Marine Equipment Repairing & Maintenance CO.LLC

INTRODUCTION

"SAFETY" COMES "FIRST" Safety is an important concern worldwide and supersedes all industry planning decisions today. Several studies in the past have proved that damages due to poor safety measures are more than to any other reasons.

The crane operator on his experience and j udgment has to often carry out difficult lifts thus introducing chances of human error. This may lead to an accident or damage to the crane, surrounding equipment/property and cause serious injury to the operator or people near the vicinity of the crane.

Safe Load Indicator System is an important operational aid to the crane operator to enhance his experience and judgment by providing him "in -box", all information he needs to carryout the various lifts. The Safe Load Indicator System provides the crane ope rator with the information necessary to operate the crane safely within the maximum permitted loading as specified by the crane manufacturer. It helps in eliminating over -turning, overloading and reducing the down time of the crane, thus maximising product ivity and improving work safety.

Electronic Safe load indicator System provides improved accuracy, faster response and very high reliability over other conventional Safe load indicator systems. Those electronic Safe load indicator systems which use the lat est digital technology are far more robust, have longer life and are very easy to operate and service. No wonder today, all mission critical equipments are based on the digital technology.

SPECIAL NOTE: *Safe Load Indicator system is an AID only; it can not be a substitute for a good operator and his experience. The system warns the operator about impending overload or overhoist conditions. It is operator's sole responsibility to analyse the warnings and carryout crane operations safely.*

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SPECIAL NOTE FOR DYNAMOMETER INSTALLATION AND USE

Please Note: Remove dynamometers during dragline and piling operations.

Dynamometers (Tensiometers / line-riders) are NOT designed for use on wire ropes performing Piling operations due to the high cycle and high speed s combined with high line pulls.

Please ensure that they are removed before commencing operations.

We will not accept responsibility for either rope or dynamometer damage resulting from this type of use.

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Salient features of Fusion Tech system:

- Designed keeping in mind the requirements of the crane operator provides all information simultaneously.
- Simple but versatile product.
- Suits all types of cranes, Modular design, and system can be varied to suit each customer's requirement.
- Latest technology using the Digital Signal Processing (DSP) technology.
- Robust design optimised for harsh and severe environmental conditions. All system components Encapsulated for environmental protection.
- Compact easy to read display, requires minimal cabin space.
- Site calibration facility.
- Easy to install and maintain.
- Clear audio-visual warning with on display panel describing alarm condition.
- Minimal maintenance required.
- Digital (Relay) output for interfacing motion cut off facility.
- Hooks se lection (Main or Auxiliary) and Tare facility.
- Rugged power supply unit capable for varying input 10 Vdc to 36Vdc.
- Operating Temperature Range: 0°C to 60°C.

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System General Description

The SLI system functions by continuously monitoring the load applie d to the crane due to lifted load and other inbuilt loads, and comparing that with the maximum permitted load, at that particular crane configuration i.e. Safe Working Load (SWL). The SWL depends on the configuration of the crane i.e. boom length, boom ang le, Jib length, Jib angle, outrigger position, front lifting or 360 degree lift etc. This information is either user (operator) selected or is sensed directly using high accuracy sensors placed on the crane. Sensors are usually required to sense the boom a ngle, boom length(in case of telescopic crane), slew angle, crane super structure angle, hook height, Jib angle, counterweight, wind speed and the outrigger positions. Number of parts of lines (falls), lattice boom length and crane mode is operator selecte d.

The load on the hook is continuously monitored and is compared by the calculated SWL, to get the load in terms of %SWL. This complex and tedious %SWL calculation is quickly carried out internally by the system within a fraction of a second. Using the preset limits programmed in the system, the system gives the visual, audible warnings and motion cut off signals, depending upon the value of %SWL. The system is very responsive to any changes in the crane parameters thus ensuring that the crane does not enter into an unsafe condition.

The ASLI-8048 SLI system also monitors the hooks of the crane against over Hoisting. A limit switch along with a dead weight is suspended from the boom tip, and the switch operates when the over hoisting of the hook takes pl ace. The system instantaneously gives the visual, audible warnings and motion cut off signals.

The motion cut off can be implemented in a crane by interfacing control values in the crane drive mechanism or magnetic linkages in the pedal or lever mechanism.

The SLI system for a crane will basically consists of:

1. Display unit.
2. Load sensor (for Main and Auxiliary hook or Jib).
3. Angle transducer
4. Length transducer (For Telescopic cranes)
5. Anti two block (optional)
6. Motion over ride (optional)

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Both the hooks of the cranes are independently monitored. The system has the provision to selects the hook, to which the load is applied and monitors the hook

All lift and crane operating conditions are displayed simultaneously on the displayUnit. The operator is provided with all the information he needs to carry out a safe lift.

The display unit displays these readings:

Load

S.W.L. or Maximum Permitted Load for the actual crane condition as a bargraph

Boom Angle

Crane Radius

Boom Length

Configuration Selected includes, winch selected, part of lines (falls).

Tare Facility indicating ON or OFF

Status indication for load conditions; ‘Safe’, ‘Alert’, ‘Alarm’, ‘Stop’, ‘Over ride’, Anti -Two-Block’.

The %SWL preset limits are factory programmed and may vary depending upon each country’s safety regulation or customer safety requirements. The SLI system offers facility to users to modify these limits to suit requirements. But this modification requires a supervisory password.

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System Components

1. Display unit:

The display unit is the most important component of the SLI system. It is the interface between the SLI system and the crane operator. The display unit has digital display modules, Indicating lights, audible alarm unit and a small keypad. The display module has a backlight for night and low light operations. The display unit simultaneously displays all information required by the operator without need for toggling any keys.

The system can be calibrated by us ing the four keys on the display unit. The keys have dual functions; they work differently during normal and calibration mode. The software calibration is quick and easy, and requires no external aids or equipment.

Input from all sensors is terminated at the display unit. The display unit processes these signals and gives the required output. The display unit ideally houses the control and display electronics circuitry, the power supply unit and the relay board for interfacing motion cut off facility.

The display unit has a robust power supply unit capable of handing large variation in input voltage. The power supply unit can work from 10Vdc to 36Vdc. This ranges is vast and suits power requirements for almost all types of cranes. Care must be taken at th e power source to suppress any large voltage spikes and disallow over –voltage to be given to the display unit.

The display unit enclosure is made of cast aluminium with IP54 grade protection. It has gland entry for all cables coming from the sensors, powe r supply source and output actuators like the solenoid values. The connection of the cables is through PCB mounted connectors. Number ferules or specific colour codes are provided to each separate wire to avoid any wrong connections.

Note: *Nothing inside the display unit is user serviceable. If tampered, the system may fail permanently and may need replacement . Do not open the cover when system is powered on. At power on, verify that the configuration indicated on the display is the current crane –operating configuration in use.*

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2. Load Sensor:

The ASLI-8048 SLI System uses various types of Load sensors. The selection of the load sensor to be used depends upon the crane type, crane configuration, lifting conditions, installation ease and other conditions. All load sensors provide the same level of reliability, safety and accuracy. The load sensors are rugged and designed to handle impact loading and safe overload up -to 200% of its capacity. The ultimate overloading capacity of the load sensor is usually 300% or more. All load sensors are made of special alloy steel and coated to withstand harsh climatic conditions. The sensors incorporate a special purpose electronic circuitry to provide an output variable with the load applied.

The various load sensors used with Fusion Tech System are:

a. Dynamometer
b. Tensile Load cell
c. Pressure transducer
d. Load Pins

a. Dynamometer

The Dynamometer is suited for all types of cranes; hydraulic, mechanical or electrically operated cranes having lattice or telescopic boom. Dynamometer or t he running wire tensiometer is fitted on the hoist line wire rope between the wire rope drum and the sheave pulley block. The hoist wire rope is made to deflect between a set of three pulleys in a manner to allow the force to act on the centre pulley. A co mponent of the force in the wire rope acts on the centre pulley. This force component is measured by a load cell and is equated with the load lifted. The dynamometer is welded on to the boom, either the base section or the top section, if the hoist wire ro pe is running parallel to the boom, or else it is left floating on the wire rope with one end tied to the boom using articulating arm.

b. Tensile Load

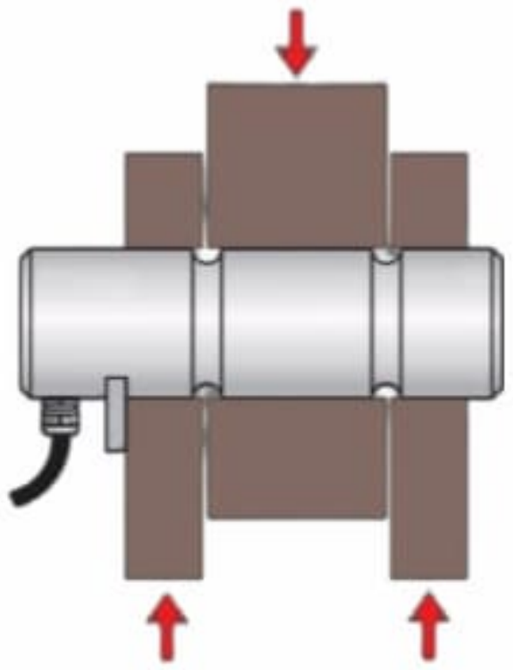
cellTensile load cell is best suited to be used in cranes having fixed boom and cranes where luffing mechanism is with wire rope. Tensile Load cell is used to measure the force in hoist wire rope, which is equated directly to the load lifted. It can also be used to measure the force in luff wire rope to calculate the load moment and then equated it with t he load lifted. Tensile Load cell are connected in line with the luff or hoist wire rope and at the dead end of the wire rope, using load plates and pins.

c. Pressure Transducer

Pressure transducer can be used only for hydraulic telescopic cranes having lu ffing cylinders. The pressure transducers measure the pressure in the luffing cylinder(s), to calculate the load moment and then equate it with the load lifted. Usually two pressure transducers are used to measure the differential pressure of the luffing cylinder.

d. Instrumented Load Pin

The load pin of the sheave pulleys can be replaced by an instrumented load pins as a load sensor. Usually used in a single pulley system, instrumented load pins are usually used in monitoring the load on Auxiliary or Jib hook. Since they replace the existing load pin they have to be customised.



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3. Angle Transducer

Angle transducer is used to measure the boom angle of the crane. The measured boom angle is used in the calculation of the crane radius. The Angle transducer is usually mounted at the base section of the boom, close to the boom foot pin. The Angle transducer has an electronic high precision sensor. The change in the angle of the boom produces electrical signal. This signal is input to the display unit. The angle t ransducer is designed to measures angle from 0 degree to 90 degree. The angle transducer has internally dampening techniques to avoid vibration.

4. Anti-two-block

unitAnti two-block unit or over hoist limit switch is used to monitor the hooks of the cran e against over hoisting. The unit consists of a limit switch along with a dead weight, which is suspended from the boom tip over the wire rope. When the hook is over hoisted the hook raises the dead weight operating the limit switch. The anti two block sig nals are directly sent to the control unit in a lattice boom crane or through a length transducer in a telescopic crane.

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Display Function

The display unit simultaneously displays all the information required by the crane operator to operate the crane safely. The display unit is compact in size and uses very little cabin space.

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System Installation

This chapter includes procedure for installing the SLI system on the crane. The procedure is common for lattice boom and telescopic boom crane.

Display unit

The display unit is to be mounted inside the cabin in front of the cr ane operator in a position from where the operator will have clear view of the readings and can operate the system. The display unit is supplied with a U frame for mounting. The U frame has mounting blocks which is to be welded to the cabin. To change the viewing angle of the display unit, loosen the screws and adjust the display unit and tighten the screws.

Load Sensor

Dynamometer

Preferably, the dynamometer should be placed close to the boom tip, away from the winch drum, either welded on the boom or fix ed to the boom using the articulating arm. Alternatively it can also be placed down close to the boom foot pin, tied to the base section of the boom using articulating arm. The later arrangement is usually not preferred since the dynamometer will be subjected to lots of movements.

To install the dynamometer first remove the upper two pulleys. Hold the wire rope through the center pulley and then fit the upper pulleys. The dynamometer should be mounted such that the arrow on the load cell should be facing to wards the tip of the boom. The articulating arm is welded towards the tip of the boom. The hook joint of the articulating arm is to be welded on the box boom in case of telescopic crane else to a plate in case of lattice boom. The plate then has to be bolted to the lattice interlacing close to the tip of the base section. Bolt another plate to let the dynamometer rest on the lattice boom.

Connect the dynamometer cable to the preamp. Carefully route the cable along the boom member, then from the boom butt to the crane cabin. Use cable tie to tie the cable firmly to the boom. Keep the cable loose around the boom hinge pin; this area is most p rone to cable damage. Connect the load cell cable to the display unit.

Pressure Transducer

Pressure sensors are mounted on the control valve of the luffing cylinder to the rod end and piston end. Connect the Pressure sensor cables to the display unit. Use cables tie to tie the cable firmly to the base.

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Angle Transducer

Angle Transducer Unit is to be mounted on the boom close to the cabin. It can be mounted on the right or the left side of the boom. The mounting position acceptable for the angle sensor unit is with its connector side facing down. This ensures the correct positioning of the electronic angle sensor unit. To mount the angle sensor unit, first mount the frame supplied. The frame is to be welded to the boom base section.

Then mount the angle transducer unit on the frame with the four screws supplied. Connect the angle transducer cable to the angle transducer unit. Carefully route the cable along the boom member, then from the boom butt to the crane cabin. Use cable tie to tie the cable firmly to the boom. In case of box boom section a pipe of appropriate internal diameter has to be welded on the boom for cable routing. Keep the cable loose around the boom hinge pin, this area is most prone to cable damage. Connect the angle transducer cable to the control unit.

Cables

All Cables are braided, screen type and have quality MS connectors at both the ends and metal gland at one end (except the power supply cable, one end of this cable is without glands and has to be interfaced with the crane electri cal supply). The Cables are labeled as per the type.

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System Maintenance

Dos and don’ts (Instructions to Operator)

Operations

Start-up

For a crane having multiple configurations, the operator should select the correct configuration, otherwise the crane will be operating in a dangerous zone.

BYPASS SWITCH

Bypass switch inhibits the motion cut off facility. Bypass switch is to be used only when the operator is sure of the operations and knows that they are safe. The system will give audible and visual alarm but will not cut off a crane motion.

General

The Fudion Tech system is des igned to provide service with little routine maintenance. The following maintenance procedure will extend the life of the system and assure continued performance to the specification.

The Display unit should be kept free of accumulated dust, dirt, grease etc. It should be kept clean and away from any solvent, acid or alkali. Do not use abrasives or stiff bristle brushes; it may damage the display facial. If the display facial becomes dirty, clean it by a non -abrasive cloth dampened with isopropyl alcohol o r methyl spirit. Be careful not to press the display window unduly. Ensure the display cable connector is proper / tight.

The dynamometer is designed for heavy -duty use. Check that the cable and connector on the load sensor are in proper condition.

Check all cables external and internal to the cabin. Check cables against damages particularly on the boom. Check for tightness and bonding on cable glands. Ensure that all cables are tied to the

articulating arms and booms. Check the places were the cable is e ntering the cabin. Check the accuracy of the load indicator by lifting a load of known weight.

The system should be isolated from both terminals of the crane battery before any welding is carried out on the crane.

Check the load pins / Dynamometer for security, particularly the split pins and washers.

Periodically (Preferably once in four months), check the accuracy of the system.

• Position the boom in two or three different position with the load suspended and accurately measure the hook radius. Compare with the display radius.

• Check the accuracy of the load lifted by lifting a load (duly calibrated) by a known weight.

• If an Anti-Two-block system is fitted, it should be checked by slowly lifting the hook block close to but not up to the boom tip and chec king that the display signal is activated.

Press the test switch and check for any erratic data being displayed.