Rated Capacity Limiter (RCL)

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Introduction

⚠ WARNINGS

The rated capacity limiter, is an electronic control device, designed to help the operator in the safe use of the machine, warning him by means of visual and audible alarms when approaching a dangerous condition.
However, this device won't replace the good experience of the operator in the proper use of the crane.
The responsibility of the operations in safety conditions of the machine is on operator care, as well as the fulfilment of all safety rules prescribed.
The operator must be able to recognize if the data transmitted by the system is correct and coherent with the real conditions.
He also must be able to utilize the data in order to operate in safe conditions.
The RCL is an electronic device with several components and could be subject to failures or defects.
The operator must recognize these events and must act consequently (to proceed to repair, if possible, or to call the constructor assistance).
Before starting the operations with the machine, user must fully read and understand this manual and follow the instructions written in it.

IMPORTANT NOTES

- The RCL is supplied with a device for automatic shut-off over-ride.
- In the normal working condition this device must be positioned properly not to operate the override functions.
- It is prohibited to use this device to lift loads exceeding the load table limits provided by the manufacturer of the crane.
- The device must be used only in extreme cases: malfunctioning or situations justifying its use.
- The use of the device is allowed only by authorized personal, who are responsible of its use.
- The RCL has a powerful FAIL-SAFE self-diagnostics program suitable to verify the good operation of its circuits and measuring transducers. In case of a failure is detected, the RCL puts itself in emergency status by blocking the manoeuvres.
- Nevertheless, the operator, before starting the operation of the machine, must secure that the RCL functions correctly. To do this, he must verify the accuracy of the displayed values by performing some tests. He must also verify that there are not messages or alarm indications, and verify the correct operation of shut down function.

- The limiting device can not recognize automatically the machine stabilizing configuration (outrigger beam not fully or partially extended or retracted, operations on tyres), the operator is consequently fully responsible for stabilizing configuration setup on limiting device according to crane operating configuration.
- About this, follow the indications given forwards in the manual and concerning the operating modes. An incorrect setting of the tables associated to each work configuration can cause an incorrect operation of the RCL, will create a dangerous situation in the crane operating. For this reason it is essential to set the correct operating mode.
- These operating conditions generally vary when:

  a) outriggers are extended or retracted

  b) switching, the operation from outrigger mode to on tires mode

  c) shifting from operation in static conditions to translation

  d) telescopic mechanical extensions are extended or not

  e) further equipment (jib, ext, etc.) are installed or not

  f) the number of parts of line is properly selected.

System operation description

The Rated Capacity Limiter is designed to aid the operator in safe functions of the crane.
The RCL compares automatically the lifted load to the maximum one supplied by load table providing the necessary information to the user in order to work in safety condition.

The main readings are:

- actual lifted load
- maximum admitted load
- tilting percentage
- operating radius
- boom angle
- boom extension (length)
- working mode (Operating mode)
- warning lights (green, yellow, red) and audible alarm.

The system determines the lifted load by computing it from the relevant sensing devices signals (pressure or load cell), and by means of the measures of boom angle and extension operating radius is computed too.
The lifted load is continuously compared with the maximum allowable load obtained from the load tables.
Consequently three possible situations can occur:

1) Safety
   green lamp is on, no presence of acoustic signal: lifted load is lower than 90% of the maximum load.
2) Warning
   yellow lamp is on and audible alarm intermittently sounds; this is the warning situation.The signal occurs when the lifted load is more than 90% and less than 100% of maximum load.
3) Alarm
   red lamp is on and audible alarm sound continuously inside the cab, another audible intermittent alarm sound outside the cab. The external alarm device is positioned on the lower part of the main boom. Lifted load exceeds the allowable load so that the control functions shut down is activated.

In the alarm situation, only control function operations to allow the machine in a safe working condition are enabled.

Main features

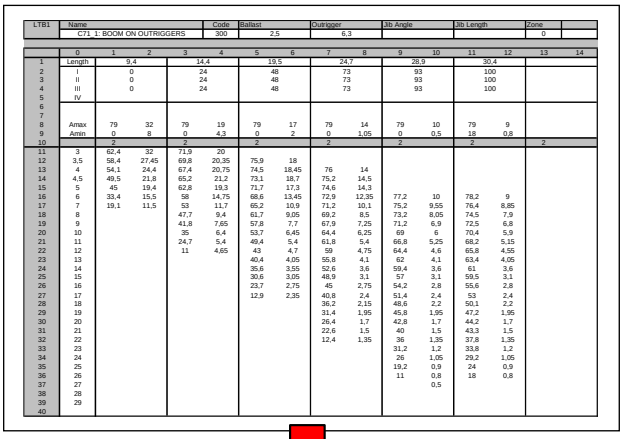
Working condition measuring

PRESSURE TRANSDUCERS (lifted weight data)

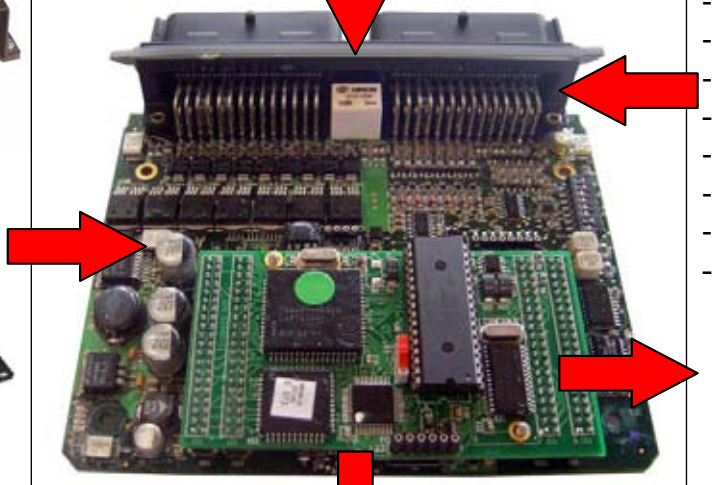
LENGTH/ANGLE SENSOR (Boom's geometrical data)

AUTOMATIC SELECTIONS External Micro-switches:
- Rotation
- A2B

Memorization of the load charts/ table and data computing



LTB1	Name				Code	Ballast		Outrigger		Jib Angle		Jib Length		Zone	
	CT1_1: BOOM ON OUTRIGGERS				300	2,5		6,3						0	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Length	9,4		14,4		19,5		24,7		28,9		30,4			
2	I	0		24		48		73		93		100			
3	II	0		24		48		73		93		100			
4	III	0		24		48		73		93		100			
5	IV														
6															
7															
8	Amax	79	32	79	19	79	17	79	14	79	10	79	9		
9	Amin	0	8	0	4,3	0	2	0	1,05	0	0,5	18	0,8		
10		2		2		2		2		2		2		2	
11	3	62,4	32	71,9	20										
12	3,5	58,4	27,45	69,8	20,35	75,9	18								
13	4	54,1	24,4	67,4	20,75	74,5	18,45	76	14						
14	4,5	49,5	21,8	65,2	21,2	73,1	18,7	75,2	14,5						
15	5	45	19,4	62,8	19,3	71,7	17,3	74,6	14,3						
16	6	33,4	15,5	58	14,75	68,6	13,45	72,9	12,35	77,2	10	78,2	9		
17	7	19,1	11,5	53	11,7	65,2	10,9	71,2	10,1	75,2	9,55	76,4	8,85		
18	8			47,7	9,4	61,7	9,05	69,2	8,5	73,2	8,05	74,5	7,9		
19	9			41,8	7,65	57,8	7,7	67,9	7,25	71,2	6,9	72,5	6,8		
20	10			35	6,4	53,7	6,45	64,4	6,25	69	6	70,4	5,9		
21	11			24,7	5,4	49,4	5,4	61,8	5,4	66,8	5,25	68,2	5,15		
22	12			11	4,65	43	4,7	59	4,75	64,4	4,6	65,8	4,55		
23	13					40,4	4,05	55,8	4,1	62	4,1	63,4	4,05		
24	14					35,6	3,55	52,6	3,6	59,4	3,6	61	3,6		
25	15					30,6	3,05	48,9	3,1	57	3,1	59,5	3,1		
26	16					23,7	2,75	45	2,75	54,2	2,8	55,6	2,8		
27	17					12,9	2,35	40,8	2,4	51,4	2,4	53	2,4		
28	18							36,2	2,15	48,6	2,2	50,1	2,2		
29	19							31,4	1,95	45,8	1,95	47,2	1,95		
30	20							26,4	1,7	42,8	1,7	44,2	1,7		
31	21							22,6	1,5	40	1,5	43,3	1,5		
32	22							12,4	1,35	36	1,35	37,8	1,35		
33	23									31,2	1,2	33,8	1,2		
34	24									26	1,05	29,2	1,05		
35	25									19,2	0,9	24	0,9		
36	26									11	0,8	18	0,8		
37	27										0,5				
38	28														
39	29														
40															



Activation of the emergency functions
External Alarm / Automatic shut off

Visualization data and setting

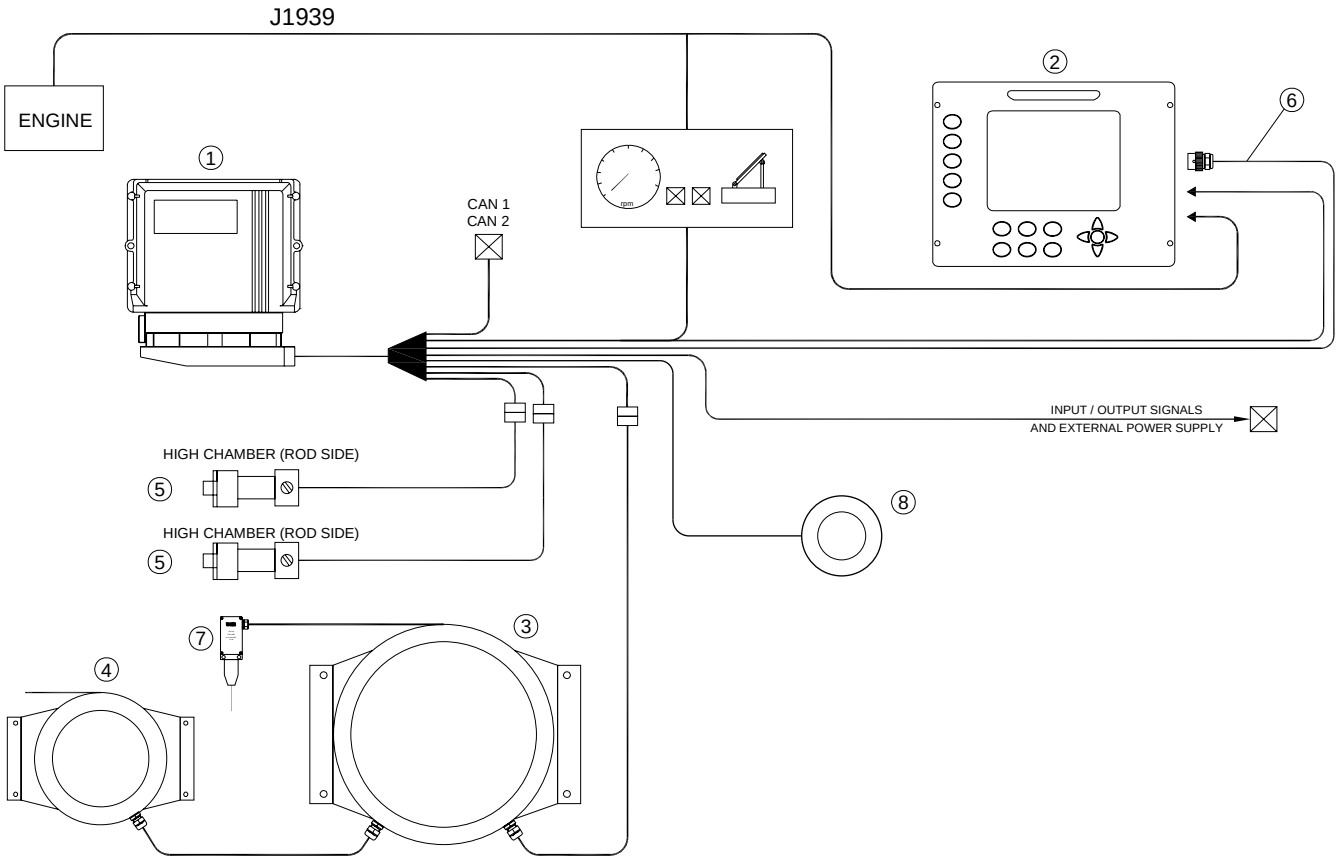
CONTROL PANEL

Readings:
- % tilting
- Lifted Weight
- Load allowed
- Working Radius
- Boom Extension
- Boom Slope
- Operating Mode
- Attachment used
- Diagnostic

ALARM:
Lights
Green,Amber,Red

MANUAL SELECTION:
- Outrigger
- Translation mode
- N° Rope
- Main Boom
- Inclination attachment

System description



Ref.	Description
1	Main Unit
2	Display unit Black e White
3	Cable reel 32mt
4	Cable reel 11 mt
5	Pressure transducer
6	Can Bus Cable L=10mt
7	Anti twoblock + weight 4 Kg
8	Encoder rotazione (se presente)

Components location on the machine

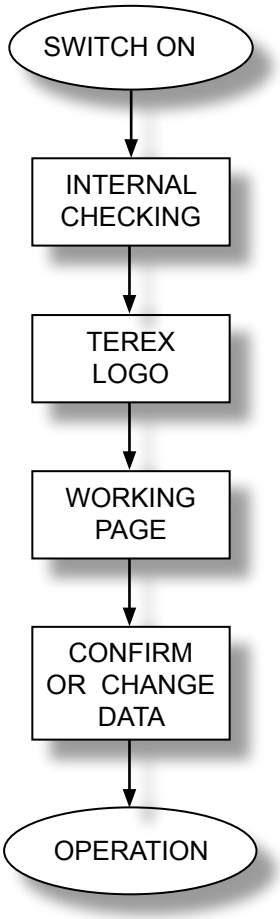
Length/Angle sensor: On the left side of the boom

Main Unit and Control Panel: in the cab

A2B

Nr.2 Pressure Transducers: On the lifting cylinder. Rod and piston side

System features



Data Integrity check and warning Lamps check

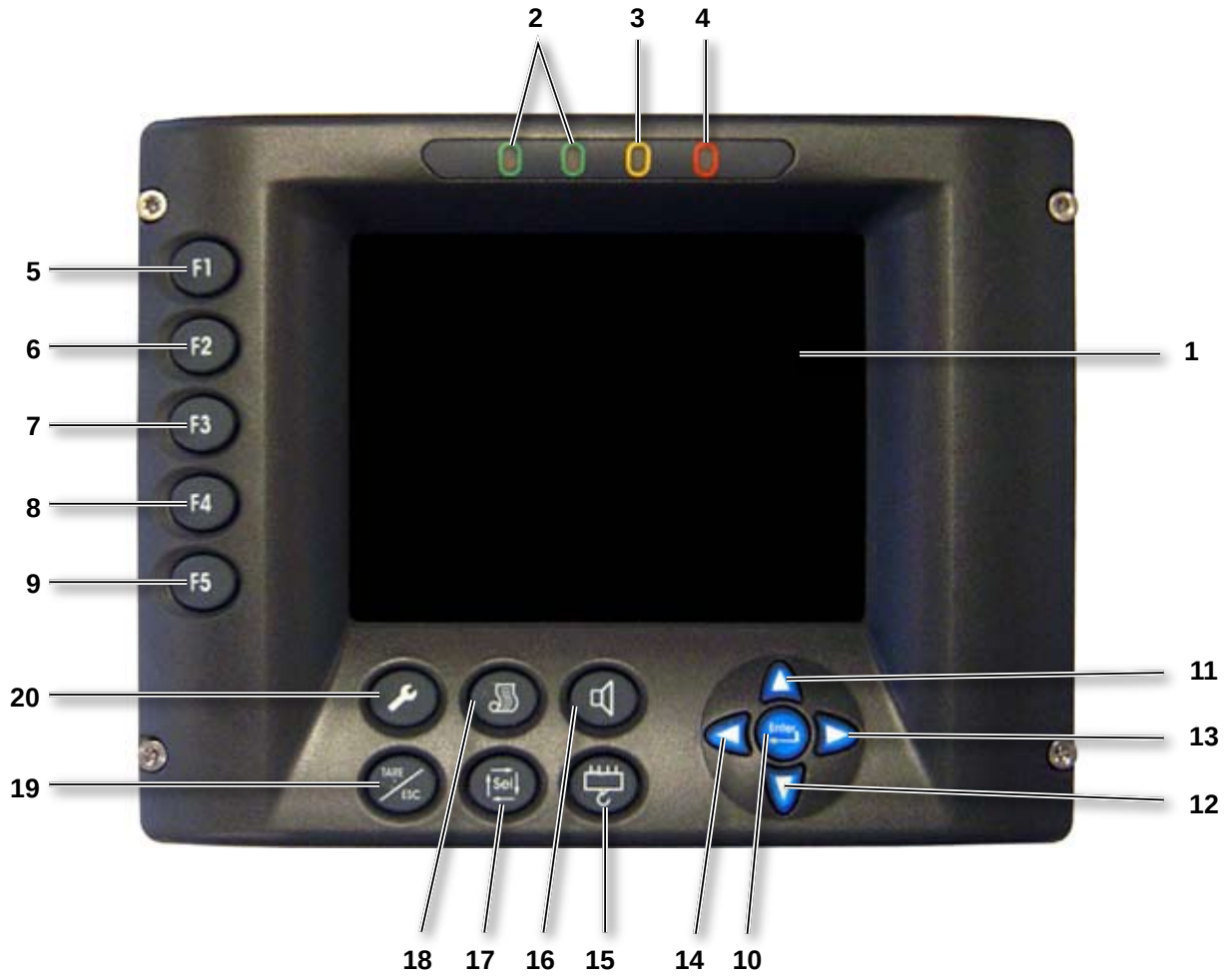
Logo Displayed and Software version

Indication of the Settings, geometrical data and operating mode of the machine

Selection and confirm of the operative mode and setting

Now the system is ready to operate

Panel description

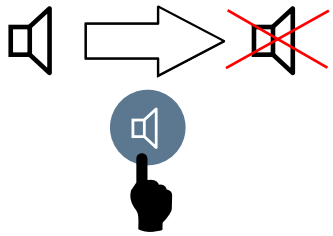


Ref.	Icon	Description
1		Working data display
2		Two lights showing the safe work condition
3		Light showing the pre alarm condition
4		Light showing the shut off condition has occurred
5		Function key button depending of the page displayed
6		Function key button depending of the page displayed
7		Function key button depending of the page displayed
8		Function key button depending of the page displayed
9		Function key button depending of the page displayed
10		Confirm an action (operating mode, procedure, limit)
11		Scroll up inside the menu
12		Scroll down inside the menu
13		Increase menu / list (operating mode, number of lines, etc)
14		Decrease menu/list (operating mode, number of lines, etc)
15		Enable/Disable the anti twoblock
16		Disabling buzzer
17		Disable the lowering boom
18		Changing of the pages
19		Back to the main page. It also has a function of deleting the alarms once knowledged
20		Key button in order to let the operator to enter in the calibration's menu. In order to have access and configure the system, the user must scroll up to the operating page. The function is available only if provided with the password (to digit when the Logo is displaying)

Key function

How to disable the buzzer:

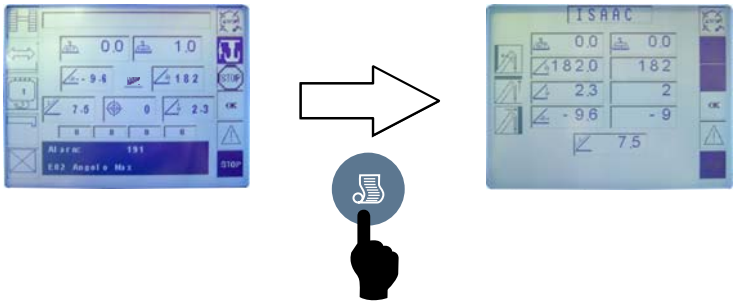
Disable: when the audible alarm is active on, by key you can disable the audible alarm until the new alarm is detected.
Enable: after few seconds that the alarm is switch off the audible alarm will enable automatically.



How to change viewing page:

By pressing, the view page can be changed to indicate the:

- RCL page
- I.S.A.A.C. page



Starting up

When the system get started, the last operating conditions is screened on the display, the latest setting before the machine was turned off. During this procedure, the system performs an auto test and it put itself in shut off condition.

How to select the operating mode

Before starting the lifting operation, the user must check that the operating mode set corresponds to the real machine's configuration (boom, outriggers, counterweight, jib's length and angle, etc) and the number of lines and confirming it pressing Enter in order to change the operating mode, please proceed as follows

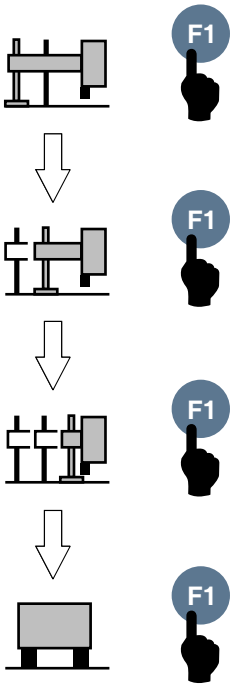
How to select the operating mode

- by F1 key you must change the outrigger/crawlers geometry;
- by F2 key you must change the translation mode
- by F4 key you must change the configuration of the boom or the attachment;
- by F5 key you must change the configuration of the attachment or the angle of the jib
- by Enter key confirm the operative mode

When you confirm the code line it indicates the number of the operative mode

Configuration list

Press the button F1 for change the outrigger configuration, like below:



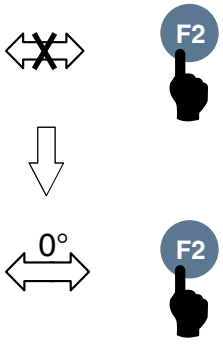
Outrigger full extended

Outrigger half extended

Outrigger fully retracted

On wheels

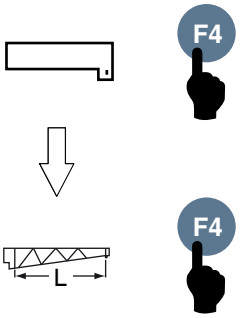
Press the button F2 for change the translation mode, like below:



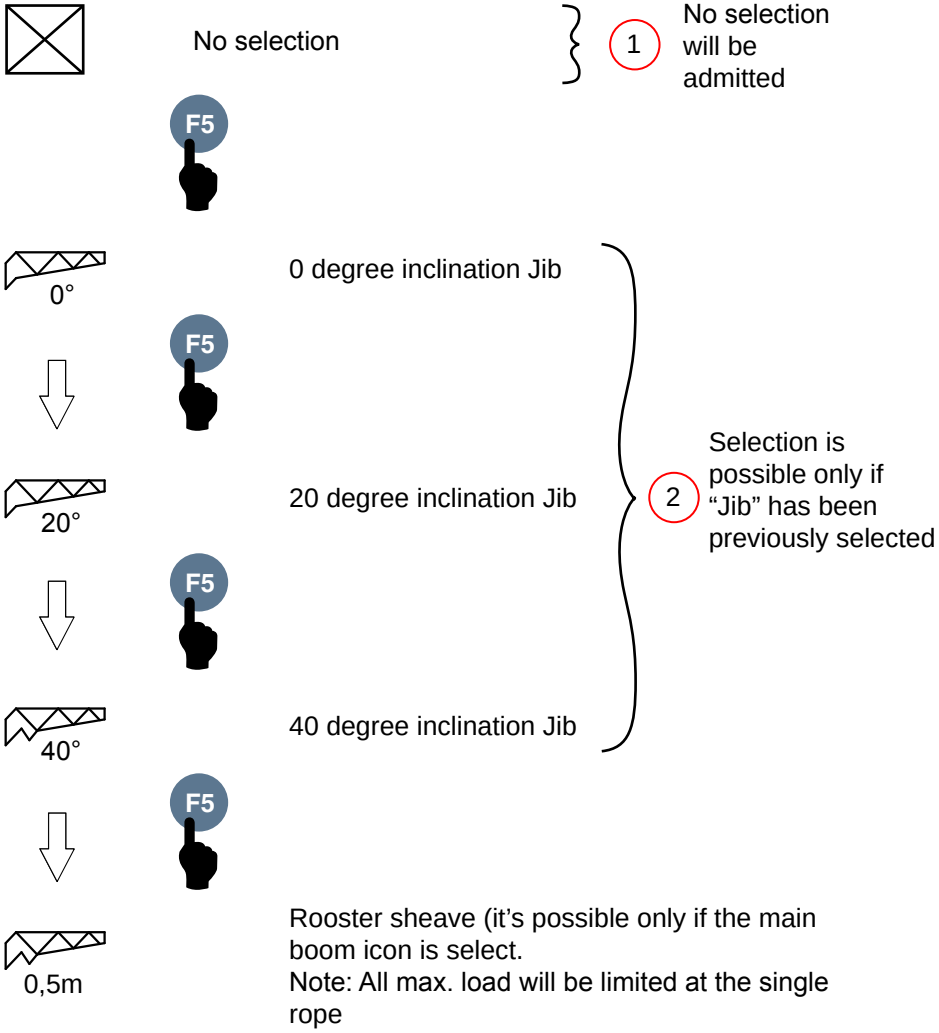
Static Translation mode

Translation mode on front side

Press the button F4 for change boom or the attachment



Press the button F5 for change the configuration of attachment or angle Jib is install at the moment, like below



By Enter key to confirm the parts of line

How to select the parts of line

Press the button F3 for change the number of rope, like below:

By Enter key to confirm the parts of line

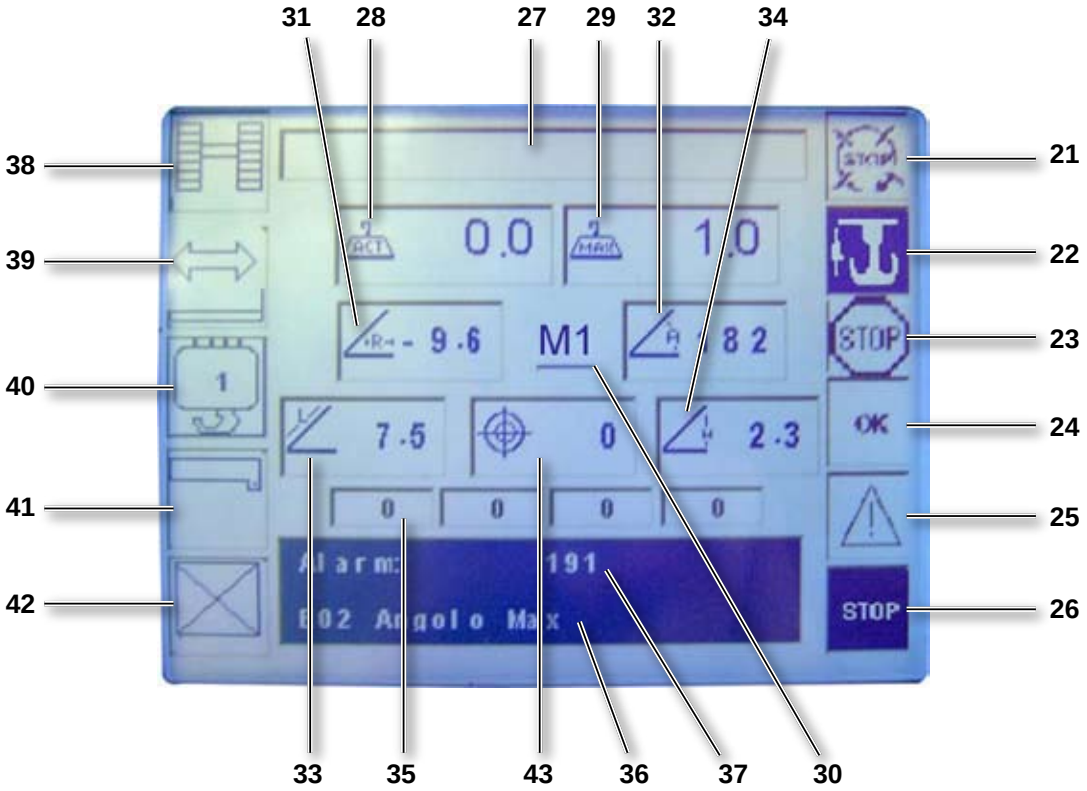
Disabling the fastener upstroke limit switch

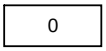
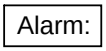
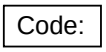
Press and hold button to disable fastener upstroke limit switch.

Releasing the boom upstroke limit switch lock

In case of boom upstroke limit switch lock, press button Sel to activate a timer releasing the boom for 10 seconds, thus allowing the operator to tilt it to less than 75°.

Panel visualizations



Ref.	Icon	Description
21		It indicates the RCL by pass key (if activated = black background)
22		It indicates the winch limit switch status (if activated = black background)
23		This icon indicates the Shut Off from Isaac
24		It indicates the machine is in the normal working condition
25		It indicates the machine is in the pre-alarm working condition (90%)
26		It indicates the machine is in the Shut off working condition (100%)
27		Indication of the Load percentage bar
28		Indication of the actual load. Value in Ton
29		Indication of the maximum load in that machine condition.
30		It indicates the Boom's extension MOD 1 or MOD 2 status (M1 = Red Icon ; M2 = Yellow Icon)
31		Indication of the main boom's radius. Value in meters or feet
32		Indication of the main boom's angle. Value in degrees
33		Indication of the main boom's length. Value in meters or feet
34		Indication of the height from the ground. Refer to the "head of the boom". Value in meters or feet
35		It indicates the element extension of the main boom. Value in %
36		Indication of the Alarm code that its present at the moment
37		Indication of the number of operative mode
38		Crawler/outrigger configuration
39		Indication of the translation mode
40		Indication of Parts of Line
41		Configuration of the boom or the attachments
42		Selection about the Jib inclination (if they are present)
43		Visualization of truck inclination (crawler crane only)

How to select the limit

To enter in this page, press the key button , until this one appears

ANGLE

A **12**

BLOCK VALUE:
Indication of the maximum value set

12.3

REAL VALUE:
Indication of the actual value

HEIGHT

H **4.0**

BLOCK VALUE:
Indication of the maximum value set

4.7

REAL VALUE:
Indication of the actual value

RADIUS

R **7.0**

BLOCK VALUE:
Indication of the maximum value set

7.7

REAL VALUE:
Indication of the actual value

How to set the maximum angle

In order to set the maximum angle, set the main boom up to the position and press the F2 key button.

To delete the set value, press F2 key button.

How to set the maximum height

In order to set the maximum height,set the main boom to the position and then press the F3 key button.

To delete the set value, press and hold the F3 key button.

How to set the maximum radius

In order to set the maximum radius, set the main boom to the position and them press the F4 key buttom

To delete the set value, press and hold the F4 key button.

Diagnostic

An overall self test diagnostic is provided. When each of the following alarm occurs cut-off relay is de-energized and proper alarm message appears on alphanumeric display.

Troubleshooting

MESSAGE	CAUSE	SOLUTION
ALARM 6 BOOM LENGTH 1 LOW	• potentiometer inside broken . • Possible lack of continuity in wires carrying the unwinding • Fault in main unit.	• Check integrity of winder • Check wire continuity • Replace it if broken. • Call assistance
ALARM 7 BOOM LENGTH 1 HIGH	• Potentiometer inside broken. • Possible lack of continuity in wires carrying the unwinding • Fault in main unit.	• Check integrity of winder • Check wire continuity • Replace it if broken. • Call assistance
ALARM 11 BOOM LENGTH 2 LOW	• Potentiometer inside broken . • Possible lack of continuity in wires carrying the unwinding • Fault in main unit.	• Check integrity of winder • Check wire continuity • Replace it if broken. • Call assistance
ALARM 12 PRESSL LOW	• Lower chamber pressure transducer broken • Possible lack of continuity in connection wires • Fault in main unit	• Replace pressure transducer • Check connection wires. • Check insertion of connector on transducer • Call assistance
ALARM 13 PRESSH LOW	• Lower chamber pressure transducer broken • Possible lack of continuity in connection wires • Fault in main unit	• Replace pressure transducer • Check connection wires. • Check insertion of connector on transducer • Call assistance
ALARM 14 ANGLE LOW	• Angle sensing device broken. Check the inclinometer. • Possible lack of continuity in wires carrying the angle signal • Fault in main unit.	• Check inclinometer • Replace it if broken. • Check connection wires • Call assistance
ALARM 20 FAULT M1/M2	• Simultaneously Input M1 and M2 ON • Fault in main unit.	• Check the input status • Deactivate the undesired one • Call assistance
ALARM 21 BOOM LENGTH 2 HIGH	• Potentiometer inside broken . • Possible lack of continuity in wires carrying the unwinding • Fault in main unit.	• Check integrity of winder • Check wire continuity • Replace it if broken. • Call assistance

MESSAGE	CAUSE	SOLUTION
ALARM 22 PRESSL HIGH	• Upper chamber pressure transducer broken • Possible lack of continuity in connection wires • Fault in main unit	• Replace pressure transducer • Check connection wires. • Check insertion of connector on transducer • Call assistance
ALARM 23 PRESSH HIGH	• Upper chamber pressure transducer broken • Possible lack of continuity in connection wires • Fault in main unit	• Replace pressure transducer • Check connection wires. • Check insertion of connector on transducer • Call assistance
ALARM 25 ANGLE HIGH	• Angle sensing device broken. • Possible shot circuit of connection wires. • Fault in main unit.	• Check inclinometer • Replace it if broken. • Check connection wires • Call assistance
ALARM 56 EPROM KO	• Error in EEPROM memory • The contained data are damaged or altered	• Call assistance
ALARM 190 CANBUS HEAD KO	• CAN BUS cable broken; • Internal problem	• Check of the CAN BUS cable • Replace unit
ALAM191 ASA CBO TRUCK	• Cable broken • ASA broken	• Check of the cable • Replace ASA
ALARM 192 CANBUS ENCODER TURRET ROTATION KO	• CAN BUS cable broken; • Internal problem	• Check of the CAN BUS cable • Replace Encoder

Auto-diagnostic

System internal working conditions monitoring

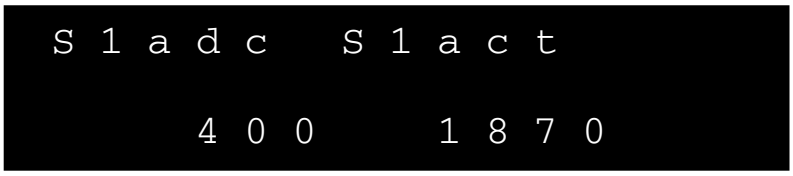
Geometric data and load data

These readings indicate the internal status of the system when troubleshooting a fault condition. Starting from the main working data page press Enter button: the display will indicate the control page, giving geometric data and main cylinder pressure summary.

The displayed parameters are as follows:

- A1adc: Value (bit) reads directly from the angle sensor
- A1act: Value (degree x 10) of the angle

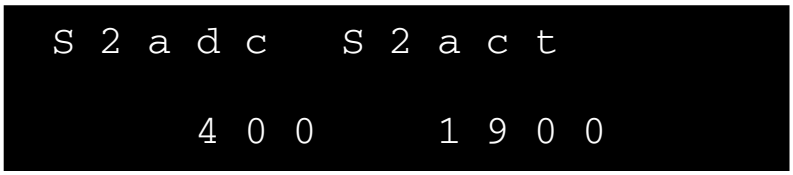
To return to the main page, press the TARE ESC button.



The displayed parameters are as follows:

- S1adc: Value (bit) reads directly from the potentiometer of the Length 1
- S1act: Value (meter x 100) of the length

To return to the main page, press the TARE ESC button.



The displayed parameters are as follows:

- S2adc: Value (bit) reads directly from the potentiometer of the Length 2
- S2act: Value (meter x 100) of the length

To return to the main page, press the TARE ESC button.

Hydraulic pressure data

By pressing the  the display shows the individual hydraulic pressures summary:

The displayed parameters are as follows:
- PLadc: Value (bit) reads directly from the pressure sensor
- PLact:: Value of the pressure on the bottom side

The displayed parameters are as follows:
- PHadc: Value (bit) reads directly from the pressure sensor
- PHact: Value of the pressure on the rod side

Sensor digital inputs

Pressing once again the  button the display will indicates the digital input page;
Where the asterisk is present means, that digital input is activated otherwise if is not present the asterisk the digital input is off

Sensor digital outputs

Pressing once again the  button the display will indicate the digital output page;
Where the asterisk is present means, that digital output is activated otherwise if is not present the asterisk the digital output is off

Diagnostic external unit

By pressing the  the display indicates the summary of the remote units

The displayed parameters are as follows:

- HEAD: counter control about Head unit: if this counter moves means that the unit is activate
- ENCODER: counter control about Encoder: if this counter moves means that the encoder is activate

Setting display contrast

Press the button  is possible to increase the contrast of the display

Press the button  is possible to decrease the contrast of the display

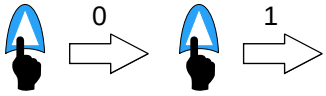
Setting languages change

After the confirm the operative mode by  button is possible to entry inside the menu called “Language” where is possible to select the right language.

Press the button  is possible to change the value of the language.

Press the button  is possible to change the language.

Press the button  is possible to confirm the language.



Press the button  is possible to exit from this menu and return on the Main Page.

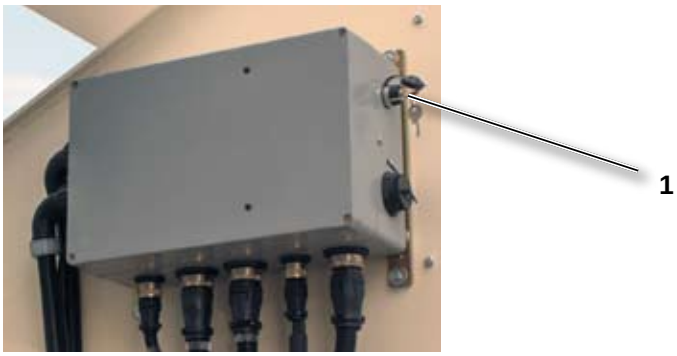
Disabling the rated capacity limiter

The machine is equipped with a device for disabling the rated capacity limiter.

A350, RC30, RC35, RC40, RC45, A600

To disable the limiter,
on upperstructure:

- turn clockwise and release key **1** on electric box. This operation involves the led on button **2** inside the cabin to switch on;



in the cabin:

- press and hold button **2** to disable the rated capacity limiter.

Release button **2** to re-enable limiter.

Switch off and then back on the crane control board to reset the system and the limiter will be operating normally again.

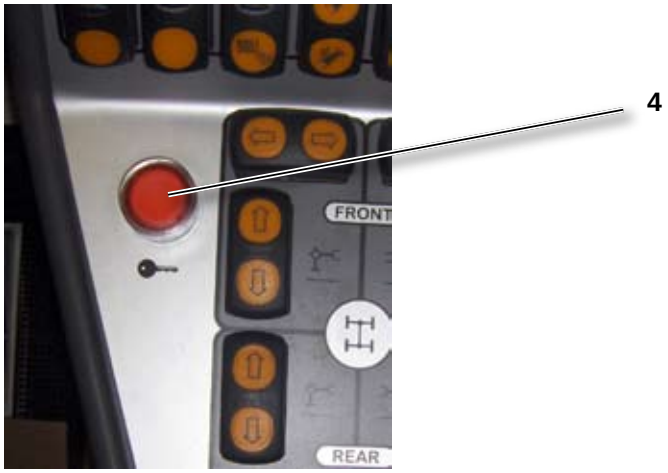
RC60

To disable the limiter,
on upperstructure:

- turn clockwise and release key **3** on electric box. This operation involves the led on button **4** inside the cabin to switch on;

in the cabin:

- press and hold button **4** to disable the rated capacity limiter.



Release button **4** to re-enable limiter.

The capacity limiter will be re-anabled:
- releasing the button **4**,
- 15 minutes after turned the key **3**,
- switching off and then back on the crane control board.

Rated Capacity Limiter

When the rated capacity limiter is disabled a visible and audible alarm is activated outside the cab. The external alarm device is located at the fixing point of luffing cylinder to boom.

WARNINGS

It is forbidden to use this device to lift loads exceeding the capacity allowed by the manufacturer.
The device shall be used only in case of system failure or malfunction.
The device can be used only by authorised and qualified personnel.
The key 44 should never be left on the machine; authorised persons in charge of its use should keep it in a safe place.