STRAIN GAUGE LOAD CELLS

SGLC SERIES 7000

INSTRUCTION MANUAL

CE

GEOSENSE

CONTENTS

1.0 INTRODUCTION

This manual is intended for all users of **Strain Gauge Load Cells SGLC Series 7000** manufactured by MGS Geosense and provides information on their installation, operation and maintenance**.**

It is VITAL that personnel responsible for the installation and use of the SGLC Load Cells READS and UNDERSTANDS the manual, prior to working with the equipment.

1.1 General Description

The primary uses for **SGLC Load Cell Series 7000** are measuring loads acting on:-

- Ground Anchors
- Rock bolts
- Tie backs
- Struts
- Arch supports
- Props

Particular features of the **SGLC Load Cell Series 7000** are:-

- Robust stainless steel construction
- Accommodates eccentric loading
- Reliable long term performance
- Rugged, suitable for demanding environments
- High accuracy
- Data logger compatible

The Geosense **SGLC 7000 series** load cell consists of a cylinder of high strength steel with a series of electrical resistance strain gauges connected around the periphery as a Wheatstone Bridge that compensates for unevenly distributed loads and provides a single mV/V signal output.

They are available in two types:-

Hollow (Anchor)
Manufactured with a centre hole to accommodate anchors, rock bolts and tendons.

Solid
Solid cell designed primarily for pile testing, struts, tiebacks and arch supports

When the load cell is subjected to load the resistance of the strain gauges will change and the output signal is directly proportional to the applied load.

The load cells are compensated for temperature variations often found during normal

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operating environments and have in-built lightening protection.

Connection to the load cell is via a heavy duty multi-core sheathed cable which can be connected to a direct portable readout, switched terminal units or a data logging system.

Mounting surfaces should be flat and parallel for optimum performance and the use of abutment plates and load distribution plates is recommended.

The abutment plate (provided locally) is normally made to suit specific site requirements and the load distribution plates (supplied by Geosense) should be inserted between this and the load cell and the anchor head and load cell.

2.0 CONFORMITY

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Declaration of Conformity

We Marton Geotechnical Services Ltd at above address declare under our sole responsibility that the Geosense products detailed below to which this declaration relates complies with protection requirements of the following harmonized EU Directives,

Low Voltage Directive 73/23/EEC (as amended by 93/68/EEC)
The Electromagnetic Compatibility Directive 2004/108/EC
The Construction Products Directive 89/106/EEC

Equipment description	**Strain Gauge Load Cells**
Make/Brand	**Geosense**
Model Numbers	**SGLC-7000 series**

This equipment has been designed and manufactured with reference to the following standards:

All mechanical drawings used in the production of this equipment are based upon BS 8888
Electrical/electronic drawings are based upon BS 3939.

A technical file for this equipment is retained at the above address
This Declaration of Conformity was prepared according to EN ISO/IEC 17050-1:2004.

Director

3.0 MARKINGS

Geosense Strain Gauge Load Cells are labelled with the following information:-

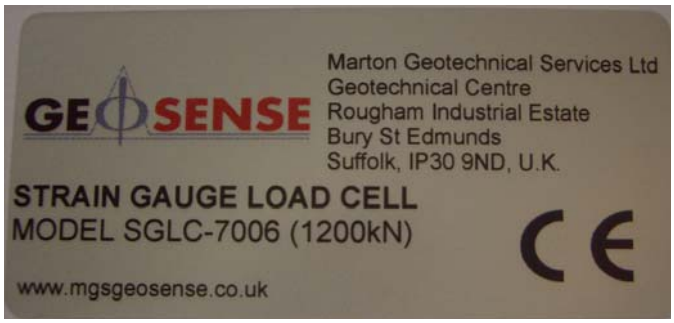
Manufacturers name & address

Product type

Model

Serial number

CE mark



4.0 DELIVERY

This section should be read by all users of **SGLC Load Cell Series 7000** manufactured by MGS Geosense.

4.1 Packaging

SGLC Load Cells are packed for transportation to site. Packaging is suitably robust to allow normal handling by transportation companies. Inappropriate handling techniques may cause damage to the packaging and the enclosed equipment. The packaging should be carefully inspected upon delivery and any damage MUST be reported to both the transportation company and MGS Geosense.

4.2 Handling

Whilst they are a robust devices, **SGLC Load Cells** are precision measuring devices. They and their associated equipment should always be handled with care during transportation, storage and installation.

Once the shipment has been checked it is recommended that **SGLC Load Cells** remain in their original packaging for storage or transportation.

Cable should be handled with care. Do not allow it to be damaged by sharp edges, rocks for example, and do not exert force on the cable as this my damage the interim conductors and render the installation useless.

4.3 Inspection

It is vital to check all the equipment in the shipment as soon as possible after taking delivery and well before installation is to be carried out. Check that all the components detailed on the documents are included in the shipment. Check that the equipment has not been physically damaged.

ALL Geosense **SGLC Load Cells** carry a unique identification serial number which is located on the cable connection block.

All **SGLC Load Cells** are supplied with individual calibration sheets that include their serial numbers and these will shipped with them.

Calibration Sheets contain VITAL information about the SGLC Load Cells.
They MUST be stored in a safe place.
Only copies should be taken to site.

4.4 Storage

All **SGLC Load Cells and associated** equipment should be stored in an environment that is protected from direct sunlight.

It is also recommended that cables be stored in a dry environment to prevent moisture migrating along inside them in the unlikely event of prolonged submersion of exposed conductors. The cables should also be protected from rodents and traffic.

No other special requirements are needed for medium or long-term storage although temperature limits should be considered when storing or transporting associated components, such as readout equipment.

5.0 INSTALLATION

This section of the manual is intended for all users of **SGLC Load Cells** manufactured by MGS Geosense and is intended to provide guidance with respect to their installation.

It is VITAL that personnel responsible for the installation and use of the SGLC Load Cells READS and UNDERSTANDS the manual, prior to working with the equipment.

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As stated before, it is vital to check all the equipment in the shipment soon after taking delivery and well before installation is to be carried out. Check that all components that are detailed on the shipping documents are included.

5.1 General Issues

- Note serial number against location
- Mark cables for future identification. Use an appropriate coding system and mark cables at frequent intervals, not just at the ends.
- Protect the ends of the signal cable. Cables should be terminated at a waterproof box or with waterproof connectors.

5.1.2 Load distribution plates

To obtain stable measurements and minimise errors due to eccentricity, the **SGLC Load Cell** should be installed using a pair of load distribution plates which are supplied by Geosense. An abutment plate should be made locally to suit the local site requirement.

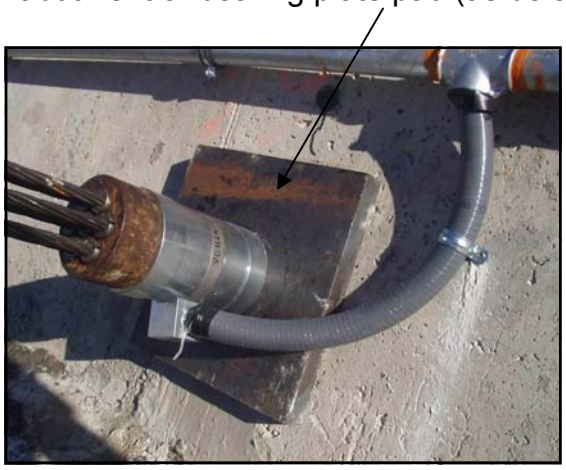
5.2 Anchors

Installation of **SGLC Load Cells** should be carried out as follows:-

1. Ensure that the internal diameter of the cell is correct for the anchor strands or bolt head.

2. Ensure that the capacity of the cell is sufficient for the anchor including the testing.

3. If necessary fabricate an abutment or bearing plate/pad (as below).



4. Place the base load distribution plate over the anchor strands or bolt followed by the cell and then the top load distribution plate.

5. Place the anchor stands through the wedge plate or nut. Connect the signal cable to the load cell and then to either a portable readout or a data logger. Record the output when it is ZERO load.

6. Place pressure jack onto top of cell and carry out the necessary tests recording the outputs and checking what load is being applied (see DATA HANDLING).

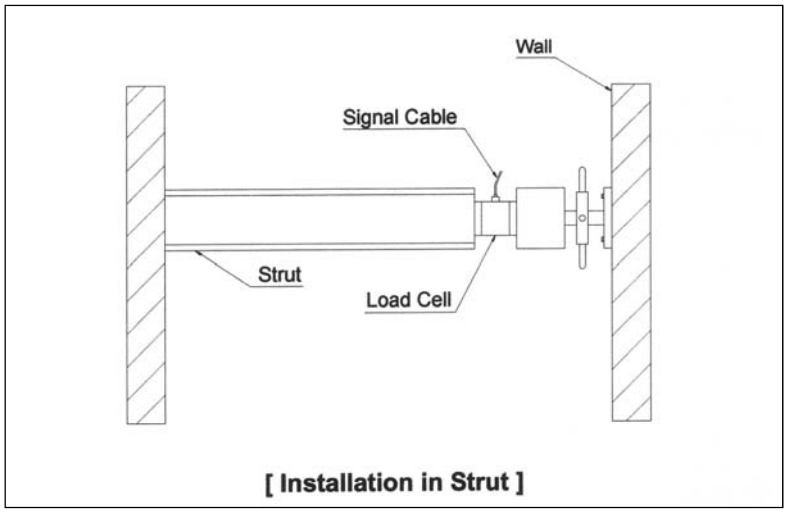
5.3 Struts

Installation of **SGLC Load Cells** should be carried out as follows:-

1. Prepare the two surfaces (e.g. strut end and wall) to ensure they are as flat as possible.

2. Fit the top and bottom load distribution plates to the load cell.

3. Place the load cell together with the load distribution plates in between the strut end and the screw jack ensuring that there are no eccentric loads.



[Installation in Strut]

4. Connect the signal cable to a suitable readout or data logger and record the output for ZERO load.

5. Use the screw jack to incrementally increase the load.

DO NOT TIGHTEN THE SCREW JACK TOO QUICKLY AS THIS WILL DAMAGE THE LOAD CELL

6.0 DATA HANDLING

The function of the instrument is to provide useful and reliable data. Accurate recording and handling of the data is essential if it is to be of any value.

6.1 Connecting to readouts

6.1.1 Portable Readouts

Geosense offer a range of readout and data logging options. Specific operation manuals are supplied with each readout device.

1. Connect signal cable from the sensor to the Intelligent Readout following the wiring colour code. Conductor colours may vary depending upon the extension cable used.

RED	=	Volt input +
BLACK	=	Volt input -
GREEN	=	Signal +
WHITE	=	Signal -
SILVER/WHITE	=	Shielding

Connect the load cell via either colour coded Binding Posts or the Input Connector as indicated in the wiring tables.

- Turn on meter and allow approximately 1 minute for warm up (until reading stops changing with no change in load) Reading will change approximately 0.07 mV during warm up.

- If required, Tare the display.

DO NOT TARE THE READOUT IF LOAD IS APPLIED.

- Manually record the required reading

6.1.2 Data Loggers

A number of data loggers are available to automatically interrogate and record the reading from **SGLC Load Cells**. These include devices manufactured by Geosense / RST in both single and multi-channel configurations, as well as equipment manufactured by independent suppliers.

Geosense configure and supply equipment manufactured by Campbell Scientific Ltd.

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This is the most commonly adopted third party manufacturer of data loggers that can be used with Strain Gauge Load Cells. Specific configuration and programming advice can be obtained from Geosense and or the manufacturers documentation.

6.2 Data Reduction

Data processing includes the conversion from electric to engineering units by means of the calibration co-efficient (f), excitation voltage and calibration values shown on the calibration certificate.

Below is an explanation of the terms used in the calculation of load.

6.2.1 Output Rating

This is the incremental value from 0 to 100% of the output during the loading of the cell. The input voltage from the Intelligent Readout is generally 5V (Excitation voltage as stated on calibration sheet) and therefore it is the OUTPUT value compared to the INPUT voltage of 5V.

For readouts which have differing input voltages a correction figure should be used as per the table below:-

INPUT VOLTAGE	1V	2V	3V	5V	10V
Rated output as per calibration	**X 0.2**	**X 0.4**	**X 0.6**	**X 1.0**	**X 2**

(Please see Calibration sheet on page 15).

Example 1: If you are using a Readout unit with a 5V input the rated output value on the calibration certificate is 1.63 mV/V then the rated output will be:-

Rated output (5V) = 1.63 x 1 = 1.63 mV/V

Example 2: If you are using a Readout unit with a 10V input the rated output value on the calibration certificate is 1.63 mV/V then the rated output will be:-

Rated output (10V) = 1.63 x 2 = 3.26 mV/V

6.2.2 Conversion to Load

In order to convert the Rated Output (1.63 or 3.26 mV/V) to load in kN the above value (1.63 or 3.26 mV/V) should be entered into the following equation:-

Load (kN) = (Present rated output (mV/V) - Rated output (zero load)) x Calibration coefficient

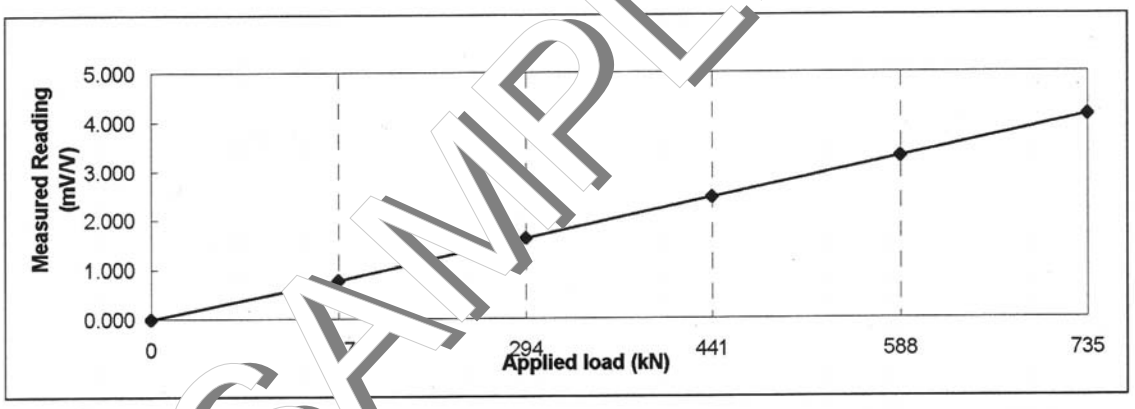
CALIBRATION CERTIFICATE

LOAD CELL SGLC-7000 SERIES

- Model : SGLC-7004
- Serial No. : 000066
- Capacity : 735 kN (75 ton)
- Cell ID : Φ110 mm
- Input & Output terminal resistance : 350Ω
- Insulation resistance : DC25V 500MΩ past

- Date : 17.2.2007
- Temperature : 19°C
- Humidity : 38%
- Cable Length : 10 M
- Excitation voltage : 5V
- Calibrated by : SHK

Load (kN)	Readings (mV/V)			Calculation Load (kN)		Error (% FSR)	
	Cycle 1	Cycle 2	Average	Linear	Polynomial	Linear	Polynomial
0	0.000	0.003	0.002	0.3	2.1	0.04	0.28
147	0.785	0.788	0.787	140.3	143.3	-0.91	-0.50
294	1.630	1.631	1.631	290.8	294.2	-0.43	0.03
441	2.463	2.466	2.464	439.5	442.3	-0.20	0.18
588	3.295	3.299	3.297	588.	9.2	0.01	0.17
735	4.123	4.122	4.122	735.3	733	0.04	-0.16



■ In case of linear meth

Load(kN) = (Di...ntial Reading) / Sensitivity

Sensitivity (mV/V / kN) : **0.005606**

■ In case of polynomial method

Load(kN) = A x (Differential Reading)^2 + B x (Differential Reading) + C

A (kN/mV/V^2) : **-0.71036289526**

B (kN/mV/V) : **180.5144803**

C (kN) : **1.790908976**

[Connection of cable]

Red : (+)Vcc	Black : (-)Vcc	White : (+)Sens	Green : (-)Sens

- The gauge factor & zero reading are calculated using a linear regression analysis method.
- Please note that the precision & accuracy will be affected by overloading, temperature & humidity.

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7.0 MAINTENANCE

SGLC Load Cells are basically maintenance free device for most applications but the following should be considered during the service life:-

- Keep away from direct sunlight to avoid large thermal affects
- Keep the cable connection cap on when Readout not connected
- Avoid any impacts or significant vibration which can damage internal sensors
- Keep cables away from physical damage
- Keep cable ends waterproof

8.0 TROUBLESHOOTING

8.1 Unstable Readings

Readings can become unstable due to external influences or problems with the Readout. If unstable readings are experienced check the following:-

- Electrical interference can be emitted from heavy or generating equipment and can I affect the readings.

Symptom	**Possible cause**	**Possible remedy**
Unstable readings	Electrical interference from Heavy or generating equipment	Remove equipment Ground all cables
	Low Readout battery	Charge or replace battery
No signal	Cable damage	Check resistance of each cable core as below

Colour of signal cable	Resistance (Ω)
Red + Black	350
Green + White	350
Red + Green	260
Red + White	260
Black + Green	260
Black + White	260

9.0 SPECIFICATION

STRAIN GAUGE LOAD CELL

Description	Specification
Bridge resistance	350 Ω
Over range capacity	150% FSR
Sensitivity	± 2.0 mV/V
Accuracy	± 0.5 % FS
Temperature range	-30°C to + 85°C
Temperature range compensated	-10°C to + 70°C
Material	SCM
Output signal	1 mV/V (1000)

ANCILLIARY EQUIPMENT

Manual readouts
Data loggers
Manual switch boxes
MUX-2104 auto switch interface
Load distribution plates
Terminal boxes
Electric cable
Centraliser bushings if required

HOLLOW (ANCHOR) - STANDARD DIMENSIONS

Model	Capacity (kN)	Internal diameter (mm)	Outside Diameter (mm)	Load cell height (mm)	Load distribution plate height (mm)
SGLC-7001	300	40	155	87	23
SGLC-7002	500	50	155	87	23
SGLC-7003	750	71	155	87	23
SGLC-7004	750	110	200	87	23
SGLC-7005	1000	120	220	87	23
SGLC-7006	1200	165	223	87	23
SGLC-7007	1500	190	237	87	23
SGLC-7008	1800	190	262	87	23
SGLC-7009	2500	225	340	87	23

SOLID - STANDARD DIMENSIONS

Model	Capacity (kN)	Outside Diameter (mm)	Load cell height (mm)
SGLC-7020	300	155	50
SGLC-7021	500	155	50
SGLC-7022	750	155	50
SGLC-7023	1000	220	50
SGLC-7024	2000	223	50
SGLC-7025	3000	237	50
SGLC-7026	5000	262	50
SGLC-7507	10000	340	50

10.0 SPARE PARTS

SGLC Load Cells do not have any replaceable parts.

Civil engineering sites are hazardous environments and instrument cables can be easily damaged, if they are not adequately protected. Geosense can therefore provide the following parts that my be required to effect repairs to instrument cables:

- PU coated 4 Core cable with foil shield and copper drain.
- PVC coated, armoured, 4 Core cable suitable for direct burial.
- Epoxy jointing kit for forming a waterproof cable joint.

Please contact Geosense for price and availability of the above components.

11.0 RETURN OF GOODS

11.1 Returns procedure

If goods are to be returned for either service/repair or warranty, the customer should contact MGS Geosense for a **Returns Authorisation Number,** request a **Returned Equipment Report Form QF034** and, where applicable, a **Returned Goods Health and Safety Clearance Form QF038** prior to shipment. Numbers must be clearly marked on the outside of the shipment.

Complete the **Returned Equipment Report Form QF034**, including as much detail as possible, and
enclose it with the returned goods.

11.1.1 Chargeable Service or Repairs

Inspection & estimate
It is the policy of MGS Geosense that an estimate is provided to the customer prior to any repair being carried out. A set charge for inspecting the equipment and providing an estimate is also chargeable.

11.1.2 Warranty Claim

(See Limited Warranty Conditions)
This covers defects which arise as a result of a failure in design or manufacturing. It is a condition of the warranty that the **SGLC Load Cells** must be installed and used in accordance with the manufacturer's instructions and has not been subject to misuse.

In order to make a warranty claim, contact MGS Geosense and request a **Returned Equipment Report Form QF034.** Tick the warranty claim box and return the form with the goods as above. You will then be contacted and informed whether your warranty claim is valid.

11.2 Packaging and Carriage

All used goods shipped to the factory **must** be packed in a suitable carton. If the original packaging is not available, MGS Geosense should be contacted for advice. MGS Geosense will not be responsible for damage resulting from inadequate returns packaging or contamination under any circumstances.

11.3 Transport & Storage

All goods should be adequately packaged to prevent damage in transit or intermediate storage.

12.0 LIMITED WARRANTY

The manufacturer, (**MGS Geosense)**, warrants the **SGLC Load Cells** manufactured by it, under normal use and service, to be free from defects in material and workmanship under the following terms and conditions:-

The **SGLC Load Cells** shall be installed in accordance with the manufacturer's recommendations.

The equipment is warranted for 1 year from the date of shipment from the manufacturer to the purchaser.

The warranty is limited to replacement of part or parts which, are determined to be defective upon inspection at the factory. Shipment of defective part or parts to the factory shall be at the expense of the Purchaser. Return shipment of repaired/replaced part or parts covered by this warranty shall be at the expense of the Manufacturer.

Unauthorised alteration and/or repair by anyone which, causes failure of the unit or associated components will void this **LIMITED WARRANTY** in its entirety.

The Purchaser warrants through the purchase of the SGLC Load Cells that he is familiar with the equipment and its proper use. In no event shall the manufacturer be liable for any injury, loss or damage, direct or consequential, special, incidental, indirect or punitive, arising out of the use of or inability to use the equipment sold to the Purchaser by the Manufacturer.

The Purchaser assumes all risks and liability whatsoever in connection with the **SGLC Load Cells** from the time of delivery to Purchaser.

STRAIN GAUGE LOAD CELLS

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