INSTRUCTION MANUAL

Vibrating Wire Load Cell
VWLC-5000 / VWLC-5050

TABLE OF CONTENTS

1. VERSION CONTROL

Version	Date	Author	Approved	Issued
V1.0	Feb 2013	MC	MC	GC
V1.1	Dec 2013	MC	MC	GC
V1.2	Apr 2015	GC	MC	GC
V1.3	Mar 2019	GC	MC	GC
V1.4	Mar 2021	GC	MC	GC
V1.5	Feb 2025	TB	TC	GC

2. INTRODUCTION

This manual is intended for all users of **Geosense®** Vibrating wire load cells manufactured by Geosense and provides information on their installation, operation and maintenance.

It is VITAL that all personnel responsible for the use of VWLC Instruments READ and UNDERSTAND this manual, prior to working with the equipment

2.1. General Description

The primary uses for the **Geosense®** VWLC (Vibrating Wire Load Cell) series are measuring loads acting on:

- Ground anchors
- Rock bolts
- Tie backs

Particular features of the **Geosense®** VWLC series are:

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

The **Geosense®** VWLC series load cell consists of a cylinder of high strength steel with 3 to 5 vibrating wire strain gauges (depending on capacity or customer requirement) mounted parallel to the longitudinal axis arranged equidistant around the circumference which measure the compression of the cylinder under load.

With the multi sensor configuration it is possible to obtain accurate readings under mildly eccentric loading conditions as the sensors are read individually.

The readings from the individual sensors are averaged and when used in conjunction with a calibration factor, supplied with each cell, allow the applied load to be calculated.

In multi strand anchors it is therefore possible to tension the strands uniformly by monitoring the load in each sensor as appropriate.

The abutment plate (provided locally) is normally made to suit specific site requirements and load distribution plate pairs (supplied by Geosense) should be used to minimise eccentric loading and provide a smooth parallel bearing surface and evenly spread the load to the cell. These should be inserted between the load cell and the anchor head.

2.2. Theory of Operation

Vibrating wire gauges consists of two end blocks with a tensioned steel wire between them. The strain gauge operates on the principle that a tensioned wire, when plucked, vibrates at its resonant frequency. The square of this frequency is proportional to the strain in the wire.

Around the wire is a magnetic coil which when pulsed by a vibrating wire readout or data logger interface plucks the wire and measures the resultant resonant frequency of vibration.

The **Geosense®** VWLC series consists of a cylinder of high strength steel with 3 to 5 vibrating wire strain gauges (depending on capacity) mounted parallel to the longitudinal axis arranged equidistant around the circumference which measure the compression of the cylinder under load.

As the **Geosense®** VWLC series undergoes compression the end blocks of the internal vibrating wire sensors will move relative to each other. The tension in the wire between the blocks will change accordingly thus altering the resonant frequency of the wire.

The frequency is read either by a portable readout or data logger and the load calculated as in section 10.

3. VARIANTS

There are two main design variants of the VWLC system, used for different applications.

3.1. VWLC-5000

The VWLC-5000 variant consists of a through-hole design to allow for tensioning strands / bars for retaining walls etc.

Figure 1: Example of a VWLC-5000

There are two options available for the VWLC-5000

- Solid Bar
- Multi Strand

These options are available to offer solutions to the different diameter of a multi strand tensioner and a solid bar tensioner.

Custom sizes are also available depending on requirements. Please contact Geosense for more information

3.2. VWLC-5050

The VWLC-5050 variant is of a solid design and is designed for measuring loads where a tensioned member does not need to pass through the centre.

Figure 2: Example of a VWLC-5050

3.3. Load Ratings

Loadcells are available in different load ranges from 500kN up to 5000kN. Custom ranges are available upon request.

See relevant VWLC datasheets for specifications available.

4. WIRING CONFIGURATIONS

Standard wiring configurations for load cells vary depending on the number of sensors within the cell. Higher load rated cells will have 5 individual sensors, whereas lower rated ones will have 3 individual sensors.

Information on the number of sensors in a loadcell can be found in the relevant datasheets.

4.1. Wiring Colour Coding

Table 1: Three sensor loadcell wiring

4 PAIR CABLE	
Paired Wires	**Sensor**
RED / BLACK	**VW sensor 1**
GREEN / BLACK	**VW sensor 2**
BLUE / BLACK	**VW sensor 3**
WHITE / BLACK	**Thermistor**

Table 2: Five sensor loadcell wiring

6 PAIR CABLE	
Paired Wires	**Sensor**
RED / BLACK	**VW sensor 1**
GREEN / BLACK	**VW sensor 2**
BLUE / BLACK	**VW sensor 3**
WHITE / BLACK	**VW sensor 4**
YELLOW / BLACK	**VW sensor 5**
ORANGE / BLACK	**Thermistor**

5. CONFORMITY

EU Declaration of Conformity

We

Geosense Ltd
Nova House, Rougham Industrial Estate, Bury St Edmunds, IP30 9ND, United Kingdom

declare under our sole responsibility that the product:

Equipment description: VW Load cells

Model Numbers(s):
VWLC-5000, VWLC-5050,

to which this declaration relates are in conformity with all the essential requirements of the Restriction on the use of certain Hazardous Substances **2011/65/EU**

The following harmonised standards have been applied with respect to this product:

EN IEC 63000:2018

Authorised Person

Tim Clegg
Director

Date: 30/04/2024
Location: Bury St Edmunds, UK.

DoC-07001-CE

UKCA Declaration of Conformity

Geosense Ltd
Nova House, Rougham Industrial Estate, Bury St Edmunds, IP30 9ND, United Kingdom

This declaration is issued under the sole responsibility of the manufacturer:

Equipment description: VW Load cells

Model Numbers(s):
VWLC-5000, VWLC-5050,

The object of the declaration described above is in conformity with the following statutory requirements:

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations	SI 2012 No. 3032

The following harmonised standards have been applied with respect to this product:

EN IEC 63000:2018

Signed for and on behalf of Geosense Ltd

Tim Clegg
Director

Date: 30/04/2024
Location: Bury St Edmunds, UK.

DoC-07001-UKCA

6. MARKINGS

Geosense® VWLC series instruments are labelled with the following information:

- Manufacturers name & contact details
- Product type
- Model
- Serial number
- CE mark / UKCA mark

Figure 3: VWLC-5050 with Geosense specification label

7. DELIVERY

This section should be read by all users of equipment manufactured by **Geosense®.**

7.1. Packaging

Geosense® VWLC's 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 **Geosense®**.

Once the shipment has been checked it is recommended that **Geosense®** VWLC's 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.

7.2. Handling

Whilst they are a robust devices, **Geosense® VWLC** series systems are precision measuring instruments. They and their associated equipment should always be handled with care during transportation, storage and installation.

Once the shipment has been inspected (see 7.3), it is recommended that equipment remains in its original packaging for storage or onward transportation.

7.3. Inspection / Functionality Check Readings

It is important 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®** VWLC instruments carry a unique identification serial number which is located on the cable connection block or on the side of the cell (dependent on model).

Geosense® VWLC instruments are supplied with individual calibration sheets that include their serial numbers and these are shipped with the equipment. Calibration sheets should be kept safe and secure for future reference. See section 8.

7.4. Storage

All **Geosense®** VWLC instruments 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.

8. CALIBRATION

All **Geosense®** VWLC instruments are supplied with a calibration sheet like the example below.

GEOSENSE QUALITY FORM
FORM No G/QF/135
ISS: 7
DATE : June-18
SIG: GC

VIBRATING WIRE LOAD CELL CALIBRATION

Model / Series	VWLC-5000
Serial Number	509553
Readout Serial No	1000475284
Capacity (kN)	1250
Shipment Reading	8491.2

Cal date	20-Feb-19
Frame Number	908565
Temp °C	19
Gauges	3

Applied Load	Digits							Load	Error	Error % fso
kN	1	2	3	4	5	6	avg.[digit]	kN	kN	linear
125	8424	8023	8306				8251	122.0	-3.0	-0.24%
250	8212	7850	8123				8062	251.1	1.1	0.09%
500	7795	7511	7771				7692	502.3	2.3	0.18%
750	7386	7174	7420				7327	751.0	1.0	0.08%
1000	6979	6836	7068				6961	1000.0	0.0	0.00%
1250	6565	6496	6727				6596	1248.4	-1.6	-0.12%

Calibration With Force Standard Equipment No 099 Certificate No 01764 17F, Calibration With Voltage Equipment Standard No 111 Certificate No TE111-18, Traceability to National Standards, Certificate Ref No 21130

CALIBRATION FACTORS

Linear factor (k)
KN per digit
-0.680514092

Polynomial Factors	
A	5.62588E-06
B	-0.764204863
C	6046.422453

Calibrated By

Note: Digits are Hz^2 x 10^{-3} units.
(please consult the User Manuals for conversion of alternative reading units)
Polynomial calculation [kN] = A * (Reading^2) + B * (Reading) + C
C = −A*(Site Zero Reading^2) − B*(Site Zero Reading)
Linear calculation [kN] = k (kN) * (Current Reading - Site Zero Reading)
THIS CERTIFICATE IS VALID ONLY WHEN CARRYING THE OFFICIAL ORIGINAL STAMP OF GEOSENSE BELOW

Nova House, Geotechnical Centre, Rougham Industrial Estate, Rougham, Bury St. Edmunds, IP30 9ND, UK
T: +44 1359 270457 F: +44 1359 272860 E:info@geosense.co.uk www.geosense.co.uk

9. INSTALLATION

This section of the manual is intended for all users of **Geosense®** VWLC instruments and is intended to provide guidance with respect to their installation.

It is VITAL that all personnel responsible for the use of VWLC Instruments READ and UNDERSTAND this manual, prior to working with the equipment

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.

9.1. General Best Practice

- 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.

9.2. Load Distribution Plates

To obtain stable measurements and minimise errors due to eccentricity, the **Geosense®** VWLC instruments 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.

It is VITAL that load cells are not subjected to point loads or eccentric loads
(i.e. loads that compress part of the cell more than another part)

9.2.1. Recommended loading procedure

It is critical that any load is transferred to a load cell effectively. This means that loads are not concentrated onto points, and are not eccentric (i.e. one side of the cell compressed more than another)

Each installation will differ, however it is important to consider the following points:

- All loads should be transmitted to the full diameter of the load cell
- All loads should be central and perpendicular to the load cell to avoid eccentric loads as best as possible
- Abutment/bearing plates should be the exact same size or a larger diameter than the load cell with a completely flat face
- Distribution plates should always be used between abutment/bearing plates

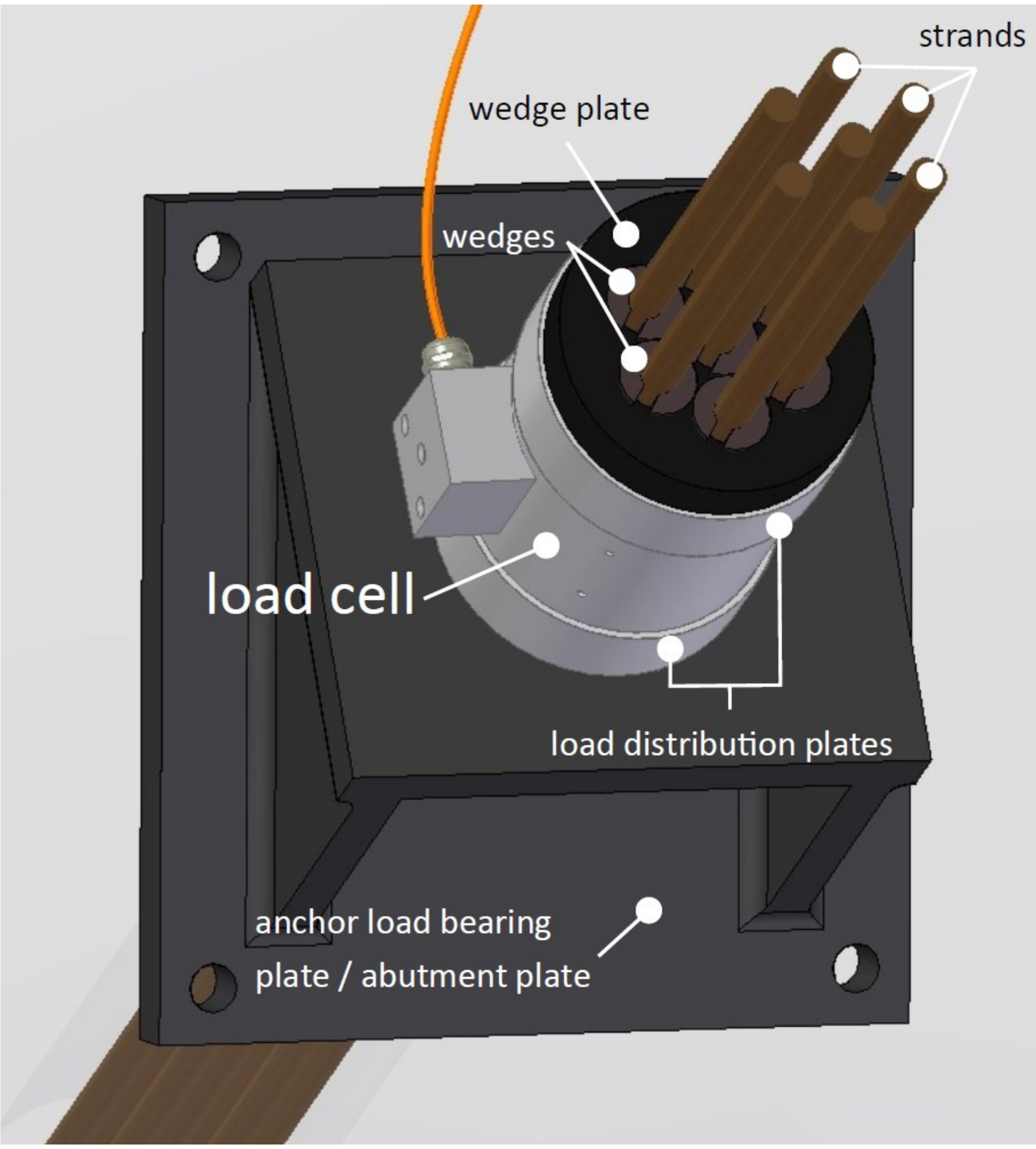


Figure 4: Proper loading setup of load cell to avoid point and eccentric loads

9.3. Anchor Load Cell (multi-strand and solid bar)

Installation of **Geosense®** Vibrating Wire Load Cell (VWLC-5000) should be carried out as follows:

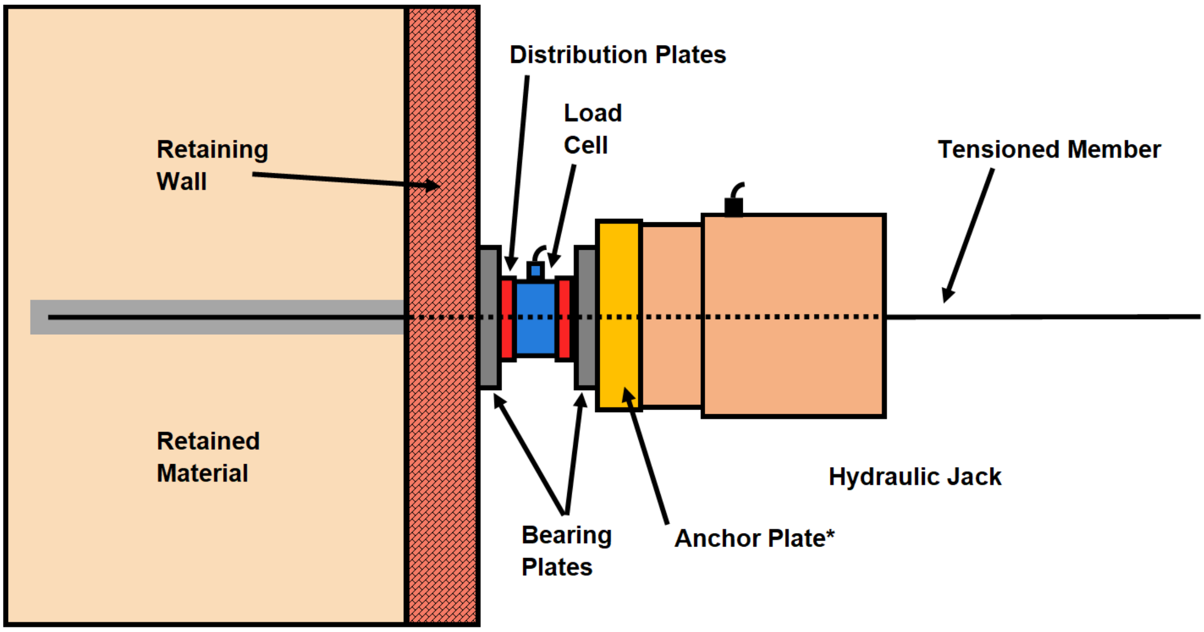


Figure 5: Anchor load cell installed between retaining wall and a tensioning jack

*Anchor plate design and nomenclature may vary depending on type of member being tensioned – image for reference only.

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 (Figure 6).

Figure 6: Bearing plate fabricated and placed between wall and loadcell distribution plate

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.

Figure 7: Jack placed above load cell

9.4. Solid Load Cell

Installation of **Geosense®** Vibrating Wire Load Cell (VWLC-5050) should be carried out as follows:

9.4.1. Strut Installation

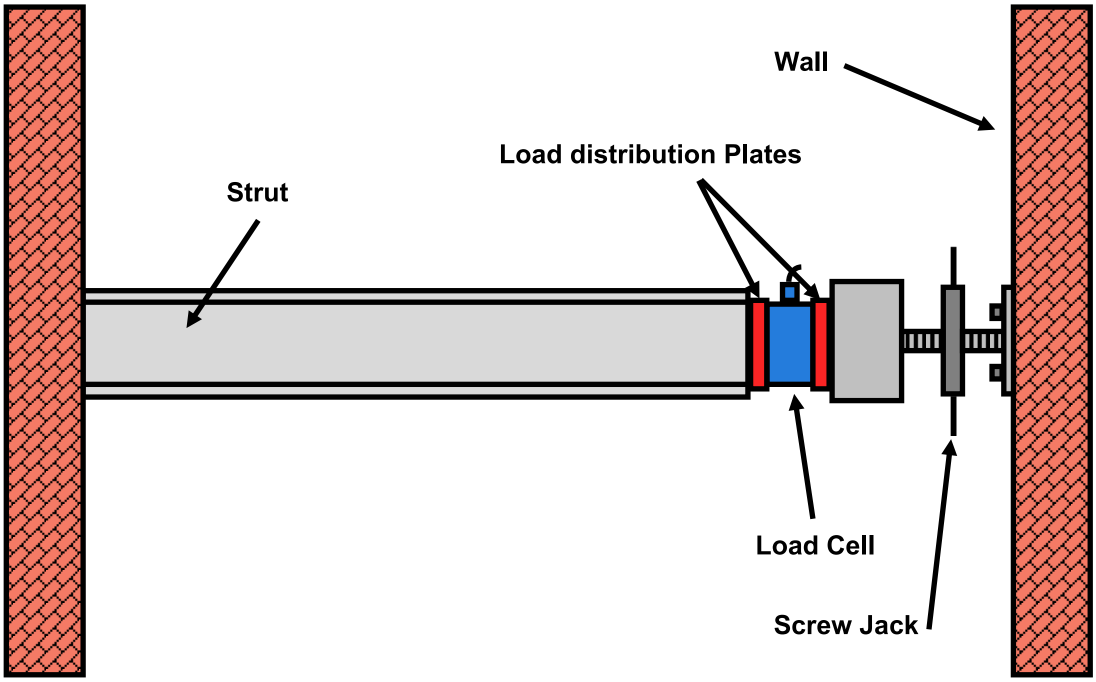


Figure 8: Solid load cell installed on a strut

1) It is recommended that load distribution plates are installed between the structural members/bearing plates and the load cell. The bearing plates (where applicable) will need to be carefully positioned and where necessary fixed in place or supported. Suitable lifting equipment may be necessary in some installations to support the weight of the load cell and to ensure correct alignment.

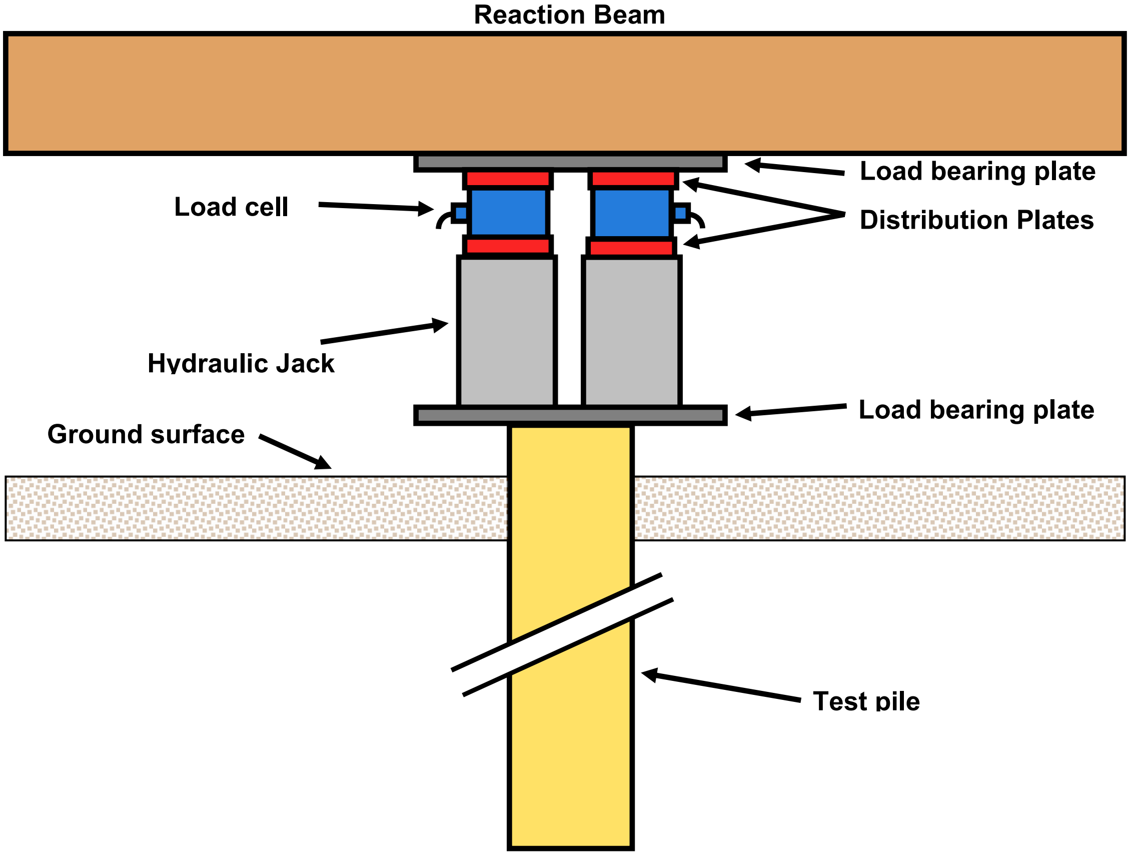
2) With the load cell in the correct position slowly move the strut towards the load cell (usually using a screw jack) until there is interaction.

3) When the strut is in interaction with the load cell, connect a readout as outline in section 10.

4) Continue to load the cell until the desired load is reached. (Please note that this should be done in multiple smaller increments, as if compressed too quickly the cell may become deformed.

5) Once the readings are stable, and at the required load, take initial readings. For VW load cells, readings from each sensor are averaged, see section 10.

9.4.2. Pile Test Installation



1) It is recommended that load distribution plates are installed between the structural members/bearing plates/reaction beam and the load cell. The bearing plates (where applicable) will need to be carefully positioned and where necessary fixed in place or supported. Suitable lifting equipment may be necessary in some installations to support the weight of the load cell and to ensure correct alignment.

2) With the load cell in the correct position slowly move the bearing plates towards the load cell (usually using a hydraulic jack) until there is interaction.

3) When the strut is in interaction with the load cell, connect a readout as outline in section 10

4) Continue to load the cell until the desired load is reached. (Please note that this should be done in multiple smaller increments, as if compressed too quickly the cell may become deformed.

5) Once the readings are stable, and at the required load, take initial readings. For VW load cells, readings from each sensor are averaged, see section 10

10. 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.

10.1. Monitoring the Load Cell Readings

Geosense® VWLC's contain temperature sensors. Where a loads cell is installed in a zone where its temperature is likely to fluctuate significantly, records of both load and temperature data should be used to assess any effects temperature on the data (see section 12.2).

10.2. Portable readouts

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

Below is a brief, step-by-step procedure for use with the **Geosense® VWR1** portable readout.

1) Connect signal cable from the sensor to the readout following the wiring colour code. Conductor colours may vary depending upon the extension cable used. The shield does not need to be connected when reading with the **Geosense® VWR1**.

Wire Colour	Function	Units / Notes
Red	VW +	Frequency (Hz / Digits (B) / Period)
Black	VW –	
Green	Temp +	Resistance (Ohms) Most readers convert this automatically to °C
White	Temp –	
Bare	Shield	Equipotential grounding for EMC

2) The recorder will output a value for frequency and temperature. Figure 9

Figure 9: VWR1 connected to a vibrating wire sensor showing frequency in digits and temperature in degrees Celsius

Whilst it is not critical that the polarity be observed for most VW instruments, a stronger signal may be obtained if the correct polarity is adopted. Since the temperature sensor is a Thermistor, its connection polarity is not so important.

Geosense® VWLCs incorporate VW Strain Sensors mounted parallel to the longitudinal axis in a radial pattern. Depending on the size of the load cell, 3 or 5 sensors are used.

Each sensor is in the load cell is read one-by-one and the result averaged.

11. DATA REDUCTION

11.1. Overview

The tension of a sensor wire can be measured by detecting the frequency at which it naturally vibrates. The following is a description of the units commonly used by the instrumentation industry.

Frequency Units (Hz)
If the wire is 'excited' electronically the frequency at which it vibrates can be measured. The units used to express frequency are Hertz (Hz).

The disadvantage of these units is that there is no 'linear' conversion from 'change in Hertz' to 'change in wire tension'.

Linear Digits (B)
In order to overcome the problem of a linear conversion described above, the frequency value can be squared, thereby rendering it linear, but quite large. To reduce its size, it is often divided by 1000. The expression $Hz^2/1000$ (or $Hz^2 \times 10^{-3}$) is the most commonly adopted as a 'linear' digital output.

$$Digits\ [B] = Frequency\ [Hz]^2 \div 1000$$

Period Units (P)
Some readout devices utilise the 'counter' function available in many common integrated circuits.

Period Units represent the time taken for the wire to vibrate over one full oscillation, expressed in seconds. Due to the very small size of the number generated most equipment manufacturers display the unit multiplied by either 1000 (10^3) or 10000000 (10^7).

The relationship between Period units and Frequency units is expressed as

$$Period\ [P] = 1 \div Frequency\ [Hz]$$

Period units are convenient to measure but do not have a linear relationship to the 'change in wire tension'.

Calibration Factor
Each VWLC-5000/5050 load cell is supplied with a Calibration certificate to enable conversion from the raw data (in the units described above) into engineering units such as kN.

The value of the calibration factor will vary depending upon the engineering units into which the raw data is to be converted.
Readings from VW sensors are typically in a form that is a function of frequency rather than in units of strain.

To convert the readings to units of load, a calibration factor must be applied to the recorded values. For Vibrating Wire load cells, the calibration factors are unique to each unit.

If a readout display is in 'Period' units (e.g. 0.03612 or 3612 depending upon the readout used) a calculation must first be performed to convert the reading from 'Period' units to 'Linear Digits' ($Hz^2/1000$) units.

Two examples of this can be seen below. The first (Example 1) where readout includes a decimal point and displays the Period in ***Seconds***$^{-2}$ and the second (Example 2) where the readout displays the Period in **Seconds**$^{-7}$

<u>Example 1</u>

$$\begin{aligned} Digits &= (1 \div (0.03612 \times 10^{-2}))^2 \div 1000 \\ Digits &= 7664.8 \end{aligned}$$

<u>Example 2</u>

$$\begin{aligned} Digits &= (1 \div (3612 \times 10^{-7}))^2 \div 1000 \\ Digits &= 7664.8 \end{aligned}$$

If the readout displays 'Frequency' values, (e.g. 2768.5 Hz) only a simple calculation is required to convert the reading to Linear Digits.

$$\begin{aligned} Digits &= (2768.5)^2 \div 1000 \\ Digits &= 7664.6 \end{aligned}$$

Certain data loggers store their Vibrating Wire data in Linear Digits but divided by a further 1000. Obviously, the data would have to be multiplied by another 1000 to maintain the standard data format for the conversion to engineering units.

There are many ways to achieve the conversion from recorded data to useful engineering values. The following is included as a guide only and as a basis for alternative approaches.

12. LOAD CALCULATION

12.1. Equations

12.1.1. Polynomial Calculation

Each **Geosense®** VWLC is calibrated by loading in incremental steps and recording the data.

The readings are averaged, and a regression is done with Applied Load versus the averaged readings to get the load cell constants. The constants are used in the polynomial formula below for calculating the current load.

$$[kN] = A \times (CAR^2) + B \times (CAR) + C$$

A	= Constant from calibration sheet
B	= Constant from calibration sheet
C	= Calculated constant from zero reading
CAR	= Current average reading in Digits [B]
[kN]	= Reading of force in kilonewtons

The constant of C shown on the calibration sheet (section 8) refers to a value calculated from the factory zero to display a true load. If a differential load from zero is required, then the C value must be calculated by the user using the below equation.

$$C = -A \times (SZ^2) - B \times (SZ)$$

A	= Constant from calibration sheet
B	= Constant from calibration sheet
C	= Calculated constant from zero reading
SZ	= Site zero reading in Digits [B] from average of sensors

12.1.2. Polynomial Example

If we take the example from the calibration sheet shown (section 8) this gives us the following constants:

C has been taken from the calibration sheet in this example

A = 5.62588 x 10E-6
B = - 0.764204863
C = 6046.422453

Therefore, if the following readings were obtained from the readout:

Table 3: Individual sensor readings for an example load of 1000kN

Sensor No.	Sensor Reading
1	6979
2	6836
3	7068

Then the value of CAR ((current average reading) in digits of all sensors combined during a measurement) would be:

$$CAR = (6979 + 6836 + 7068) \div 3$$
$$CAR = 6961$$

Using the above values, the polynomial calculation would be as follows:

$$[kN] = A \times (CAR^2) + B \times (CAR) + C$$
$$[kN] = 5.62588 \times 10^{-6} \times (6961^2) - 0.764204863 \times (6961) + 6046.422453$$
$$[kN] = 999.4\ kN$$

12.1.3. Linear Calculation

A linear calculation can also be used to calculate the change in load from site zero using the current averaged readings, however this comes with a slight drop in accuracy which is stated on the calibration sheet, though for most applications this accuracy is still sufficient.

$$[kN] = k \times (CAR - SZ)$$

SZ = Site zero in digits
CAR = Current averaged reading in digits
k = Linear factor (from calibration certificate)

12.1.4. Linear Example

For this example, the zero value is known to be 8435.94 digits from our calibration, however on site this will be the average of your zero load readings (SZ).

Therefore, given the readings in (Table 3: Individual sensor readings for an example load of 1000kN)

$$CAR = (6979 + 6836 + 7068)/3$$
$$CAR = 6961$$

Using the above values, the linear calculation would be as follows:

$$[kN] = k \times (CAR - SZ)$$
$$[kN] = -0.680514092 \times (6961 - 8435.94)$$
$$[kN] = 1003.717\ kN$$

12.2. Temperature Considerations

Thermal influences are complex because it is not only the load cell that is affected but the element to which it is attached and whole structure that is affected. The rate of temperature change and the distribution of the thermal gradients also play a major part in influencing the actual strain (load) at any point and its effect on the load cell and its readings.

Consequently, in order to apply any correction for temperature it is necessary to first establish the effects of the temperature changes on the load cell and the medium in/on which it is installed.

A useful exercise to carry out on site to establish the in-situ effects of temperature changes is to observe the installed load cell readings, together with both ambient and cell
temperatures, when no other factors are changing. This should be carried out prior to any loading or other structural changes / works are carried out.

An alternative is to use a 'No load", load cell installed close to the monitoring cells. This will enable an assessment of temperature effects on the cell itself in the working environment for a particular location. For further discussion about 'No load", load cells please contact **Geosense®**.

13. MAINTENANCE

Geosense® Vibrating wire 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

14. TROUBLESHOOTING

14.1. 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 affect the readings.

Table 4: Troubleshooting symptoms, causes and remedy

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

14.2. Troubleshooting Workflow

It is generally accepted that when a Vibrating Wire instrument is producing a stable reading on a suitable readout, the value will be correct. Only on very rare occasions will this be untrue.

In almost all cases, a fluctuating reading is a sign of a faulty signal from the sensor. The fault could be in either the sensor, the connecting cable, any switch boxes or the readout. The best way to fault-find an instrument is to isolate it from all other instruments and connections. Where possible begin fault finding from the sensor itself.

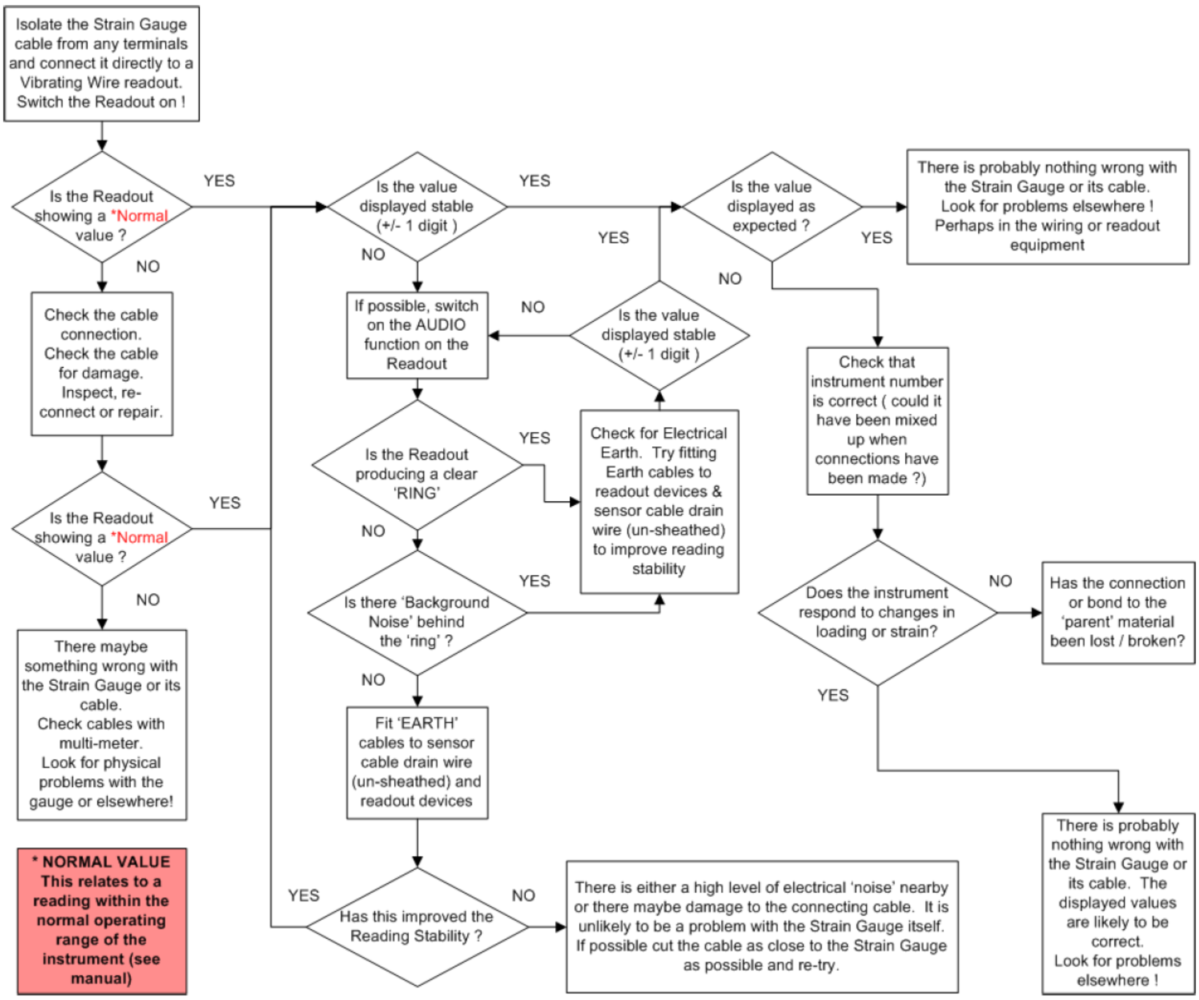


Figure 10: Troubleshooting workflow

15. SPARE PARTS

Geosense® Vibrating wire 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 may be required to effect repairs to instrument cables:

- PE coated 4 & 6 pair cable with foil shield and copper drain.
- Epoxy jointing kit for forming a waterproof cable joint.
- Quick connectors for end of load cell cable for use with various readouts if required.

Contact **Geosense®** for more details and Service / Calibration options.

16. RETURN OF GOODS

16.1. Returns Procedure

If goods are to be returned for either service/repair or warranty, the customer should contact **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.

All returned goods are also to be accompanied by a completed **Returned Goods Health and Safety Clearance Form QF038** attached to the outside of the package (to be accessible without opening the package) and a copy of both forms should be emailed to support@geosense.co.uk, in advance.

16.1.1. Chargeable Service or Repairs

Inspection & Estimate

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

A valid purchase order (credit customer) or advance payment for the inspection fee(s) is required before inspection can take place. In the event of a warrantable claim being accepted, the value will be credited back to the customer's account (credit customer) or refunded (pre-payment customer).

16.1.2. Warranty Claim

(See Limited Warranty Conditions – section 17)

This covers defects which arise as a result of a failure in design or manufacturing. It is a condition of the warranty that the **VWLC** must be handled and used in accordance with the manufacturer's instructions and has not been subjected to misuse.

To make a warranty claim, contact **Geosense®** and request a **Returned Equipment Report Form QF034.** Tick the warranty claim box and return the form with the goods as detailed above. You will then be contacted and informed whether your warranty claim has been validated.

16.2. Packaging and Carriage

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

16.3. Transport & Storage

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

17. LIMITED WARRANTY

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

Sufficient site data has been provided to **Geosense®** by the purchaser as regards the nature of the installation to allow **Geosense®** to select the correct type and range of **VWLC** and other component parts.

The **VWLC** equipment shall be installed in accordance with the manufacturer's recommendations.

The equipment is warranted for **2 years** 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 **VWLC** equipment 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 **VWLC** equipment from the time of delivery to Purchaser

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