HYMO SXX15-29 lift platform: upgrading and testing one of the HYMOs

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Introduction

Some possible upgrades of the five Hymos at EGO site have been recently proposed by the CleanOperations team, aimed at improving the safety and reliability of the system [1]. Consequently, the EGO RSPP has suggested us to implement and a pilot upgrading on one of the Hymos and write a technical document that will be part of an Operational Acceptance Testing process. Accordingly, one of the HYMOs of the Central Building has been upgraded. - In this document are reported the implementation details and the performed tests.

1. Reason for the upgrading

For convenience, the proposed improvements, detailed in [1], are here briefly reported again:

1.1 Replacement of the wire controller with a wireless one

In almost 10 years it has occurred on 2 or 3 occasions that some Hymo got stuck, remaining completely raised, due to a bad contact inside its external control box H2 (Fig.1). Each time the problem was solved quickly, but unfortunately the operators had to wait in the vacuum chamber.

Moreover the cable connecting this controller is at risk of being accidentally damaged during the operations and also to hamper the persons involved in the activity. Substituting the wire controller with a wireless one will avoid the risk of trouble during the operations on the Hymo platform and will reduce room contamination.

1.2 Removable power supply cable

The electric power cable is at risk of being accidentally damaged during the maneuvers for the Hymo displacement and also to hamper the persons during the moving.

The possibility to disconnect the electric power cable would facilitate the displacement maneuvers, avoiding the risk of its damage and failure. This improvement consists of adding a panel connector to the electric box H2 and of adding a connector on the cable.

1.3 Emergency lowering system

In its present status, the Hymo logic is such that in case of electrical blackout or failure, the platform remains blocked in its last position. Unfortunately, in this case it is even impossible to manually lower the platform. This missing feature is particularly important in the case that operators are inside the vacuum tower and the cage obstructs their exit (as happened during the problem described in paragraph 1.3).

This improvement will guarantee the lowering of the Hymo in case of failure or an electrical power loss.

A solution based only on mechanical/hydraulic actions has been discarded because it is considered to be too invasive: it would have required a deep modification of the hydraulic circuit, with also some risk of spoiling the Hymo working and stability conditions.

Therefore, an electrical-based solution has been conceived: a portable box containing a battery and voltage converter, provides at its output (connectable with the Hymo control box) a 24V ac voltage, needed to operate the electro-valves.

By means of a dedicate selector switch on the new H2 control box, it will be possible to perform the lowering action both in ***Normal mode*** or ***Emergency mode***.

Normal mode
The system works as in the standard design: the remote controller commands the lifting or the lowering of the Hymo.

Emergency mode
The portable 24 V ac power box, once plugged to H2 and activated through a push-button, feeds directly the electro-valves to accomplish the lowering of the Hymo, by-passing the rest of the control electronics.

2. Implementation of the proposed improvements

The work began with the dismantling of the Hymo's external control box H2 (Fig.1).
The content of this box (ie the control board) was moved to a new and large box (Figs.2-3). The extra space was required by the additional components of the upgrade:

- **Wireless control receiver unit**
  It is the receiver of the wireless remote control. It is powered by an added 220/12 Vac transformer.

- **12 V Relays**
  These 3 relays (by FINDER, with 2 pole changeover contact) are needed to interface the remote control system to the previous one, in correspondence of the "Power on", "Lift up", "Lift down" commands (connection/adaptation circuit in Fig.4).

- **12 V dc power supply**
  It is the power supply (15W) for the relays and the receiver unit.

- **Led indicator**
  It signals the presence of electrical power (380 Vac) in the box (green light on).

- **380Vac mains switch**
  It allows to power ON/OFF the whole box. The one pre-existing on the original box was no longer suitable, because without the contact for the neutral wire and for a matter of size.

- **Selector switch**
  It allows to select the operating mode: "normal" and "emergency". The standard mode is "normal", while "emergency" has to be selected in case of blackout or failure of the power connection.

- **Panel connector for the 380Vac mains**
  It allows to unplug the power cable from the control box (useful during the maneuvers for Hymo moving/positioning.

Fig.1: picture of the pre-existing external control box (labeled H2). Are also visible the cables connecting the box to the remote control and to the 380 Vac mains.

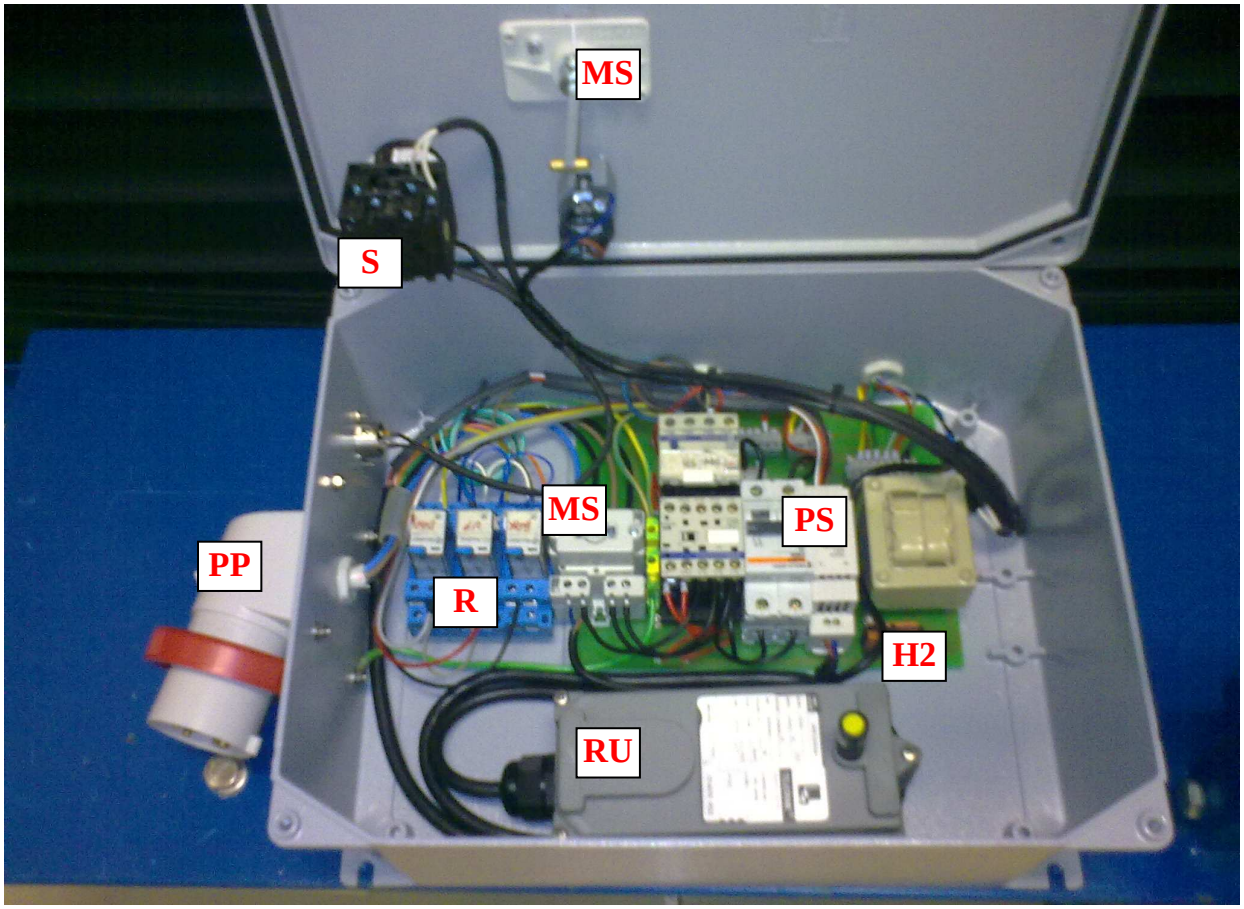


Fig.2: Inside view of the new control box. Are visible the pre-existing control board (H2), the receiver unit (RU), the relays (R), the panel plug for the mains (PP), the selector switch (S), the 12V power supply (PS, mounted on the DIN rail of the control board H2), mains switch (MS).

The installed wireless remote control is by Telecrane (type F21-2S, series Silver Line), that complies with the essential requirements and other relevant disposals and standards in the field (Declaration of Conformity attached in [1]).

Fig.3: External view of the new control box. It is also visible the wireless remote control transmitter.

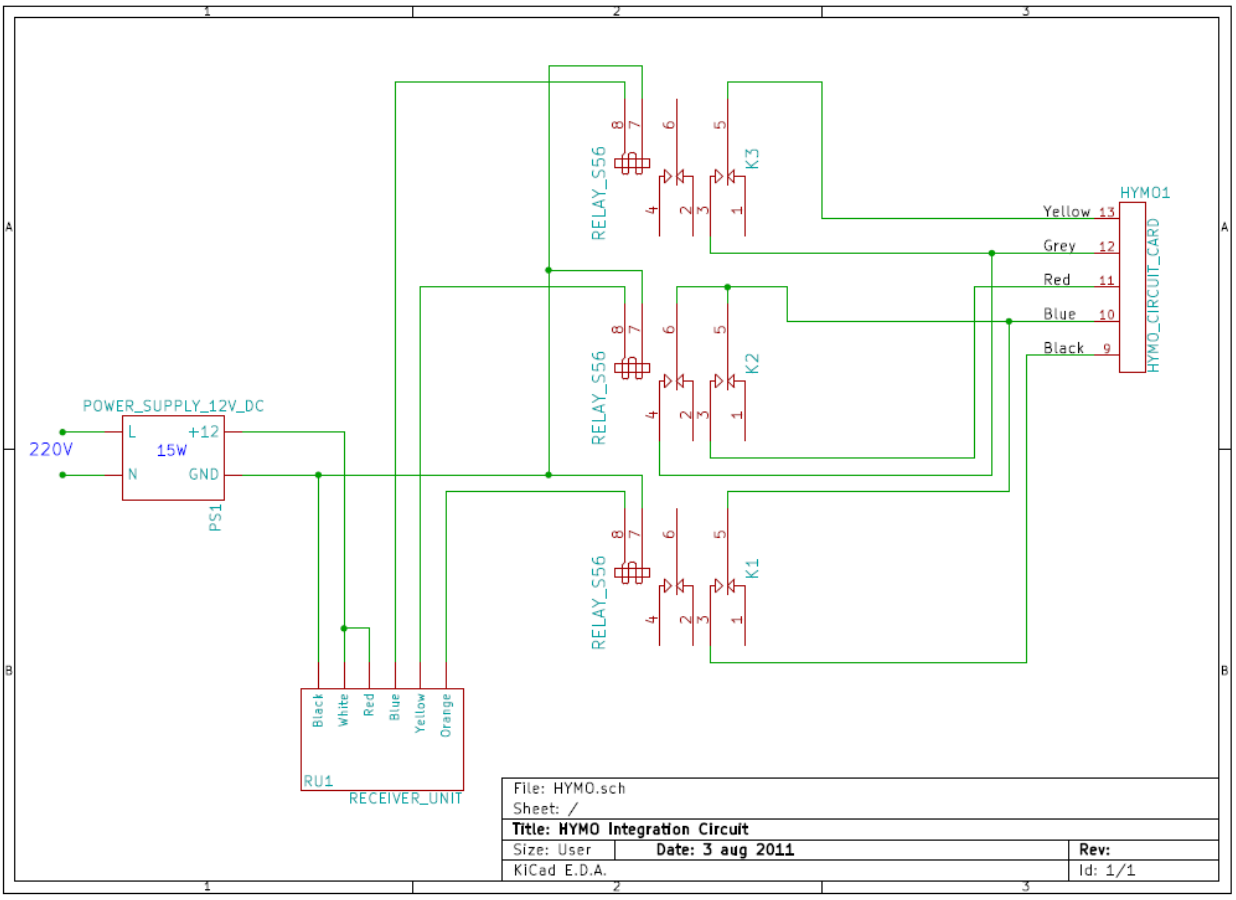


Fig.4: Connection circuit of the remote control receiver unit to the Hymo control board. Some adaptation has been needed and implemented through 3 relays.

Once assembled and checked, the new control box was installed on the Hymo and connected to the relevant circuitry/devices.

A block diagram summarizing the performed modifications and the integration of the new components is shown in Fig.5.

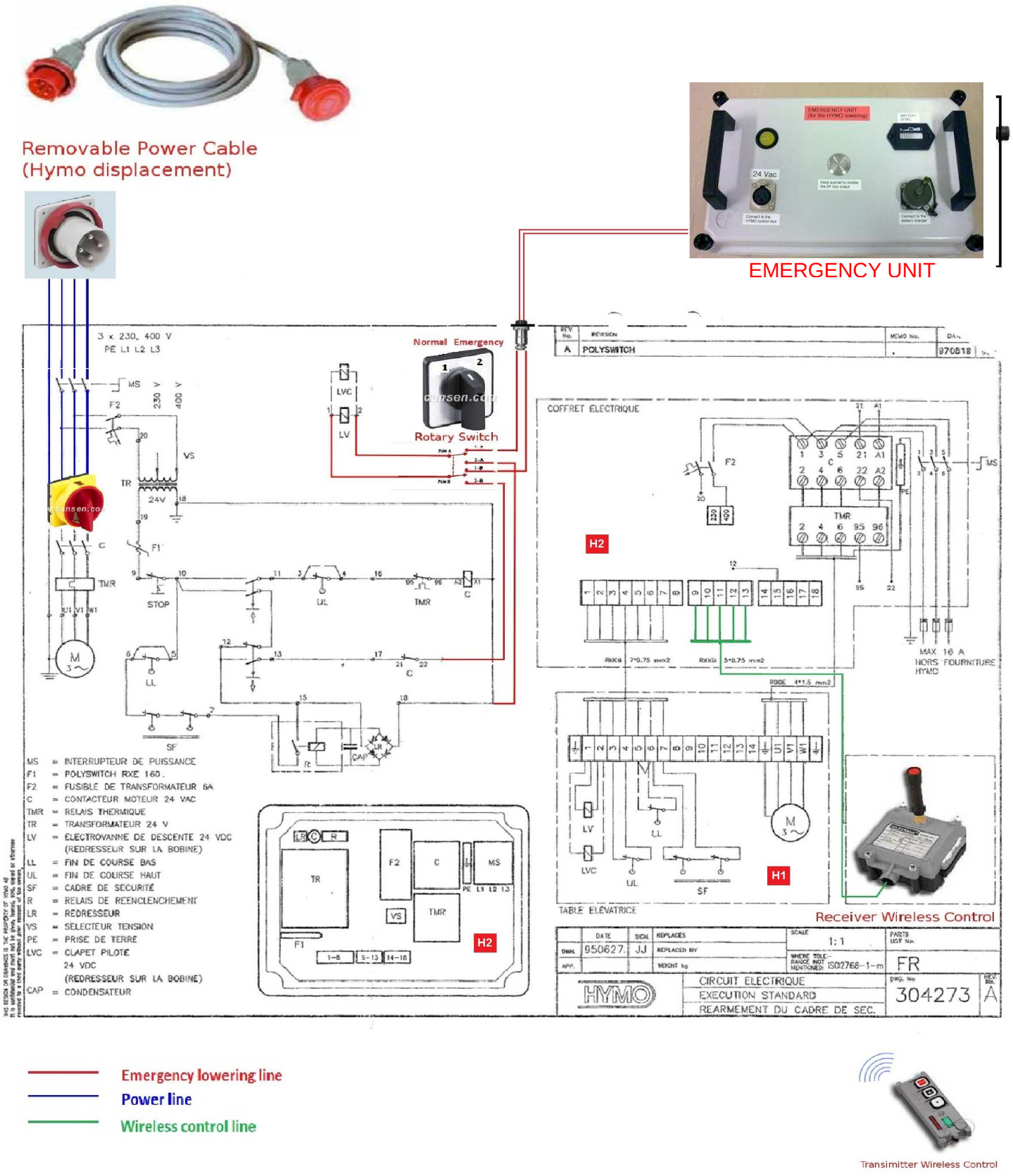
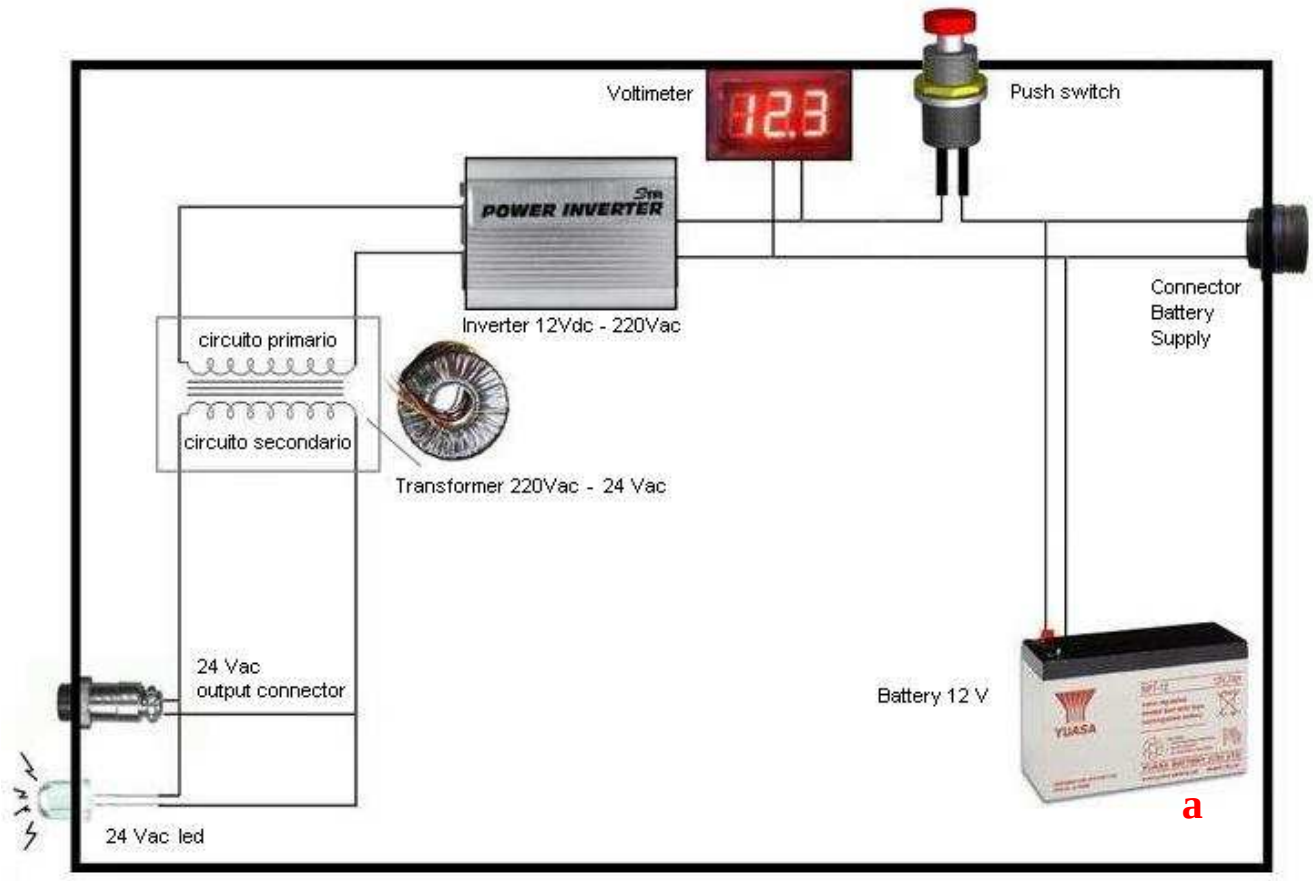


Fig. 5: Block diagram summarizing the performed modifications. The colored lines denote the connections done to integrate the new components.

Concerning the emergency unit (Fig.6), it is a portable box that in case of trouble, it has to be connected to the control box of the affected Hymo. It contains a 12V-10Ah battery, an inverter and a 220Vac-24Vac transformer, to provide at its output a 24Vac voltage, needed to operate the Hymo electro-valves. To read the battery level or to deliver the 24Vac power, it is necessary to keep pressed the pushbutton.



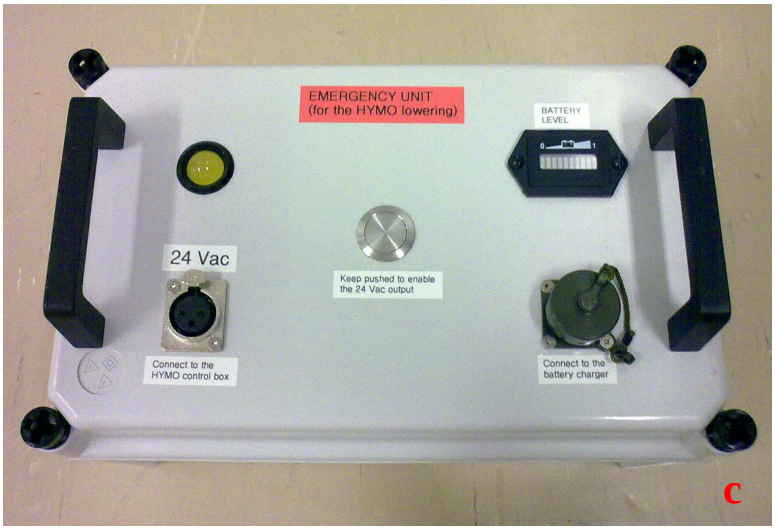


Fig. 6: Portable emergency unit: block diagram (a), inside view (b), external view (c).

3. Functional tests

Various test have been performed on the upgraded Hymo. In particular, are here described the final tests performed together with the EGO RSSP (F.Richard) and the EGO-RLS (M.Bazzi).

- **380 Vac Electrical power check**

Connecting the removable power cable to the control box and to the mains, and turning on the main switch, the green light was lit.

- **Normal mode operation (Selector in "normal" position)**

The selector switch was turned to "normal" position. The Hymo responded well to the commands of the remote controller (POWER, SAFETY LOCK, UP, DOWN).

- **Range of the Hymo remote controller**

Perhaps the only fear could be the limited range of remote controller, because of the receiver unit is inside of the Hymo electrical box (faraday gage), but despite the remote control operated far from the Hymo (from upstairs in the cleanroom gallery, even in the sas), the Hymo responded well to the commands of the remote control.

- **Emergency lift down mode (Selector in "emergency" position)**

With the Hymo lifted, to simulate an electrical blackout, the power cable was unplugged from the mains. The selector switch on the control box was turned to "emergency" position. The portable emergency unit was connected to the control box. In this situation by pushing the button of the 24 Vac power box the Hymo was successfully lowered.

- **End-stroke switches check**

To check that the upgrade has not affected the pre-existing safety, the Hymo was lifted and lowered in such a way to explore its full range. As expected, the pre-existing end-stroke switches stopped the movement once reached.

4. Conclusions and next steps

One of the Hymos of the Central Building has been upgraded from the point of view of safety and reliability and successfully tested.
The EGO-RSSP, together with the Direction, will consider this pilot upgrading, as well as other aspects of the matter, and will take a decision whether to extend the upgrading to the other Hymos.

5. References

[1] M. Ciardelli, V. Dattilo, N. Menzione: *HYMO SXX15-29 lift platform: proposal for improvement of safety and reliability*, VIR-0045B-11 (2011).