swan neck bearing (3).

Manipulate the adjuster (4) and swan neck (5) to allow the load ring to slot onto the appropriate connectors.

NOTE In order to accommodate smaller "S" type load cells, it might be necessary to reverse the adjuster assembly (2).

4.1.5 Shear box (Figure 4)

A range of shear boxes are available to suit specimens of various sizes. Each unit is manufactured throughout in non-ferrous metal and is supplied as a complete assembly comprising:

- (1) upper and lower shear box bodies
- (2) upper and lower pressure pads
- (3) upper and lower porous plates
- (4) alignment screws
- (5) separator screws

See accessories for full details.

4.1.6 Load cells (if fitted)

To fit load cells to machine, remove ball and socket ends from load cell and replace with special adaptors supplied with load machine.

4.1.7 Vertical and horizontal displacement dial gauges (optional, see Figure 2)

The vertical displacement dial gauge (5) attaches directly to the upstand arm (6) and is secured by a single thumbscrew (7).

The horizontal displacement dial gauge (8) attaches directly to the swan neck guide shaft arm (9) and is secured by a single thumbscrew (10).

4.1.8 Vertical and horizontal displacement transducers (optional, see Figure 5)

The vertical displacement transducer (1) is supplied with a 'split' bracket (2) which clamps around the transducer body. This bracket then attaches to the upstand arm (3) and is secured by a thumbscrew (4).

The horizontal displacement transducer (5) is supplied with a 'split' bracket (6) which clamps around the transducer body. This bracket then attaches to the swan neck guide shaft arm (7) and is secured by a thumbscrew (8).

For identification purposes the transducer brackets are marked 'V' for vertical displacement and "H" for horizontal displacement.

4.1.9 Assembling shear box (Figures 2, 3 and 4)

It is important to lock the shear box rigidly into the carriage by use of the locking screws (11 Figure 2 and C Figure 8).

Select the required shear box and remove all plates except the lower pressure pad (2L Figure 4).

Place the shear box in the carriage with the driving lugs of the upper body (IU Figure 4) connected to the swan neck (12 Figure 2).

Important Note: it may be necessary to adjust the load device position (4 Figure 3) to achieve this.

Screw in the two shear box locking screws (11 Figure 2) and tighten to lock the shear box into the carriage.

4.2 Electrical- Power Supply

DANGER: Servicing of this equipment must be performed by a qualified ELE service technician. Before removing any covers or performing maintenance repair and service, isolate from electrical supply by removing mains plug. Where mains supply connection is required during these activities, only fully trained technicians should perform the work.

DANGER: Dry hands before operating electrical machines.

DANGER: This unit is dual pole fused having both line and neutral fused, hence the two fuses for both 115V and 230V operation.

DANGER: Misapplication of the voltage to the machine can result in both electrical hazards and damage to the equipment. The position of the fuseholder drawer in the power inlet module determines the line voltage the machine is set for. The machine normally ships factory set for the correct voltage for the supplied power cord, but. ALWAYS verify proper line voltage settings prior to applying power during the initial installation/s. (See item 2 in the following paragraph for details.

Fuses/Voltage Selection (See Figure 8, Item 3)

If it is necessary to convert the product to a different line voltage, the line voltage must be manually switched and a suitable line cord for the voltage must be connected before connecting to mains power. The machine's voltage setting can be changed by removing and repositioning the fuseholder drawer, located in the machines power inlet module. To change the machines line voltage:

- 1) Pull the fuseholder drawer from the power inlet module. (It is not necessary to replace the fuses. The supplied T, 1.6A, 250V fuses are suitable for either 115 or 230 volt 50/60 Hz (26W) operation.
- 2) Select the desired line voltage by aligning the voltage setting on the fuseholder drawer. The desired voltage setting (i.e. 110-120V or 220-240V) must be upright at the base of the fuseholder drawer; the selected voltage indicator's arrow will be pointing down. When properly oriented, push the fuseholder drawer into the power inlet module for the desired line voltage.
- 3) Select and install a power cord suitable for per local country code. A 3 conductor power cord with Protective Earth (Ground) terminal is required).

DANGER: A good low impedance Protective Earth Ground connection is required to the power cord to assure electrical safety.

DANGER: Never attempt to operate the machine with any covers removed.

5 Portable Appliance Tests (PAT)

All ELE designed products are tested for electrical safety prior to sale.

An electrical safety test label is fitted, (usually adjacent to the mains input socket).

Organisations have an obligation to ensure equipment is maintained and is safe for use. Regular PAT testing is one means of ensuring equipment continues to be electrically safe.

Important: do not connect PAT leads to sensitive components such as PCBs, control switches and the like.

DO NOT FLASH TEST ELECTRONIC EQUIPMENT.

If in doubt as to the most suitable connection point (which will usually be an earth stud or an external earth connection) contact ELE Service Department for assistance.

6 Controls/Description

6.1 Mains (Reference Figure 8, Item 2)

Situated at the rear of the machine, this switch turns the power supply ON and OFF.

When the mains supply is first switched on the display will show:

SHEARBOX	<<	SYSTEM CHECK	>>
----------	----	--------------	----

This will remain for approximately 2 seconds, during which time a series of automatic, electronic checks are made. If the checks are passed, the display will show either:

(MANUAL)	= STOP =	x.xxxxx	mm/min
[Mode] / Enter Speed		#.#####	mm/min

or

(MANUAL)	= STOP =	0.xxxxxx	in/min
[Mode] / Enter Speed		0.#####	in/min

or

(RS232)	= STOP =	0.00000	mm/min
[	]RX Tx[		]

or

(RS232)	= STOP =	0.000000 in/min
[	]Rx Tx[	]

Note: x.xxxxx denotes last speed retained in memory.

6.2 Mode Selection

The [Mode] key is used to enable the selection of the system's various operating modes. These are:

Manual	Control from front panel push buttons and keypad
Serial	Control via serial RS232 interface
Set 0 Datum	Set Datum position for Return-to-Datum function
Set-Up	Configuration for Serial Interface protocol and System Options (units/type/contrast/diagnostics)

When the [Mode] key is repeatedly pressed, the bottom line display will scroll through:

' [Enter] [Mode] : Manual or [Esc] '

' [Enter] [Mode] : Serial or [Esc] '

' [Enter] [Mode] : Set 0 Datum or [Esc] '

' [Enter] [Mode] : Set-Up or [Esc] '

When the desired mode is displayed, press the [Enter] key to select it, or press the [Esc] key to abort and return to the current mode.

6.3 Manual Mode

The display will show:

(MANUAL)	= STOP =	x.xxxxx mm/min
[Mode] / Enter	Speed	#.##### mm/min

The top line shows the system status and the preset speed.

The preset speed may be changed, at any time, by numeric entry via the keypad. The new speed will be indicated on the bottom line, in place of the # markers, and will become active when the [Ent] key is pressed. The [Clr] key may be used to clear an erroneous entry prior to the [Ent] key being pressed. Trailing zeros do not need to be entered.

The motor is controlled by the Command Push Buttons:

[Stop]	Cancels all movement functions	<i>motor stops</i>
[Forward]	Move FORWARD at Preset Speed	<i>momentary</i>
[Reverse]	Move in REVERSE at Preset Speed	<i>latching</i>
[Fast Forward]	Move FORWARD at Fast Speed	<i>momentary</i>
[Fast Reverse]	Move in REVERSE at Fast Speed	<i>latching</i>
[Pause]	See Pause-Mode later	<i>latching</i>
[Run]	Move FORWARD at Preset Speed	<i>latching</i>
[↓]	Return-to-Datum (if Datum 0 Set)	<i>latching</i>

The system's status is indicated on the display as follows:

= STOP = *steady* Motor stopped normally

→ RUN →	<i>flashing</i>	Run Mode, moving FORWARD Preset Speed
→	<i>flashing</i>	Moving FORWARD at Preset Speed
←	<i>flashing</i>	Moving in REVERSE at Preset Speed
→→	<i>flashing</i>	Moving FORWARD at Fast Speed
←←	<i>flashing</i>	Moving DOWN at Fast Speed
PAUSE	<i>steady</i>	Paused (stopped) in Run Mode
← STOP ←	<i>flashing</i>	Stopped at Overtravel limit
→ STOP →	<i>flashing</i>	Stopped at Undertravel limit
↓ ←←	<i>flashing</i>	Returning to Datum
↓ →→	<i>flashing</i>	Returning to Datum

6.4 Pause-Mode

If the [Pause] button is pressed during a Run sequence, the motor will stop. Press the [Pause] button again to continue the Run sequence. While the motor is stopped in PAUSE, a Pause-Mode Speed may be entered via the keypad. This new speed will operate when PAUSE is released by pressing the [Pause] button again, and will be retained while in Pause-Mode. Pressing any other control button than [Pause] will exit the Pause-Mode and return to the Preset Speed.

Note: the Pause-Mode Speed is indicated by an '*' on the top line display thus:

(MANUAL)	PAUSE	* 2.34567 mm/min
----------	-------	------------------

6.5 Serial Mode

The display will show:

(RS232)	= STOP =	0.00000 mm/min
[	Rx Tx]	]

The top line shows the system status and the requested speed.

The bottom line shows the Received Characters (Rx) on the left and Transmitted Characters (Tx) on the right.

The speed and direction may be remotely controlled, by a computer or terminal, via the serial interface.

The speed may be programmed over the range 0.00000 to 9.99999 mm/min for metric, or 0.000000 to 0.399999 in/min for Imperial units. The direction is controlled by a leading '+' or '-' character (+ for UP, - for DOWN). Positive (UP) speeds may also be entered without a leading '+' symbol.

Example: for speed of 3.25400 mm/min or 0.125400 in/min in the FORWARD direction, the following ASCII string would be sent:

(+) 3.25400 (metric) or (+)0.125400 (Imperial), '+' not necessary for UP speeds.

All serial command strings must be terminated with the receive terminator as selected in the Serial Interface Set-Up (see later).

If the command string is accepted by the system, it will be returned to the source along with the transmit terminator.

If the motor is inhibited from moving in the requested direction, because it is at a limit switch or at the MAX position (see later), the following string will be returned:

+0.00000 (metric) or +0.000000 (Imperial)

If the command string is incorrectly formed, or the wrong termination is used, the following string will be returned:

6.6 COMMAND ERROR *

Again, the selected transmit termination will be appended to these strings.

The sequence of Command/Reply must be maintained by the source controller at all times.

When the Mode is changed from Manual to Serial, the motor will stop and remain stopped until a serial command is received.

Press the [Stop] Command Push Button to manually override any serial command and force the motor to stop.

Use the [Mode] key (see earlier) to select any of the alternative operating modes.

6.7 Additional Serial Commands (Metric)

Command	Reply	Function
VSN	V **.*	Echo firmware release version number **.*
FAST +	FAST +	Ram moves FORWARD at 40 mm/min for 250 mS
FAST -	FAST -	Ram moves in REVERSE at 40 mm/min for 250 mS
MAX +**	MAX +**	Set Forward Limit at **mm from current position
MAX -**	MAX -**	Set Reverse Limit at **mm from current position Power-up default is ± 99 mm
POSN	+***	Echo current position $\pm$ *** mm relative to point at which last MAX command was issued.
STATUS	ABCDEFGHIJ	Echo system status
	A	Motor Stopped
	B	Motor Moving FORWARD
	C	Motor moving in REVERSE
	D	Ram limit FORWARD
	E	Ram limit REVERSE
	F	MAX limit FORWARD
	G	MAX limit REVERSE
	H	Stepper fault
	I	For future use
	J	For future use
		Any status code that is not valid will be replaced by a period (.) character.
DATUM	DAT-0	Set Datum for RETURN at current position. A symbol will show in the display to indicate that the datum has been set.
RETURN	RET-0	Return-To-Datum position (if Datum set) NO-DATUM if Datum has not been set since power-up.
HOME	HOME	Return to the bottom limit switch.
XSW	000000	Echo switch status.

6.8 Alternative Serial Commands (Imperial)

Command	Reply	Function
MAX +*. *	MAX +*. *	Set Upper Limit at *. * in from current position.
MAX -*. *	MAX -*. *	Set Lower Limit at *. * in from current position.
		Power-up default is ± 3.9 in.
		Maximum range is ± 3.9 in.
POSN	+*. *	Echo current position $\pm *. *$ in relative to point at which last MAX command was issued.

6.9 Return-To-Datum

Position the system at the required Datum Position.

Press the [Mode] key until the bottom line display shows:

[Enter] [Mode] : Set 0 Datum [Esc]

Press the [Ent] key to datum an internal position counter to 0.

The display will revert to the current bottom line, and a $\Downarrow$ symbol will appear on the top line to indicate that the datum has been set. Press the [$\Downarrow$] key, at any time after setting the datum, to initiate a Return-To-Datum at the Fast Speed. The motor will stop at the Datum Position. The Return-To-Datum sequence may be terminated by pressing any of the other Command Push Buttons. The Datum may be cleared by selecting Manual Mode.

6.10 Set-Up Mode

The display will show the <SET-UP> Menu:

(SETUP)	[1]:Serial Interface
V *. *. *	[2]:System Options [$\Downarrow$] [Esc]

The bottom line shows the Firmware Release Version Number 'V *. *. *'.

Press the [1] key to configure the Serial Interface.

Press the [2] key to select System Options (factory set only).

Press the [$\Downarrow$] key to show setup option [3].

Press the [3] key to select Diagnostics (service only).

Press the [Esc] key to return to the current Operating Mode.

6.11 Set-Up for Serial Interface

The display will show:

(SETUP)	= STOP =	x.xxxxx mm/min
Baud Rate : 9600	* [$\Updownarrow$] [$\Downarrow$] [Enter] [Esc]	

Press the [$\Updownarrow$] or [$\Downarrow$] keys until the desired setting is indicated.

The current setting is indicated by the presence of an asterix (*) next to the value.

Press [Enter] to select the indicated value, and to step on to the next configuration parameter in the sequence.

If a value is changed, then [Enter] key must be pressed to save the new selection.

Press the [Esc] key to return to the (SET-UP) Menu, when the settings are satisfactory.

Available serial settings are as follows:

'Baud Rate'	1200, 2400, 4800, 9600 or 19200
'Rx. Term.'	CR, LF, CRLF or LFCR
'Tx. Term.'	CR, LF, CRLF or LFCR
'Echo Mode'	Off or On

Note: Echo Mode, when set to On, is for use with a dumb terminal. All received characters will be echoed back to the terminal.

7 Operation

It is recommended that this section should be read in conjunction with chapter 12 of Soil Laboratory Testing Vol, 2, by K H Head (90-008).

For details of using the controls of the machine see Section 6.

7.1 Sample assembly (Figures 4 and 6)

7.1.1 Set the shearing system to the relaxed position.

7.1.2 The shear box will be assembled as shown in Figure 4.

Note 1: Later shear boxes are supplied with 3 porous plates and a thinner lower pressure pad.

2 porous plates, 1 upper and 1 lower are used for 25 mm thick samples.

3 porous plates, 1 upper and 2 lower are used for 20 mm thick samples.

Note 2: The porous plates must be saturated before conducting drained test by boiling in water until all signs of air have been eliminated from the plates.

7.2 Use of specimen cutter (Figures 4 and 6)

7.2.1 Specimen cutters to suit individual shear boxes are offered as an accessory for cutting undisturbed specimens from a sample.

7.2.2 To transfer the specimen to the shear box proceed as follows:

- 1) Place the lower porous plate or plates into the shear box body assembled in the carriage.
- 2) Position the cutter with specimen onto the shear box with the cutting face upwards (Figure 6).
- 3) Transfer the specimen into the shear box by using a wooden pusher until it is firmly seated on the lower porous plate or plates.
- 4) Assemble the upper porous plate (2U Figure 4) and pressure pad (3U Figure 4).

7.3 Applying normal stress (Figures 1, 2 and 4)

7.3.1 The normal stress required on the specimen must be related to a mass comprising the set weights W:

$$W = \sigma_n L^2 \text{ kg}$$

9810

Where L represents length of box in mm σ_n stress kN/m².

- 7.3.2 The shear machine is fitted with a balanced lever loading device, fine adjustment of which is achieved by the balance weight.
- 7.3.3 The initial position of the lever loading device and hence loading yoke (13 Figure 2) can be achieved by adjusting the jacking handle (Figure 1) and load pin (14 Figure 2).

Note: Depending upon the consolidation of the sample it is often required to commence the test with the lever loading arm above the horizontal position.

- 7.3.4 To apply the load to the sample the weights may either be added to the weight hanger (2 Figure 1) with the jacking handle fully down, or with the jacking handle supporting the lever loading arm then slowing winding the jacking handle down to transfer the load to the sample.

- 7.3.5 Set strain rate.

7.4 Pre-test check (Figure 8)

- A Load ring of required capacity/sensitivity and are set correctly.
- B The 'train' of components are all in contact from load ring adjuster (1) to strain lead screw (2).
- C The shear box is tight in carriage.
- D The loading yoke is correctly positioned with vertical displacement measuring device set. The correct strain rate has been selected (refer to Section 5).
- E The alignment screws have been removed.
- F The shear box separator screws are screwed in to just lift the upper box away from the lower box then retracted.

7.5 Forward shear testing

- 7.5.1 Run machine 'forward' to commence initial shearing.
- 7.5.2 During a test, maintain a check for available travel of the assembly components.
- 7.5.3 Record data as required.
- 7.5.4 Press stop on completion of a test.

7.6 Forward residual shear testing

- 7.6.1 After completing the test it may be necessary to conduct a repeat forward shear on the same specimen to determine the residual shear strength.
- 7.6.2 Return the shear box to the start position under normal load.
- 7.6.3 When the two shear box halves are aligned run the lead screw forward until a very small load is noted on the load ring indicating that all slack in the system has been taken up.
- 7.6.4 Conduct pre-test checks and start the repeat shearing test.
- 7.6.5 Repeat as necessary.

7.7 Reverse residual shear testing

This technique is adopted where the operator wishes to record information for shear in both directions, repeating as necessary to achieve the desired results.

- 7.7.1 Before commencing a reverse residual shear test, the operative must fit and check a load ring calibrated in compression.
- 7.7.2 Test the specimen for initial shear (Section 7.5).
- 7.7.3 At the completion of the initial shear switch machine off.
- 7.7.4 Then run machine in reverse using the 'Return-to-Datum' facility if repeats are required.

8 References

BS 1377: Part 7 Soils for Civil Engineering Purposes; Shear Strength Tests.
ASTM D3080 'Direct Shear Test of Soils Under Consolidation Drained Conditions'.

9 Maintenance

Ensure all moving parts are thoroughly secured before attempting any installation or maintenance activities.

Ensure all appropriate measures are taken to protect the operator from excessive noise. See noise certificate (when supplied).

DANGER: Servicing of this equipment must be performed by a qualified ELE service technician. Before removing any covers or performing maintenance repair and service, isolate from electrical supply by removing mains plug. Where mains supply connection is required during these activities, only fully trained technicians should perform the work.

DANGER: Before removing any covers or performing maintenance repair and service, isolate from electrical supply by removing mains plug. Where mains supply is required during these activities, only competent persons should perform the work.

9.1 Cleaning

Clean the outside paintwork of the machine only using a damp cloth, and a little non-scouring detergent if necessary.

9.2 Draining the carriage (Reference Figure 2).

9.2.1 At the completion of each test sequence the shear box carriage should be drained. A drain plug (15) is provided for this.

9.2.2 Switch off the machine and disconnect power cord from the mains power supply.

9.2.3 Remove, clean and dry the shear box assembly, except the porous plates.

9.2.4 When not in use, it is advisable to keep the porous plates in de-aired water.

9.3 Routine Maintenance Activities (Reference Figure 2)

9.3.1 Check free running of the carriage ball races (1).

9.3.2 Check that shear carriage and main frame ball race tracks are clean and free from any debris.

9.3.3 Check for free running of the swan neck bearings and lightly oil.

9.3.4 Check the loading yoke anvils for cleanliness.

9.4 Gearbox Maintenance

The gearbox is packed with grease during assembly and will not require attention over an extended period.

9.5 Fuse Replacement

DANGER: Always replace fuses with fuses of the same type and rating.

This machine is dual pole fused having both line and neutral fused, hence the two fuses.

To replace or check a fuse, pull the fuseholder drawer from the power inlet module. (See Figure 3, Item 3 for fuse location). If necessary, replace the failed fuse/s with a fuse of the same type and rating (T, 1.6A, 250V). A T, 1.6A, 250V fuse is suitable for either 115 or 230 volt operation. Properly orient the fuseholder for the desired line voltage by aligning the voltage setting on the fuseholder drawer. The desired voltage setting (i.e. 110-120V or 220-240V) must be upright at the base of the fuseholder drawer; the selected voltage indicator's arrow will be pointing down. When properly oriented, push the fuseholder drawer into the power inlet module for the desired line voltage.

DANGER: Misapplication of the voltage can result in both electrical hazards and damage to the equipment.

Important Note: Fuse failures generally indicate an electrical problem with the equipment. If problem persists contact ELE for machine servicing. .

10 Spare Parts

Shear box spares

Porous plates

Catalogue no.	Qty Req'd	Shear Box Type
26-2181/10	3	60 mm x 60 mm
26-2197/10	3	100 mm x 100 mm
26-2213/10	3	2.5 inch diameter

Shear box alignment screws

Part no.	Qty Req'd	Shear Box Type
1150A0408	2	60 mm x 60 mm
1150A0458	2	100 mm x 100 mm
1150A0458	2	2.5 inch diameter

Shear box separating screws

Part no.	Qty Req'd	Shear Box Type
1150A0409	2	60 mm x 60 mm
1150A0459	2	100 mm x 100 mm
1150A0459	2	2.5 inch diameter (early model)

1627A0151 4 2.5 inch diameter (later model)

11 Accessories

Catalogue No.	Description
26-2181	60 mm square Shear box
26-2197	100 mm square Shear box
26-2213	2.5 inches diameter Shear box
26-2231	71.4 mm diameter Shear box
25-0440	Vertical displacement DTI
83-5456	Horizontal displacement DTI
27-1689	Vertical displacement transducer
27-1697	Horizontal displacement transducer

Appendix A: RS232

A.1 Communication connection

A.1.1 Rear panel connector (4) (figure 8) 9-way male D type.

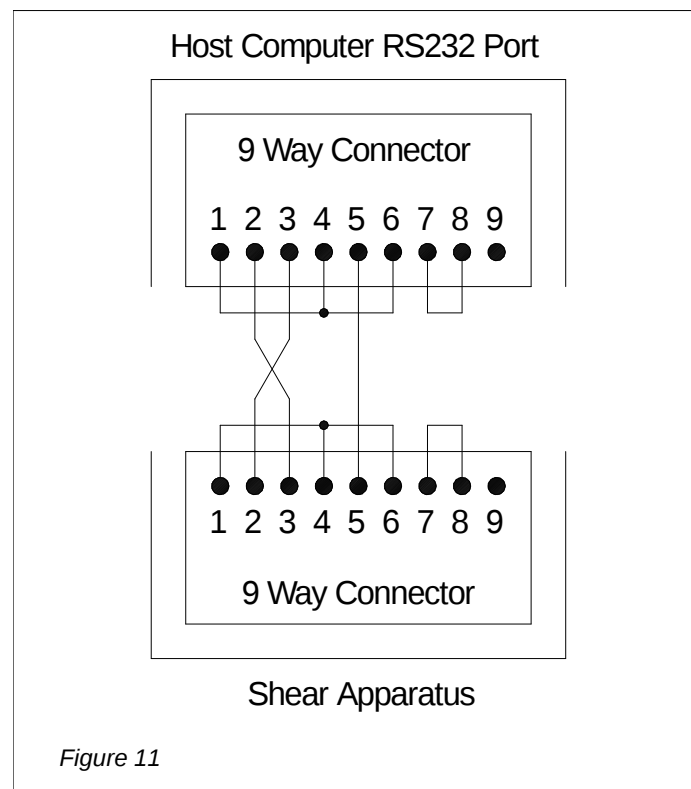
The Shear Apparatus is configured to behave as 'Data Terminal Equipment' (DTE).

Pin No.	Assignment	Comment
2	RXD	Receive data
3	TXD	Transmit data
5	Signal ground	

Note: A minimum connection of pins 2, 3 and 5 are required on the RS232 lead.

A 'cross-over' cable is required when connecting a host computer to the Shear Apparatus. This style of cable will have pins 2 – 3 and 3 – 2 connected (*see below*). Linking of the handshake lines, pins 1 – 4 – 6 and pins 7 – 8 may also be necessary at the host computer end of the cable. Because both the PC and Shear Apparatus require the same style of connector, it would be wise to insert these links to both connectors.

The wiring connection format for all IBM compatible PC's is shown in figure 11.



EC DECLARATION OF CONFORMITY

Name : **ELE International**
Address: Chartmoor Road
Chartwell Business Park
Leighton Buzzard
Bedfordshire LU7 4WG
UK

We hereby declare that the following product is in conformity with the requirements of the following EC Directives:

Title and No. of Directive: Machinery Directive, 2006/42/EC

Product : Direct/Residual Shear Apparatus, 1885D0001
Catalogue number : 26-2114
Description : Test equipment designed to test soil shear strength

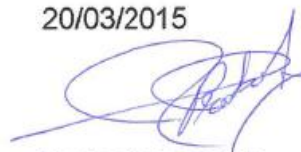
The product is designed and manufactured in accordance with the following standards:

EN61326-1:2013	EMC (General)
EN61000-3-2:2014	EMC (Emissions)
EN61010-1:2010	Safety requirements for electrical equipment for measurement, control and laboratory use.

The year in which the CE marking was affixed : 2015

Date : 20/03/2015

Signed :



Prakash Iyengar
Managing Director

DIRECTIVE ON WASTE ELECTRICAL & ELECTRONIC EQUIPMENT (WEEE)



Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user.

Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment for proper disposal.

Important document. Retain with product records.

GERMAN

Elektrogeräte, die mit diesem Symbol gekennzeichnet sind, dürfen in Europa nach dem 12. August 2005 nicht mehr über die öffentliche Abfallentsorgung entsorgt werden. In Übereinstimmung mit lokalen und nationalen europäischen Bestimmungen (EU-Richtlinie 2002/96/EC), müssen Benutzer von Elektrogeräten in Europa ab diesem Zeitpunkt alte bzw. zu verschrottende Geräte zur Entsorgung kostenfrei an den Hersteller zurückgeben.

Hinweis: Bitte wenden Sie sich an den Hersteller bzw. an den Händler, von dem Sie das Gerät bezogen haben, um Informationen zur Rückgabe des Altgeräts zur ordnungsgemäßen Entsorgung zu erhalten.

Wichtige Informationen. Bitte zusammen mit den Produktinformationen aufbewahren.

FRENCH

A partir du 12 août 2005, il est interdit de mettre au rebut le matériel électrique marqué de ce symbole par les voies habituelles de déchetterie publique. Conformément à la réglementation européenne (directive UE 2002/96/EC), les utilisateurs de matériel électrique en Europe doivent désormais retourner le matériel usé ou périmé au fabricant pour élimination, sans frais pour l'utilisateur.

Remarque : Veuillez vous adresser au fabricant ou au fournisseur du matériel pour les instructions de retour du matériel usé ou périmé aux fins d'élimination conforme.

Ce document est important. Conservez-le dans le dossier du produit.

ITALIAN

Le apparecchiature elettriche con apposto questo simbolo non possono essere smaltite nelle discariche pubbliche europee successivamente al 12 agosto 2005. In conformità alle normative europee locali e nazionali (Direttiva UE 2002/96/EC), gli utilizzatori europei di apparecchiature elettriche devono restituire al produttore le apparecchiature vecchie o a fine vita per lo smaltimento senza alcun costo a carico dell'utilizzatore.

Nota: Per conoscere le modalità di restituzione delle apparecchiature a fine vita da riciclare, contattare il produttore o il fornitore dell'apparecchiatura per un corretto smaltimento.

Documento importante. Conservare con la documentazione del prodotto.

DANISH

Elektriske apparater, der er mærket med dette symbol, må ikke bortskaffes i europæiske offentlige affaldssystemer efter den 12. august 2005. I henhold til europæiske lokale og nationale regler (EU-direktiv 2002/96/EF) skal europæiske brugere af elektriske apparater nu returnere gamle eller udtjente apparater til producenten med henblik på bortskaffelse uden omkostninger for brugeren.

Bemærk: I forbindelse med returnering til genbrug skal du kontakte producenten eller leverandøren af apparatet for at få instruktioner om, hvordan udtjente apparater bortskaffes korrekt.

Vigtigt dokument. Opbevares sammen med produktdokumenterne.

SWEDISH

Elektronikutrustning som är märkt med denna symbol kanske inte kan lämnas in på europeiska offentliga sopsstationer efter 2005-08-12. Enligt europeiska lokala och nationella föreskrifter (EU-direktiv 2002/96/EC) måste användare av elektronikutrustning i Europa nu återlämna gammal eller uttrangerad utrustning till tillverkaren för kassering utan kostnad för användaren.

Obs! Om du ska återlämna utrustning för återvinning ska du kontakta tillverkaren av utrustningen eller återförsäljaren för att få anvisningar om hur du återlämnar kasserad utrustning för att den ska bortskaffas på rätt sätt.

Viktigt dokument. Spara tillsammans med dina produktbeskrivningar.

SPANISH

A partir del 12 de agosto de 2005, los equipos eléctricos que lleven este símbolo no deberán ser desechados en los puntos limpios europeos. De conformidad con las normativas europeas locales y nacionales (Directiva de la UE 2002/96/EC), a partir de esa fecha, los usuarios europeos de equipos eléctricos deberán devolver los equipos usados u obsoletos al fabricante de los mismos para su reciclado, sin coste alguno para el usuario.

Nota: *Sírvase ponerse en contacto con el fabricante o proveedor de los equipos para solicitar instrucciones sobre cómo devolver los equipos obsoletos para su correcto reciclado.*

Documento importante. Guardar junto con los registros de los equipos.

DUTCH

Elektrische apparatuur die is voorzien van dit symbool mag na 12 augustus 2005 niet meer worden afgevoerd naar Europese openbare afvalsystemen. Conform Europese lokale en nationale wetgeving (EU-richtlijn 2002/96/EC) dienen gebruikers van elektrische apparaten voortaan hun oude of afgedankte apparatuur kosteloos voor recycling of vernietiging naar de producent terug te brengen.

Nota: *Als u apparatuur voor recycling terugbrengt, moet u contact opnemen met de producent of leverancier voor instructies voor het terugbrengen van de afgedankte apparatuur voor een juiste verwerking.*

Belangrijk document. Bewaar het bij de productpapieren.

POLISH

Sprzęt elektryczny oznaczony takim symbolem nie może być likwidowany w europejskich systemach utylizacji po dniu 12 sierpnia 2005. Zgodnie z europejskimi, lokalnymi i państwowymi przepisami prawa (Dyrektywa Unii Europejskiej 2002/96/EC), użytkownicy sprzętu elektrycznego w Europie muszą obecnie przekazywać Producentowi stary sprzęt lub sprzęt po okresie użytkowania do bezpłatnej utylizacji.

Uwaga: *Aby przekazać sprzęt do recyklingu, należy zwrócić się do producenta lub dostawcy sprzętu w celu uzyskania instrukcji dotyczących procedur przekazywania do utylizacji sprzętu po okresie użytkowania.*

Ważny dokument. Zachować z dokumentacją produktu.

PORTUGUESE

Qualquer equipamento eléctrico que ostente este símbolo não poderá ser eliminado através dos sistemas públicos europeus de tratamento de resíduos sólidos a partir de 12 de Agosto de 2005. De acordo com as normas locais e europeias (Directiva Europeia 2002/96/EC), os utilizadores europeus de equipamentos eléctricos deverão agora devolver os seus equipamentos velhos ou em fim de vida ao produtor para o respectivo tratamento sem quaisquer custos para o utilizador.

Nota: *No que toca à devolução para reciclagem, por favor, contacte o produtor ou fornecedor do equipamento para instruções de devolução de equipamento em fim de vida para a sua correcta eliminação.*

Documento importante. Mantenha junto dos registos do produto.