

Figure 5-2. Piston With Nut Thread

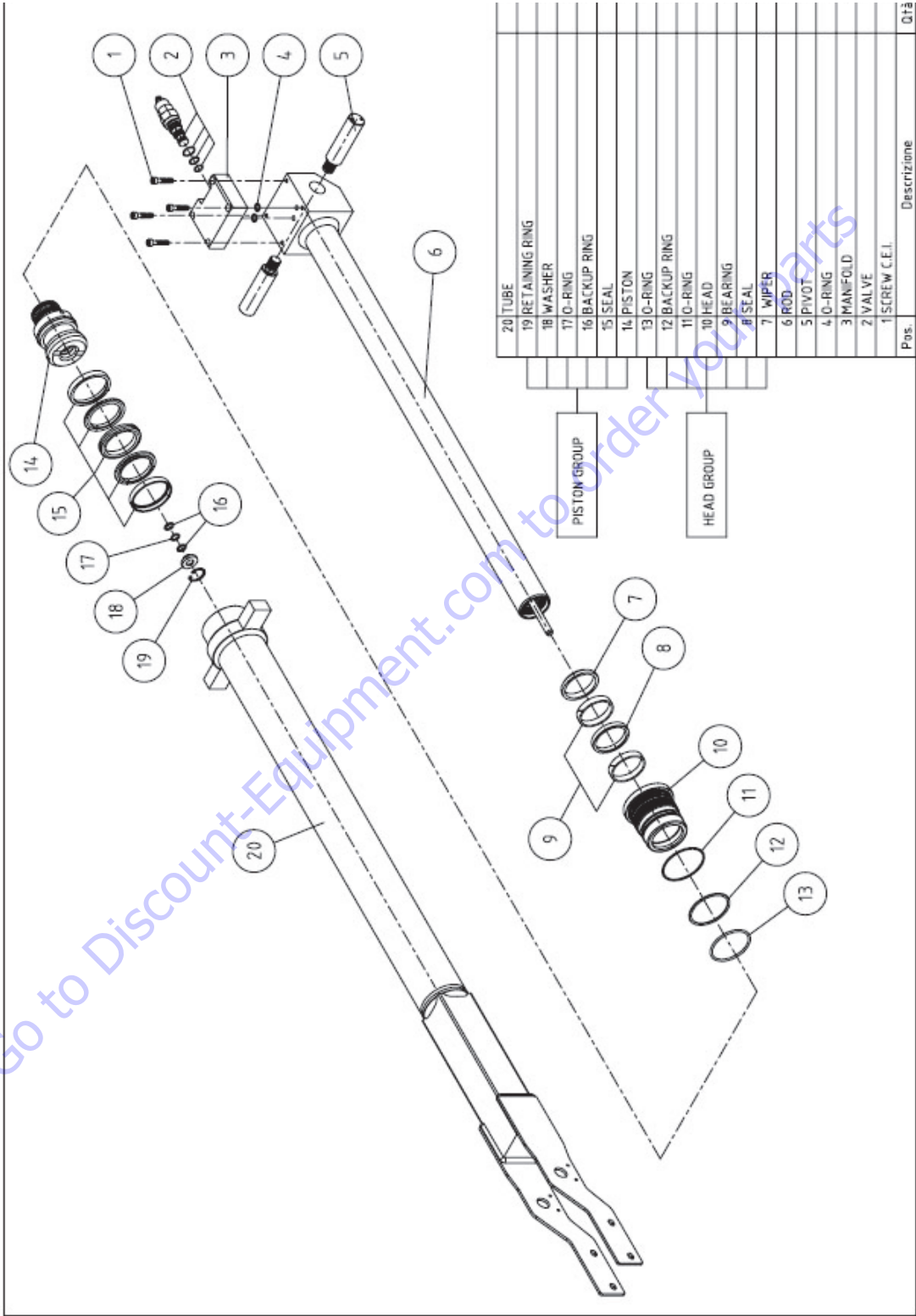


Figure 5-3. Telescope Cylinder

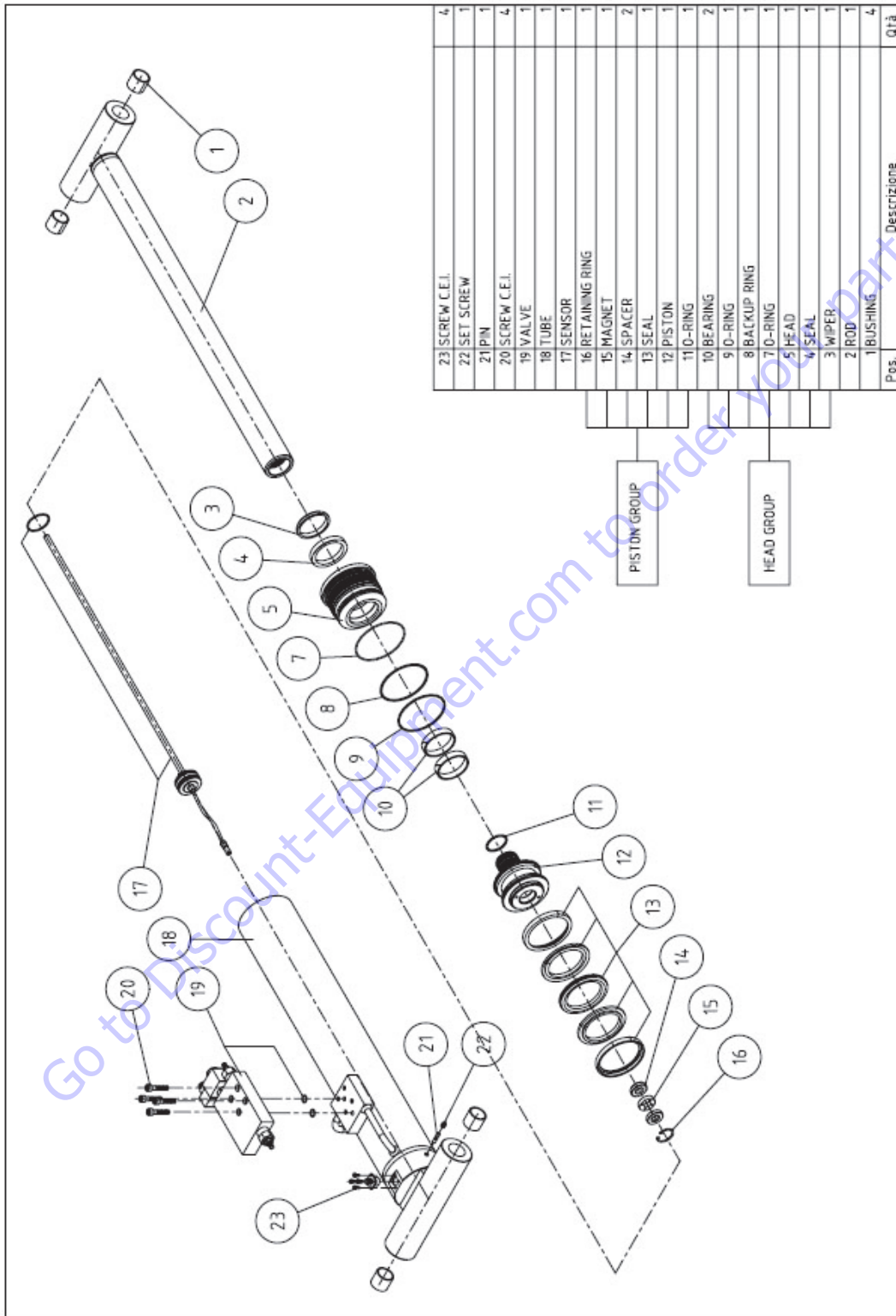


Figure 5-4. Cylinder With Sensor

Hydraulic Cylinders Torque Specifications**Screws Torque Specifications**

CYLINDER SCREWS	TORQUE VALUE
DRILLED SCREW 3/8"	70N/m
SCREW M8	25N/m
SCREW M6	11N/m
SCREW M4	3N/m
CAP 1/4"	30N/m
PURGE SCREW	8N/m
GREASE NIPPLE	2N/m
SENSOR SETSCREW	0.5N/m

Hose Connections Torque Specifications

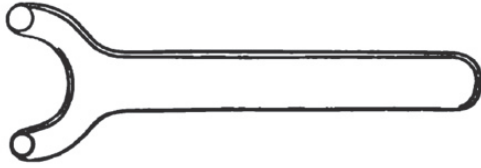
JUNCTION		
Ø HOSE	METRIC THREAD	TORQUE VALUE (N/m)
6	M12x1.5	20
8	M14x1.5	25
10	M16x1.5	30
12	M18x1.5	40
15	M22x1.5	60
18	M26x1.5	90
22	M30x2	170
28	M36x2	210
35	M45x2	360
42	M52x2	490

Cylinders Head Torque Specification

TIGHTENING TORQUE HEAD		
HEAD DIAMETER (mm)	TORQUE [Nm]	
	MIN	MAX
30	50	100
35	50	100
40	100	150
45	100	150
50	150	200
55	150	200
60	200	250
65	200	250
70	250	300
75	250	300
80	300	350
90	350	400
100	400	450
110	450	500
120	500	550
130	500	550
140	500	550
150	500	550
160	550	600
170	550	600
180	550	600
190	550	600
200	600	650
210	600	650
220	600	650
230	600	650
240	600	650
250	700	750

Equipment And Product List

- Spanner Wrench



NOTE: The following are general procedures that apply to all of the cylinders with sensor. Procedures that apply to a specific cylinder will be so noted.

Cylinder With Sensor - General Cylinder Disassembly



1. Clean the cylinder with a suitable cleaner before disassembly. Remove all dirt, debris and grease from the cylinder.
2. Clamp the barrel end of the cylinder in a soft-jawed vise or other acceptable holding equipment if possible.

NOTICE

AVOID USING EXCESSIVE FORCE WHEN CLAMPING THE CYLINDER IN A VISE. APPLY ONLY ENOUGH FORCE TO HOLD THE CYLINDER SECURELY. EXCESSIVE FORCE CAN DAMAGE THE CYLINDER TUBE.

3. Remove the counterbalance valve from the side of the cylinder barrel.

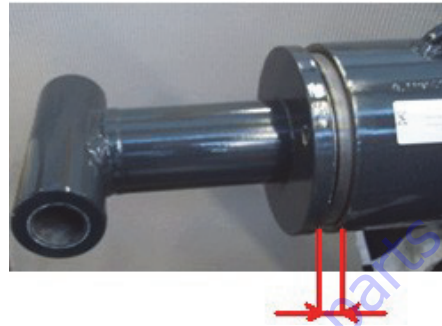
NOTICE

CYLINDER ARE UNDER PRESSURE.

NOTICE

DO NOT TAMPER WITH OR ATTEMPT TO ADJUST THE COUNTERBALANCE VALVE CARTRIDGE. IF ADJUSTMENT IS NECESSARY, REPLACE THE COUNTERBALANCE VALVE WITH A NEW PART.

4. Partially extend the rod ~ 15mm and unscrew the head about ~ 15mm.



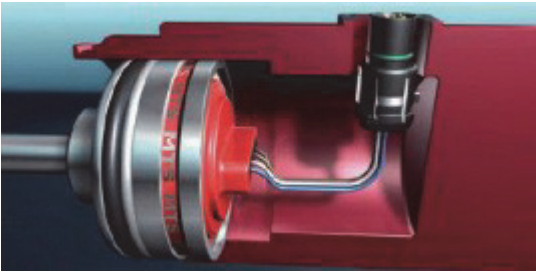
5. Remove 4 screws of the sensor



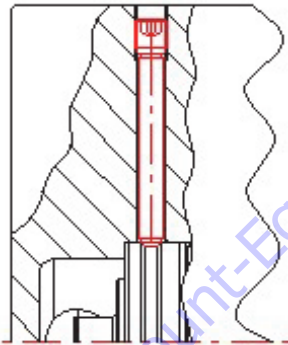
6. Unhook the connector from the base making pressure on 2 wing signed in the picture.



- 7. Push the connector inside the hole and fix the plate again.



- 8. Unscrew the setscrew and remove the pin. Use a magnet to pull out the pin.



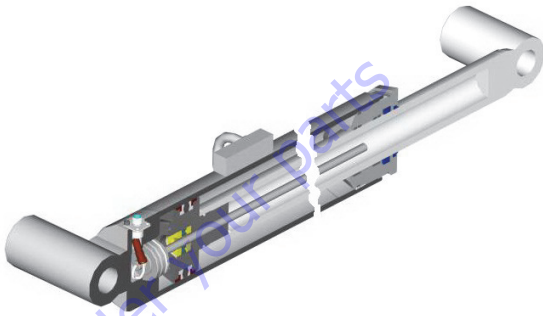
- 9. Secure the setscrew in order to keep the air pressure.



- 10. Blow pressurized air with caution on the connection in order to push the sensor out of the housing.

NOTICE

WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE TUBE TO HELP PREVENT BINDING.



NOTICE

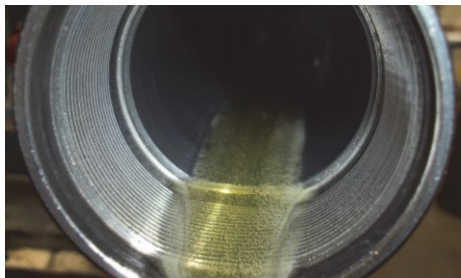
BE CAREFUL IN THIS OPERATION IN ORDER TO AVOID TO BREAK THE WIRE OR DAMAGE THE SENSOR.



Cleanness And Inspection

Cylinder Cleaning Instructions

1. Discard all seals, back-up rings and o-rings. Replace with new items from complete seal kits to help ensure proper cylinder function.



2. Clean all metal parts with an approved cleaning solvent such as trichlorethylene. Carefully clean cavities, grooves, threads, etc.



NOTE: *If a white powdery residue is present on threads and parts, it can be removed. Clean the residue away with a soft brass wire brush prior to reassembly, and wipe clean before reinstallation.*

3. Blow pressurized air on the connection of the manifold for cleaning.

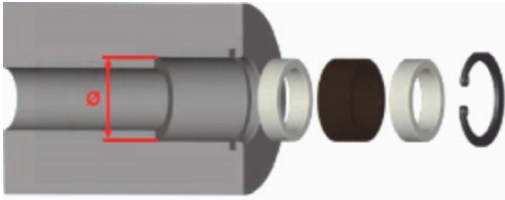


4. Verify the integrity of the tube checking that the surface doesn't present scratches.



Magnetic Sensor Removal

1. Pull out retain clip with pliers.



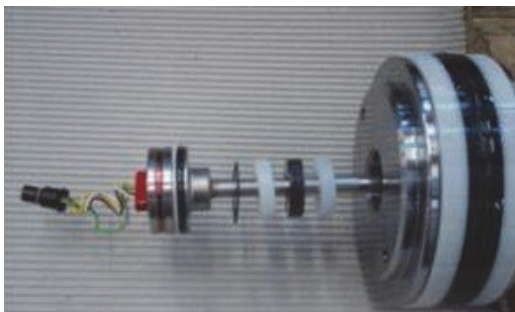
2. Pull out the spacer.



3. Pull out the magnet.



4. Pull out the other spacer.



Threaded Piston Disassembly

NOTICE

PROTECT THE FINISH ON THE ROD AT ALL TIMES. DAMAGE TO THE SURFACE OF THE ROD CAN CAUSE SEAL FAILURE.

Fix the rod into the vice.

NOTE: Before attempting to disassemble the piston remove any accessible seals.

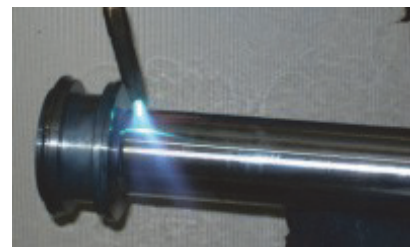


NOTE: Apply heat to break the bond of the sealant between the piston and the rod before the piston can be removed.

CAUTION

WARM THE SURFACE INDICATED MAX 300°C

Avoid overheating, or the parts may become distorted or damaged.



Apply sufficient torque for removal while the parts are still hot. The sealant often leaves a white, powdery residue on threads and other parts, which must be removed by brushing with a soft brass wire brush prior to reassembly.

General Cylinder Assembly

1. Use the proper tools for specific installation tasks. Clean tools are required for assembly.
2. Install new seals, back-up rings and o-rings on the piston and the head.
3. Fasten the rod eye in a soft-jawed vise, and place a padded support under and near the threaded end of the rod to prevent any damage to the rod.
4. Lubricate and slide the head over the cylinder rod. Install the piston head on to the end of the cylinder rod. Loctite® 243TM and install the set screw in the piston head. Refer to "Hydraulic Cylinder Torque Specifications," for tightening guidelines for the piston, head and the set screws.

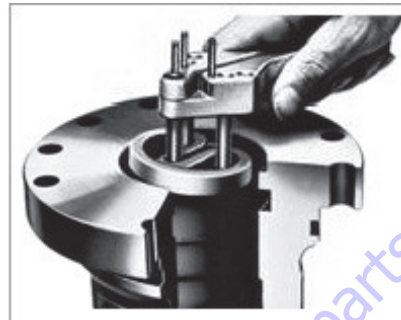
Seals Head Replacing

Remove all seals, back-up rings and o-rings from the piston head and all seals, back-up rings and orings.



N°	DESCRIPTION	Qty.
1	O-RING	2
2	BEARING	2
3	BACKUPRING	1
4	SEAL	2

Install new seals, back-up rings and o-rings on the piston and the head using the proper tool.



Cylinder Mounting

Cylinder Inspection

5. Inspect internal surfaces and all parts for wear, damage, etc. If the inner surface of the tube does not display a smooth finish, or is scored or damaged in any way, replace the tube.
6. Remove light scratches on the piston, rod or inner surface of the tube with a 400-600 grit emery cloth. Use the emery cloth in a rotary motion to polish out and blend the scratch(es) into the surrounding surface.
7. Check the piston rod assembly for run-out. If the rod is bent, it must be replaced.

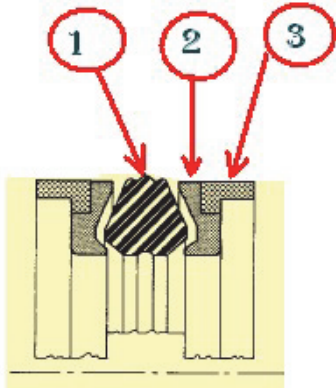


8. Replace the seals on the piston. **DO NOT** attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.



Mount the seals in the following order:

- 9. Seal
- 10. Support bearing
- 11. Bearing



Install the piston on to the end of the cylinder rod. Loctite® 270TM

NOTE: If a white powdery residue is present on threads and parts, it can be removed. Clean the residue away with a soft brass wire brush prior to reassembly, and wipe clean before reinstallation.



Refer to "Hydraulic Cylinder Torque Specifications," for tightening guidelines for the piston.

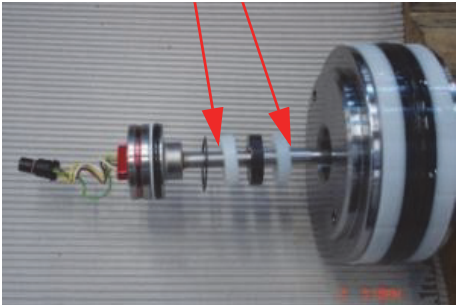


Sensor Assembling

Spacer has chamfer.



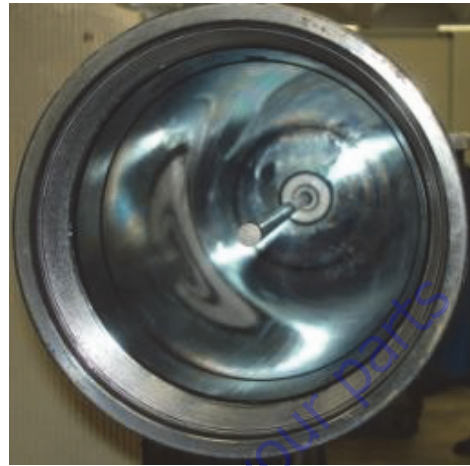
- 12. Mount spacer with chamfer face outside.



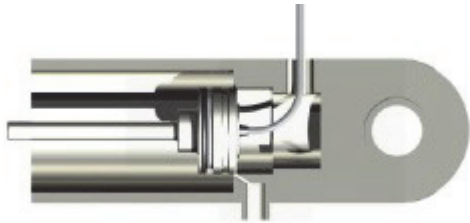
- 13. Lubricate the o-ring



14. Joint the sensor pin with a guidance cable.



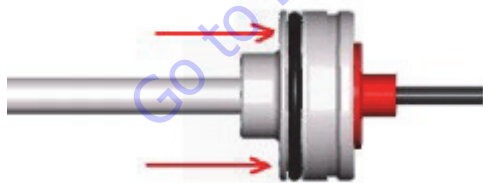
15. Insert sensor with a cable pass



16. Use plastic tool to insert the sensor



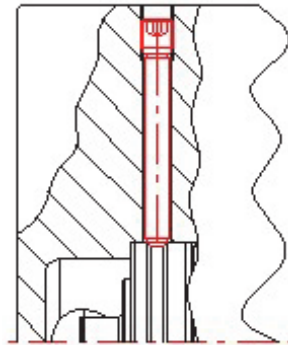
17. Push the tool carefully



18. Remove the set screw, insert the pin and then fix the set screw.

Pay attention do not overtighten the set screw because the sensor could be damaged.

Tightening torque 5 Nm seal with AREXON 35A77.



Cylinder Assembling

Pay attention to not damage the sensor



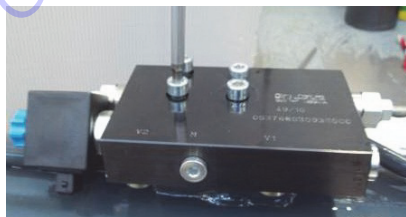
NOTICE

WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE TUBE TO HELP PREVENT BINDING.

1. Screw the head into the cylinder barrel and tighten with a spanner wrench. Refer to "Hydraulic Cylinder Torque Specifications," for tightening guidelines for the head.



2. Thread the counterbalance valve into the block on the cylinder barrel. Refer to Section 3.2 "Hydraulic Cylinder Torque Specifications".



NOTE: The following are general procedures that apply to all of the cylinders without sensor. Procedures that apply to a specific cylinder will be so noted

Cylinder Repair Without Sensor

Rod Removal

General Cylinder Disassembly

1. Clean the cylinder with a suitable cleaner before disassembly. Remove all dirt, debris and grease from the cylinder.
2. Clamp the barrel end of the cylinder in a soft-jawed vise or other acceptable holding equipment if possible.



NOTICE

AVOID USING EXCESSIVE FORCE WHEN CLAMPING THE CYLINDER IN A VISE. APPLY ONLY ENOUGH FORCE TO HOLD THE CYLINDER SECURELY. EXCESSIVE FORCE CAN DAMAGE THE CYLINDER TUBE.

3. Remove the counterbalance valve from the side of the cylinder barrel.

NOTICE

DO NOT TAMPER WITH OR ATTEMPT TO ADJUST THE COUNTERBALANCE VALVE CARTRIDGE. IF ADJUSTMENT IS NECESSARY, REPLACE THE COUNTERBALANCE VALVE WITH A NEW PART.

NOTE: Cylinder can have residual pressure inside.

4. When the cylinder has been emptied pull out the rod ~ 15mm and loosen the head until ~ 15mm.



NOTICE

WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE TUBE TO HELP PREVENT BINDING.

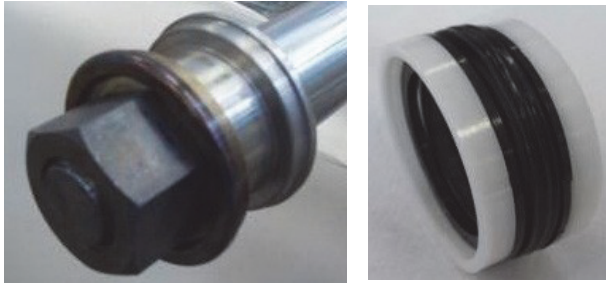
Piston With Nut Disassembling

NOTICE

PROTECT THE FINISH ON THE ROD AT ALL TIMES. DAMAGE TO THE SURFACE OF THE ROD CAN CAUSE SEAL FAILURE.

1. Fix the rod into the vice.

NOTE: Before attempting to disassemble the piston remove any accessible seals.



NOTE: Apply heat to break the bond of the sealant between the piston and the rod before the piston can be removed.

CAUTION

WARM THE SURFACE INDICATED MAX 300°C

2. Avoid overheating, or the parts may become distorted or damaged.



Apply sufficient torque for removal while the parts are still hot. The sealant often leaves a white, powdery residue on threads and other parts, which must be removed by brushing with a soft brass wire brush prior to reassembly.

3. Remove the piston head from the rod and carefully slide the head gland off the end of the rod.



Cylinder Assembly

General Cylinder Assembly

1. Use the proper tools for specific installation tasks. Clean tools are required for assembly.
2. Install new seals, back-up rings and o-rings on the piston and the head.
3. Fasten the rod eye in a soft-jawed vise, and place a padded support under and near the threaded end of the rod to prevent any damage to the rod.
4. Lubricate and slide the head over the cylinder rod. Install the piston head on to the end of the cylinder rod. Loctite® 243TM and install the set screw in the piston head. Refer to "Hydraulic Cylinder Torque Specifications" for tightening guidelines for the piston, head and the set screws.

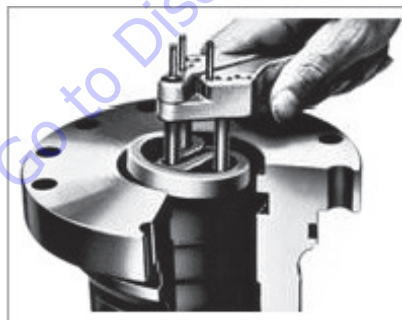
Seals Head Replacing

1. Remove all seals, back-up rings and o-rings from the piston head and all seals, back-up rings and orings



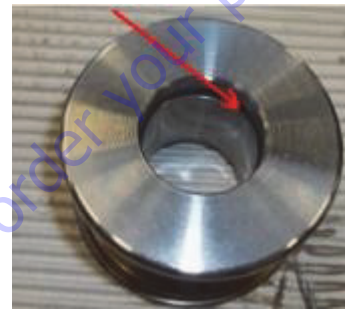
N°	DESCRIPTION	Qty.
1	O-RING	2
2	BEARING	2
3	BACK UP RING	1
4	SEAL	2

2. Install new seals, back-up rings and o-rings on the piston and the head using the proper tool.



Cylinder Inspection

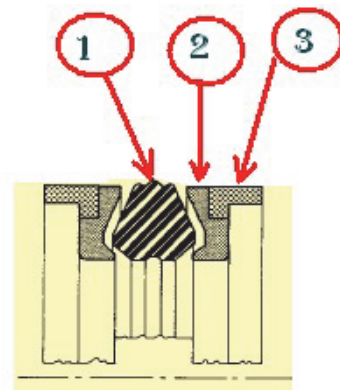
1. Inspect internal surfaces and all parts for wear, damage, etc. If the inner surface of the tube does not display a smooth finish, or is scored or damaged in any way, replace the tube.
2. Remove light scratches on the piston, rod or inner surface of the tube with a 400-600 grit emery cloth. Use the emery cloth in a rotary motion to polish out and blend the scratch(es) into the surrounding surface.
3. Check the piston rod assembly for run-out. If the rod is bent, it must be replaced.



Replace the seals on the piston. DO NOT attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.

Mount the seals in the following order:

4. Seal
5. Support bearing
6. Bearing



NOTICE

PROTECT THE FINISH ON THE ROD AT ALL TIMES. DAMAGE TO THE SURFACE OF THE ROD CAN CAUSE SEAL FAILURE.

Replace the seals on the piston. DO NOT attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.



7. Install the piston on to the end of the cylinder rod. Loctite® 270TM.

NOTE: *If a white powdery residue is present on threads and parts, it can be removed. Clean the residue away with a soft brass wire brush prior to reassembly, and wipe clean before reinstallation.*

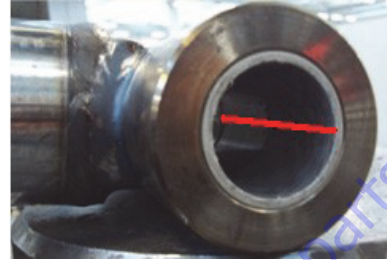


Refer to "Hydraulic Cylinder Torque Specifications," for tightening guidelines for the piston.



Bushing Replacement

1. Carefully grind the bush with a milling cutter for plastic.



2. After that the bushing has been removed inspect the internal surface.



3. Replace the bush with a new one and put it inside with a press.

Cylinders Bleeding

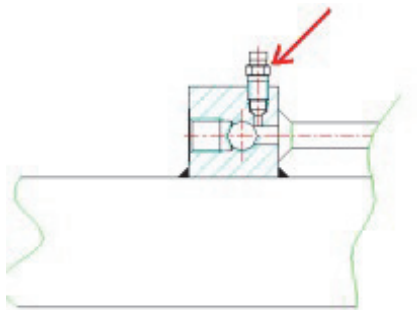
Vent Valve

Air inside the circuit has to be removed in order to avoid vibration and irregular motion of the cylinder, vent valves are apply to make this kind of operation.

Failure to remove air from the circuit can cause diesel effect with consequent damage of the seals.

Be sure that there is no presence of air inside the cylinder before it start working.

Bleeder screw



⚠ CAUTION

LOOSEN BLEEDER SCREW TO LET AIR ESCAPE RE-TIGHTENING TORQUE 6 FT. LB. (8 Nm).

5.9 REPLACEMENT HYDRAULIC PUMP

Pump removal

1. Open the top cap of the hydraulic oil tank.
2. Tag & disconnect the hoses from the pump 15.
3. Loose screws 16.
4. Remove from the pump 15 from the adapter 12.
5. Loosen nut 10 and remove the coupling 11 and plate 14 from the pump shaft.
6. Move the new pump the particular 14.

Pump installation

1. Install the plate 14, coupling 11, and the nut 10 on the pump.
2. Tighten the nut 10 at (15Nm).
3. Fit the pump 15 on the coupling 15 with screw 16.
4. Connect the hoses to the pump 15.

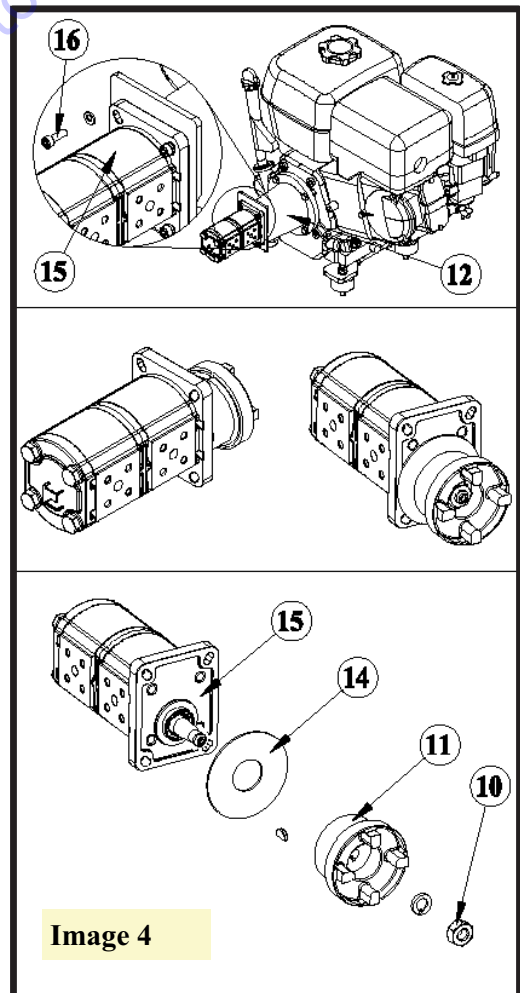
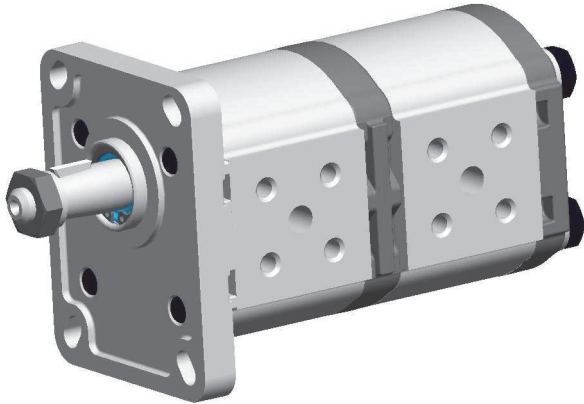


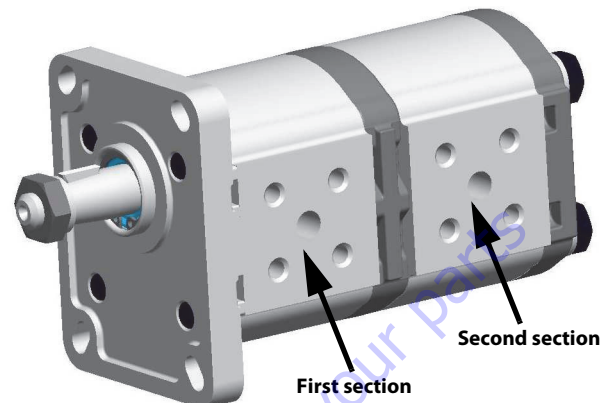
Image 4

5.10 HYDRAULIC PUMP REPAIR

Seal Kit Replacement Instruction



External Components Disassembly

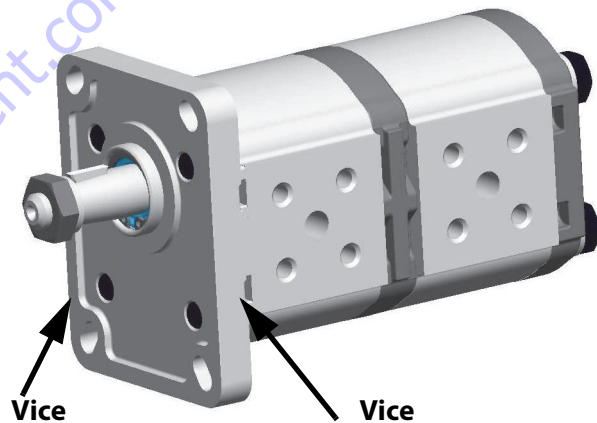


⚠ CAUTION

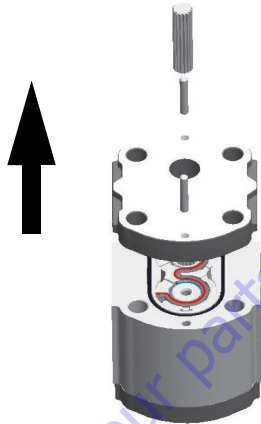
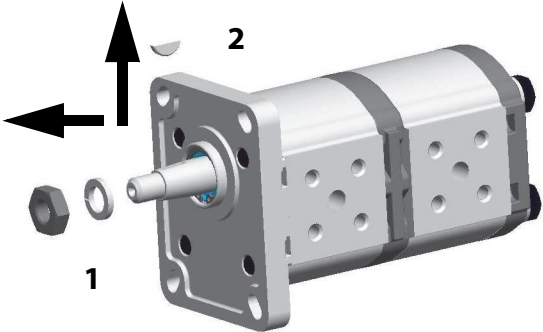
USE SOME ALUMINIUM PROTECTION ON THE VICE TO NOT DAMAGE THE MACHINED SURFACES. PUT THE PUMP IN HORIZONTAL POSITION AND BLOCK THE COVER IN THE VICE'S JAWS. LOOSEN THE BOLTS.

General Suggestions

1. Check the parts have not been damaged during the shipment.
2. Work in a clean area.
3. Clean with solvent (except the seals) and air dry all components before assembling.
4. Pay attention not to damage the machined surfaces.
5. The components need to be fitted in place without forcing them. If too much force is required, it is due a bad clearances issues.
6. When hand pressure is not enough, use only mallet and never hammer.
7. Respect the tightening torque for bolts.

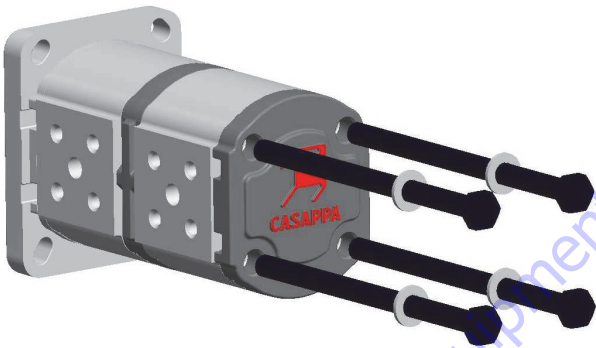


- 1. Unscrew the nut and remove the nut and washer (1).
- 2. Take out the shaft key (2).



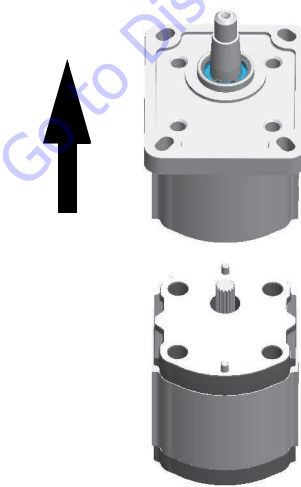
- 3. Put the pump on the work bench and remove the bolts and the washers.

- 3. Remove the rear cover.



Components disassembly

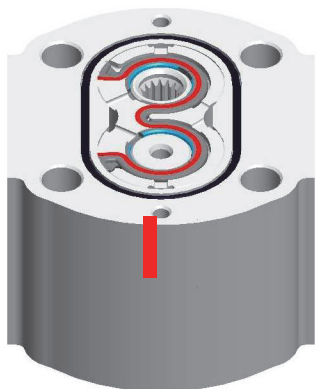
- 1. Remove the first section from the second section.



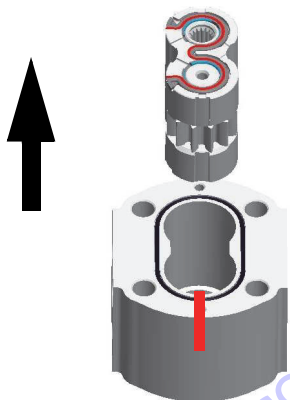
- 2. Remove the connecting hub and the dowel pins.

Second Section Components Disassembly

1. Using a marker draw a reference mark on the plate and the body. It will be used later during reassembly.

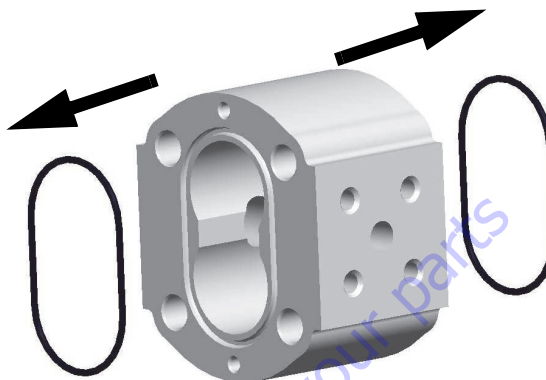


2. Remove the gears and the pressure plates.

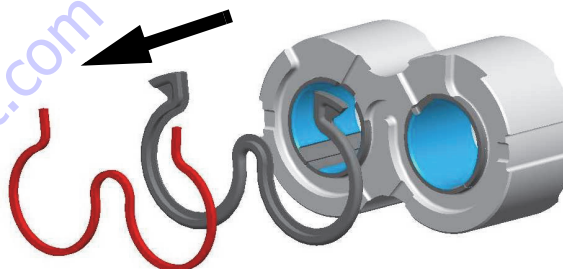


Second Section Seals Disassembly

1. Remove the seals from the body.

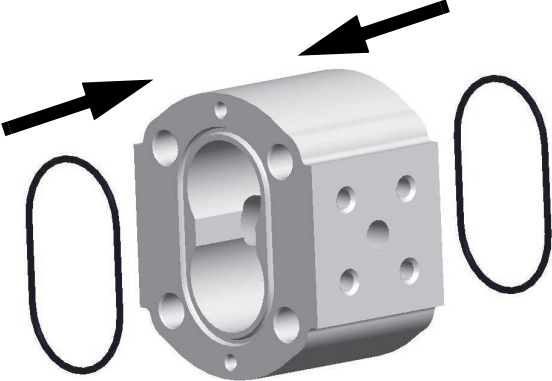


2. Remove from the plate the back-up ring (1) and the seal (2).

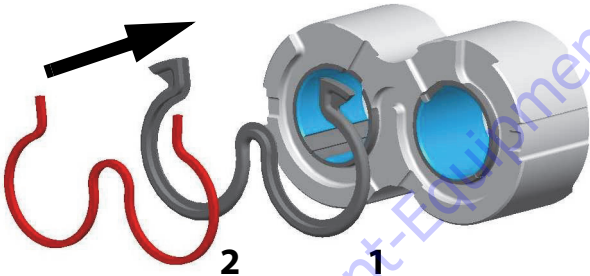


Second Section Seals Replacement

- 1. Place on the body the new seals. Use clean grease to keep the seal in place.

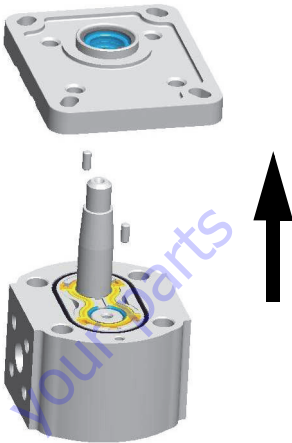


- 2. Fit the new seal (1) and back-up ring (2) on the plate.



First Section Seals Disassembly

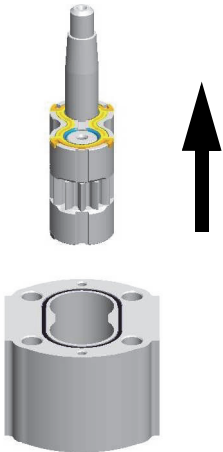
- 1. Remove the front cover.



- 2. Using a marker draw a reference mark on the plate and the body. It will be used later during reassembly.

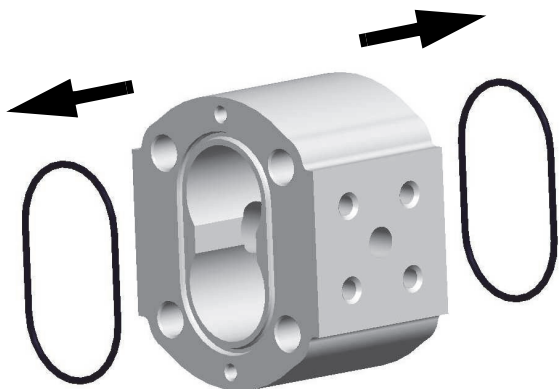


- 3. Remove the gears and the pressure plates.

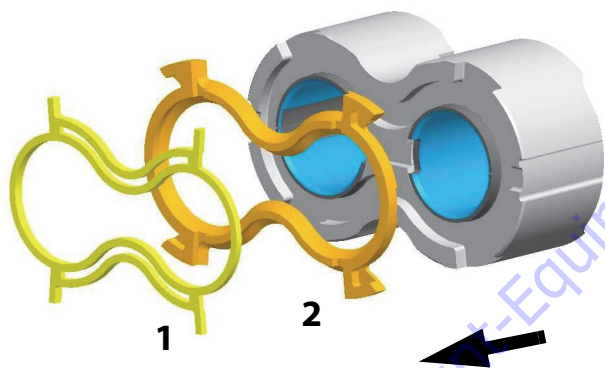


First Section Seals Disassembly

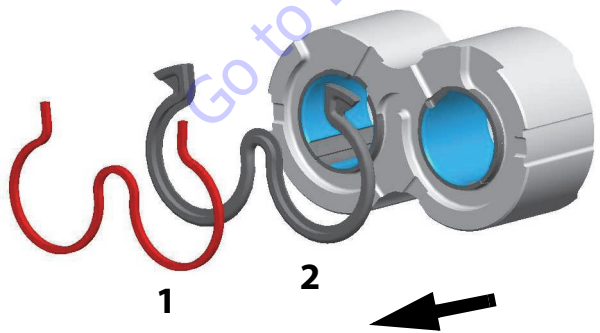
1. Remove the seals from the body.



2. Remove from the plate the back-up ring (1) and the seal (2).



3. Remove from the plate the back-up ring (1) and the seal (2).

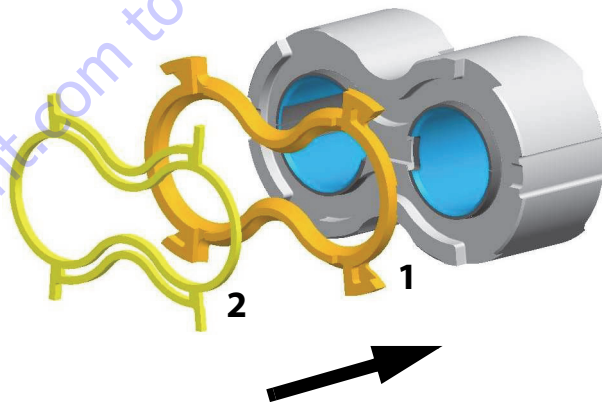


First Section Seals Replacement

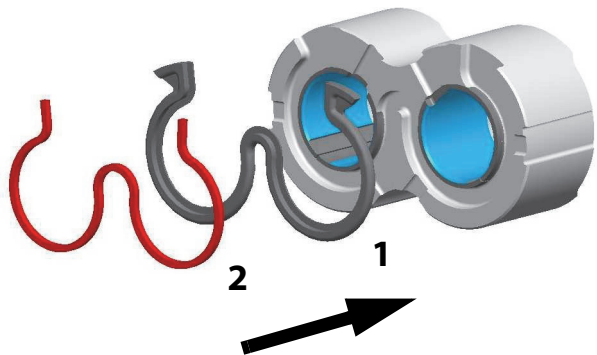
1. Use clean grease on the pressure plate to help the seals stay in place before fitting them.



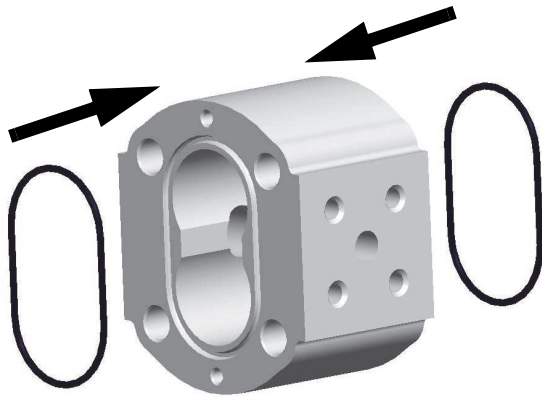
2. Fit the new seal (1) and back-up ring (2) on the plate.



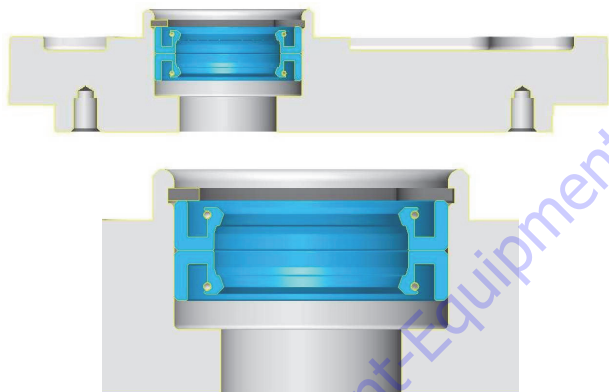
3. Fit the new seal (1) and back-up ring (2) on the plate.



- Place on the body the new seals. Use clean grease to keep the seal in place.



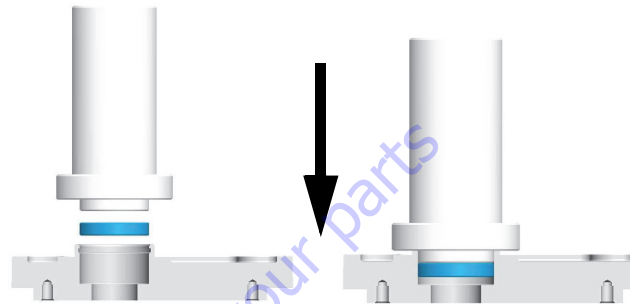
Cover Seals Replacement



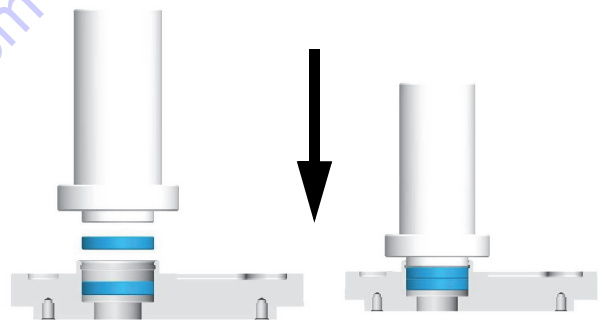
- Put the cover on the working bench.
- Remove the snap ring (1).
- Paying attention not to damage the seat remove with a screw driver (flat head) the shaft seals.(2 - 3)
- Put some clean grease into the seat seal.



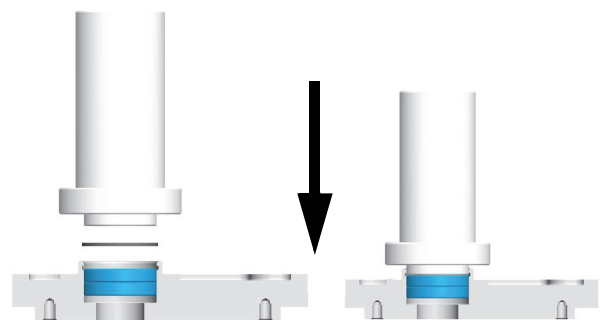
- Insert the shaft seal. Pay attention to the assembling direction of the shaft seal (see section). Using a mallet push all the way down the CASAPPA tool pn. 06100091.



- Insert the second shaft seal. Pay attention to the assembling direction of the shaft seal (see section). Using a mallet push all the way down the CASAPPA tool pn.06100091

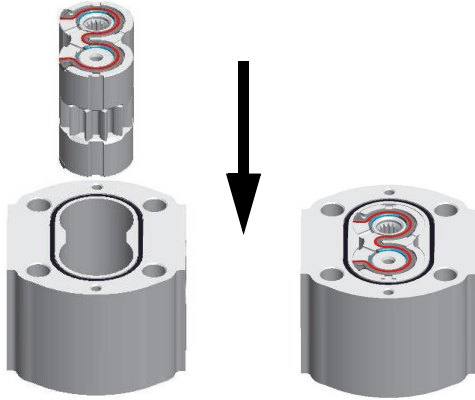


- Insert the back-up ring.
- Using a mallet push all the way down the CASAPPA tool pn. 06100091.



Second Section Components Reassembly

1. Reassemble the gears and the plates. Use as reference the mark made previously.

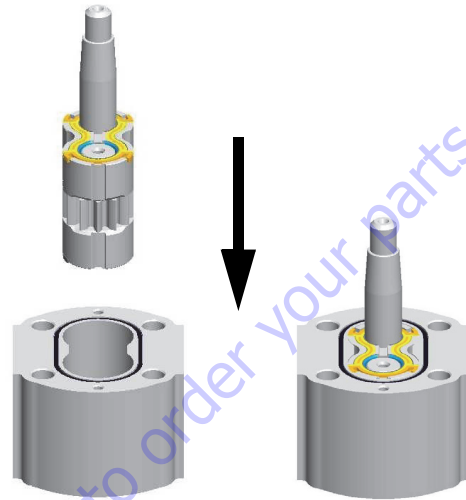


2. Reassemble the rear cover.



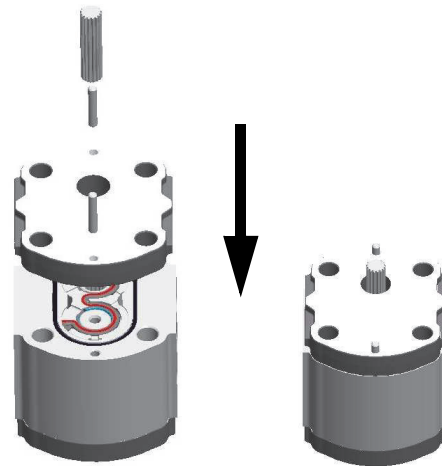
First Section Components Reassembly

Reassemble the gears and the plates. Use as reference the mark made previously.

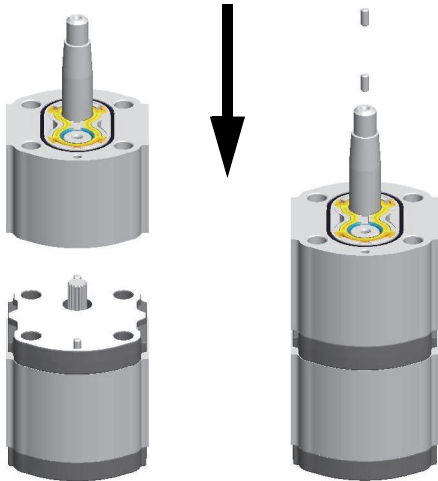


Components Reassembly

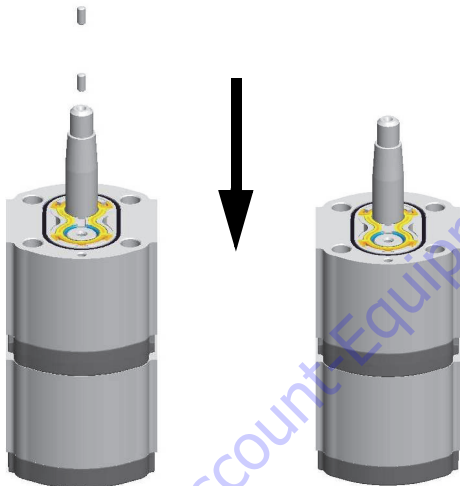
1. Put back the flange and the pins. Put the connecting hub into the second section shaft.



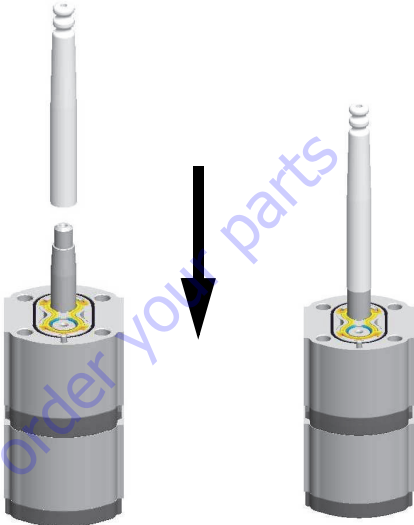
2. Put back the first section.



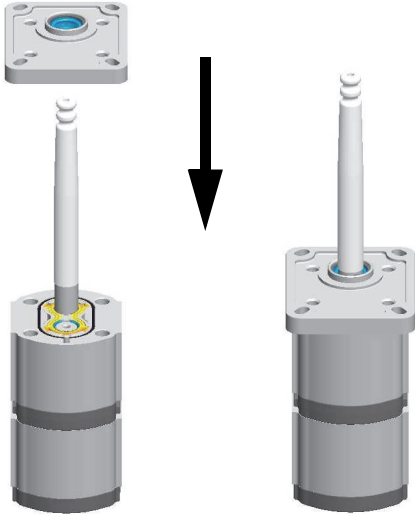
3. Put back the dowel pins.



4. Put the appropriate CASAPPA tool pn 0610090 on the drive shaft or protect with adhesive tape to avoid damaging the shaft seal.

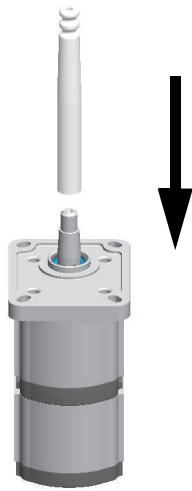


5. Use grease on the CASAPPA tool. Assemble the cover on the pump.



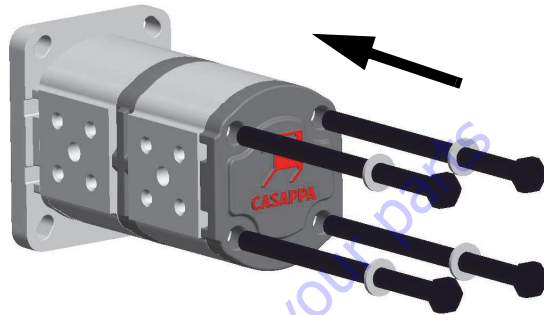
Go to DiscountEquipment.com to order your parts

6. Remove the CASAPPA tool pn 06100090.



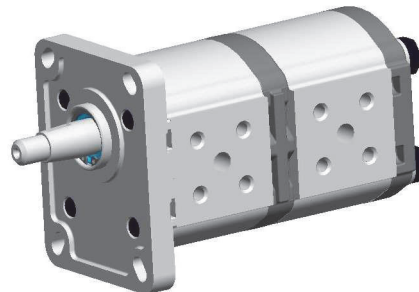
Final Assembly And Check

1. Put the pump in the vice and tighten the bolts with a torque wrench. Tightening torque 30 Nm.

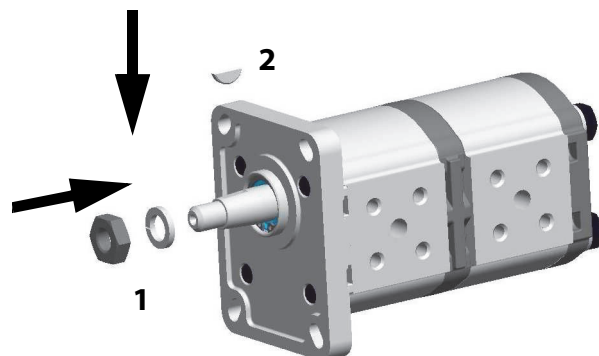


NOTICE

WITH A CLAMP VERIFY THAT THE SHAFT OF THE PUMP CAN ROTATE AFTER THE OPERATION IN BOTH DIRECTIONS. THE SHAFT MUST EASILY ROTATE. IF THE SHAFT IS LOCKED THIS MEANS THAT SOME OF THE SEALS HAVE COME OUT OF THEIR SEATS DURING ASSEMBLY. IF THIS HAPPENS THE WHOLE OPERATION MUST BE DONE AGAIN AND THE DAMAGED SEALS REPLACED.



2. Put back the shaft key (2). Insert the washer and tighten the nut (1). Tightening torque 10 Nm.



5.11 HYDRAULIC COMPONENT START-UP PROCEDURES AND RECOMMENDATIONS

From a hydrostatic component standpoint, the goal at system start up is to put into functional operation, the hydrostatic system in such a way as to preserve the designed life span of the system. The following start-up procedure should be adhered to whenever a new pump or motor is initially installed into a machine, or a system is restarted after either a pump or motor has been removed and/or replaced.

⚠ WARNING

THE FOLLOWING PROCEDURE MAY REQUIRE THE MACHINE TO BE DISABLED (WHEELS RAISED OFF THE GROUND, WORK FUNCTIONS DISCONNECTED, ETC.) WHILE PERFORMING THE PROCEDURE IN ORDER TO PREVENT INJURY. TAKE NECESSARY SAFETY PRECAUTIONS BEFORE MOVING THE VEHICLE/MACHINE.

Prior to installing the pump and/or motor, inspect the unit(s) for damage that may have been incurred during shipping and handling. Make certain that all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

1. Fill the reservoir with recommended hydraulic fluid. This fluid should be passed through a 10 micron (nominal, no bypass) filter prior to entering the reservoir. The use of contaminated fluid will cause damage to the components, which may result in unexpected vehicle/machine movement.

NOTE: *If a pump or motor is being replaced due to internal damage, the remaining units (pump or motors) need to be inspected for damage and contamination, and the entire hydraulic system will need to be flushed and the fluid replaced. Failure to do so may cause considerable damage to the entire system.*

2. The inlet line leading from the reservoir to the pump must be filled prior to start-up. Check the inlet line for property tightened fittings and make sure it is free of restrictions and air leaks.

NOTE: *In most cases, the reservoir is above the pump inlet so that the pressure head created by the higher oil level helps to keep the inlet pressures within an acceptable range and prevent high vacuum levels. However, due to hose routing or low reservoir locations, there may be air trapped within this line. It is important to assure that the air is bled from this line. This can be accomplished by loosening the hose at the fitting closest the pump. When oil begins to flow, the line is full, the air has been purged, and the fitting can be retightened to its specified torque. If the tank needs to be pressurized in order to start the flow of oil, a vacuum reading should be taken at the inlet of the pump during operation in order to verify*

that the pump is not being asked to draw an inlet vacuum higher than it is capable of.

3. Be certain to fill the pump and/or motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.

NOTE: *It is highly recommended to use the highest possible case drain port, this ensures that the housing contains as much oil as possible and offers the greatest amount of lubrication to the internal components.*

NOTE: *In initial start-up conditions, it may be convenient to fill the housing, just prior to installing the case drain line. Component, (especially motor), location may be such that access to the case drain port after installation is not realistic.*

NOTE: *Make certain that the oil being used to fill the component housing is as clean as possible, and store the fill container in such a way as to prevent it from becoming contaminated.*

4. Install a 60 bar (or 1000 psi) pressure gauge in the charge pressure gauge port in order to monitor the charge pressure during start-up.
5. It is recommended that the external control input signal, (electrical connections for EDC), be disconnected at the pump control until after initial start-up. This will ensure that the pump remains in its neutral position.

⚠ WARNING

DO NOT START THE ENGINE UNLESS PUMP IS IN THE NEUTRAL POSITION (0 DEGREES SWASHPLATE ANGLE). TAKE PRECAUTIONS TO PREVENT MACHINE MOVEMENT IN CASE PUMP IS ACTUATED DURING INITIAL START-UP.

6. "Jog" or slowly rotate the engine until charge pressure starts to rise. Start the engine and run at the lowest possible RPM until charge pressure has been established. Excess air should be bled from the system lines as close to the motors as possible.

NOTE: *With the engine on low idle, "crack", (loosen-don't remove), the system lines at the motor(s). Continue to run the engine at low idle and tighten the system lines as soon as oil is observed to leak from them. When oil is observed to "leak" at the motor the line is full, the air has been purged, and the system hoses should be retightened to their specified torque.*

7. Once charge pressure has been established, increase speed to normal operating RPM. Charge pressure should be as indicated in the pump model code. If charge pressure is inadequate, shut down and determine the cause for improper pressure.

⚠ WARNING

INADEQUATE CHARGE PRESSURE WILL AFFECT THE OPERATOR'S ABILITY TO CONTROL THE MACHINE.

8. Shut down the engine and connect the external control input signal. Also reconnect the machine function(s), if disconnected earlier.
9. Start the engine, checking to be certain the pump remains in neutral. With the engine at normal operating RPM, slowly check for forward and reverse machine operation.
10. Charge pressure may slightly decrease during forward or reverse operation. Continue to cycle slowly between forward and reverse for at least five minutes.
11. Shut down engine, remove gauges, and plug ports. Check reservoir level and add filtered fluid if needed.

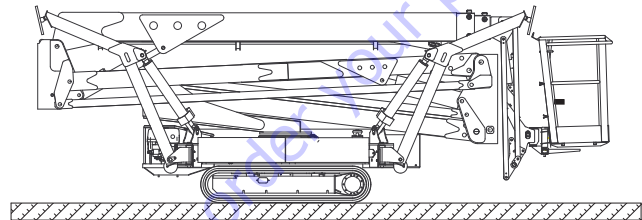
The machine is now ready for operation.

5.12 PRESSURE SETTING PROCEDURE

Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends operating the machine until the hydraulic system has warmed to normal operating temperatures prior to checking pressures. JLG Industries Inc. also recommends the use of a calibrated gauge. Pressure readings are acceptable if they are within $\pm 5\%$ of specified pressures.

Control Valve (Chassis functions)

1. Machine completely closed.



2. Install the pressure gauge at the port marked MA.
3. Activate the function outrigger IN on remote control.
4. Verify that the pressure is as on Table below.

CONTROL VALVE LEFT SIDE (CHASSIS FUNCTIONS)			
MODEL	PRESSURE PORT	PRESSURE SETTING	
		BAR	PSI
X17JP / X500AJ	MA	165	2400
X20JP / X600AJ			
X26JP / X770AJ		200	2900

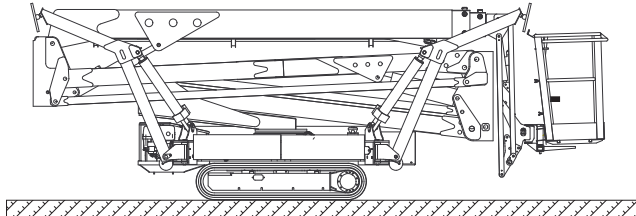
Figure 5-5.

To adjust the relief valve, turn clockwise to increase, turn counterclockwise to decrease the pressure.

Automatic Reductions Drive Speed (X17JP-X500AJ and X26JP-X770AJ Only)

Adjust pressure reducing valve (only X17JP - X500AJ)

1. Adjust the pressure when the machine is completely closed.

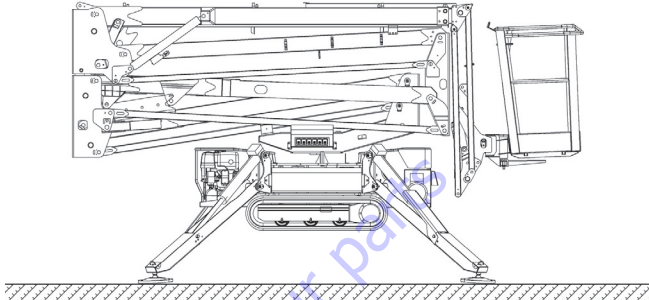


2. Install the pressure gauge at the port 5.
3. Activate the function outrigger IN on remote control 1.
4. Verify that the pressure is as on Table below.
5. Pressure adjust on relief valve point 6

AUTOMATIC REDUCTIONS DRIVE SPEED				
MODEL	PRESSURE PORT	FUNCTION	PRESSURE SETTING	
			BAR	PSI
X17JP / X500AJ X26JP / X770AJ	MA	Function Outrigger IN	26	380

Control Valve Turntable Functions

1. Machine with outrigger fully extended.



2. Install the pressure gauge at the port marked MB.
3. Activate the function Telescope IN on remote control.

NOTE: The calibration must be made with oil hot and speed setting to RABBIT.

4. Verify that the pressure is as on Table below.

CONTROL VALVE TURNTABLE FUNCTIONS				
MODEL	PRESSURE PORT	FUNCTION	PRESSURE SETTING	
			BAR	PSI
X17JP / X500AJ	MB	Telescope IN	185	2683
X20JP / X600AJ			210	3050
X26JP / X770AJ			200	2900

Figure 5-6.

5.13 OUTRIGGERS AUTO-RETRACTION

To be able to automatically retract the outriggers the machine must be closed and aligned and outriggers must be all opened as the previous paragraph describes.

To automatically retract the outriggers you have to press and hold remote control button n.1 "AUTOMATIC OUTRIGGERS RETRACTION", the display will shows "DEST".



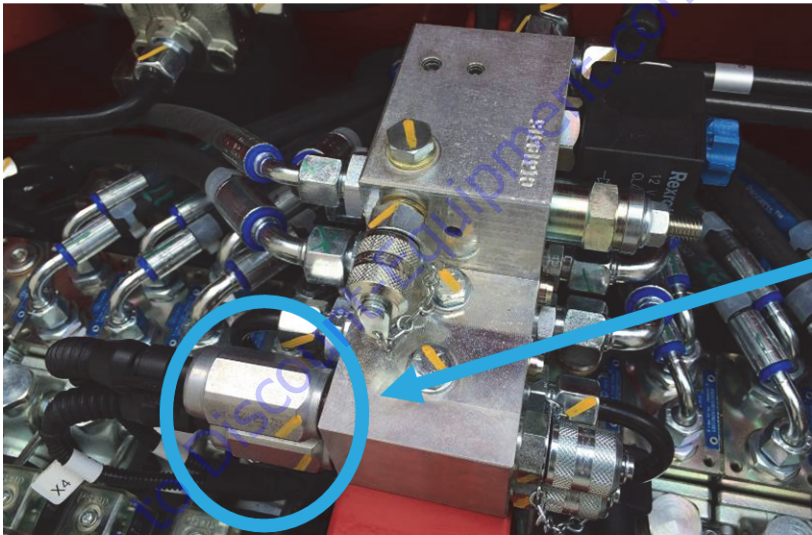
Figure 5-7. Outriggers Auto-Retraction In Progress

It's possible to keep automatic outriggers retraction running till outriggers are completely lifted up.

To achieve the stowed condition outriggers must be completely lifted up till the end of their stroke and have to be manually rotated while unlocked with their pivot.

The machine is equipped with two pressure switches on the hydraulic manifold, one for the right side and one for the left side. When both the same side outriggers are at end of the stroke, the hydraulic oil pressure reaches the maximum value so that the pressure switch informs the ECM1-2 that outriggers are completely lifted up. When ECM1-2 senses that all the four outriggers are completely lifted up starts to feed one side outriggers at a time, this will help when outriggers need more power to be lifted up, for instance in case of cold hydraulic oil.

NOTE: During the intermediate steps of auto-stabilization and outriggers auto-retraction, while two or three outriggers are touching the ground, the engine automatically runs at minimum RPM to ensure smooth movements.



PRESSURE SWITCHES

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We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

SECTION 6. JLG CONTROL SYSTEM

6.1 INTRODUCTION

NOTICE

WHEN INSTALLING ANY NEW MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS AND PROPERLY CALIBRATE THE TILT SENSOR.

NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSUREWASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG Control System is a 12 volt based control unit installed on the compact crawlers boom lift.

The JLG Control System has reduced the need for exposed terminal strips, diodes and trim pots and provides simplicity in viewing and adjusting the various personality

Settings for smooth control of: acceleration, deceleration, creep, min speed, and max.-speed for all boom, and drive functions.

The main lift, swing, and drive are controlled by individual Joysticks. To activate Drive, Lift, and Swing move the joystick into the direction desired.

The control system will control the voltage output to the valves, as programmed for smooth operation and maximum cycle time.

The JLG Remote Control has a built in Display and by a push buttons, could show any present faults.

The Remote Control is connected by cable on the following models:

CE - X17JP - X20JP - X26JP

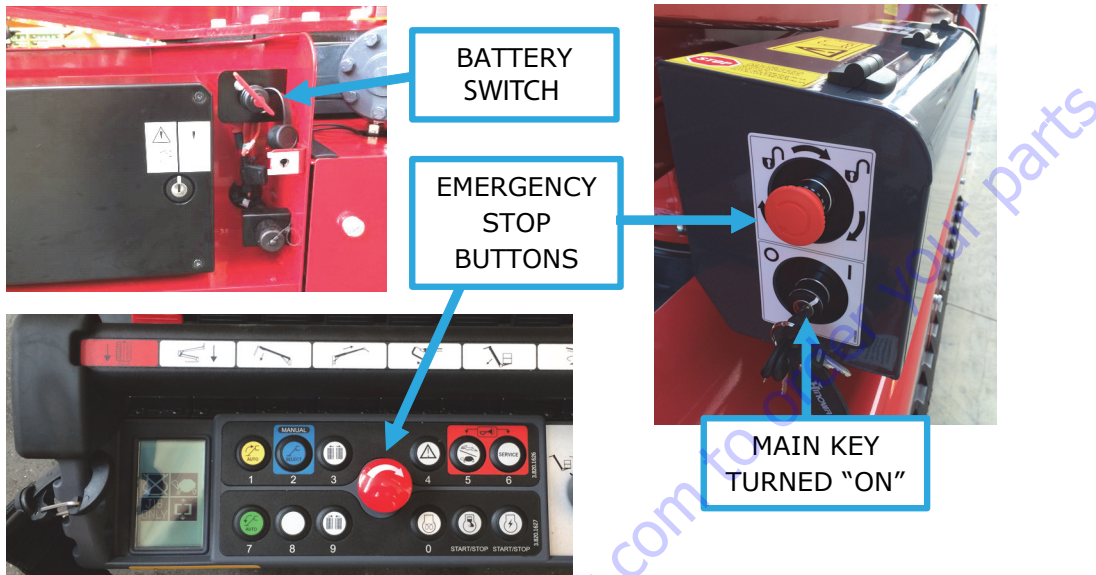
ANSI - X500AJ - X600AJ - X770AJ

The system can be accessed for troubleshooting even by the analyzer RamHino; kit JLG part no.17162400.

6.2 MACHINE IGNITION

To start up the machine, the battery cutter that is under the ground bonnet must be active, both the emergency stop buttons (on the remote control and on the ground control box) must be released, than the main key on ground control box has to be turned ON.

In case of need to restart the machine, main key must be turned ON again after at least 10 seconds from the switching OFF.

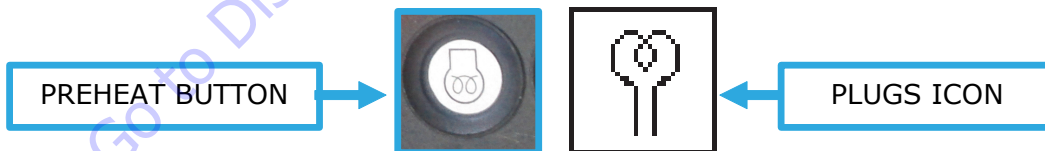


Once remote control display will switch ON, to ignite diesel engine press remote control "diesel engine" button, to start the electric motor press "electric motor" button.

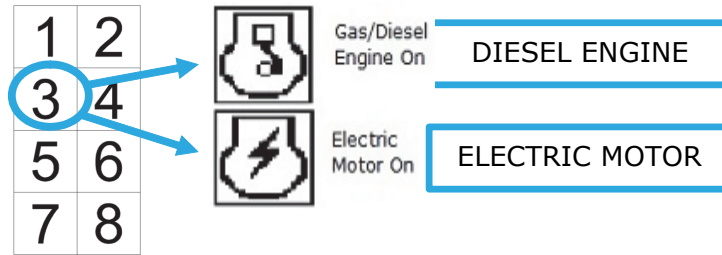
To switch OFF diesel engine or electric motor it's possible to press an emergency stop button or to press once again respectively the "diesel engine" button or "electric motor" button.

Diesel engine and electric motor cannot be ignited together and the system avoids it.

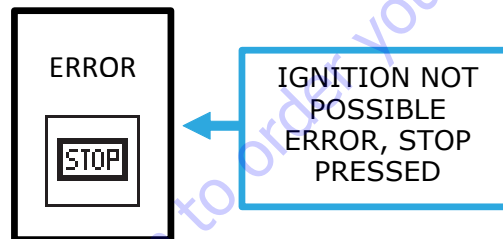
With cold temperatures it's recommended to press the "preheating button" before to ignite diesel engine to warm it up by the plugs and ignite it when the plugs icon will disappear from the display.



The display shows always in position 3 the motor selected and in case it's OFF the icon will be marked with an "X".



If the operator tries to start up the machine with a stop button pressed, the "ERROR STOP" message will appear as illustrated here below.



After machine has been used it must be switched OFF by the main key on ground control box.

When engine and electric motor are switched OFF with machine closed and aligned, remote control will emit an intermittent acoustic signal to notify the operator that the main key is still turned ON.

6.3 PLATFORM - REMOTE CONTROL STATION

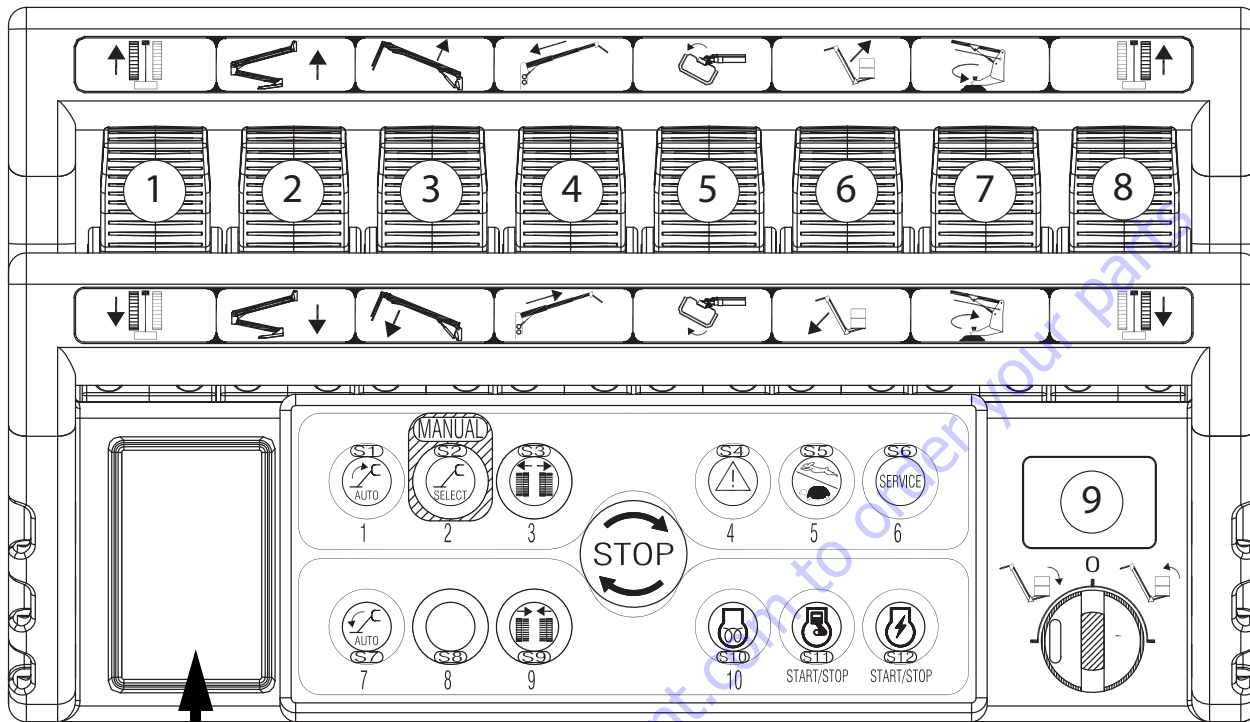


Figure 6-1. Remote Control

At machine start-up and during machine operation the main LCD display screen (Figure 6.1) is activated. There are eight (8) display positions which indicate machine status during various stages of operation.

The remote control is made up of buttons, joysticks, a key selector switch and a display.

The display is used to view the status of the machine and the operating information necessary or useful for the operator.

When the machine's main control board is powered via the engine key, the information to be shown on the display is sent to the remote control.

This operation has a variable duration. Normally a few seconds are sufficient, however the following screen may appear on the display:

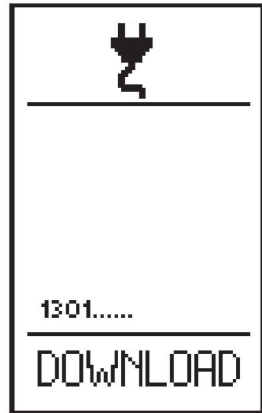


Figure 6-2.

In this case about 5-10 minutes are needed to send all the information from the main board to the remote control. The machine cannot work during this period.

Do not stop the machine or operate it during this period.

NOTE: The numbers shown above DOWNLOAD are the data transferred. The Download will be completed when about more that 24000 steps are transferred.

LCD Display Screen

When the machine is started, the main screen is displayed, giving a general overview of the machine status. For the sake of simplicity and clarity a layout is provided with 8 icon display positions.

Example of the main screen:

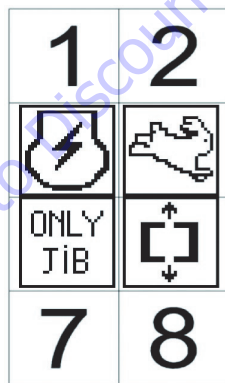


Figure 6-3.

Icon position diagram:



Figure 6-4.

POSITION 3:

Position 3 displays the engine/motor selection and the engine status



Figure 6-5. Petrol/diesel engine



Figure 6-6. Electric motor

An X on the icon indicates that the engine/motor is off, no X indicates that it is on.

POSITION 4:

Position 4 displays the selected speed or the reduced speed for the Lithium:

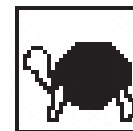


Figure 6-7. Slow



Figure 6-8. Normal

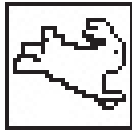


Figure 6-9. Fast



Figure 6-10. Reduced

POSITION 5:

Position 5 displays the icon confirming that overhead movements are enabled.



Figure 6-11.

This icon means that all conditions for using the overhead movements have been checked and the aerial part can be lifted. No icon on means that the aerial part cannot be lifted.

In place of this icon, the basket overload icon may be shown.



Figure 6-12.

When the load sensor measures a load exceeding the allowed work load - 230 kg - the main screen disappears for three seconds, replaced by the overload error display,

the audible warning is activated, then the overload icon appears in position 5 in place of the icon enabling the overhead movements.

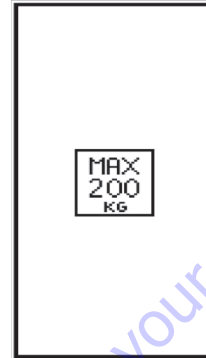


Figure 6-13. Overload error display

POSITION 6:

Position 6 displays the icon confirming that track movements (stabilizers, tracks, track extension) are enabled.

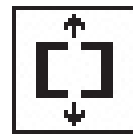


Figure 6-14.

This icon means that all conditions for operating the track movements have been checked. No icon on means the stabilizers cannot be used and the track cannot be extended. The machine, however, can travel even when the icon is off, as long as all 4 stabilizers are lifted from the ground.

POSITION 7:

Position 7 is used for functional signals:

Emergency STOP pressed



Figure 6-15.

Signals that one of the emergency stop buttons on the machine has not been released.

Battery Voltage Below Minimum Limit.

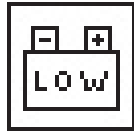


Figure 6-16.

Indicates that the battery charge level is below the minimum limit allowed. If this message appears, it is advisable to recharge the battery, either by keeping the diesel or petrol engine on, or by connecting to the network.



Figure 6-17.



Figure 6-18.

Signals an error in the battery management system of Lithium version.

In this position also other functional signals can be displayed that are useful for machine diagnostics.



Figure 6-19.

The machine has a CANBUS line connection fault.



Figure 6-20.

A faulty or incorrect electronic board (card) has been installed, or alternatively an incorrect software version has been loaded.

POSITION 8:

Position 8 displays the battery charge status or the icon indicating the battery is being recharged in the Lithium version.



Figure 6-21.



Figure 6-22.

Position 8 is used to show the selection of the emergency descent operation from the basket with solenoid valves on the cylinders.



Figure 6-23.

In addition to the main screen described above, there are other functional displays that will be described successively.

LCD Display Icon Description

The display indicates machine conditions and eventual errors occurred in order to help operator and to have a quick diagnose, here follows icons meanings.

	Engine selected not running		Electric motor selected not running		Machine closed and aligned		Close and align machine
	Engine running		Electric motor running		Lift outrigger from the ground		Max tilt angle reached while driving
	Rotate aerial part on the opposite side		Lift 1 st -2 nd booms		Machine stabilized		Max tilt angle reached while manually stabilizing
	Manually rotate the machine back to the allowed area		Machine on reduced area		Open outriggers		Select which outrigger to move
	Minimum speed		Standard speed		Maximum speed for tracks		Inclination too high to stabilize machine
	Stop button pressed		Press pedal (option)		Only jib movement allowed		Remove weight or remote control from basket
	Basket overload		Basket underload		Gravity emergency descent		Movement not allowed by gravity emergency descent
	Engine preheating active		Engine RPM signal alarm		Engine oil pressure alarm		Engine temperature alarm
	Ropes sensor alarm		12V battery voltage low		12V battery down or 1 st -2 nd booms cables sensor anomaly		12V battery down or 3 rd boom cables sensor anomaly
	Double line sensor error, check error menu		Handling error, only jib movement allowed		Machine fully rotated, rotate a few degree back		Turret rotation sensor system anomaly
	Safeties by-pass activated		Motor ignition not possible error, stop pressed		CAN BUS error, check CAN TIME OUT menu		Board or software wrong
	Remote connection in progress		Software updates available		Automatic periodical service reminder		Jib moved with aerial part by-pass activated, machine need to be closed
	Machine stabilized error list (*)						

Figure 6-24. LCD Display Icon Description

Lithium Only Icons



Lithium battery level



Machine in charge



Extra low speed



Error warning, check lithium error list



Low voltage detected on lithium cell



Cold Weather functions active




Emergency procedure active, connect 120V

Joystick Controls

Using the joysticks the operator selects the movement to be performed, the direction and the speed. The direction of the joystick determines the direction of the movement. The degree of movement of the joystick determines the speed. The more the joystick is moved away from the central neutral position, the faster the movements obtained.

The following table shows the movement controlled and its direction depending on the joystick shifting direction.

Table 6-1.

JOYSTICK	JOYSTICK SHIFTING DIRECTION	MOVEMENT CONTROLLED
		AERIAL MOVEMENTS ENABLED 
1	FORWARDS	LEFT TRACK FORWARDS
	BACKWARDS	LEFT TRACK BACKWARDS
2	FORWARDS	1st-2nd ARM UP
	BACKWARDS	1st-2nd ARM DOWN
3	FORWARDS	3rd ARM UP
	BACKWARDS	3rd ARM DOWN
4	FORWARDS	EXTENSION ARM IN
	BACKWARDS	EXTENSION ARM OUT
5	FORWARDS	BASKET ANTICLOCKWISE ROTATION
	BACKWARDS	BASKET CLOCKWISE ROTATION
6	FORWARDS	JIB OPENING
	BACKWARDS	JIB FOLDING
7	FORWARDS	ANTICLOCKWISE ROTATION
	BACKWARDS	CLOCKWISE ROTATION
8	FORWARDS	RIGHT TRACK FORWARDS
	BACKWARDS	RIGHT TRACK BACKWARDS
9	R	CLOSE BASKET LEVELLING
	L	OPEN BASKET LEVELLING

Tilt Conditions Drive Cut-out

X17JP-X500AJ X20JP-X600AJ X26JP-X770AJ are provided with a special system that automatically reduces tracks speed or stops the movement in case of stability risks.

This control depends automatically on different factors:

- Weight in the basket
- Jib opened or closed
- Tracks widened or not
- Slope inclination gradient in axles X and Y

The consequence of a stability emergency is, with increasing severity:

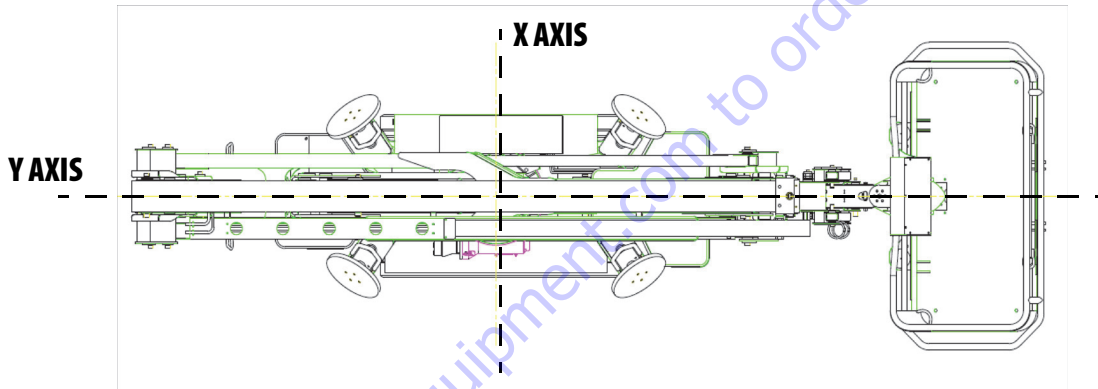
- Track speed reduction.
- Tracks movement stopped, display icon -->



Also the buzzer on the remote control could be activated.

⚠ WARNING

TO MOVE THE TRACKS WHEN THE MACHINE IS STOPPED BY THOSE CONDITIONS IT'S NECESSARY TO PRESS BUTTON 8 ON REMOTE CONTROL, A COUNTER-DOWN OF 10 SECONDS WILL BE ACTIVATE ON THE DISPLAY AND IN THE MEANTIME TRACKS MOVEMENT IS ALLOWED IN TURTLE SPEED WITH BEEPER ON. DURING THAT BY-PASS THE OPERATOR CAN BRING MACHINE BACK TO STABILITY CONDITION.












Speed Control Possible Conditions On The X17JP - X500AJ

JIBOPEN	Not possible to select HARE	X or Y > 5°		TURTLE	
		Y > 7°		TURTLE + BUZZER	
		Y > 13°		BUZZER + MOVEMENT STOPPED+ ALARM ICON	
		UNDERCARRIAGE CLOSED	X > 6°	TURTLE + BUZZER	
			X > 10°	BUZZER + MOVEMENT STOPPED+ ALARM ICON	
		UNDERCARRIGE WIDENED	X > 10°	TURTLE + BUZZER	
X > 15°	BUZZER + MOVEMENT STOPPED+ ALARM ICON				

JIBCLOSED	Weight inside basket <=120Kg Possible to select HARE	X or Y >8°		TURTLE	
		Y>10°		TURTLE + BUZZER	
		Weight inside basket <=40kg	Y>16°	BUZZER + MOVEMENT STOPPED + ALARM ICON	
		Weight inside basket >40kg<=120Kg	Y>13°	BUZZER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE CLOSED	X>6°	TURTLE + BUZZER	
			X>10°	BUZZER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE OPEN	X>10°	TURTLE + BUZZER	
	X>15°		BUZZER + MOVEMENT STOPPED + ALARM ICON		
	Weight inside basket >120<=230Kg Not possible to select HARE	X or Y >5°		TURTLE	
		Y>7°		TURTLE + BUZZER	
		Y>13°		BUZZER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE CLOSED	X>6°	TURTLE + BUZZER	
			X>10°	BUZZER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE OPEN	X>10°	TURTLE + BUZZER	
	X>15°		BUZZER + MOVEMENT STOPPED + ALARM ICON		
Weight inside basket >230Kg			MAX WEIGHT ALARM + MOVEMENT STOPPED		

Speed Control Possible Conditions on the X20JP - X600AJ

JIBOPEN	Not possible to select HARE	X or Y >6°		TURTLE	
		Y >13°		TURTLE + BEEPER	
		Y >20° BASKET DOWNSTREAM OR Y >16° BASKET UPSTREAM		BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE CLOSED	X >8°	TURTLE + BEEPER	
			X >10°	BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE WIDENED	X >10°	TURTLE + BEEPER	
X >15°	BEEPER + MOVEMENT STOPPED + ALARM ICON				
JIBCLOSED	Weight inside basket <=120Kg Possible to select HARE	X or Y >6°		TURTLE	
		Y >13°		TURTLE + BEEPER	
		Y >20° BASKET DOWNSTREAM OR Y >16° BASKET UPSTREAM		BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE CLOSED	X >8°	TURTLE + BEEPER	
			X >10°	BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE OPEN	X >10°	TURTLE + BEEPER	
	X >15°		BEEPER + MOVEMENT STOPPED + ALARM ICON		
	Weight inside basket >120<=230Kg Not possible to select HARE	X or Y >6°		TURTLE	
		Y >10°		TURTLE + BEEPER	
		Y >15°		BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE CLOSED	X >8°	TURTLE + BEEPER	
			X >10°	BEEPER + MOVEMENT STOPPED + ALARM ICON	
		UNDERCARRIAGE OPEN	X >10°	TURTLE + BEEPER	
	X >15°		BEEPER + MOVEMENT STOPPED + ALARM ICON		
Weight inside basket >230Kg			MAX WEIGHT ALARM + MOVEMENT STOPPED		

Speed Control Possible Conditions on the X26JP - X770AJ

JIB OPEN (HARE NOT AVAILABLE)	Y>6° BASKET ON LOWER SIDE	TURTLE
	Y>13°	TURTLE + BEEPER
	Y>20° BASKET ON LOWER SIDE Y>16° BASKET ON UPPER SIDE	BEEPER + STOP + ALARM ICON
JIB CLOSED WITH <=120Kg	Y>6° BASKET ON LOWER SIDE	TURTLE
	Y>13°	TURTLE + BEEPER
	Y>20° BASKET ON LOWER SIDE Y>16° BASKET ON UPPER SIDE	BEEPER + STOP + ALARM ICON
JIB CLOSED WITH <=230Kg (HARE NOT AVAILABLE)	Y>6°	TURTLE
	Y>10°	TURTLE + BEEPER
	Y>15°	BEEPER + STOP + ALARM ICON

Speed Control Conditions On X Axle



ALWAYS	X>6°	TURTLE
TRACKS NOT OPENED	X>10°	TURTLE+BEEPER
	X>13°	BEEPER + STOP + ALARM ICON
TRACKS OPENED	X>15°	TURTLE+BEEPER
	X>18°	BEEPER + STOP + ALARM ICON

Push Buttons

The buttons have a dual function: they can be used to select machine functions or as numerical keys in the service submenus.

They in fact feature an icon that represents their meaning and a number for use as a numerical keypad.

An emergency STOP button is also available which, when pressed, stops the motor and brings the machine to a standstill.

The pressed position of the emergency STOP button is represented on the display in position 7.

To make the machine operational again, the button must be turned and released.

For the description of the individual functions, see paragraph 6 Using the machine.

BUTTON 1:



Figure 6-25. Used to automatically raise the stabilizers.

BUTTON 2:



Figure 6-26. Enters the menu for the manual movements of the individual stabilizers.

BUTTONS 3-9:



Figure 6-27. Used to extend and narrow the tracked undercarriage.

BUTTON 4:



Figure 6-28. Used to enable control of the emergency descent from the basket. Confirmation that the operation is enabled is displayed on the screen in position 8.

BUTTON 5:



Figure 6-29. Used to select the travel speed and the engine/motor speed.

There are three speeds available:

- SLOW: engine at idle for the operation of the aerial part, at medium for the operation of the drive. Lowest drive speed.
- NORMAL: variable rpm according to the selected movement. Travel motors always with maximum displacement, therefore medium travel speed
- FAST: variable rpm according to the selected movement. Travel motors in automatic displacement variation mode, therefore maximum travel speed.

The three speeds are selected by pressing button 5 in sequence, with a cyclical routine. The selected speed is displayed on the screen in position 4.

BUTTON 6:



Figure 6-30. Enters the auto service menu

BUTTON 7:



Figure 6-31. Used to automatically lower the stabilizers.

BUTTON 10:



Figure 6-32. Preheating

PETROL ENGINE

Allows the preheating of the petrol engine. One pressure on the button sets the engine at 2200 rpm for 20 seconds, in order to heat the engine and improve the initial phases of use.

DIESEL ENGINE

Enables the activation of the sparking plugs preheating. One pressure on the button causes a preheating equal to 10 seconds. In case of anticipated starting, the preheating ends when starting.

BUTTON 11:



Figure 6-33. Allows the engine to be switched on/off. If the button is pressed with the engine on, this will be stopped.

BUTTON 12:



Figure 6-34. Allows the electric motor to be switched on/off. If the button is pressed with the engine on, this will be stopped.

If the start buttons are pressed with an emergency STOP button pressed, starting will be impossible.

This condition is indicated by the icon STOP in position 7.

If the operator attempts to start one of the two motors while the other is already running, starting will be impossible and the icon showing the motor already on will appear at the centre of the screen.

NOTE: Buttons 5 and 6 when pressed simultaneously also activate the horn (optional).



Figure 6-35.

6.4 CANBUS COMMUNICATIONS

The electrical system works with a CAN BUS system, where:

CAN = Control Area Network

BUS = Channels for peripherals

CANbus: CAN (Control Area Network) is a two wire differential serial link between the, Ground Module ECM1-2; the Remote Control; the LSS ECM3, the Cylinders position sensors and the Rham Modem Module providing bi-directional communications.

Two-wire: One wire (White; Black or Black with numbers) is driven high (5v) and the other low (Gray; Brown or Black with number) (0v) to send a signal; both wires "float" (2.5v) when no signal is being sent.

Differential: Any electrical line noise can affect the high or the low wires but never both, so communications is not corrupted.

Serial Link: Messages are being sent bit by bit along the wires; the high bus speeds allow all modules to be constantly updated around 20 times per second. Typical traffic is 300 - 500 messages per second.

A complete CANbus circuit is approximately 60 ohms,

Each individual circuit from the modules is approximately 120 ohms.

The GROUND MODULE ECM1-2 is the master system controller.

Most functions are dispatched and coordinated from this module, all other system modules; Remote Control; LSS ECM3; Cylinders position sensors; Rham Modem.

Fundamental characterized information (values) are stored into the ground module ECM 1-2 (i.e., Personalities or Calibrations), while on the LSS ECM3 the basket load setting.

Lift, Tele, Swing & Drive:

The GROUND MODULE ECM1-2 stores default values, handles interlocks and calibration information.

Lift, Telescope Swing and Drive commands are dependent upon interlocks through out the machine that enables the power supply of the ON -OFF proportional coils after verification of the safety conditions by handles interlocks.

The safety control functioning ECM1 can be by - passed by the key selector switch (spring return) "safety device by-pass key".

The circuit board ECM1 record any by-pass event by date, time and duration of the "safety device by-pass key" action.

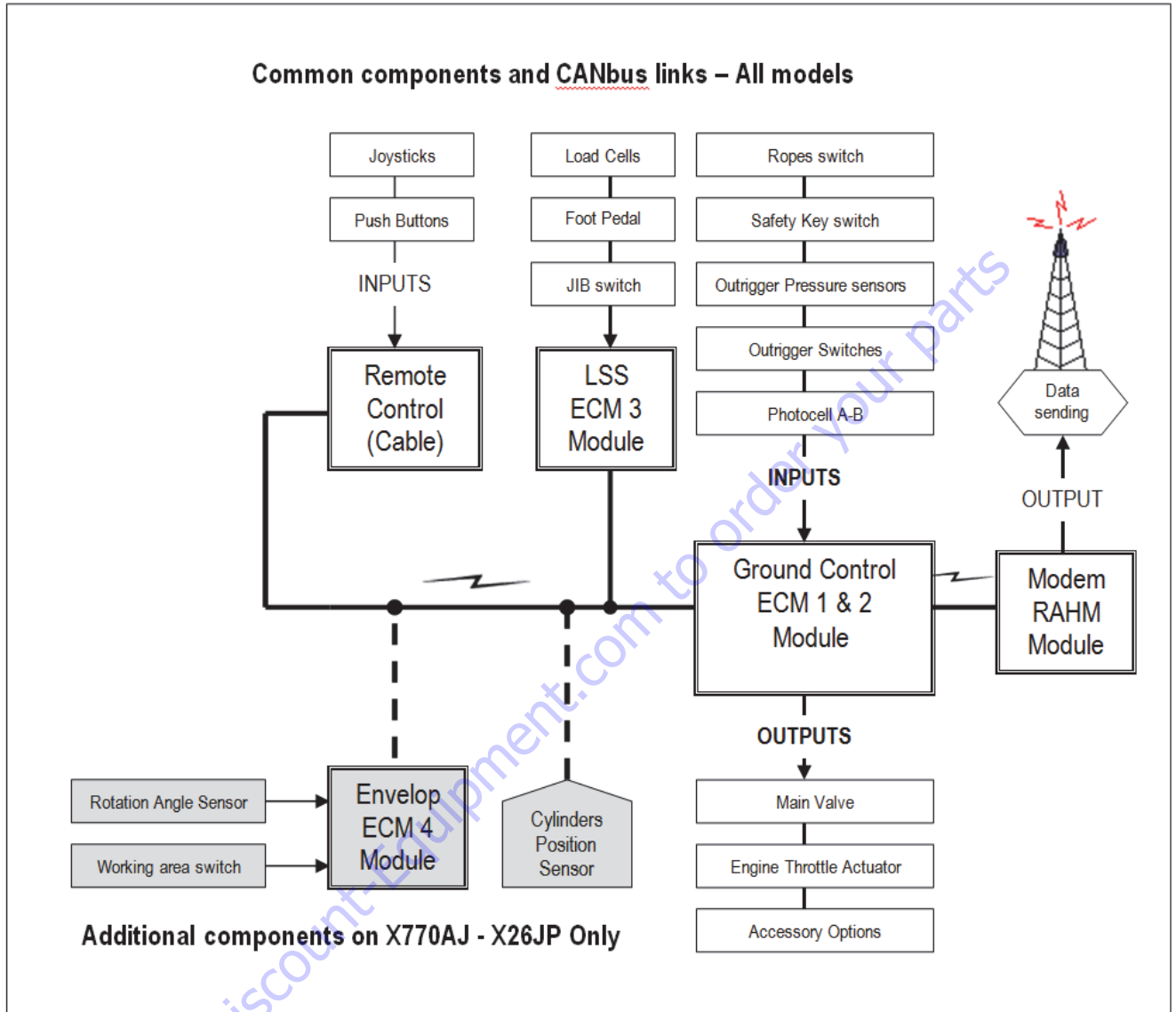


Figure 6-36. Common Components And Canbus Links

Can Bus Device Positions

X17JP-X500AJ - X20JP-X600AJ



Figure 6-37. Control Module Location - X17JP-X500AJ - X20JP-X600AJ

X26JP-X770AJ

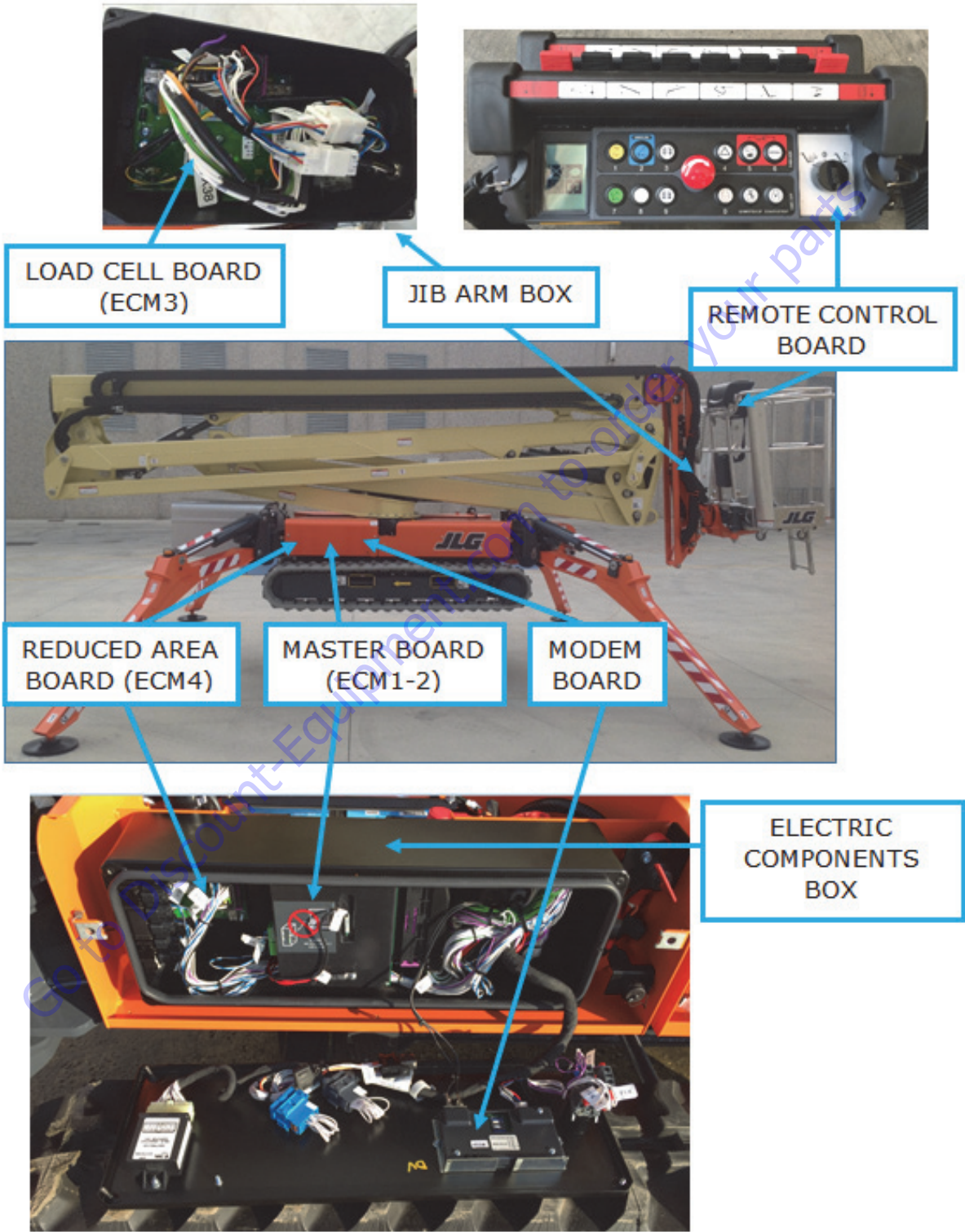







Figure 6-38. Control Module Location - X26JP-X770AJ

CAN-BUS Diagnostics

DISPLAYED ICONS

If an icon of the followings appears on the display check as indicated here below.

<p>THIS IS NOT A CAN-BUS ERROR</p> <p>Control error menu: check from the display into the ERROR MENU pushing 6 – MENU and then 3 – ERRORS, then skipping the pages it will be showed the devices error status, where there's a NO means that the signal from two lines of that device are not according each other, so check it and check its connections</p>	
<p>Electronic board or software wrong: check if the platform's devices are compatibles with installed software, if necessary contact Hinowa with the serial number and the release number of the installed software</p>	
<p>CAN BUS signal missing: check the connection as indicated at the step 4 of the present procedure</p>	
<p>2° cylinder sensor missing: check the connector of the position sensor on 3° arm cylinder and the sensor itself check also the battery charge level, in case of low battery level let the engine run for some minutes, then check if this alarm disappear.</p>	
<p>Battery low charge alarm: it could appear especially after the engine start, check the charge level and eventually recharge.</p>	

CAN Timeout Menu'

As soon as you have CAN BUS error shown on the display, check the error list on page 4, pushing the buttons 6 – MENU --> 3 – ERRORS and then pushing 2 times NEXT till page 4 CAN TIMEOUT, the display will show the following screen on (left side) with the followings meaning (right side).

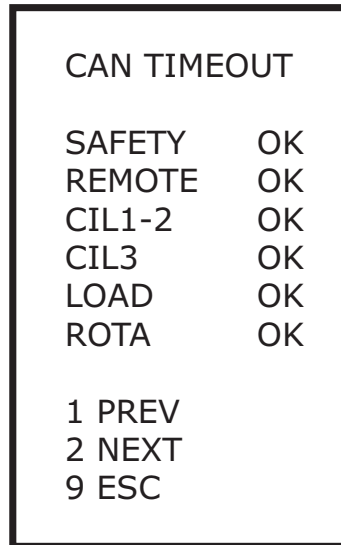


Figure 6-39.

Table 6-2. CAN-Message

SAFETY	Master board (ECM1-2) Safeties lines
REMOTE	Remote control
CIL 1-2	1st and 2nd booms cylinder position sensor (X26JP-X770AJ Only)
CIL 3	Third boom cylinder position sensor
LOAD	Load cell board (ECM3)
ROTAT.	Reduced area board (ECM4)

This page with OK indicates the correct presence of the signals in the CAN BUS line of the different connected devices. The indication shall always be OK, if the indication is NO it means that the device is not communicating by CAN BUS line and therefore it is not considered in function by the other devices.

If it results some NO within this error page, try to check the connection, afterward if it doesn't fix the problem check and eventually replace the device, if otherwise there are only YES it's requires to go on with a software check.

Software Check

Only if the problems occurred after a software updating, check if the platform's devices are compatibles with the new software, in this case, if necessary contact Hinowa with the serial number and the release number of the software install.

CAN BUS Devices And Connections

If you didn't fix the problem it's requires going on with CAN BUS devices and connections check that requires the following schematics:

1. CAN BUS DEVICES CONNECTIONS (here below).
2. CAN BUS DEVICES LAY-OUT (here below).
3. CAN NETWORK sheet on the electric wiring diagram ("E3").

Proceed step by step as follows:

4. DEVICES CHECK: Always with ignition switch turned OFF and the battery cutter disconnected, disconnect one by one every CAN BUS devices, the blue lines indicated in the CAN BUS devices connections here below, starting with the modem and continue with load cell board (ECM3) on the jib arm and so on. Anytime that you have disconnected one device, connecting the battery cutter and turning ON ignition switch, check if CAN BUS error disappears. To know which are the CAN BUS contacts on the devices, consult the relative page on the electric wiring diagrams
5. CONNECTIONS CHECK: Always with ignition switch turned OFF and the battery cutter disconnected, connect 2 external wires to create an alternative CAN BUS line from green connectors (example picture here below) of ECMs and disconnect the original wires. To know which are the CAN BUS contacts on the devices, consult the relative page on the electric wiring diagrams.

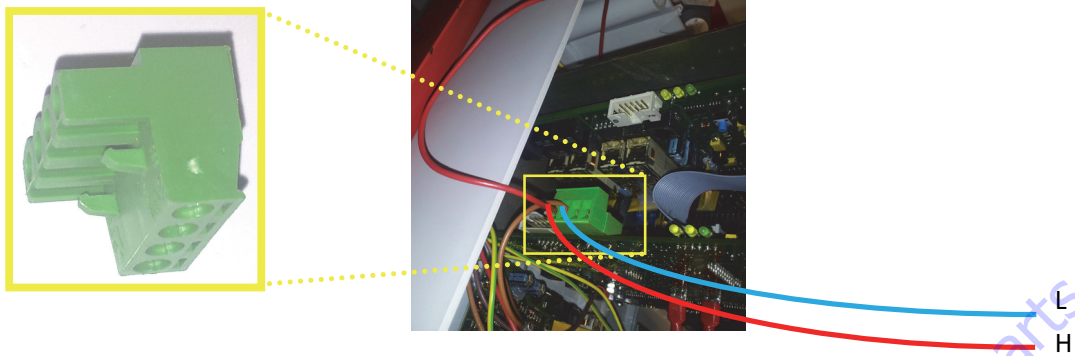


Figure 6-40.

Anytime that you have replaced a connection, connecting the battery disconnect and turning ON ignition switch, check if CAN BUS error disappears. This operation is necessary to check not only the continuity of the wires but also the status, because it could happen that a wire is scratched so even maintaining the continuity it introduces a disturb into the signal

NOTE: *Exchanging the wires H and L the system doesn't work, so it's important to replace each connection as was originally.*

PROCEEDING EXAMPLE: Always changing the connections configuration with battery disconnect disconnected, connect two external wires (red lines here below) between ECM1-2 and ECM3, disconnecting the original wires on this tract, then check the status: if with this configuration the error doesn't disappear means that the failure is on a device, otherwise if the error disappears it means that the failure was in the original connections (it could be possible that it appears "SEN 3 FAIL" 2nd cylinder sensor missing). Then, in case we detected the problem on the connection, replacing the original connections and substituting only the connection between ECM1-2 and the JIB CONNECTOR SCHEDULE with an external couple of wires (green lines here below), check the status, if the error appear it means that the failure was on this tract original connection, otherwise if the error disappear check the other possible tracts.

Go to Discount-Equipment.com for your parts

X17JP - X20JP - X500AJ - X600AJ - CAN BUS Device Layout

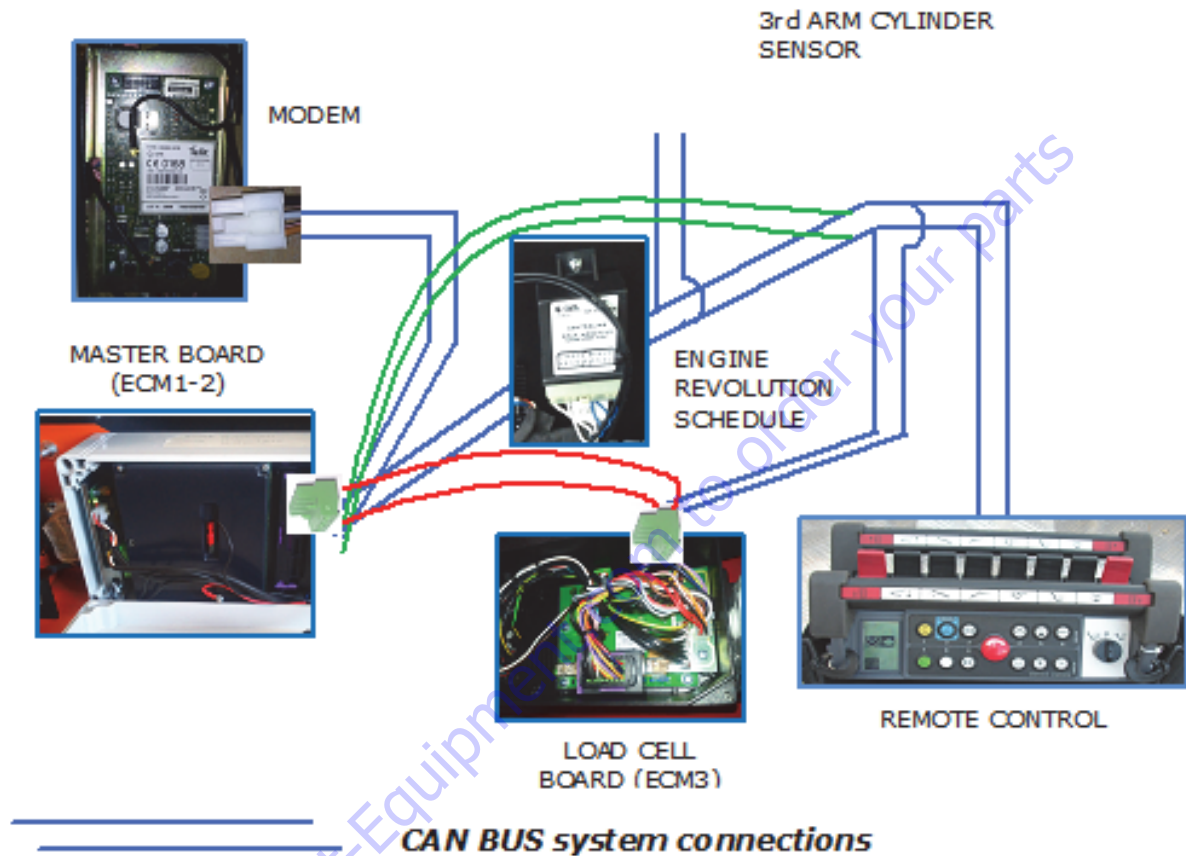


Figure 6-41.

After checking, if the device is defective, change the device, if the problem is the connection it's required to repair or replace the wires.

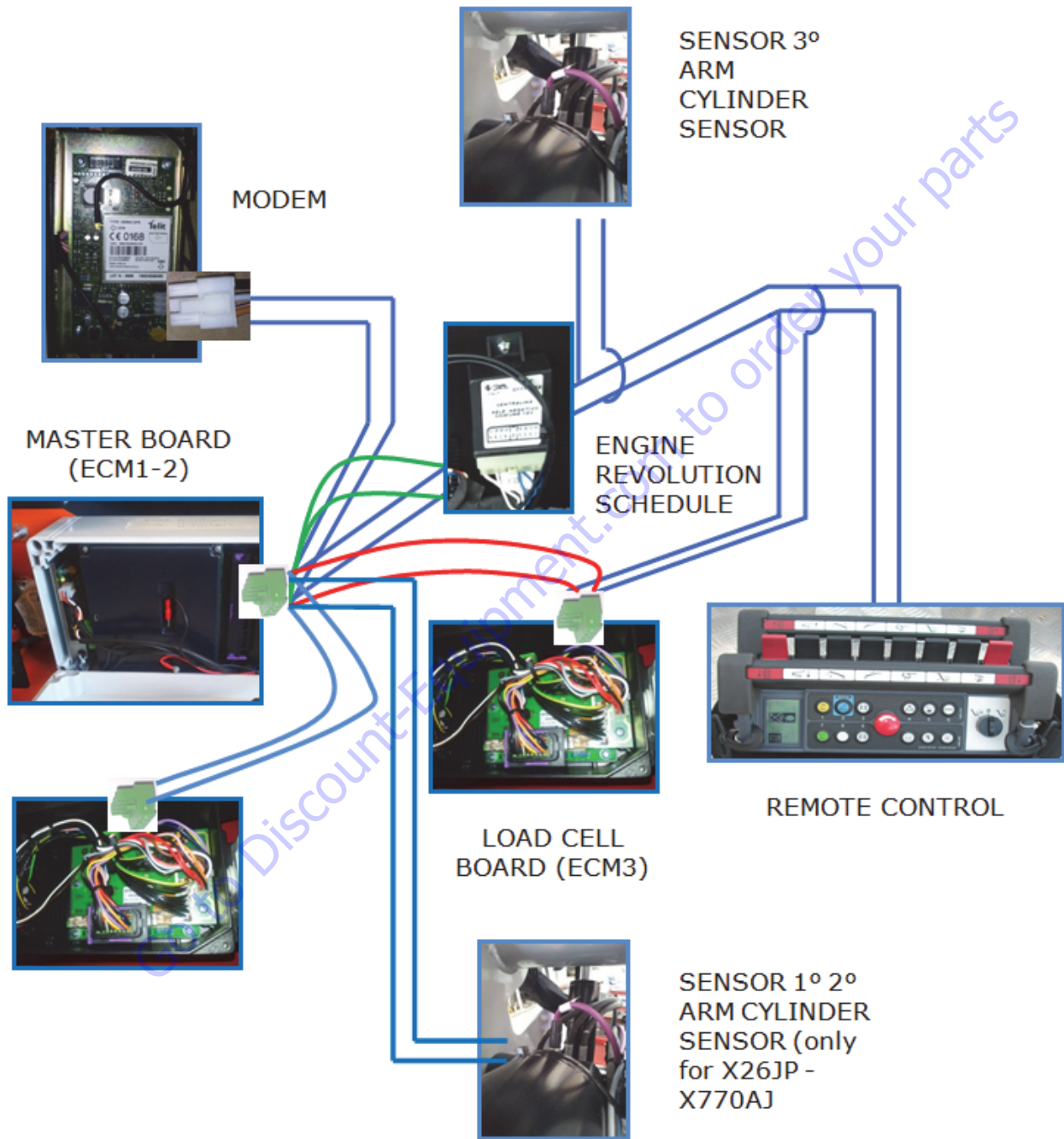
NOTE: Evaluate that if you have already changed more than one spares of the same device, in this case the problem could be caused for example by water going inside the box, so take a look to possible traces of oxidation on the contacts, in this case isolate better the box. Be careful that the jib box cover has a direction to be assembled, if assembled in the wrong direction water goes inside.

Resistance Check

WITHOUT FEEDING THE SYSTEM, looking into the electric diagram of your platform (as the example here below), check the remote control/receiver and ECM1-2 CAN BUS resistances (in the red round) on page CAN NETWORK (page "E"), i.e. test the resistance measured within the cable H and L that should be about 120 Ohm with the device disconnected from the other and 60 Ohm with the device connected each other, (always with FEED OFF)

X26JP - X770AJ - CAN BUS Device Layout

CAN BUS DEVICE LAY-OUT



CAN BUS system connections

Figure 6-42.

CAN NETWORK - CYLINDER POSITION SENSOR - MODEM

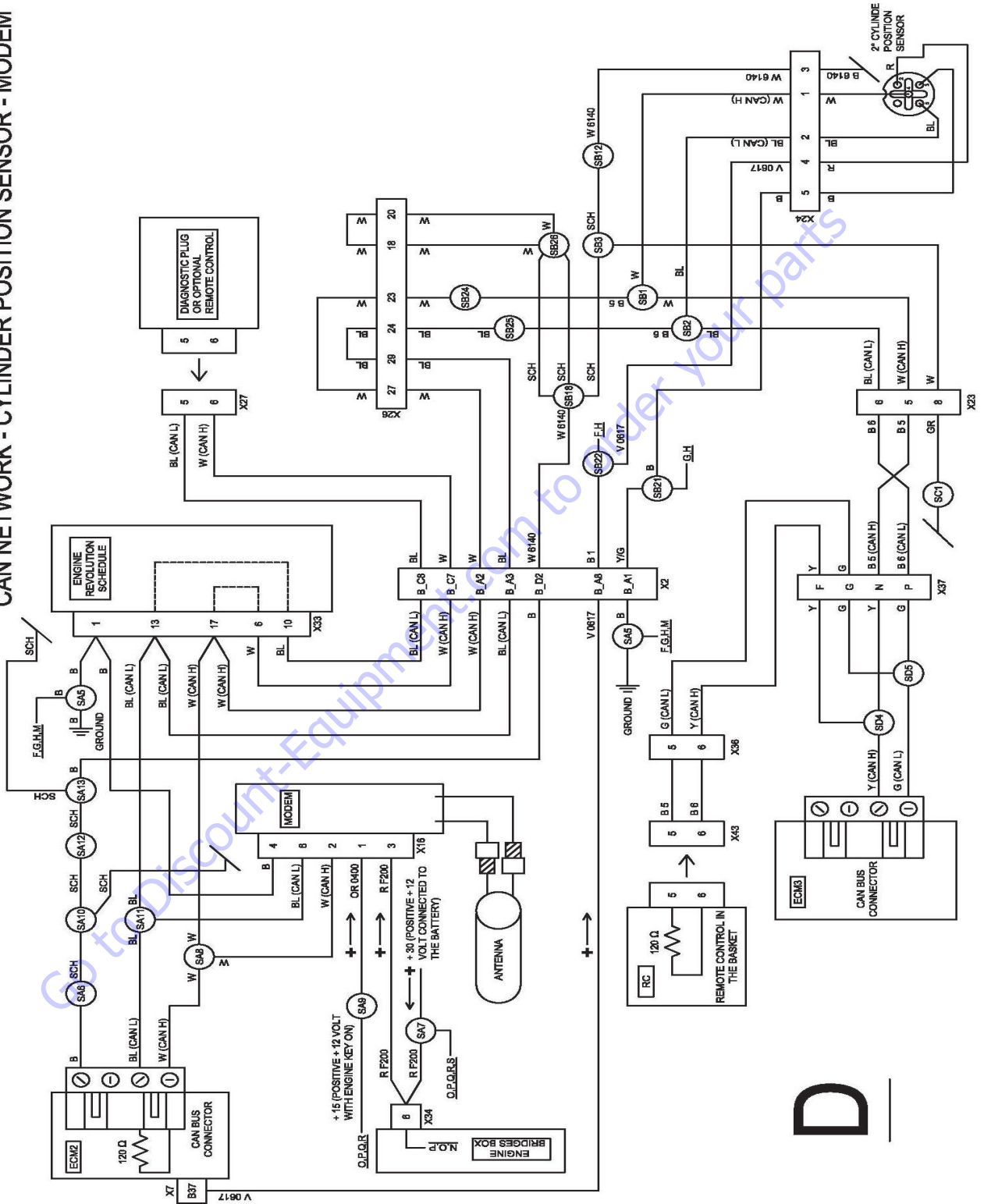


Figure 6-43.

E - CAN BUS LINE

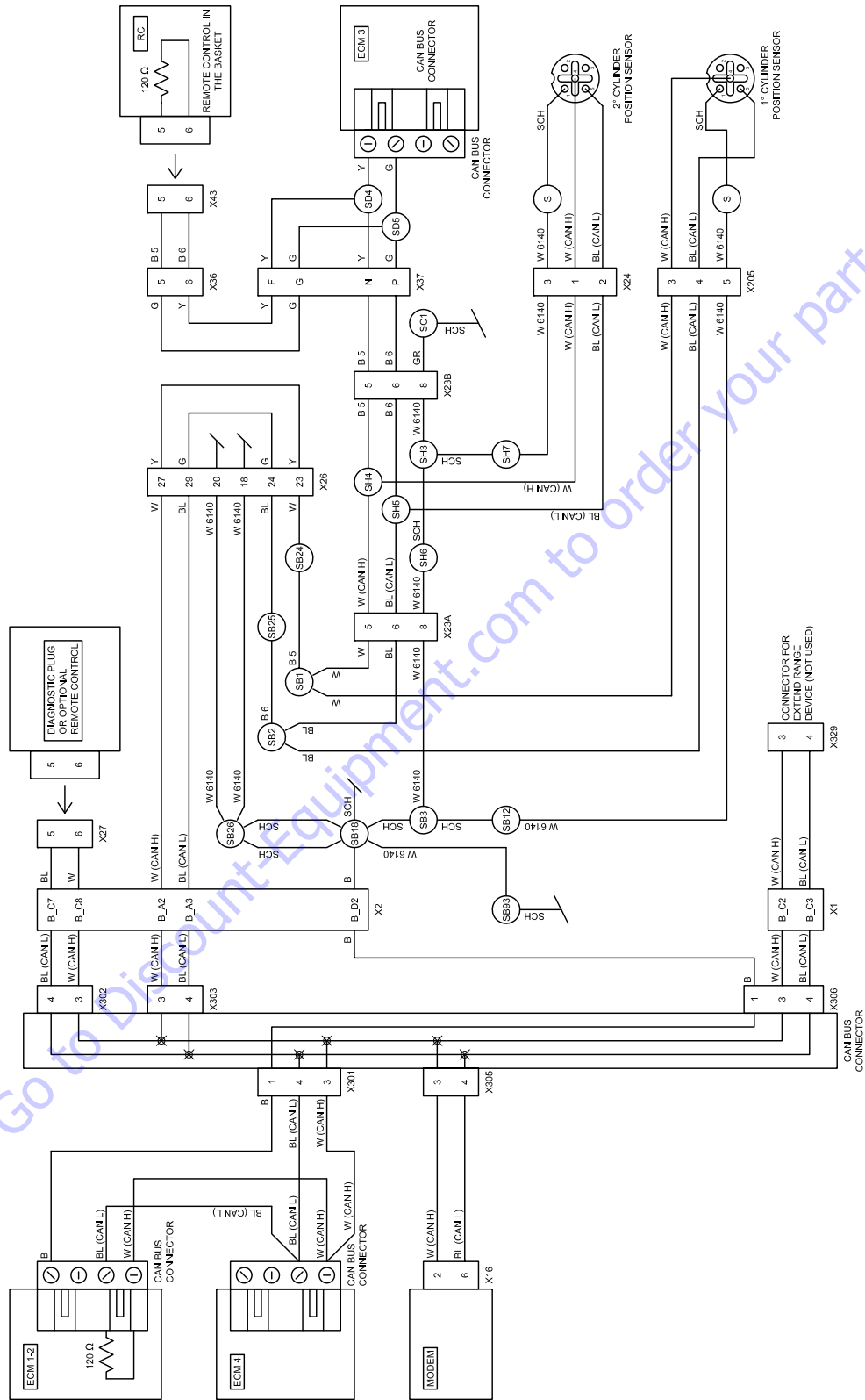


Figure 6-44.

Electronic Module LED Flashing Codes

ECM (Master Board Modules) Led Code :

Master board (ECM1-2) is composed by two modules, the front module called ECM2 and the back module called ECM1.



Figure 6-45.

ECM2 LED CODE

DL1 - green LED steady ON: Power +5V to MASTER BOARD FRONT MODULE CPU

DL2 - yellow LED steady ON: All the outriggers are lifted from the ground or machine is closed and aligned (photocells signal)

DL3 - yellow LED steady ON: All the outriggers are touching the ground or all the outriggers are lifted from the ground

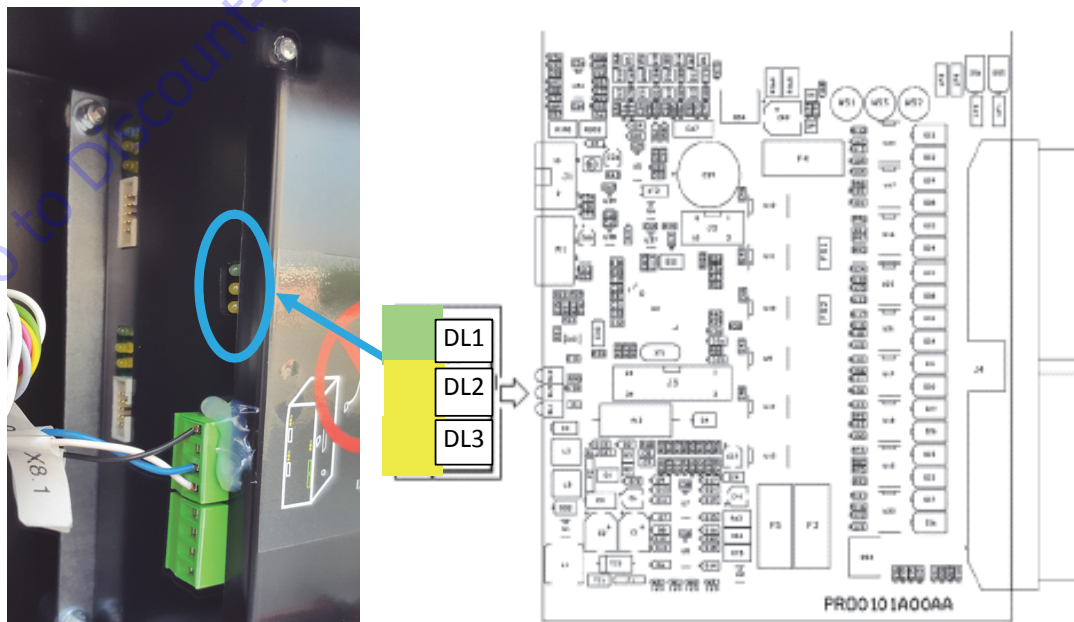


Figure 6-46.

ECM1 LED CODE

- DL1 green steady LED ON: power +5V to safety channel "A" CPU
- DL2 yellow steady LED ON: tracks safety relay for channel "A" CPU closed
- DL3 yellow steady LED ON: aerial part safety relay channel "A" CPU closed
- DL4 green steady LED ON: power +5V to safety channel "B" CPU
- DL5 yellow steady LED ON: tracks safety relay channel "B" CPU closed
- DL6 yellow steady LED ON: aerial part safety relay channel "B" CPU closed

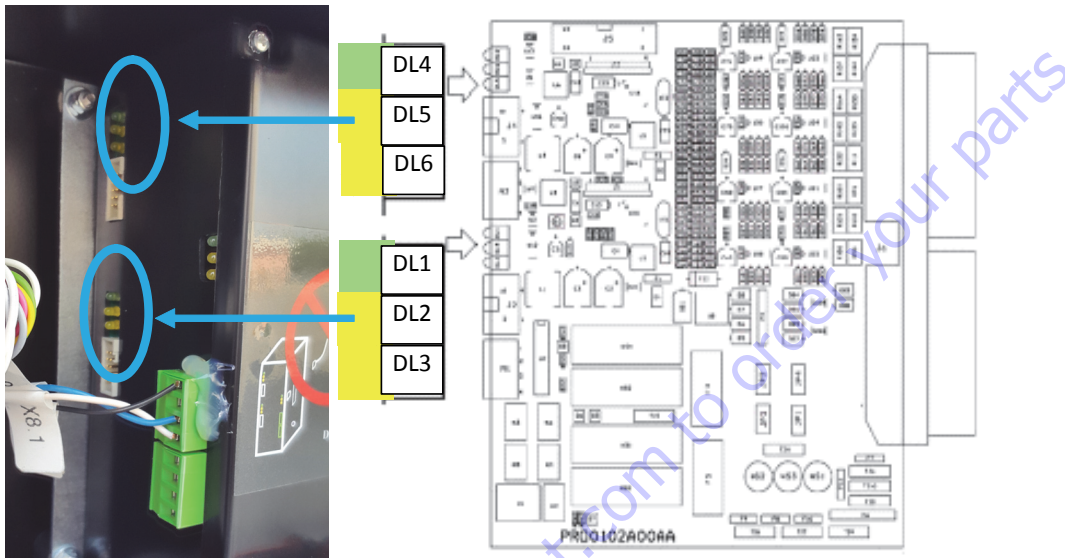


Figure 6-47.

ECM3 and ECM4 LED CODE

LOAD CELL BOARD (ECM3) and REDUCED AREA BOARD (ECM4) are similar but not equal, they must not be confused.

- DL1/DL3 and DL2/DL4 blinking green/red: board not calibrated
- DL1-DL2 green LED steady ON: board calibration values are memorized, even it does not means that it is properly calibrated

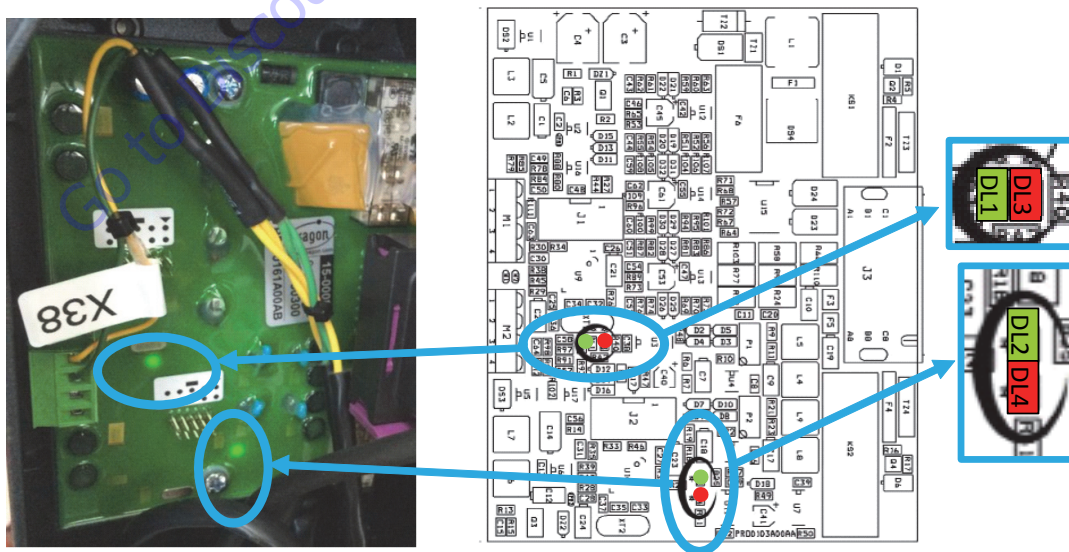


Figure 6-48.

MODEM LED CODE

DL1 green LED steady ON: power ON

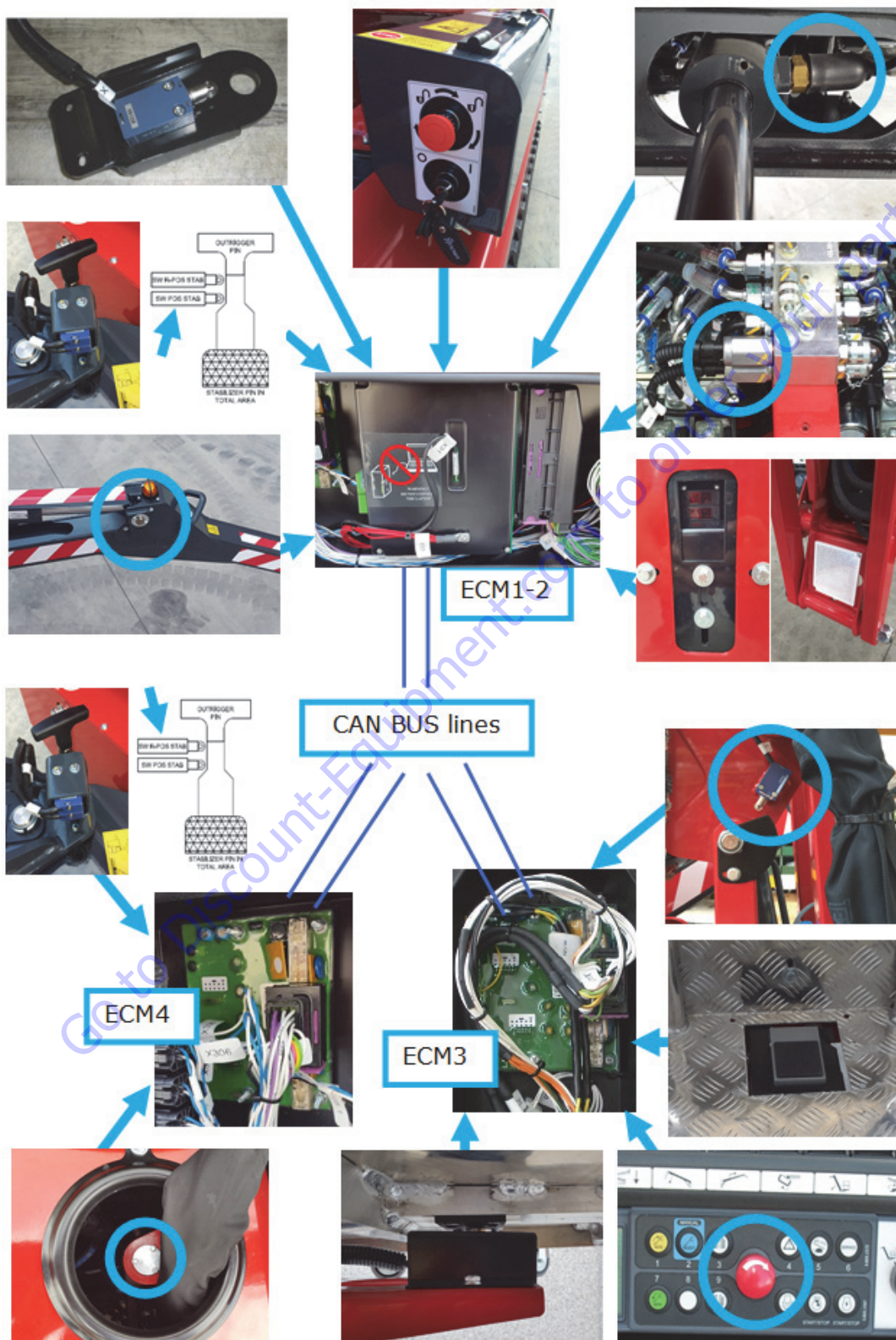
DL2 blue LED flashing each 1 second: Network signal searching

DL2 blue LED flashing each 3 seconds: Line ready



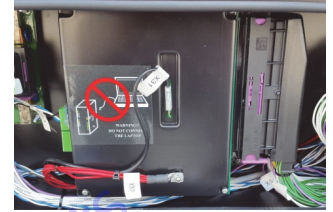
Figure 6-49.

6.5 SENSORS AND DEVICES NOT COMMUNICATING THROUGH CAN-BUS

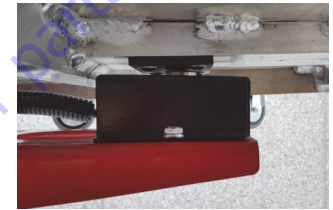


The following devices **not** communicating through CAN BUS system are or directly connected to the ECM1-2 or indirectly through ECM3 or ECM4 that communicate through CAN BUS their conditions.

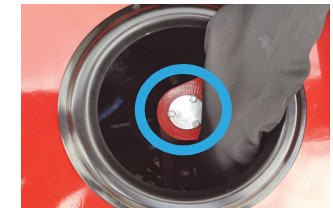
Inclinometers: they are two accelerometers sensors (one each axles) welded on the ECM1-2. They detect the machine inclination on both axles, each one works with a double line. EMC1-2 accelerometers have to be calibrated once it's installed on the machine.



Load sensor: it's an extensimeter sensor that sends a double electric signal to the ECM3. These signals are compared and transduced by ECM3 that communicates the load measured through CAN BUS to the ECM1-2. EMC3 has to be calibrated with load cell sensor.



Turret rotation position sensor: it's an encoder sensor that sends a double electric signal to the ECM4. These signals are compared and transduced by ECM4 that communicates the rotation angle measured through CAN BUS to the ECM1-2. EMC4 has to be calibrated with turret rotation position sensor.



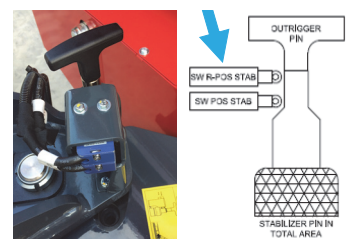
Photocells: they are installed on machine rear side interacting with the reflector installed on the bottom of jib, when they receive back the reflector signal it means that machine is closed and aligned. They are normally opened (NO) and are closed when the machine is closed and aligned. They are directly connected to the ECM1-2 working in parallel as a double line sensor.



Outriggers ground microswitches: they are four switches (one each outrigger) that detect if the outrigger is touching the ground or not. They are normally closed (NC) and are released when the outrigger is touching the ground. Each one is directly connected to the ECM1-2 with a double line.

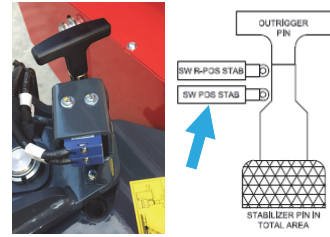


Outrigger reduced area microswitch (the upper one): they are four switches (one each outrigger) that detect if the outrigger is opened (at least half-way) or closed. They are normally closed (NC) and are released when the outrigger is opened. Each one is connected to the ECM4 with a double multiplex line (different frequencies).

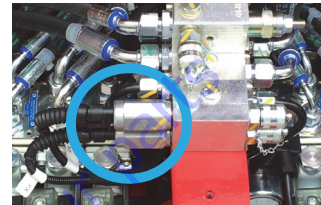


SECTION 6 - JLG CONTROL SYSTEM

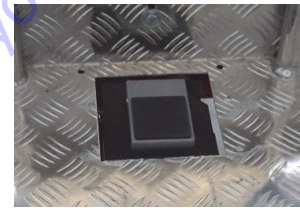
Outrigger completely opened microswitch (the lower one): they are four switches (one each outrigger) that detect if the relevant outrigger is completely opened or not. They are normally closed (NC) and are released when the outrigger is completely opened. Each one is directly connected to the ECM1-2 with a double line.



Pressure sensors: they are two pressure sensors installed on each hydraulic line that give the signal to the ECM1-2 when an high pressure value is reached. They are normally opened (NO), released when the pressure is lower than that value. They are directly connected to the ECM1-2 as two single lines.



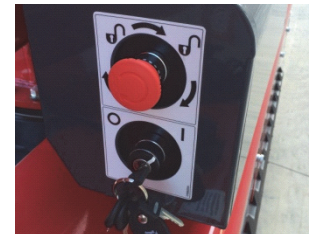
Pedal: it's an OPTIONAL that could be activated by the service menu, if activated operator must press it to move the machine from the basket, preventing unintentional movements. It is normally opened (NO) and when is pressed it sends the signal to the ECM3 by a single line.



Emergency stop button on the remote control: it's a switch inside the remote control that through ECM3 and ECM4 is connected to the ECM1-2 with a double line. It is normally closed (NC) and it is released when the red button is released. When the remote control is connected to the ground optional cable, its emergency stop button is directly connected to the ECM1-2 with a single line.



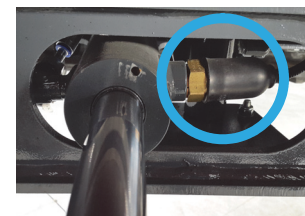
Emergency stop button on the ground: it's a red button switch installed on the ground controls box directly connected to the ECM1-2 with a double line. It is normally closed (NC) and it is released when the red button is released.



Jib microswitch: it's used for the AUTOMATIC SPEED CONTROL function and it is installed on the upper part of jib detecting if the jib is completely closed or not. It is normally closed (NC) and is released when the jib is closed. It is connected to the ECM3 with a double line.



Tracks widening sensor switches: they are two sensors used for the AUTOMATIC SPEED CONTROL function. They are installed on the two tracks widening cylinders and detect the position of tracks completely widened or not. They are normally opened (NO) and they are connected in series directly to the ECM1-2.



Ropes sensor switch: It's a microswitch installed inside the third boom bottom side that detect the ropes integrity. It is normally closed (NC), it would be pressed in case of the ropes will move. It is directly connected to the ECM1-2 with a single lines.



NOTE: Some other devices not listed here above, such as the ones for the emergency procedures, are indicated by the wiring diagrams.

Electrical System Sections

The cables that starting at the base going through the booms are sectionized with connectors on the 1st and 2nd booms cylinder inside the sock.



Inclination Sensor System

The inclinometers system is composed by two sensors (one each axles) welded on the master board (ECM1-2) that gives a double signal each one translated into and "X" inclination and "Y" inclination by the master board (ECM1-2).

Each double signal and compared verifying their coherency (same values within a certain tolerance).

In same case, depending on the machine condition, if an inclination is exceeding the limit or in case of anomalies such as a discordance between the two lines machine will avoid the movements showing an error message.

EMC1-2 accelerometers must be calibrated once ECM1-2 is installed on the machine, the calibration must be carried out as indicated by the APPENDIX 2.

Load Cell System

The load cell system has two components, load cell board (ECM3) and the load cell sensor.

The load cell sensor is located under the basket and it has two extensimeters so that send a double signal to the ECM3.

ECM3 is located into the jib arm box and it elaborates that double signal communicating it translation in "Kg" or "Lbs" to the master board (ECM1-2) through CAN-BUS line.

ECM3 also compares the double signal verifying their coherency (same values within a certain tolerance).

In case of an overcharge (more than 230 Kg for CE system, more than 500 Lbs in ANSI system) or in case of anomalies such as a discordance between the two lines machine will avoid the aerial part movements showing an error message.

ECM3 must be calibrated with the load cell sensor, in case of one of these components need to be replaced the calibration must be carried out as indicated by the APPENDIX 4.

Rotation Sensor System

The rotation sensor system, has two components, the reduced area board (ECM4) and the turret rotation sensor.

The turret rotation sensor is installed in the centre of the turret slew ring and it is an encoder sensor that sends a double signal to the ECM4.

ECM4, located into the electric components compartment, elaborates that double signal translating it into a rotation angle and communicating it to the master board (ECM1-2) through CAN-BUS line.

ECM4 also compares the double signal verifying their coherency (same values within a certain tolerance).

In case of turret rotation angle is not compatible with a machine safe condition concerning variable area system and anti-collision system or in case of anomalies such as a discordance between the two lines, machine will act accordingly in case avoiding the aerial part movements and showing an error message.

ECM4 must be calibrated with the rotation sensor, in case of one of these components need to be replaced the calibration must be carried out as indicated by the APPENDIX 5.

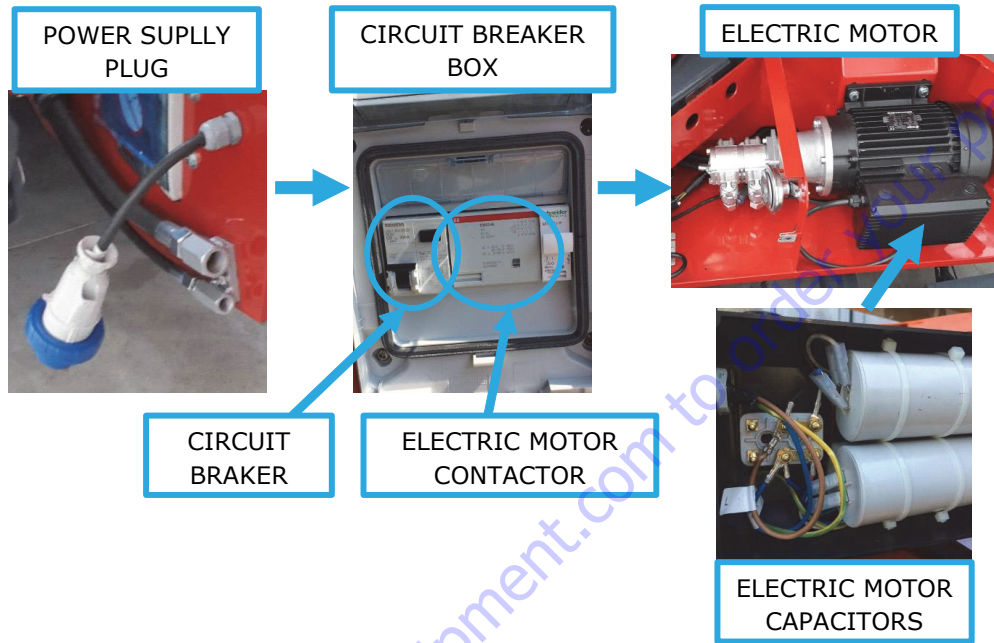
Electric Motor (Not For Lithium Version)

Electric motor works only when the machine is connected to the electric network (110÷230 V). To start the electric motor it is necessary to:

- connect the 110÷230V plug of the machine to the electric network
- activate the circuit breaker

- start the motor by pressing the electric motor start button (on the remote control or at the ground control box) so that its contactor is closed

Electric motor runs always at minimum speed 1500 rpm, it is equipped with two capacitors in order to limit the absorption during the motor starting.



12 Volt Battery

The machine electric system works at 12 Volt, the accumulation system is composed by an AGM start&stop battery with a capacity of 70 Ah.



12 Volt battery is feed by the engine generator while engine is running or by the battery charger described by the following chapter while machine is plugged to the electric network.

Battery Charge System

The battery charge is carried out by the electronic transformer located under the base bonnet aside the electric motor.



The output tension from the electronic transformer is fixed at 14 Volt DC and it does not depend on the electric network tension or frequency.

The output current is automatically regulated at a maximum of 19 Amp.

6.6 CALIBRATION REQUIREMENT

This machine incorporates a variety of sensors and a high degree of function interaction. For safety and proper machine functionality, the calibration procedures must be repeated for any control module replacement, system calibration related fault, or removal or replacement of any sensors, valves, coils.

The chart below lists the calibrations required and potential reasons for recalibrating.

All calibration procedures are menu driven through the REMOTE CONTROL.

The user is prompted to exercise the machine in a specific order to use the machines physical properties to consistently establish sensor response and the interaction of valves, pumps, and motors.

NOTICE

A REPLACEMENT OF A NEW ECM 1-2 & 3 REQUIRE TO FLASH THE PROPER MACHINE MODEL SOFTWARE AND TO ADJUST THE MACHINE SETTINGS. A REPLACEMENT OF A NEW ECM 1-2 DO NOT REQUIRE THE CALIBRATION OF THE ECM3 AND THE JOYSTICKS.

Table 6-3. Calibration modules

CALIBRATION PROCEDURE	REASONS FOR RE-CALIBRATION
LOAD Cell Calibration	LSS Module ECM3 replacement LSS Sensor removal or replacement
Joystick Calibration	Joystick replacement
Chassis Tilt Calibration	Master Board ECM1- ECM2 removal or replacement Tilt indication inaccuracy
Rotator Sensors Calibration	X770AJ - X26JP Only Board ECM4 rotator sensor replacement Rotator sensor removal or replacement

6.7 PLATFORM REMOTE CONTROL SERVICE

The top level menus are as follows:

Service Button

A SERVICE button is present on the remote control which allows to view the status of the machine parameters and is an aid in the safety checks of the machine.

With machine power on, by pressing the SERVICE button a numerical menu is displayed on the LCD display, each of these menu items can be accessed by pressing the corresponding platform/remote control buttons.

To navigate through the menu use the Buttons Numbered 1 Thru 9.

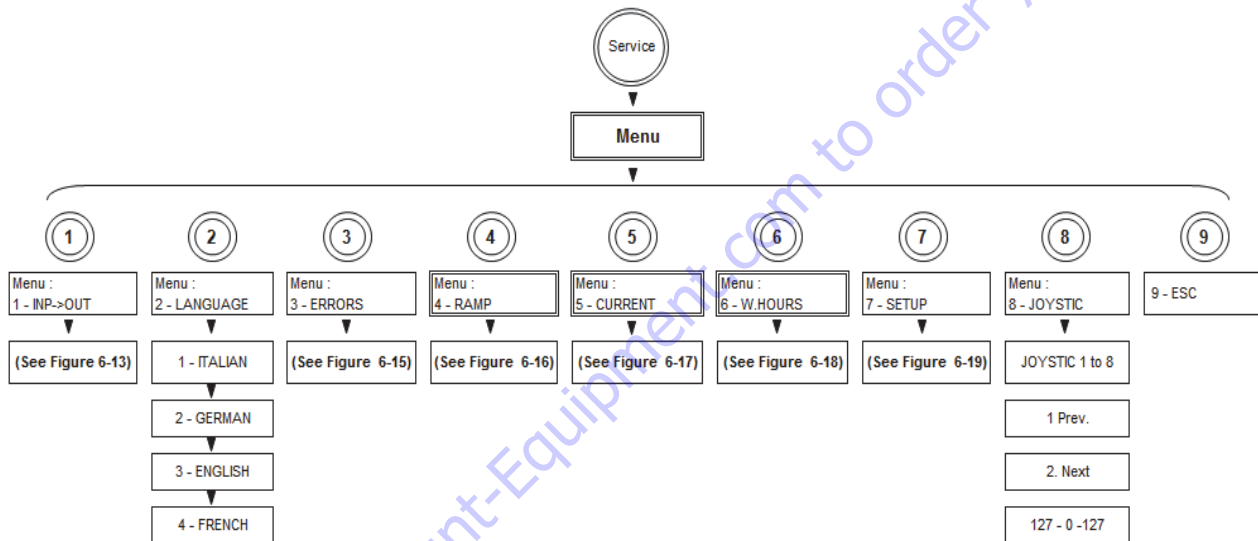
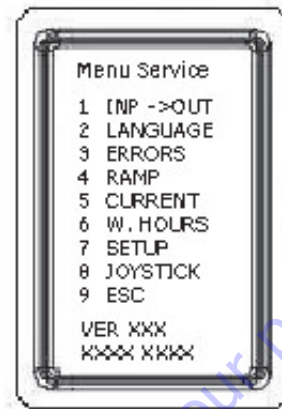


Figure 6-50. Menu Services

NOTE: The layout shown includes all possible analyzer screens. Please note that some screens may not be available or with different description depending upon machine configuration or language set-up.

Using The Service Program

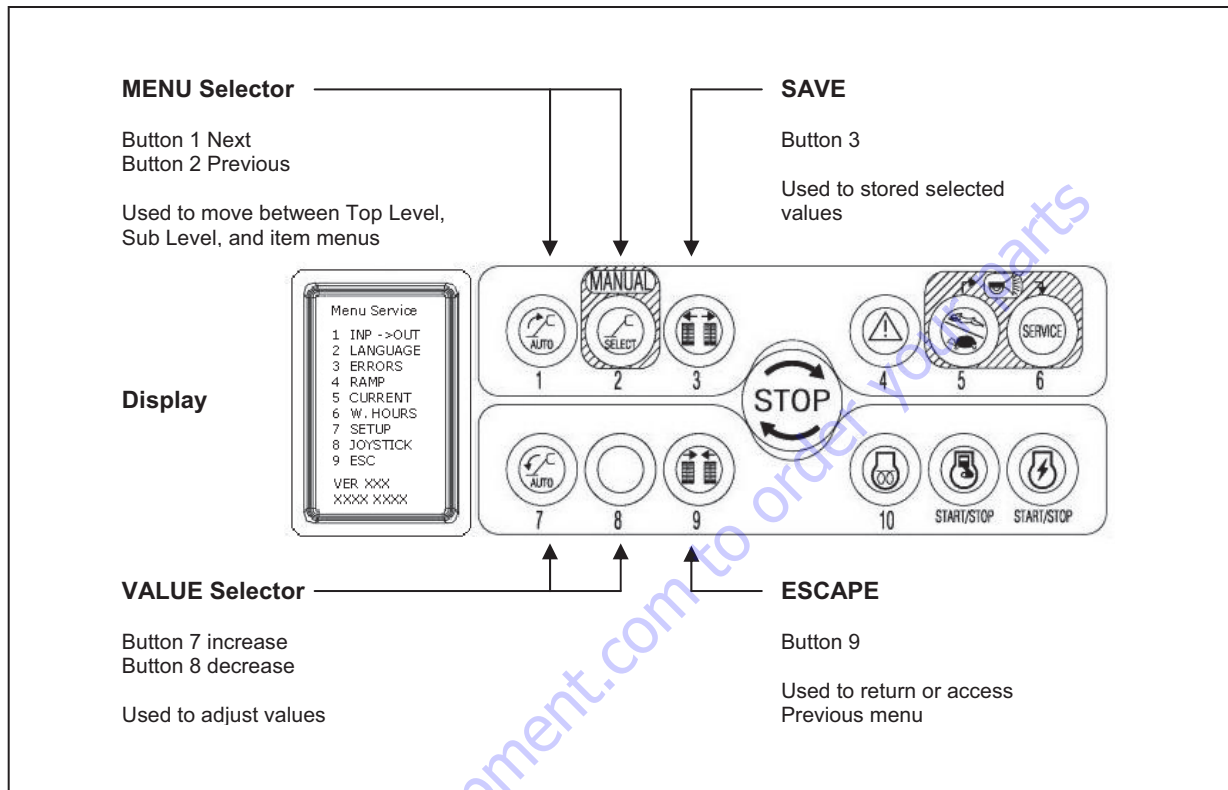


Figure 6-51. Service Mode Button Use

- To select a displayed menu item, press button 6 - **SERVICE**.
- To cancel a selected menu item, press button 9 - **ESC**, to escape.
- From the SERVICE menu use the buttons 1-2-3-7-8 to navigate through the menu, as noted in illustration above.
- From the SERVICE menu, use button selection "7 Setup", the button "5 Password" then enter a proper password (by using buttons 1 to 9) to advance to a lower level.
- Once OK is displayed, press button "9 ESC", MENU should display and then press the button for proper MENU, which will permit to change machine settings.

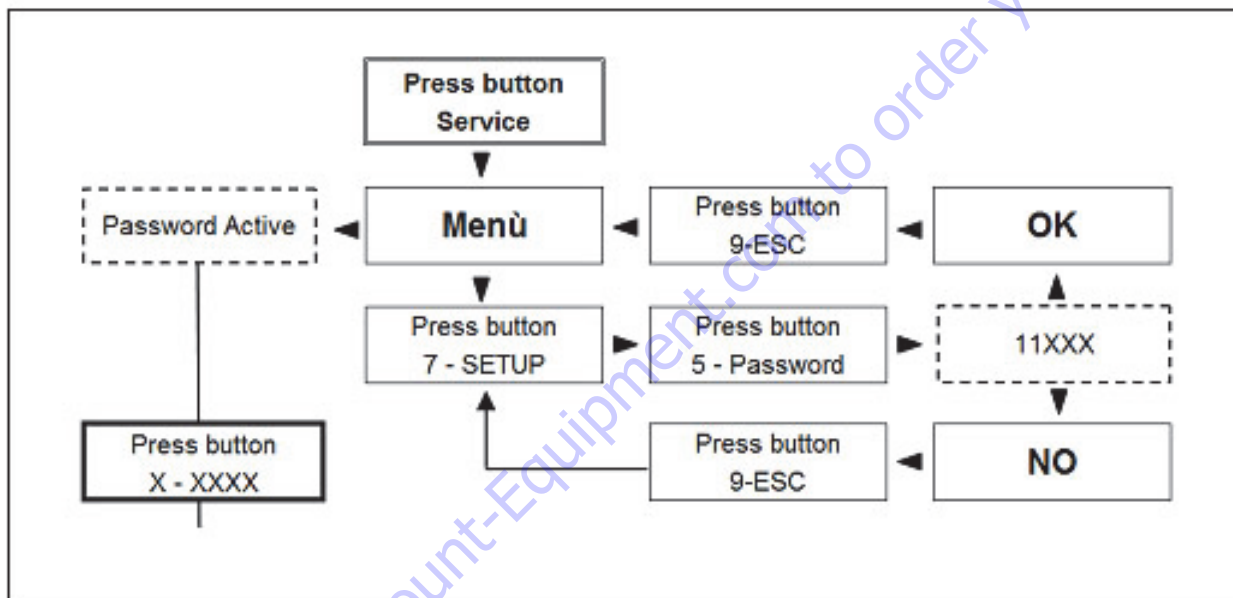
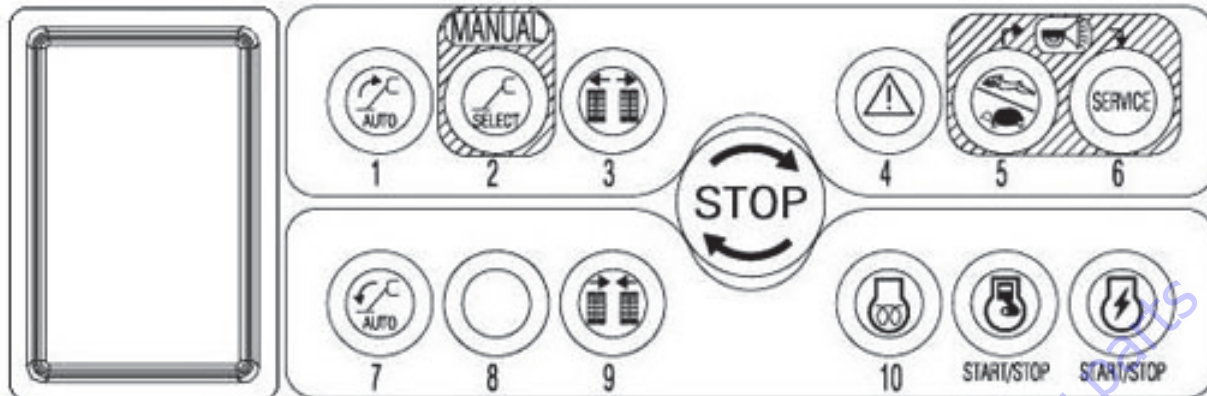


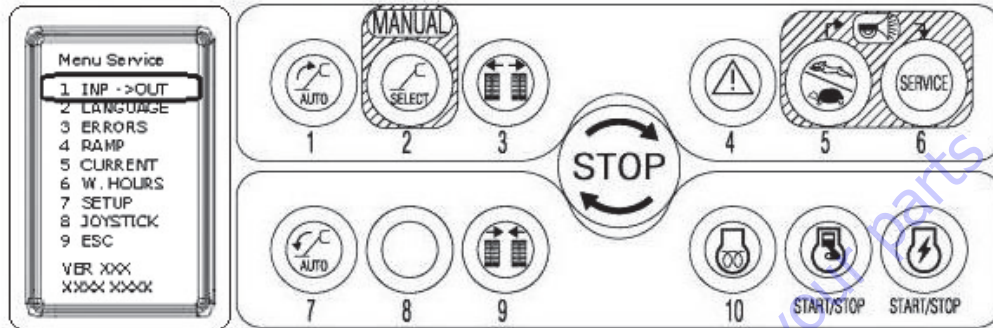
Figure 6-52. Password Use

NOTE: If NO is displayed, after digit the password, press button "9 Esc" to return to Menu, and repeat the procedure.

NOTE: Password will remain active if Key Switch is left ON, even if "9 - Esc" is pressed from the service menu.

Input Menu

From the SERVICE menu, pressing button 1 "INPUT" to accesses menu INPUT.



The menu INPUT allows you to visualize the status (or changes of status) of all the devices connected to the main control module. Machine diagnostic devices status or values are shown on the display

Use the buttons 1 "PREV." and 2 "NEXT" to choose the device.

Press button 9 "ESC" to Esc from menu.



SECTION 6 - JLG CONTROL SYSTEM

ANSI-SPEC - X500AJ - X600AJ

CE-SPEC - X17JP - X20JP

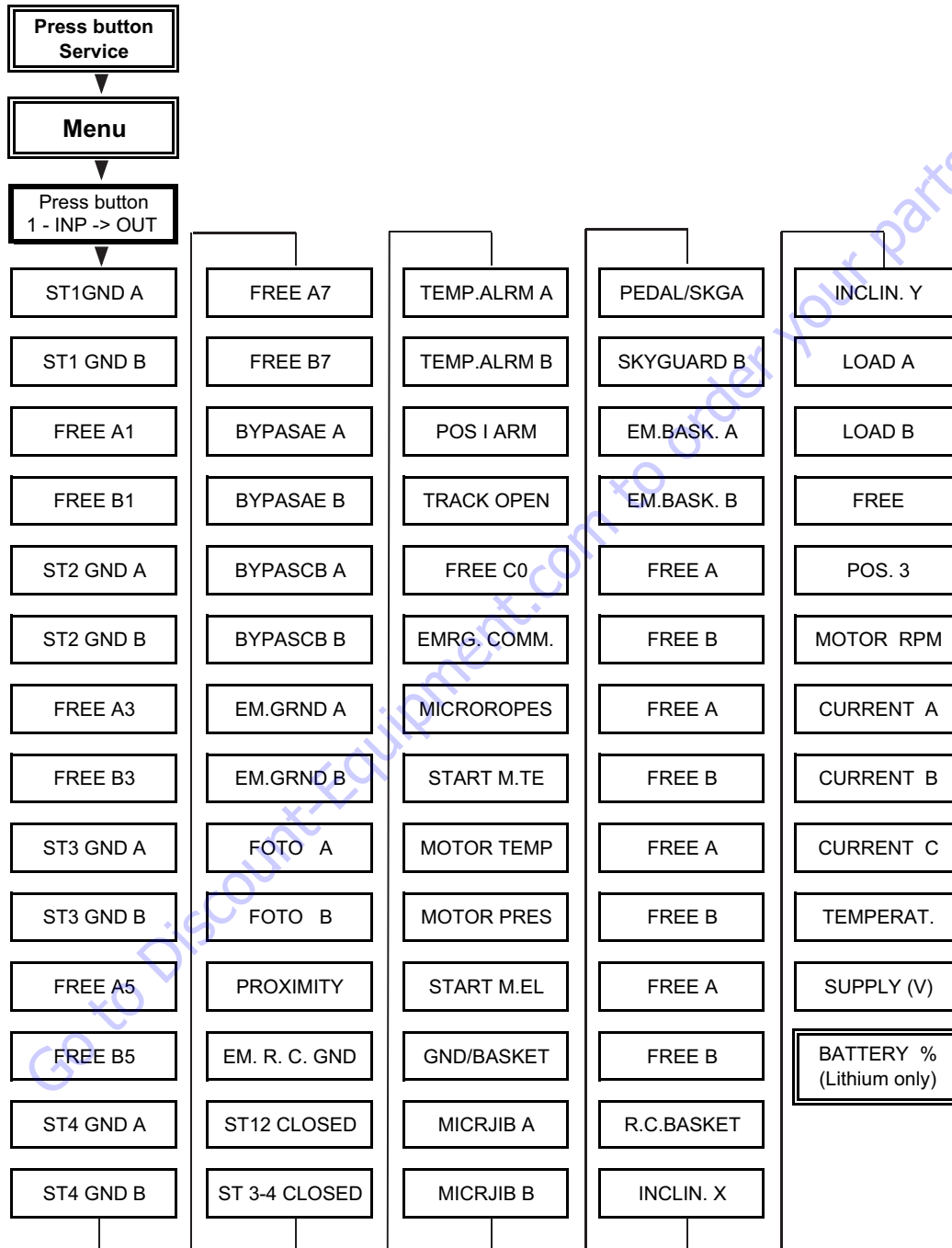


Figure 6-53. Input Menu Flow Chart

ANSI-SPEC - X770AJ
 CE-SPEC - X26JP

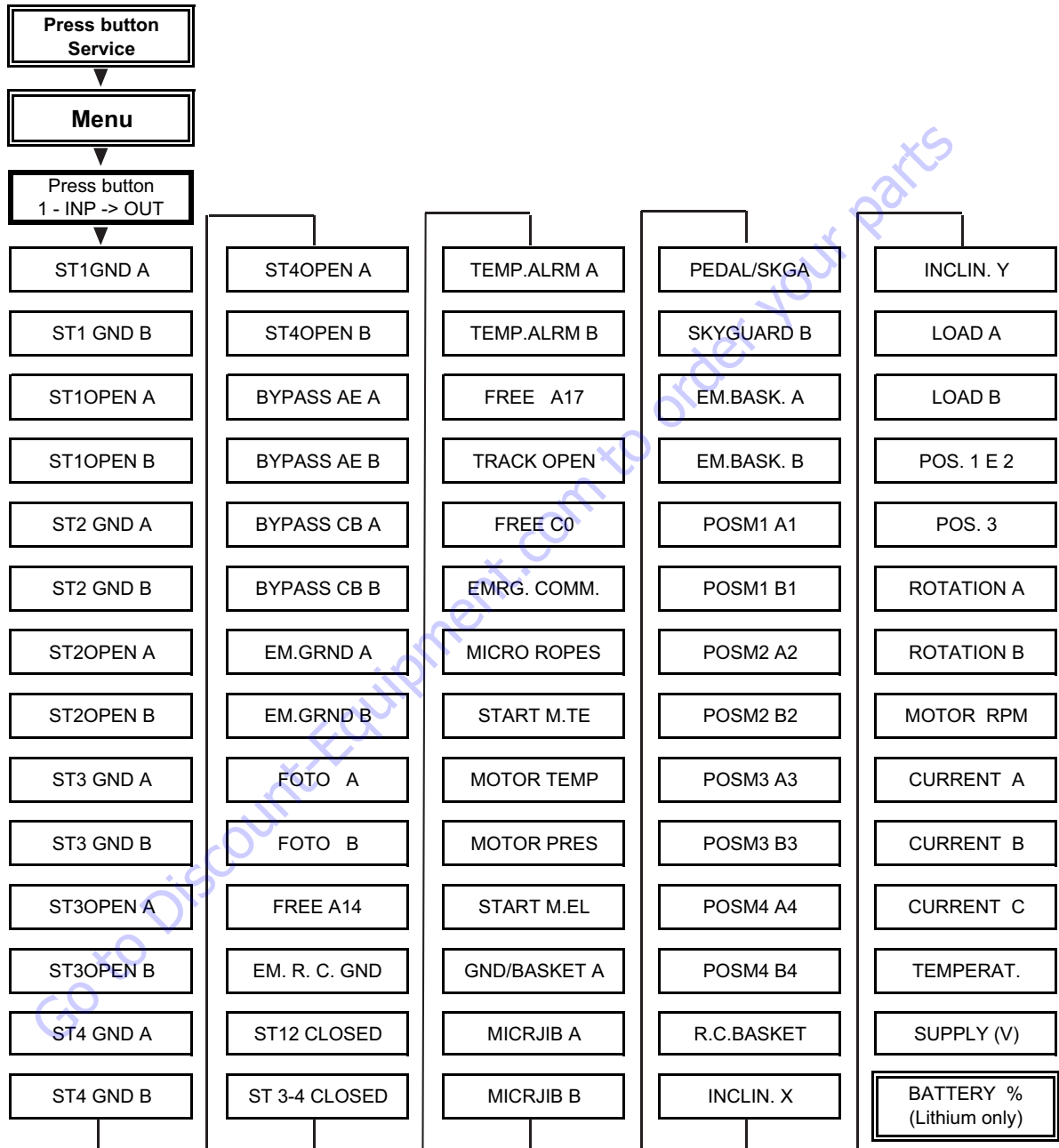


Figure 6-54. Input Menu Flow Chart

Table 6-4. Input Menu Item - Explanation
X17JP - X20JP - X500AJ - X600AJ

ST1 GND A	ON	Outrigger n.1 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.1 lifted – the switch is pressed and A line is opened
ST1 GND B	ON	Outrigger n.1 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.1 lifted – the switch is pressed and B line is opened
FREE A1	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B1	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
ST2 GND A	ON	Outrigger n.2 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.2 lifted – the switch is pressed and A line is opened
ST2 GND B	ON	Outrigger n.2 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.2 lifted – the switch is pressed and B line is opened
FREE A3	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B3	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
ST3 GND A	ON	Outrigger n.3 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.3 lifted – the switch is pressed and A line is opened
ST3 GND B	ON	Outrigger n.3 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.3 lifted – the switch is pressed and B line is opened
FREE A5	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B5	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
ST4 GND A	ON	Outrigger n.4 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.4 lifted – the switch is pressed and A line is opened
ST4 GND B	ON	Outrigger n.4 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.4 lifted – the switch is pressed and B line is opened
FREE A7	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B7	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER

X17JP - X20JP - X500AJ - X600AJ

BYPASAE A	ON	The aerial part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “A” of the aerial part safeties by-pass is closed
	OFF	The aerial part safeties are activated (normal working condition) – line “A” of the aerial part safeties by-pass is opened
BYPASAE B	ON	The aerial part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “B” of the aerial part safeties by-pass is closed
	OFF	The aerial part safeties are activated (normal working condition) – line “B” of the aerial part safeties by-pass is opened
BYPASCB A	ON	The ground part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “A” of the ground part safeties by-pass is closed
	OFF	The ground part safeties are activated (normal working condition) – line “A” of the ground part safeties by-pass is opened
BYPASCB B	ON	The ground part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “B” of the ground part safeties by-pass is closed
	OFF	The ground part safeties are activated (normal working condition) – line “B” of the ground part safeties by-pass is opened
EM GRND A	ON	Stop button on the ground is released – “A” line of the stop button is closed
	OFF	Stop button on the ground is pressed – “A” line of the stop button is opened
EM GRND B	ON	Stop button on the ground is released – “B” line of the stop button is closed
	OFF	Stop button on the ground is pressed – “B” line of the stop button is opened
FOTO A	ON	Photocell A receives the signal from the reflector (Aerial part closed and aligned)
	OFF	Photocell A does not receive the signal from the reflector (Aerial part opened)
FOTO B	ON	Photocell B receives the signal from the reflector (Aerial part closed and aligned)
	OFF	Photocell B does not receive the signal from the reflector (Aerial part opened)
PROXIMITY	ON	Turret is not almost completely rotated, contact is close, the 1st-2nd arm is not above the engine
	OFF	Turret is almost completely rotated, contact is open, the 1st-2nd arm is above the engine
EM.R.C.GND	ON	The stop button on ground remote control is released
	OFF	The stop button on ground remote control is pressed or the ground remote control is disconnected
ST12 CLOSED	ON	The pressure switch of outriggers 1 and 2 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	The pressure switch contact of outriggers 1 and 2 is opened – the outriggers are open, partially open or already closed
ST34 CLOSED	ON	The pressure switch of outriggers 3 and 4 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	The pressure switch contact of outriggers 3 and 4 is opened – the outriggers are open, partially open or already closed

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X17JP - X20JP - X500AJ - X600AJ

TEMP ALRM A Option reserved for some markets	ON	The temperature external probe reached the maximum value – “A” line of the temperature probe is closed
	OFF	The temperature external probe hasn’t reached the maximum value – “A” line of the temperature probe is open
TEMP ALRM B Option reserved for some markets	ON	The temperature external probe reached the maximum value – “B” line of the temperature probe is closed
	OFF	The temperature external probe hasn’t reached the maximum value – “B” line of the temperature probe is open
POS.1 ARM	ON	The switch of 1-2 arm position is released, contact is close, the 1st-2nd arm is open
	OFF	The switch of 1-2 arm position is pressed, contact is open, the 1st-2nd arm is closed
TRACK OPEN	ON	Tracks are in wide position. Widening cylinders switches are pressed, contact is closed
	OFF	Tracks are not in full wide position. Widening cylinders switches are released, contact is open
FREE CO		DO NOT CONSIDER
EMRG. COMM	ON	The control position key selector for aerial part operation from the ground is activated (emergency condition)
	OFF	The control position key selector for aerial part operation is released (normal working condition)
MICROROPES To consider only for X20JP - X600AJ	ON	The cables of the extension are OK. The control switch of the cables on extension is released and the line is closed (normal working condition)
	OFF	At list one cable on the extension is out of order. The control switch of the cables on extension is pressed and the line is open (emergency condition)
START M.TE	ON	The ground button for engine start is pressed
	OFF	The ground button for engine start is released
MOTOR TEMP. To consider only for X20JP - X600AJ	ON	The engine reached the max functioning temperature (emergency condition – the engine remains at min)
	OFF	The engine maintains the correct functioning temperature (normal working condition)
MOTOR PRES. To consider only for X20JP - X600AJ	ON	The engine oil pressure is inadequate (emergency condition – engine turns off)
	OFF	The engine oil pressure is OK
START M.EL	ON	The ground button for electric motor start is pressed
	OFF	The ground button for electric motor start is released
GND/BASKET	ON	The control position key selector is positioned on “basket”
	OFF	The control position key selector is positioned on “ground”
MICROJIB A	ON	The JIB is closed – the control switch is released and “A” line is closed
	OFF	The JIB is open – the control switch is pressed and “A” line is open
MICROJIB B	ON	The JIB is closed – the control switch is released and “B” line is closed
	OFF	The JIB is open – the control switch is pressed and “B” line is open

X17JP - X20JP - X500AJ - X600AJ

PEDAL / SKY A	ON	The pedal is pressed and if Skyguard is installed its bar is pressed– the pedal electric line is closed and the Sky-guard electric line A is closed
	OFF	The pedal is released or if Skyguard is installed its bar is released – the pedal electric line is open or the Sky-guard electric line A is open
SKYGUARD B	ON	If Skyguard is installed its bar is pressed– the Skyguard electric line B is closed
	OFF	If Skyguard is installed its bar is released – the Skyguard electric line A is open
EM.BASK.A	ON	The stop button on remote control in basket is released – “A” line is closed
	OFF	The stop button on remote control in basket is pressed or the ground remote control is disconnected – “A” line is open
EM.BASK. B	ON	The stop button on remote control in basket is released – “B” line is closed
	OFF	The stop button on remote control in basket is pressed or the ground remote control is disconnected – “B” line is open
FREE A	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE A	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE A	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE A	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
FREE B	ON	DO NOT CONSIDER
	OFF	DO NOT CONSIDER
R.C. BASKET	ON	The remote control is in the support in basket
	OFF	The remote control is not in the support in basket
INCLIN. X	0	Indicates the inclination of the machine on the X axis in tenth of degrees (accelerometer A)
	0	Indicates the inclination of the machine on the X axis in tenth of degrees (accelerometer B)
INCLIN. Y	0	Indicates the inclination of the machine on the Y axis in tenth of degrees (accelerometer A)
	0	Indicates the inclination of the machine on the Y axis in tenth of degrees (accelerometer B)
LOAD A	94	Indicates the weight in Kg in the basket on line A
LOAD B	95	Indicates the weight in Kg in the basket on line B

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FREE	0	DO NOT CONSIDER
POS. 3	2398	Indicates the opening of the 3 arm cylinder in tenths of a millimeter
MOTOR RPM	2200	Only diesel version: Indicates the engine RPM read by rpm sensor
CURRENT A	0	DO NOT CONSIDER
CURRENT B	0	DO NOT CONSIDER
CURRENT C	0	DO NOT CONSIDER
TEMPERAT.	37.6	Indicates the temperature of the ECM1-2 in °C
SUPPLY (V)	12.1	Indicates the batteries voltage, or the output voltage from the battery charger
BATTERY %	100	Only for Lithium version: indicates the % level of charge of the pack

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Table 6-5. Input Menu Item - Explanation**X26JP - X770AJ**

ST1 GND A	ON	Outrigger n.1 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.1 lifted – the switch is pressed and A line is opened
ST1 GND B	ON	Outrigger n.1 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.1 lifted – the switch is pressed and B line is opened
ST1 OPEN A	ON	Outrigger n.1 is completely opened – the switch is released and A line is closed
	OFF	Outrigger n.1 is closed or only half-way opened– the switch is pressed and A line is opened
ST1 OPEN B	ON	Outrigger n.1 is completely opened – the switch is released and B line is closed
	OFF	Outrigger n.1 is closed or only half-way opened– the switch is pressed and B line is opened
ST2 GND A	ON	Outrigger n.2 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.2 lifted – the switch is pressed and A line is opened
ST2 GND B	ON	Outrigger n.2 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.2 lifted – the switch is pressed and B line is opened
ST2 OPEN A	ON	Outrigger n.2 is completely opened – the switch is released and A line is closed
	OFF	Outrigger n.2 is closed or only half-way opened– the switch is pressed and A line is opened
ST2 OPEN B	ON	Outrigger n.2 is completely opened – the switch is released and B line is closed
	OFF	Outrigger n.2 is closed or only half-way opened– the switch is pressed and B line is opened
ST3 GND A	ON	Outrigger n.3 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.3 lifted – the switch is pressed and A line is opened
ST3 GND B	ON	Outrigger n.3 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.3 lifted – the switch is pressed and B line is opened
ST3 OPEN A	ON	Outrigger n.3 is completely opened – the switch is released and A line is closed
	OFF	Outrigger n.3 is closed or only half-way opened– the switch is pressed and A line is opened
ST3 OPEN B	ON	Outrigger n.3 is opened (at least half-way) – the switch is released and B line is closed
	OFF	Outrigger n.3 is closed or only half-way opened– the switch is pressed and B line is opened
ST4 GND A	ON	Outrigger n.4 on the ground – the switch is released and A line is closed
	OFF	Outrigger n.4 lifted – the switch is pressed and A line is opened
ST4 GND B	ON	Outrigger n.4 on the ground – the switch is released and B line is closed
	OFF	Outrigger n.4 lifted – the switch is pressed and B line is opened
ST4 OPEN A	ON	Outrigger n.4 is opened (at least half-way) – the switch is released and A line is closed
	OFF	Outrigger n.4 is closed or only half-way opened– the switch is pressed and A line is opened
ST4 OPEN B	ON	Outrigger n.4 is opened (at least half-way) – the switch is released and B line is closed
	OFF	Outrigger n.4 is closed or only half-way opened– the switch is pressed and B line is opened

X26JP - X770AJ

BYPASAE A	ON	The aerial part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “A” of the aerial part safeties by-pass is closed
	OFF	The aerial part safeties are activated (normal working condition) – line “A” of the aerial part safeties by-pass is opened
BYPASAE B	ON	The aerial part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “B” of the aerial part safeties by-pass is closed
	OFF	The aerial part safeties are activated (normal working condition) – line “B” of the aerial part safeties by-pass is opened
BYPASCB A	ON	The ground part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “A” of the ground part safeties by-pass is closed
	OFF	The ground part safeties are activated (normal working condition) – line “A” of the ground part safeties by-pass is opened
BYPASCB B	ON	The ground part safeties are deactivated through the safeties bypass key switch (emergency condition) – line “B” of the ground part safeties by-pass is closed
	OFF	The ground part safeties are activated (normal working condition) – line “B” of the ground part safeties by-pass is opened
EM GRND A	ON	Stop button on the ground is released – “A” line of the stop button is closed
	OFF	Stop button on the ground is pressed – “A” line of the stop button is opened
EM GRND B	ON	Stop button on the ground is released – “B” line of the stop button is closed
	OFF	Stop button on the ground is pressed – “B” line of the stop button is opened
FOTO A	ON	Photocell A receives the signal from the reflector (Aerial part closed and aligned)
	OFF	Photocell A does not receive the signal from the reflector (Aerial part opened)
FOTO B	ON	Photocell B receives the signal from the reflector (Aerial part closed and aligned)
	OFF	Photocell B does not receive the signal from the reflector (Aerial part opened)
FREE 14		DO NOT CONSIDER
EM.R.C.GND	ON	The stop button on ground remote control is released
	OFF	The stop button on ground remote control is pressed or the ground remote control is disconnected
ST12 CLOSED	ON	The pressure switch of outriggers 1 and 2 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	The pressure switch contact of outriggers 1 and 2 is opened – the outriggers are open, partially open or already closed
ST34 CLOSED	ON	The pressure switch of outriggers 3 and 4 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	The pressure switch contact of outriggers 3 and 4 is opened – the outriggers are open, partially open or already closed
TEMP ALRM A Option reserved for some markets	ON	The temperature external probe reached the maximum value – “A” line of the temperature probe is closed
	OFF	The temperature external probe hasn’t reached the maximum value – “A” line of the temperature probe is open

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TEMP ALRM B Option reserved for some markets	ON	The temperature external probe reached the maximum value – “B” line of the temperature probe is closed
	OFF	The temperature external probe hasn't reached the maximum value – “B” line of the temperature probe is open
FREE A17		DO NOT CONSIDER
TRACK OPEN	ON	Tracks are in wide position. Widening cylinders switches are pressed, contact is closed
	OFF	Tracks are not in full wide position. Widening cylinders switches are released, contact is open
FREE CO		DO NOT CONSIDER
EMRG. COMM	ON	The control position key selector for aerial part operation from the ground is activated (emergency condition)
	OFF	The control position key selector for aerial part operation is released (normal working condition)
MICROROPES	ON	The cables of the extension are OK. The control switch of the cables on extension is released and the line is closed (normal working condition)
	OFF	At list one cable on the extension is out of order. The control switch of the cables on extension is pressed and the line is open (emergency condition)
START M.TE	ON	The ground button for engine start is pressed
	OFF	The ground button for engine start is released
MOTOR TEMP. To consider only for Diesel Machine	ON	The engine reached the max functioning temperature (emergency condition – the engine remains at min)
	OFF	The engine maintains the correct functioning temperature (normal working condition)
MOTOR PRES. To consider only for Diesel Machine	ON	The engine oil pressure is inadequate (emergency condition – engine turns off)
	OFF	The engine oil pressure is OK
START M.EL	ON	The ground button for electric motor start is pressed
	OFF	The ground button for electric motor start is released
GND/BASKET	ON	The control position key selector is positioned on “basket”
	OFF	The control position key selector is positioned on “ground”
MICROJIB A	ON	The JIB is closed – the control switch is released and “A” line is closed
	OFF	The JIB is open – the control switch is pressed and “A” line is open
MICROJIB B	ON	The JIB is closed – the control switch is released and “B” line is closed
	OFF	The JIB is open – the control switch is pressed and “B” line is open
PEDAL / SKY A	ON	The pedal is pressed and if Skyguard is installed its bar is pressed– the pedal electric line is closed and the Sky-guard electric line A is closed
	OFF	The pedal is released or if Skyguard is installed its bar is released – the pedal electric line is open or the Skyguard electric line A is open

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SKYGUARD B	ON	If Skyguard is installed its bar is pressed– the Skyguard electric line B is closed
	OFF	If Skyguard is installed its bar is released – the Skyguard electric line A is open
EM.BASK.A	ON	The stop button on remote control in basket is released – “A” line is closed
	OFF	The stop button on remote control in basket is pressed or the ground remote control is disconnected – “A” line is open
EM.BASK. B	ON	The stop button on remote control in basket is released – “B” line is closed
	OFF	The stop button on remote control in basket is pressed or the ground remote control is disconnected – “B” line is open
POSM1 A1	ON	Outrigger n.1 is opened, half-way or completely – the switch is released and A line is closed
	OFF	Outrigger n.1 is closed – the switch is pressed and A line is opened
POSM1 B1	ON	Outrigger n.1 is opened, half-way or completely – the switch is released and B line is closed
	OFF	Outrigger n.1 is closed – the switch is pressed and B line is opened
POSM2 A2	ON	Outrigger n.2 is opened, half-way or completely – the switch is released and A line is closed
	OFF	Outrigger n.2 is closed – the switch is pressed and A line is open
POSM2 B2	ON	Outrigger n.2 is opened, half-way or completely – the switch is released and B line is closed
	OFF	Outrigger n.2 is closed – the switch is pressed and B line is opened
POSM3 A3	ON	Outrigger n.3 is opened, half-way or completely – the switch is released and A line is closed
	OFF	Outrigger n.3 is closed – the switch is pressed and A line is opened
POSM3 B3	ON	Outrigger n.3 is opened, half-way or completely – the switch is released and B line is closed
	OFF	Outrigger n.3 is closed – the switch is pressed and B line is opened
POSM4 A4	ON	Outrigger n.4 is opened, half-way or completely – the switch is released and A line is closed
	OFF	Outrigger n.4 is closed – the switch is pressed and A line is opened
POSM4 B4	ON	Outrigger n.4 is opened, half-way or completely – the switch is released and B line is closed
	OFF	Outrigger n.4 is closed – the switch is pressed and B line is opened
R.C. BASKET	ON	The remote control is in the support in basket
	OFF	The remote control is not in the support in basket
INCLIN. X	0	Indicates the inclination of the machine on the X axis in tenth of degrees (accelerometer A)
	0	Indicates the inclination of the machine on the X axis in tenth of degrees (accelerometer B)
INCLIN. Y	0	Indicates the inclination of the machine on the Y axis in tenth of degrees (accelerometer A)
	0	Indicates the inclination of the machine on the Y axis in tenth of degrees (accelerometer B)
LOAD A	94	Indicates the weight in Kg in the basket on line A
LOAD B	95	Indicates the weight in Kg in the basket on line B
POS. 1E2	2218	Indicates the opening of the 1st and 2nd booms cylinder in tenths of a millimetre
POS. 3	2398	Indicates the opening of the 3 arm cylinder in tenths of a millimeter

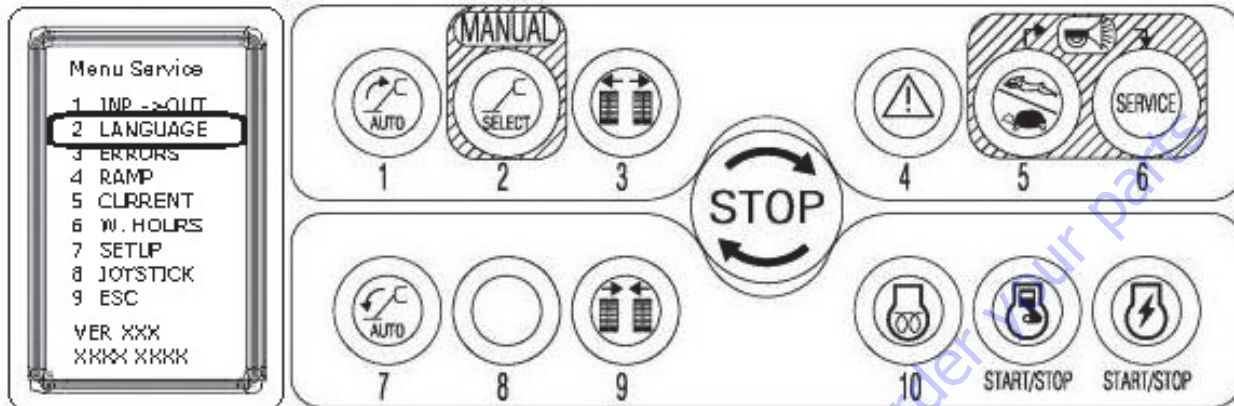
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MOTOR RPM	2200	Only diesel version: Indicates the engine RPM read by rpm sensor
CURRENT A	0	DO NOT CONSIDER
CURRENT B	0	DO NOT CONSIDER
CURRENT C	0	DO NOT CONSIDER
TEMPERAT.	37.6	Indicates the temperature of the ECM1-2 in °C
SUPPLY (V)	12.1	Indicates the batteries voltage, or the output voltage from the battery charger
BATTERY %	100	Only for Lithium version: indicates the % level of charge of the pack

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Language Menu

From the SERVICE menu, pressing button 2 "LANGUAGE" to access menu language.



Using the buttons 1 to 4 to select the language desired.

Press button 9 "ESC" to save the change.

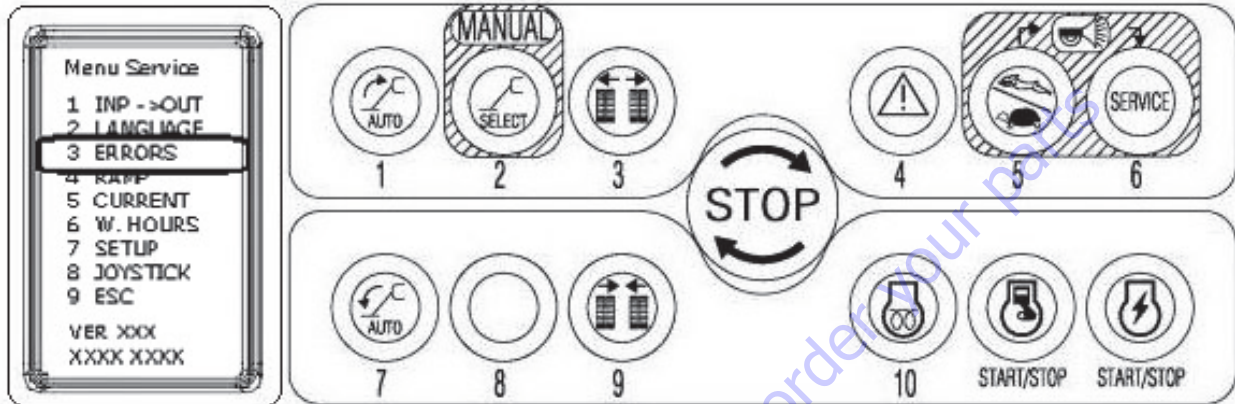
The languages available are:

- Button 1 - Italian
- Button 2 - German
- Button 3 - English
- Button 4 - French
- Button 5 - Spanish



Errors Menu

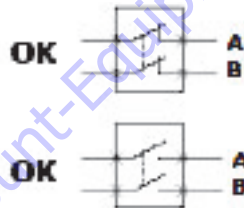
From the SERVICE menu, pressing button 3 "ERROR" accesses the menu of errors to identification of malfunctioning of some devices.



The faults highlighted by this list refer to devices with two safety lines, where the signal of the two lines is not coherent. Errors menu underlines only the non-concordance between two safety lines (A and B) monitoring the same control, gives OK or NO in the errors menu.

OK

- Indication the signals agree.



NO

- Indication the signals have a discordant value, in this case the icon HELP ERROR may automatically appear on the display.

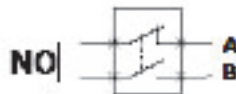


Table 6-6. Error Menu Flow Chart



Errors 1 - SCREEN

ERRORS			
ST1 GND	OK	ST1 GND	Outrigger n.1 on the ground switch
ST1 OPEN	OK	ST1 OPEN	Outrigger n.1 opened (at least half-way) switch (Only X26JP-X770AJ)
ST2 GND	OK	ST2 GND	Outrigger n.2 on the ground switch
ST2 OPEN	OK	ST2 OPEN	Outrigger n.2 opened (at least half-way) switch (Only X26JP-X770AJ)
ST3 GND	OK	ST3 GND	Outrigger n.3 on the ground switch
ST3 OPEN	OK	ST3 OPEN	Outrigger n.3 opened (at least half-way) switch (Only X26JP-X770AJ)
ST4 GND	OK	ST4 GND	Outrigger n.4 on the ground switch
ST4 OPEN	OK	ST4 OPEN	Outrigger n.4 opened (at least half-way) switch (Only X26JP-X770AJ)
1 PREV			
2 NEXT			
9 ESC			

Errors 2 - SCREEN

ERRORS			
BYPASA	OK	BYPASA	Aerial part safeties by-pass switch
BYPASC	OK	BYPASC	Ground part safeties by-pass switch
EM.GRD	OK	EM. GRN	Stop button on the ground
FOTO	OK	FOTO	Photocells
TEMP. A	OK	TEMP A.	External temperature probe
1 PREV		<i>Option reserved for some markets</i>	
2 NEXT			
9 ESC			

Errors 3 - SCREEN

ERRORS			
MICRJI	OK	MICRJI	Jib opening switch
EM.BAS	OK	EM.BAS	Stop button on remote control
POSM1	OK	POSM1	Outrigger n.1 completely opened switch (Only X26JP-X770AJ)
POSM2	OK	POSM2	Outrigger n.2 completely opened switch (Only X26JP-X770AJ)
POSM3	OK	POSM3	Outrigger n.3 completely opened switch (Only X26JP-X770AJ)
POSM4	OK	POSM4	Outrigger n.4 completely opened switch (Only X26JP-X770AJ)
ACCEL.	OK	ACCEL.	Machine inclination sensors
LOAD.	OK	LOAD.	Basket load cell sensor
ROTA.	OK	ROTA.	Turret rotation sensor
1 PREV			
2 NEXT			
9 ESC			

CAN Message - SCREEN

CAN TIMOUT	
SAFETY	OK
REMOTE	OK
CIL1-2	OK
CIL3	OK
LOAD	OK
ROTAT.	OK
1	PREV
2	NEXT
9	ESC

SAFETY	Master board (ECM1-2) Safeties lines
REMOTE	Remote control
CIL1-2	Third boom cylinder position sensor
CIL3	1 st and 2nd booms cylinder position sensor
LOAD	Load cell board (ECM3)
ROTAT.	Reduced area board (ECM4)

Lithium Powered Model - SCREEN

LITH ERR	
BATT:	0
INVER:	0
CARIC:	0
BMS ?:	
V MIN:	2950
T MIN:	12
V AVG:	3050
1	PREV
2	NEXT
9	ESC

The fifth page has to be considered only for Lithium machines, BATT, INVER and CARIC are indicated as "0" otherwise it means there's a Lithium error in progress.

BMS ? = BMS generation, "1" means first gen., "2" means second gen.

V MIN = Cells minimum voltage

T MIN = Cells minimum temperature

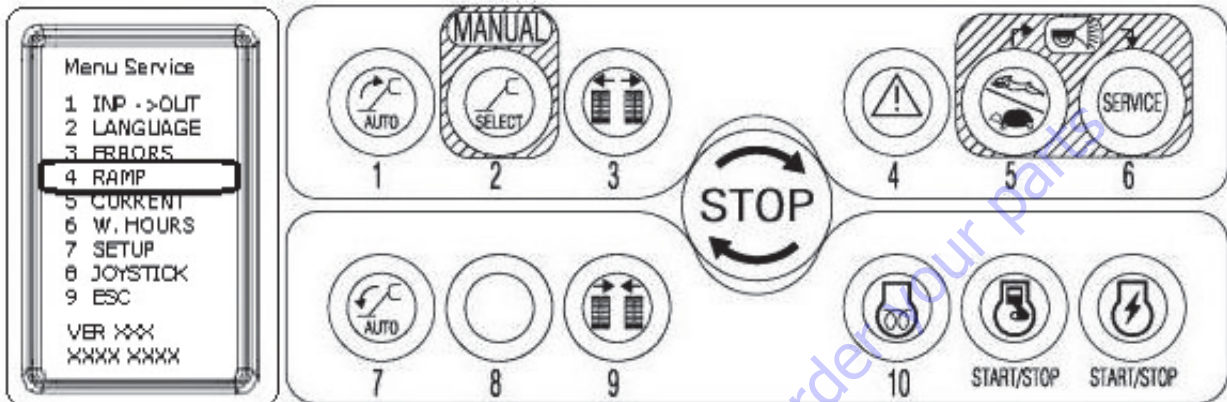
V AVG = Cells average voltage

More information about those data are detailed on the manual section Lithium

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RAMP Menu

From the SERVICE menu, pressing button 4 "RAMP" accesses the menu RAMP to adjust the parameter settings in order to achieved optimum machine performance.



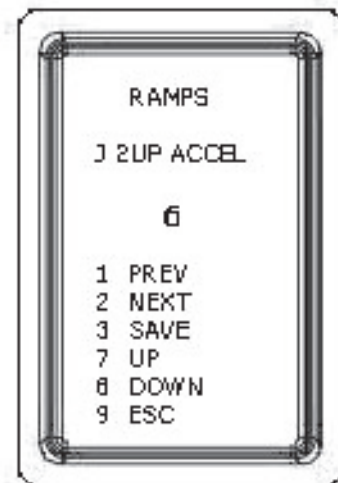
1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".

Using the remote control buttons to enter the password 1883.

NOTE: password permit to change all RAMP Settings.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC" two times.
Repeat the above steps if "NO" appear on the display.
4. Press button 4 "RAMP" to enter in menu ramps setting.
Use buttons 1 "PREV." and 2 "NEXT" to scroll the various functions.
5. Use buttons 7 "UP" and 8 "DOWN" to adjust the values.
6. Press button 3 "SAVE" to save.



NOTE: Every time the ramp value gets modified button 3 to save must be pressed, otherwise the modification is not activated.

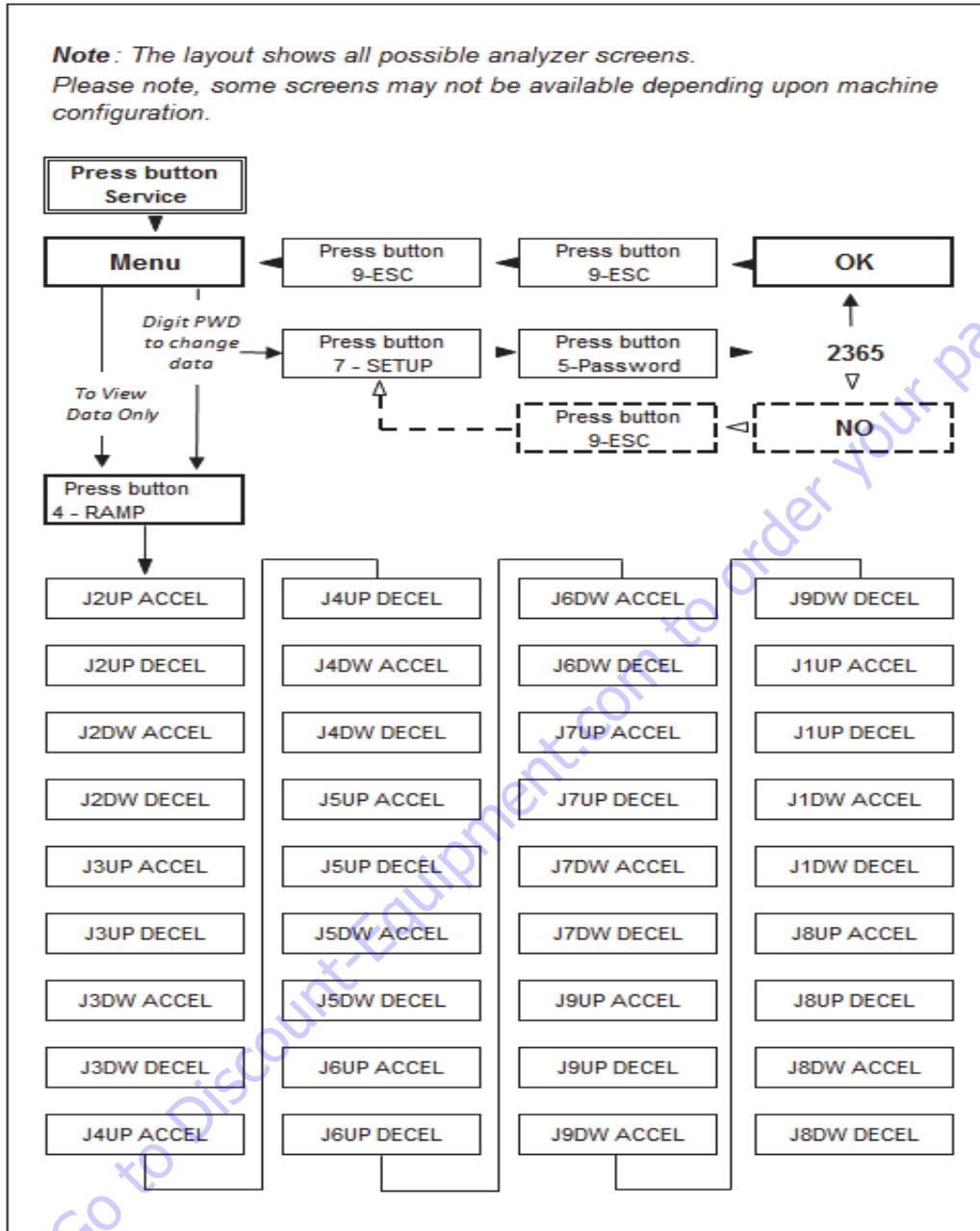
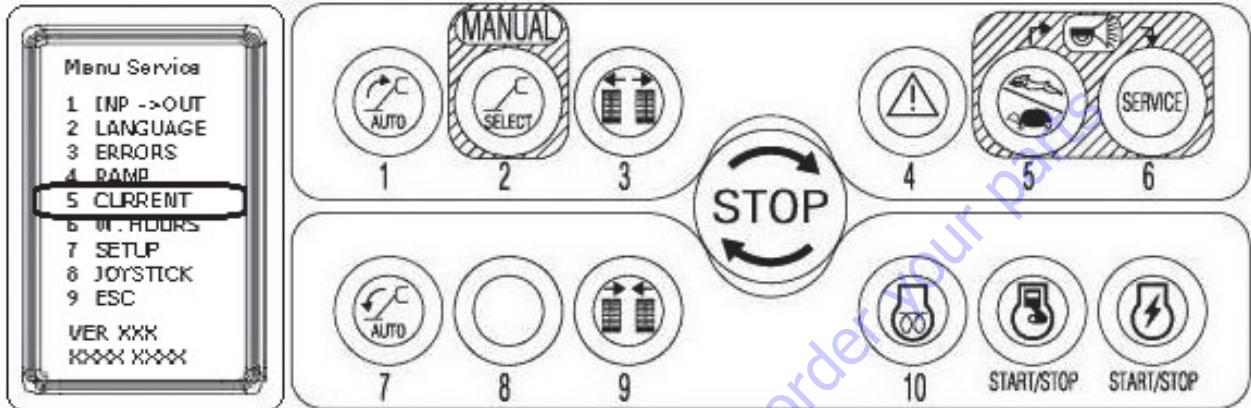


Figure 6-55. RAMP Menu Flow Chart

CURRENT Menu

From the SERVICE menu, pressing button 5 "CURRENT" accesses the menu CURRENT to adjust the parameter settings in order to achieved optimum machine performance.



1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".

Using the remote control buttons to enter the password 1883.

NOTE: password permit to change all CURRENT Settings.

Once the correct password is accepted the display shown "OK".

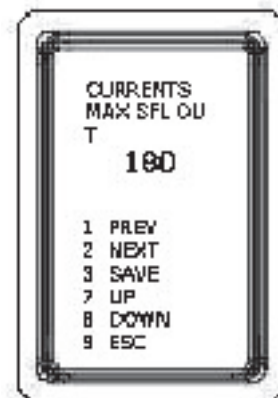
3. Press button 9 "ESC" two times.

NOTE: Repeat the above steps if "NO" appear on the display.

4. Press button 5 "CURRENT" to enter in menu current setting.
Use buttons 1 PREV. and 2 NEXT to scroll the various functions.
5. Use buttons 7 UP and 8 DOWN to adjust the values.
6. Press button 3 SAVE to save

NOTE: Every time the ramp value gets modified button 3 to save must be pressed; otherwise the modification is not activated.

NOTE: Personality settings can be adjusted within the adjustment range in order to achieve optimum machine performance.



NOTE: Refer to Table 6.8, Time range (sec) for recommended settings.

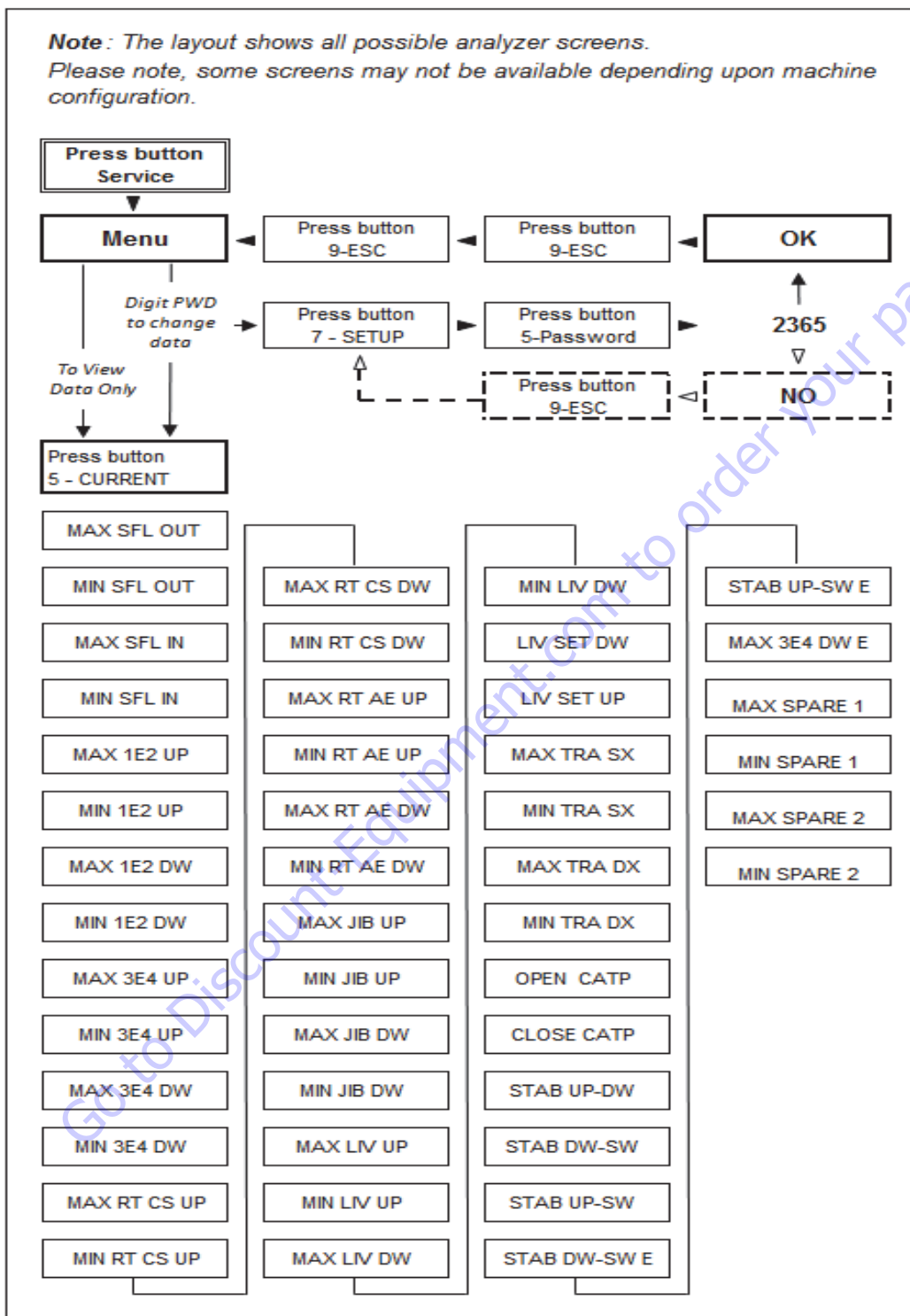
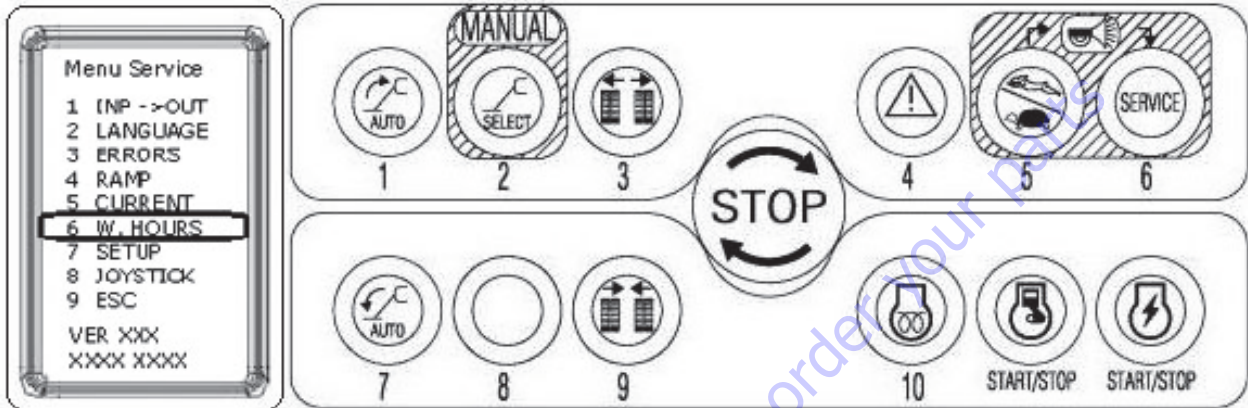


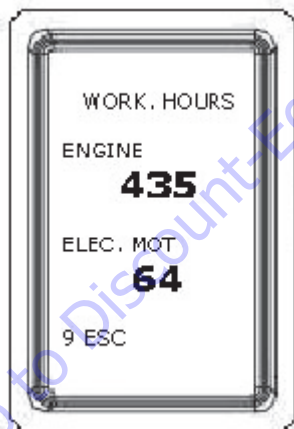
Figure 6-56. CURRENT Menu Flow Chart

Working Hours Menu

From the SERVICE menu, pressing button 6 "W.HOURS" accesses the menu Working Hours. This menu allows viewing the working hours of the thermic engine and the electrical motor. On lithium models, machine hours only.



To view the working hours of the Engine or Electrical motor. Press button 6 "W.HOURS".



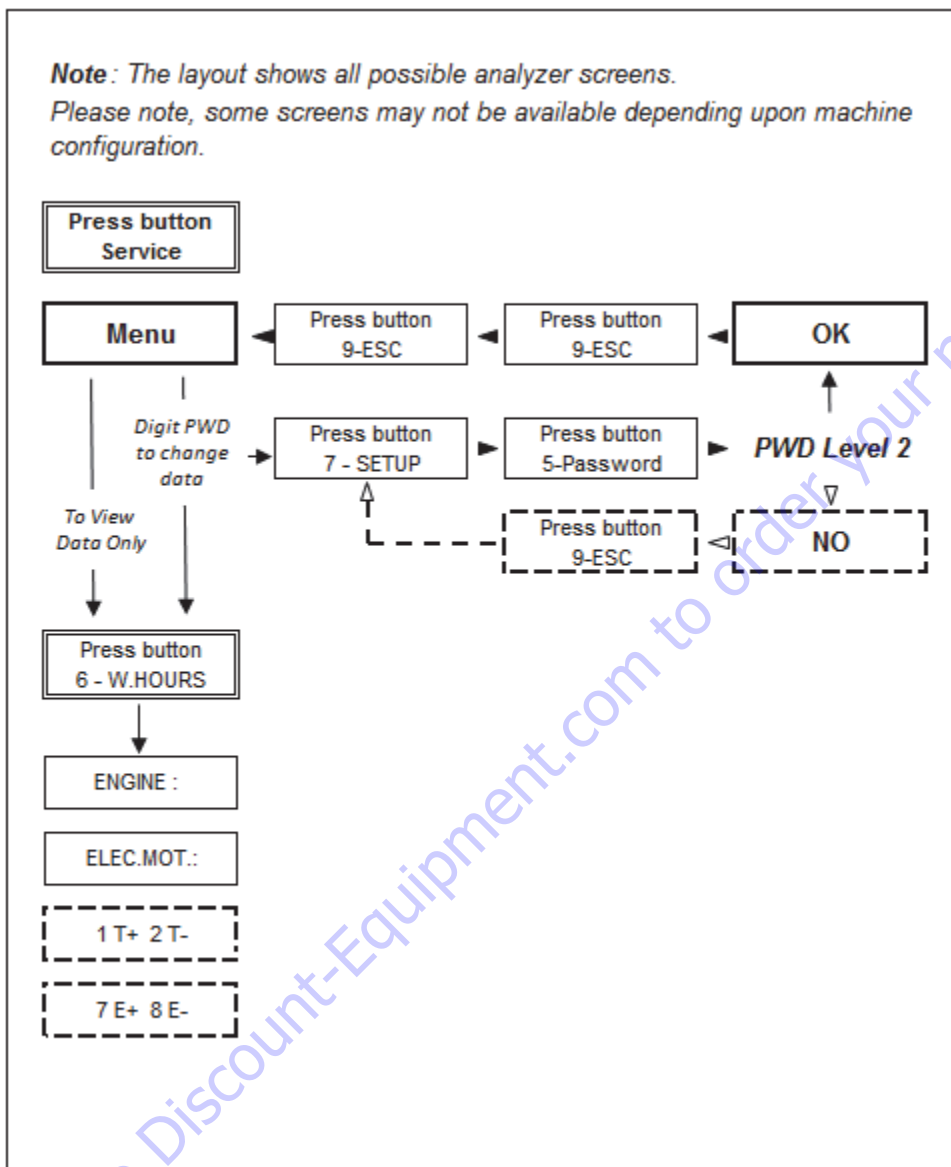
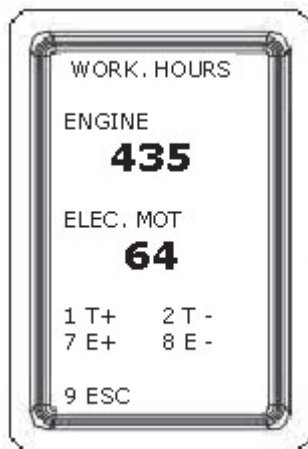


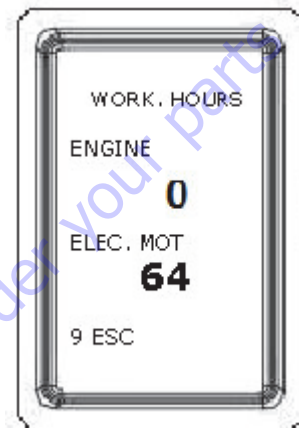
Figure 6-57. Working Hours Menu Flow Chart

To change the working hours of the Engine or Electrical Motor.



On Lithium models the Engine working HOURS will stay always 0.

The procedure to view or change the working Hours of the electrical motor are the same as per double powered models.



1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 7385.

NOTE: *password allow to change the Working Hours of Engine and Electrical Motor.*

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC" two times.

NOTE: *Repeat the above steps if "NO" appear on the display.*

4. Press button 6 "W:HOURS".
KEEPING PRESSED the button 6 use the button 1 "T+" to increase and button 2 "T-" to decrease the working hours of the ENGINE.

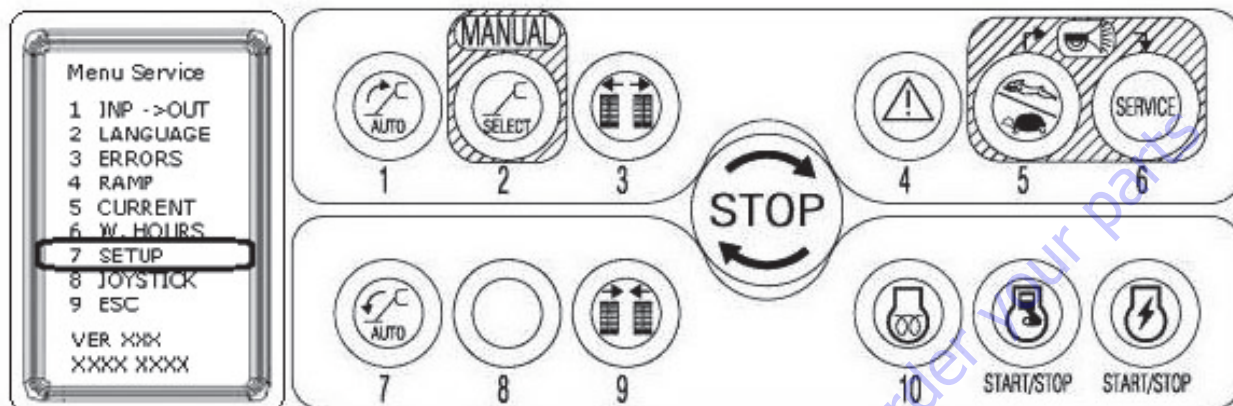
KEEPING PRESSED the button 6 use the button 7 "E +" to increase and button 8 "E - "to decrease the working hours of the Electric Motor.

KEEPING PRESSED the button 6 and than button 3 to set zero the working hours of Engine and Motor.

5. Press button 9 ESC 3 times to escape.

6.8 MACHINE SETUP MENU

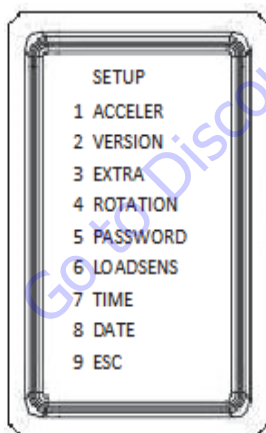
From the SERVICE menu, pressing button 7 "SETUP" accesses the menu SETUP to adjust the parameter settings in order to achieved proper machine performance.



When selection the machine model to match the size of the machine, the personality settings will all default to the factory recommended setting.

NOTE: Refer to the following steps in this Service Manual for the recommended factory settings.

NOTE: Passwords will give you access to level, which will permit you to change all machine settings.



Sheet 2-3

Note: The layout shows all possible analyzer screens.
Please note, some screens may not be available depending upon machine configuration.

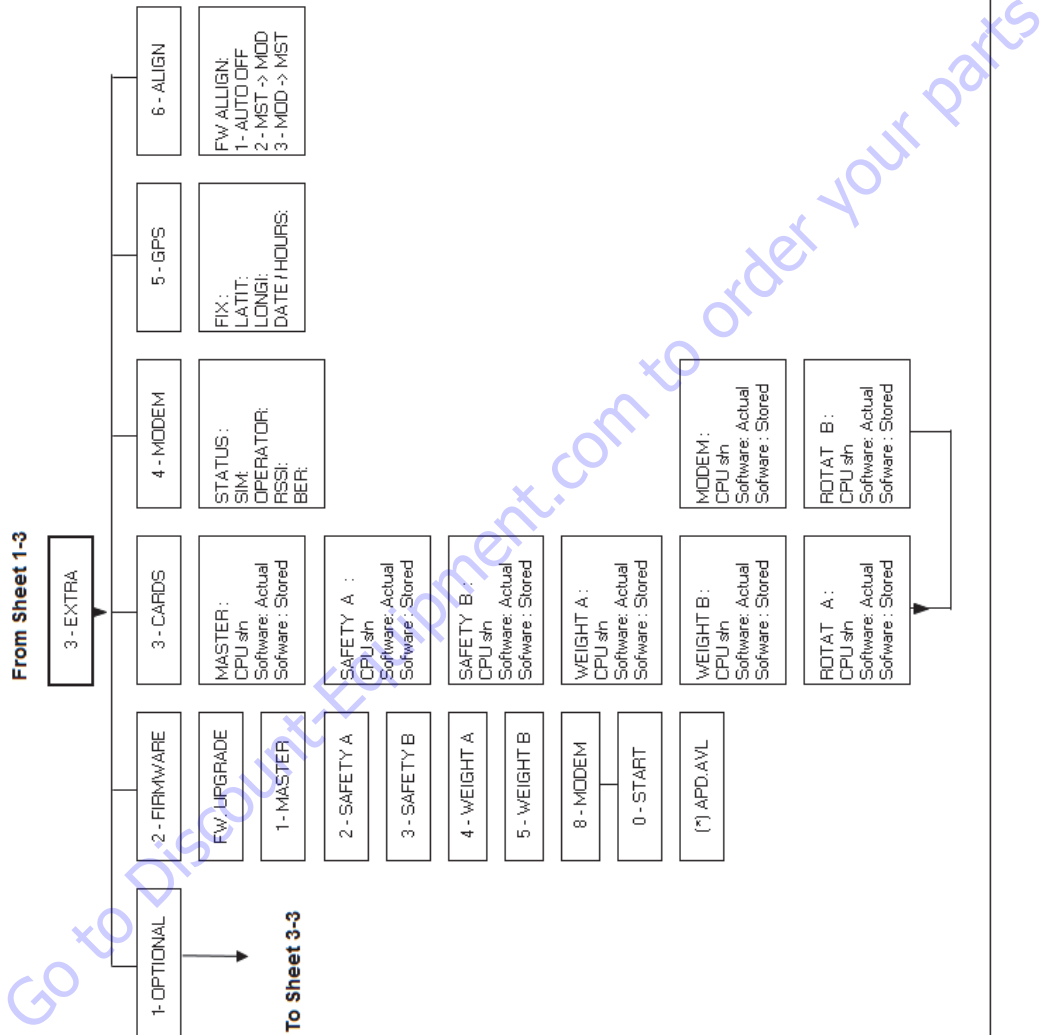


Figure 6-59. Machine Setup Flow Chart - 2 of 3

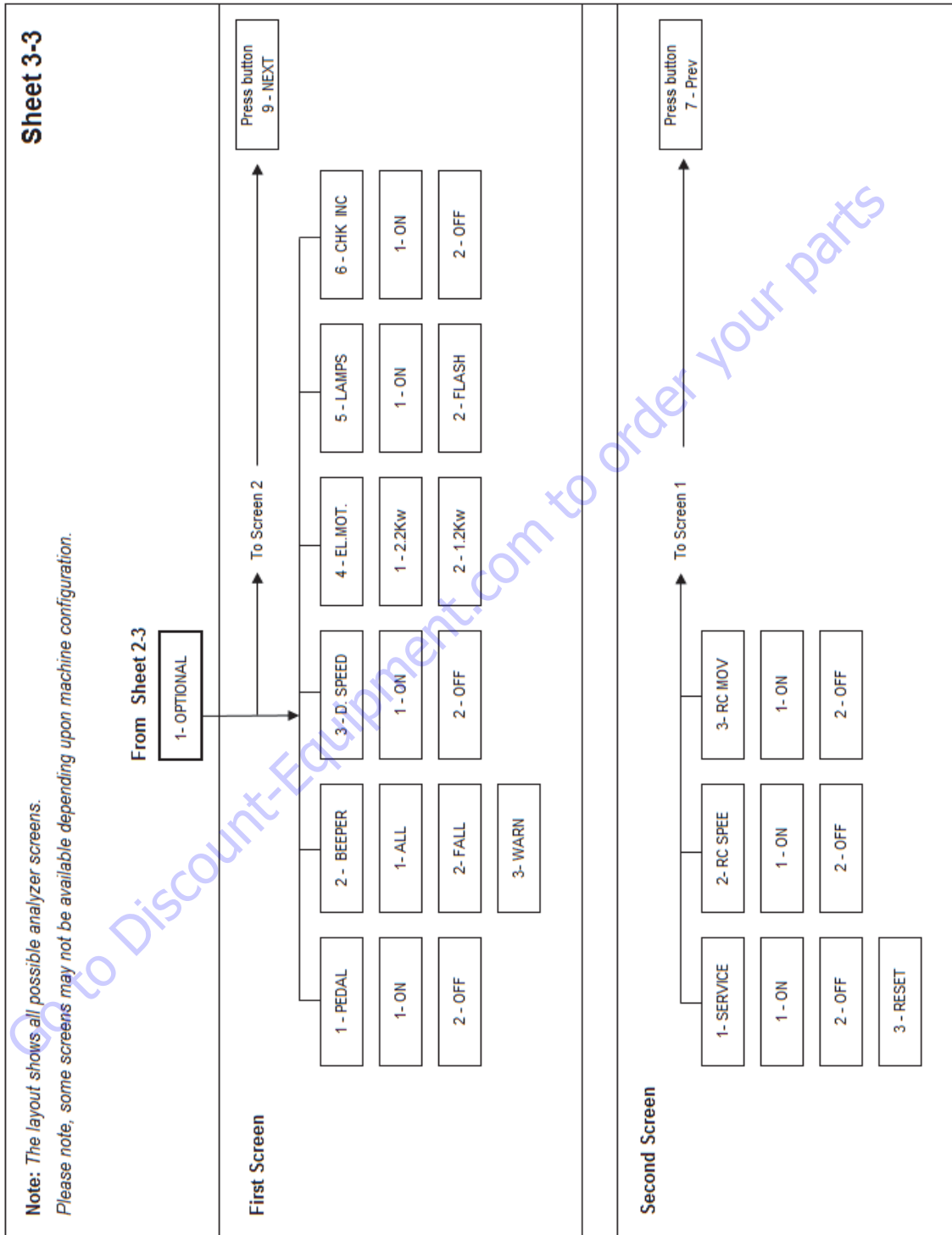


Figure 6-60. Machine Setup Flow Chart - 3 of 3

Setup 1 - ACCELER - (Calibrating Tilt Sensor)

This menu allows the calibration of the tilt sensor.

NOTICE

A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT WITH THE UNIT LEVELED ON BOTH AXIS. CHECK THE BUBBLE LEVEL TO CONFIRM UNIT IS LEVEL (BUBBLE IS IN THE 1° GREEN (CENTER) AREA).



NOTICE

EXTEND, AND ADJUST THE OUTRIGGERS UNTIL UNIT IS LEVEL (BUBBLE IS IN THE 1° GREEN (CENTER) AREA) AND THE TRACKS ARE RAISED OF THE GROUND.

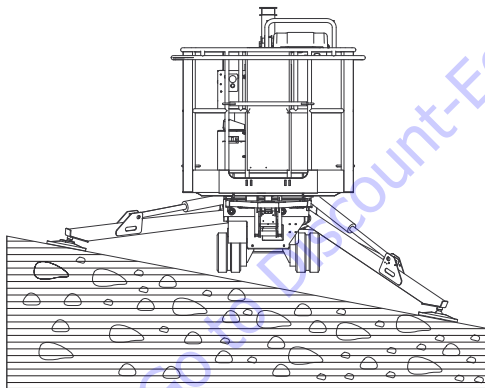


Figure 6-61.

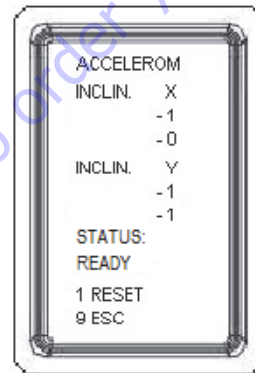
1. Engine OFF.
2. Engine Key Switch ON.
3. Press button 6 "SERVICE"
4. Press button 7 "SETUP"
5. Press button 5 "PASSWORD"
Using the remote control buttons to enter the password "Level 2": 2857.

NOTE: Password above allow to calibrate the TILT SENSOR.

Once the correct password is accepted the display shown "OK".

6. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
 7. Press button 1 "ACCELER" to enter in SETUP TILT SENSOR.
- NOTE:** If "ready" --> Go to point 8. If "not ready", mean one or more outrigger not tach the ground or photocell not aligned.
8. Press Button 1 to reset the TILT.

Check the values if both axle showed in the display become zero, otherwise press button 1 again until both values are zero.



Press 3 times button 9 to Esc to escape.

NOTE: Using the password "Level 3" 4658 to read the values only

Setup 2 - VERSION - Model Number - Engine Type

This menu allows the setting of the machine model and the engine type.

1. Press button 6 "SERVICE"
2. Press button 7 "SETUP".
3. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password "Level 2": 3684.

NOTE: password above allow to choose machine number and engine type.

Once the correct password is accepted the display shown "OK".

4. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
5. Press button 2 "VERSION" to enter in VERSION SETUP.
6. Press Button 1 for machine number.
7. Press Button 7 for engine type.



Press button 9 ESC 3 times to escape.

NOTE: Using the password "Level 3" 7715 to read the values only

Table 6-7.

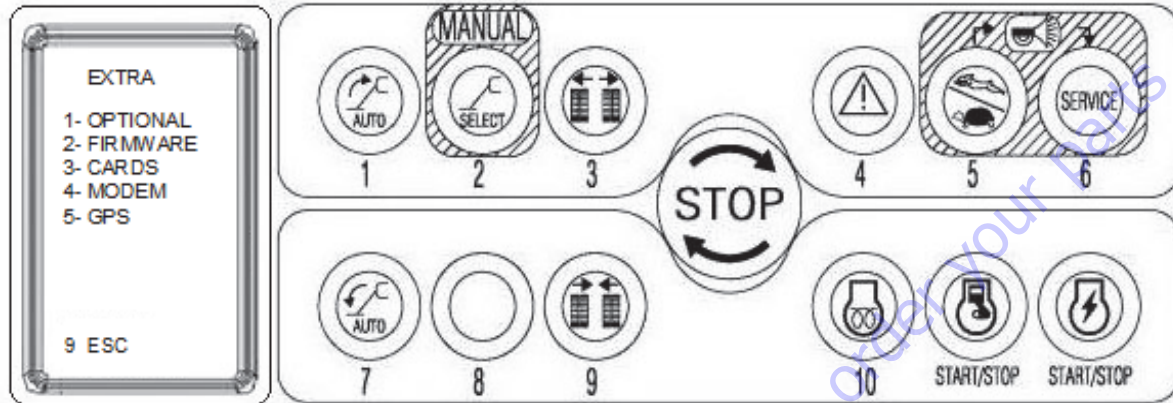
PERSONALITY SETTING		
MODEL	VERSION	ENGINE
X17JP X500AJ	LL1775	D.STD
		D.RPM
		B.13I
		B.15I
		G.15I
X20JP X600AJ	LL2010	LITH.
		D.STD
		D.RPM
		B.13I
		B.15I
X26JP X770AJ	LL2614	G.15I
		LITH.

Table 6-8.

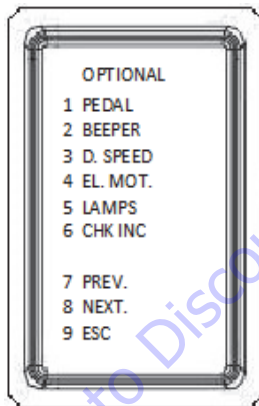
ENGINE ID	ENGINE IDENTIFICATIONS
D.STD	Diesel RPM Manual Adjustment
D.RPM	Diesel RPM Auto Adjustment
B.13I	Gasoline RPM Auto Adjustment for Engine Model iGX 390
B.15I	Gasoline RPM Auto Adjustment for Engine Model iGX 440
G.15I	Gasoline RPM Auto Adjustment for Engine Model iGX 440 (Up to serial number C170000892)
LITH.	Engine Lithium Version

Setup 3 - EXTRA - Machine Configuration

This menu allows the machine configuration.



Press button 1 to enter in menu "OPTIONAL"



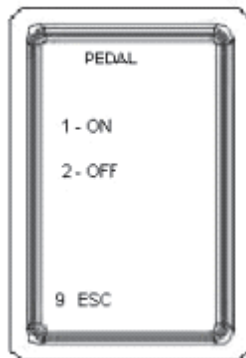
1 - FOOT PEDAL

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password "Level 2": 4771.

NOTE: *password above allow to choose the options shown on the screen.*

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC"
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 1 "PEDAL".



7. Press button 1 ON to activate the "PEDAL".
8. Press button 2 "OFF to deactivate the Pedal".
Press 4 times button 9 to Esc to escape.

2 - MOTION ALARM (BEEPER)

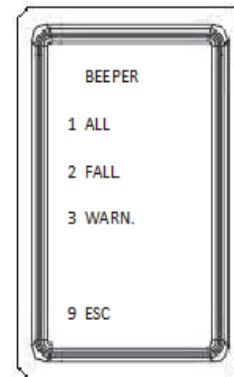
This menu allows the set ON or OFF of the motion alarm with upper fame and undercarriage movements, or for boom down only.

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password "Level 2": 8365.

NOTE: *password above allow to choose the options shown on the screen.*

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL"
6. Press button 2 "BEEPER".



7. Press button 1 ALL to activate all movements.
8. Press button 2 "FALL to activate the descent movements only".
9. Button 3 "WARN" spare (not available)

Press 5 times button 9 Esc to escape.

NOTE: *Using the password "Level 3" 3336 to read the values only*

3 - 2ND DRIVE SPEED

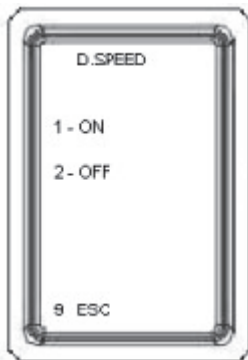
This menu allows to set ON or OFF of the high drive speed on models with this option.

1. Press button 7 SETUP “.
2. Press button 5 “PASSWORD”.
Using the remote control buttons to enter the password "Level 2": 5216.

NOTE: password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown “OK”.

3. Press button 9 “ESC”.
Repeat the above steps if “NO” appear on the display.
4. Press button 3 “EXTRA”.
5. Press button 1 “OPTIONAL”
6. Press button 3 “D.SPEED”2 “.



7. Press button 1 ON to activate 2ND DRIVE SPEED.
8. Press button 2 “OFF to deactivate the 2ND DRIVE SPEED.

Press 5 times button 9 Esc to escape.

4 - SKYGUARD ACTIVATION

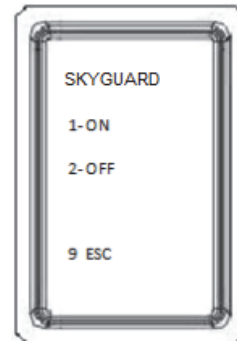
This menu allows to set ON or OFF the enable drive switch. The enable drive switch (button 8) allow the drive function with remote control off of the basket.

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 4771.

NOTE: password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 4 "SKYGUARD"



7. Press button 1 ON to activate the function
8. Press button 2 OFF to deactivate the function
Press 5 times button 9 to Esc to escape

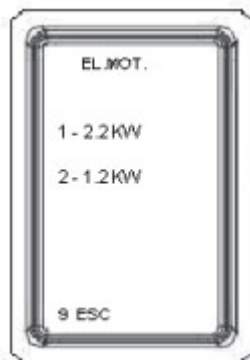
5 - ELECTRICAL MOTOR

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password "Level 2":3522.

NOTE: Password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL"
6. Press button 4 "EL.MOT".



7. Press button 1 2,2 KW for 220- 240 Volt 50HZ.
8. Press button 2 1,2 KW" for 110 Volt 60HZ.

Press 5 times button 9 Esc to escape

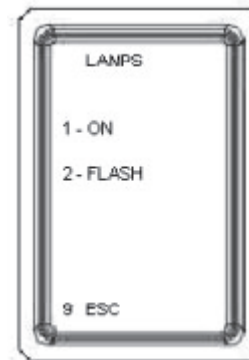
6 - LAMPS on OUTRIGGER

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 6661.

NOTE: Password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 5 "LAMPS".



7. Press button 1 for Lamps continuously ON. Press button 1 for lamps continuously ON with outrigger on the ground and full work area active, while blinking in restricted work area.
8. Press button 2 for Lamps Blinking. Press button 2 for lamps blinking with outrigger on the ground while lamps ON in restricted work area.

Press 5 times button 9 to Esc to escape

7 - TILT DRIVE CUT-OUT FUNCTION (CHK INC)

This menu allows to set ON or OFF the drive cut-out function.

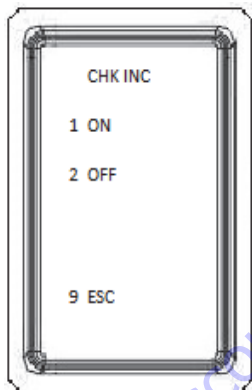
The drive function is reduce or stopped above certain incline

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 6661.

NOTE: password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 6 "CHK INC"



7. Press button 1 ON to activate the function
8. Press button 2 OFF to deactivate the function

Press 5 times button 9 to Esc to escape

1 - MACHINE SERVICE (SERVICE)

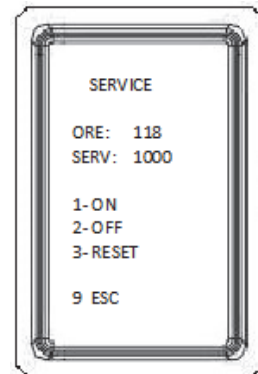
This menu allows to set ON or OFF the icon service function, or to turn off the service required warning icon, when the service is performed.

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 4538.

NOTE: password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 1 "SERVICE"



7. Press button 1 ON to activate the function
8. Press button 2 OFF to deactivate the function
9. Press button 3 RESET to off the service required warning icon
10. SET NEXT SERVICE INTERVAL:

While pressing and holding button 6, use the button 7 to increase and button 8 to decrease the total hours until the next service is required, once that hour setting is reached a warning icon will appear on the display.

Press 5 times button 9 to Esc to escape

2 - HI DRIVE SPEED LIMITATION (RC SPEE)

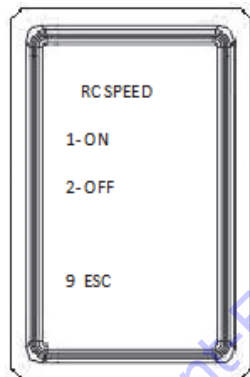
This menu allows to set ON or OFF the high drive speed with remote control off of the basket

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 4771.

NOTE: password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 2 "RC SPEE"



7. Press button 1 ON to activate the function
8. Press button 2 OFF to deactivate the function
9. Press button 3 RESET for reset the icon SERVICE

Press 5 times button 9 to Esc to escape

3 - ENABLE DRIVE SWITCH (RC MOV)

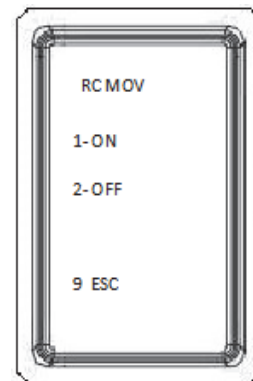
This menu allows to set ON or OFF the enable drive switch. The enable drive switch (button 8) allow the drive function with remote control off of the basket.

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 4771.

NOTE: Password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

3. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
4. Press button 3 "EXTRA"
5. Press button 1 "OPTIONAL".
6. Press button 3 "RC MOV"



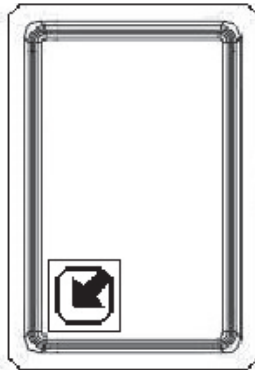
7. Press button 1 ON to activate the function
8. Press button 2 OFF to deactivate the function

Press 5 times button 9 to Esc to escape

4 - SOFTWARE UPDATE (FIRMWARE)

This menu allow to flash a software on ECM 1-2, ECM 3 and the MODEM.

When on the ECM1-2 is uploaded a "new" software version, different as of the currently installed one, on the remote control display right-down corner it is visualized a unique icon, as follows.



This function allow flash the software stored on the modem to the ECM's or on modem module.

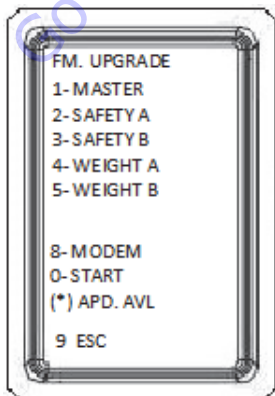
- 9. Press button 7 "SETUP".
- 10. Press button 5 "PASSWORD".

Using the remote control buttons to enter the password 1883 "Level 2".

NOTE: Password above allow to choose the options shown on the screen.

Once the correct password is accepted the display shown "OK".

- 11. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
- 12. Press button 3 "EXTRA"
- 13. Press button 2 "FIRMWARE".
- 14. Press button 1,2,3,4,5,8 to select the modules to update.

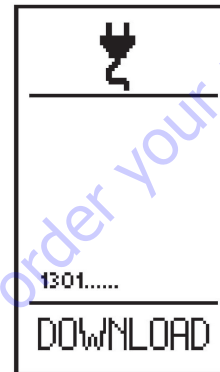


- 15. Press button 0 to "START"
- 16. Press button 1 to "PROCEED" or press button 9 to "ESC"

⚠ WARNING

AFTER PRESSED BUTTON 1 TO PROCEED, DON'T TURN OFF THE SYSTEM UNTIL THE SOFTWARE UPGRADE

- 1. When the procedure ends the display will show the screen with the icon

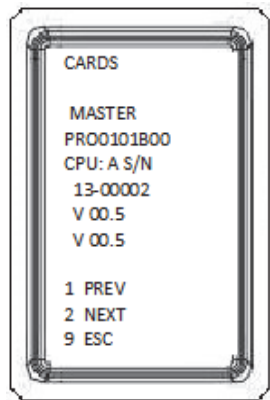


NOTE: The numbers shown above DOWNLOAD are the data transferred. The Download will be completed when about more that 25000 steps are transferred.

5 - MODULES SERIAL NUMBER/SOFTWARE VERSION (CARDS)

This menu show the ECM's modules serial number and the software revision.

1. Press button 7 "SETUP".
2. Press button 3 "EXTRA"
3. Press button 3 "CARDS".
4. Press button 1 or 2 to scroll through the screen to view the serial number and the software revision



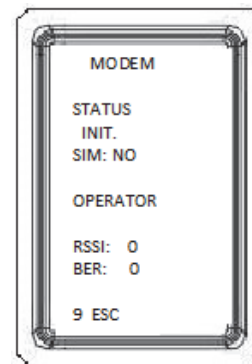
5. Press 4 times button 9 to Esc to escape

6 - MODEM STATUS (MODEM)

This menu show the status of the modem.

6. Press button 7 "SETUP".
7. Press button 3 "EXTRA"
8. Press button 4 "MODEM".

STATUS: INIT. --> Initialization
 CAN TOUT --> Modem not connected
 READY --> Active modem
 SIM: NO --> Sim not present
 OK --> Sim present
 OPERATOR: Operator of the company rooming
 RSSI: Signal strength
 BER: Communication quality



9. Press 4 times button 9 to Esc to escape

7 - GPS DATA (GPS)

This menu show the position GPS

10. Press button 7 "SETUP".
11. Press button 3 "EXTRA"
12. Press button 5 "GPS".

STATUS: INIT. --> Initialization

CAN TOUT --> Modem not connected

READY --> Active modem

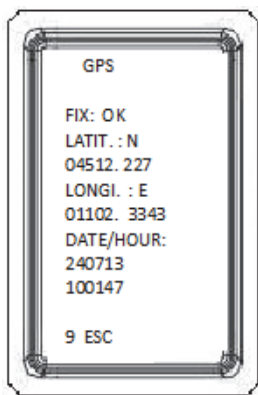
SIM: NO --> Sim not present

OK --> Sim present

OPERATOR: Operator of the company rooming

RSSI: Signal strength

BER: Communication quality



13. Press 4 times button 9 to Esc to escape

Setup 4 - CALIBRATION SWING SENSOR (X26JP - X770AJ Only)

NOTICE

A NEW SWING SENSOR WILL ACT AS IF IT IS WITHOUT RESTRICTED AREA UNTIL THE FOLLOWING PROCEDURE IS PERFORMED. THE UPPER FRAME COULD INTERFERE WITH THE OUTRIGGERS.

This menu allows calibrating the swing sensor for proper operating with outriggers on restricted work area.

1. Connect the remote control box to ground cable.
2. Stabilize the machine (full work area).
3. Lift up the lower boom almost 1m (to avoid contacts with outrigger) for calibration position.

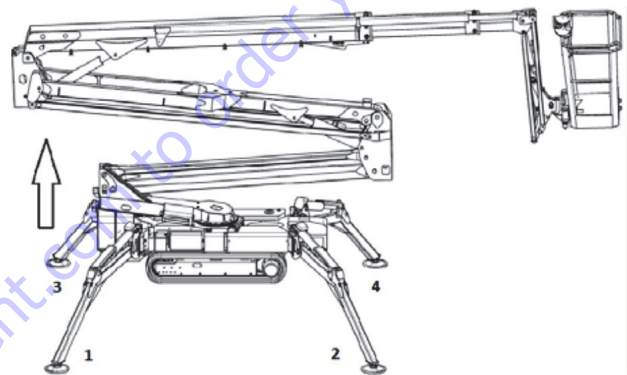


Figure 6-62.

4. Swing CW 180 degrees (centred over opposite end of chassis) for Calibration Position.

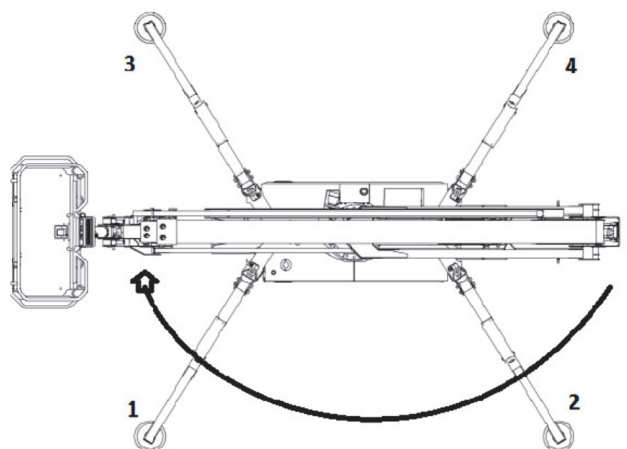


Figure 6-63.

5. Stop the engine.

NOTICE

TO ENSURING THE SUCCESS OF THE CALIBRATION IT IS ESSENTIAL SWING THE UPPER FRAME ON CW DIRECTION ONLY, AND THE ROTATION HAS BEEN CARRIED OUT AGAINST THE MECHANICAL STOP 1.

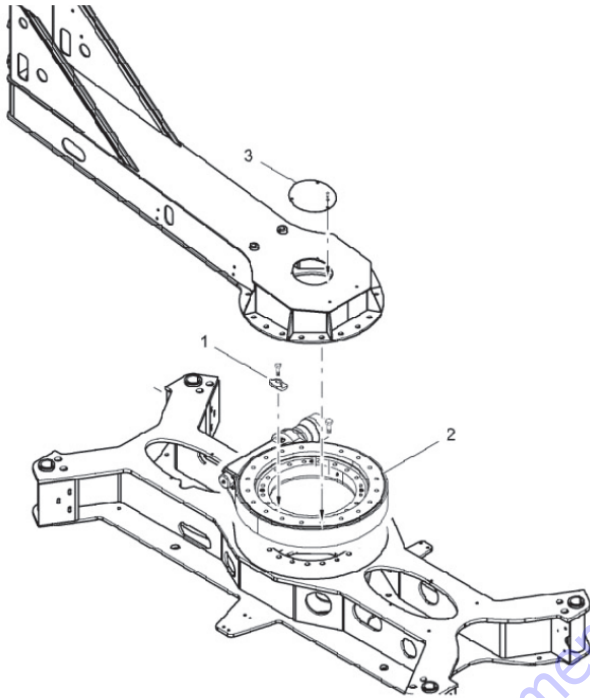


Figure 6-64.

NOTICE

IN CASE OF REPLACING A NEW SWING SENSOR OR ECM4; THE SWING FUNCTION COULD BE REVENTED TO MANUAL ROTATIE THE TURNTABLE, ACTIVATE THE SWING CONTROL BY THE EMERGENCY PROCEDURE.

1. Press button 6 "SERVICE"
2. Press button 7 "SET-UP".
3. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 2857.

NOTE: password above allow to choose machine number and engine type.

Once the correct password is accepted the display shown "OK".

4. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
5. Press button 4 "ROTATION" to enter in ROTATION SETUP.

6. With machine completely rotated on left side, hold the auxiliary reflector on the photocells (icon "machine closed and aligned" has to appears on the display) in order to keep the signal always ON during the procedure, then press and keep pressed for a couple of seconds button n.1 (RESET) and check that the displayed values become one "0" and the other "360" (360 is equal to zero)

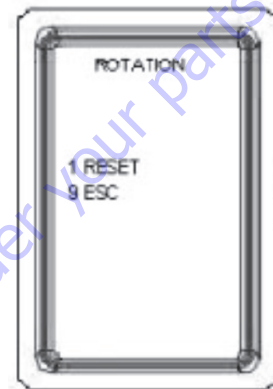


Figure 6-65.

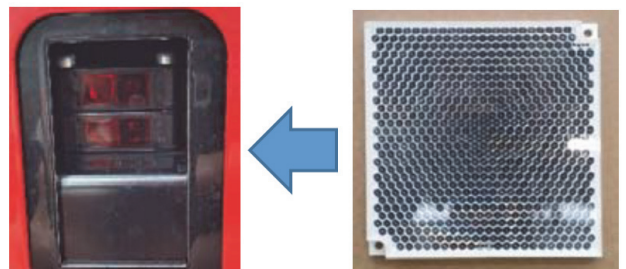


Figure 6-66.

Reflector in front of the photocells during the procedure.

7. Press 3 times button 9 to Esc to escape and then turn OFF the main key. After at least 10 seconds turn ON again the main key
8. Press button 6 "SERVICE".
9. Press button 1 INP OUT.
10. Press button 2 "SUCC" until shown "ROTATION".
11. Check by INPUT "ROTAT.A" and "ROTAT.B" that calibration is correct by checking the alignment turret position that must be 180°, moving leftward must decrease till about 0° (or 360°) and moving rightward must increase till 360° (or 0°)

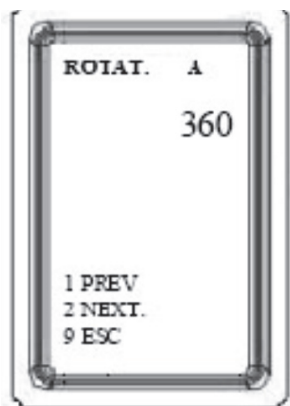


Figure 6-67.

If the value is different from 360 degrees repeat the procedure.

NOTICE

MAKE SURE TO NOT LEAVE THE REFLECTOR ON THE PHOTOCELLS

**Setup 5 - LOAD SENSING SYSTEM (LSS CALIBRATION)
(Before machine S/N- C170000892)**

This menu allows the Calibration Menu is used with Platform weight.

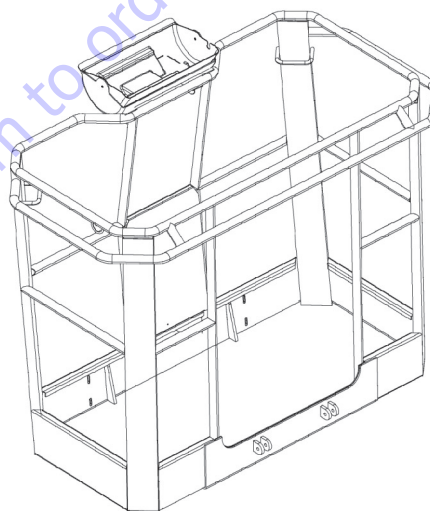
NOTICE

A NEW LOAD CELL OR A NEW LSS MODULE WILL ACT AS IF IT IS WITHOUT AREA UNTIL THE FOLLOWING PROCEDURE IS PERFORMED. THE UPPER FRAME COULD INTERFERE WITH THE OUTRIGGERS.

NOTICE

THE LOAD SENSING SYSTEM REQUIRES PERIODIC FUNCTION. VERIFICATION.

Empty the platform to allow the Load Sensing System to record its weight during calibration.



Remove the remote control from the basket and keep it on hand.

1. Press button 6 "SERVICE"
2. Press button 7 "SETUP".
3. Press button 5 "PASSWORD".

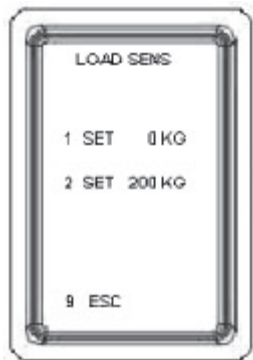
Using the remote control buttons to enter the password "Level 2": 6138

Once the correct password is accepted the display shown "OK".

4. Press button 9 "ESC".

Repeat the above steps if "NO" appear on the display.

5. Press button 6 "LOADSENS" to enter in LOAD-SENS SETUP.

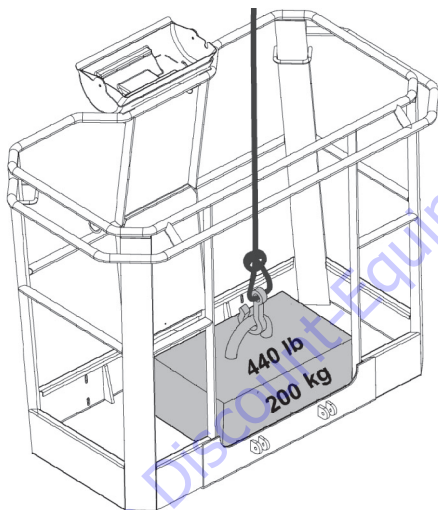


6. Press button 1 "SET 0KG" and wait for about 5 seconds.

Add weight of 200 kg (CE) / 440 Lb (ANSI) in the basket.

⚠ WARNING

200KG OR 440LB ARE THE CORRECT WEIGHT FOR THE CALIBRATION



Wait for about 5 seconds.

7. Press button 2 to SET 200KG.



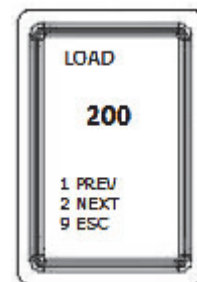
8. Press 3 times button 9 to Esc to escape.

NOTE: Using the password "Level 3" 5726 to read the values only

LSS VALIDATION

1. Stabilize the machine.
2. Press button 6 "SERVICE".
3. Press button 1 INP OUT.
4. Press button 2 "SUCC" until shown "LOAD".

Check that the value if is in reference to the weight on the basket.



If the values shown is almost greater than 10 kg, repeat the procedure.

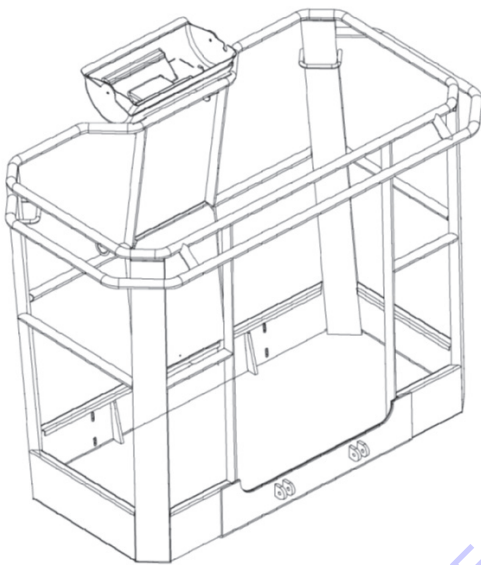
**Setup 5 - LOAD SENSING SYSTEM (LSS CALIBRATION)
(S/N- C170000893 to Present)**

This menu allows the Calibration Menu is used with Platform weight.

NOTICE

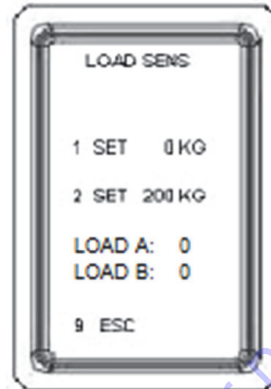
A NEW LOAD CELL OR A NEW LSS MODULE WILL ACT AS IF IT IS WITHOUT AREA UNTIL THE FOLLOWING PROCEDURE IS PERFORMED. THE UPPER FRAME COULD INTERFERE WITH THE OUTRIGGERS.

THE LOAD SENSING SYSTEM REQUIRES PERIODIC FUNCTION. VERIFICATION.



Remove the remote control from the basket and keep it on hand.

1. 1. Press button 6 "SERVICE"
2. 2. Press button 7 "SETUP".
3. 3. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password "Level 2": 6138
Once the correct password is accepted the display shown "OK".
4. 4. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
5. 5. Press button 6 "LOADSENS" to enter in LOAD-SENS SETUP.



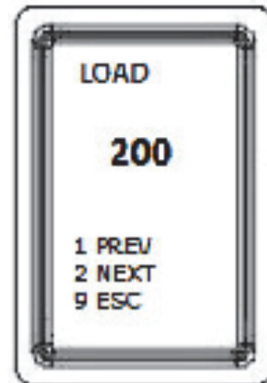
6. 6. Press button 1 "SET OKG" and wait for about 5 seconds.
Press 3 times button 9 to Esc to escape.

NOTE: Using the password "Level 3" 5726 to read the values Only

LSS VALIDATION

1. 1. Stabilize the machine.
2. 2. Press button 6 "SERVICE".
3. 3. Press button 1 INP OUT.
4. 4. Press button 2 "SUCC" until shown "LOAD".

Check that the value if is in reference to the weight on the basket.



If the values shown is almost greater than 10 kg, repeat the procedure.

Setup 6 - TIME Setup

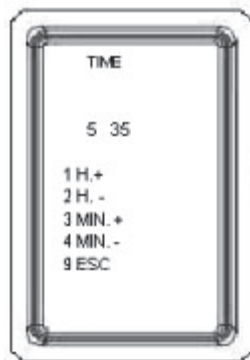
This menu allows the setting of the clock.

1. Press button 6 "SERVICE"
2. Press button 7 "SETUP".
3. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 1468.

NOTE: Password above allow to change the time.

Once the correct password is accepted the display shown "OK".

4. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
5. Press button 7 "TIME" to enter in TIME SETUP.



6. Press buttons 1 Hours UP
7. Press buttons 2 Hours Down
8. Press buttons 3 Minutes UP
9. Press buttons 4 Minutes Down

Press 3 times button 9 to escape.

Setup 7 - DATE Setup

This menu allows the setting of the data.

1. Press button 6 "SERVICE"
2. Press button 7 "SETUP".
3. Press button 5 "PASSWORD".
Using the remote control buttons to enter the password 1468.

NOTE: Password above allow to change the date.

Once the correct password is accepted the display shown "OK".

4. Press button 9 "ESC".
Repeat the above steps if "NO" appear on the display.
5. Press button 8 "DATE" to enter in DATE SETUP.

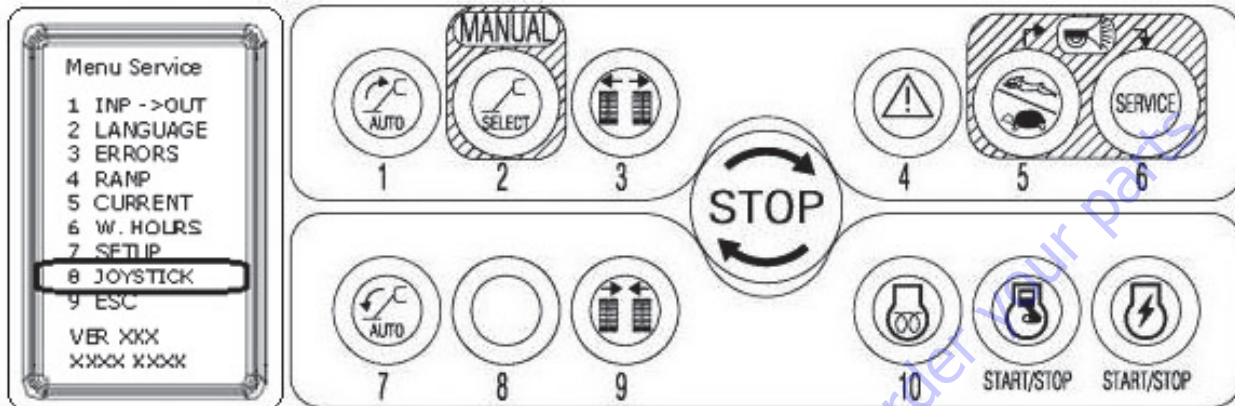


6. Press buttons 1 Day UP
7. Press buttons 2 Month Down
8. Press buttons 3 Year UP
9. Press buttons 4 Year Down

Press 3 times button 9 to escape.

6.9 JOYSTICK

From the SERVICE menu, pressing button 8 "JOYSTICK" accesses the menu JOYSTICK to visualize the numeric values.



Engine Key Switch ON.

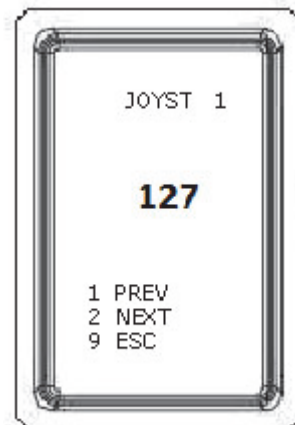
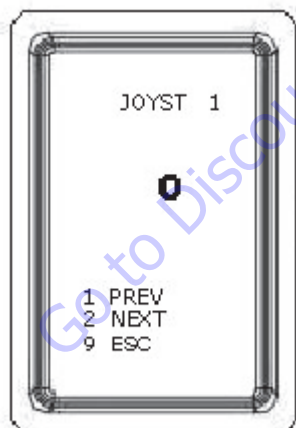
Joystick Fully stroking (both direction)

Value = 127

USE Buttons 1 or 2 to choose the JOYSTICK.

Joystick Neutral position

Value = 0



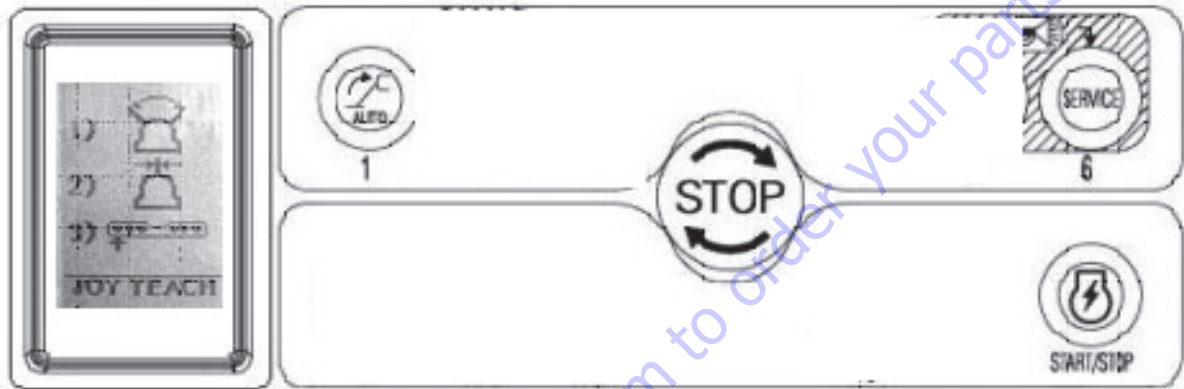
6.10 CALIBRATING JOYSTICK

This menu allows the calibration on Joystick replacement.

NOTICE

A NEW JOYSTIC WILL ACT AS IT IS AWAITING UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

1. Turn Engine and Electrical Motor OFF.
2. Press at the same time the 3 buttons below for at least 7 seconds, until "JOY TEACH" appears.
3. Move each Joystick fully stroking on both direction.
4. Press Button 7 to escape.



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SECTION 7. GENERAL ELECTRICAL INFORMATION & SCHEMATICS

7.1 GENERAL

This section contains schematics to be used for locating and correcting most of the operating problems which may develop. If a problem should develop which is not

presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

7.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. A digital meter with reasonable accuracy (within 7%) is recommended for the measurements in these procedures. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the voltage source.

Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read the voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

Polarity

Finding a negative voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, the location of the signal and that the leads are connected to the device under test correctly. Also check that the lead on the "COM" port goes to the ground or negative side of the signal and the lead on the other port goes to the positive side of the signal.

Scale

M = Mega = 1,000,000 * (Displayed Number)

k = kilo = 1,000 * (Displayed Number)

m = milli = (Displayed Number) / 1,000

μ = micro = (Displayed Number) / 1,000,000

Example: 1.2 k Ω = 1200 Ω

Example: 50 mA = 0.05 A

Voltage Measurement

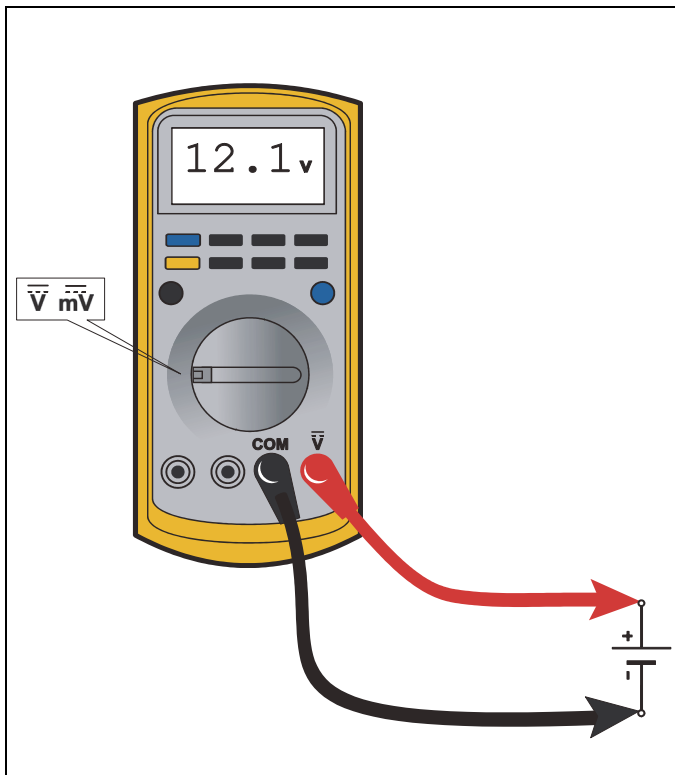


Figure 7-1. Voltage Measurement (DC)

- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- Use firm contact with meter leads

Resistance Measurement

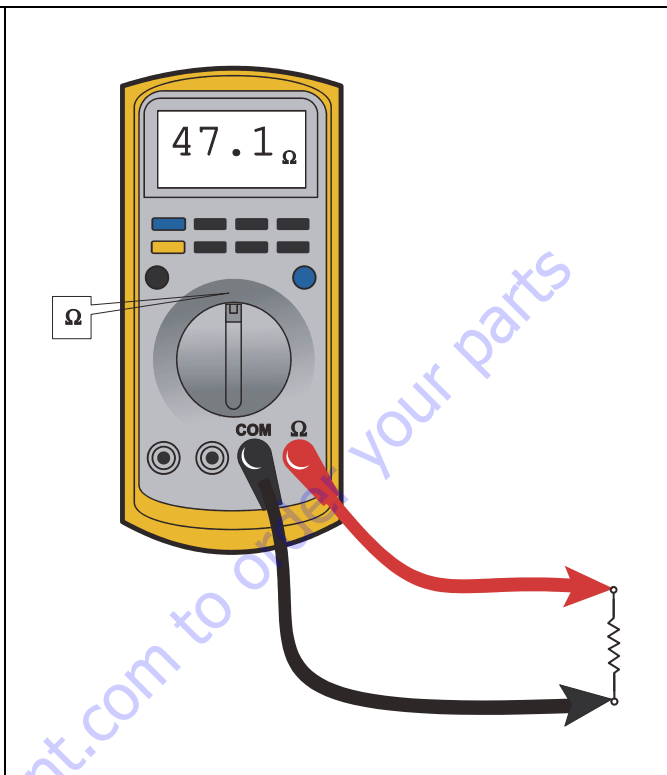
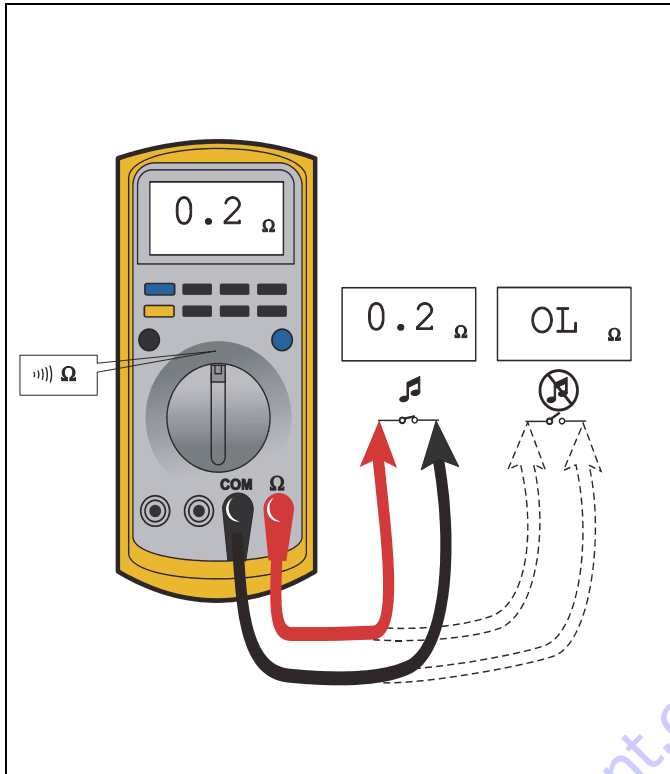
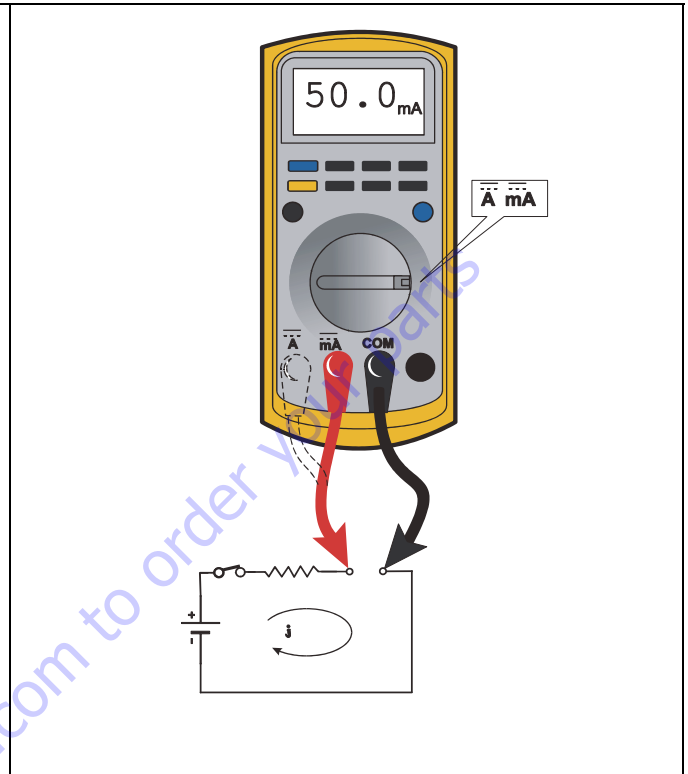


Figure 7-2. Resistance Measurement

- First test meter and leads by touching leads together. Resistance should read a short circuit (very low resistance)
- Circuit power must be turned OFF before testing resistance
- Disconnect component from circuit before testing
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual)
- Use firm contact with meter leads

Continuity Measurement**Figure 7-3. Continuity Measurement**

- Some meters require a separate button press to enable audible continuity testing
- Circuit power must be turned OFF before testing continuity
- Disconnect component from circuit before testing
- Use firm contact with meter leads
- First test meter and leads by touching leads together. Meter should produce an audible alarm, indicating continuity

Current Measurement**Figure 7-4. Current Measurement (DC)**

- Set up the meter for the expected current range
- Be sure to connect the meter leads to the correct jacks for the current range you have selected
- If meter is not auto ranging, set it to the correct range (See multi meter's operation manual)
- Use firm contact with meter leads

Continuity Measurement Over Long Distances

When trying to determine continuity of a harness or wire, longer than the reach of standard instrument leads, is possible to perform the check without excessively long leads. Using the other wires in the harness one can determine the condition of a particular wire in the harness.

Requirements:

- Harness with at least three separate wires including the wire under test.
- These wires must be able to be isolated from other wires, etc.
- Jumper or method to connect contacts on one side of harness.
- Meter that can measure resistance or continuity.

Procedure

Test multimeter leads resistance. Subtract this value from the measured resistance of the wires to get a more accurate measurement.

Consult the circuit schematic to determine which wires to use in addition to wire under test, here called wire #1 and wire #2, and how to isolate these wires. These wires should appear in the same connectors as the wire under test or are within reach of the jumper.

1. Disconnect all connections associated with the wire under test and the two additional wires. If harness is not completely isolated disconnect battery terminals also, as a precaution.
2. Measure continuity between all three wires, the wire under test, wire #1 and wire #2. These should be open. If not, repair the shorted wires or replace the harness.

3. On one side, jumper from contact of wire #1 and wire #2.
4. Measure continuity between wire #1 and wire #2. If there is continuity, both wires are good and can be used for this test. If there is not continuity, either wire could be bad. Check connections and measurement setup. Redo measurement. If still no continuity, repair wires or consult schematic for other wires to use for test.
5. Jumper from wire under test to wire #1.
6. Measure continuity. If there is continuity, the wire under test is good. Resistance of a wire increases as the length increases and as the diameter decreases.

One can find the continuity of two wires, here #1 and #2, at once by following steps 1 through 4. If there is a problem the third wire is used to troubleshoot the other wires. To find the problem, start at step 1 and use the entire procedure.

7.3 ELECTRICAL SCHEMATICS MANUALS

The electrical schematics manuals are separate from this manual. They are available online (Online Express or www.jlg.com - Manuals) in the same folder where this Service Manual was found.

Here is a listing of the schematic manuals available:

- X17JP/X500AJ and X20JP/X600AJ -
Machines prior to S/N-C170000893 3121762
- X17JP/X500AJ and X20JP/X600AJ -
Machines S/N-C170000893 to Present 3121763
- X26JP/X770AJ -
Machines prior to S/N-C170000944 3121764
- X26JP/X770AJ -
Machines S/N-C170000944 to Present 3121765

7.4 X17JP-X500AJ AND X20JP-X600AJ - HYDRAULIC SCHEMATICS

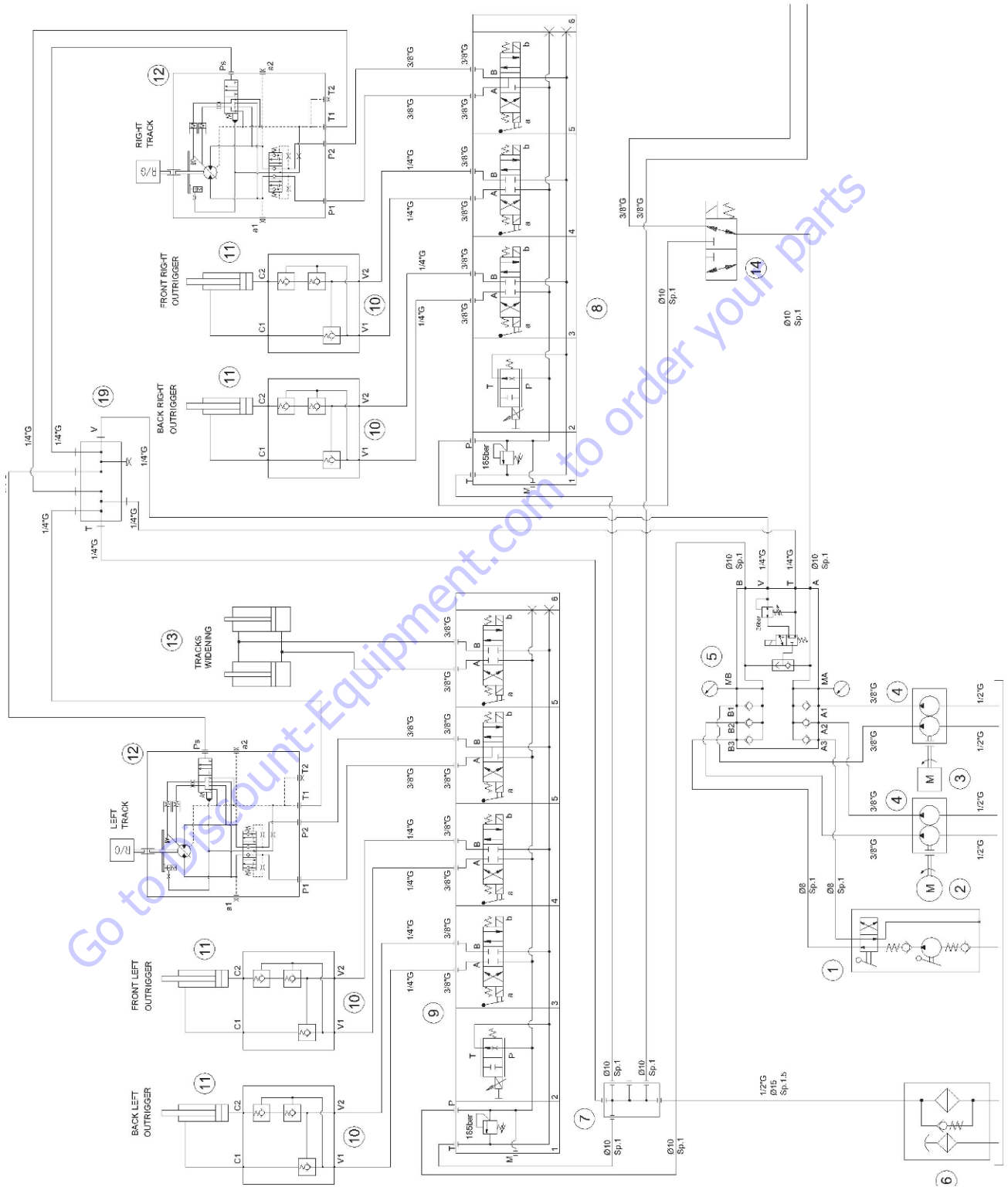


Figure 7-5. X17JP/X500AJ - X20JP/X600AJ - Hydraulic Schematic - 1 of 3

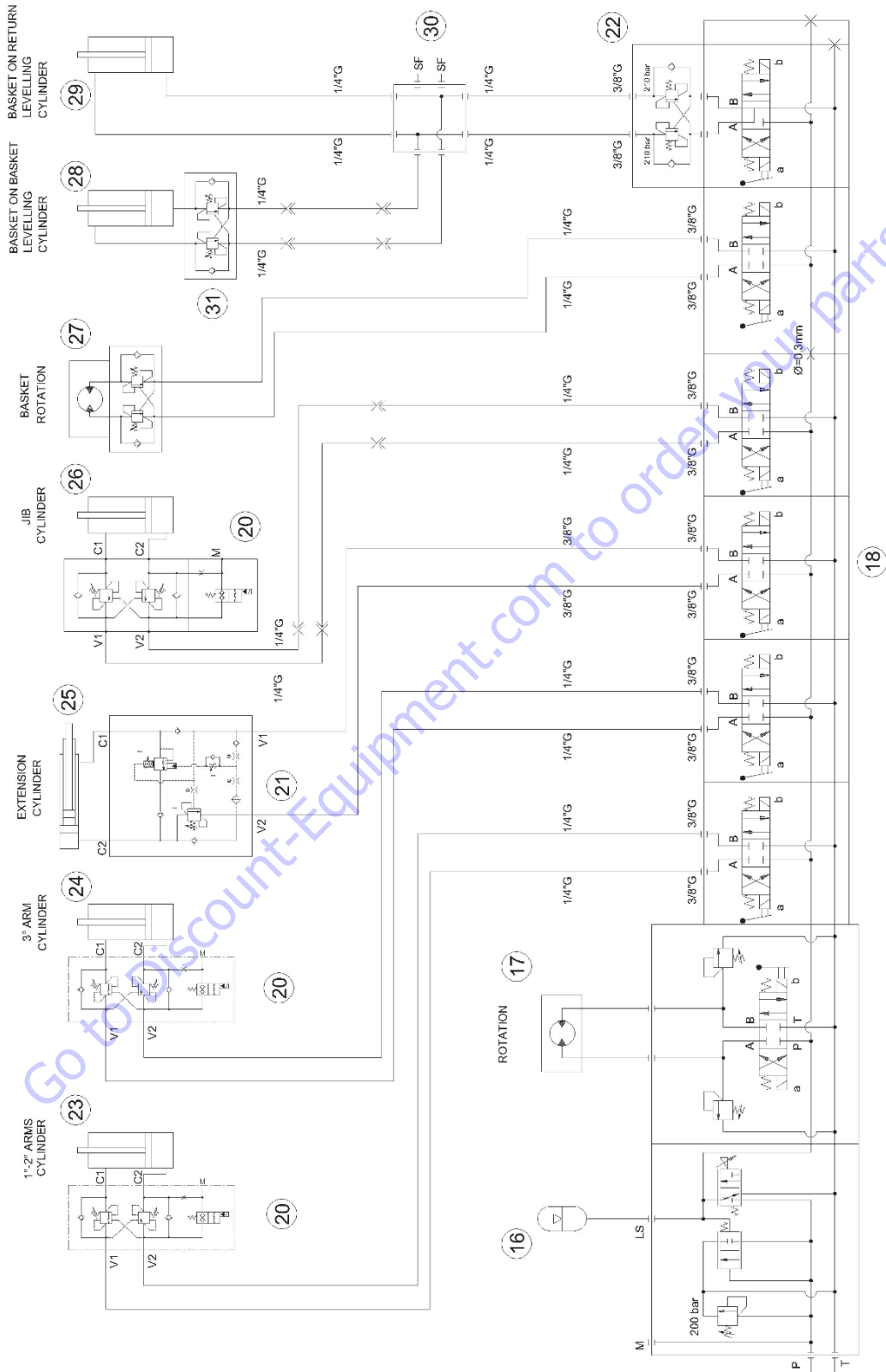


Figure 7-6. X17JP/X500AJ - X20JP/X600AJ - Hydraulic Schematic - 2 of 3

GROUND COMPONENT CONTROLS

1	HAND PUMP
2	ELECTRIC MOTOR 2.2 kW 4 poles IP55
3	GASOLINE ENGINE IGX440
3	DIESEL ENGINE 1B40 10HP
4	DOUBLE PUMP
5	MANIFOLD
6	WASTE FILTER
7	WASTE COLLECTOR
8	DISTRIBUTOR
9	DISTRIBUTOR
10	OUTRIGGER BLOCK VALVE
11	OUTRIGGER CYLINDER
12	GEAR REDUCTOR
13	TRACKS WIDENING CYLINDER
14	DEVIATOR VALVE

BOOM COMPONENT CONTROLS

16	ACCUMULATOR
17	ROTATION MOTOR
18	DISTRIBUTOR
19	COLLECTOR
20	ARMS BALANCING DOUBLE VALVE
21	EXTENSION BALANCING VALVE
22	BALANCING DOUBLE VALVE
23	FIRST-SECOND ARM CYLINDER
24	THIRD ARM CYLINDER
25	EXTENSION CYLINDER
26	JIB CYLINDER
27	BASKET ROTATION MOTOR
28	BASKET ON BASKET LEVELING CYLINDER
29	BASKET ON RETURN LEVELING CYLINDER
30	CLOSE CIRCUIT DEVIATION BLOCK
31	LEVELING BALANCING DOUBLE VALVE

Figure 7-7. X17JP/X500AJ - X20JP/X600AJ - Hydraulic Schematic - 3 of 3

7.5 X26JP-X770AJ - HYDRAULIC SCHEMATICS

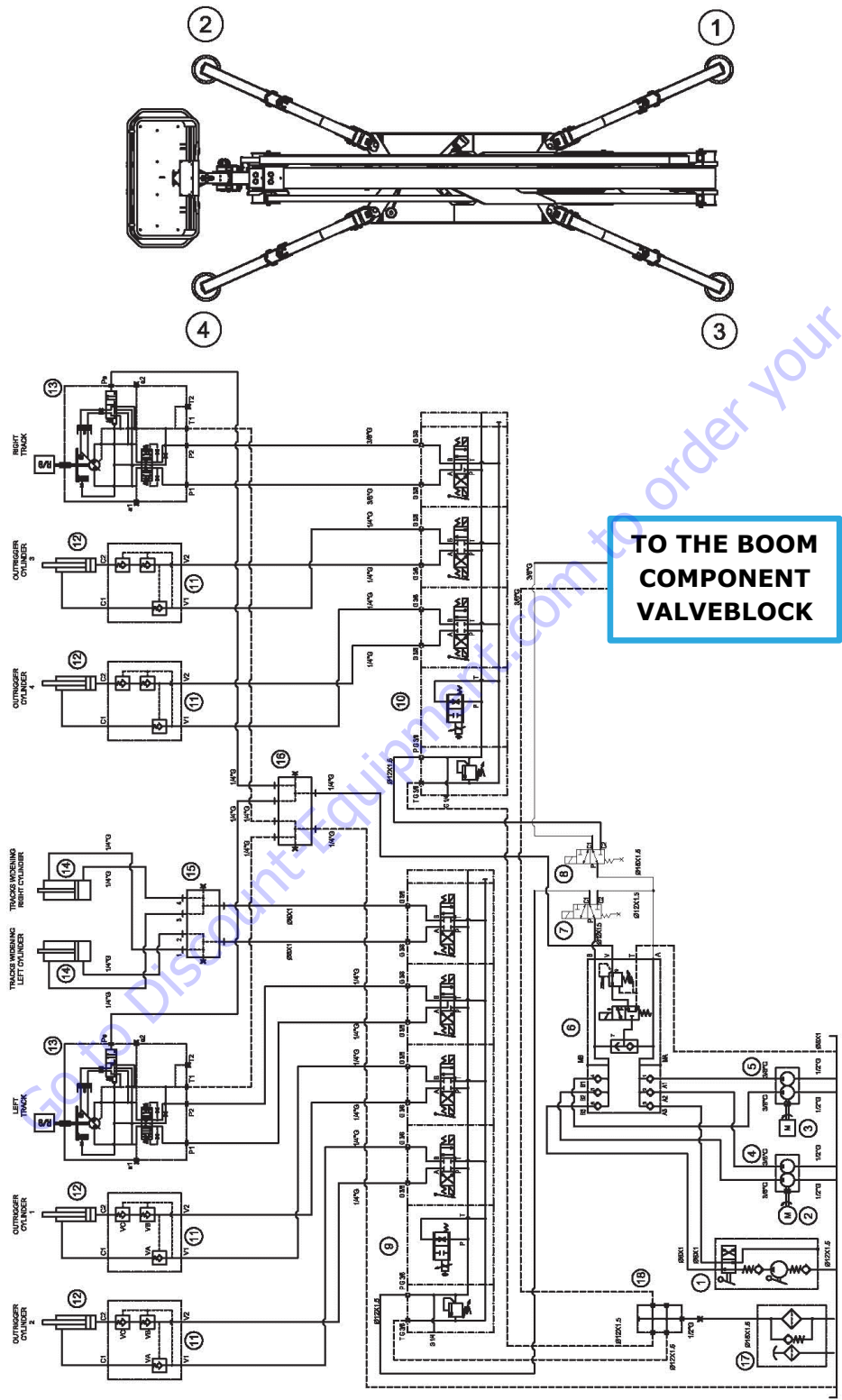


Figure 7-8. X26JP/X770AJ - Hydraulic Schematic - 1 of 2

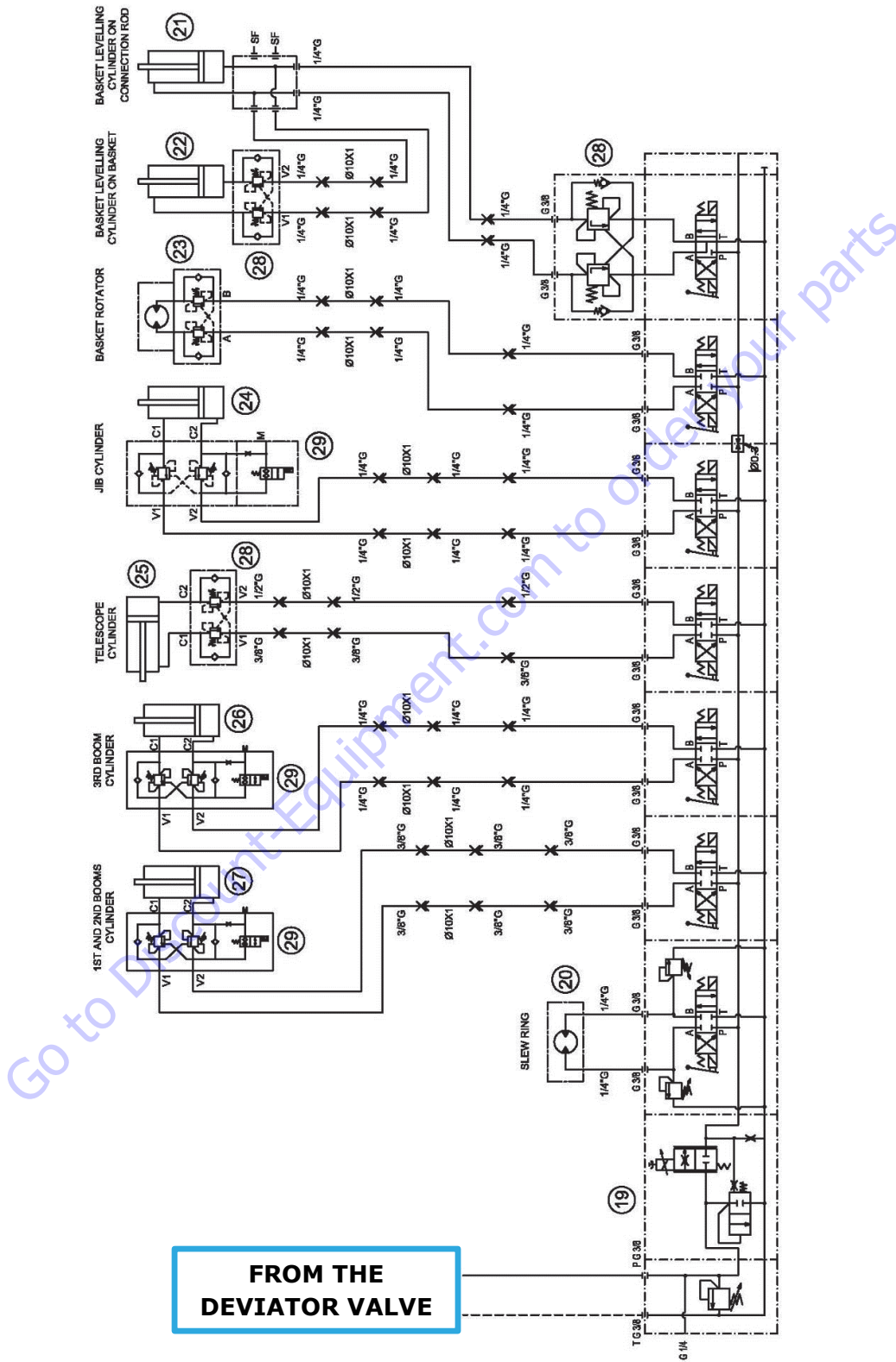


Figure 7-9. X26JP/X770AJ - Hydraulic Schematic - 2 of 2

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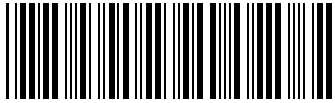
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