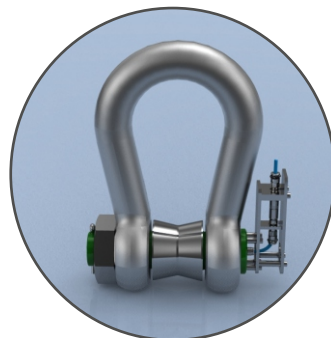
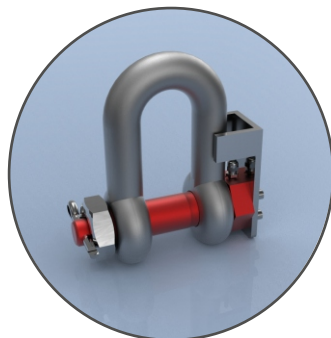




Operator Instructions for Load Shackles

Types: SHK-B, SHK-D, TELSHACK-B & TELSHACK-D



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1. GENERAL INFORMATION

1.1 Introduction

This instruction manual refers to the LCM Systems range of load shackles and includes instructions for both cabled and telemetry options. Before installing or operating any LCM Systems load shackle, this and any reference documents, should be read and understood.

In compliance with the Machinery Directive, LCM Systems load shackles will be supplied with the following documents: Instruction Manual, Calibration Certificate and a Declaration of Conformity.

These load measuring devices were designed and manufactured to be installed as partly completed machinery into a machine or partly completed machine.

These instructions must be retained and incorporated in the technical documentation for the machine or partly completed machinery into which the load shackle is installed.

All LCM Systems load shackles are designed and manufactured to LCM Systems Quality Management System which is certified to ISO 9001:2015.

LCM Systems load shackles affixed with the **CE** mark, are manufactured in compliance with the Machinery Directive 2006/42/EC and the following harmonised standards:

BS EN ISO 13849-1:2023 Safety of machinery - Safety-related parts of control systems
Part 1: General principles for design

BS EN ISO 13849-2:2015 Safety of machinery - Safety-related parts of control systems
Part 2: Validation

1.2 Markings CE

Each load shackle pin will be marked with an individual serial number and CE label. The WLL (Working Load Limit) or SWL (Safe Working Load) will be shown as standard embossed on the shackle bow.

1.3 Electromagnetic Compatibility (EMC)

The electromagnetic compatibility of the load cell device can only be assessed in conjunction with the entire installation, including its control systems. The machine builder who installs this partly completed machinery into a machine is responsible for compliance with the EMC directive.

1.4 Load Shackle Type/Model Number

Load Shackle: SHK-B, SHK-D, TELSHACK-B, TELSHACK-D and LCMXXXX (custom design).

All LCM Systems load cell designs are allocated a unique LCM number/model number. LCM number = LCMXXXX (where X= 0-9, i.e. LCM4203) or a model number (i.e SHK-B-1). LCM Systems send a drawing to the customer for approval prior to the manufacture of any custom designed load shackle.

1.5 Contact Details

Supplier/Manufacturer:

LCM Systems Ltd
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Barry Way, Newport
Isle of Wight PO30 5GY
United Kingdom

Tel: +44(0)1983 249264
e-mail: sales@lcmsystems.com

Service/Repair/Support:

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Isle of Wight PO30 5GY
United Kingdom

Tel: +44(0)1983 249264
e-mail: sales@lcmsystems.com

2. OPERATING INSTRUCTIONS

2.1 Installation and Operation

To ensure safe and trouble free installation of the load cell measuring device, the load shackle must be properly transported and stored, professionally installed and commissioned.

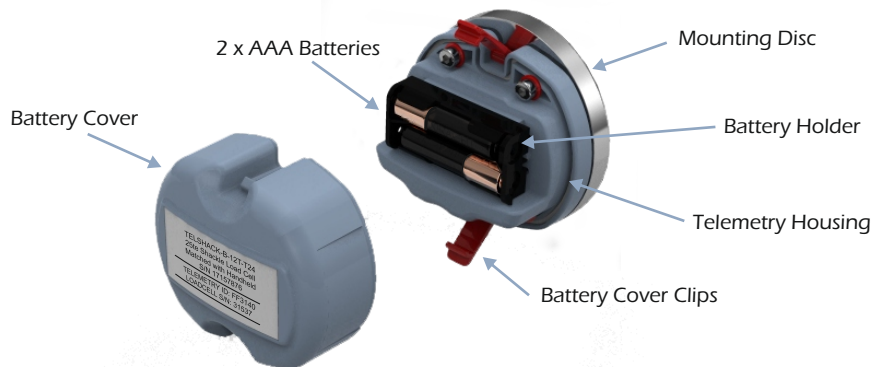
Unpacking

Before removing the load shackle, inspect the packaging for signs of damage and immediately inform the supplier if any damage is found. Unpack the load shackle carefully, taking special care with cables and be aware to the possibility of damaging low range devices by mishandling. Ensure that calibration and instruction information is not inadvertently discarded.

Checks Prior to Installation

- ⦿ If the load shackle is fitted with a cable and gland, check that the cable is held securely by the gland.
- ⦿ If the load shackle pin is fitted with a connector, check the connector is secure to the pin, check the plug and socket for any damage and check that the connector mates correctly.
- ⦿ Check the cable for damage, such as cuts or abrasions, especially where the cable enters the gland or connector assembly.
- ⦿ Check that all parts (as defined by the general arrangement drawing); cable assembly, anti-rotation bracket, split pins, nuts, washers, spacers, bobbins etc. are present.
- ⦿ If the load shackle is fitted with a telemetry module, check that the 2 off AAA batteries are correctly installed, that the two RED clips on the telemetry housing are closed and that the battery cover is secure. See Figure-1 for details.

Figure 1



Installation

Load shackles are normally classified as portable devices, and as such correct installation is critical to ensure product life cycle. To avoid damage or loss of accuracy during installation the following points should be followed:

- ⦿ The direction of the load applied to a shackle should be linear, as shown in figure 2.
- ⦿ Ensure the shackle pin does not experience torque or bending forces during operation.
- ⦿ For optimal performance the load should be central to the pin. The use of a load bobbin is recommended.
- ⦿ If the load shackle is fitted with a cable, it must be installed in such a way as to avoid damage from impact, abrasion or movement. The installer must ensure the cable meets the operational requirements of the application.
- ⦿ If the load shackle is fitted with a telemetry module, ensure that there is clear line-of-sight between the transmitter and receiver, and that objects or structures are kept at least one metre away from the antennae wherever possible. The installer should also first read the T24 Telemetry User Manual which can be found at the following web address: <http://www.lcmsystems.com/T24>

Figure 2

Typical load shackle (bow type telemetry version shown)

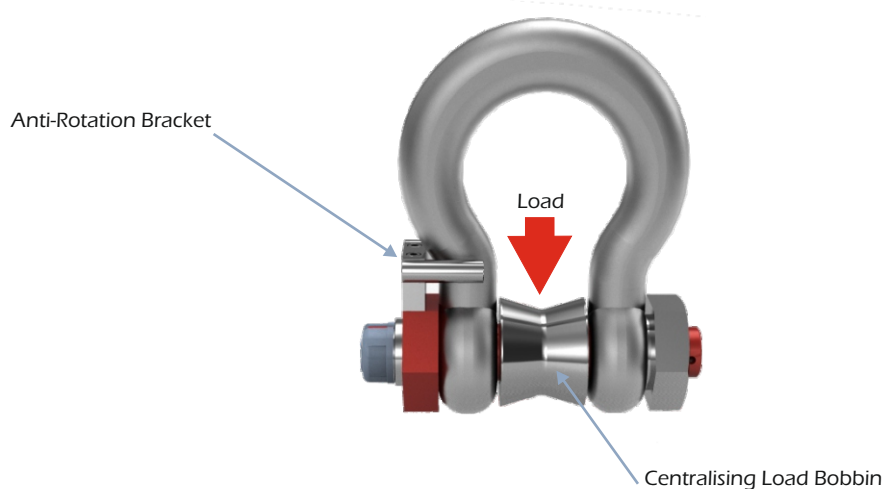
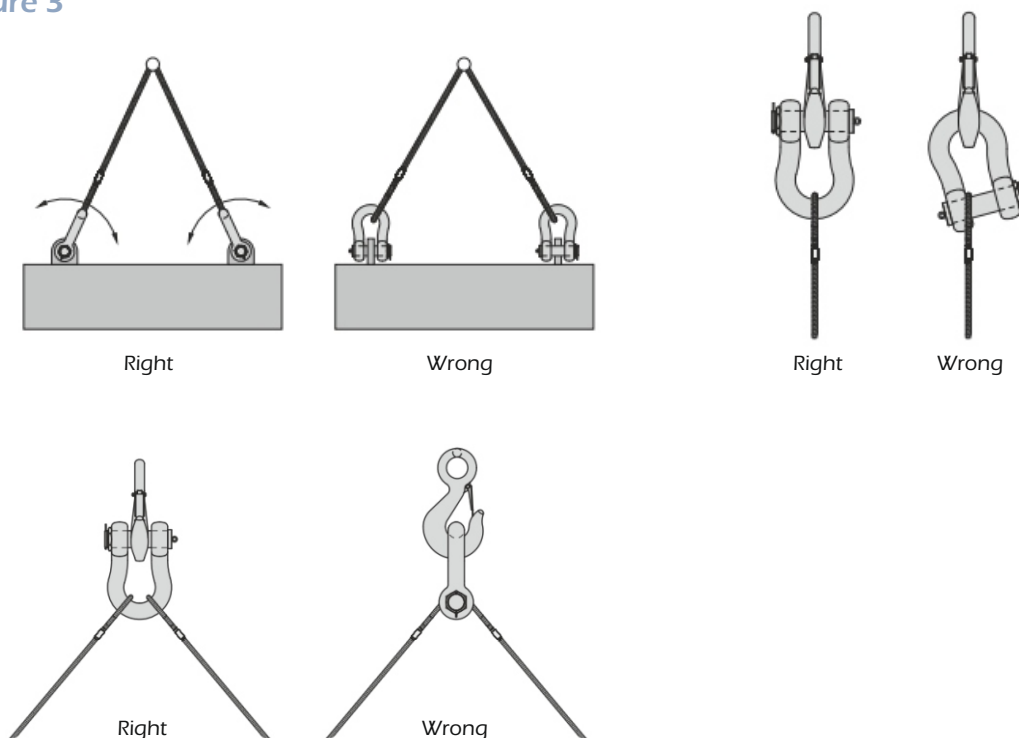


Figure 3



All load shackles supplied by LCM Systems Ltd are sold with the express understanding that the purchaser is thoroughly familiar with the safe and proper use and application of the product. Responsibility for the use and application of the product rests with the user. Our engineering personnel are readily available to answer any technical questions.

Failure of the product can occur due to misapplication, abuse, or improper maintenance. Product failure could allow the load to become out of control, resulting in possible property damage, personal injury or death.

Load limit ratings indicate the greatest force or load a product can carry under usual environmental conditions. Shock loading and extraordinary conditions must be taken into account when selecting products for use in a system. In general, products are used as parts of a system being employed to accomplish a task. Therefore, we can only recommend within the Working Load Limits (WLL), or other stated limitations.

The Working Load Limit (WLL) of each product may be affected by wear, misuse, overloading, corrosion, deformation, intentional alteration, and other use conditions. Regular inspection must be conducted to determine whether use can be continued at the assigned WLL, a reduced WLL, or whether the product must be withdrawn from service.

LCM Systems shackle products are intended for tension or pull. Side loading must be avoided, as it exerts an additional force or loading which the product is not designed to accommodate.

Ensure the nut is screwed onto the shackle pin (finger tight only) and held in position by the split pin provided.

Incorrect seating of the pin may be due to a bent pin, too tight fitting thread or misalignment of the pin holes. Do not use the shackle under these circumstances.

The forged and hand-made nature of shackles invariably means there are inconsistencies in the finished manufacture (large forgings may have a dimensional tolerance of $\pm 5\%$). This can have an effect on the performance/accuracy of the shackle load pin; for example, if the shackle pin is inserted into the opposite side of the shackle to which it was calibrated, or if a different shackle is used.

Select the correct type of shackle and its WLL for the particular application. Should extreme circumstances or shock loading be applicable, this must be taken into account.

Make sure that the shackle is supporting the load correctly, i.e. along the axis of the shackle body centerline; avoid introduction of bending loads, unstable loads and do not apply overloads. Avoid eccentric loading of the shackle by either using loose spacers or a centralising bobbin.

Inspection

Inspection should take place at least every six months, and more frequently when the shackles are used in severe operating conditions. The load shackle should be inspected before use to ensure that:

- ⦿ All markings are legible.
- ⦿ The shackle body and pin are both identifiable as being of the same size, type and make.
- ⦿ The threads of the pin and the body are undamaged.
- ⦿ The body and the pin are not distorted or unduly worn.
- ⦿ The body and pin are free from nicks, gouges, cracks and corrosion.
- ⦿ Never use a safety bolt type shackle without using a securing pin.
- ⦿ Shackles may not be heat treated as this may affect their WLL.
- ⦿ Never modify, repair or reshape a shackle by machining, heating or bending, as this will affect the WLL.
- ⦿ Welding on shackles body and pins is not allowed.

This instruction manual assumes good rigging practices and does not advise on actual in the field use.

Terminology

Working Load Limit (WLL):	The maximum mass or force which the product is certified to support in service.
Proof Load Test:	A test applied to a product solely to determine injurious material or manufacturing defects.
Ultimate Strength:	The average load or force at which the product fails or no longer supports the load.
Design (Safety) Factor:	Denotes a products theoretical reserve capability; computed by dividing the Ultimate Load by the Working Load Limit, and expressed as a ratio.

2.2 Wiring and Electrical Checks

The correct connection of the load shackle to an instrument is critical to achieving and maintaining its performance and reliability:

- ⦿ Wiring connections are given on the calibration certificate supplied with each load shackle.
- ⦿ If a screened cable is fitted, the screen should be connected as specified by the manual of the instrument or signal conditioning board (including internally mounted boards) to which the load shackle is connected to.
- ⦿ Cable length should not be added to, or removed from the load shackle, as this could alter the outputs from the calibration figures issued.
- ⦿ If a junction box is to be used, check the connections are of good quality, secure, clean and the enclosure is free of moisture.
- ⦿ Load shackle cabling must be kept away from high power cables and equipment, high output RF equipment, inductive loads and generators. **Cables must not be run alongside power cables.**

2.3 Instrumentation and Display Set Up

The electrical output of the load shackle should only be connected to instrumentation with a high enough input impedance, preferably 1Mohm or greater, in order to prevent loading effects on the output sensitivity of the load shackle. LCM Systems offers a wide range of digital and analogue instruments ensuring compatibility. When setting up your load shackle, the following points should be acknowledged:

- ⦿ The zero load output given on the calibration certificate is the output of the load shackle with no load applied. This includes the removal of the load caused by any lifting accessories within tolerance.
- ⦿ The load on an installed load shackle will comprise of the load of your assembly (including sheaves blocks, shackles, ropes, hooks, slings etc.) and the active load (load lifted). Therefore, the output with no active load will be greater than the zero output indicated on the calibration certificate.
- ⦿ The output from the load shackle can be in various forms, 4-20mA, 0-10V, mV/V etc. See the calibration certificate for details.

2.4 Load Shackle Output Options

The load shackle can be fitted with a variety of built in (in-cell) signal conditioning pcbs, to offer either analogue, voltage, current signals or RS485 digital signals (in various protocols). When a wireless signal is required, the load shackle pin can be fitted with a T24 Telemetry Module as shown in Figure 1.

ICA

The ICA analogue signal conditioning (amplifier) pcb is available in six versions, offering a range of current and voltage outputs. All amplifiers have a wide operating voltage range.

- ⦿ ICA1 - 3 wire, 0.1 to 10.1V
- ⦿ ICA2 - 3 wire, 0.1 to 5.1V
- ⦿ ICA3 - 4 wire, $\pm 10V$
- ⦿ ICA4 - 3 wire, 4 to 20mA
- ⦿ ICA5 - 2 wire, 4 to 20mA
- ⦿ ICA6, 3 wire, $\pm 10V$

See the ICA Datasheet and Instruction Manual for further details:

http://www.lcm systems.com/ICA_In-Cell_Analogue_Strain_Gauge_Amplifier

DCELL

The DCELL Digital Signal Conditioning (amplifier) pcb, offers high speed, RS485 and CANBus outputs in several protocols.

DCELL Communication:	⊙ RS485 Baud Rate	2400 Min to 230K Max
	⊙ Protocols	ASCII MANTRABUS II Modbus RTU MANTRACAN

See the DCELL Datasheet and Instruction Manual for further details:

http://www.lcmsystems.com/DCELL_In-Cell_Digital_Strain_Gauge_to_Data_Converter

Telemetry

The T24 product range uses high performance two-way radio communication. Each load shackle fitted with the telemetry module requires either a T24 handheld device, digital/analogue interface or a base station and PC to communicate with. See the T24 User Manual for further details on the T24 range of products:

<http://www.lcmsystems.com/T24>

2.5 Checks after Installation

- ⊙ With the load shackle installed, check the displayed output is not negative, as this may indicate either a fault, or that a compressive force is being applied to the load shackle. See section 1.5 (installation) and Figures 2 and 3 for details of correct loading.
- ⊙ When applying a load to the shackle the output should increase in the positive direction. Use the calibration certificate for reference, to compare the output observed at certain loads. If these are not the same, check the following:
 - a. All electrical connections are correct, i.e. to an instrument or a junction box etc.
 - b. If a connector is fitted, ensure that it is fully mated.
 - c. The pin is fitted as calibrated.
 - d. The load shackle is properly loaded.

2.6 Load Shackle Specification

LCM Systems load shackles are split into 4 different types, all of which have datasheets which can be found at the following website address: http://www.lcmsystems.com/resources/load_cell_datasheets.html

SHK-B	Standard design load shackle (Bow) - LCM standard range
SHK-D	Standard design load shackle (D) - LCM standard range
TELSHACK-B	Standard design telemetry load shackle (Bow) - LCM standard range
TELSHACK-D	Standard design telemetry load shackle (D) - LCM standard range

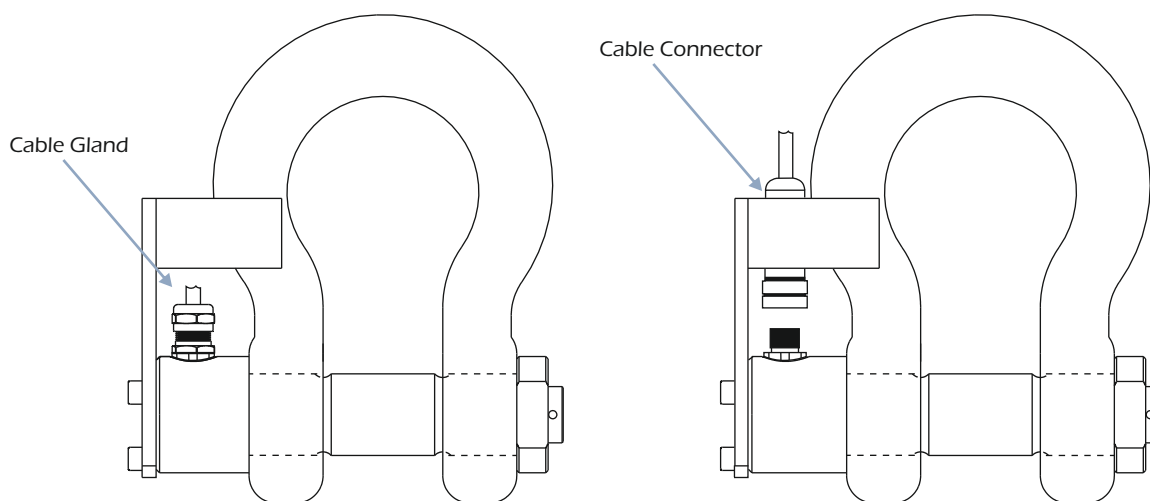
3. CABLE INFORMATION

3.1 Cable Gland and Connector Configurations

Load measuring shackles are designed for many diverse applications, and as direct replacements for standard shackles already in service. The range of LCM Systems load shackle pins can be supplied with various cable gland and connector configurations. All cable gland wiring colours or connector pin details are shown on the Calibration Certificate supplied.

The removal or replacement of the cable gland or bulkhead connector or any adjustment or repair must either be performed by LCM Systems or by a suitably qualified and approved engineer.

Examples of cable gland and connector arrangements:



3.2 Mating and de-mating connector assembly

- ⦿ Check both halves of the connector for any damage or obstructions.
- ⦿ Align the connector assembly and mate the two halves. Press firmly to ensure they are fully engaged.
- ⦿ Tighten the locking sleeve. Finger tight is enough to complete the mating process.
- ⦿ Always fully disengage the locking sleeve before attempting to de-mate the connector.

4. ONGOING MAINTAINANCE AND CARE

4.1 Calibration

All LCM Systems load shackles are calibrated in UKAS traceable test machines, configured to best simulate normal loading conditions.

We endeavor to match the loading conditions that would be experienced in service, but it is not possible to totally simulate the on-site structure for every load shackle manufactured. For this reason, and optimum system accuracy, calibration in the final assembly is recommended.

On-site calibration should be performed in accordance with the manual for the instrument to which the load shackle is connected to.

4.2 Warnings/Hazards

Load shackles are highly stressed devices, and commonly have safety factors between three and five times the rated capacity under static conditions. Fatigue applications and environmental factors can contribute to reducing this margin.

The user should determine the effect of any substance to the exposed load pin materials. Where a corrosive environment is present, load shackle pins can often be manufactured from corrosion resistant materials, or alternatively, isolation barriers can be employed between the corrosive environment and the load shackle pin.

The following points should be followed to avoid potentially hazardous situations:

- ⦿ Do not weld near to installed load shackles. Leakage currents may destroy the load shackle pins circuits.
- ⦿ Load shackle pins are sealed units and must not be dismantled. Damaged load shackle pins should be returned to LCM Systems for any repairs and re-calibration.

- ⦿ The accuracy of the system is dependent upon the correct installation of the load shackle.
- ⦿ Load shackles must not be handled or carried by the cable.
- ⦿ Load shackles must not be subjected to shock loads, such as using a hammer to force an assembly on to the pin.
- ⦿ Avoid using within 20-30 minutes of a rapid change in temperature, as this can affect the accuracy of the device. The operating temperature is -20°C to $+70^{\circ}\text{C}$.
- ⦿ The load shackle must never be placed in a potentially explosive environment, unless the product is suitably certified (ATEX or IECEx).

4.3 Inspection and Repair

Repair

Only LCM Systems personnel are authorised to carry out a repair or service to their products. All repairs or services will be carried out in the premises of LCM Systems. The unit is not serviceable outside of LCM Systems premises.

Inspection

All LCM Systems load shackles should be subject to periodic inspection, which should include, but is not exclusive to the following checks:

- ⦿ Completion of the checks after installation, see section 2.5.
- ⦿ Check output at zero load (shift in zero offset). Verify against calibration certificate.
- ⦿ Inspect to see if the load shackle has been damaged/worn or chemically attacked (from a corrosive environment or lubricants etc.).
- ⦿ For cabled versions, verify the integrity of the cable.
- ⦿ After any serious operating incident, repeat first four checks above.
- ⦿ For load shackles fitted with a telemetry module, check that the batteries are correctly installed. The battery holder shows pictorially the correct orientation.
- ⦿ For load shackles fitted with a telemetry module, check for any signs of water ingress to the battery compartment and for any battery corrosion.
- ⦿ In the unlikely event of this device failing, fit new batteries (if applicable) and re-test. Only when this has been done should you report the fault. When reporting the fault, give a full description of the problem and the type of application the device is being used for.

**IF IN DOUBT ABOUT ANY ASPECT OF THE SELECTION,
INSTALLATION OR USE OF A LOAD SHACKLE,
CONTACT LCM SYSTEMS FOR ADVICE BEFORE INSTALLING**

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LCM Systems Ltd reserve the right to make changes to its products and specifications without notice.

5. DECLARATION OF CONFORMITY



SAFETY COMPONENTS PUT ON THE MARKET SEPARATELY

LCM Systems Ltd. certifies that the load cells described hereafter are in accordance with the essential requirements defined in the European Machinery Directive 2006/42/EC and the related harmonised standards:

BS EN ISO 13849-1:2023 - Safety of machinery - Safety-related parts of control systems
Part 1: General principles for design

BS EN ISO 13849-2:2015 - Safety of machinery - Safety-related parts of control systems
Part 2: Validation

Technical files regarding the conformity of the products detailed herein are at the disposal of an authorised body on request.

This declaration is only valid for use with product types as detailed herein. Products must be used strictly according to the specifications and instructions detailed in this manual. The load cells are defined by their product datasheets, which are to be used in conjunction with this manual and their Calibration Certificate to ensure the correct maintenance and repair of the product.

Load Cell Type: Load Shackle: SHK-B, SHK-D, TELSHACK-B, TELSHACK-D and LCMXXXX (custom design)

Product Description: See corresponding product datasheets, calibration certificates and general arrangement drawings for full details.

To be in accordance with the CE requirements, the customer has to verify the compatibility between any electronics not supplied by LCM Systems (in accordance with referred directives in the industrial environment) and the LCM Systems load cells.

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