OPERATING INSTRUCTIONS

Digital Point Load Test Apparatus

77-0115

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Prologue

The index I_s is determined from the formula P/D^2 where *D* is the distance between the point load platens at the moment of failure and *P* the force required causing the failure. Considerable work has been conducted on this method of strength determination but only recently is this being related to the field study of specimens. The following is an excerpt from an article '*Logging the Mechanical Character of Rock'* by Dr J A Franklin, Mr E Broch and Mr G Walton in *Transactions of the Institute of Mining and Metallurgy volume 80*, which adequately introduces the technique.

'The Strength Log –
Traditionally, rock strength is either estimated in the field by use of a hammer or in the laboratory with sophisticated apparatus. The former method is at best qualitative, whereas the latter requires careful specimen preparation. There is an obvious need for a device to test quickly and reliably, unprepared core in the field.

A portable point load tester has been developed at Imperial College, London, as an aid to core logging. The apparatus consists of a small hydraulic pump and ram, with a loading frame of maximum rigidity easily adjustable to test core of different sizes. Core is loaded between pointed platens of standard dimensions. The two quantities measured in the test are the distance, *D,* between platen contact points, which is read from a graduated scale incorporated in the load frame, and the force, *P*, required to break the specimen, which is read from a calibrated readout unit in the hydraulic circuit. The point load strength index, I_s, is the ratio P/D^2.

This type of test is not new, having been used extensively in the USA, Russia and several European countries, but mainly as a research laboratory tool rather than as a convenient technique for field index testing. Theoretical consideration of the point load test showed that it gives a measure of tensile strength, as indeed does the geological hammer. The results are, however, sufficiently related to other measures, such as unconfined compressive strength, to allow this test to give an index of strength in a general sense. The point loading gives several important advantages:

A the specimen fails at much lower loads than in compression, needing a machine load capacity less than one-tenth of that usually required for compression;

B core can be tested direct from the core box without previous machining – even weak or broken rock can thus be tested;

C as fracture initiates in the specimen interior, platen contact conditions are of little importance.

1 Introduction

The ELE Point Load Apparatus comprises a two-column fixed crosshead frame mounted directly onto a hand-operated hydraulic jack.

Pressure applied by the handpump in the base of the jack extends the piston carrying the lower of the two conical points. The upper point is fixed to the crosshead and the frame can accommodate sample sizes up to 101.6 mm (4 in.) in diameter. A scale is fitted to indicate the distance between contact points (*D*).

The applied load is indicated directly in kN on the digital readout display unit. The maximum load achieved during the test is then held and displayed until the readout is zeroed ready for the next test.

The apparatus is supplied with a heavy-duty face mask for operator protection.

2 Specification

Case dimensions	320 x 715 x 370 mm (width x height x depth)
Overall weight	25 kg
Load capacity	55 kN
Specimen max. diameter	 101.6 mm
Oil	Shell Tellus 37. **Note:** If T 37 is unavailable then either T 32 or T 46 may be used but do not mix oils of different specifications.
Working temperature range	+5 Deg C to +40 Deg C
Recommended humidity range	30% to 95%
Batteries	4 X AA

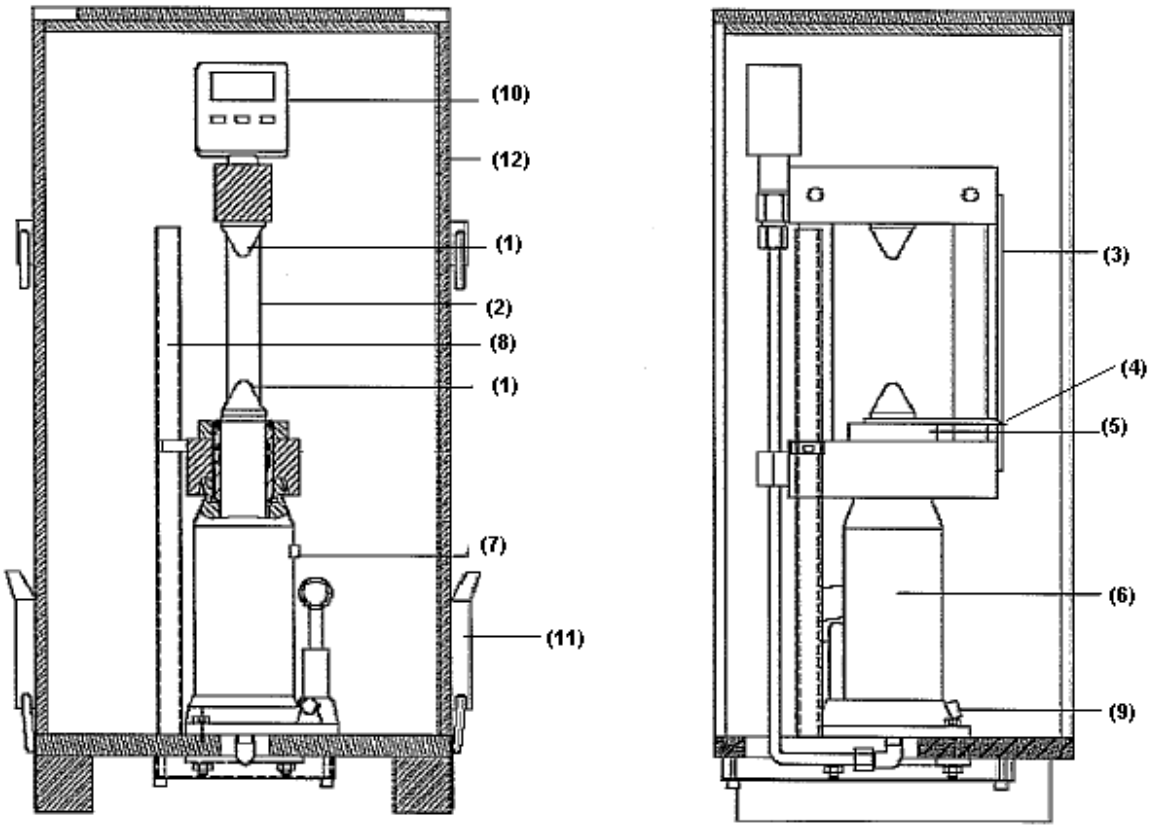


Fig. 1

2.1 Load frame and case general layout (figure 1)

2.1.1 Comprises a two column fixed crosshead frame (2) attached by a bolt (5) to the hydraulic ram assembly (6).

2.1.2 Load is applied to the specimens through two standard hardened points (1).

2.1.3 Attached to one column is a millimetre scale (3) used in conjunction with the pointer (4) to determine the specimen dimensions ‘D’ between the two load points at the start of the test.

2.1.4 The hydraulic piston assembly incorporates the oil reservoir, a single acting pump, pressure relief valve (9), and a handle (8) for pumping and pressure release control.

2.2 Case and accessories (figure 1)

2.2.1 The unit is contained in a case (12) that can convert to a workbench for testing.

2.2.2 A clear see-through face mask is provided, essential to avoid injury and damage due to debris that can fly at time of failure, particularly when testing hard rock.

3 Installation & Setting Up

3.1 Place the point load tester case (12) onto a flat surface.

WARNING: When lifting take care that the machine is conveniently held and secured and that it cannot slide.

3.1.1 Remove the top cover of the point load tester.

3.1.2 Check that all accessories are present:

a) Pump handle,

b) Face protection mask.

3.1.3 If ram fails to move to its full extension during testing then check oil level (see section 7 on maintenance for the oil filling procedure).

3.1.4 If ram moves in jerky movements, pump ram to its maximum position and carefully turn the whole assembly upside down, taking care not to damage the readout unit, then force the ram back to its original position and turn the unit up the correct way. This process should remove all the air from the ram and the ram should now move smoothly to pump strokes.

3.2 The digital readout unit has a range of user settings which need to be set before testing commences.

3.2.1 To switch on the digital display refer to Appendix 2. The readout unit will shut down automatically after 30 minutes (Factory Default) if no keys are pressed in this time.

4 Operation

4.1 Switch on the digital display press the [ON] button and initiate the peak hold function by pressing the [PEAK] button for 1 second until the PEAK+ status sign shows on the top of the digital readout screen.

4.1.1 The digital readout is now ready for operation.

4.1.2 Basic diametral test procedure (Figure 1 and 8a).

4.1.3 Select a core to be tested.

4.1.4 Close the pressure release valve (9).

4.1.5 Place the core diameter between the load points (1).

4.1.6 Using the pump handle (8), raise the lower point slightly, and zero the reading by pressing the [ZERO] button for approximately 3 seconds until the reading is set to zero. Then pump the ram up to make firm contact with the specimen.

4.1.7 Measure the diameter ‘D’ of the specimen from the scale pointer (4).

4.1.8 Record ‘D’ to an accuracy of ±2%.

4.1.9 Check the PEAK+ status is showing on the digital readout.

Important: The face mask for eye protection should be worn at this point.

4.1.10 Steadily apply the load using the pump handle to cause failure of the specimen within the period 10 to 60 seconds.
Note! Do not exceed the 100% indicator during loading.

4.1.11 Record the maximum load achieved on the screen after sample failure. Press zero to reset readout.

4.1.12 Open the pressure release valve (9) and manually force the lower platen down using the pump handle horizontally ready for the next specimen to be tested.

4.2 The axial test (figure 8b)

4.2.1 Where the specimen length/diameter ratio is between 0.3 and 1.0, the axial test can be used.

4.2.2 Locate the specimen with the ends contacting the platen points.

4.2.3 Proceed as in 4.1.4.

4.3 The block and irregular lump test (figures 8c and 8d)

4.3.1 Where the specimen size is 50 ± 35 mm and of suitable shape, the block test can be used.

4.3.2 The ratio of depth/width should be between 0.3 and 1.0 and preferably nearer to 1.0.

4.3.3 Place the specimen with the smallest dimension between the platen points.

4.3.4 Proceed as for the basic test 4.1.4.

Note: for irregular lumps, calculate W from the formula:

$$W = \frac{W1 + W2}{2}$$

Where W1 is opposite to W2.

4.3.5 It is recommended that a minimum of 10 specimens are tested to obtain a mean point load index value I_s.

4.4 Anisotropic rock (figure 9)

4.4.1 Where the rock exhibits anisotropic properties, the sample should be tested in both directions.

4.4.2 Using the diametral and axial techniques, it is recommended that at least 10 specimens are tested parallel to and perpendicular to the weakest plane of the sample.

4.4.3 The strength Anisotropic Index Ia is defined as the ratio of mean I_s values measured perpendicular and parallel to planes of weakness.

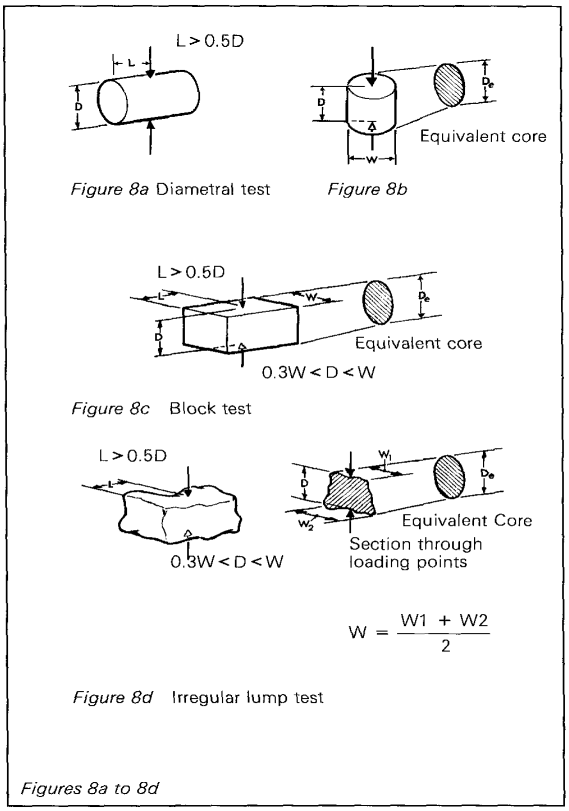


Figure 8a Diametral test *Figure 8b*

Figure 8c Block test

Figure 8d Irregular lump test

Figures 8a to 8d

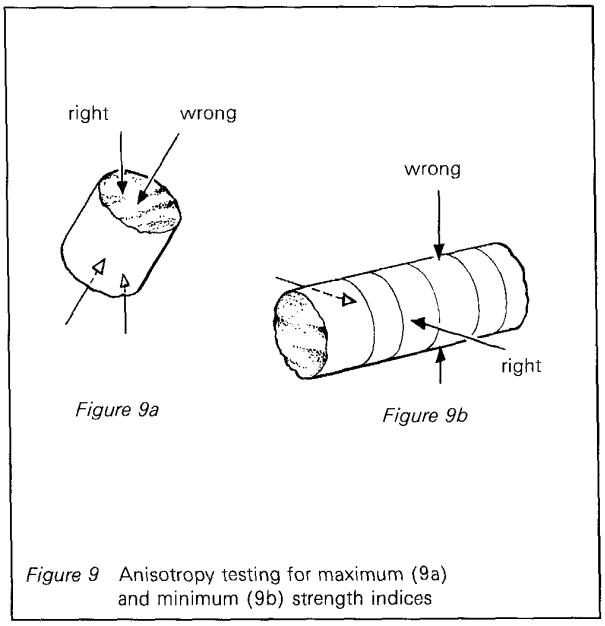


Figure 9a *Figure 9b*

Figure 9 Anisotropy testing for maximum (9a) and minimum (9b) strength indices

5 Calculations

5.1 Uncorrected point load strength (table 1)

5.1.1 The uncorrected point load strength value I_s is calculated as:

P/De^2

where De^2 the equivalent, core diameter is given by:

$De^2 = D^2$ for diametral tests
$De^2 = {}^{4A}/_{\pi}$ for axial, block and lump tests

and

A = WD = minimum cross sectional area of a plane through the platen contact points.

5.1.2 The Nomogram Table 1 offers a quick method to determine the uncorrected point load strength value I_s.

5.2 Point load strength correction (figure 10)

5.2.1 The point load strength index will vary slightly with specimen diameter ‘D’. To overcome this, it is common practice to relate the test to that for specimens of 50 mm diameter.

5.2.2 To obtain the maximum accuracy and repeatability it is therefore recommended that tests are conducted on specimens as near as possible to 50 mm diameter.

5.2.3 The most reliable method of size correction is to test the sample over a range of D or De^2 and to plot graphically the relationship between P and De. If a log-log plot is used, the relationship will follow closely to a straight line.

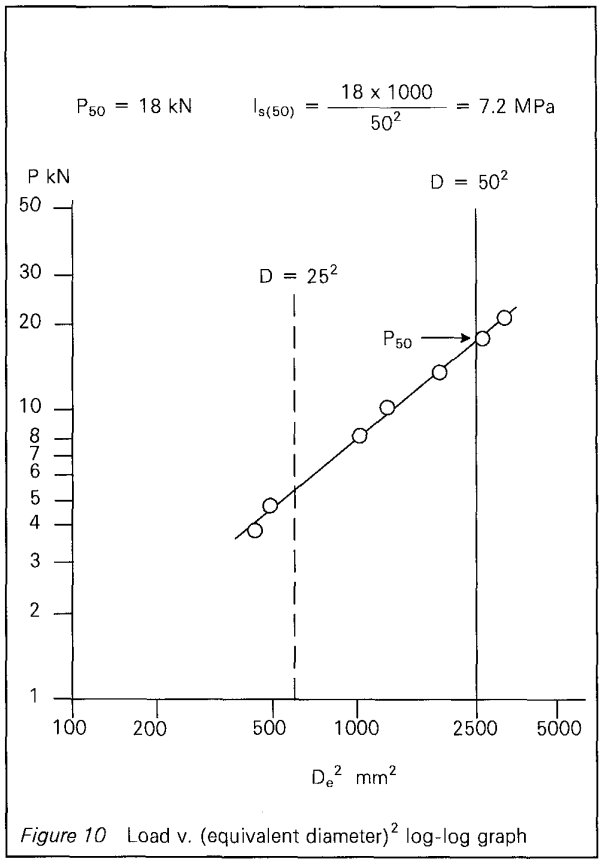


Figure 10 Load v. (equivalent diameter)^2 log-log graph

5.3 Result tabulation (figure 11)

5.3.1 It is recommended that results are collated in a similar manner to that shown.

Point Load Strength Index

Location: date

Borehole ref:

Description

Depth from to

No.									

Type data
d - diametral
a - axial
b - block
i - irregular lump
relationship to weakest plane
- perpendicular
// - parallel

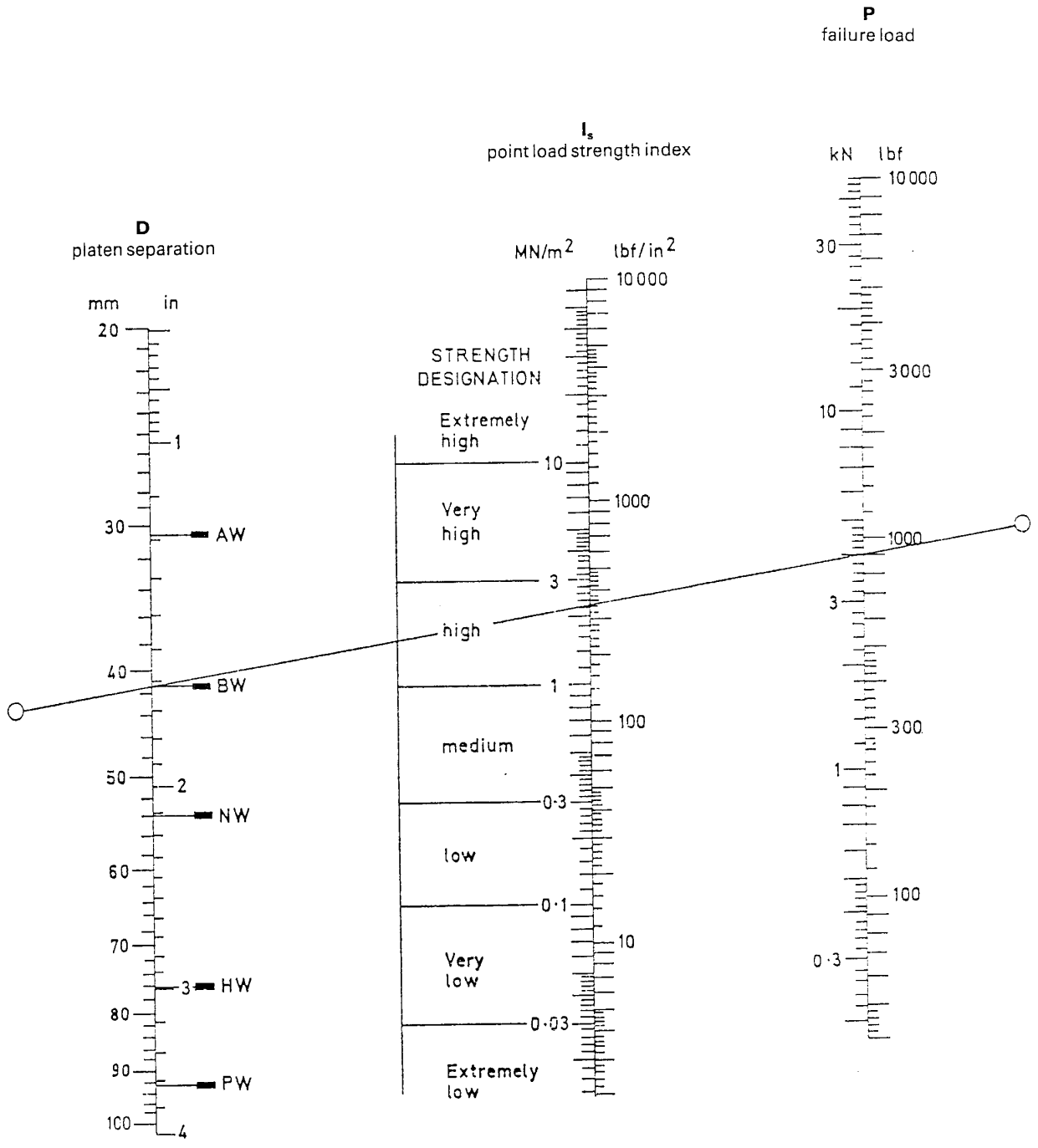
Result summary
mean $I_s(50)$ .....
mean $I_s(50)$// .....

Signed .....

Date .....

Figure 11

Table 1 Nomogram for computing point load strength $I_s = \frac{P}{D^2}$



6 Testing Concrete Cores

6.1 Development of the technique

6.1.1 In 1980 a research programme was reported by Mr P J Robins (Department of Civil Engineering, Loughborough University of Technology), related to the use of the point load tester for testing concrete cores as a method of determining the comparative compressive strength of in-situ material.

6.1.2 The technique was reported in the Magazine of Concrete Research : Vol. 32, No. 111 : June 1980. Some fundamental points are listed below for those interested in considering the technique.

6.2 Specimen size

6.2.1 A value of 4 is suggested as a minimum ratio of core diameter to maximum aggregate size.

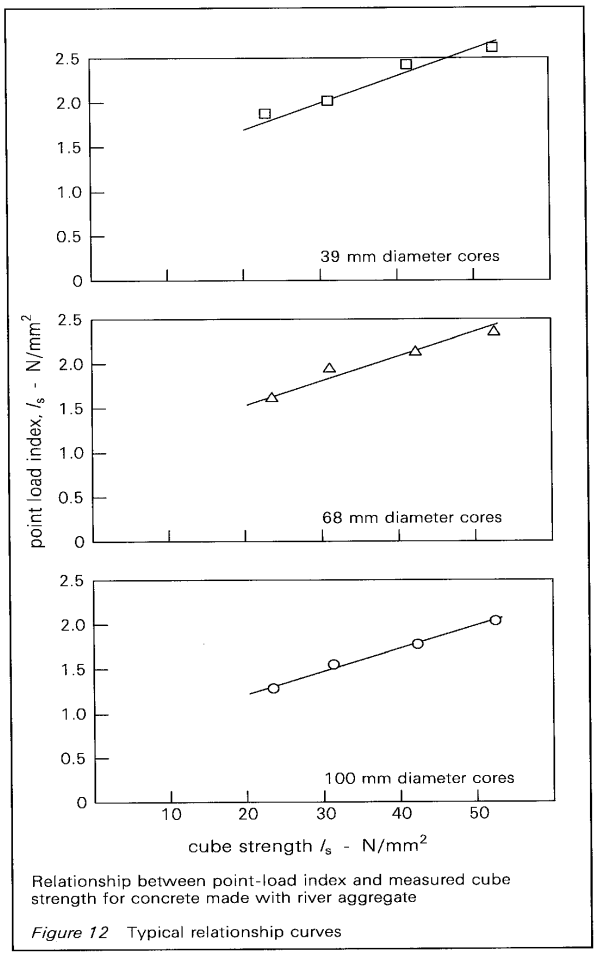
6.2.2 The minimum value for the length/diameter ratio of test cores should 1.2.

6.3 Point load index/compressive strength

6.3.1 The point load index can be directly related to the cube compression test for a given concrete mix providing the size relations detailed above can be maintained.

6.3.2 The use of 100 mm diameter cores will achieve a coefficient of variation similar to that for compressive tests on similar diameter cores.

6.4 Test procedure (figures 8 and 12)



Relationship between point-load index and measured cube strength for concrete made with river aggregate

Figure 12 Typical relationship curves

6.4.1 The test procedure will be similar to that for diametral or axial rock tests.

6.4.2 Where possible, laboratory design tests should be used to define the relationship curve between the point load index and the compressive strength of the concrete.

7 Maintenance

7.1 General

7.1.1 Keep the unit clean and free from debris.

7.1.2 Check for low batteries in the digital readout unit. Change when necessary (4 X AA).

7.1.3 Check regularly for signs of oil leaks.

7.1.4 Check the oil level in reservoir and top up as necessary with correct oil using the following procedure.

7.1.5 If the oil reservoir is low and the ram fails to reach maximum travel, follow the procedure below to fill the reservoir. **Note:** the units are normally supplied filled with the correct amount of oil. It is recommended to check the level every 3 to 6 months.

7.1.6 If the oil reservoir in the hydraulic pump body (6) requires filling with the appropriate oil, see specification for oil details.

7.1.7 Remove the oil filler cap (7). Note: only add oil with the ram at its lowest position.

7.1.8 Lay the unit on its side with rubber filler plug uppermost and using a funnel fill the reservoir. **NOTE:** do not overfill as the reservoir is full when the oil level is at the filler port when the unit is in its normal standing position. Replace rubber plug.

7.1.9 To test, close the pressure release valve (9) (fully clockwise), engage the pump handle and pump some strokes, and the ram should be seen to rise. If successful, release the pressure relief valve and push the ram down to its original start point using the pump handle in the horizontal position.

Note: Please dispose of any waste oil in a correct manner according to local rules.

7.2 Check the platen points for damage and replace as necessary.

7.3 If the hydraulic pump is leaking or not functioning correctly, contact the ELE Service Department for advice.

7.4 If the main piston is leaking oil past the seal, the piston seals might need replacing (contact ELE Service Department for advice).

7.5 Default settings for the readout unit. Press and hold the SET button to enter change options. Press the SET button again to step through options until required option shows. It is then suggested to only modify the options marked user definable below.

UNIT	user definable (kN,kgf)
FL = 15	Fixed
R = 01	Fixed
OFF = 30	user definable (1 – 30)
BAUd = 0	Fixed

Note the calibration section within the readout is guarded by a password. If for some reason you need to re-calibrate the unit contact the ELE service department.

8 References

8.1 ISRM Commission on Testing Methods Working Group on Revision of the Point Load Test Method.

8.2 The Point Load Strength Test for Concrete Cores, P J Robins, Magazine of Concrete Research, Vol. 32, No. 111, June 1980

Appendix 1

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Appendix 2 : A

Load Cell Indicator : SLIM

Operating Manual

Contents **Page**

OPERATING FEATURES :

A. Display Views

Operation

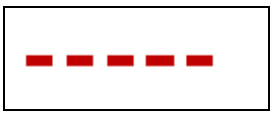
On the 5-digit numerical display the current weight is usually displayed. When the “PEAK” function is activated, the maximum weight value is displayed. During setup steps, the displayed messages and values shown depend on the programming function in execution.

Power On

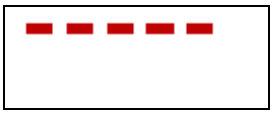
Display test is executed at instrument power on. An ID code is then displayed representing software and version number. Please remember to communicate this ID code in case of a service request.

Weight Views and Error Messages

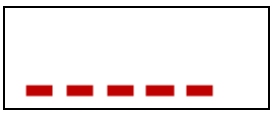
When there are no programming procedures in progress, the weight value is displayed. Some error conditions are highlighted on the display as follows:-



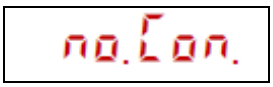
WEIGHT INVALID AT POWER ON
When the instrument is switched on, during initialization and while the weight is not zero, this alert appears on display.



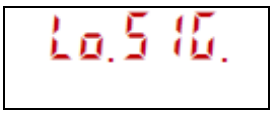
OVERLOAD CONDITION
When the gross weight exceeds the maximum capacity for more than 9 divisions, this alert appears on the display.



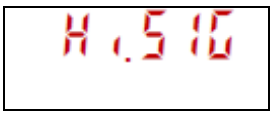
UNDERLOAD CONDITION
When the gross weight is less than -9999, this alert appears on the display.



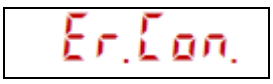
LOAD CELL CABLE NOT CONNECTED



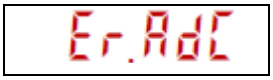
LOAD CELL SIGNAL UNDER NEGATIVE RANGE LIMIT
Load cell signal is lower than –7.81mV/V. This may be a connection error.



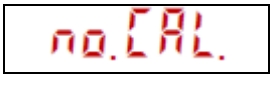
LOAD CELL SIGNAL OVER POSITIVE RANGE LIMIT
Load cell signal is higher than +7.81mV/V. This may be a connection error.



CONNECTION ERROR CONDITION
Load cell is not connected correctly.



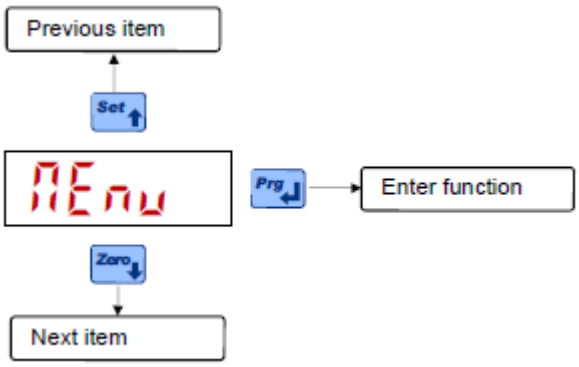
INTERNAL FAULT CONDITION
There is an internal fault relating to the weight acquisition system.



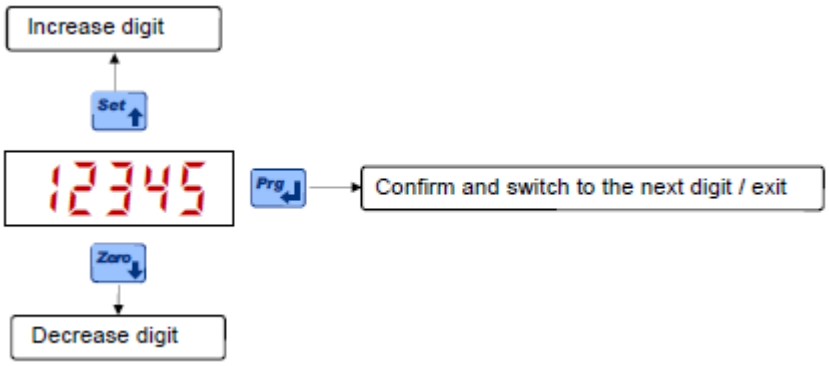
WEIGHT NOT YET CALIBRATED

B. Keyboard Functions

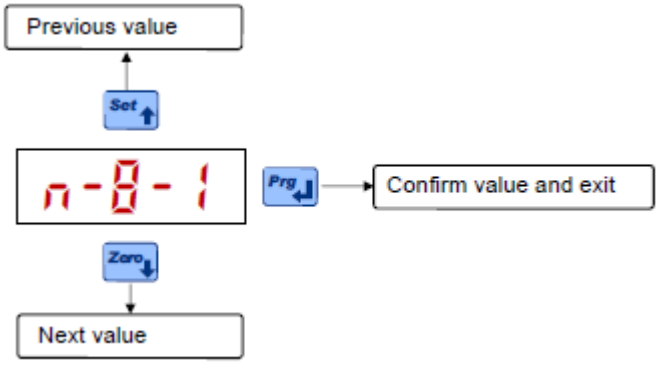
Menu Navigation



Numerical Value Setting

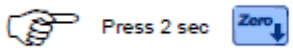


Select Value



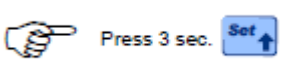
C. Operating Functions

Autotare

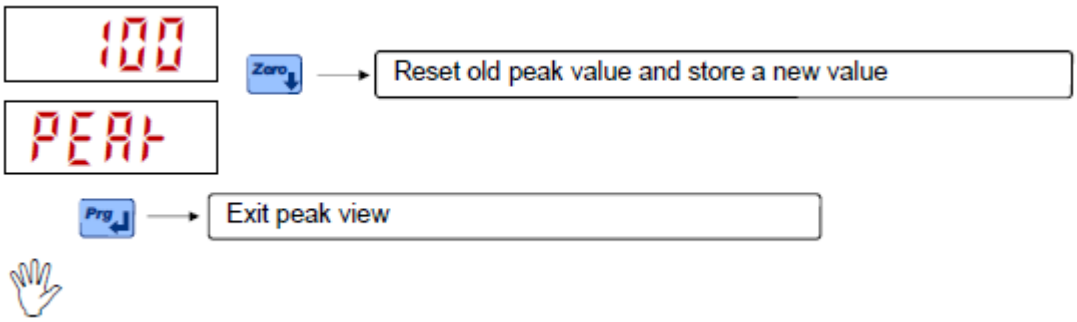


The autotare command has no effect with an unstable weight (timeout 2 sec.). Parameter 0 BND represents the maximum weight value that can be zeroed (positive or negative), compared to the zero value stored during calibration operations.

Peak Functions

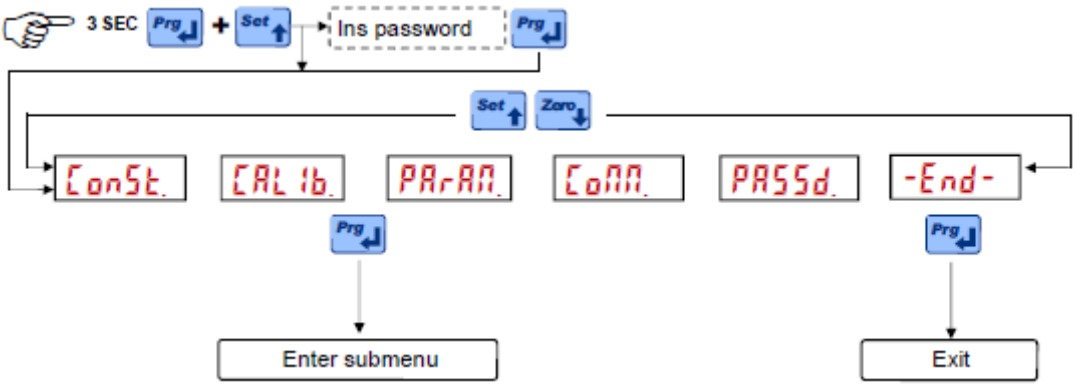


Peak weight value is displayed alternatively with PEAK message.



The peak value is always stored, even when not displayed. It is stored both for positive and negative weight values. The peak value is lost after power off. The peak value is stored at weight acquisition frequency (see weight filter).

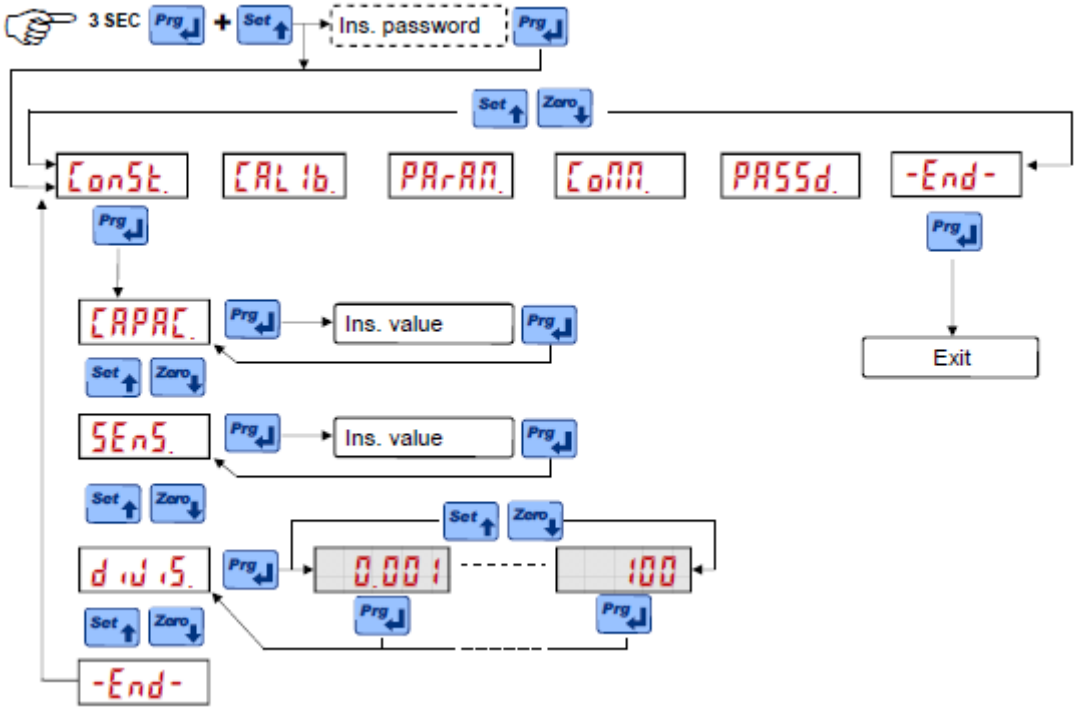
Set Up Menu



Password access is requested only if a password was set.
Select “End” to Exit menu.

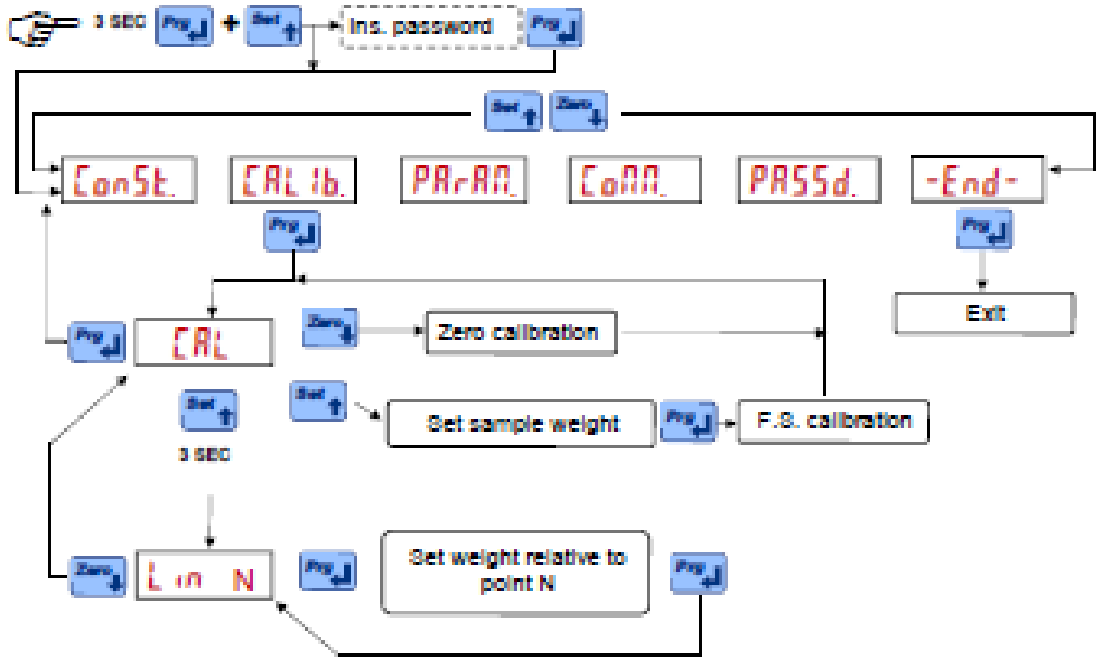
SET UP :

D. Weight Data Menu (Theoretical Calibration)



CAPAC.	**WEIGHING SYSTEM CAPACITY** Enter the total capacity of the load cell/s in kg. This value represents the weighing system's full scale. Values between 1 and 99000 kg are accepted. By modifying the weighing system's full scale value, the theoretical calibration will be done.
SEnS.	**LOAD CELL SENSITIVITY** Enter the average value of the sensitivity rated value of the load cell/s in mV/V. Values between 0.5 and 4 mV/V are accepted. If no value is set the default value 2 mV/V will be used. By modifying the sensitivity's value, the theoretical calibration will be done.
d iv iS.	**DIVISION VALUE** This value is represented in kg. Select a value between 0.001 kg and 50 kg. The ratio between the weighing system total capacity and the display division value represents the resolution of the instrument. By modifying the weighing system capacity, a new division value will be automatically set to obtain a system resolution at the best of 10000 divisions. The system resolution must be set from 500 to 100.000 divisions. By modifying the division's value, if weighing system's full scale value has not been changed, the weight calibration will be automatically corrected.

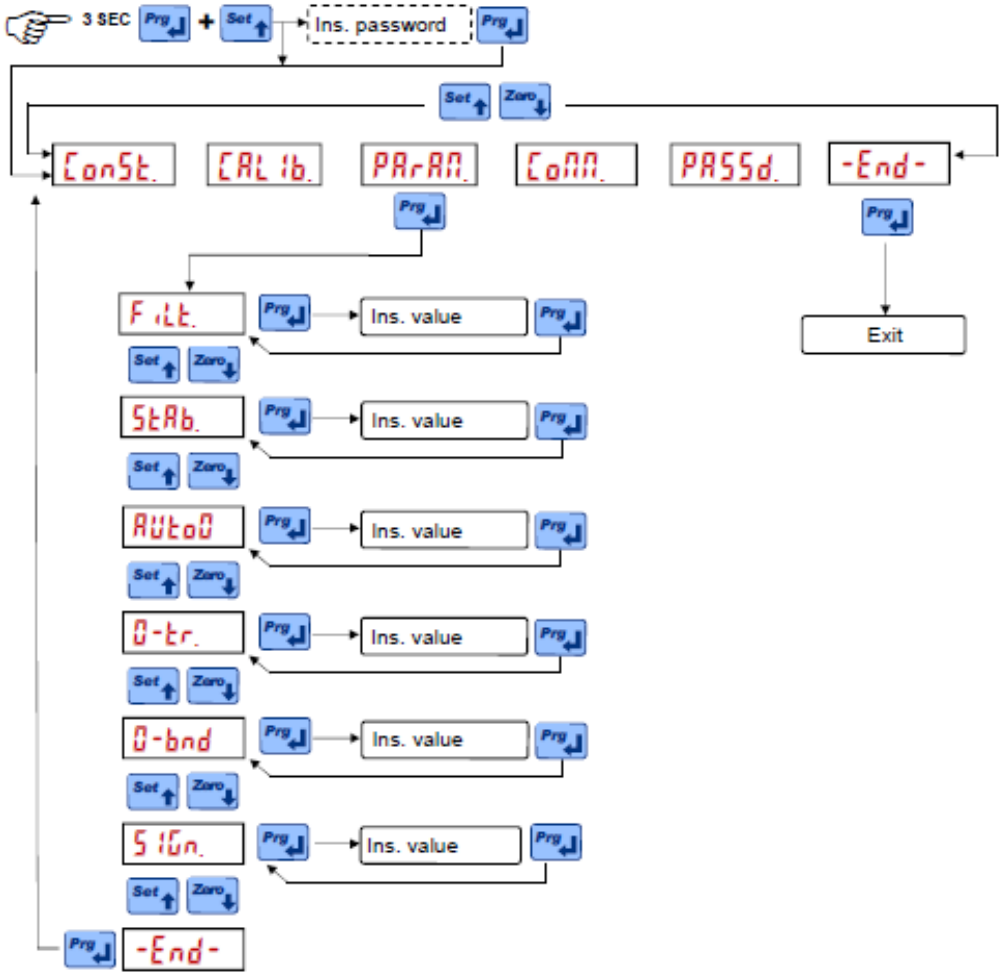
E. Weight Calibration and Linearization Menu



During the calibration procedure the message “CAL” blinks on the display.
During the linearization procedure the message “LIN n” blinks on the display: N is the number of the linearization point you are programming (N range: from 1 to 5).

ZERO CALIBRATION	The zero calibration must be done when the weighing system is unloaded (tare included). Weight must be stable. The weight displayed will be zeroed. This procedure can be repeated more times.
FULL SCALE CALIBRATION	Load a known weight (sample weight) on the weighing system and wait for the stabilization; the display shows the value to be calibrated. If the value just entered is higher than the maximum available resolution, the full scale calibration is not accepted and the display shows an error message. This procedure can be repeated more times.
WEIGHT LINEARIZATION	Up to 5 linearization points can be set, in weight ascending order (from 1 to 5). During a linearization point procedure, the display shows the current weight alternately with message “LIN n”. After setting the corresponding value, the procedure switches automatically to next point (N+1). To exit without setting all 5 linearization points, press key: only the points entered will affect the new weight linearization.

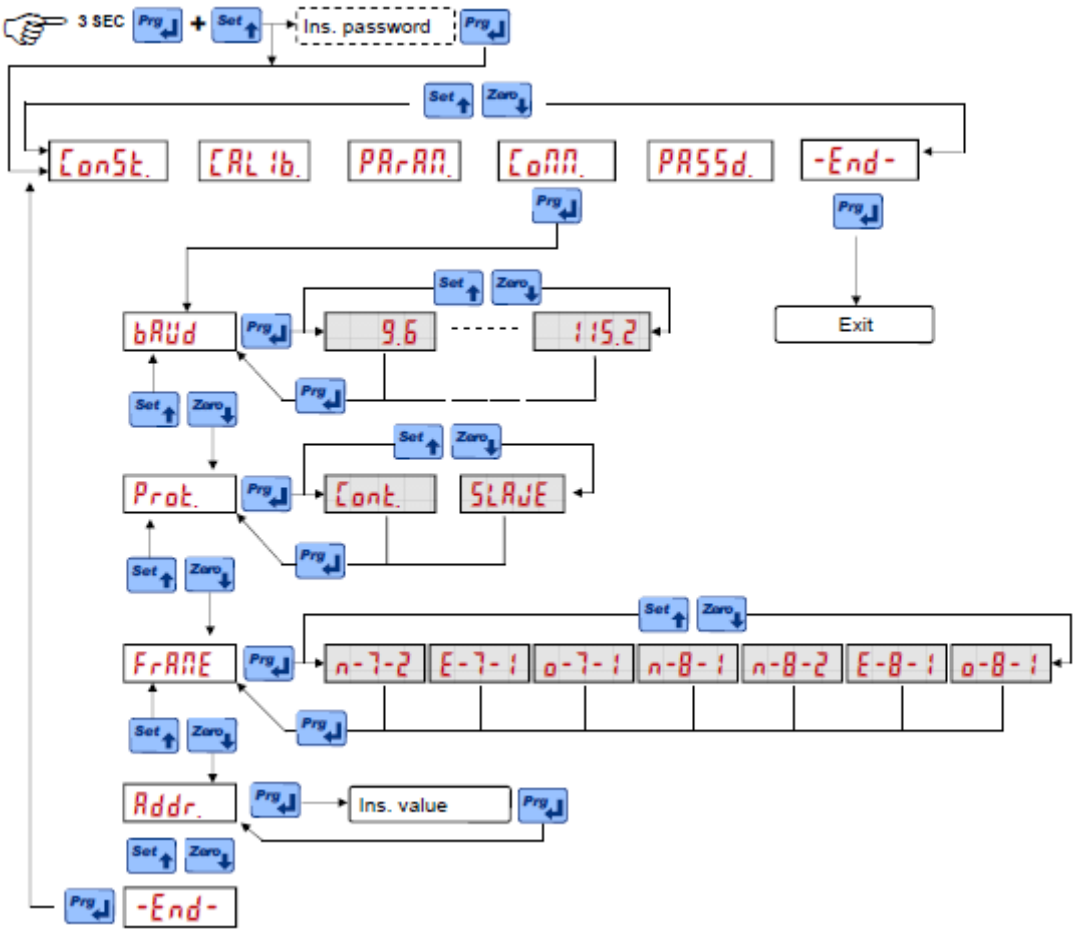
F. Weight Parameters Menu



F iLt.	**DIGITAL FILTER VALUE** This parameter adjusts the working of the digital filter, this parameter is applied on the weight. The digital filter affects the visualization of the weight. Low digital filter values cause very fast updates of the weight, whereas high values cause slow updates of the weight.		
	Filter Value	**Weight update rate**	**Response (Hz)**
	0	16,7 Hz	3
	1	16,7 Hz	2,5
		12,5 Hz	1,5
	3 (default)	12,5 Hz	1
	4	10 Hz	0,7
	5	10 Hz	0,55
	6	8,3 Hz	0,4
	7	6,2 Hz	0,35
	8	6,2 Hz	0,3
	9	4 Hz	0,25

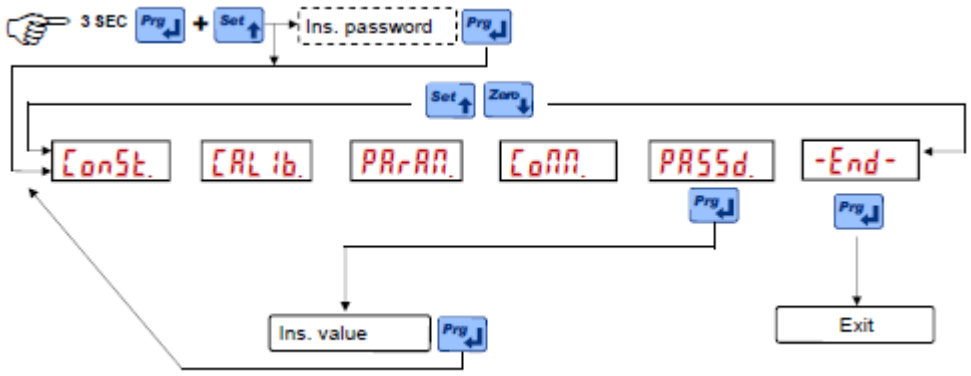
<table>
<tr><td>StAb.</td><td>
WEIGHT STABILITY
The weight is considered stable when it remains in a given range, within a given period of time.
<table>
<tr><th>Value</th><th>Weight range</th><th>Time range</th></tr>
<tr><td>0</td><td colspan="2">Always stable</td></tr>
<tr><td>1</td><td>10 div.</td><td>1.5 sec.</td></tr>
<tr><td>2</td><td>5 div.</td><td>2 sec.</td></tr>
<tr><td>3</td><td>3 div.</td><td>2 sec.</td></tr>
<tr><td>4</td><td>1.5 div.</td><td>2.5 sec.</td></tr>
</table>
</td></tr>
<tr><td>AUtoO</td><td>AUTOZERO AT POWER ON
This parameter is the maximum value that can be zeroed at the power-on. The autozero function performs the automatic zero calibration when the instrument is switched on, but only if the weight present on the weighing system stabilizes within the zero-set-point value. Set 0 to disable this function.</td></tr>
<tr><td>0-tr.</td><td>
<table>
<tr><th>Value</th><th>Variation</th></tr>
<tr><td>0</td><td>Function disabled</td></tr>
<tr><td>1</td><td>0.5 div / sec.</td></tr>
<tr><td>2</td><td>1 div / sec.</td></tr>
<tr><td>3</td><td>2 div / sec.</td></tr>
<tr><td>4</td><td>3 div / sec.</td></tr>
</table>
</td></tr>
<tr><td>0 bnd</td><td>ZERO BAND
Maximum weight value that can be zeroed through autotare command, compared to the zero value stored during calibration operations. Set 0 to enable full range of zeroing (from 0 to capacity).</td></tr>
<tr><td>5 IGn.</td><td>LOAD CELL SIGNAL
The real-time load cell signal will be displayed in mV/V (3 decimal digits).</td></tr>
</table>

G. RS485 Serial Communication Port Menu



bAUd	**BAUD RATE** Select a value: 9600, 19200, 38400, 57600 e 115200 bit / sec.
Prot.	**COMMUNICATION PROTOCOL** • CONT: Weight continuous transmission (5 Hz transmission frequency). • SLAVE: MASTER / SLAVE ASCII protocol.
FrAME	**DATA FORMAT** Select combination for parity / data bits number / stop bits number.
Addr.	**COMMUNICATION ADDRESS** Address used for master/slave protocols (from 0 to 99).

H. Password Access Menu



PASSd.	**SETUP MENU PASSWORD** This parameter is the password which protects setup menu access. The modification or cancellation of the password is only possible from setup menu, which is accessed by entering the active password .

I. Serial Communication Protocols

Continuous Transmission Protocol

This protocol can be used to drive a weight repeater.
String transmitted at 5 Hz:

STX <status> <net weight> ETX <csum> EOT

<status> = 1 byte, see following table (bit = 1 if the condition is TRUE)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	Tare entered	0	Stable weight	0

<net weight> = 8 ASCII bytes, weight value is right hand justified.
If overload condition: "^^^^^^^^".
If underload condition: "---------- ".
If weight reading error " O-L ".

<csum> = string data control sum. It is calculated executing the exclusive OR (XOR) of all characters from STX (or from <addr>) to ETX, excluding the latter; the XOR result is resolved into 2 characters considering the 4 highest bit (first character) and the for lowest bit (second character) separately; the 2 resulting characters are then coded in ASCII; (e.g.: XOR = 5Dh; <csum> = "5Dh" i.e. 35h and 44h).

"SLAVE" Transmission Protocol

AVAILABLE COMMANDS:

- Current net weight request.
- Current gross weight request.
- Current peak value request.
- Autotare command.
- Peak reset command.

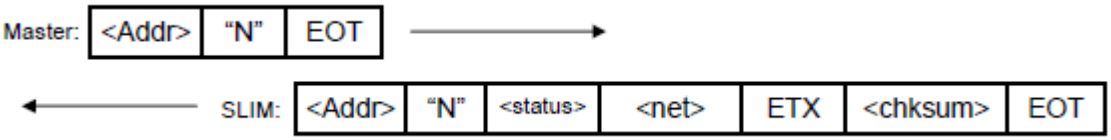
The unit connected to the instrument (usually a personal computer) is the master-unit and is the only unit that can start a communication procedure.

The communication procedure must always start with the transmission of a string by the master-unit, followed by a response string from the interested slave-unit.

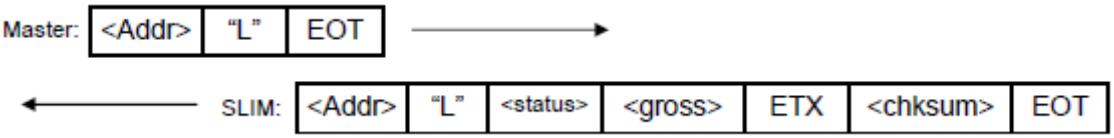
COMMAND FORMAT DESCRIPTION:

The quotes enclose the constant characters (attention to capital / lowercase characters); the symbols < and > enclose variable numerical fields.

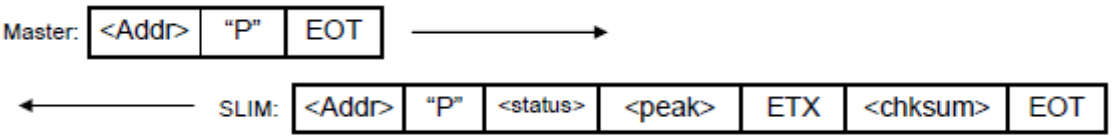
Current Net Weight Request



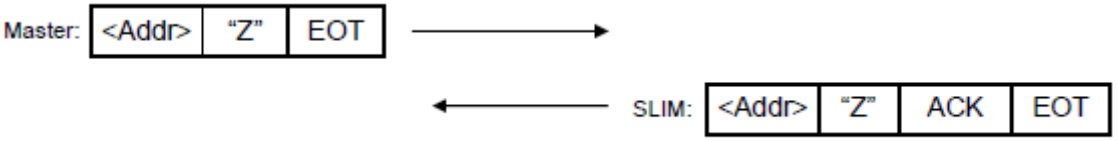
Current Gross Weight Request



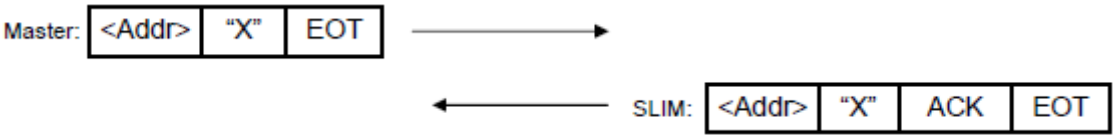
Current Peak Value Request



Autotare Command



Peak Value Reset Command



In case of communication error, or in case the command is not correctly recognized, the instrument will respond with the following string:

Fields Description

The quotes enclose the constant characters (attention to uppercase / lowercase characters); the symbols < and > enclose variable numerical fields.
STX (start of text) = 0x02h, **ETX** (end of text) = 0x03h, **EOT** (end of transmission) = 0x04h, **ACK** (acknowledge) = 0x06h, **NAK** (No acknowledge) = 0x15h.
<Addr> = Serial communication address + 0x80h (e.g.: address 2: <Addr> = 0x82h (130 in decimal format)).
<status> = 1 byte, see following table (bit = 1 if condition is TRUE).

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	Tare entered	0	Stable weight	0

<gross>, <net>, <peak> = 8 ASCII bytes, weight value is right hand justified (without non-significant zeroes, with decimal point and negative sign).
If overload condition: “^^^^^^^^”.
If underload condition: “---------- ”.
If weight reading error “ O-L “.
<csum> = string data control sum. It is calculated executing the exclusive OR (XOR) of all characters from STX (or from <addr>) to ETX, excluding the latter; the XOR result is resolved into 2 characters considering the 4 highest bit (first character) and the for lowest bit (second character) separately; the 2 resulting characters are then coded in ASCII; (e.g.: XOR = 5Dh; <csum> = "5Dh" i.e. 35h and 44h).

Appendix 2 : B

Load Cell Indicator : SLIM

Installation Manual

Contents **Page**

MAIN FEATURES :

A. Technical Features

Power supply	5 - 13Vdc polarity inversion protection. Protection with replaceable fuse.
Power consumption	1.5 W
Isolation	Class III
Operating temperature	-10°C ~ +50°C (max humidity 85% non-condensing)
Storage temperature	-20°C ~ +60°C
Weight display	5 digit red LED's, 7 segments, (h 10 mm)
Keyboard	3 mechanical keys
Circuit overall dimensions	76 mm x 29 mm x 22 mm (l x h x p)
Mounting	Inside load cell / other containers
Connections	Solder pads or AMP2 connectors
Load cells:	max 2 350 Ohm parallel load cells (or 4 700 Ohm load cells).
Load cells power supply	3.3Vdc
Linearity	< 0.01% of full scale
Temperature drift	< 0.001% of full scale / C°
A/D converter resolution	24 bit
Input signal range	From -3.9 mV/V to +3.9 mV/V
Digital filter	From 0.25 Hz to 3 Hz selectable
Weight decimal digits	from 0 to 3 decimal digits
Zero and full scale calibration	Executable via keyboard
Load cells cable fail check	Always working
Serial ports (optionals)	Rs485 half duplex CAN bus
Code memory	32 Kbytes
Data memory	2 Kbytes
Conformity to standards	EN61000-6-2, EN61000-6-3 (EMC)
	EN61010-1 (Electric safety)

B. Symbols

A list of the symbols used in the manual are given below:

Caution! Only specialised personnel can perform this operation.

Read the following instructions carefully.

Further information.

C. Identification Data Plate

It is important to provide these data when requesting information or instructions regarding the instrument, along with the program number and the software version which are shown on the manual cover and are displayed when the instrument is switched on.

D. Warnings

Only specialised personnel can perform the following operation.
All wiring must be carried out with the instrument switched-off.

The following information concerns all the SLIM's functions available on the different models.

E. Power Supply

- The power supply must be wired to connector J5 pin 1 and 2.
- The power supply cable must be channelled separately from other power supply cables with different voltages, from the load cells cables and from the I/O cables.

Power supply : 5-13 Vdc max 1.5 W

CONNECTIONS

Pin 1 on J5 + Alim.
Pin 2 on J5 GND

F. Load Cell Wiring

- The load cell cable must not be channelled with other cables (i.e. Outputs connected to remote switches or power supply cables), but must follows its own route.
- Any cable extension must be carefully shielded, the colour code must be respected and a cable of the same type as the one provided from the manufacturer must be used. The extensions on the cables must be soldered, otherwise a supportive terminal block or a junction box must be used.
- The load cell cable shouldn't have more conductors than those effectively used (4 or 6). In case of a cable with more conductors, connect those unused wires to the –power supply (terminal block 2).

A maximum of 4 x 350-ohm load cells can be connected to the instrument in parallel. The load cell excitation voltage is 3.3 Vdc and is protected against a temporary short circuit.
The instrument's input signal range requires the use of load cells with sensitivity from 1 mV/V to 3.9 mV/V. The load cell wires must be connected to terminals 1 ...4 of 4 pins connector (or soldered).

Connect the load cell's cable shield to the load cell body, or to GND.

NUM.	J6
1	+ Excitation
2	- Excitation
3	+ Signal
4	- Signal

G. RS485 Serial Wiring

- A bipolar shielded cable must be used and the shield must be connected to GND.
- The cable must not be channelled with other cables (i.e. outputs connected to remote switches or power supply cables), but must follow its own route.

NUM.	J5
1	+ ALIM. **6** - 13 Vdc
2	GND
3	CAN H
4	CAN L
5	RS485 +
6	RS485 -

H. Can Bus Wiring

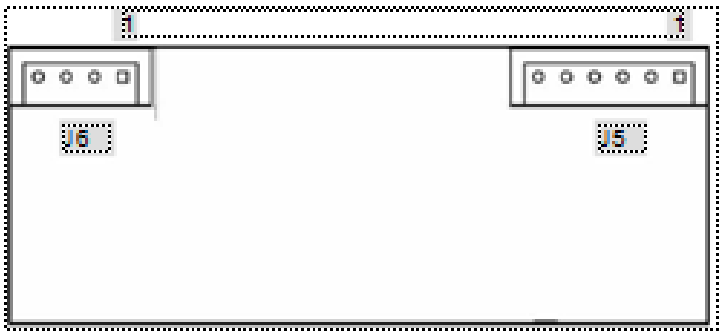
- A bipolar shielded cable must be used and the shield must be connected to GND.
- The cable must not be channelled with other cables (i.e. outputs connected to remote switches or power supply cables), but must follow its own route.

NUM.	J5
1	+ ALIM. **6** - 13 Vdc
2	GND
3	CAN H
4	CAN L
5	RS485 +
6	RS485 -

I. Summary of Wiring

NUM.	J6
1	+ Excitation
2	- Excitation
3	+ Signal
4	- Signal

NUM.	J5
1	+ ALIM. **6** - 13 Vdc
2	GND
3	CAN H
4	CAN L
5	RS485 +
6	RS485 -



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 sopstationer 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 utrangerad 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 wetgegeving (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.

PORTUGESE

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.