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“FSC/S” SYSTEM FASSI STABILITY CONTROL – Super Version

To comply with the Machine Directive 2006/42/CE and the technical harmonised standards EN 12999:A3 requiring, for cranes with a capacity of 1000 Kg or higher, or a higher lifting moment than 40000 Nm, the integration of the control of the vehicle stability in the safety function executed by the lifting moment limiting device, **Fassi has developed the system FSC = Fassi Stability Control**, which is proposed in different executions in relation with the crane models and respective configurations.

The S version (Super), subject of this TechniComm, is the option for the crane range from F245A to F1500AXP and it's also available as option for all the other crane models, provided they are equipped with FX500 or FX800, radio control RCH/RCS and hydraulic extendable outriggers.

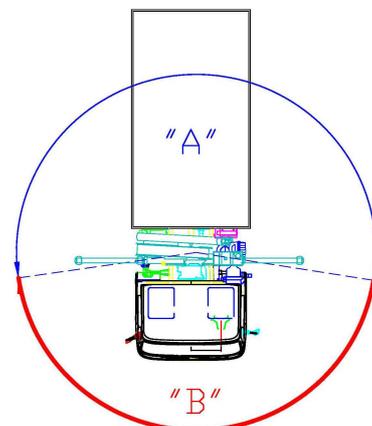
Functional features:

The system detects the right and left working areas (1-4 and 2-3) and manages automatically the lifting moment limiting device for two working zones (above the cab and above the body, compatibly with the current stability in the two sectors). In both sectors the lifting moment limiting device operates autonomously according to the position of the supports for the lateral extension of the outriggers (retracted, partially or totally extended) detected through some linear encoders. Moreover a tilting sensor, whose task is to detect the horizontal position of the crane taking into account the inclination of the crane crossbeam, all this managed by a dynamic software, limits the crane performances and protects the different working configurations considering the sector in which the crane is working, the position/extension of the outriggers and the inclination that the crane base can assume. When the outriggers are not completely extended, the activation pressure of the lifting moment limiting device is recalculated and decreased, and according to the crane boom position the working speed may be reduced (the function ADC – Automatic Dynamic Control – is integrated in the system). Therefore the value of the activation pressure of the lifting moment limiting device and of the movement speed changes automatically according to the above parameters. As far as the supplementary outriggers are concerned, the system checks if the outriggers are completed extended or retracted, or partially extended in case the supplementary outriggers have a double support for the lateral extension.

The functional features are graphically displayed here below:

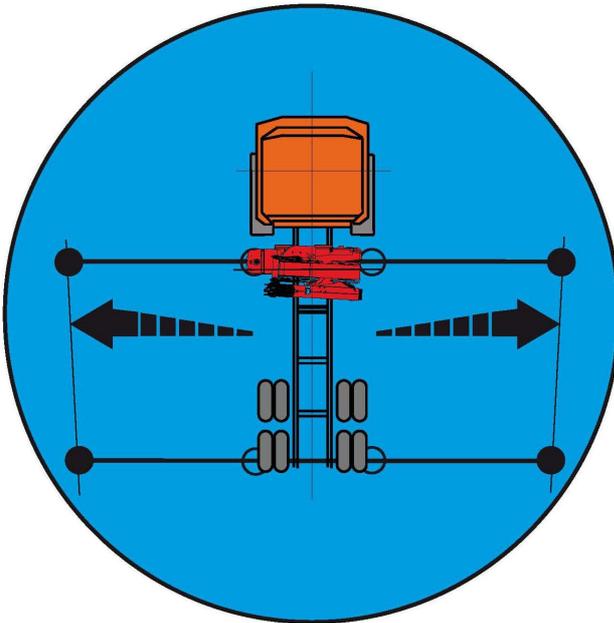
Lifting moment limiting device for two working zones

It manages two working zones (body side “A” and cab side “B”) basing the activation values of the lifting moment limiting device on a practical check of the stability condition. The activation of the lifting moment limiting device is differentiated according to the crane configuration: with boom over 45° above the horizontal line, there's the activation of the setting of the lifting moment limiting device for two working zones based on the stability test executed in the front zone, while with booms placed below 45° there's the activation of the tilting sensor. The lifting performances are limited by a by-pass valve.



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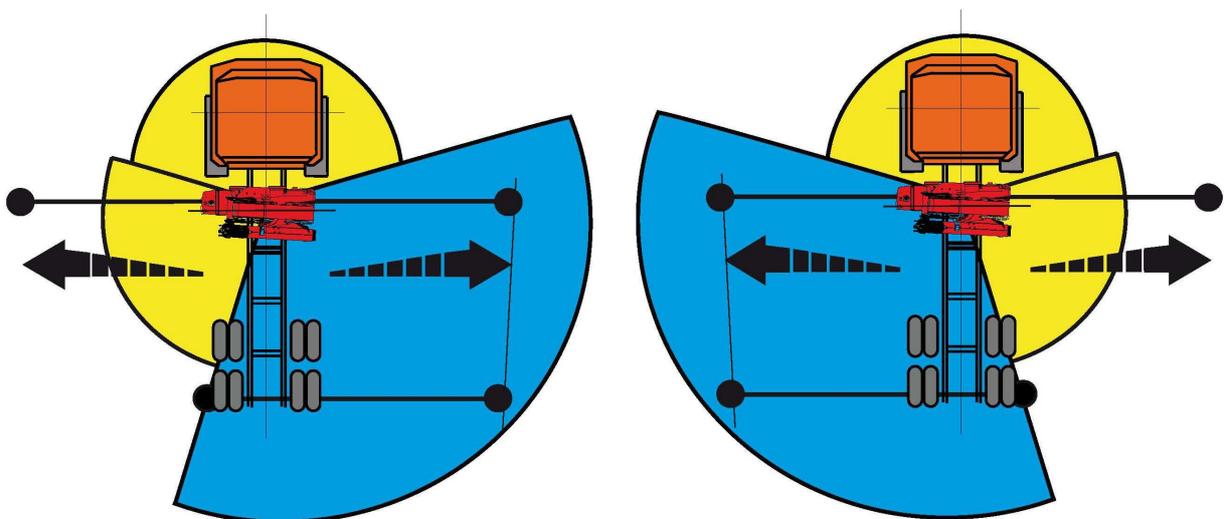
Stability control on body side



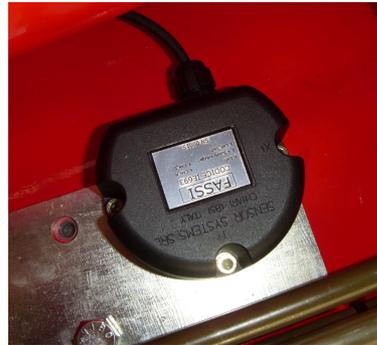
Maximum pressure for the activation of the lifting moment limiting device when all the outrigger rams are on the ground and the supports for the lateral extension of the outriggers on load side are completely extended. In this configuration the nominal lifting diagram of the crane, with and without XP, will correspond to the one resulting from the practical check of the stability condition carried out according to the European Standards in force (EN12999:A3).

The performance above the cab (sector "B") has been already described.

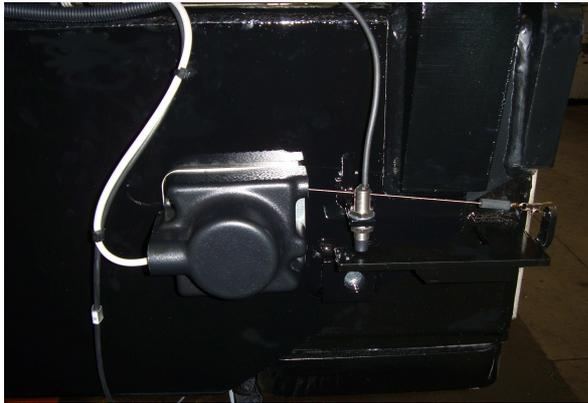
All the intermediate positions of the lateral extension of the outriggers will make the crane derate automatically and such derating (and the activation of the lifting moment limiting device) will be managed according to the position in which the supports may be and the inclination of the base in the sector where the crane is working. When the supports for the lateral extension of the outriggers are almost fully extended it's the tilting sensor which manages the lifting moment limiting device activation. In case a support for the lateral extension of the outriggers (of the crane and of the supplementary outriggers) is completely retracted on one side, the derating of crane capacity and the handling of the lifting moment limiting device on this side take place according to the value which is foreseen for the use of the crane with completely retracted supports.



Installed components for the functioning of the FSC/S system



Digital tilting sensor with a double axis XY mounted on the crossbeam of the crane base.

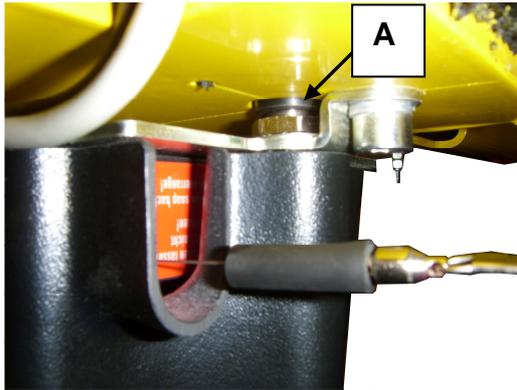


Digital cable-reel encoder mounted on each side of the crane crossbeam and of the supplementary outriggers with triple hydraulic extension to read and quantify the lateral extension of the outrigger supports and to transmit the data to the electronic card of the FX through Can Bus connection.

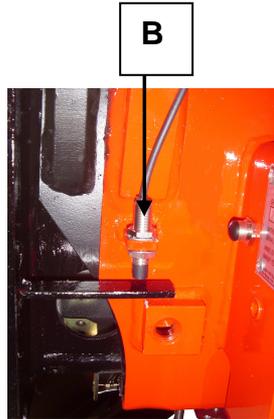
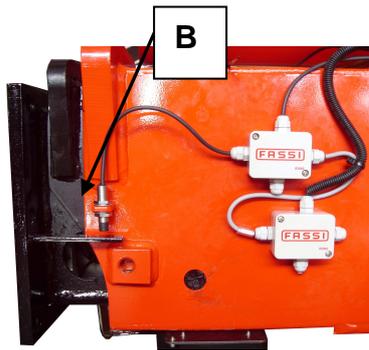


Micro-switch cable reel mounted on all the hydraulically extendable supplementary outriggers, both single and double.



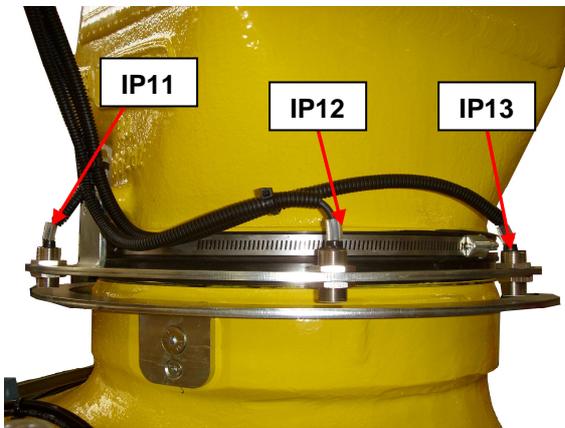


Proximity sensors (A) integrated in the cable reel encoder to check the placement on the ground of the outrigger rams.



Proximity sensors (B) to check if the supports for the outrigger extension are completely retracted on each side of the base crossbeam.

Components for the control and management of the rotation working areas



3 proximity sensors, IP11 - IP12 - IP13, are mounted at the base of the column.

The proximity sensor IP11, by reading the presence of the iron strap, detects when the rotation reaches the front working area (above the vehicle cab) and takes care of its management.

It's possible to enter the area above the cab only with a reduced load meeting the values set for the management of the lifting moment limiting device for two working zones when the crane configuration is with booms over 45° above the horizontal line, while with the booms below 45° it's the tilting sensor which authorises or denies the access.

In synergy with the outrigger control they manage the rotation movement limitations according to the current stabilization situation.

The proximity sensors IP12 and IP13 manage two working zones above the body (1-4 and 2-3) defining the rotation stroke end at the body edge, in case of going from one side to the other with a load which is not suitable for the stability.

On cranes with continuous rotation, the above mentioned functions are carried out by the angle encoder mounted inside the electric rotating joint (See technicomm news no. 051).

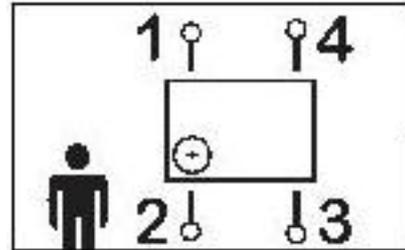
System adjustment

The adjustment of the system FSC/S is a task of the installer, who has to follow an extremely simplified and guided self-learning procedure using the PC and the program Fassilim related to the mounted electronic system (FX500 or FX800).

Displayed information

On the display of the radio control (and of the user's panel) you can visualise the activation levels of the lifting moment limiting device on the two sides (right and left) by selecting the icon or pushing the button %. The identification of the sides can be made thanks to the signalling chart placed on the control handle of the radio control and near the distributor for the outriggers.

Chart showing the position of the operator with respect to the vehicle and the crane.



Information is shown in the second row of the display.

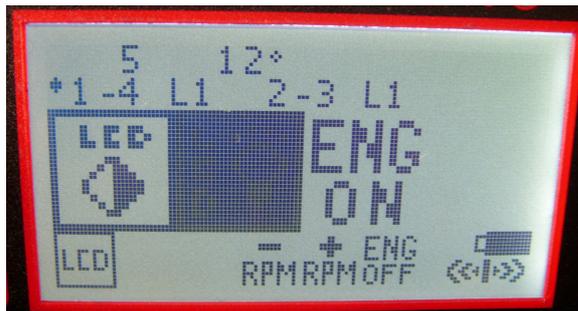
Examples of the information shown on the display of the radio control and of the user's panel

Meaning of the displayed information:

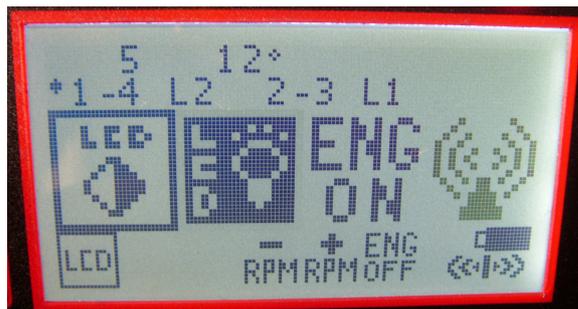
* = identification of the current working zone

1-4 o 2-3 = working zones as per above chart

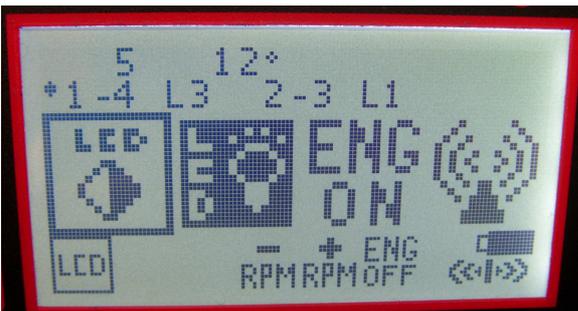
L1÷L3 = activation levels of the lifting moment limiting device



The display of the control handle shows that the crane is working in the working zone 1-4 prearranged for the **level L1** and that the zone 2-3 is prearranged to work in **level L1** as well. This means that the supports for the lateral extension of the outriggers on the two sides are completely retracted.



The display on the control handle shows that the crane is working in the working zone 1-4 prearranged for the **level L2** and that the zone 2-3 is prearranged to work in the **level L1**. This means that the supports for the lateral extension of the outriggers are partially extended on the side 1-4 (they do not overcome the middle) and are retracted on the side 2-3.



The display on the control handle shows that the crane is working in the working zone 1-4 prearranged for the **level L3** and that the zone 2-3 is prearranged to work in **level L1**. This means that the supports for the lateral extensions of the outriggers are completely extended or at least they overcome the middle (the tilting sensor sets in motion the lifting moment limiting device) on the side 1-4 and completely retracted on the side 2-3.



The display of the user's panel shows that the crane is working in the working zone **1-4** prearranged for the **level L3** and that the zone **2-3** is also prearranged to work in **level L3**. This means that the supports for the lateral extension of the outriggers are completely extended on both sides or at least they overcome the middle.

The system FSC/M incorporates the following functions:

- MOL (Manual Outrigger Lock) for manual/hydraulic outrigger supports.
- Detection of the complete retraction, rest position, of the outrigger supports.
- Display for these functions to be placed in the vehicle cab.

Advantages for the user:

- Use of the crane in full safety conditions from the point of view of the installation stability control.
- Automatic derating of the crane performances, of the activation of the lifting moment limiting device and of the working speeds according to the working positions of the supports for the lateral extension of the outriggers and to the inclination of the crane base.
- Visualisation on the display of the possible crane use conditions thanks to the information about the activation levels of the lifting moment limiting device which are available as a consequence of the outrigger extension.
- In comparison with the systems offered by the competitors, Fassi system is remarkably different as it carries out a double control of the stabilisation through the check of the position of the supports for the lateral extension of the outriggers and of the inclination of the base. If wholly considered, the system results to be more complex but guarantees a better exploitation of the machine in terms of performance and safety.