SILICON INTERNATIONAL

Crane Moment Limiter

SLI-400

(Crane Computer)

PRELIMINARY

TECHNICAL MANUAL

SILICON INTERNATIONAL

171-COOPERATIVE MARKET SADDAR

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I. General Introduction

During operation, according to the specific circumstances at the working site, a crane has to frequently change its working conditions, such as the lifting angle and the boom length, to provide lifting. On the other hand, the rated maximum lifting capacity and the maximum and minimum working angle changes under different working parameters are also different. Therefore, we need a set of devices to indicate the working status of a crane, such as safe operation, overload, angle or length error, and to implement relevant alarming, indication and control, so as to ensure proper operation of the lifting machinery.

The full automatic crane moment limiters are suitable for use with telescopic boom or fix boom cranes. The system, which is a micro processing embedded operating system, has a friendly user interface, a small power consumption, strong functionalities and a high sensitivity and is compact in design, easy to operate and expand. It can display a crane's working parameters such as the actual lifted Load, the rated lifting Capacity, the Angle, the Length and the Radius. It has complete pre-alarming, overload alarming and overload output control functions; it has a complete system failure self-detection function and can display failures, which provides the operator with effective guidance in solving the problems.

1) Functions

The product is integrity of electronic technologies, microcomputer technologies and crane mechanical technologies. It has the following major functions:

☞ It can automatically detect various kinds of signals related to lifting devices and enter the signals into instruments for micro processing. The signals include: weight signals, length signals, signals of included angle between boom and horizon, etc.;

☞ The instrument can display various kinds of pre-defined parameters related to the working conditions. The parameters include: jib length, rated lifting capacity, actual lifted load, working angle of boom etc.

☞ The system can carry out automatic sampling and real-time tracking of the performance parameters of the lifting device and can use a microcomputer to calculate, compare and determine the parameters and give out acousto-optic alarms when necessary.

☞ The host computer is universal and can be adapted to various kinds of lifting devices by changing the software, without having to change the host computer. This facilitates mass production. The computer has stored multiple sets of rated load curves, which meets the requirements for alarming under various working conditions;

2) Major technical parameters

1. Working ambient temperature: $-20℃\sim60℃$

2. Working ambient humidity: 95% (25℃)

3. Working voltage: DC 12 or 24V ±20%

4. Working mode: Continuous

5. Vibration: Acceleration≤5g (g is gravity acceleration)

6. Overall system error: Less than ±5%

7. Overall power consumption: Less than 10W

8. Alarm volume: More than 60db

II. Composition and operating principles

A) System composition

Complete system consists of Operator Console, Junction Box, Length Sensor, Angle Sensor and Load Sensor.

1. Operator Console

Operator Console is a Micro Controller based low power latest technology that were developed based on single-chips are used. All-in-one means that all hardware circuits (CPU, A/D converter, EPROM, EEPROM, serial ports and other peripherals) of a system is integrated onto a single chip, thus providing extremely high reliability and resistance against interference and ensuring proper operation under the harsh ambient Temperature of -20Deg. C ~ +60Deg. C.

This Console consist of two PCBs. One is Controller PCB and other is Display PCB. Controller PCB receives all signals and power from Junction Box. After processing these signals it passes on to the Display PCB.
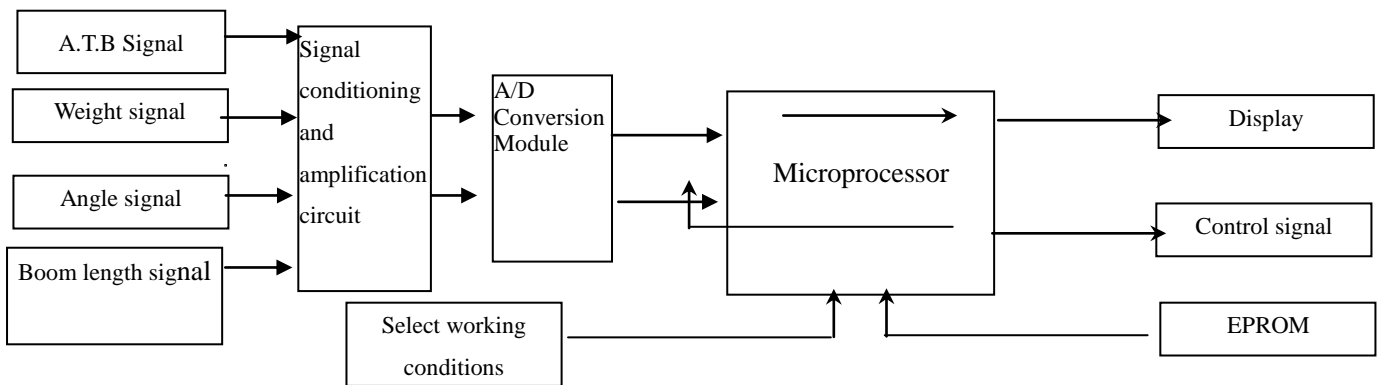
Display PCB displays all data with which a customer may be concerned on a single screen, such as the Angle, the actual lifted Load, the rated lifting Capacity, boom, Length & Radius. In addition these data it also display Continuously Crane Capacity and crane's safety status.

This Console is conne4cted with a Junction Box by a 10 core cable. This cable carries 12V or 24V power lines and preconditioned sensor signals.

2. Junction Box

Junction Box connects all Sensors, Operator Console, Power and Trip Alarm by connectors and cables. It also conditions sensor signals for the Micro Controller.

3) Schematic Block Diagram

A.T.B Signal → Signal conditioning and amplification circuit

Weight signal → Signal conditioning and amplification circuit

Angle signal → Signal conditioning and amplification circuit

Boom length signal → Signal conditioning and amplification circuit

Signal conditioning and amplification circuit → A/D Conversion Module → Microprocessor

Select working conditions → Microprocessor

Microprocessor → Display

Microprocessor → Control signal
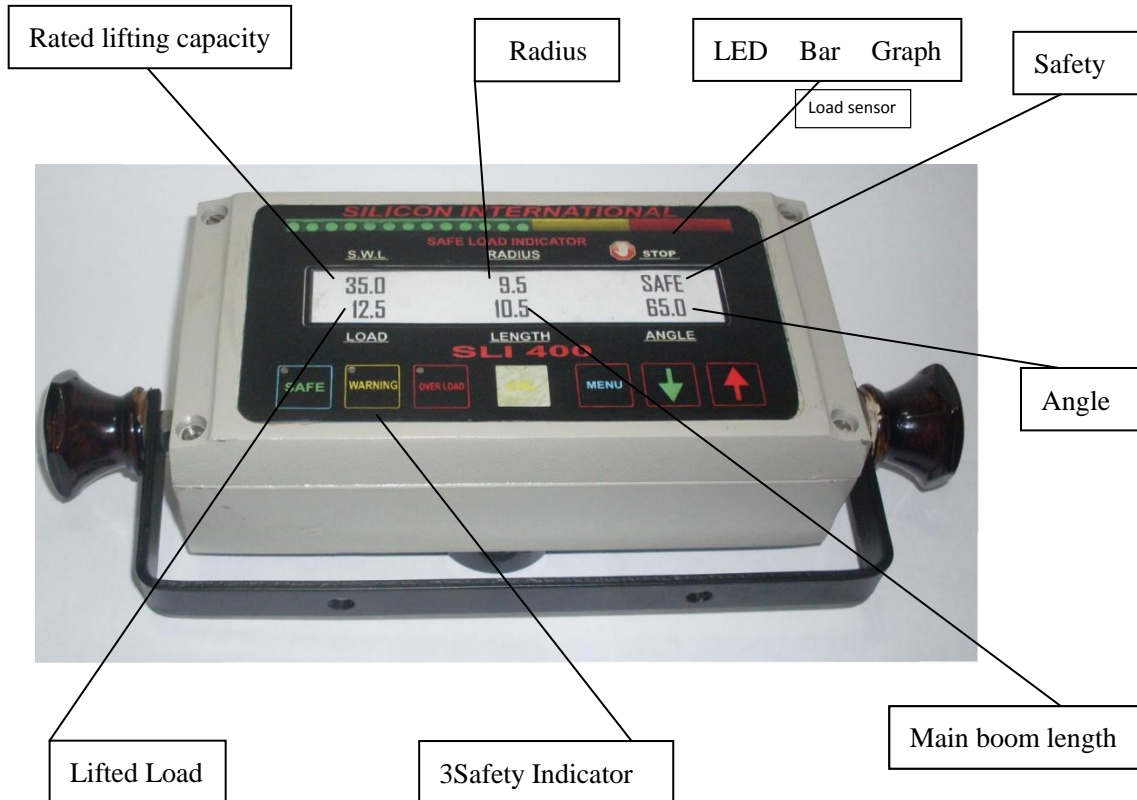
EPROM → Microprocessor

4) Operating principles

During the operation of Crane, the Microprocessor receives the current status of the sensors. Therefore, after collecting and processing of corresponding signals, the CPU will search for the corresponding curves of the load chart's, and determine the rated lifting capacity under the conditions, compare the capacity with the actual lifted load and carry out control. Of course it can also determine whether the limit is exceeded by checking the angles and carry out control.

During operation, the moment limiter first detects various kinds of operational parameters (angle, length & weight) of crane by corresponding sensors and sends signals to main board after simulated amplification adjustment, then converts the signals into digits by A/D and sends them to the core host computer. Then, microprocessor makes process and calculation

to data according to sets and some condition signals, after that, it on one hand sends the processing results to display, on the other hand compares the processing results with inherent load characteristic curves of crane (this part of curve is solidified in EPROM) to judge if the crane is in safe work area, based on which the microprocessor sends out corresponding control order in order to achieve the purpose of protecting the crane to operate safely.

III. DISPLAY

Interpretation of display interface

Rated lifting capacity

Radius

LED Bar Graph

Load sensor

Safety

SILICON INTERNATIONAL
SAFE LOAD INDICATOR

STOP

S.W.L   RADIUS

35.0   9.5   SAFE
12.5   10.5   65.0

LOAD   LENGTH   ANGLE

SLI 400

SAFE   WARNING   OVER LOAD   MENU

Angle

Main boom length

Lifted Load

3Safety Indicator

IV. Calibration

There are Three Parameters to be adjusted by the calibration.

1-Load

2-Boom Length

3-Angle

To enter into Calibration Mode, press "Cal" and "Menu" button together, first lift the "Cal" button and then lift "Menu" button.

Password request will display, to enter password press buttons in following sequence.

"Down"   "Menu"   "Down"   "Up"

Upon entering correct password following screen will appear,

"CALIBRATE WEIGHT   Y"

Press "Menu" button for YES if Load calibration is required, and if Load Calibration is not required then Press "Down" and then "Menu". It will skip to Length Calibration. If Calibration Weight is selected, following two lines screen appear.

  First line "CALIB. MIN WEIGHT"

Second line "000.0   000.0"

Second line first reading indicate the Weight AD Count. This reading range is with in "000.0 to 009.9" Lower down the Hook to completely on the GROUND and check that the reading is with in the range.

Now set the Min Weight = 000.0 Ton by following buttons

"Up" button for cursor shift "Down" button for change of the cursor Digit and "Menu" button for finish.

After minimum weight adjustment screen will display.

" MAX WEIGHT " Lift the Heaviest Weight available in the range.

Second Line left side reading AD Count should be less then 102.4 and now adjust the lifted Weight+Hook Weight in Right side reading same as above by the three buttons "Menu"   "Up"   "Down'.

Repeat the same process for Length and Angle Calibration.