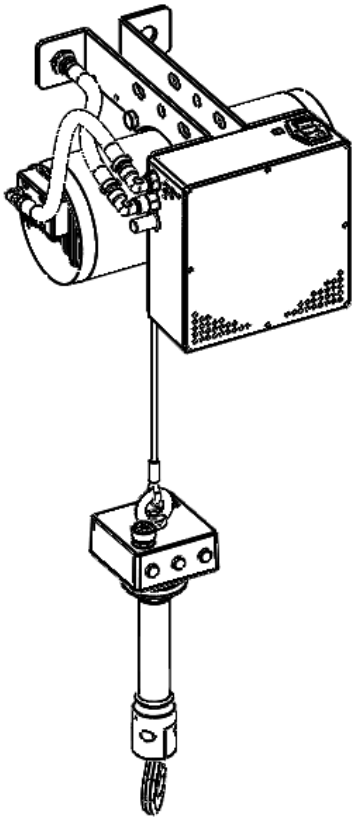
Product Parts Information

Zero Gravity V1.5
Control kit for Air Balancer



Save these Instructions

Ingersoll Rand
Industrial Technologies

Edition 2
August 2018

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Specifications

Principe of operation

This product is an electronic control kit for air balancer. It allows up and down movement by action on the handle or directly on the load if it's already lifted (progressive control by handle and multiple loads balancing).

It's composed by two main units :

- Zero Gravity main box attached to the balancer : it includes 6 pneumatics actuators and an electronic board. The opening or closing of these actuators, inflate or deflate the balancer to lift or lower the load.

- Zero Gravity handle : contains control buttons and a force sensor.

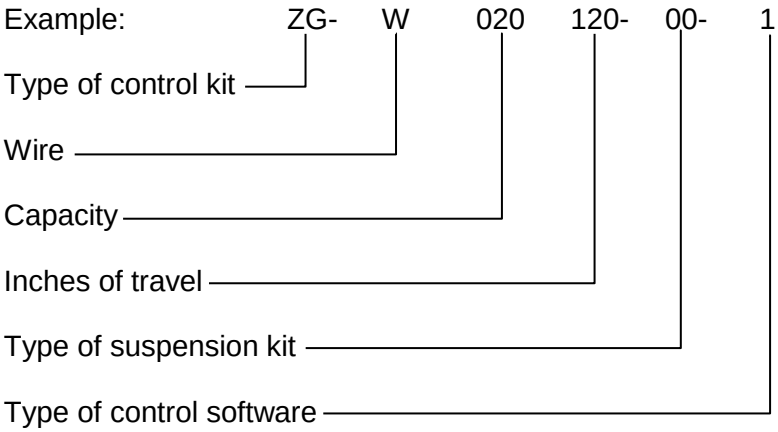
To carry a load, the operator actuates the sensitive cell of the handle in the desired direction. If the operator pushes down, the load moves down, or pushes up, the load rises up proportionally to the force applied. When the load is completely lifted and stationary, the system switches automatically in balancing mode. The position will be controlled by direct actions on load itself. The system is able to do this thanks to a pressure sensor included in the control box. 3 electric inputs and outputs are available and joined to the command handle in order to control additional part or gripper according to the application (in option).

This product must be used by only one person. In the opposite case, simultaneous request done by several operators can result in hazardous movements.

This product must not be used to lift persons.

This product must not be used in explosive or wet atmosphere.

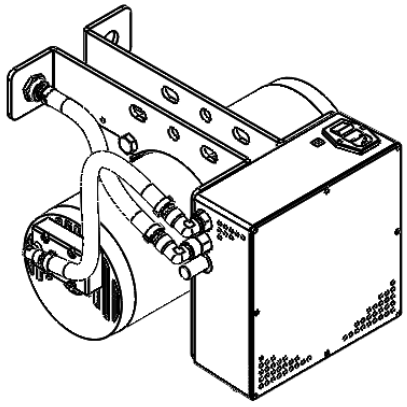
Model code



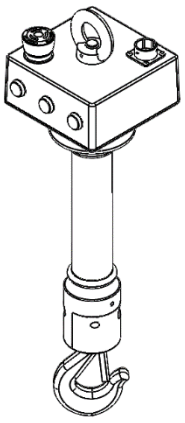
Type of control kit	Wire or Chain	Capacity in Pounds (at 100 psi)	Inches of travel	Type of mounting kit	Type of control software
ZG = Zero Gravity	W = Wire Rope	015 = 150lbs (68kgs) 020 = 200lbs (91kgs) 035 = 350lbs (158kgs) 050 = 500lbs (227kgs)	80 = 80in (203 cm) 120 = 120 in (305cm)	00 = no suspension AT = ZRAT rail A1 = ZRA1 rail A2 = ZRA2 rail HM = Top hook mount	1 = standard software 2 = specific software (use input and output)

Unboxing the Zero Gravity

Check that all components listed are present in the box:

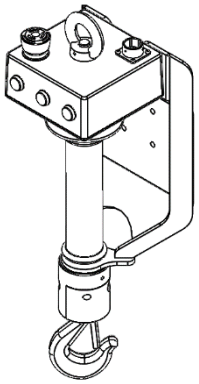


Zero Gravity main box + balancer + mounting kit (optional)

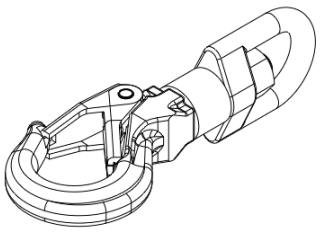


Zero Gravity handle

or

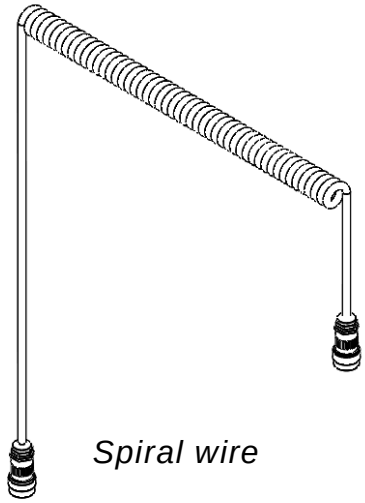


with mounting bracket (optional)



Balancer wire hook + installation kit

Main power cord EU plug to C13 with lock function



Spiral wire

CE Certificat and installation manual

Installation tool required

Allen wrench 3/16 installation hook.

Wrench 19mm for 3/8 air fitting hose.

Wrench 13mm for IR end stop rail in case of AT, A1, A2 mounting kit

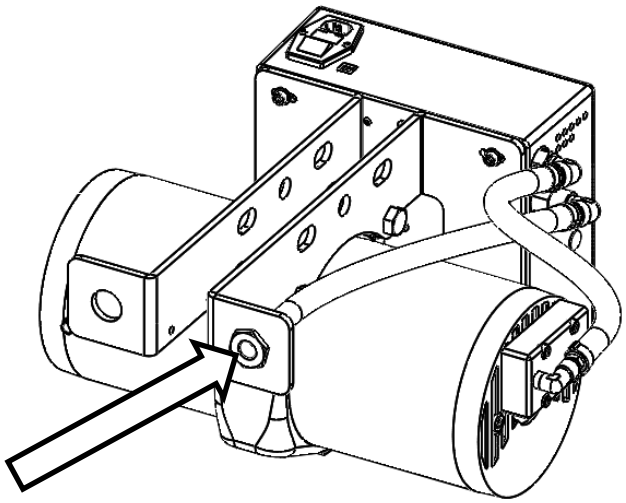
Tie raps.

Shear for balancer wire.

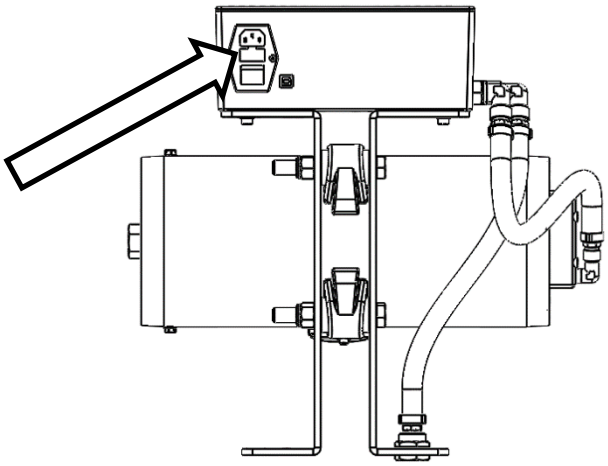
6mm diameter heat shrink tubing to avoid fraying of the wire rope.

Pre-assembly

1) Safely hang the Zero gravity using the suspension kit included (please refer to the Air balancers manual ref 16598849)
2) Connect the air to the main air inlet (3/8” coupling)



3) Connect the power cord to the Zero Gravity (85V to 240V AC, 50 to 400hz)



After having connected air and electricity, please go to First operation / Installation guidelines

First operation/Installation guidelines

For safety reason during transportation, the chamber of the balancer is filled with air, the wire rope is in the highest position.

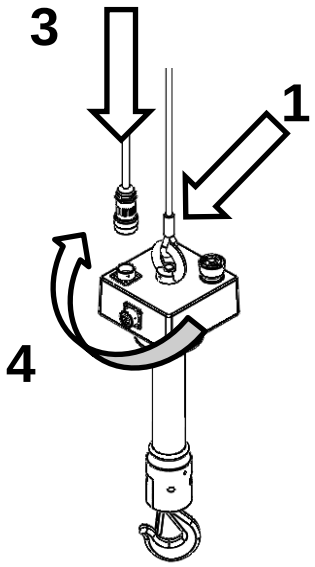
Balancer hook adjustment

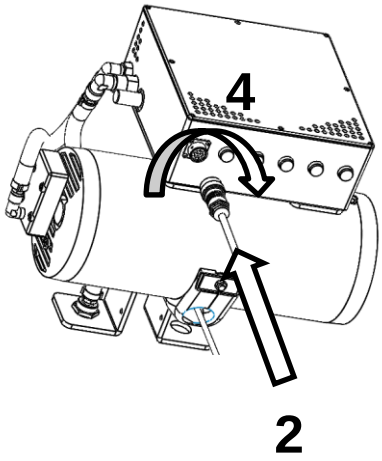
Please refer to the air balancers manual ref 16598849 for hook installation. Please consider that the position you will choose for the hook will be the highest point of your application.

We don’t recommend using balancing mode at the balancer’s mechanical down limit to ensure good running stability.

Handle connection

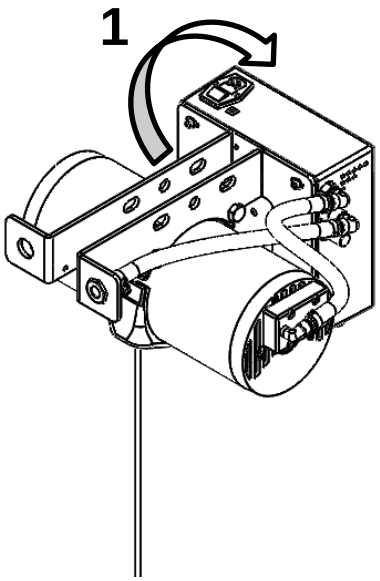
1. Hang the handle eye bolt to the wire rope hook.
2. Connect the electric spiral wire to the Zero gravity electronic box.
3. Connect the electric spiral wire to the plug on top of Zero Gravity handle.
4. Make sure you turn the ring clockwise to secure the connection!

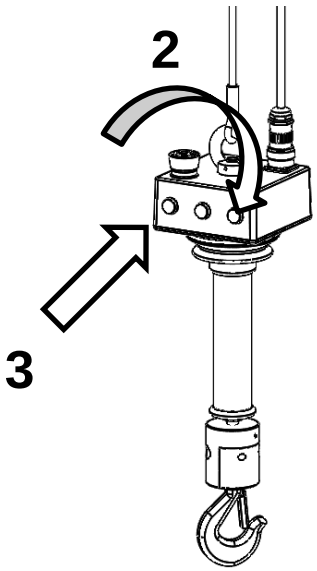




Initial switch on

1. Switch on the Zero Gravity using the power switch on the main box.
2. Disengage the emergency stop on top of the handle.
3. Push the green button on the handle.

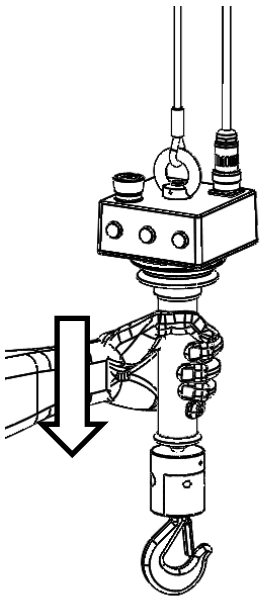




During initialization of the Zero Gravity, the handle must not be touched by the operator.

Deflate the chamber

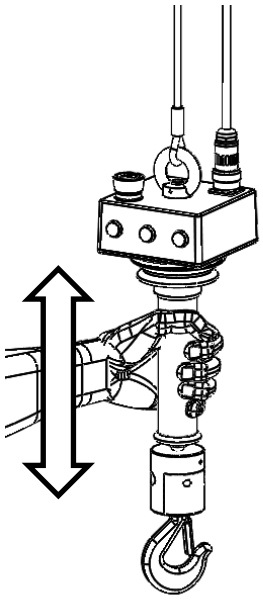
Once the Zero Gravity has initialized (3 yellow leds lit on the electronic box), pull down the sliding part of the handle (as show on picture).



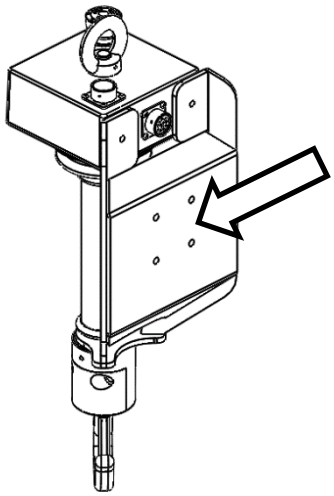
Operational guideline

How to use the Zero Gravity handle

The zero Gravity handle can be installed inline with the wire rope and the load. For up and down movements use the sliding part of the handle as shown on picture



The Zero Gravity handle can be remote mounted using the bracket ref ZGB00-BRK as shown on picture (for specific applications, please contact your local Ingersoll Rand distributor).



Mounting holes (position can be modified upon request)

In case of problems, use the emergency button to stop movement.

How to use the float mode

Float mode engagement

The float mode will be automatically activated once the load is stable and the handle is not touched during 1 second (red light will lit on the Zero Gravity electronic box during calculation). The up and down movements will be done acting directly on the load itself (the 3 yellow lights lit on the Zero Gravity electronic box).

Float mode disengagement

The float mode will automatically disengage once the handle is touched (yellow leds will go out on the Zero Gravity electronic box), up and down movements will be done using the sliding part of the handle.

How not to use the float mode :

Do not apply any force on the load (upward or downward) while float mode is being activated, this would result in a faulty calculation of the weigh and will cause up or down drift of the load.

Zero Gravity connection to a laptop

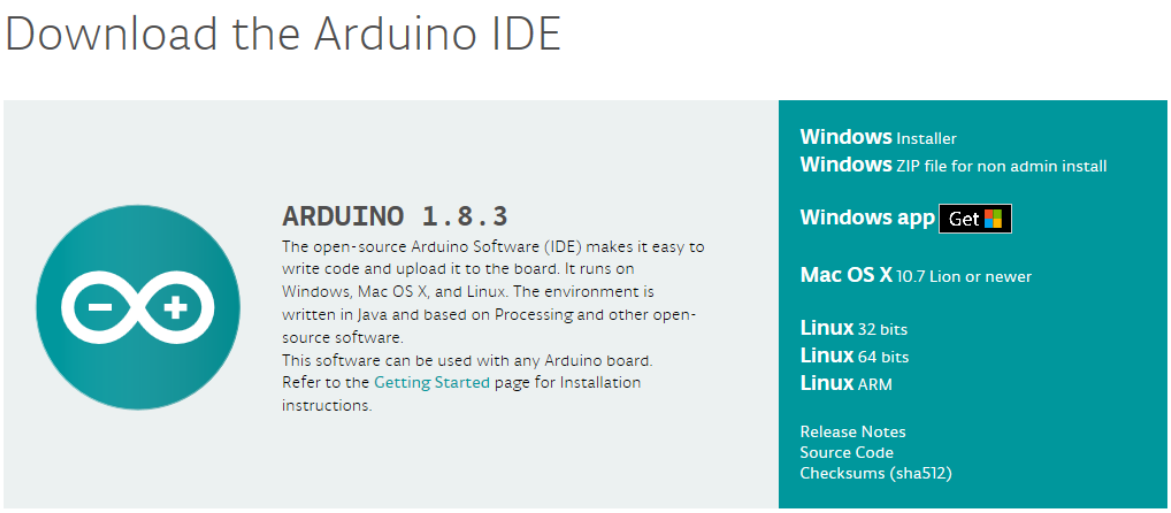
Installation

What is needed :

Equipment	Tool
	- Computer
	- Arduino software rev 1.8.x

To do :

- Connect your computer to this internet link : https://www.arduino.cc/en/Main/Software
- Select the right OS according to your computer.



- Download and install the software setup.
- Open the program to check the installation.

Connection

Step 1

What is needed :

Equipment	Tool
- Zero Gravity main box	- Computer - USB cable type A to type B

To do :

- Connect the main box of the Zero Gravity to an available USB plug on your computer.

Step 2

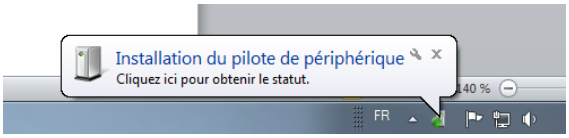
What is needed :

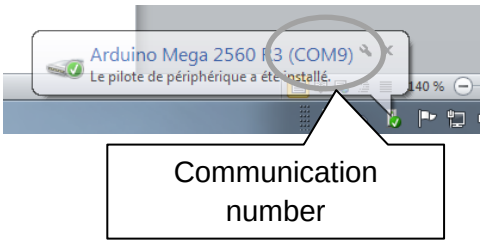
Equipment	Tool
	- Computer

To do:

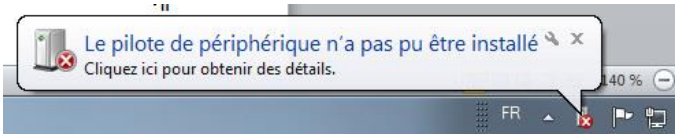
Auto installation of the Arduino board's driver:

The latest version of Windows will install drivers automatically. When done, please note the communication port number attached to the board.

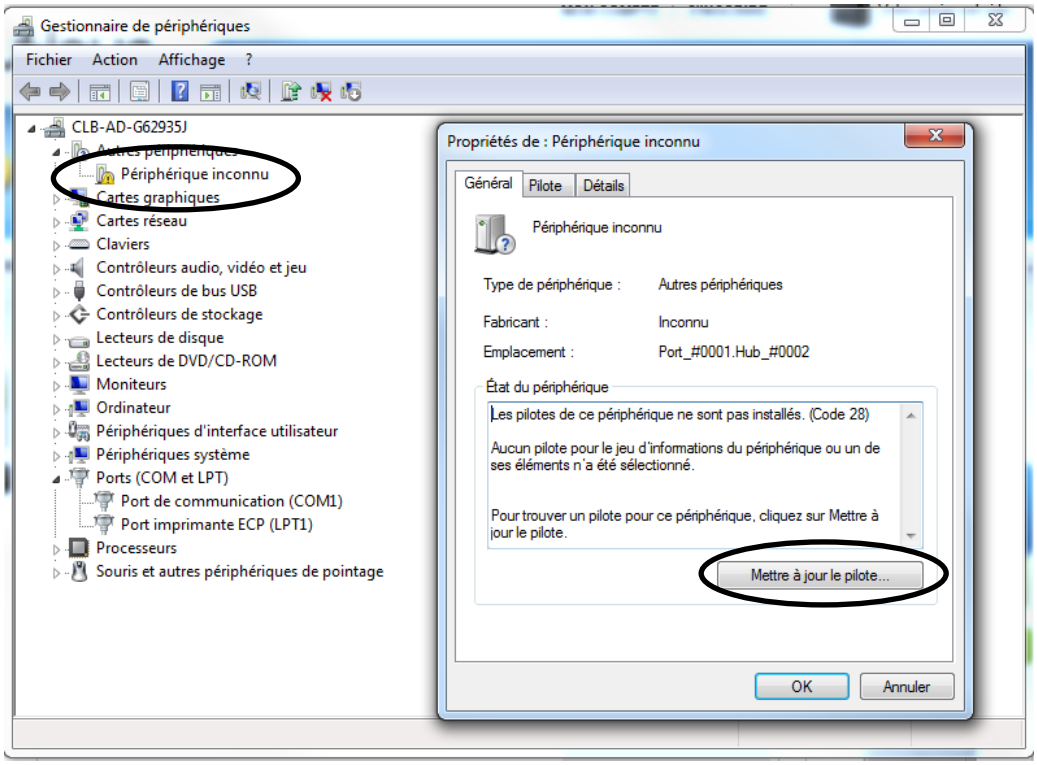




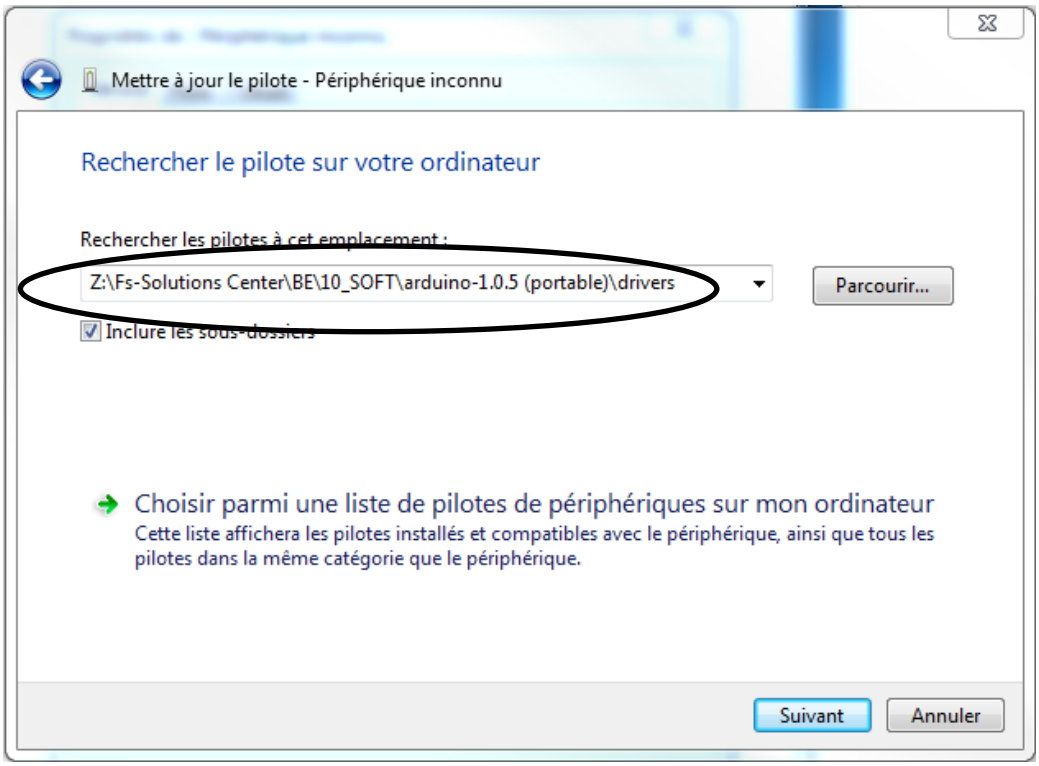
Manual installation:



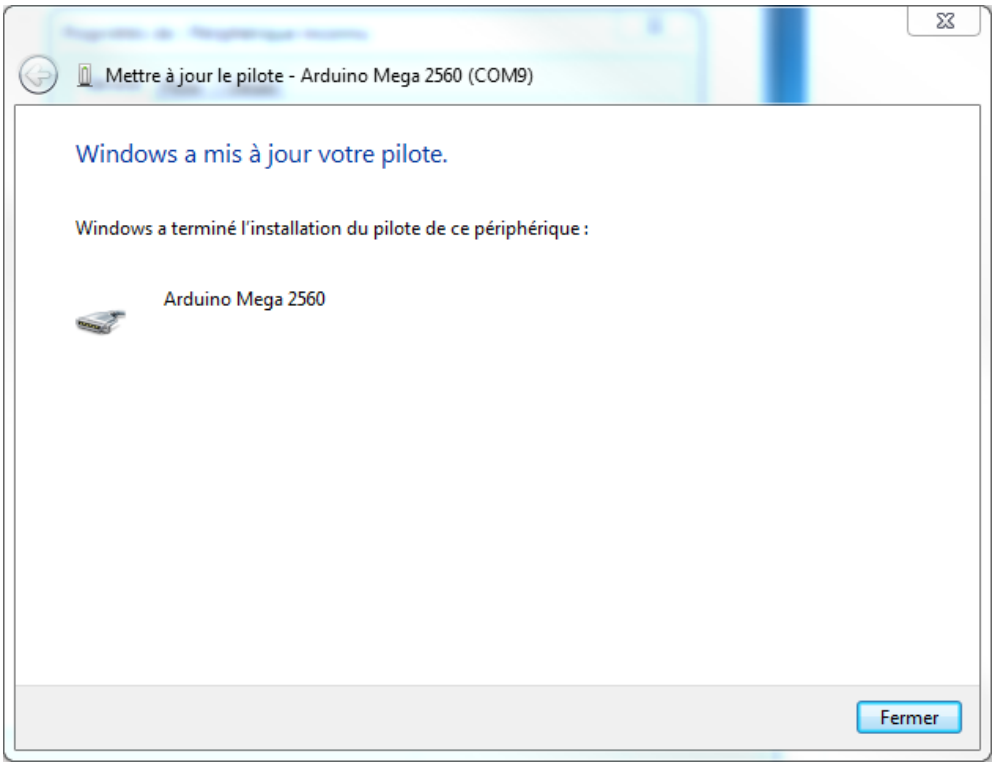
- Open the device manager of the computer: Control panel -> System -> Device manager.
- Open "unknow device" and right click to update the device driver.



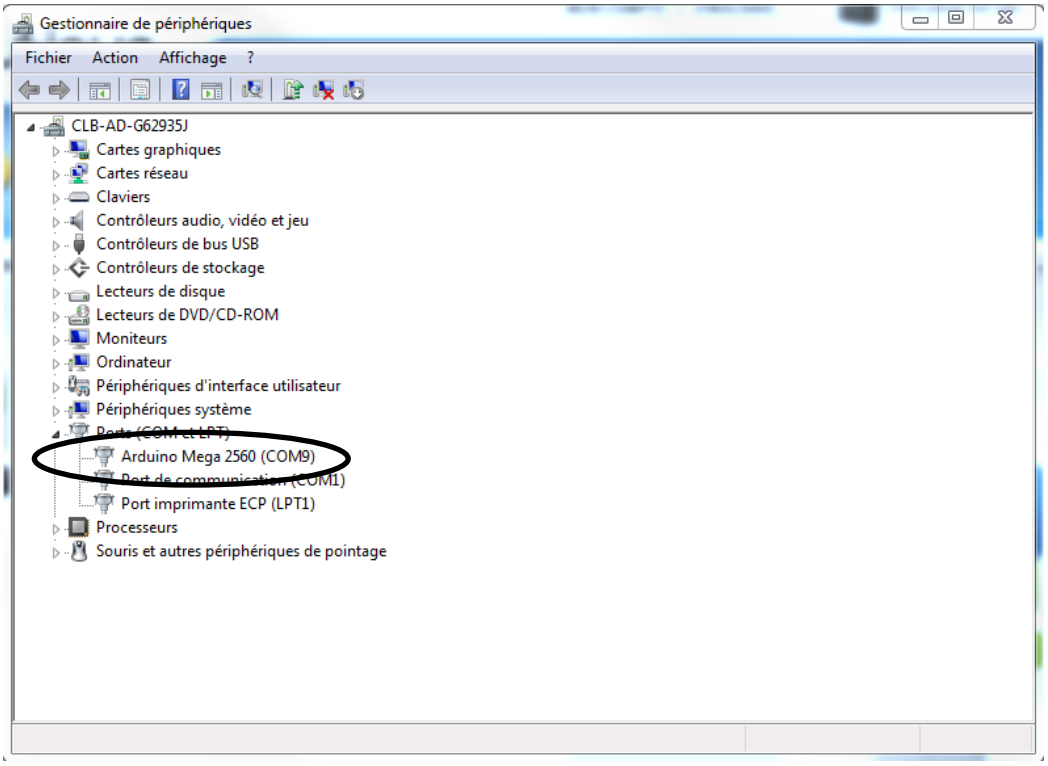
- Click on option: find driver from my computer.
- All drivers are in the folder: \Arduino\drivers\ from the main directory of the Arduino program (usually C:\Program Files\Arduino\drivers).



- Click next.
- A warning message appears, click install.
- After a moment the device is ready for use.



- Come back to the Device Manager and open the communication (COM and LPT). Note the communication number attached to the board Arduino Mega 2560.



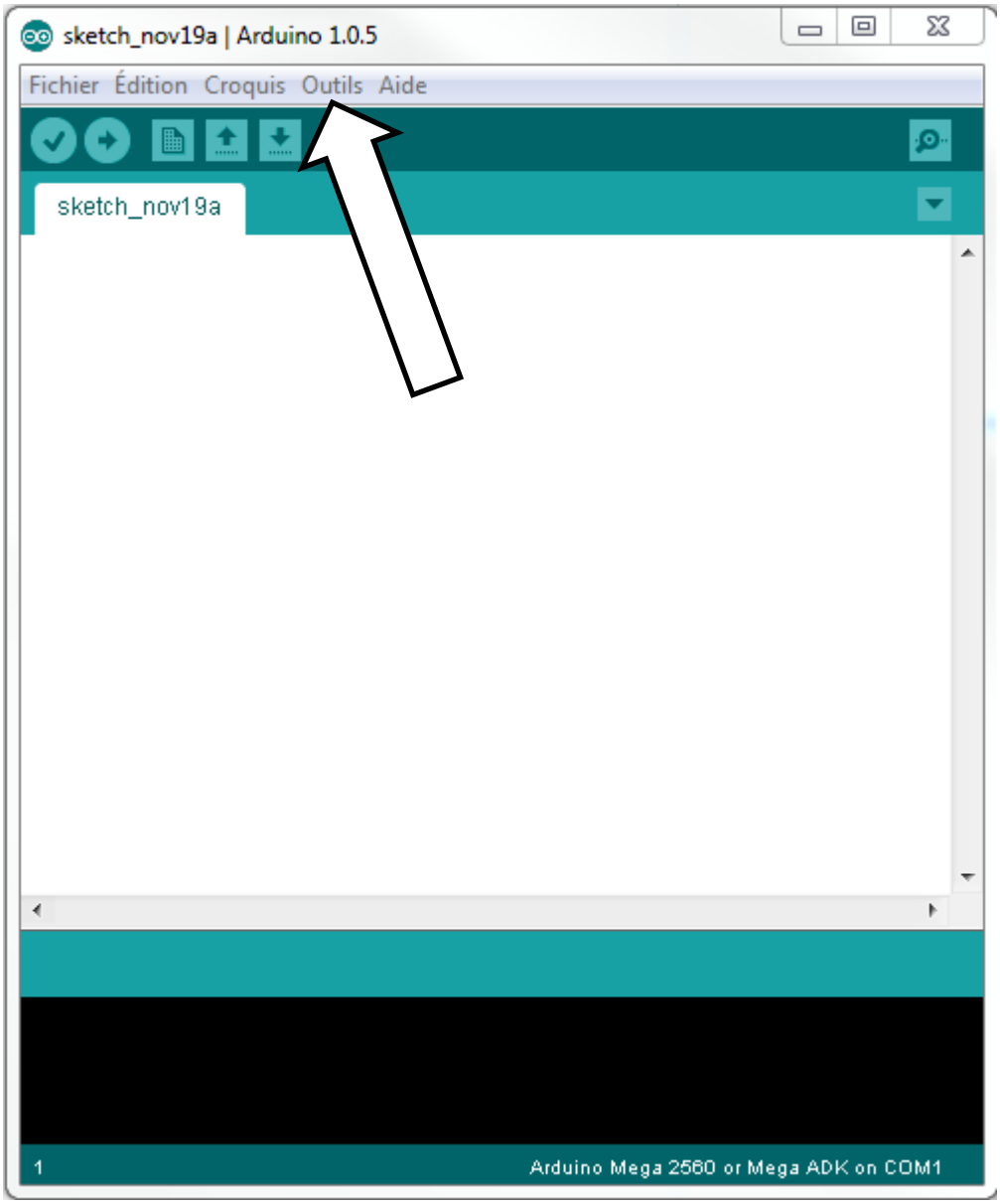
Serial Communication

Step 1
What is needed :

Equipment	Tool
- Zero Gravity main box	- Computer
	- USB cable type A to type B
	- Arduino software rev 1.8.x

To do :

- Open Arduino.exe.
- Click “Tool” menu, then “Type of board”.
- Select “Arduino Mega 2560 or Mega ADK”.



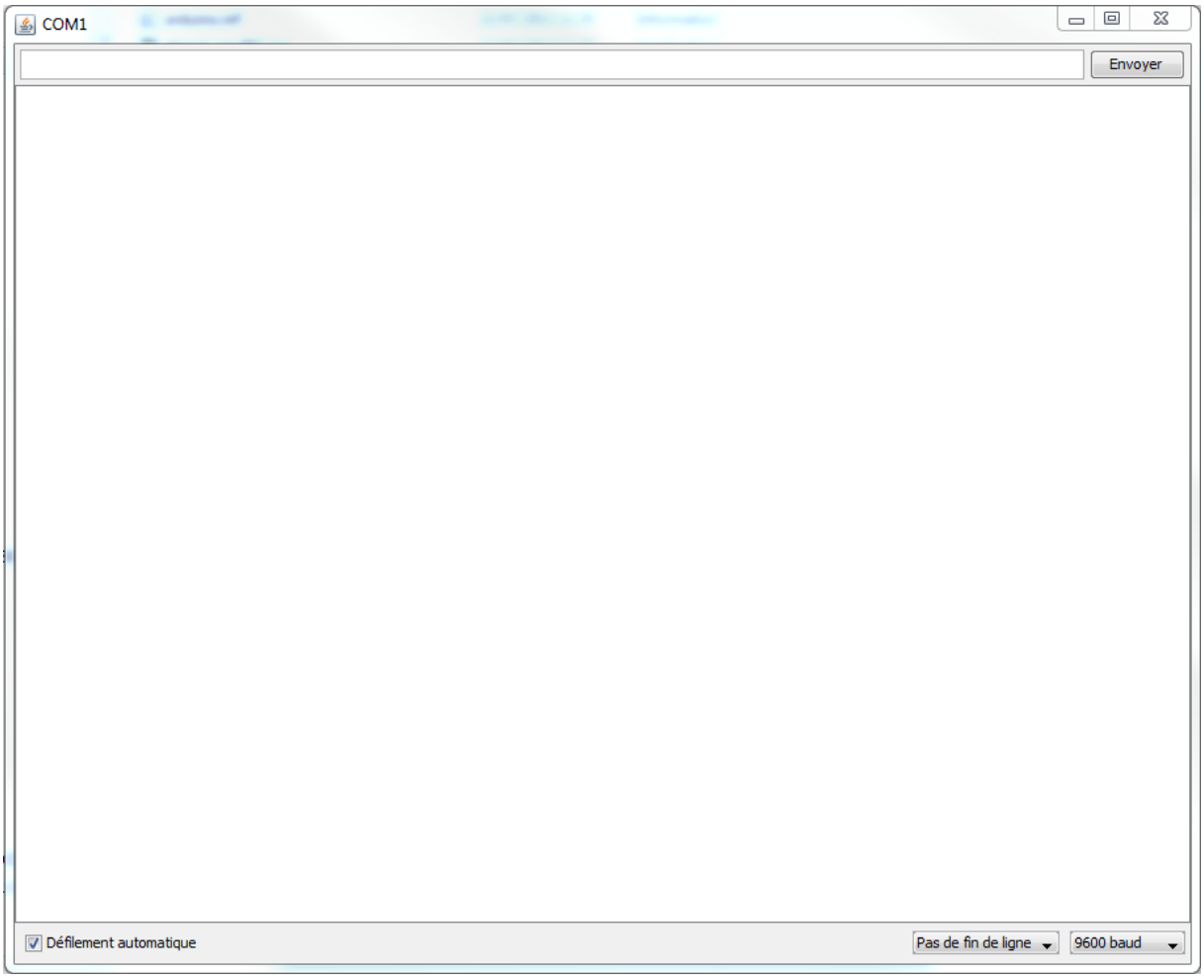
- Click “Tool” menu, then “Port”.
- Select the right port’s number, previously noted in Connection section.

Step 2
What is needed:

Equipment	Tool
- Zero Gravity main box	- Computer
	- USB cable type A to type B
	- Arduino software rev 1.8.x

To do:

- Push Ctrl + Shift + M on keyboard.
- A serial communication windows will open.
- The Zero Gravity main box will restart and start the communication automatically.

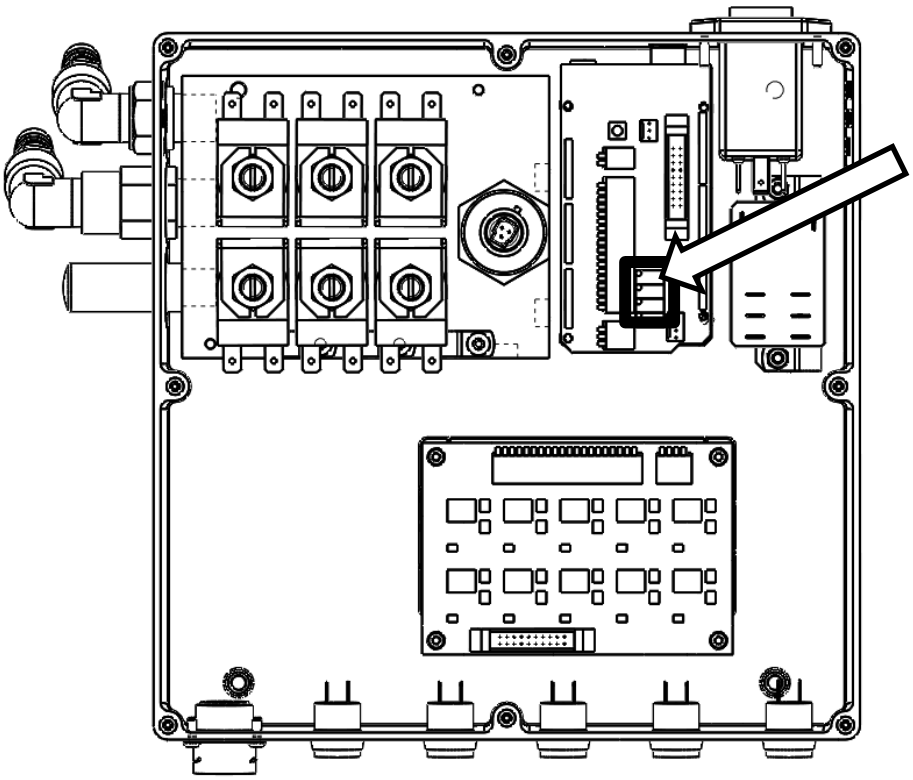


Final set up

3 settings can be adjusted during installation or maintenance to fit specific application :

- No load balancing
- Overpressure
- Interlock

Those 3 functions are available by trimmer inside the main box as shown on the picture :



Disconnect the power supply before working on the equipment, maintenance, repair or set up must be done by qualified personnel, risk of electric shock.

No load balancing

If you have a handling device permanently hanged to the Zero Gravity, the “no load balancing” will guaranty that this handling device will remain balanced (float mode) and will prevent damage on the part when loading or unloading**.**

- Switch off the Zero Gravity using the power switch on the main box.
- Disconnect the electric power supply.
- Remove the cover of the Zero Gravity main box.
- Connect the Zero Gravity main box to the laptop and start a serial communication (please refer to the Serial communication section).
- Turn clockwise the no load balancing trimmer until you see the correct weight adjustment on the laptop screen (value must be the gripper weight).
- Close the cover of the Zero Gravity main box.
- Re-plug the electric wire.
- Switch on the Zero Gravity (please refer to the Initial switch on section).
- Use the handle to move the handling device down
- As soon as the handling device touches the ground, the Zero Gravity should stop the down movement.

Over pressure

If the load or the load of the gripper is blocked somewhere, the control of the pressure in the chamber will prevent a fast up movement if the load is suddenly released.

- Switch off the Zero Gravity using the power switch on the main box.
- Disconnect the electric power supply.
- Remove the cover of the Zero Gravity main box.
- Connect the Zero Gravity main box to the laptop and start a serial communication (please refer to the Serial communication section).
- Turn anticlockwise the Pressure max trimmer until you see the correct weight adjustment on the laptop screen (value must be the gripper + max load weight).
- Close the cover of the Zero Gravity main box.
- Re-plug the electric wire.
- Switch on the Zero Gravity (please refer to the Initial switch on section).
- Use the handle to move the handling device up.
- As soon as the handling device is in the up position, the Zero Gravity should stop the up movement.

Interlock

The Zero Gravity includes an Interlock feature : if you need to control a handling device, the interlock will not allow the handling device to open as long as the load remains in the air. Once this option is activated, the 3 yellow lights on the main box will have new signification :

- 1st : part clamped.
- 2nd : part released.
- 3rd : ready to release (indicates the load is not carried anymore by the Zero Gravity and can be released).

Interlock adjustment

The interlock must be adjusted to your application regarding the example as follow :

If your handling device is 20kg, and your load 25kg, you must adjust the interlock to 20kg (the interlock will not allow the handling device to open once the total load carried by the Zero Gravity exceeds 20kg)

- Switch off the Zero Gravity using the power switch on the main box.
- Disconnect the electric power supply.
- Remove the cover of the Zero Gravity main box.
- Connect the Zero Gravity main box to the laptop and start a serial communication (please refer to the Serial communication section).
- Turn clockwise the Interlock trimmer until you see the correct weight adjustment on the laptop screen (value must be the gripper weight).
- Close the cover of the Zero Gravity main box.
- Re-plug the electric wire.
- Connect the gripper to the extension plug of the Zero Gravity handle as following section.
- Switch on the Zero Gravity (please refer to the Initial switch on section).

Interlock wiring

The interlock activates an available output on the I/O plug at the back of the handle.

Please connect your handling device to the Zero gravity as follow :

- Pin J and K : Clamp control actuator.
- Pin J and L : Release control actuator.
- Pin J and M : Ready to release information.

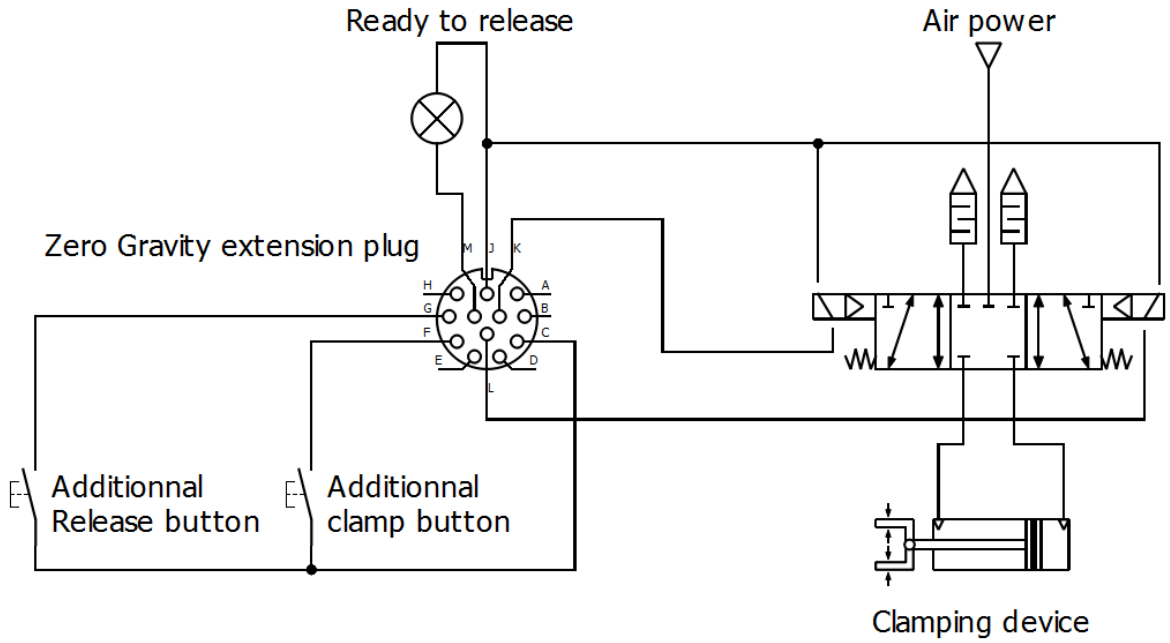
To activate the clamping action, push the orange button on the Zero Gravity handle and pull down the sliding part of the handle (bimanual action).

To activate the release action (the ready to release light must be on) push the black button on the Zero Gravity handle and pull down the sliding part of the handle (bimanual action).

These buttons can be wired outside of the handle thanks to connection on pins :

- Pin C and F : Additionnal clamp push button (NO contact).
- Pin C and G : Additionnal release push button (NO contact)

Schematics



Extension plug pinout

Pin	Function
A	Not used
B	Not used
C	Ground
D	+5V for input
E	Additionnal force sensor input
F	Additionnal clamp button input
G	Additionnal release button input
H	Input 4
J	+12V for output
K	Clamping output
L	Release output
M	Ready to release output

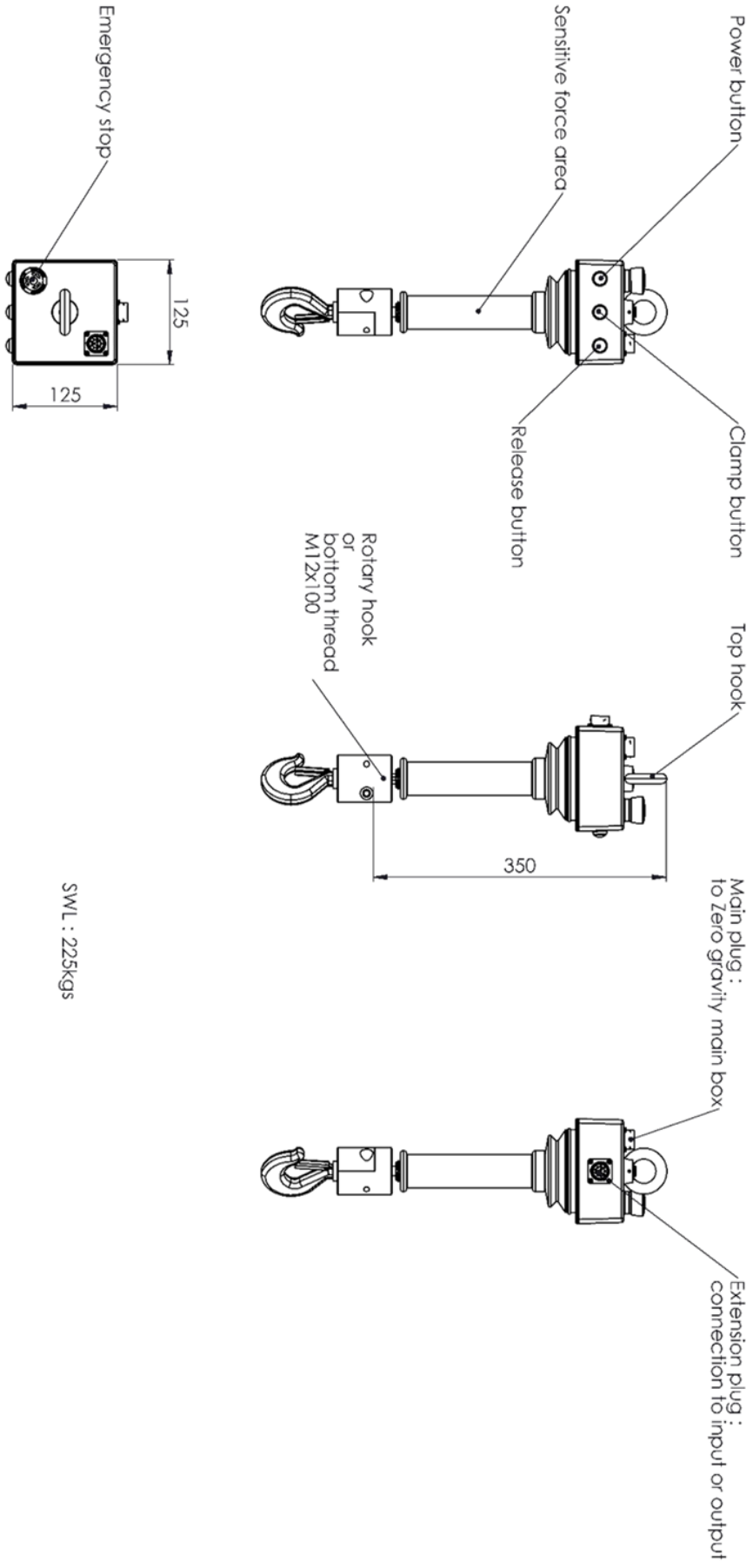
Input/output hardware

Connection to the extension plug can be done using the kit ref ZGB00-I/O.

Input activation must be done by switching to the ground and input deactivation by switching to the +5Vdc or open wire.

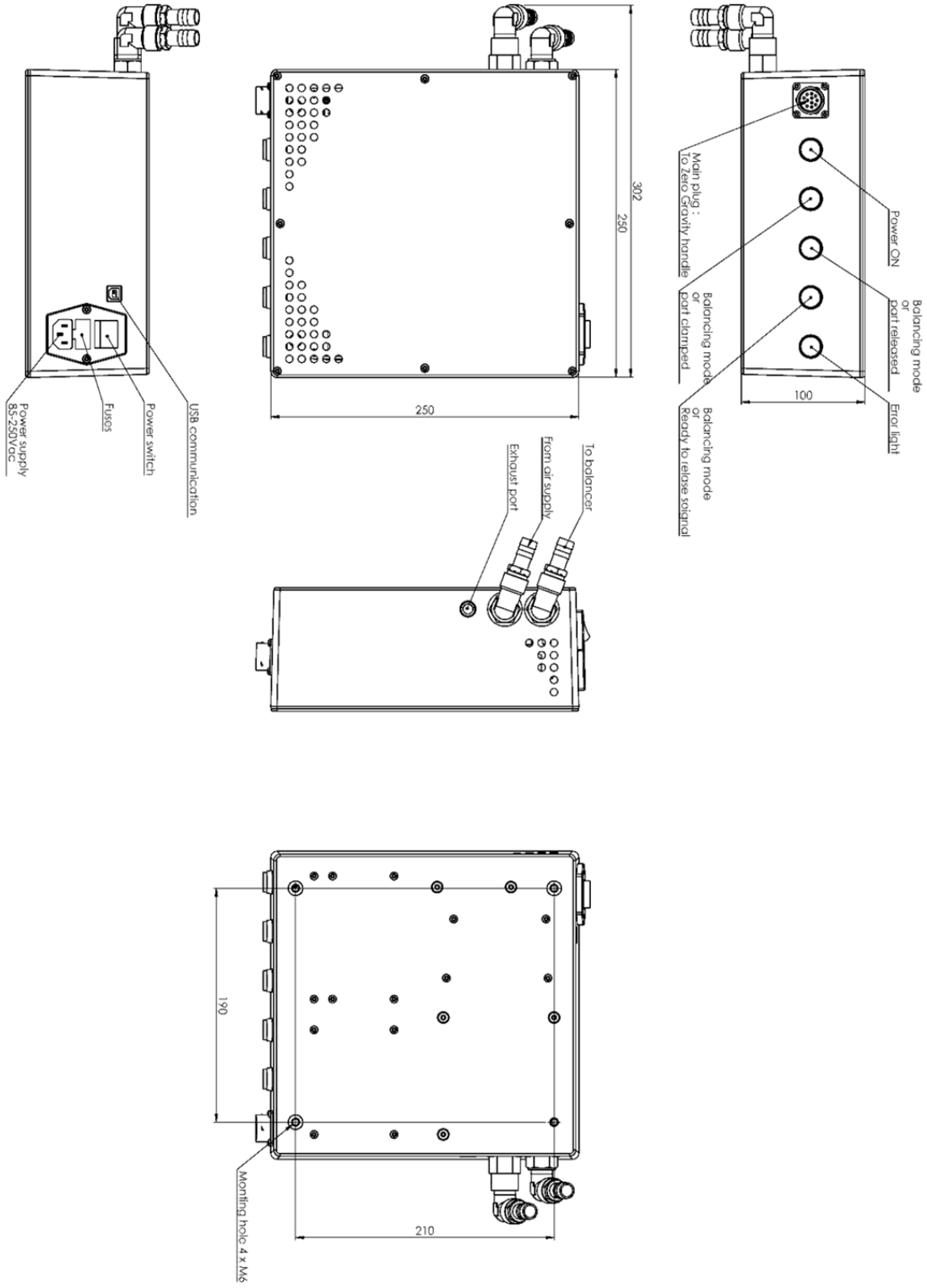
Zero Gravity activate output by switching output pin to the ground. Output power supply voltage is 12Vdc and current can’t exceed 3A in total.

Zero Gravity handle review



Zero Gravity main box review

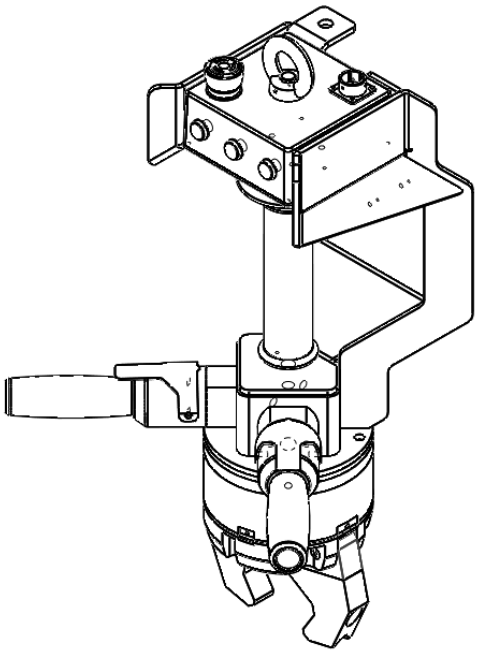
1



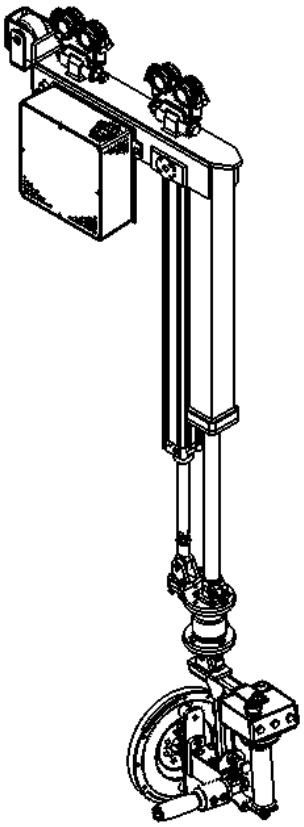
Electric specifications

This device needs to be connected to a standard E type plug (for other option, contact factory). It works from 85 to 250Vac at 50 to 400Hz and the power consumption is 3.5A max. This system is protected by 2 fuses. Fuses characteristics: T type, dimension 5x20mm, 3.15A 250Vac.

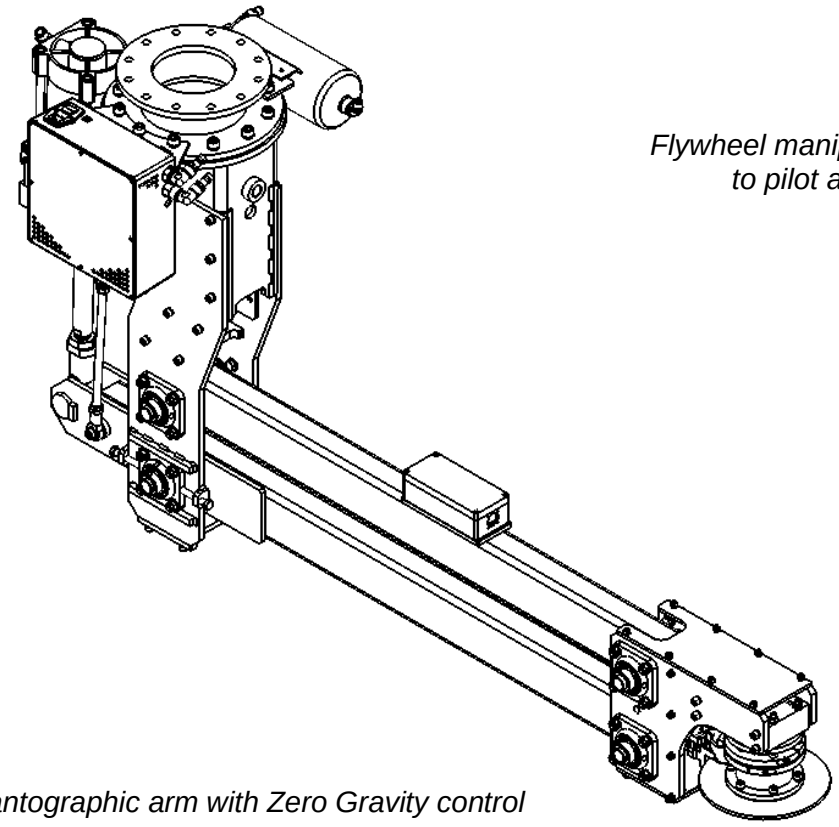
Application example



Automotive exhaust pipe gripper



Flywheel manipulator, Zero Gravity used to pilot a torque tube lifting system



Pantographic arm with Zero Gravity control

Maintenance checks and service

Electronic check :

Fixed redlight on the Zero Gravity electronic box indicates error during running. Restarting the system will eliminate errors thanks to the auto check. If the problem is recurring, the system switches to safety mode and the red light stays on.

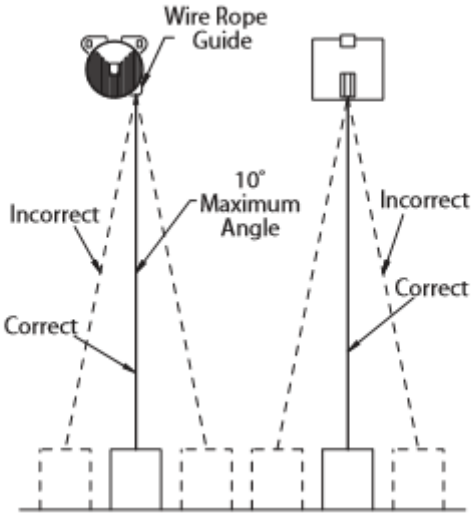
An electronic check must be done every year to prevent drifting of the sensor.

Spiral / electric wire check :

Electric wires should be inspected on a daily basis. Be sure that all electric wires are free of rust, dirt, water, oil, damage on insulating or plug. Spiral wire must be changed every year.

Wire rope check :

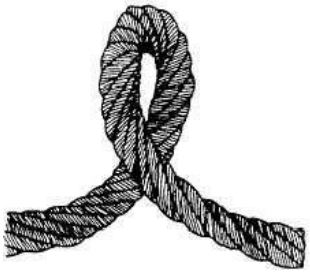
Wire rope should not be yarded more than 10 degrees from the vertical center line of the wire rope guide. Excessive yarding will cause increased wear on balancer and decrease life of components.



In those 3 cases, cable must be replaced :

Component	Inspection	Criteria for Operation	Daily (1st Operation of Shift)	Frequent (Less than 6 months/ semiannual)	Periodic (More than 6 months/annual)
Wire Rope	Kinks	No visible kinks on entire length.	X	X	X
	Fraying	No visible fraying on entire length.	X	X	X
	Bird caging	No visible separations on entire length.	X	X	X

Fraying



Kink

Bird cage

Other checks :

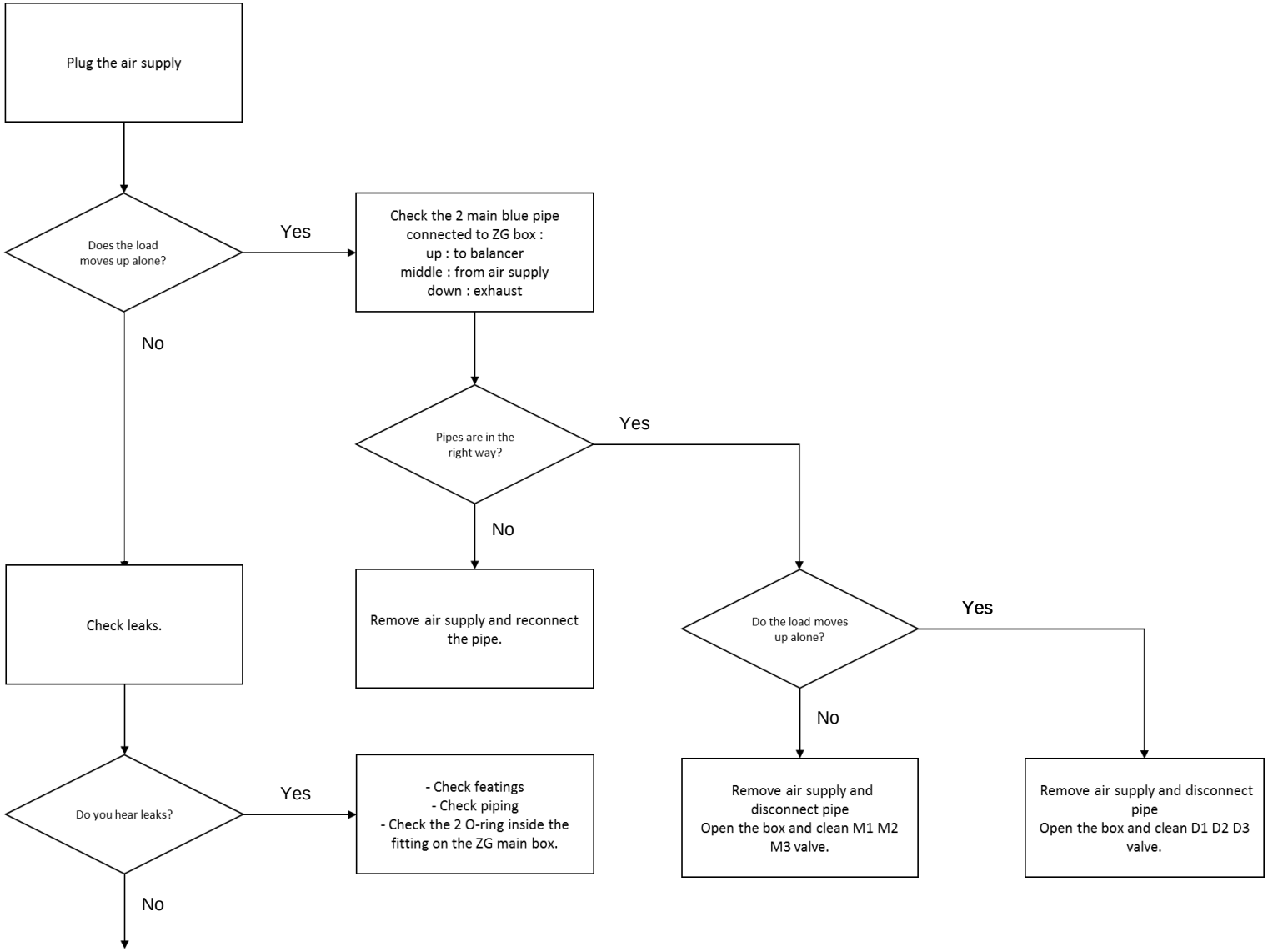
Please refer to Air Balancer maintenance manual.

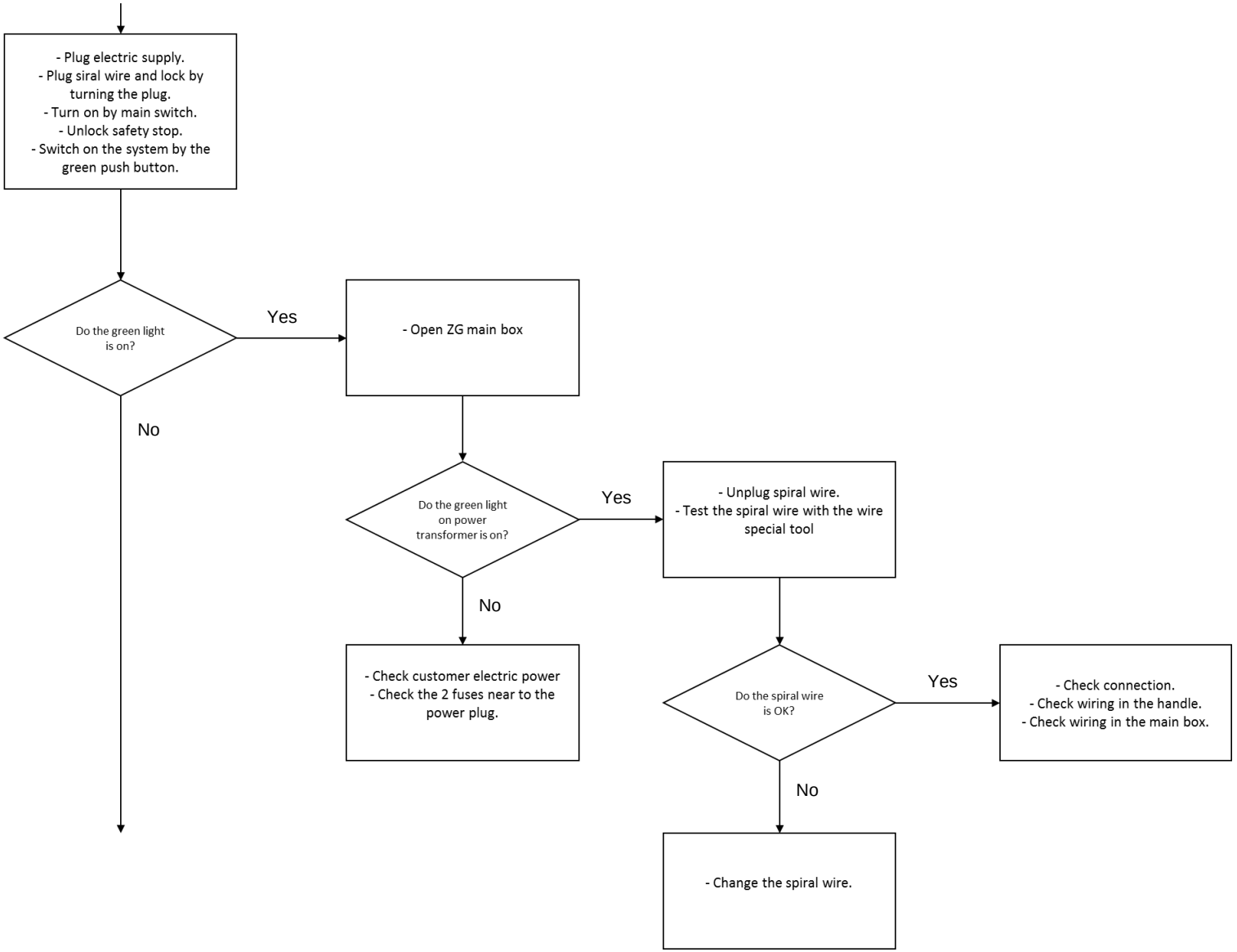
Disconnect the power supply before working on the equipment. The unit must be repaired by qualified personal, risk of electric shock.

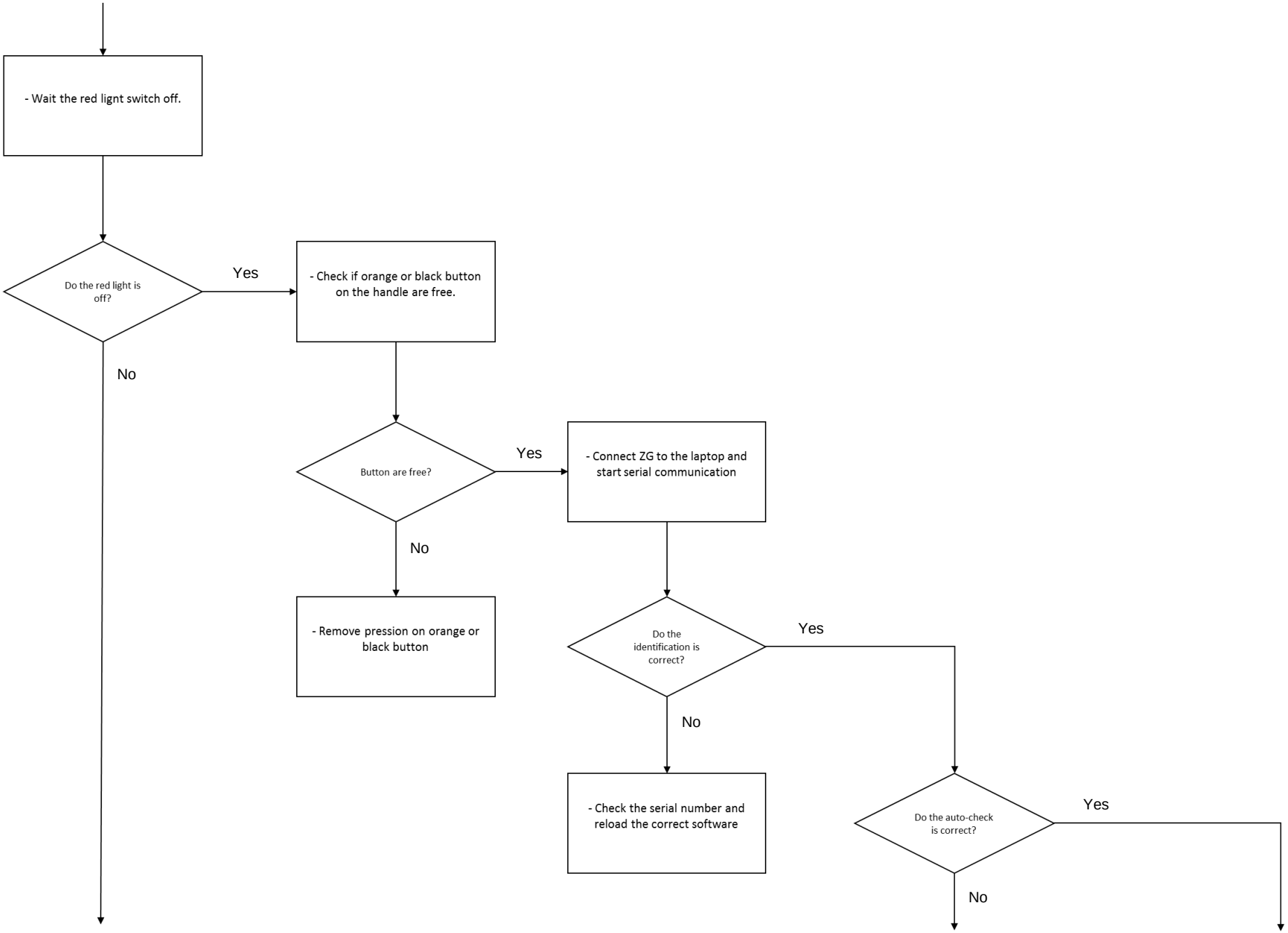
Maintenance schedule

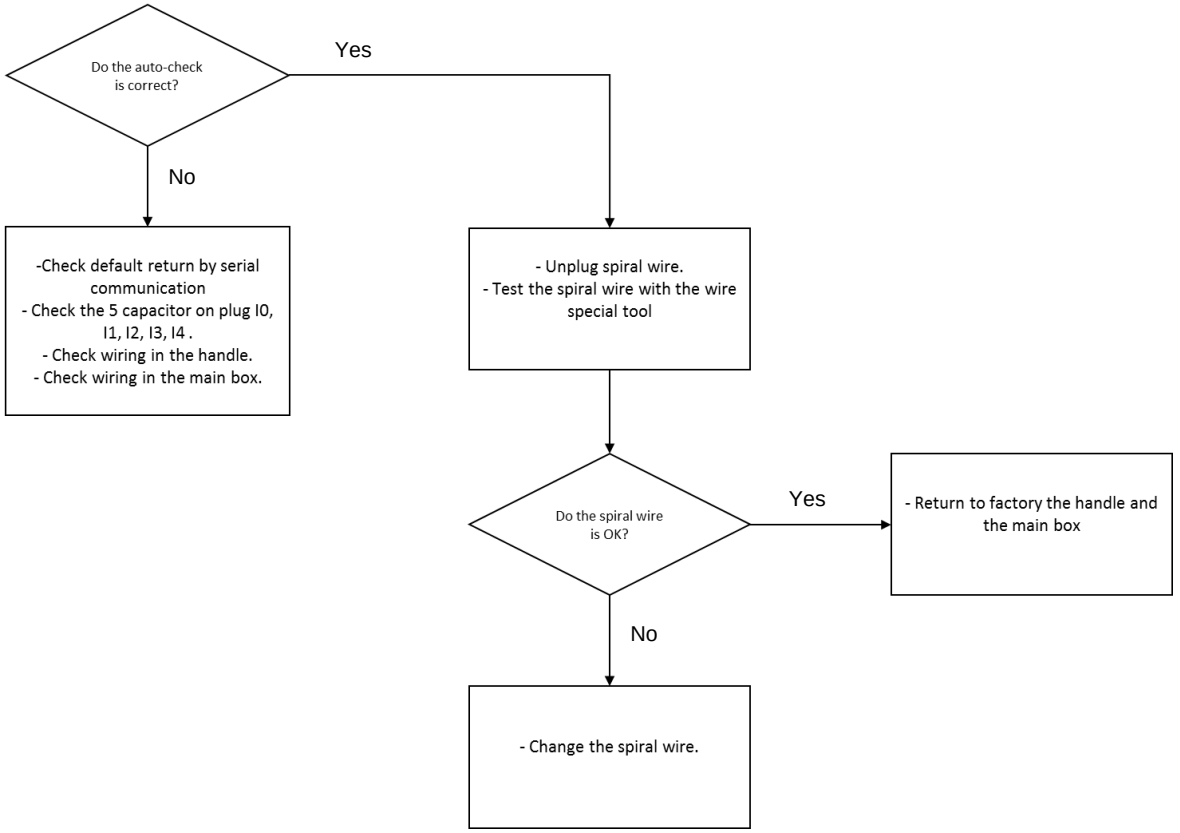
Component	Inspection	Criteria for operation	Daily	Frequent (6 months)	Periodic (1 year)
Spiral wire	Damages	No visible damage on entire length or on plugs.	X	X	X
	Kinks	No visible kinks on entire length.	X	X	X
Power wire	Damages	No visible damage on entire length or on plugs.	X	X	X
	Kinks	No visible kinks on entire length.	X	X	X
Control box	Valves leaks	Load doesn't move when the system is switched off.		X	X
	Pressure sensor damages	Balancing mode operational.		X	X
Command handle	Force sensor damage	Load doesn't move when handle is free and power on.	X	X	X
	Gap between sensitive area and handle	No resistance in motion, only axial motion must be possible.			X
	Emergency stop	Good running of this part.	X	X	X
	Control buttons	No visible looseness, or sticking of buttons	X	X	X

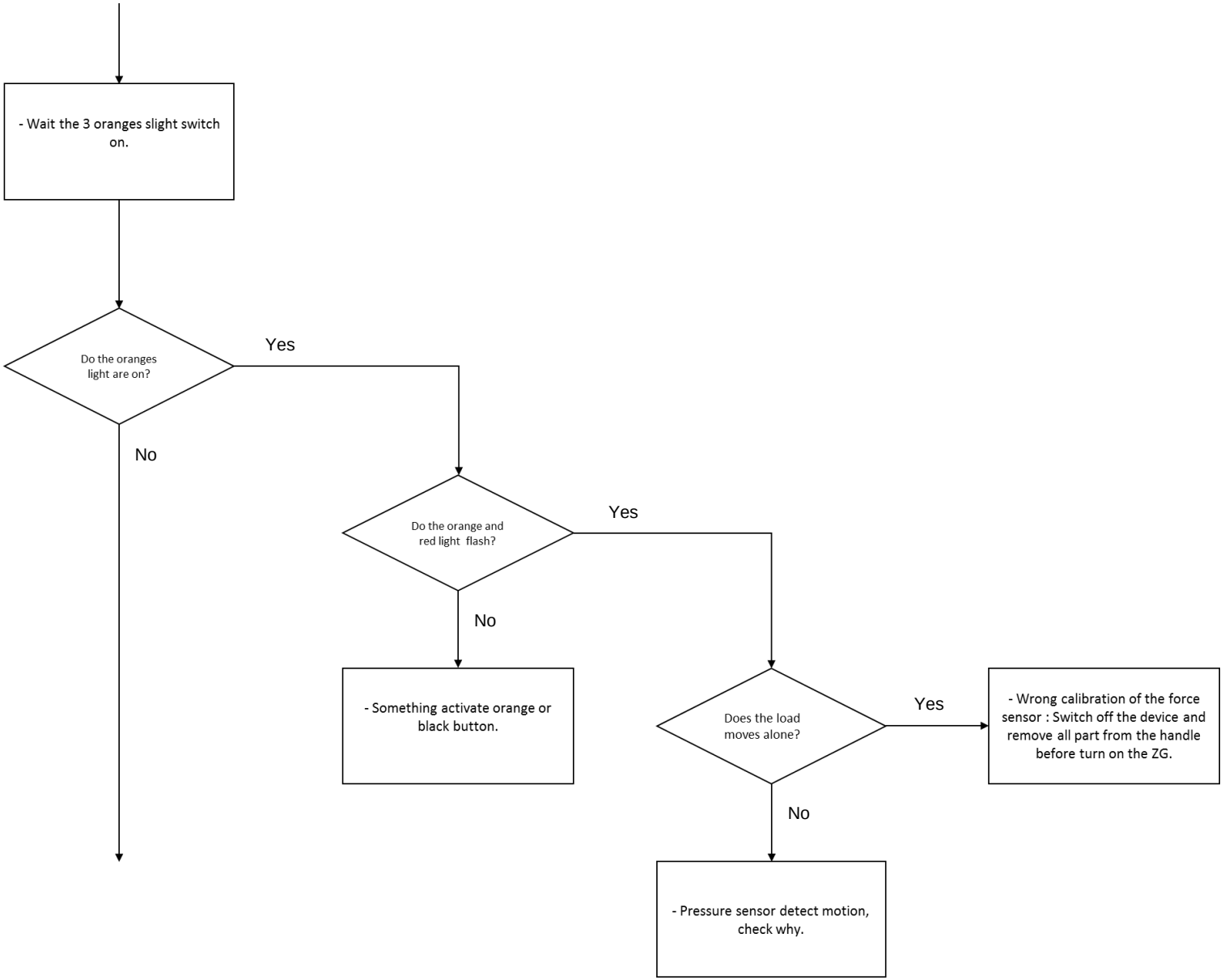
Troubleshooting

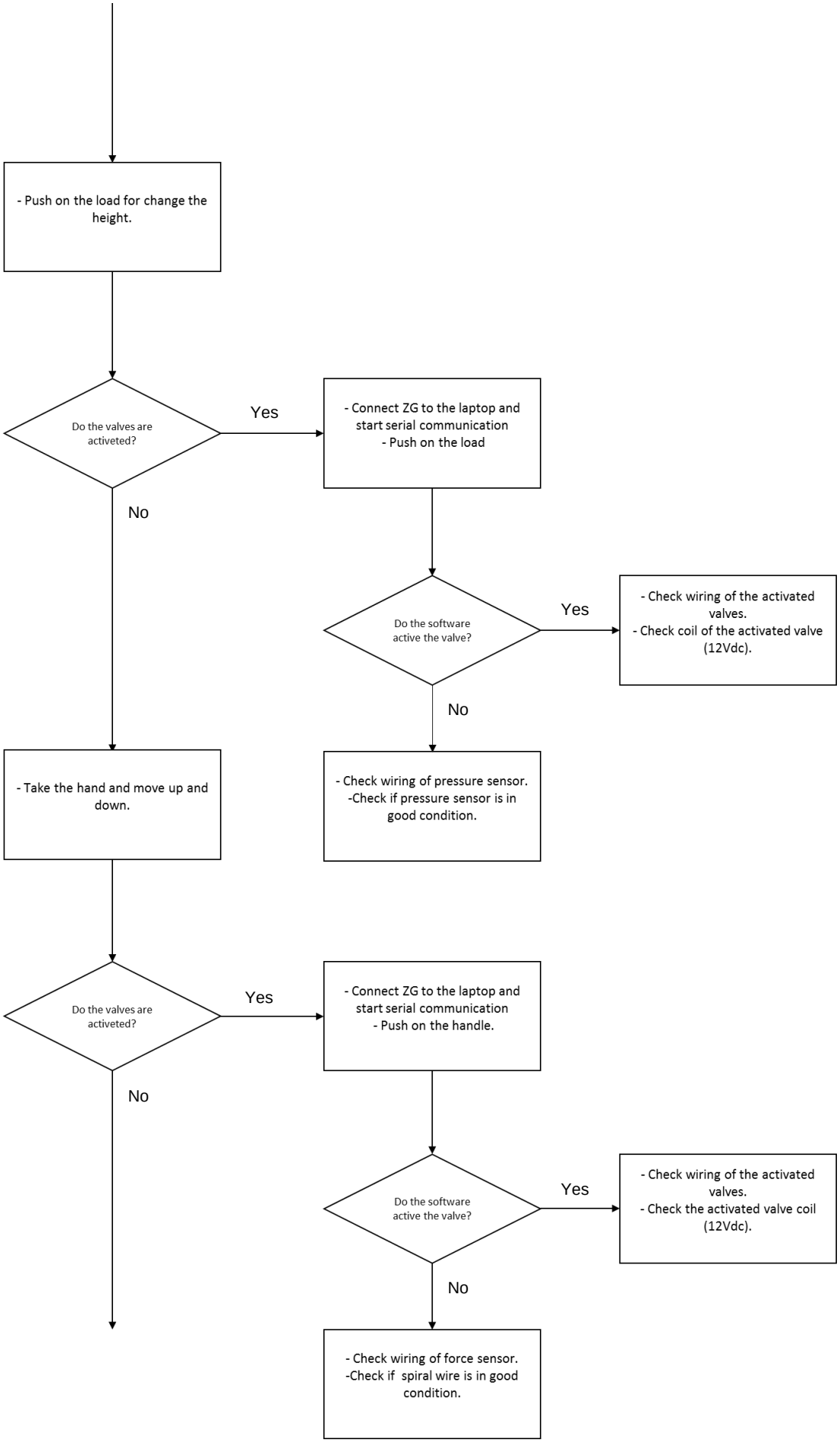


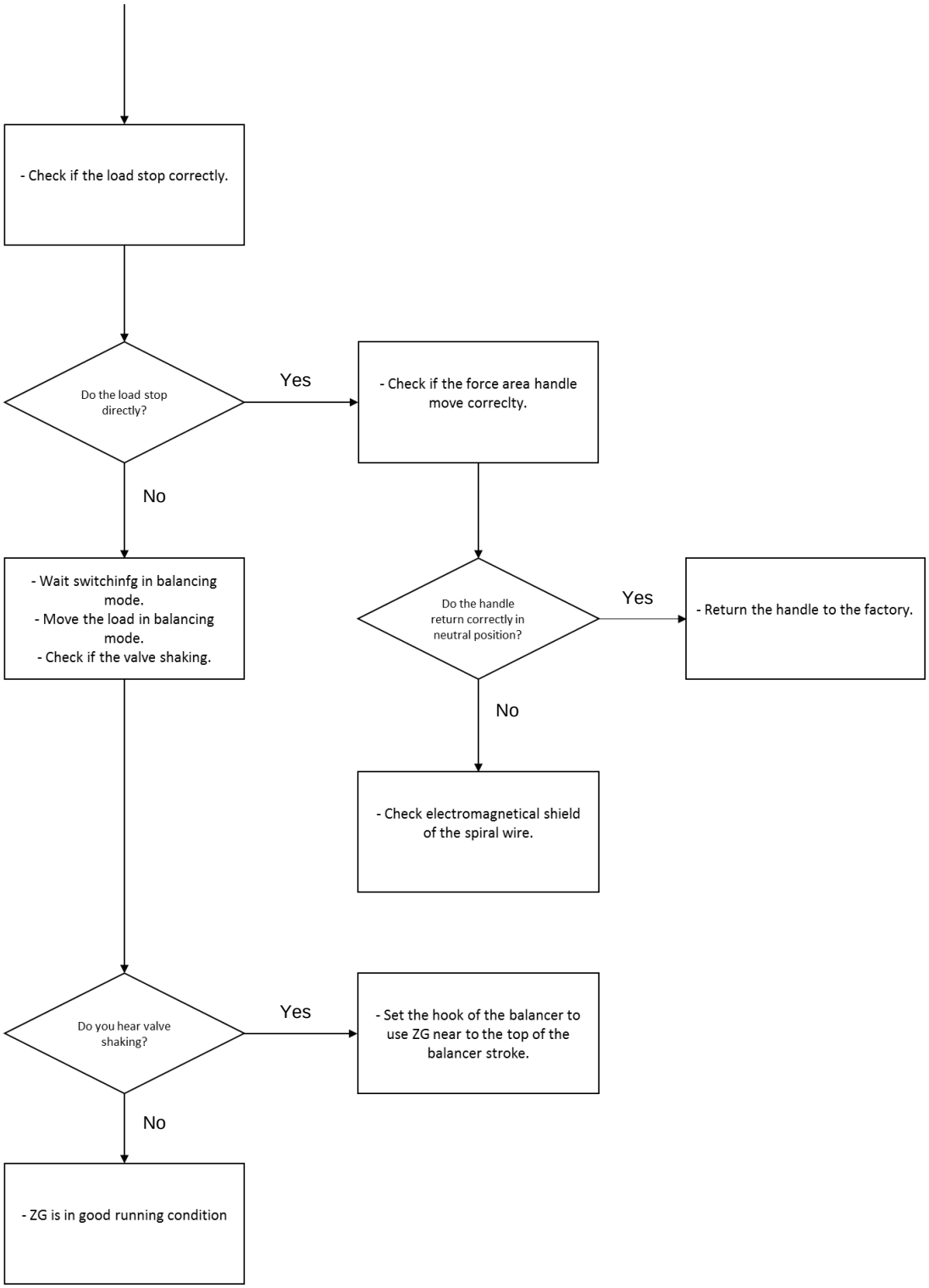

- Plug electric supply.
- Plug siral wire and lock by turning the plug.
- Turn on by main switch.
- Unlock safety stop.
- Switch on the system by the green push button.
Do the green light is on?
Yes
No
- Open ZG main box
Do the green light on power transformer is on?
Yes
No
- Unplug spiral wire.
- Test the spiral wire with the wire special tool
- Check customer electric power
- Check the 2 fuses near to the power plug.
Do the spiral wire is OK?
Yes
No
- Check connection.
- Check wiring in the handle.
- Check wiring in the main box.
- Change the spiral wire.


- Wait the red lignt switch off.
Do the red light is off?
Yes
No
- Check if orange or black button on the handle are free.
Button are free?
Yes
No
- Connect ZG to the laptop and start serial communication
- Remove pression on orange or black button
Do the identification is correct?
Yes
No
- Check the serial number and reload the correct software
Do the auto-check is correct?
Yes
No

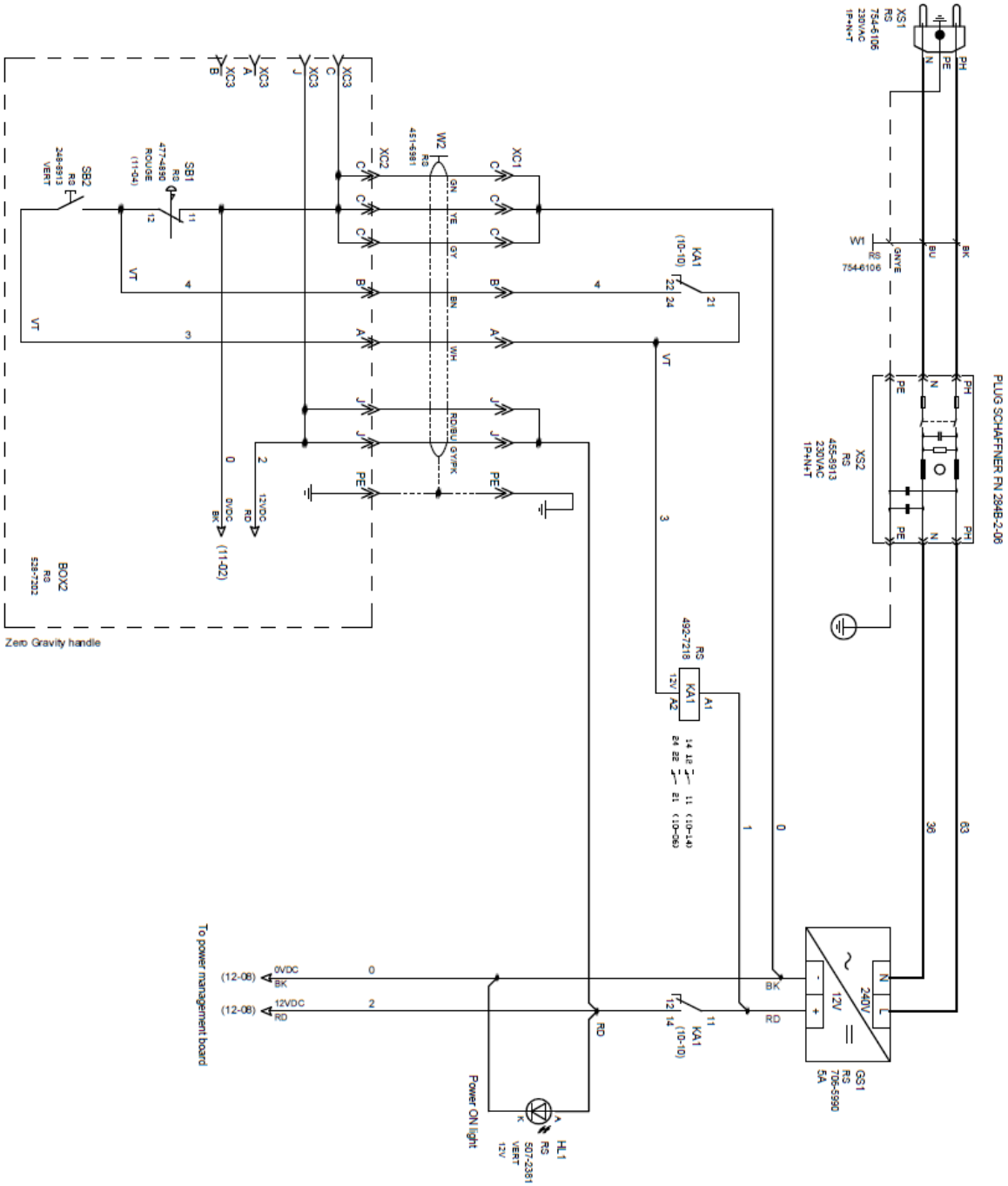

Do the auto-check is correct?
Yes
No
-Check default return by serial communication
- Check the 5 capacitor on plug I0, I1, I2, I3, I4 .
- Check wiring in the handle.
- Check wiring in the main box.
- Unplug spiral wire.
- Test the spiral wire with the wire special tool
Do the spiral wire is OK?
Yes
- Return to factory the handle and the main box
No
- Change the spiral wire.

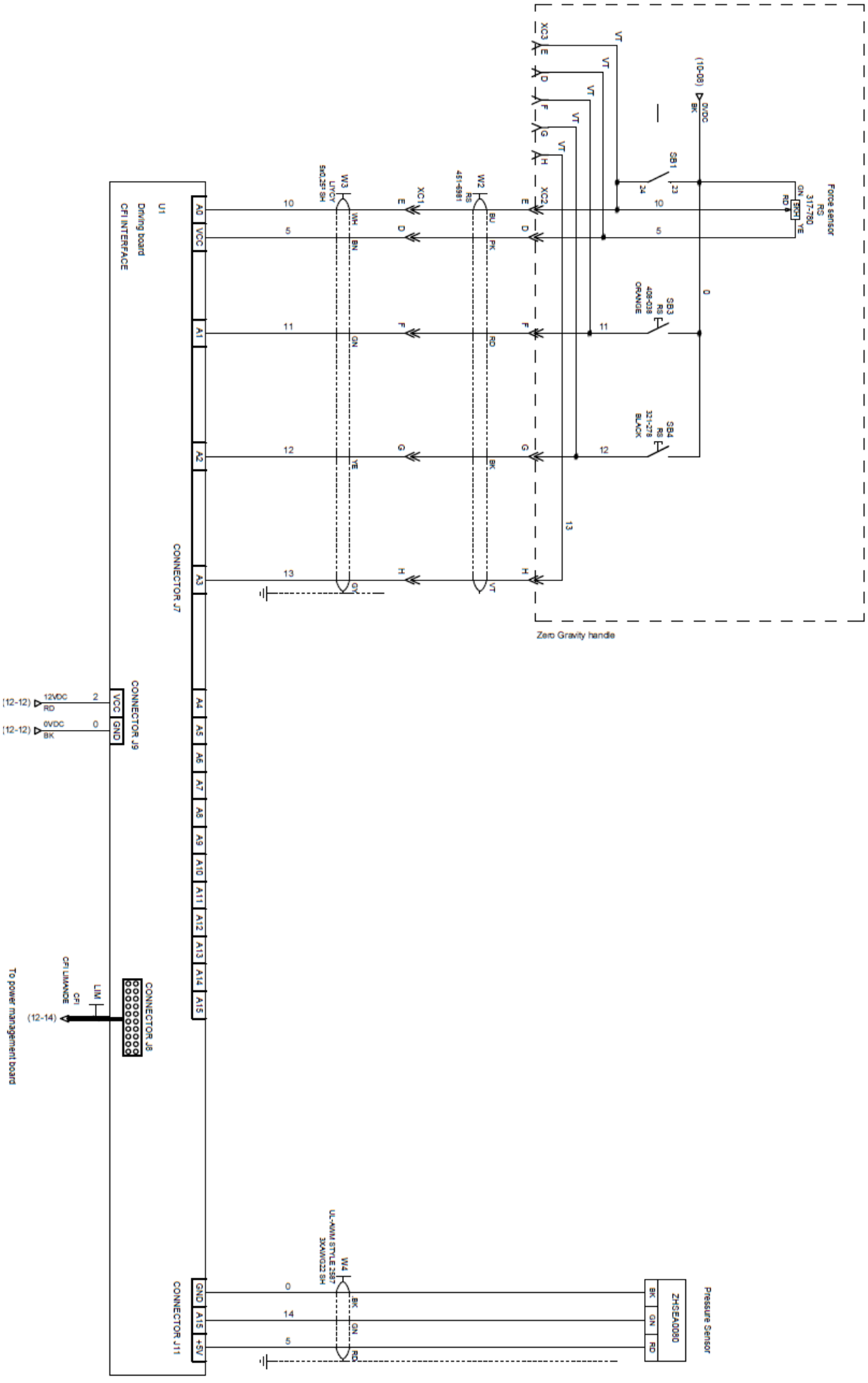

- Wait the 3 oranges slight switch on.
Do the oranges light are on?
Yes
No
Do the orange and red light flash?
Yes
No
- Something activate orange or black button.
Does the load moves alone?
Yes
- Wrong calibration of the force sensor : Switch off the device and remove all part from the handle before turn on the ZG.
No
- Pressure sensor detect motion, check why.

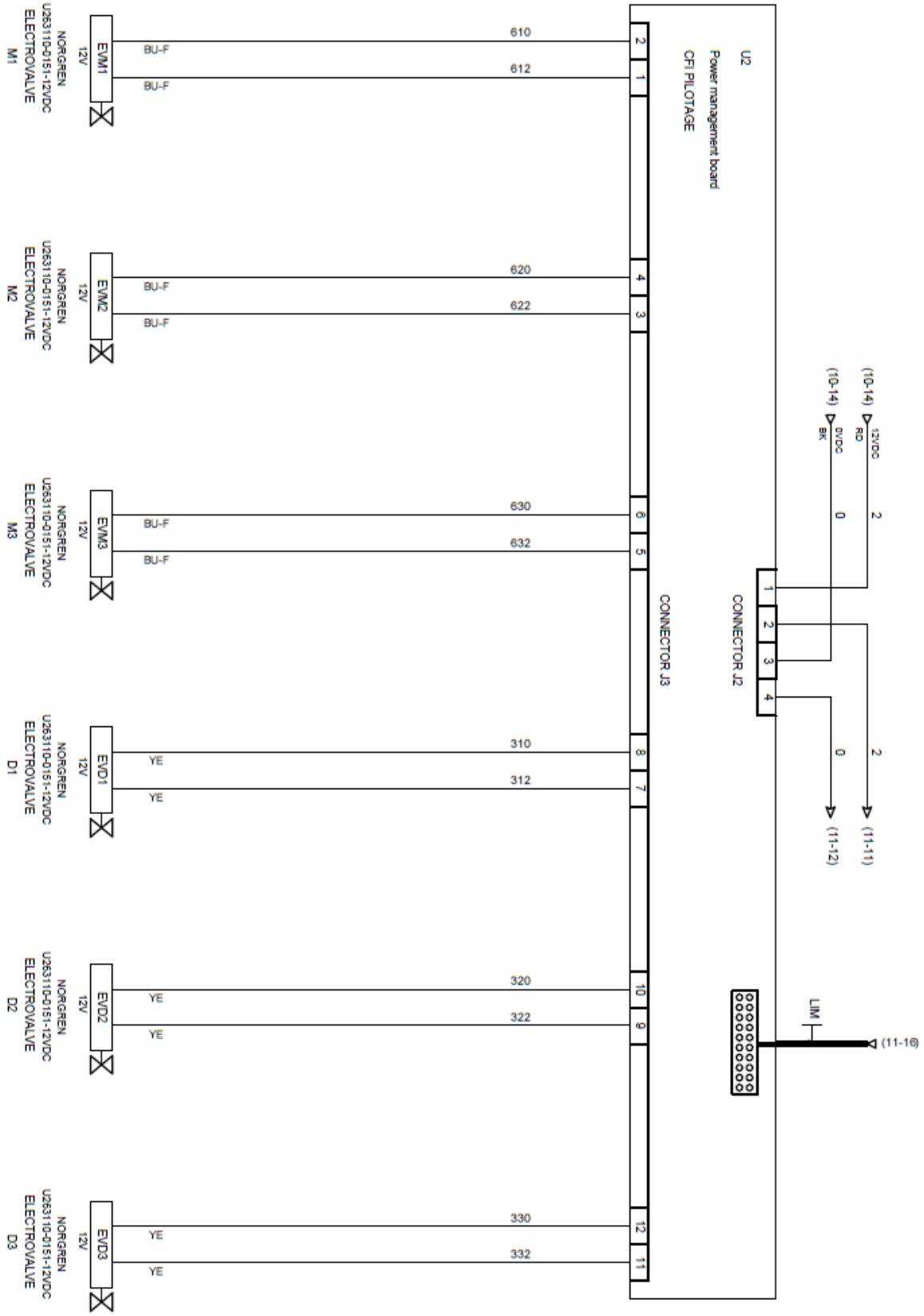

- Push on the load for change the height.
Do the valves are activeted?
Yes
- Connect ZG to the laptop and start serial communication
- Push on the load
No
Do the software active the valve?
Yes
- Check wiring of the activated valves.
- Check coil of the activated valve (12Vdc).
No
- Check wiring of pressure sensor.
-Check if pressure sensor is in good condition.
- Take the hand and move up and down.
Do the valves are activeted?
Yes
- Connect ZG to the laptop and start serial communication
- Push on the handle.
No
Do the software active the valve?
Yes
- Check wiring of the activated valves.
- Check the activated valve coil (12Vdc).
No
- Check wiring of force sensor.
-Check if spiral wire is in good condition.

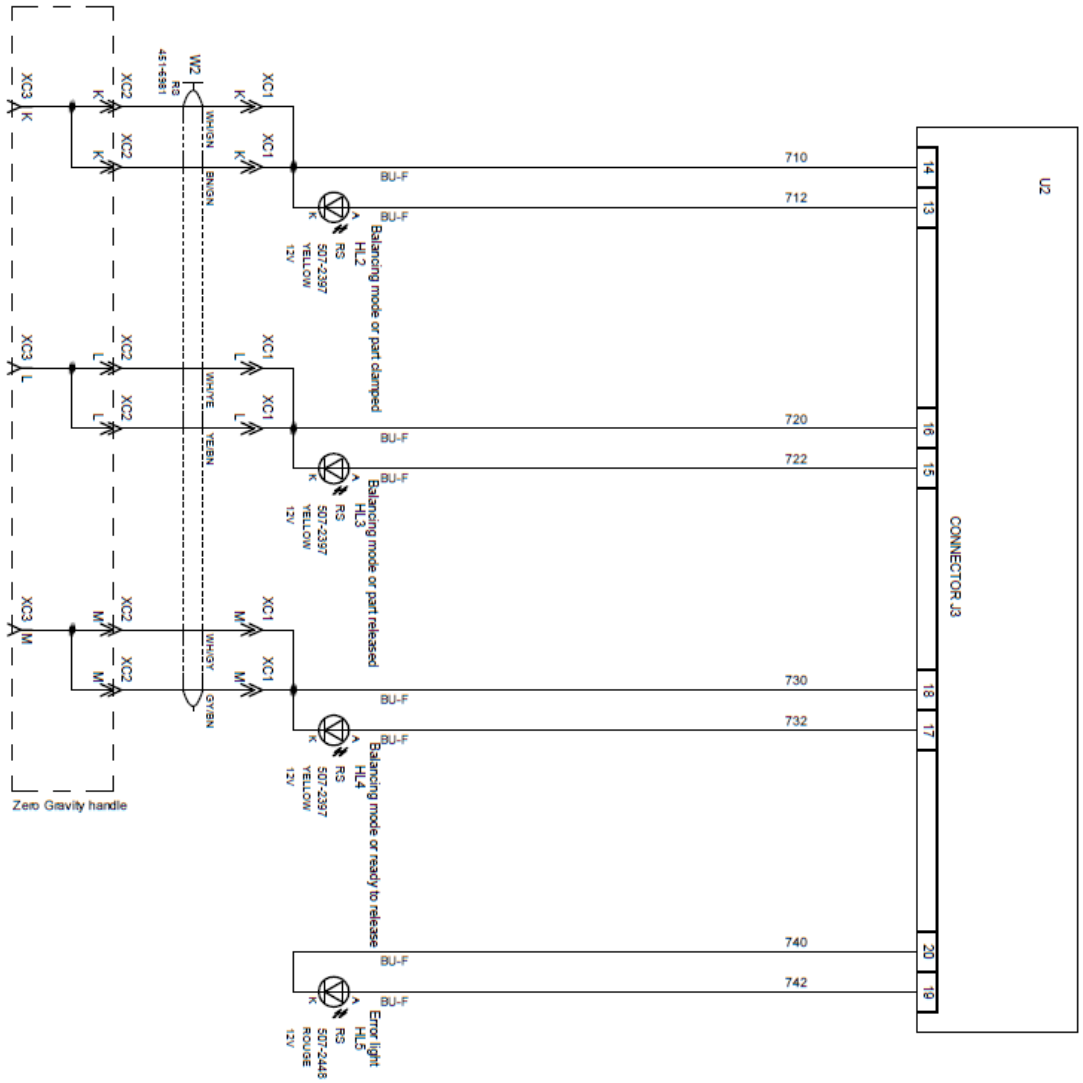

- Check if the load stop correctly.
Do the load stop directly?
Yes
- Check if the force area handle move correclty.
No
- Wait switchinfg in balancing mode.
- Move the load in balancing mode.
- Check if the valve shaking.
Do the handle return correctly in neutral position?
Yes
- Return the handle to the factory.
No
- Check electromagnetical shield of the spiral wire.
Do you hear valve shaking?
Yes
- Set the hook of the balancer to use ZG near to the top of the balancer stroke.
No
- ZG is in good running condition

Electric wiring




Force sensor
FSS
317-790
Zero Gravity handle
SB1
SB3
SB4
Driving board
CFI INTERFACE
CONNECTOR J7
CONNECTOR J9
CONNECTOR J8
CONNECTOR J11
To power management board
Pressure Sensor
ZHSEA0050


U2
Power management board
CFI PILOTAGE
CONNECTOR J3
CONNECTOR J2
LIM
(11-16)
(10-14)
0V/DC
BK
(10-14)
12V/DC
RD
2
0
(11-12)
(11-11)
EVM1
EVM2
EVM3
EVD1
EVD2
EVD3
12V
NORGREN
U263110-0151-12VDC
ELECTROVALVE
M1
M2
M3
D1
D2
D3
610
612
620
622
630
632
310
312
320
322
330
332
BU-F
YE


Zero Gravity handle
XC3
XC2
XC1
W2
451-4981
WHIGN
BNIGN
WHITE
YEIBN
WHIGY
GYIBN
BU-F
710
712
720
722
730
732
740
742
U2
CONNECTOR J3
14
13
16
15
18
17
20
19
HL2
Balancing mode or part clamped
HL3
Balancing mode or part released
HL4
Balancing mode or ready to release
HL5
Error light
507-2397
507-2446
YELLOW
ROUGE
12V

Parts information

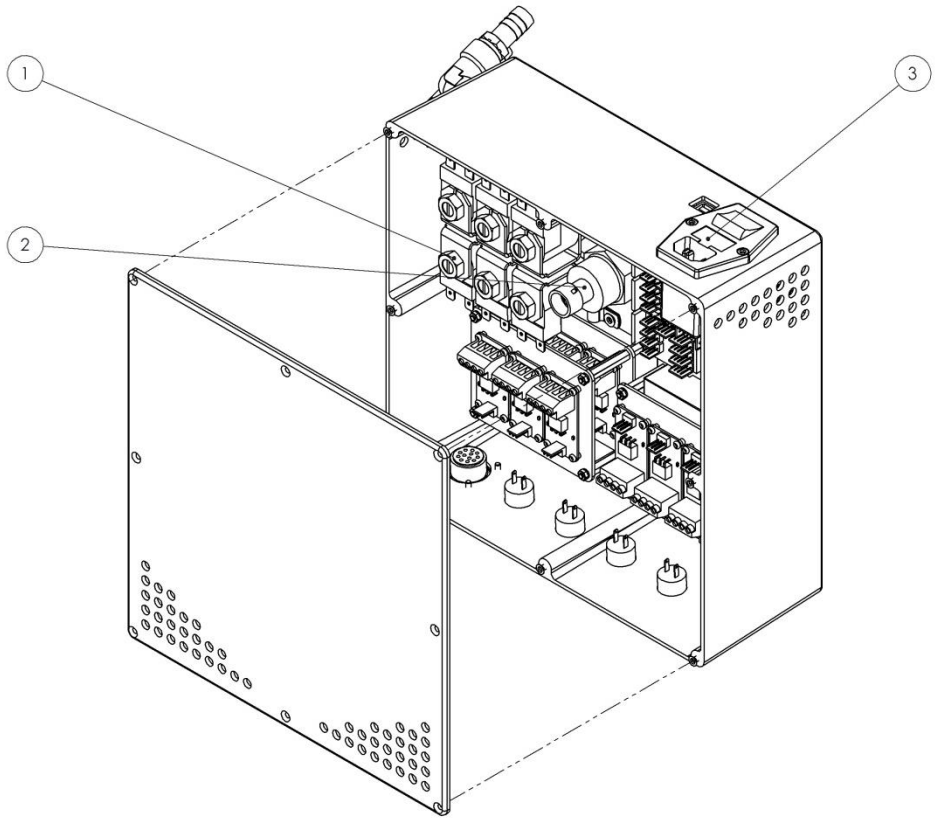
Composition of the Zero Gravity kit

Reference	Suspension kit	Balancer	Manifold tandem esclave	Balancer bracket	Control box	Command handle	Spiral wire
ZG W015080 00 1	16380	BW015080	15093	ZGE06	ZGB015	ZGP00	ZGC2
ZG W015080 HM 1	16360						
ZG W015080 AT 1	16355						
ZG W015080 A1 1	16305						
ZG W015080 A2 1	16310						
ZG W020120 00 1	16480	BW020120		ZGE10	ZGB020		
ZG W020120 HM 1	16460						
ZG W020120 AT 1	16455						
ZG W020120 A1 1	16405						
ZG W020120 A2 1	16410						
ZG W035080 00 1	16480	BW035080			ZGB035		
ZG W035080 HM 1	16460						
ZG W035080 AT 1	16455						
ZG W035080 A1 1	16405						
ZG W035080 A2 1	16410						
ZG W050080 00 1	16480	BW050080			ZGB050		
ZG W050080 HM 1	16460						
ZG W050080 AT 1	16455						
ZG W050080 A1 1	16405						
ZG W050080 A2 1	16410						

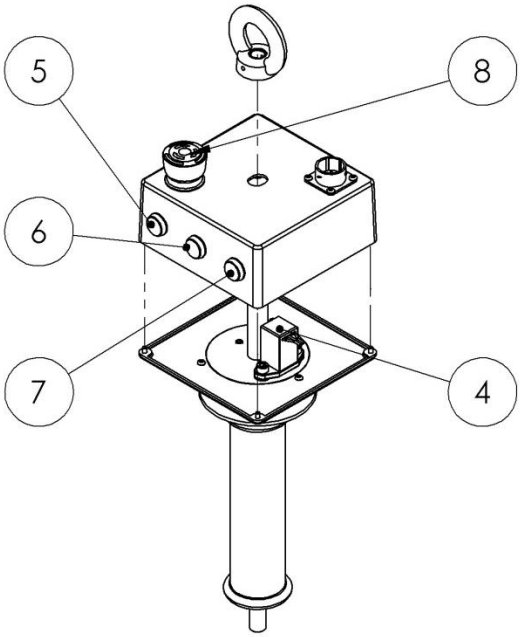
Waste parts

Part number	Description	Supplier	Quantity
RS754-6106 47563680001	Electric power wire	IR	1
ZGC2 47563687001	Spiral wire	IR	1
ZGP00 47565289001	Zero Gravity control handle	IR	1
ZGB015 47565285001	150lbs balancer command box	IR	1
ZGB020 47565286001	200lbs balancer command box	IR	1
ZGB035 47565287001	350lbs balancer command box	IR	1
ZGB050 47565288001	500lbs balancer command box	IR	1

Spare parts



Command box				
Item	**Part number**	**Description**	**Supplier**	**Quantity**
1	KIT/INGER/150LB 47563675001	Set of valve for FSB015	IR	1
	KIT/INGER/020LB 47563676001	Set of valve for FSB020	IR	1
	KIT/INGER/035LB 47563677001	Set of valve for FSB035	IR	1
	KIT/INGER/050LB 47563678001	Set of valve for FSB050	IR	1
2	ZHSEA0080 04709614	Pressure sensor	IR	1
3	610-9989	Fuses	RS	2



Control handle				
Item	**Part number**	**Description**	**Supplier**	**Quantity**
4	RS317-780 47563682001	Force sensor	IR	1
5	RS248-8913 47563683001	Power button	IR	1
6	RS321-278 47563684001	Input 1 button	IR	1
7	RS408-038 47563685001	Input 2 button	IR	1
8	RS477-4890 47563686001	Emergency stop	IR	1

Service notes