it's all about connections

Manual

Hobart 2400 Power Coil

400 Hz Ground Power Unit
&
Cable Retriever System

Serial no.	_____
Type	3GWC -200/ -

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IMPORTANT NOTICE

We recommend that the battery that safeguards GPU settings etc. is changed **after 5 years** of use in order not to lose data.

Refer to section 8.3 for further information

Diagrams and drawings are subject to change without prior notice.
Latest diagram versions can be found at www.itwgse.com

Printed: June 2015

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1.0 Declaration of Conformity

CE

CE Declaration of Conformity

This declaration covers :

Designation : Combined 400 Hz Ground Power Unit and Cable Coil

Type : 3PBB-200/XXX-N, 3GVC-200/XXX-N, 3GWC-200/XXX-N…

Description: Solid state power supply converting a three-phase mains supply into an isolated three-phase 400 Hz supply. The converter is combined with a cable coil for handling and storage of the output cable.

Complying with the following directives:

2006/95/EC	(LVD)
2006/42/EC	(Machinery)
2004/108/EC	(EMC)

Conformity attained by complying with:

EN 62040-1-1	(LVD – Safety standard)
EN 61558-2-6	(LVD – Safety standard)
EN 1915-1 & 2	(Machinery – General safety requirements)
EN12312-20	(Machinery – Specific safety requirements)
EN60204-1	(Machinery – Electrical safety)
EN 61000-6-2	(EMC – Immunity standards)
EN 61000-6-4	(EMC – Emission standards)

30.03.2015

Date

Søren R. Dahl

Søren R. Dahl, Development Manager

799.326 Rev. F

IMPORTANT SAFEGUARDS

DANGER – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS

2.0 Safety Instructions

This unit is only intended to be installed, operated and maintained by competent persons having the necessary knowledge regarding delivery of external power to an aircraft. Prior to use, service and maintenance, the competent person must, be familiar with all relevant parts of this manual.

Electric Shock

To ensure personal health and safety, the electrical installation must fulfil all local regulations and legislation

- Touching live electrical parts can cause fatal shocks and severe burns.
- Internal parts where the voltage exceeds 50 V are covered and / or marked with:
- Keep all panels and covers securely in place.
- Have only qualified people remove covers for maintenance or troubleshooting.
- When connecting the unit to the aircraft, make sure that the output power is off.
- Frequently inspect the installation for damage and bare wiring – Repair / replace if necessary.

Moving Parts

- Keep away from fans, cable drum, cable rollers and cable guides.
- Keep panels, covers and guards closed and securely in place.
- Have only qualified people remove guards or covers for maintenance or troubleshooting and if possible only when the mains input dis-connector Q1 is open.
- To prevent accidental coiling during service, make sure the mains input dis-connector is open.
- Keep hands, hair, loose clothing and tools away from moving parts.

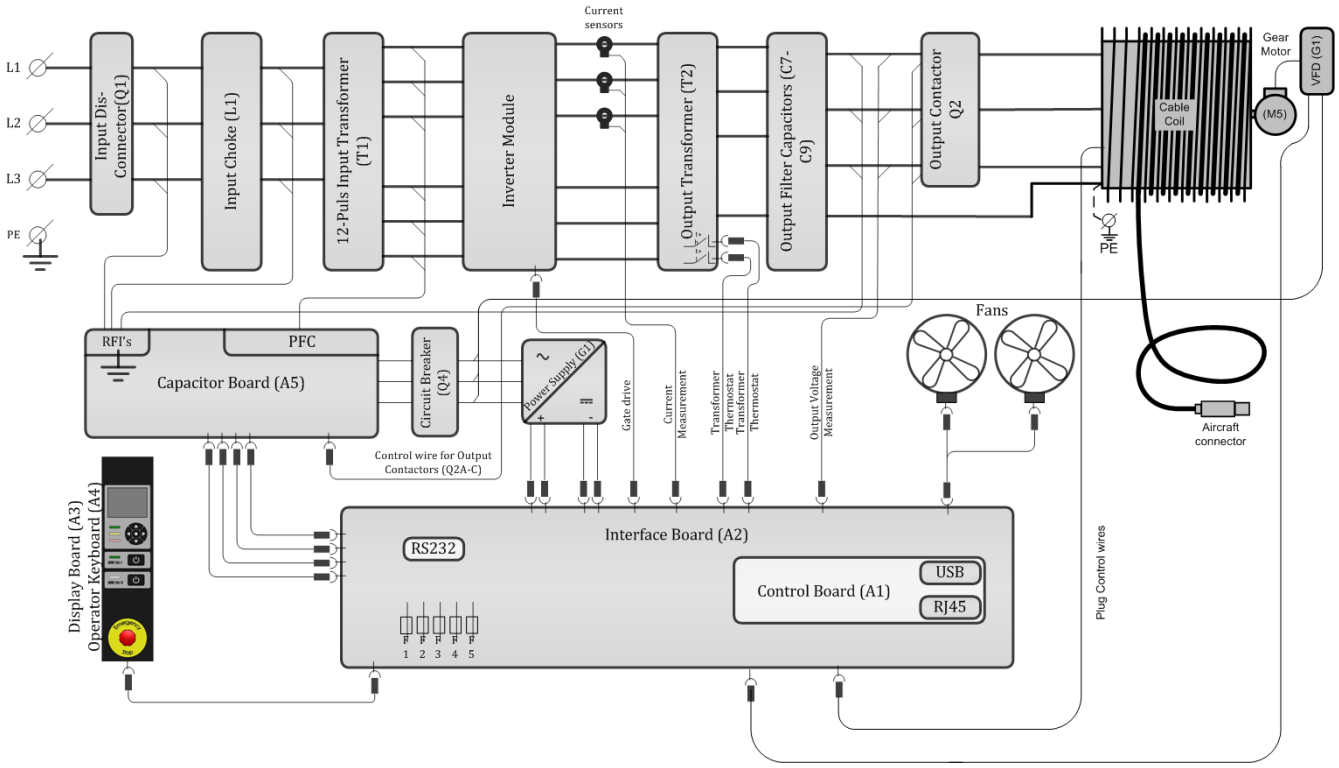
Hot Parts

- Do not touch hot magnetics.
- Allow a cooling period before doing maintenance.

SAVE THESE INSTRUCTIONS!

3.0 General Description

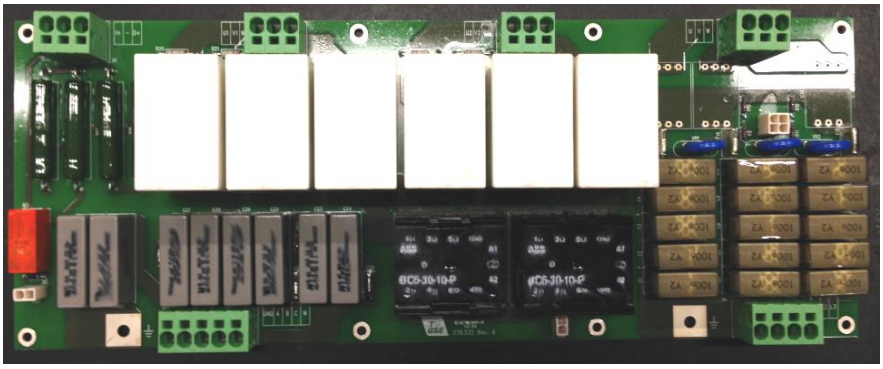
The figure below shows the basic principle of the Hobart 2400 Power Coil unit. The 50/60 Hz mains voltage is converted into a galvanic isolated 3-phase, 400 Hz output voltage. A functional description of each part is given in the following sections.



3.1 Basic Principle

Input Disconnector (Q1):
The Input Disconnect, disconnects all power to the ground power unit. Upon closing the disconnect/breaker, the ground power unit passes through an initialization test and then into standby mode.

Capacitor Board (A5):



This module includes the following functions:

- Input RFI filters to reduce the EMI/EMC emission into the mains to such a level that surrounding equipment is not disturbed. In addition, the two filters prevent voltage transients from reaching vital parts in the ground power unit.
- Resistors in combination with the soft start contactor (Q5).
- Magnetic Wave shaping circuit.
- Link from the main supply phases L1-L2-L3 to the Supply Module (G1) and VFD via the breaker (Q4).

Input Choke & 12-pulse Transformer (L1 / T1):
The combination of the choke, the 12-pulse transformer, the magnetic wave shaping circuit and the rectifier situated at the inverter module, ensures an almost sinusoidal line current with a Total Current Harmonic Distortion (ITHD) of 5% at 90 kVA/kW and a unity power factor at all loads. This means less stress on the main supply network and the distribution transformers.

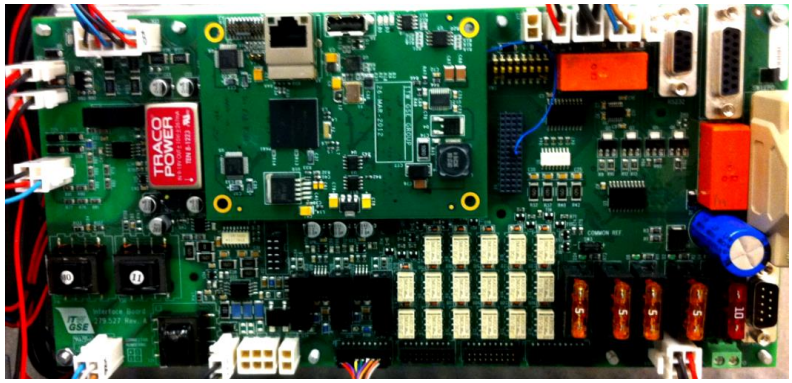
Inverter Module (PM1):
Beside the rectifier (V1-V6), the DC-filtering capacitors (C1-C6) and the soft start circuit (Q5) controlled via connector X12, the module consists of a 3-phase inverter which generates a 400 Hz voltage system with a very low harmonic content and individual phase control. Two PCBs (gate drive top & gate drive bottom) are used to interface between the control unit and the IGBTs. Voltage supervision of the DC-filtering capacitors is likewise performed at the gate drives via connector X19.

Output Transformer (T2):
The output transformer ensures galvanic separation between input and output. It also transforms the voltages from the Inverter Module into the required aircraft voltage (3 x 200/115 V). The filter choke for the output AC-filter is an integral part of the transformer.

AC Filter Capacitors (C7-C9) / Output RFI (A7):
The harmonic content of the inverter voltage is further reduced by means of the AC Filter, resulting in a total voltage distortion of less than 2%. In addition to the filter choke (integrated into the transformer) and the AC capacitors, the ground power unit is equipped with an output RFI-filter that reduces the high frequency emissions from the ground power unit or from the aircraft.

Output Contactor:
The ground power unit is equipped with a 3-phase output contactor per outlet. The contactor is engaged at start-up of the corresponding output, and it is disengaged, when the stop button is activated or a system error occurs. If the interlock voltage, provided by the aircraft, is not returned to the ground power unit within the delay settings (refer to chapter 6.3), the contactor also disengages.

Interface Board (A2):
The purpose of this board is to interface between the Control Board and the rest of the ground power unit. The interface module includes the following functions:



- Interface to the Display Board (CAN Bus, 24 VDC and EPO (External Emergency Stop))
- Fuse (F1 & F2) provides the 24 VDC for I/O connections
- Fuse (F3) for Display Board (A3) and Operator Keyboard (A4)
- Fuse (F4) provides the 24 VDC for interface
- Fuse (F5) PWM control (X10) of the fans (M1-M2) situated above the magnetics
- User EPO input (X14)
- Measuring transformers for supervision of the 400 Hz output voltage (X26)
- Interface for gate drives situated at the Inverter Module (X13)
- Interface for current sensors situated at the Inverter Module (X23)
- Relay control of output contactor Q2 (X16)
- Soft start control of Q5 (X12)
- Input for temperature sensors (X18)
- Plug control Start, Stop etc.(X1)
- Cable drum limit switch inputs (X2)
- VFD control (X3)

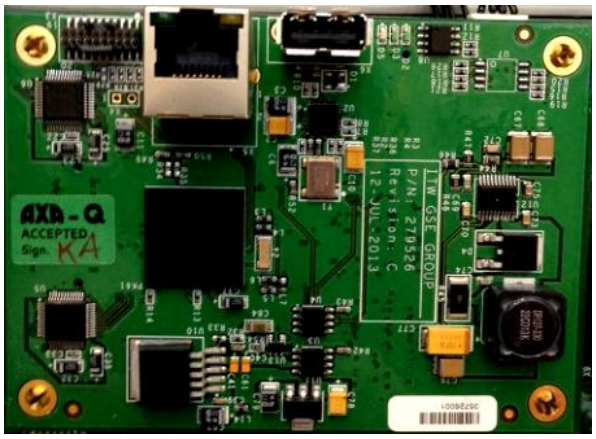
- Remote I/O and Dry contacts for PBB (X4)
- Protected interface for interlock signals.
- Neutral Voltage Supervision.
- Neutral Conductor Rupture supervision.
- Door Interlock (X27).
- Earth Leakage Failure via (X22) and current sensor on ground wire from 400 Hz neutral.
- Interface for RS232.
- EEPROM (X34) contains the unique identity key of the unit.

Supply Module (G1):

The generation of the 24 VDC / 10 A (Adjusted from factory = 25 Volt) regulated control voltage is done by the Supply Module G1. This module has a wide input range (340-575 VAC). It is supplied via the capacitor module and pre-fused from the 3-phase circuit breaker Q4.

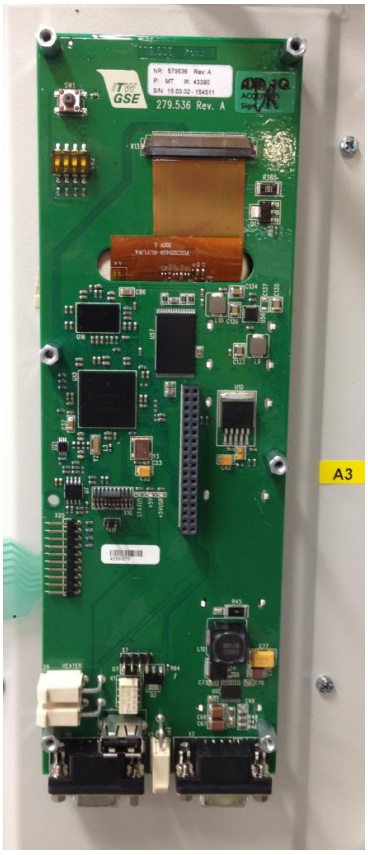
Control Board (A1):

The Control Board is based on a micro-controller and a digital signal processor (DSP). Together they regulate, supervise and diagnose possible external and internal faults. As soon as the ground power unit is connected to the mains, and constantly during normal operation, the Control Board runs through a self-check program which checks all internal functions of the ground power unit. If an internal or external error is detected, the display shows the nature of the error. All immediate parameters related to a shut-down are stored in the ground power unit's memory. The Control Board has an on-board Ethernet RJ45 connector, which can be used to communicate with the BMS (Building Management System) and USB host Type A connection to retrieve data from the converter or to up-date the software.



Display Board & Keyboard (A3 / A4):

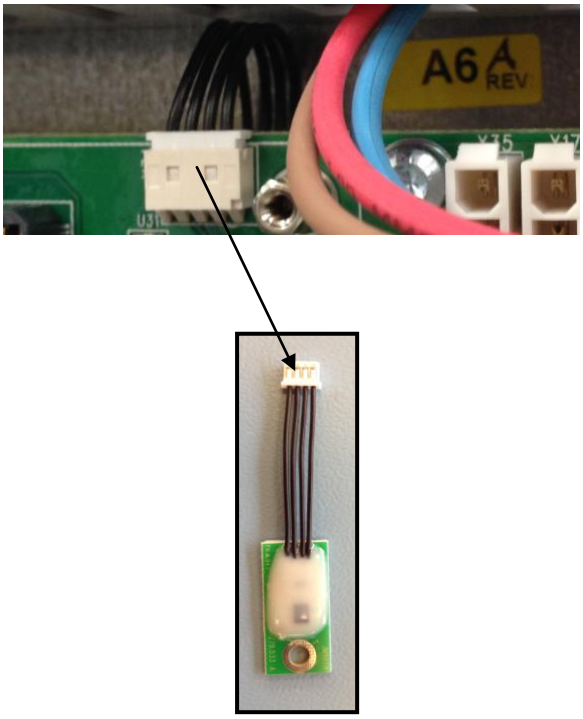
The display module serves as the interface for daily operation.



The display communicates with the Control Board via a CAN bus (Controller Area Network) and can be placed up to 100 m away from the unit, when using the Remote Control Box. Furthermore, the display module includes a USB connection, which can be used to download the Black Box and the Power Log and for update of the display software.

ID Chip (A6):

The ID Chip, is connected to Interface Board A2 and fixed to the I/O zone plate.
Contains information on the GPU configuration, stores all set-up values, Black Box / Power Log records.



3.1 Built in features / protections

No Break Power Transfer:
The unit is protected against misalignment during a No Break Power Transfer.

Over/under voltage at input:
The input voltage supervision is based on the rectified DC. The supervision ensures that the unit does not trip even in the case of an abnormal low input voltage level. This of course presupposes that the 400 Hz output level and quality, required by the aircraft, can still be maintained. If the rectified DC level gets too low or too high, the unit trips to protect itself.

Over/under voltage at output:
If the output voltage exceeds or is below the levels in the table below, the unit automatically shuts down and opens the output contactor.

Output Voltage U > 130V – 250ms
Output Voltage U > 140V – 15ms
Output Voltage U < 104V – 500ms

Overload:
If the output current exceeds the overload ratings in the table below, the unit shuts down to protect itself

- 125% for 600 seconds
- 150% for 60 seconds
- 200% for 30 seconds
- 300% for 10 seconds
- 400% for 1 second

Short circuit at output:
The unit has a built in system to protect itself & the output cables, if the units output(s) are short circuited for some reason.

Internal high temperature:
If for some reason the internal temperature on the Inverter Module or the Output Transformer, rises above the factory set temperature level, the unit shuts down, reporting either "***INVERTER TEMP TOO HIGH***" or "***TRANSFORMER TEMP TOO HIGH***"

Control voltage error:
If the control voltage supplied from G1 is < 20 VDC, the unit shuts down and reports
"CONTROL VOLTAGE LOW"

Aircraft Connector Insertion:
This feature verifies that the aircraft connector is correctly inserted. When the aircraft connector is 90 % correctly inserted the split "F" pin sends a signal to the unit allowing the respective outlet to be engaged. Furthermore this feature ensures that the drum can't coil the cable in when the aircraft connector is inserted.
How to Bypass / Activate the function please refer to section 6.4.2 & 7.11

Neutral Voltage Supervision (NVS):
As a standard, the unit is delivered with a jumper wire between the 400 Hz neutral and earth. If the jumper wire for any reason (eg. Local regulation) is removed, the unit monitors the voltage between the 400Hz neutral and earth. If this voltage exceeds 42 V (factory setting), the unit shuts down and reports "NVS failure".
For change of setting please refer to section 6.3.

Neutral Voltage Displacement Supervision (NVD):
The combination of a grounded converter and an un-grounded aircraft might lead to an energized aircraft chassis. The reason is the neutral voltage displacement caused by an unbalanced load. In case the aircraft frame is or will be grounded during operation, a broken neutral might result in sparks as well as burned ground wires.
The neutral voltage displacement of the aircraft chassis is measured as an AC voltage imposed on the EF interlock signal.
For change of setting please refer to section 6.3.

Earth Leakage Supervision (ELS)
In systems where the 400 Hz neutral is grounded and there is a break of the cable's 400 Hz neutral, the ELS system monitors the residual current in the internal neutral / earth connection. The supervision will shut down the unit in case the residual current reaches the pre-set level.
For change of setting please refer to section 6.3.

Note!
An additional protection method offered by ITW GSE as an option is the Neutral Conductor Rupture (NCR). The supervision is based on the presence of an injected current in the neutral conductor (i.e. as long as the injected current is present, the neutral is intact). The advantage of this method is that a broken neutral will be detected immediately.

In general ITW GSE does not recommend the NCR option for the following reasons:

1) The need for an additional control wire, which is likely to be the first to break.

2) The difficulties of implementing the method in existing installations if a free control wire is not present.

3) The standard protections built into the Hobart 2400 series are considered adequate to safeguard against hazards related to a broken neutral.

4.0 Transport and Installation

4.1 Storage Before Installation

To secure optimal storage conditions prior to installation, we recommend that the converter is stored inside. This protects the unit from rain and excessive humidity while it is left without power.
Only equipment in seaworthy packing should be stored outside.
For storage conditions please refer to section 5.0

4.2 Operational and Environmental Conditions after Commissioning

When the converter has been installed and commissioned, we strongly advise that the unit is always kept with input power on. This provides optimal conditions for the electronic components and prevents humidity in the form of condensed water from reaching vital parts.
If for some reason the converter has been without input voltage for a period of time, a visual inspection should be carried out. If condensation on any internal parts is discovered, the parts have to be dry before the input voltage is again applied.

4.3 Transport

The Hobart 2400 Power Coil is delivered on a specially designed wooden pallet. Transport and mounting of the Hobart 2400 Power Coil is carried out by lifting the unit by a fork-lift, truck or the like to the intended mounting position while it is still placed and firmly fixed to on the pallet. For safety reasons, the passenger boarding bridge should be placed in a horizontal position at the lowest possible height above ground before lifting is started.

We recommend that you keep the original pallet for future dismantling in connection with service and maintenance.

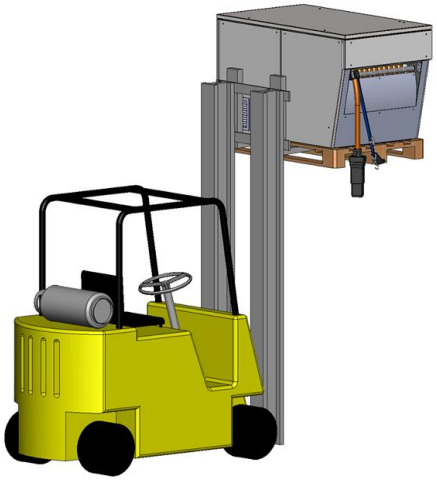


Fig. 4.3.1 Transport and mounting of the Hobart *PoWerMaster*® 2400 Power Coil by means of a fork-lift truck

Note:
The Hobart 2400 Power Coil must be fastened to the passenger boarding bridge with 8 M12 bolts of grade 8.8 or superior. To meet UL 1012requirement, suspension brackets must be designed for a minimum of 4 times the unit weight of 1550 pounds (700 kg).

4.4 Installation and fastening instructions

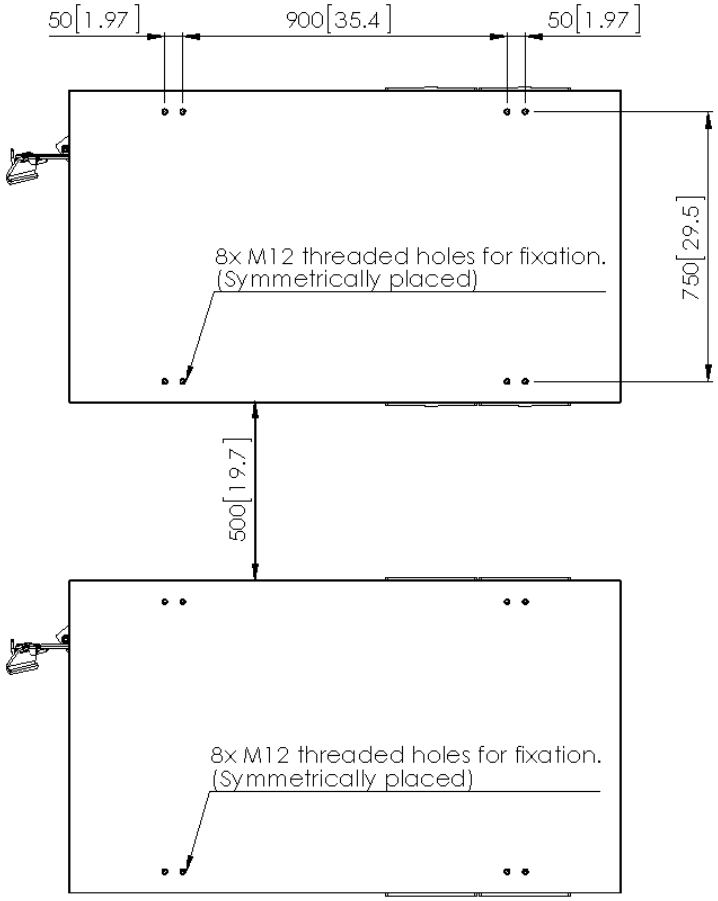


Fig. 4.4.1 Spacing between units and mounting holes for bracket.

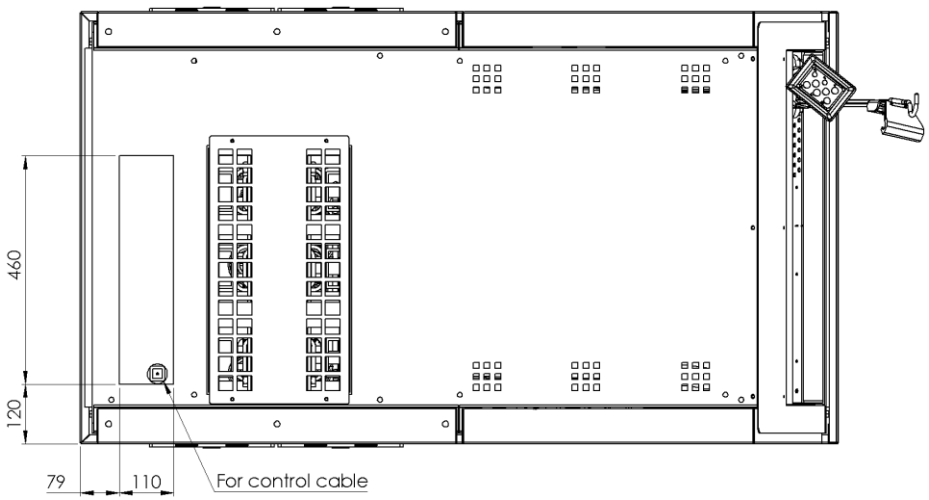


Fig. 4.4.3 Cable entry via gland plate

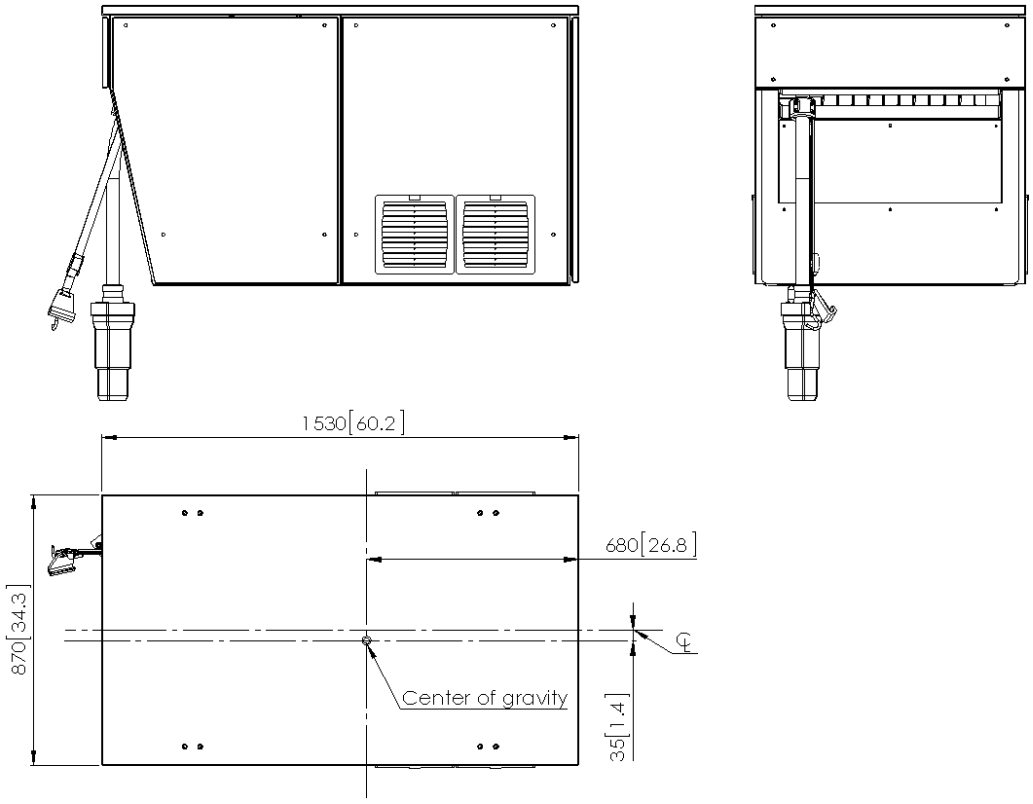
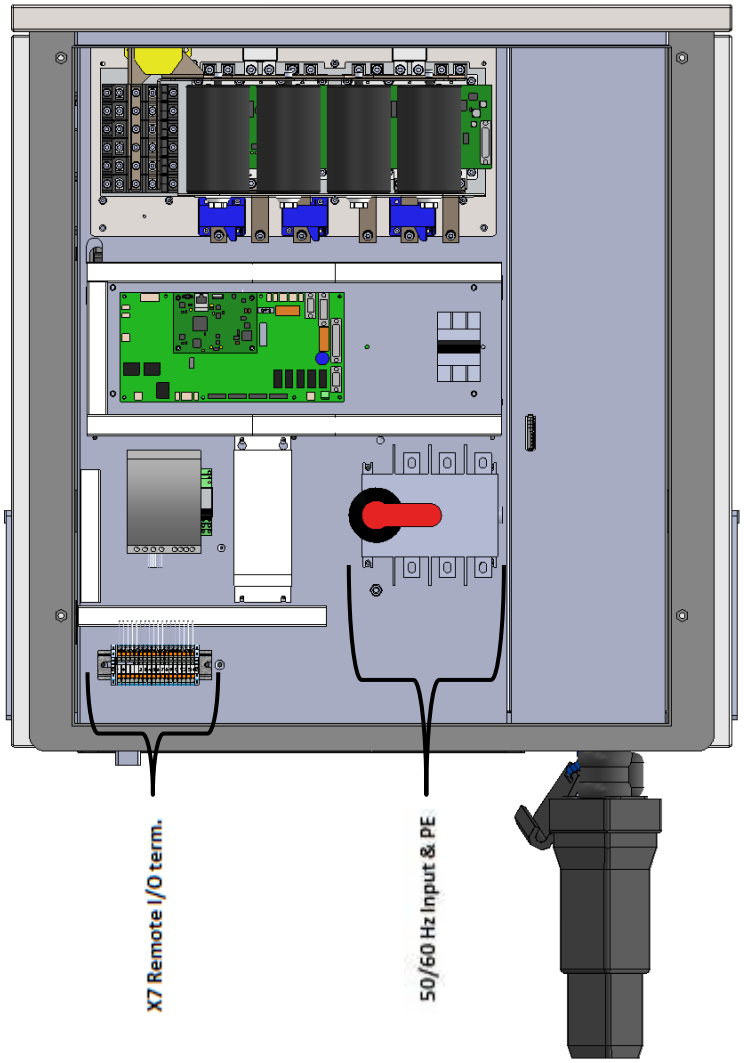
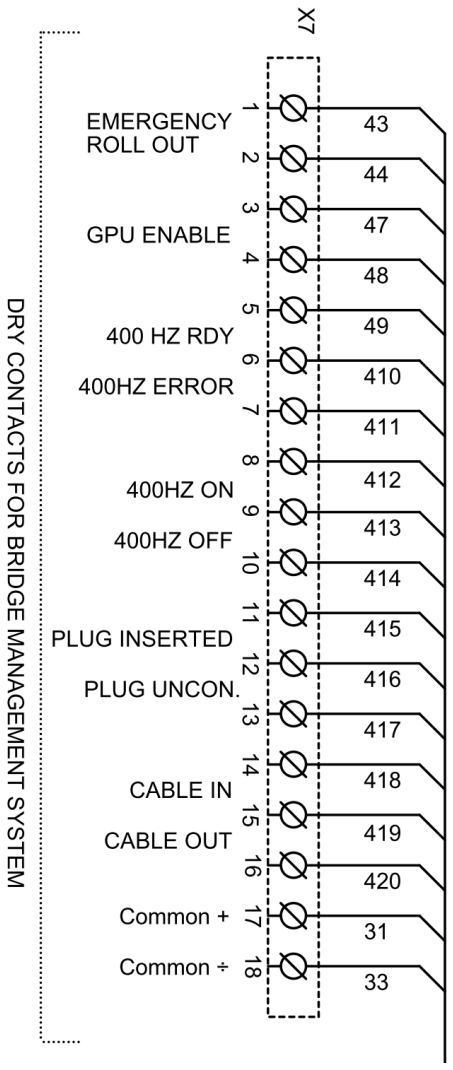


Fig. 4.4.4 Center of Gravity

4.5 Connection of Cables

Remote I/O terminals available
(refer to **section 4.9** for connection of I/O terminals)





50/60 Hz Input terminals:	3 x ¼-20 by 1” (M8/25mm) 25.4 Nm (225 in-lb) (L1–L2–L3) 1 x M10 bolt 50 Nm (444 in-lb) (Ground/PE)
Remote I/O terminals:	18 x 0.4 - 4 mm² (AWG 21-11)

Fig. 4.5.1 Connection of Cables

4.6 Mains Input

Due to personal health and safety, the Hobart 2400 Power Coil unit must always be protected by grounding the PE terminal (⏚).
NOTE: The minimum ground wire size is #6 AWG.
Consult local authorities to ensure this meets local requirements.

The mains input connection to the unit should be externally pre-fused according to the table below:

100% load @ PF 0.8 Aircraft:

Rating	**60 kW**	**90 kW**
Line Current @ 400V/480V	75/63 A	111/93 A
Recommended Fuse Size	100 A	125 A
Maximum Fuse Size	200 A	200 A
Minimum Input Wire size	#4	#2
Output Wire size*	#2	1/0

* Based on single wire at 30 feet, consult the factory for recommendations on different lengths.

100% load @ PF 1.0 Aircraft:

Rating	**60 kW**	**90 kW**
Line Current @ 400V/480V	96/80 A	141/118 A
Recommended Fuse Size	125 A	160 A
Maximum Fuse Size	200 A	200 A
Minimum Input Wire size	#2	#1
Output Wire size*	#2	1/0

* Based on single wire at 30 feet, consult the factory for recommendations on different lengths.

Tightening torques:

Input disconnect: 8 Nm to 17.6 Nm (72 in-lb to 156 in-lb)
Input circuit breaker: 14.9 Nm to 21.7 Nm (132 in-lb to 192 in-lb)
Output contactor: 17.6 Nm (156 in-lb)

Due to the RFI filter at the input, the leakage current for the Hobart 2400 Power Coil is > 40 mA.

4.7 400 Hz Output

At delivery, the 400 Hz neutral is connected to the Protective Earth terminal (PE). If a floating output is required, the green/yellow jumper wire must be removed.

Independent of installation method, it is mandatory to meet local regulations and legislation to ensure personal health and safety.

4.8 400 Hz Interlock

The interlock safety system ensures that the output contactor stays engaged as long as the aircraft connector is inserted into the aircraft receptacle. The aircraft provides 28 VDC on the F terminal with respect to the 400 Hz neutral terminal.

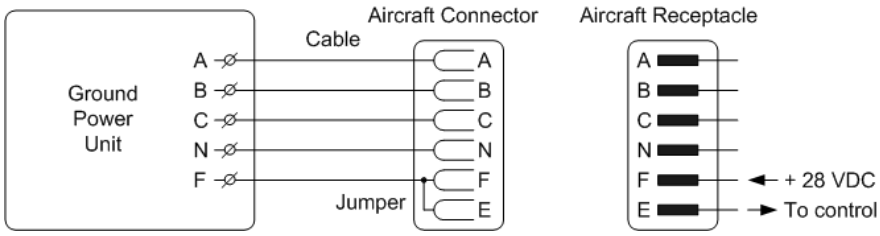


Fig. 4.8.1 Standard wiring diagram for civil aircraft

For service, maintenance and test purposes, the interlock system can be by-passed via the display setup. To ensure personal health and safety, the ground power unit automatically returns to its initial interlock mode, once it receives 28 VDC at the F terminal, e.g. when the ground power unit is connected to an aircraft.

To ensure personal health and safety, the interlock safety system must always be activated unless the ground power unit is undergoing service, maintenance or test by qualified personnel.

4.9 User Remote I/O Terminals

Using the Remote I/O terminals, situated behind the front door to the left, it is possible to interface to:

- External Emergency Stop (EPO).
  The external EPO input A2:X14 is a 24 VDC input, either by using the internal 24 VDC supply or an external 24 VDC voltage. The SW1 “EPO JUMPER” (at the top right corner of the A2 Module) is then removed. Refer to Fig. 4.9.1 / 4.9.2 for connection.

- The terminal block X7 is the dry contacts for bridge management system and contains the following I/O signals:

  - EMERGENCY Roll Out – Input signal (X7:1 - 2)

- GPU Enable – Input signal (X7:3 - 4)
- 400 Hz Ready / 400 Hz Error – Contact N.O. (X7: 5 - 6) / N.C. (X7: 6 - 7)
- 400 Hz On / 400 Hz Off – Contact N.O (X7: 8 - 9) / N.C. (X7: 9 - 10)
- Plug inserted / Plug Unconnected – Contact N.O (X7: 11 - 12) / N.C. (X7: 12 - 13)
- Cable In / Cable Out – Dry Contact N.O (X7: 14 - 15) / N.C. (X7: 15 - 16)
- +24 VDC (X7:17 - 18)

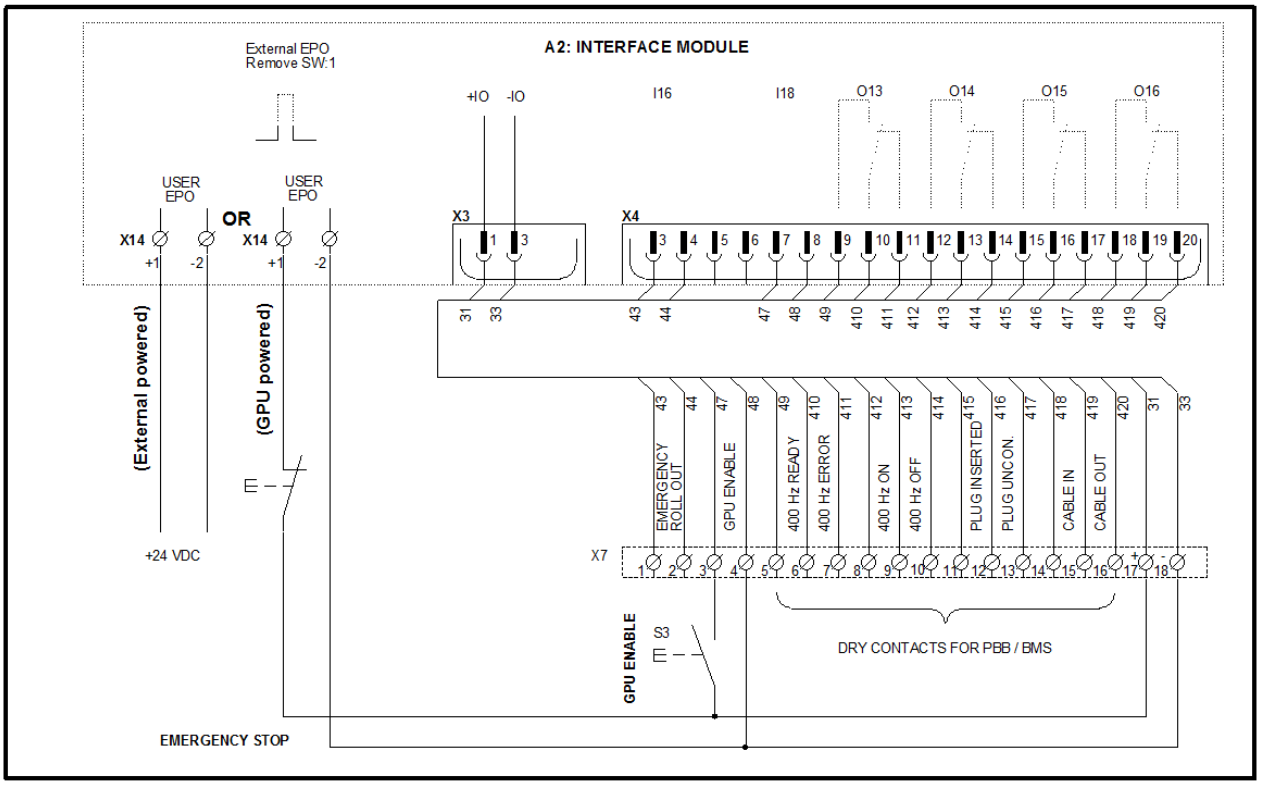


Fig. 4.9.1 Example of wiring for external control and Dry Contacts to PBB/BMS

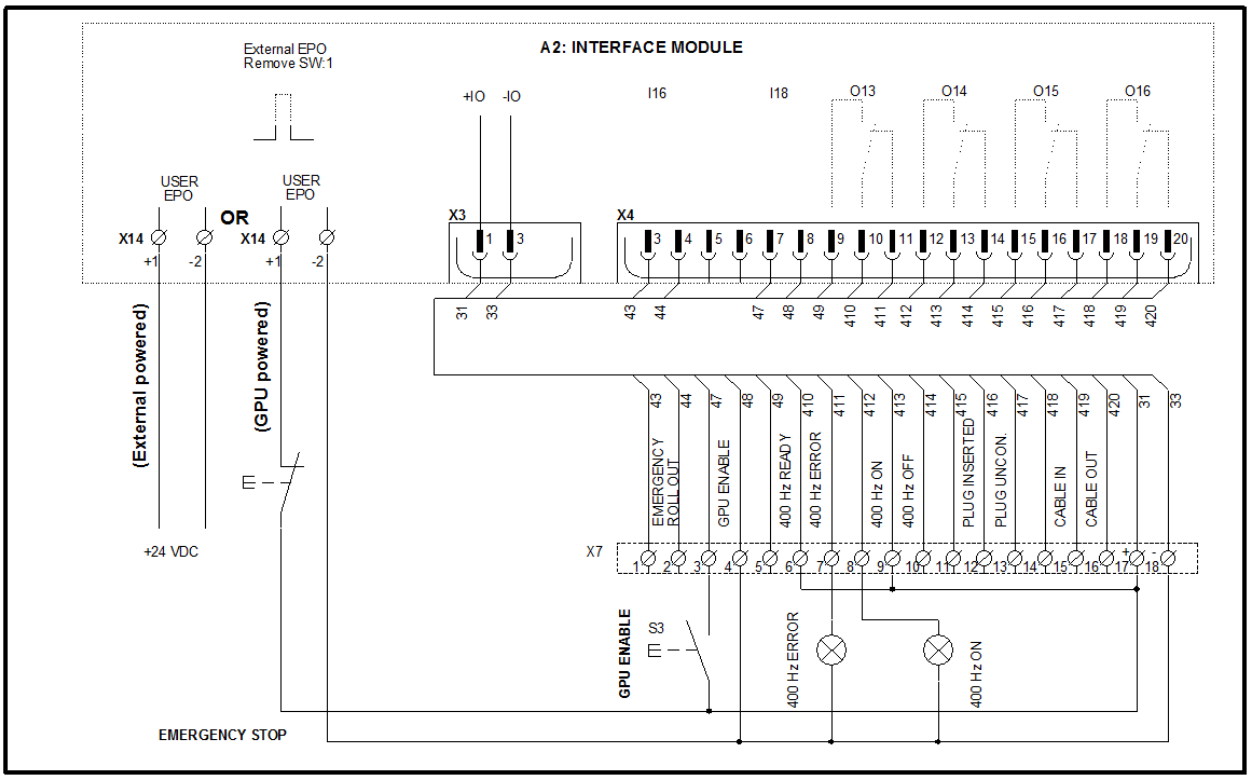
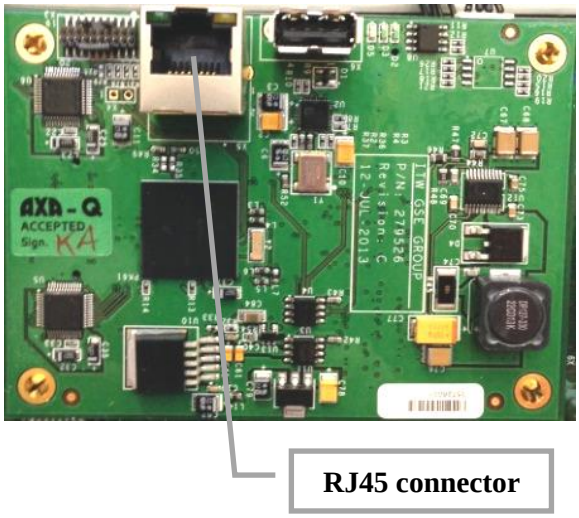


Fig. 4.9.2 Example of wiring for external control and Lamps indication

4.10 TCP/IP On-board Interface

The Hobart 2400 Power Coil is equipped with a TCP/IP (RJ45) communication port for supervision and monitoring of the Ground Power Unit (GPU) e.g. using a central computer. The port is located on the Control Board (A1).



The protocol is limited to MODBUS TCP/IP. The data available from the GPU are comprehensive and should meet most requirements.

Supported Modbus Function Codes.

The Hobart 2400 Power Coil implements a subset of the Modbus Application Protocol Specification V.1.1b.

The following function codes are supported in Modbus requests:

- 03 (0x03) Read Holding Registers
- 04 (0x04) Read Input Registers
- 06 (0x06) Write Single Register
- 16 (0x10) Write Multiple Registers

In the following section, the different kinds of data available are described.

- The most common modes are: System in use, system in standby and system in fault.

- The GPU provides a comprehensive range of internal and external parameter measurements and information e.g. voltages, currents, temperatures, time, date etc.

- The GPU provides two kinds of logs:
  The Black Box which contains the last 100 errors detected together with all relevant parameters and status information available in connection with a shut-down.
  The Power log which contains the time in use and the power consumption for the last 100 operations.

Note!
Detailed information on the Modbus Communication and available parameters can found in the document 999.008, which can be obtained from ITW GSE on request.
Refer to chapter 6.4.2 / 7.17 and 7.18 for communication set-up

5.0 Technical Specifications

Standards:

ISO 6858	Aircraft ground support electrical supplies - general requirements
BS 2G 219	General requirements for ground support electrical supplies for aircraft
SAE ARP 5015	Ground equipment – 400 Hz ground power performance requirement
MIL-704F	Aircraft electric power characteristics
DFS 400	Specification for 400 Hz aircraft power supply
EN2282	Aerospace series characteristics of aircraft electrical supplies
EMC & Safety standards	Please refer to the declaration of conformity, chapter 1

Solid State Ground Power Unit:

Input:

Model	Amps (0.8)	Amps (1.0)	Hertz	Voltage	Max. Fuse	Line Current Dist.	PF at nominal load
60SX240	75 A	93 A	45-65	400 ± 15%	200 A	< 9%	> 0.99
	62.5 A	77.5 A	45-65	480 +10% -15%			
	50 A	62 A	45-65	600 ± 15%			
90SX240	111 A	141 A	45-65	400 ± 15%	200 A	< 5 %	1
	92.5 A	117.5 A	45-65	480 +10% -15%			
	74 A	94 A	45-65	600 ± 15%			

Phase	ABC or CBA
Rectification	12-pulse
Inrush current	None
Interruption ride-through	20 ms

Output:

Power	60 or 90 kVA/kW, cos(φ) = 1
Voltage	3 x 200/115 V
Power factor	0.7 lagging to 0. 95 leading
Voltage regulation	< 0.5 % for balanced load and 30 % unbalanced load
Voltage transient recovery	ΔU < 8 % and recovery time < 10 ms at 100 % load change
Total harmonic content	< 2 % at linear load (typically < 1.5 %) < 2 % at non-linear load according to ISO 1540
Crest factor	1.414 ± 3 %
Voltage modulation	< 1.0 %
Phase angle symmetry	120° ± 1° for balanced load 120° ± 2° for 30 % unbalanced load
Frequency	400 Hz ± 0.001 %

Overload	100 % continuous 125 % for 10 minutes 150 % for 60 seconds 200 % for 30 seconds 300 % for 10 seconds 400 % for 1 second

Efficiency:

Overall efficiency	0.94 at 35-90 kVA load PF 0.8
at cos φ = 0,8	0.90 at 25 kVA load PF 0.8
Standby losses	65 W
No-load losses	2.2 kW

Protections:

Input over-and under voltage
Leakage current supervision
Control voltage error
Internal high temperature
Output over-and under voltage
Overload at output
Short circuit at output
No Break Power Transfer
Neutral Voltage supervision
Broken Neutral supervision

Miscellaneous:

Physical:

Dimensions	Please refer to the outline drawing at following pages
Weight (incl. standard cable)	
Bridge-Mount	1550 lbs. (700 kg)
On Stand	1689 lbs. (766 kg)

Environmental:

Storage temperature	50°F to 95°F (+10 to +35°C) / 20 to 70% RH
Operating temperature	-40°F to + 132°F (-40°C to +56°C) (+140°F at aircraft load)
Relative humidity	10-100 % (non-condensing)
Noise level	< 65 dB (A) @1m
Ingress protection	IP54 (NEMA 3R) Overall unit IP55 (NEMA 4) Electronic section

Miscellaneous:

Color	RAL 7035 standard, other colours on request
MTTR	Max. 20 minutes

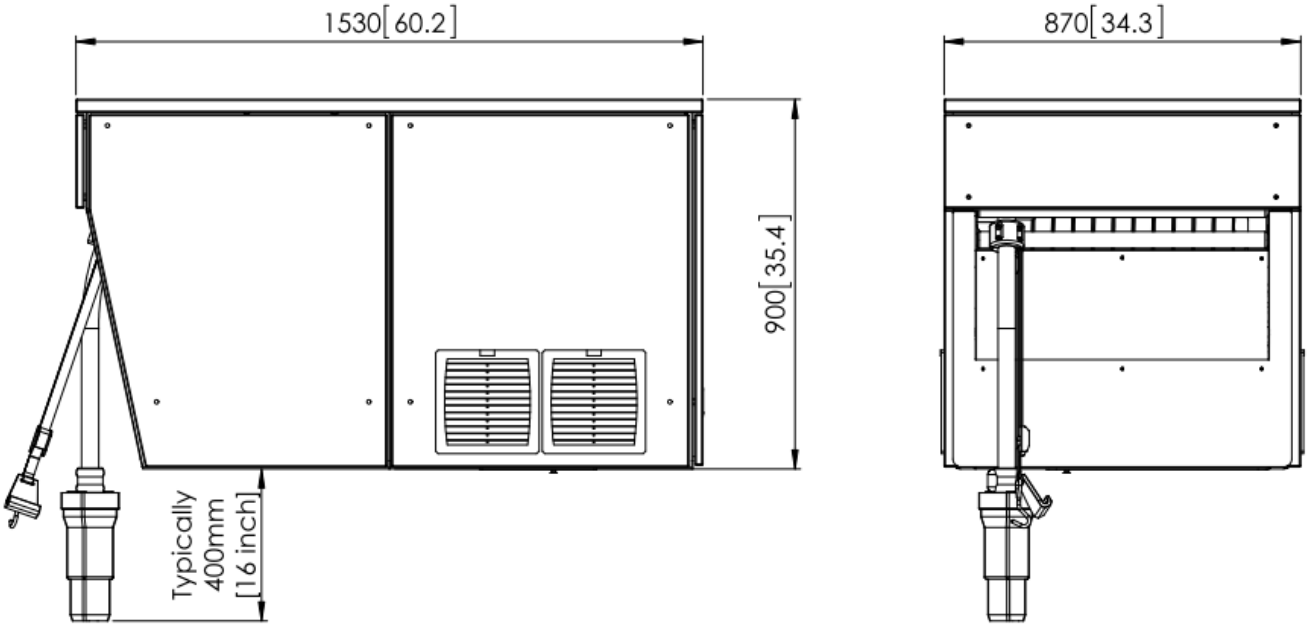
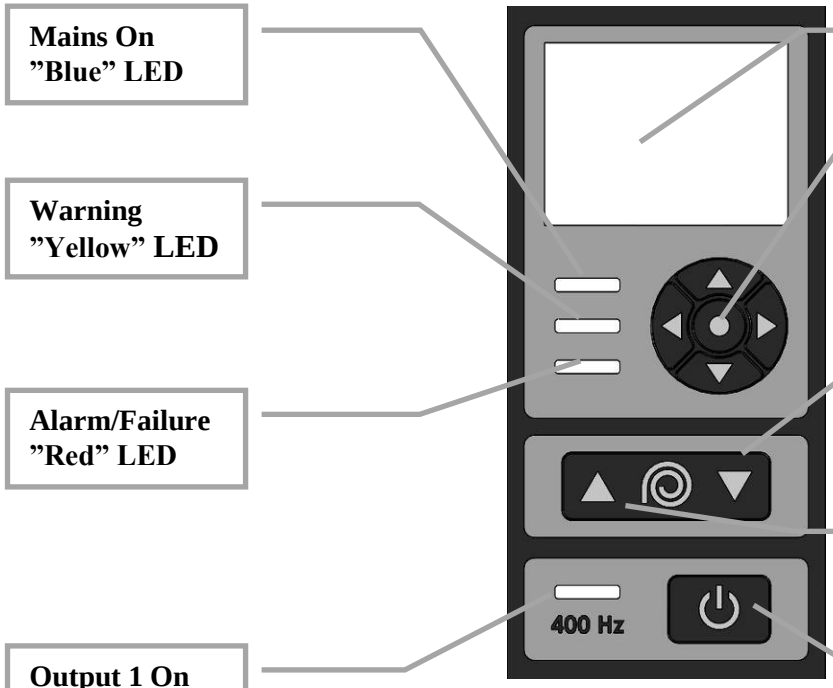


Fig. 5.0.1 Bridge Mounted

6.0 Operator's Instructions (Display/LED/Keypad layout)



3 x LED indications.

Blue LED:
As soon as the main power is connected and the unit is switched on, this LED is illuminated.

Yellow LED:
If any warnings are reported, this LED is illuminated to draw the operator's attention. *

Red LED:
This LED is illuminated as soon as the unit shuts down due to a failure.

Single push button, for Start/Stop of the unit.
The 400Hz LED turns **"Green"** when the unit is supplying power at the output.
The push button also functions as a reset button.

*
Warnings may arise during operation on the following issues:
Plug Temperature Too High
Neutral Conductor Rupture Output
EF Signal Drop Out – Output
Aircraft Connector not inserted – Output

6.1 Using the Display/Keypad:

To enable a smooth and easy operation, the operator control panel has a simple layout. The LED display is located at the top. It is used to provide information during operation / service / maintenance. It either shows operational data, warnings or failure information in plain text combined with a time stamp and a 4 digit code which can be used in combination with the manual to show more detailed information on the reported message.

Note!
Please refer to section **6.0** for the push button layouts.

6.2 Operator's instructions (operating via aircraft plug)

The Hobart 2400 Power Coil offers the possibility to operate the unit from the plug.

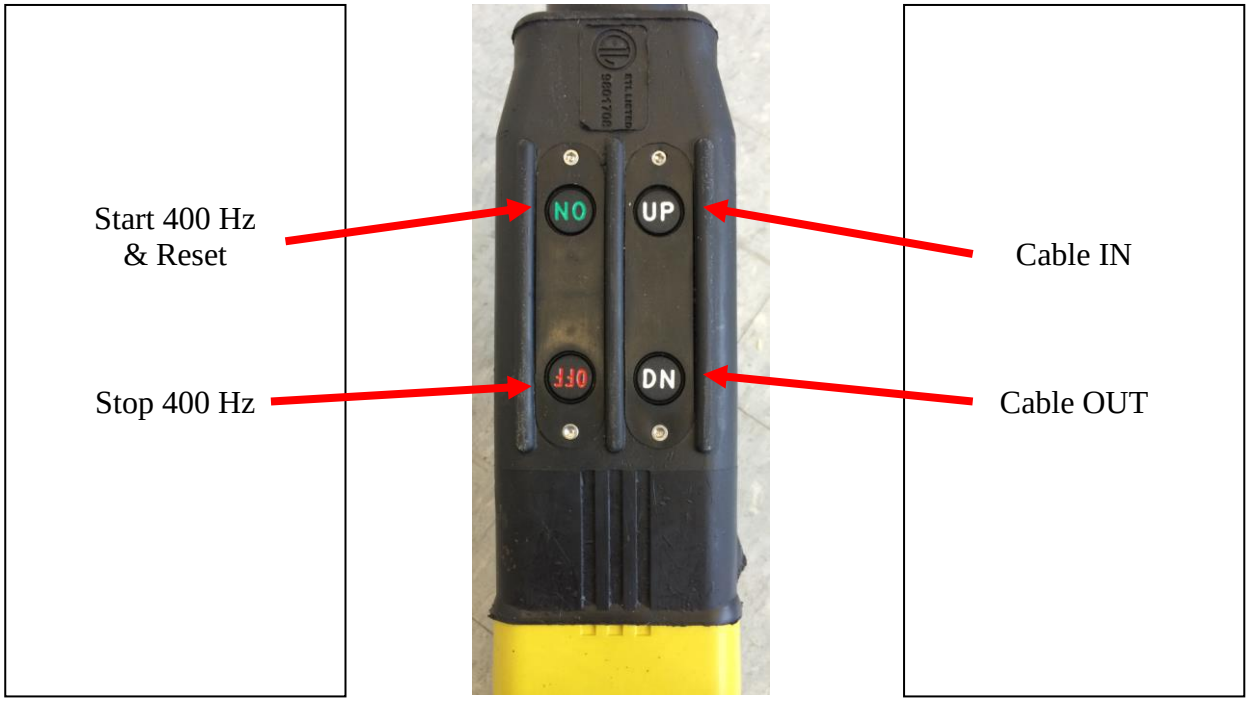


Fig. 6.2.1 Aircraft Plug push buttons

6.3 Operating the unit:

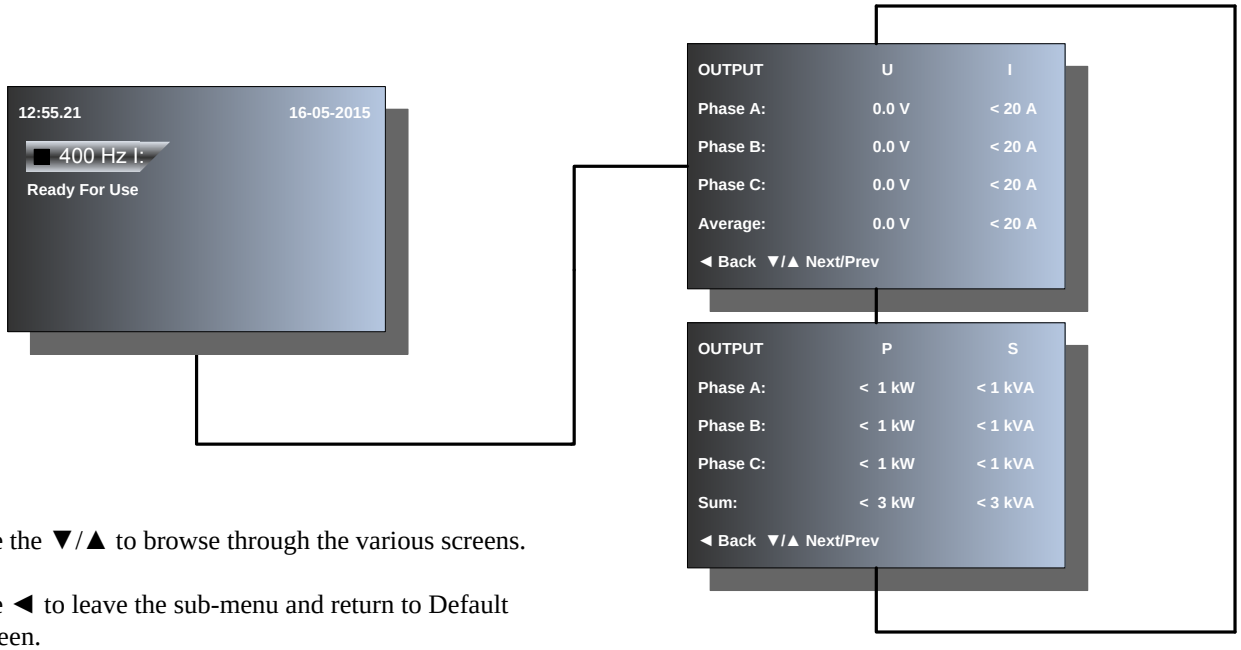
- If the cable plug is out of reach, use the  to lower the cable until it can be reached by hand. Use the "Cable Out" on the plug to fully unroll the cable.

- Insert the aircraft cable into the aircraft. Make sure the cable is inserted till you feel a strong resistance. The plug is equipped with an Aircraft Connector insertion switch and the unit will not function if the plug is not fully inserted.
- Press the "Start" button on the plug or the "Start/Stop" button  on the unit.
- The unit is now in operation and supplying power to the aircraft. This is indicated on the GPU control panel located close to the

  "Start/Stop" button 

- If the unit shuts off and is no longer supplying power to the aircraft, this is reported in clear text in the display. Also a corrective action is displayed.
- From the default display screen and during operation, various parameters can be viewed via the display. Use the navigation keys ▼▲ to browse through the available screens:

Default Display Screen Standby

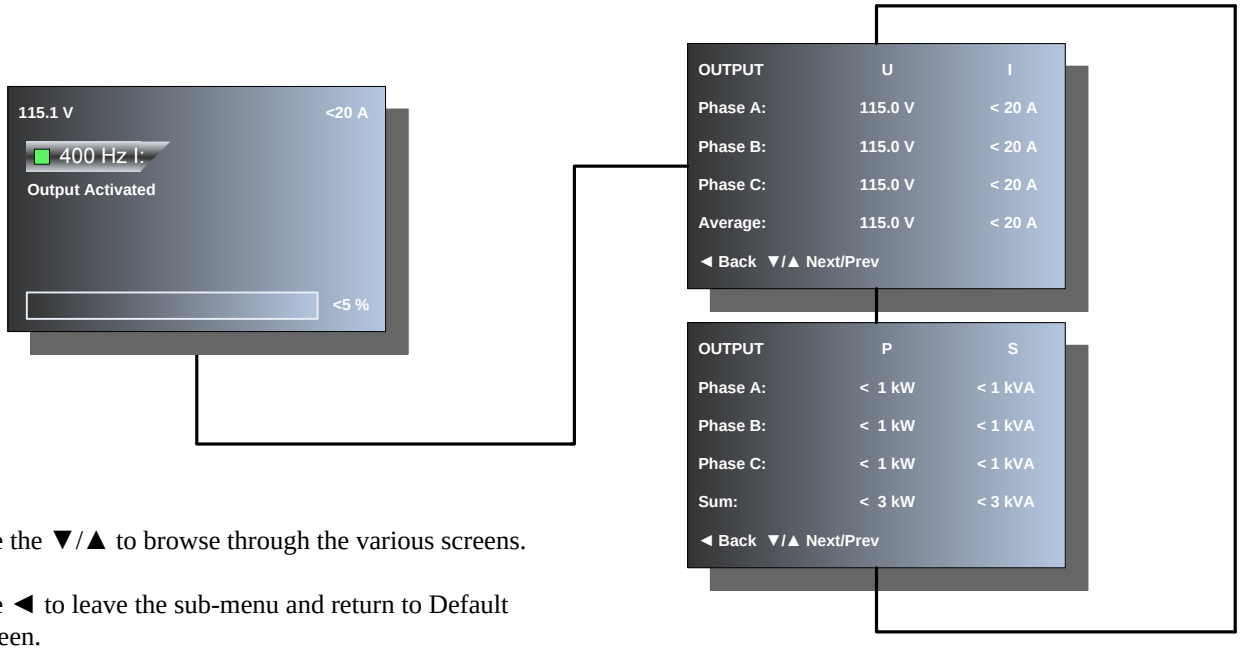


Use the ▼/▲ to browse through the various screens.

Use ◄ to leave the sub-menu and return to Default Screen.

Note!
Parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

Default Display Screen Operating



Use the ▼/▲ to browse through the various screens.

Use ◄ to leave the sub-menu and return to Default Screen.

Note!
Parameters may vary depending on the mode of the unit
Standby / operating / load profile etc.

- After operation, the unit has to be turned off before removing the aircraft plug.

  Press the "Stop" button on the plug or Start/Stop button on the control panel 

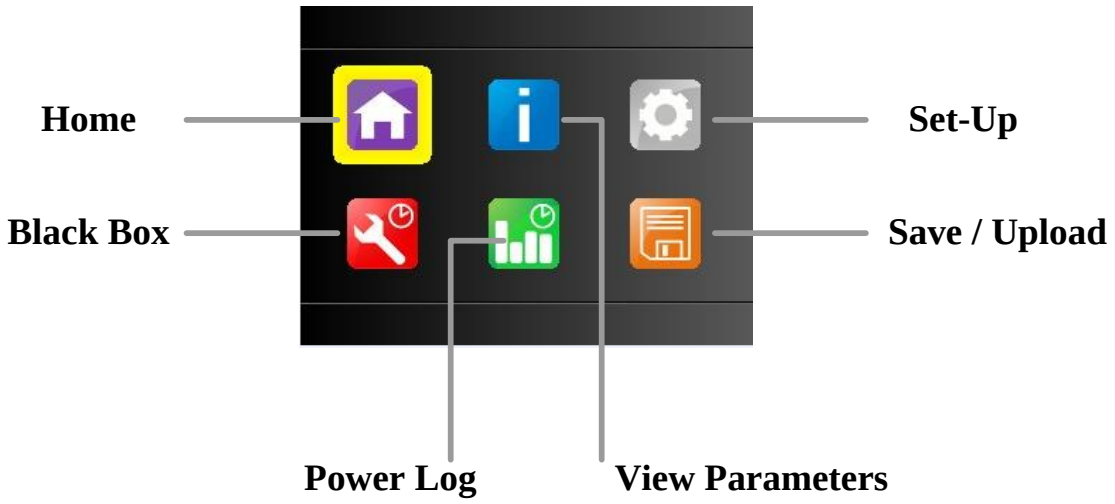
- The aircraft cable can now be removed from the aircraft and use the "Cable in" push button to coil the cable back on the Power Coil.
- To get the last few meters of cable back on the coil, use the  on the operators panel.

Note!
To minimise the heat dissipation on the drum, the cable should be totally unrolled. This will also extend the lifetime of the cable.

Note!
Please notice that the "Start/Stop" button  also functions as a "Reset" push button.

If, for some reason, the unit stops due to an error / failure, press the Start/Stop/Reset to reset the unit. (The Start pushbutton on the cable head can also be used to reset the unit.)

6.4 Basic Menu:



The basic Icon Menu is shown above with the available sub-menus.

To enter the Icon Menu, press the ● from the default menu and hold it down for approximately 10 seconds.

To Select a sub-menu, simply use the navigation keys ◄▼▲► to highlight the icon and then press the ● to enter the sub-menu.

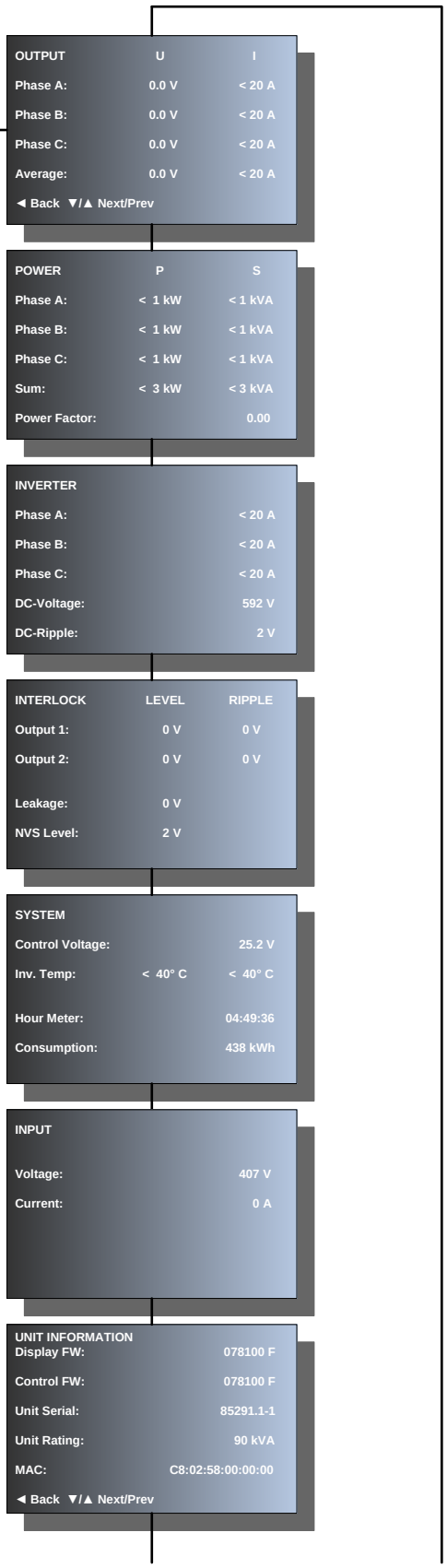
To leave the Icon Menu highlight the "Home" icon and press ●

Icon explanation:

- Back to Default screen
- Viewing actual converter parameters
- Set-up menu for changing converter parameters
- Black Box with last 100 failures / errors
- Power Log with last 100 operations
- Save "Black Box" / "Power Log" records or update software *

*
Detailed instructions on the Software Update can be found in the document 699.135, which can be obtained from ITW GSE on request.

6.4.1 Parameters – Menu structure



Highlight the  by using the navigation ◄▼▲► keys.

Press ● to select "View parameters" sub-menu.

Use the ▼/▲ to browse through the various screens.

Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

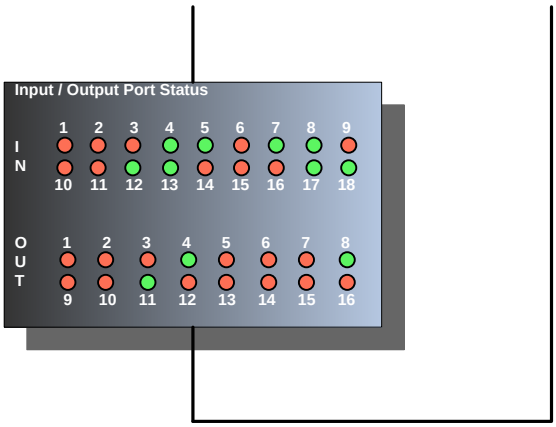
Parameters (continued) – Menu structure

Use the ▼/▲ to browse through the various screens.

● = Active

● = Not Active

Use ◄ to leave the sub-menu and return to basic Icon Menu.

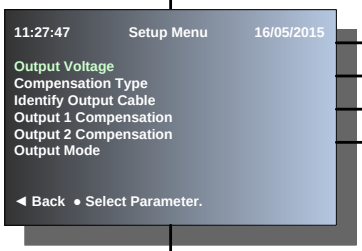


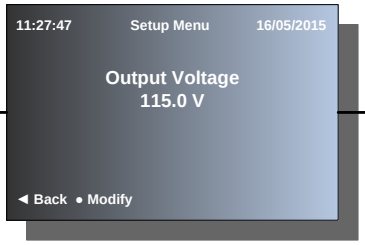
Note!
I/O Port status may vary depending on the mode of the unit Standby / operating etc.

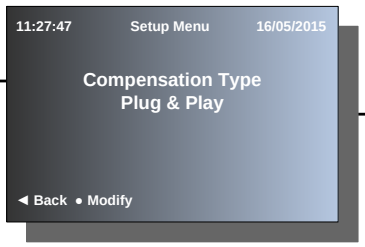
Inputs							Outputs					
No	**Function**	**Ref.**	**No**	**Function**	**Ref.**		**No**	**Function**	**Ref.**	**No**	**Function**	**Ref.**
1	Start/Reset	X1: I1	**10**	Cable Roll Out	X2: I10		**1**	400 Hz On	X1: O1	**9**	VFD Start/Stop	X3: O9
2	Stop	X1: I2	**11**	Limit 4 m	X2: I11		**2**	Interlock present	X1: O2	**10**	VFD In/Out	X3: O10
3	Aircraft Connector Insertion	X1: I3	**12**	Limit Stop Out	X2: I12		**3**	Aircraft Connector inserted	X1: O3	**11**	VFD Speed 1 VFD Speed 2	X3: O11
4	Connector Temp.	X1: I4	**13**	*Not used*	X21: I13		**4**	GPU Ready / Common Error	X1: O4	**12**	VFD Torque	X3: O12
5	NCR	X21: I5	**14**	Limit Stop In	X2: I14		**5**	*Not used*	X2: O5	**13**	400 Hz RDY 400 Hz Error	X4: O13
6	*Not used*	X1: I6	**15**	VFD Error	X4: I15		**6**	*Not used*	X2: O6	**14**	400 Hz On 400 Hz Off	X4: O14
7	Remote EPO	X14: I7	**16**	Emergency Roll Out	X4: I16		**7**	*Not used*	X2: O7	**15**	Plug Inserted Plug Uncon.	X4: O15
8	Door Interlock	X27: I8	**17**	*Not used*	X4: I17		**8**	*Not used*	X2: O8	**16**	Cable In Cable Out	X4: O16
9	Cable Roll In	X2: I9	**18**	GPU Enable	X4: I18							

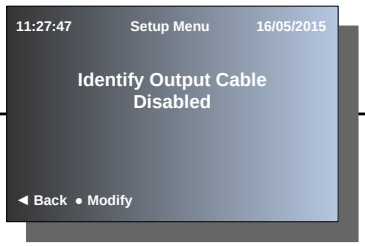
Note: please refer to the schematic at the back of the manual for further information.

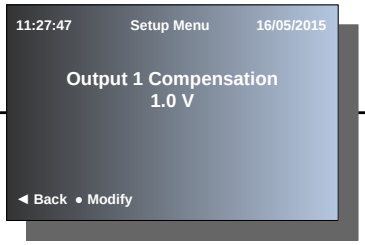
6.4.2 Setup – Menu structure











Highlight the  by using the navigation ◄▼▲► keys.

Press ● to select "Setup" sub-menu.

Use the ▼/▲ to browse through the various set-up lines / parameters. The selectable line will be highlighed in green.

Press ● to select the parameter you want to change.

Press ● to Modify parameter. Parameter will now be highlighted in green.

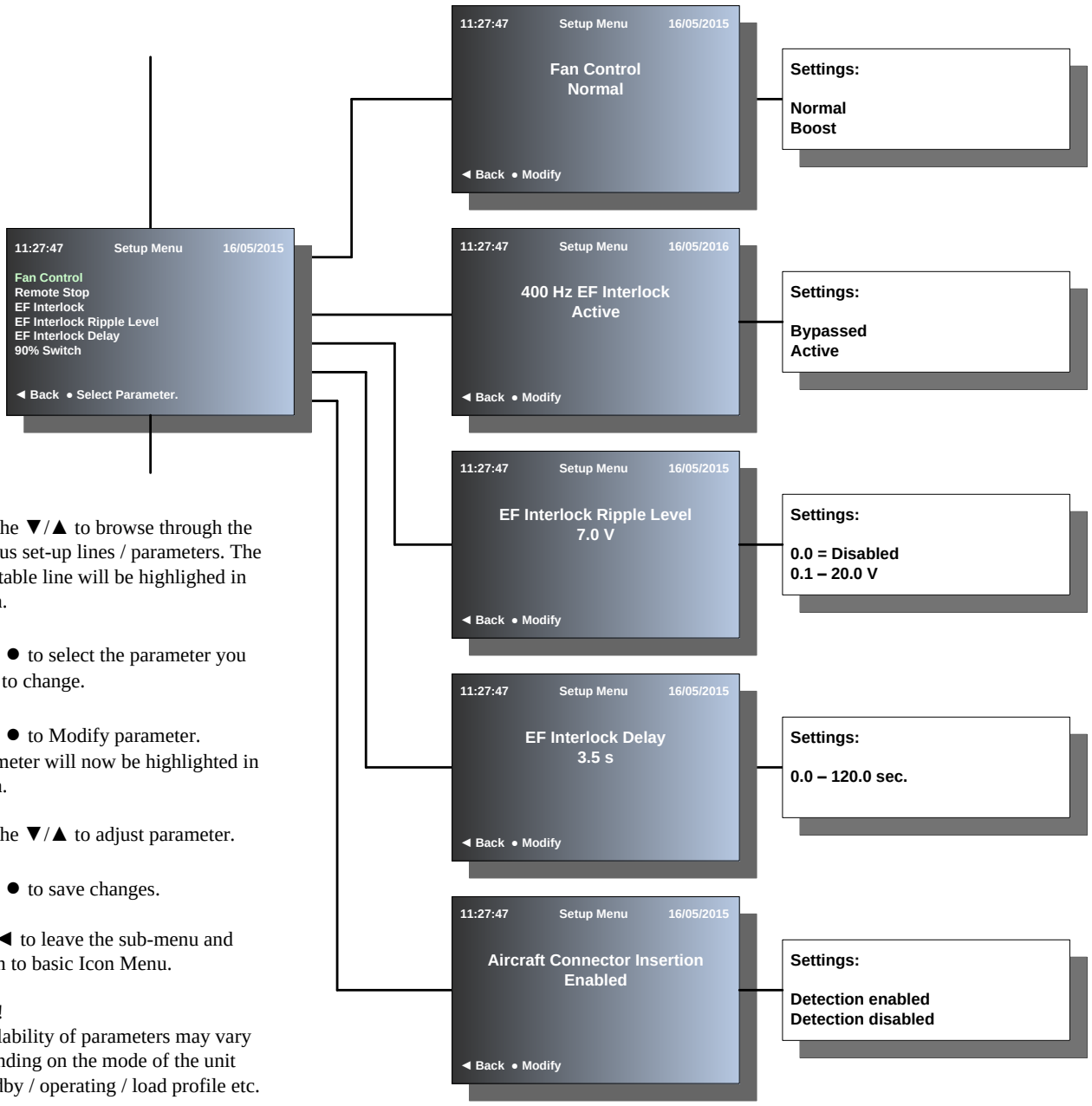
Use the ▼/▲ to adjust parameter.

Press ● to save changes.

Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Availability of parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

Setup (continued) – Menu structure



Use the ▼/▲ to browse through the various set-up lines / parameters. The selectable line will be highlighed in green.

Press ● to select the parameter you want to change.

Press ● to Modify parameter. Parameter will now be highlighted in green.

Use the ▼/▲ to adjust parameter.

Press ● to save changes.

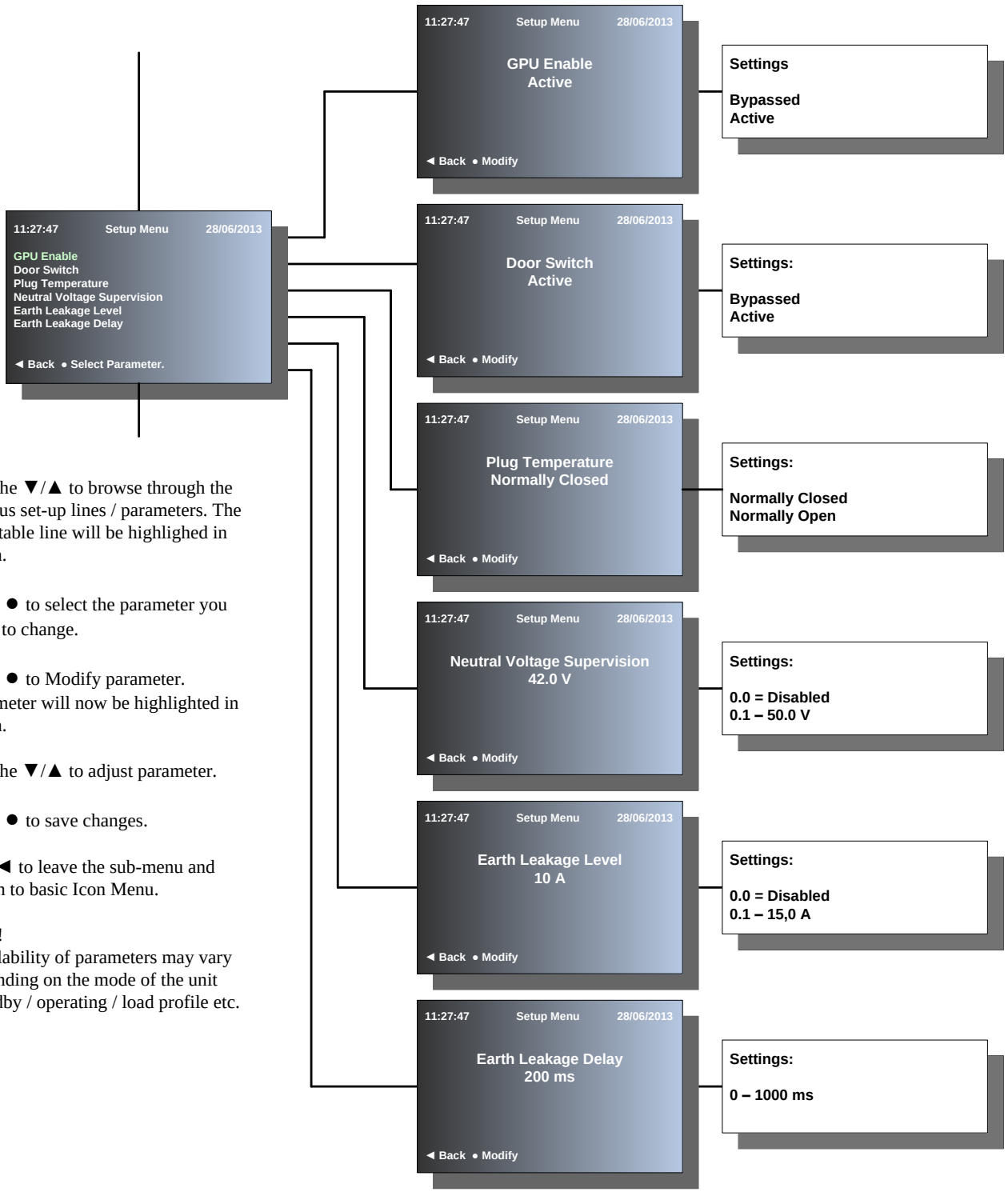
Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Availability of parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

Operation Manual - Hobart 2400 Power Coil – 60 - 90 kVA

Operator's Instructions

Setup (continued) – Menu structure



Use the ▼/▲ to browse through the various set-up lines / parameters. The selectable line will be highlighed in green.

Press ● to select the parameter you want to change.

Press ● to Modify parameter. Parameter will now be highlighted in green.

Use the ▼/▲ to adjust parameter.

Press ● to save changes.

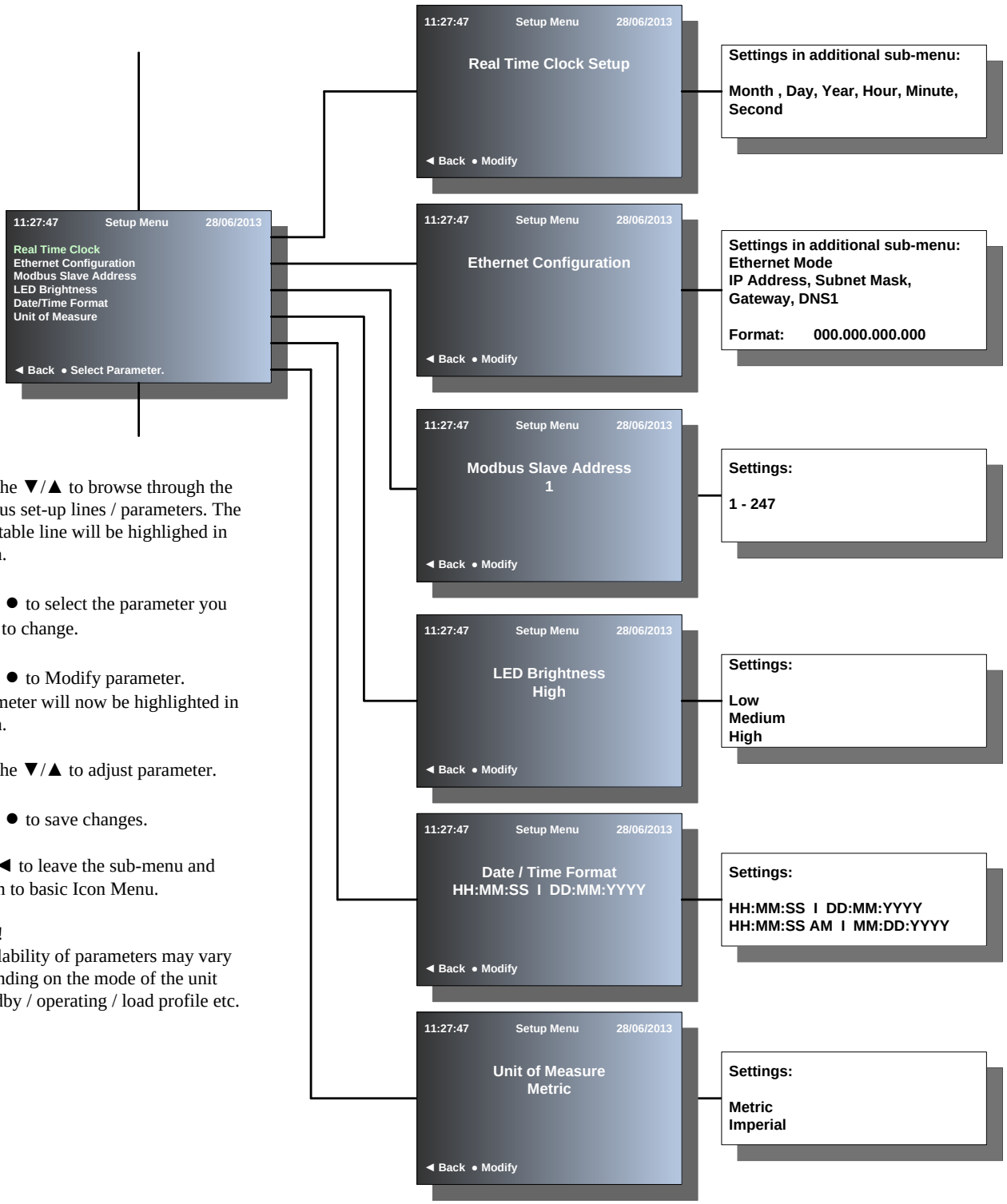
Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Availability of parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

Operation Manual - Hobart 2400 Power Coil – 60 - 90 kVA

Operator's Instructions

Setup (continued) – Menu structure



Use the ▼/▲ to browse through the various set-up lines / parameters. The selectable line will be highlighed in green.

Press ● to select the parameter you want to change.

Press ● to Modify parameter. Parameter will now be highlighted in green.

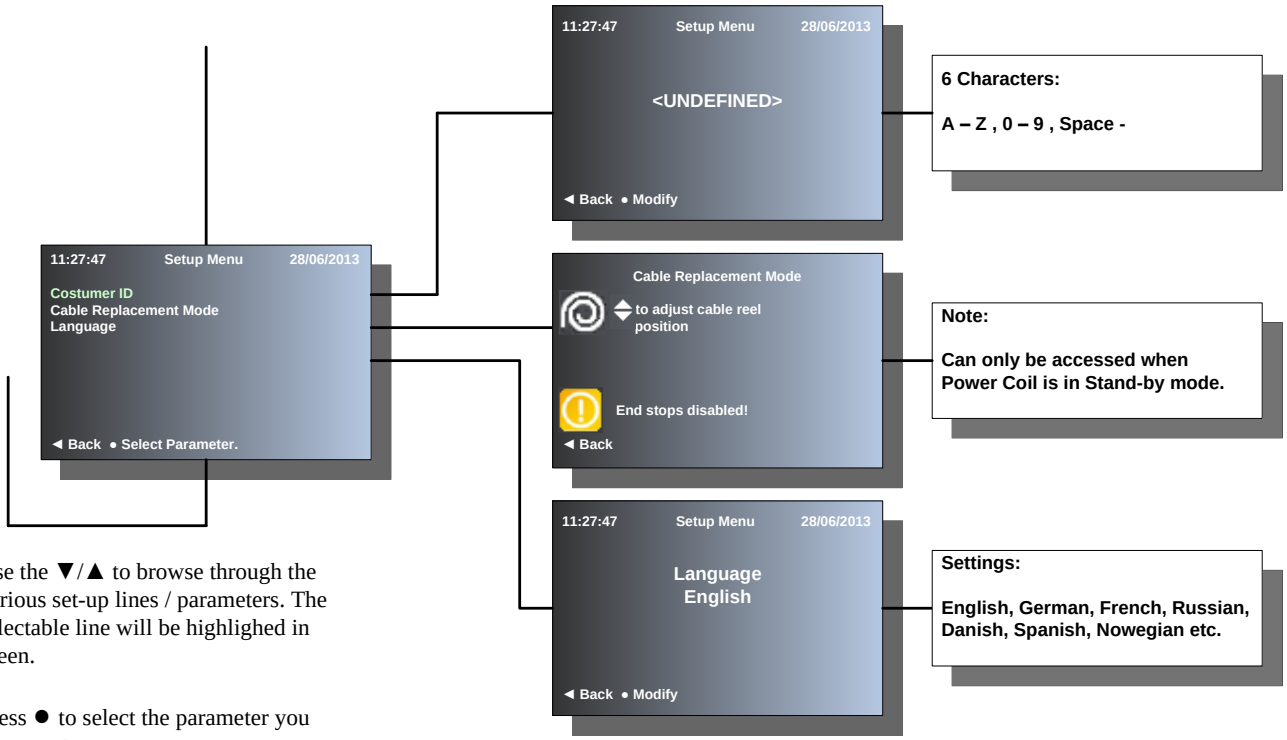
Use the ▼/▲ to adjust parameter.

Press ● to save changes.

Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Availability of parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

Setup (continued) – Menu structure



Use the ▼/▲ to browse through the various set-up lines / parameters. The selectable line will be highlighed in green.

Press ● to select the parameter you want to change.

Press ● to Modify parameter. Parameter will now be highlighted in green.

Use the ▼/▲ to adjust parameter.

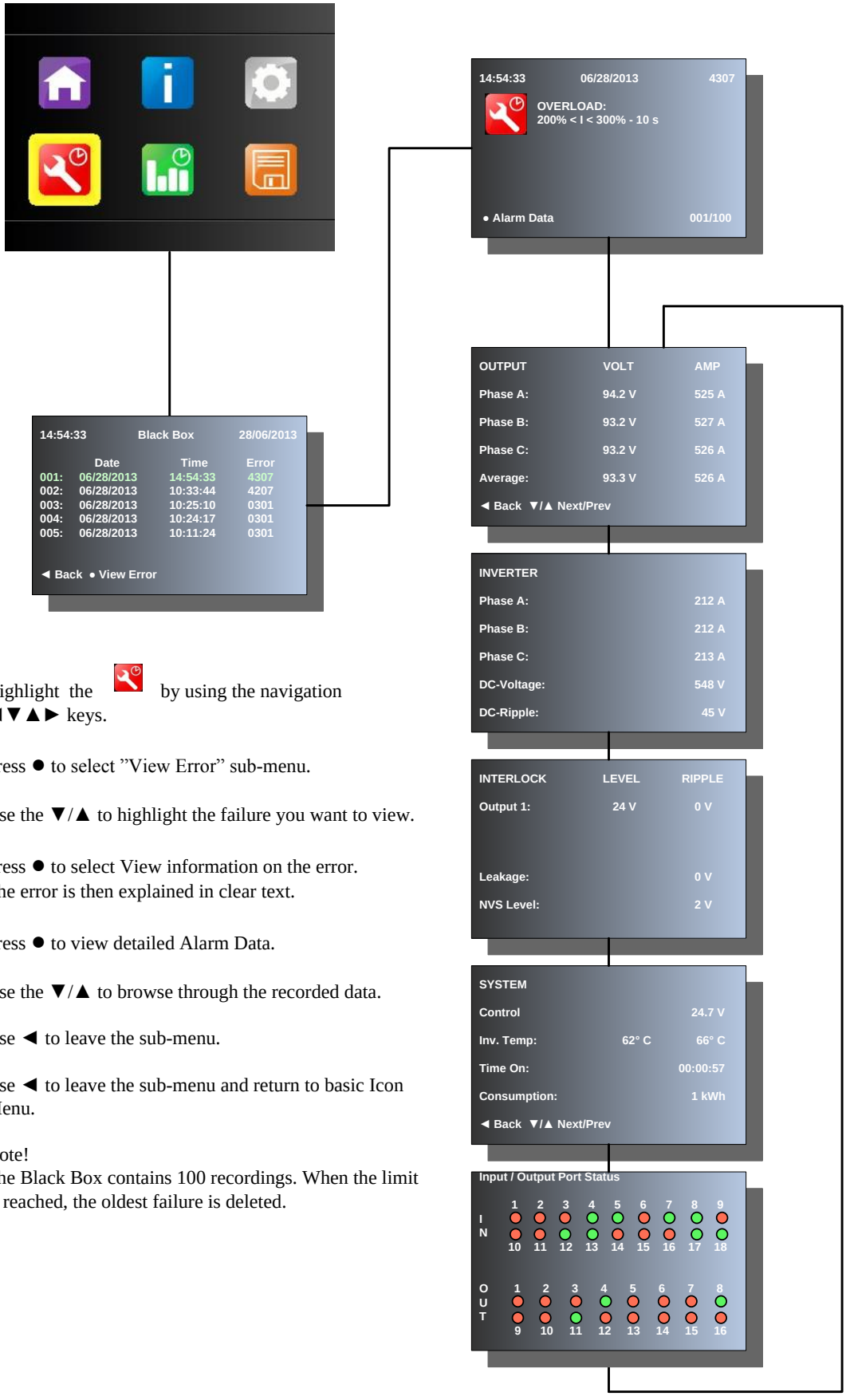
Note!
◄► can be used when entering Costumer ID

Press ● to save changes.

Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
Availability of parameters may vary depending on the mode of the unit Standby / operating / load profile etc.

6.4.3 Black Box – Menu structure



Highlight the by using the navigation ◄▼▲► keys.

Press ● to select "View Error" sub-menu.

Use the ▼/▲ to highlight the failure you want to view.

Press ● to select View information on the error.
The error is then explained in clear text.

Press ● to view detailed Alarm Data.

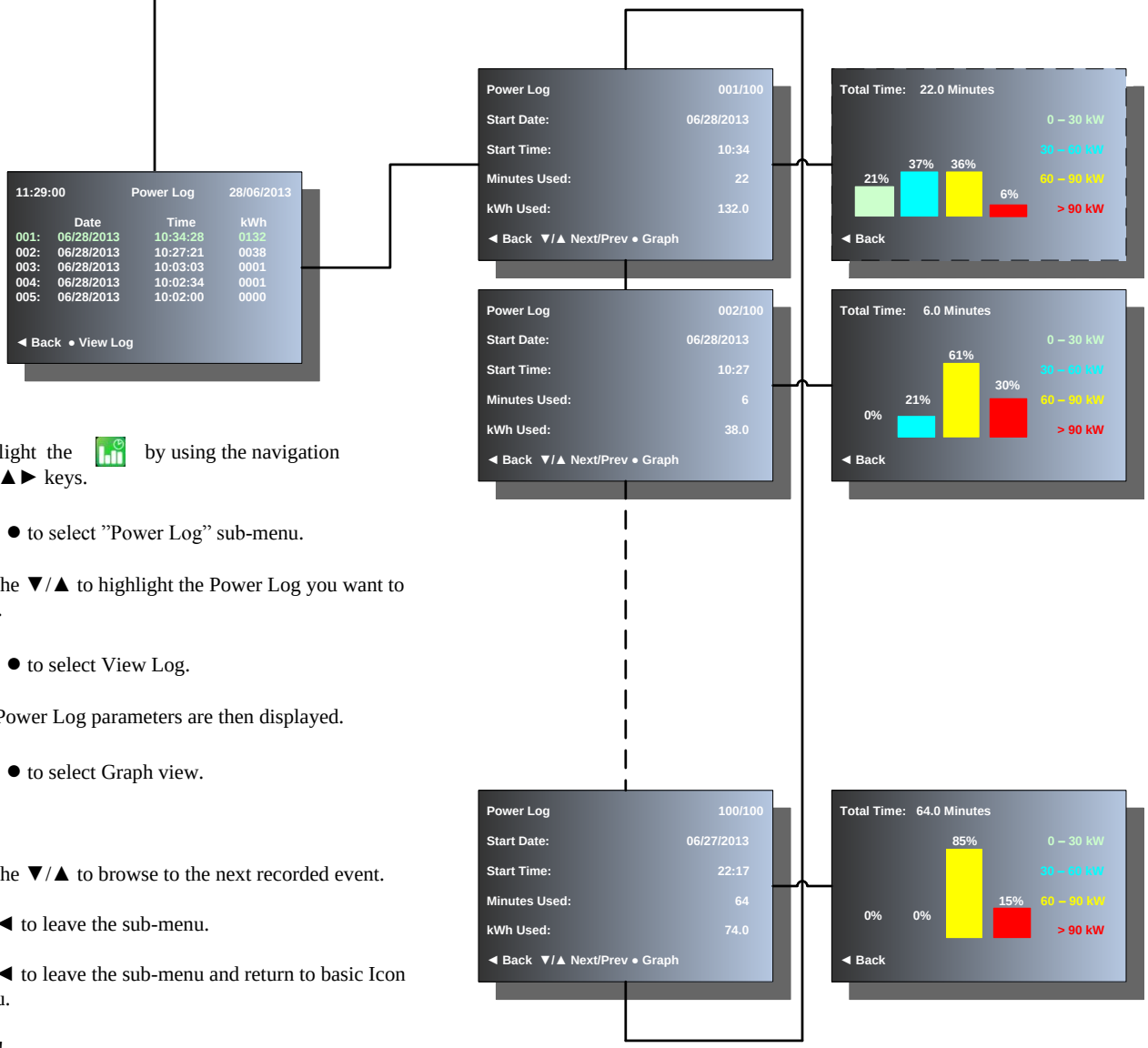
Use the ▼/▲ to browse through the recorded data.

Use ◄ to leave the sub-menu.

Use ◄ to leave the sub-menu and return to basic Icon Menu.

Note!
The Black Box contains 100 recordings. When the limit is reached, the oldest failure is deleted.

6.4.4 Power Log – Menu structure



Highlight the by using the navigation ◄▼▲► keys.

Press ● to select "Power Log" sub-menu.

Use the ▼/▲ to highlight the Power Log you want to view.

Press ● to select View Log.

The Power Log parameters are then displayed.

Press ● to select Graph view.

or

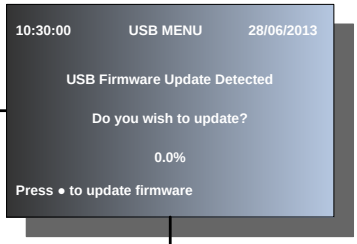
Use the ▼/▲ to browse to the next recorded event.

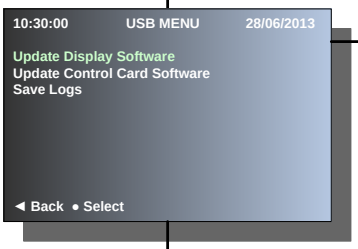
Use ◄ to leave the sub-menu.

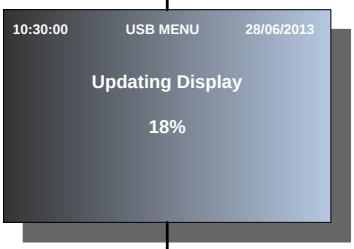
Use ◄ to leave the sub-menu and return to basic Icon Menu.

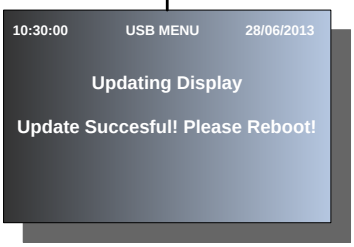
Note!
The Power Log contains 100 recordings. When limit is reached, the oldest Log is deleted.

6.4.5 Save/Upload – Menu structure









Highlight the  by using the navigation ◄▼▲► keys.

Press ● to select "USB Menu" sub-menu.

The default, green highlighted function is: "Update Display Software" otherwise use the ▼/▲ to highlight the function "Update Display Software".

Before pressing ● to select "Update Display Software", please remember to insert a USB stick into the USB port on the Display (located on the back of the front door).

Press ● to select function.

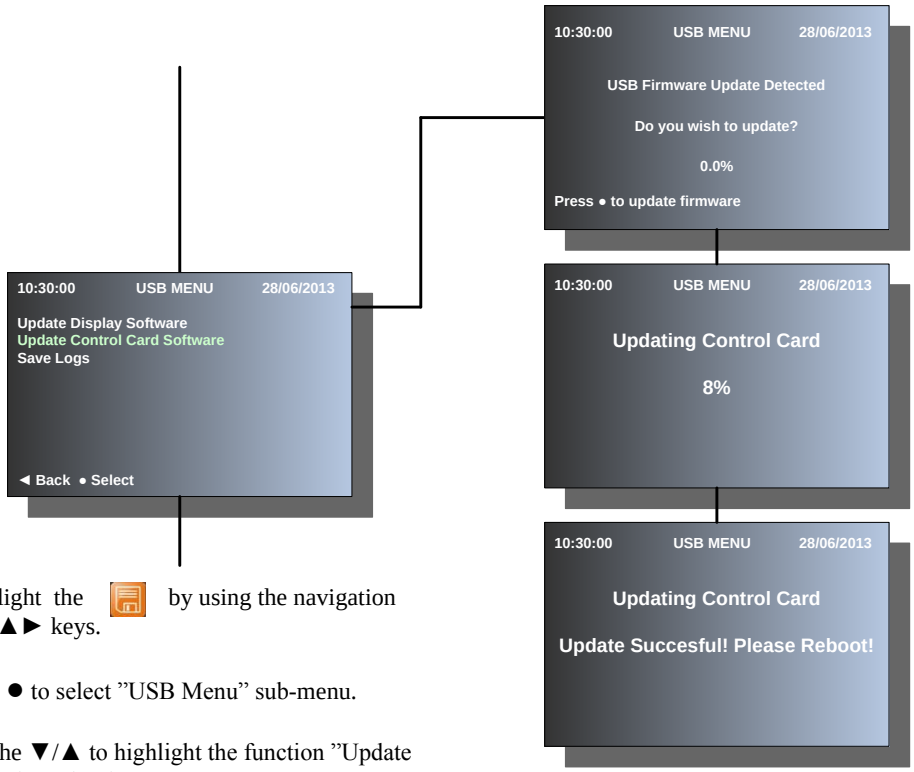
Press ● to confirm update firmware.

The firmware is now being uploaded to the display card. Upload % is counting from 0% to 100% and **"Update Succesful! Please reboot"** is displayed, when the update has been completed.

To Reboot the unit, press ● button.

USB connection Display

Save/Upload (continued) – Menu structure



Highlight the by using the navigation ◄▼▲► keys.

Press ● to select "USB Menu" sub-menu.

Use the ▼/▲ to highlight the function "Update Control Card software".

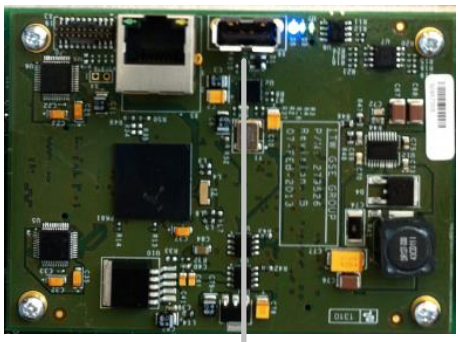
Before pressing ● to select "Update control card software", please remember to insert an USB stick into the USB port on the control card (located on the interface board).

Press ● to select function.

Press ● to confirm update firmware.

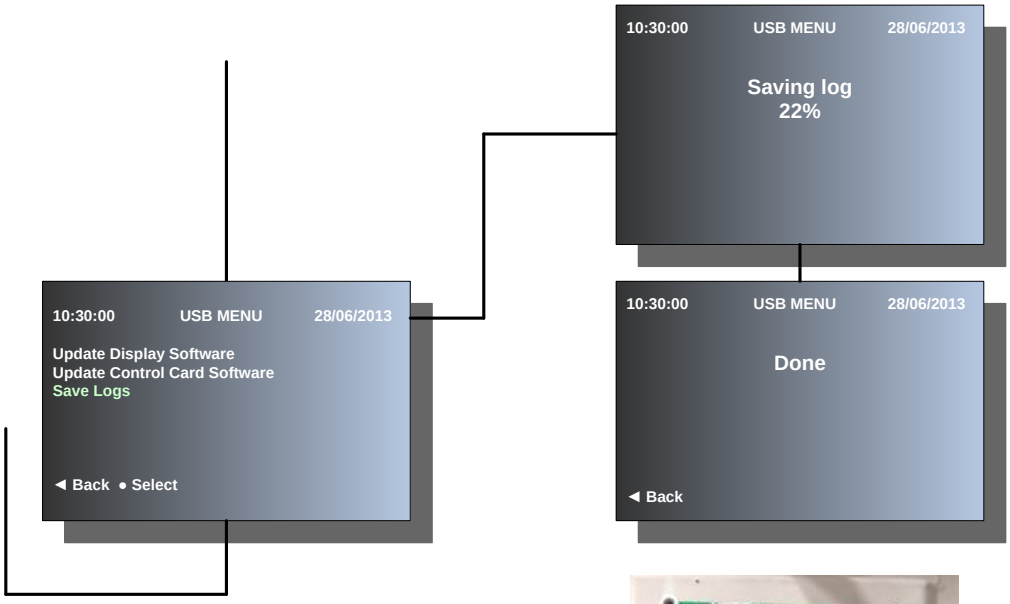
The firmware is now being uploaded to the control card. Upload % is counting from 0% to 100% and "Update Succesful! Please reboot" is displayed, when the update has been completed.

To Reboot the unit, press ● button.



USB connection Control card

Save/Upload(continued) – Menu structure



Highlight the  by using the navigation ◄▼▲► keys.

Press ● to select "USB MENU" sub-menu.

Use the ▼/▲ to highlight the function "Save Logs".

Before pressing ● to select Save logs, please remember to insert a USB stick into the USB port on the display (loacted on back of the front door).

Press ● to select function.

The logs are now saved to the USB stick. Saving log % is counting from 0% to 100% and "Done" is displayed, when the saving has been completed.

The logs are saved as one CSV File and can be viewed with the **ITW GSE Service Tool**.

Note!
The USB stick can be inserted while the unit is connected to the power.

6.5 Default Factory Settings:

Output Voltage (V):	115.0
Compensation Type:	Plug & Play
Fan Control:	Normal
Remote Stop:	Normally Open
EF Interlock:	Active
EF Interlock Ripple Level (V):	20.0
EF Interlock Delay (sec.):	3.5
Aircraft Connector Insertion:	Enabled
GPU Enable:	Bypassed
Door Switch:	Bypassed (Active with option 578805)
Plug Temperature:	Normally Open
Neutral Voltage Supervision (V):	42.0
Earth Leakage Level (A):	15.0
Earth Leakage Delay (ms):	1000
Real Time Clock Setup:	Actual (Manufacturer's location)
Ethernet Configuration:	192.168.1.100
Modbus Slave Address:	1
LED Brightness:	Medium
Date/Time Format:	HH:MM:SS & DD:MM:YYYY
Unit of Measure:	Imperial
Language:	Actual

7.0 Set-up Lock / Output Mode / Compensation

7.1 Preventing changes of set-up parameters

To avoid unintentional modification of the Set-up parameters, it is possible to block the access to the Set-up Mode, by means of a DIP switch situated at the Display Board A3.

Note!
If the DIP switch is set to blocked, pressing the SW1 enables the user to enter the set-up menu within 10 seconds. After the time elapses the menu will be blocked again.

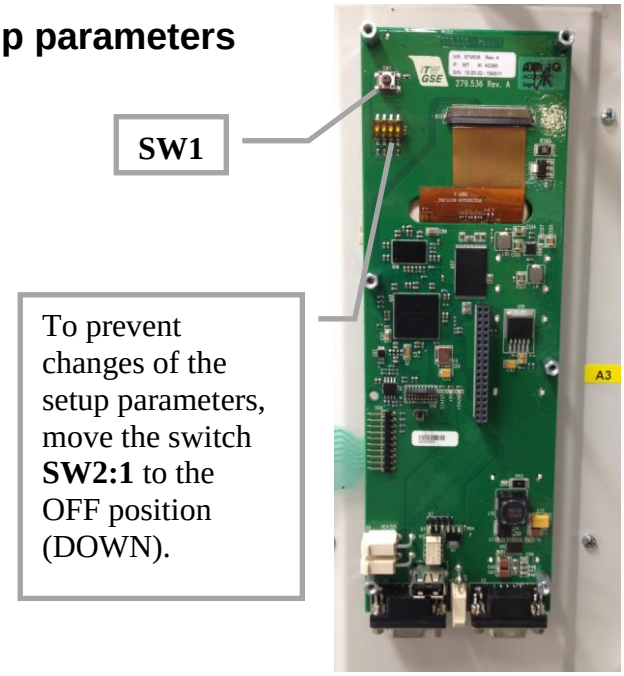


Fig. 7.1.1 Display Board A3

7.2 Output Voltage:

This setup submenu allows the output voltage to be adjusted between 80.0 VAC and 135 VAC using the UP and DOWN navigation buttons. (Please note that the acceptable voltage range for all commercial aircraft is 115 V ±3V. This range is even tighter for some aircraft.)

Enter the Setup Menu and then scroll up or down to the Output Voltage submenu. Press the center ● button to enter the submenu, and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return the submenu list.

7.3 Plug & Play Cable compensation:

The unique Plug & Play compensation system automatically identifies all relevant cable parameters and keeps the voltage at the aircraft connector constant, at all aircraft loads.

1. Short circuit the aircraft connector using the Auto Calibration Plug (P/N 591100).
2. Select compensation type to “PLUG & PLAY” via Setup Mode.
3. Change “IDENTIFY OUTPUT” to “ENABLE”

4. Initiate the cable identification process by pressing the ground power unit's START button. 

5. Within a few seconds, the cable parameters are identified and the ground power unit returns to Standby Mode.

6. Remove the Auto Calibration Plug and the ground power unit is ready for use.

7.4 Manual Compensation:

This is the traditional method of cable compensation. The output voltage is increased in proportion to the load current (Volt / 100 A). The method is used where the influence of unsymmetrical cables, unbalanced load and varying power factor can be neglected.

1. Apply full load to the output 1 aircraft connector.

2. Select compensation type "MANUAL" via Setup Mode.

3. Select "OUTPUT 1 COMPENSATION".

4. Adjust the compensation using the vertical arrow buttons until the voltage at the aircraft connectors equals the no load value.

7.5 Fan Control

The default is set to Normal. This allows the software to control the speed of the fan based on the internal temperature of the unit. Boost mode should be selected when the GPU is running in a high ambient temperature area at full load and the unit is used more or less continuously due to short turnaround times at the gate. When the Boost mode is selected, after the unit has been used, the fans keep running for 20 minutes to cool down the magnetics, this ensures that the starting temperature for the magnetics will be close to the ambient temperature before starting the next cycle of operation.

Enter the Setup Menu and then scroll up or down to the Fan Control submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.6 EF Interlock

The EF interlock is a personnel and equipment safety feature that is found in all commercial aircraft**.** This 28VDC signal will not be present until the SSFC closes its output contactor and provides 400 Hz power to the aircraft. The aircraft will evaluate the 400 Hz power and if it is within the aircrafts tolerance limits it will then close a relay in the aircraft to provide a 28VDC signal to the “F” pin/wire in the power connector plug/cable.

Some load banks do not provide this EF Interlock so the EF interlock function in the unit has to be bypassed. Do not set this value to Bypassed for normal operation with aircraft. This setting is only to be used by qualified personnel for testing the SSFC unit or when the unit will be providing power to equipment outside of an aircraft.

Note! The value will be automatically reset to Active if the unit detects 28 volts on the "F" pin input of the I/O board.

Go into the Setup Menu and then scroll up or down to the EF Interlock submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.7 EF Interlock Ripple Level

The EF Interlock Ripple Level is part of the Neutral Voltage Displacement circuit. If an aircraft has a large unbalanced load and the aircraft power cable has a broken neutral, then it is possible for the aircraft frame to be energized to a dangerous level. This condition will result in an AC voltage induced onto the EF DC signal.

This sub-menu sets the trip level for the AC ripple on the DC EF interlock signal. The default value is 20.0 volts and a setting of 0.0 volts disables the function.

Go into the Setup Menu and then scroll up or down to the EF Interlock Ripple Level submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.8 EF Interlock Delay

Some of the newer aircraft take a longer time between when 400 Hz power is supplied to the aircraft and when the aircraft returns the 28 VDC EF Interlock signal. This setting allows the adjustment of the amount of time the unit will wait until determining that the EF signal is not present and that the output power should be shut off. The default value is 3.5 seconds.

Go into the Setup Menu and then scroll up or down to the EF Interlock Delay submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.9 Aircraft Connector Insertion

Some aircraft power cables are equipped with a micro-switch or split "F" pin in the connector. This device sends a 28 VDC signal to the unit when the connector is inserted at least 90% of the way into the aircraft power receptacle. Set this sub-menu value to Enable when such a cable is connected to the unit. The default value is set to Disable.

Go into the Setup Menu and then scroll up or down to the Aircraft Connector Insertion submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.10 GPU Enable

Some airports utilize a key card reader or key lock to keep track of who is using the GPU. This feature prevents the GPU from turning on the output unless the GPU Enable signal is present. The default value is Bypassed.

Go into the Setup Menu and then scroll up or down to the GPU Enable submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.11 Door Switch

Some GPU units have a door interlock switch installed on the front door. When the front door is opened the unit will shut off when this sub-menu is set to Active. Use this sub-menu to bypass the door switch during maintenance operations.

Go into the Setup Menu and then scroll up or down to the Door Switch submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.12 Plug Temperature

Underneath the last turn of the output cable which is always on the drum a thermostat is placed. This thermostat ensures that the output cable does not reach a critical temperature and a hazardous situation can occur. If the limit of the thermostat is reached the unit will shut off the output power and report an error in the display indicating that the cable has reached too high a temperature.
This sub-menu allows the unit to accept Normally Opened or Normally Closed temperature sensor switches to be used.

Go into the Setup Menu and then scroll up or down to the Plug Temperature submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.13 Neutral Voltage Supervision

If the output Neutral wire is not connected to the chassis ground then the unit can monitor the voltage difference between aircraft neutral and ground. If the voltage is greater than the set value (typically 42 volts) an unsafe condition exists and the unit will shut off the output power. The default value is 42 volts and the function is disabled if the value is set to 0.0 volts.

Go into the Setup Menu and then scroll up or down to the Neutral Voltage Supervision submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.14 Earth Leakage Level

If the output Neutral wire is connected to the chassis ground and the neutral wire breaks while there is an unbalanced aircraft load then an unsafe condition exists. This function monitors the current in the ground wire. If the current exceeds the set value (typically 15 A) for a set time (set in the Earth Leakage Delay sub-menu), an unsafe condition exists and the unit will shut off the output power. The default value is 15 A. The function is disabled if the value is set to 0.0 A.

Go into the Setup Menu and then scroll up or down to the Earth Leakage Level submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.15 Earth Leakage Delay

This sub-menu is used in conjunction with the Earth Leakage Level sub-menu. The default value is 1000 ms.

Go into the Setup Menu and then scroll up or down to the Earth Leakage Delay submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.16 Real Time Clock Setup

This set of sub-menu s allows the user to adjust the internal clock to the correct local time.

Go into the Setup Menu and then scroll up or down to the Real Time Clock Setup submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.17 Ethernet Configuration

This set of sub-menu s allows the user to enter the Ethernet IP address, Subnet Mask, Gateway address and DNS1 values for TCP/IP communications with a BMS or RMS central monitoring system.

Go into the Setup Menu and then scroll up or down to the Ethernet Configuration submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.18 Modbus Slave Address

If the unit will be part of an RS-485 Modbus RTU BMS/RMS monitoring system, it must be assigned a Modbus Slave Address. This sub-menu allows the user to enter the slave address.

Go into the Setup Menu and then scroll up or down to the Modbus Slave Address submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.19 LED Brightness

The unit status LED's have three brightness levels. The default is set to medium.

Go into the Setup Menu and then scroll up or down to the LED Brightness submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.20 Date/Time Format

The date and time format that is displayed on all of the screens and reports can be adjusted using this submenu. The selection is a 24 hour clock and DD:MM:YYYY date format or a 12 hour clock with the MM:DD:YYYY date format.

Go into the Setup Menu and then scroll up or down to the Date/Time Format submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.21 Unit of Measure

This submenu is used to set the unit of measurements to Metric or Imperial.

Go into the Setup Menu and then scroll up or down to the Unit of Measure submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.22 Costumer ID

This submenu allows the user to assign a name to the unit for reporting purposes when Fault or Power Log files are saved to a USB stick or drive.

Go into the Setup Menu and then scroll up or down to the Costumer ID submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.23 Cable Replacement Mode

This submenu allows the user to enter the Cable Replacement Mode. See 8.2 for more information about this mode.

Go into the Setup Menu and then scroll up or down to the Cable Replacement Mode submenu. Press the center ● button to enter the submenu, a new screen is shown and the unit is in the Cable Replacement Mode. Press the LEFT arrow button to exit the Cable Replacement Mode and return to the submenu list.

7.24 Language

This submenu is used to change the language that all of the display screens, messages, alarms and reports are displayed in. The unit comes with Danish, English, German, French and Spanish already installed. The default is set to English.

Go into the Setup Menu and then scroll up or down to the Language submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

8.0 Service, Maintenance, Overhaul

To make certain that the unit is always ready for use it must be maintained on a regular basis.

Only qualified personnel should remove covers for service, maintenance or overhaul purposes.

8.1 Recommended Maintenance Schedule

The recommended maintenance plan for the Power Coil is shown below. Additional maintenance instructions regarding the positions marked with a # in the table can be found at the end of this chapter.

Pos.	**Check**	Check Interval		
		Monthly	Quarterly	Yearly
01.	Output cable and aircraft connector visually for possible damage including reduced insulation due to excessive wear or bad relief.	x		
02.	Aircraft connector contacts and push buttons/LEDs. Clean contacts if necessary.	x		
03.	Visual inspection of power contacts A, B, C & N. Visual inspection of interlock contacts E & F.	x		
04.	Micro-switch contact, located in F pin of plug. (LED is lit when activated).	x		
05.	Visual check for any accumulation of dirt inside the cable coil section – remove and clean as appropriate.		x	
06.	Visual check of the output cable relief and connections to the cable drum (tighten or correct if necessary).		x	
07.	Visual check of the integrity and function of the cable guide if possible during operation of the drum – tighten and clean if necessary.		x	
08.	Visual check that the drum/gear-motor bearings are working smoothly during operation of the cable drum.		x	
09.	Position of limit stop switches by letting the cable reach all limits (adjust and check fixation of the limit switches if necessary) #.		x	
10.	Air inlet / Air Outlet filters. Wash or change as appropriate.		x	
11.	Visual check of the flexible power & control cables in the drum for possible damages (only via removed side covers) #.			x
12.	Check that all fans are running properly (i.e. fan set to “Boost” via display setup menu).			x
13.	Check internal bolt/screw and wire connections (tighten if necessary)			x

14.	Visual inspection of components and printed circuit boards i.e. – control unit / gate drives.			x
15.	Check of the output contactor's contact sets and coil. (clean or replace if necessary)			x
16.	Check output voltage at aircraft connector with and without load (adjust if necessary)			x
17.	Check cabinet rubber sealing at all covers including the top rain cover. (repair or replace if necessary)			x

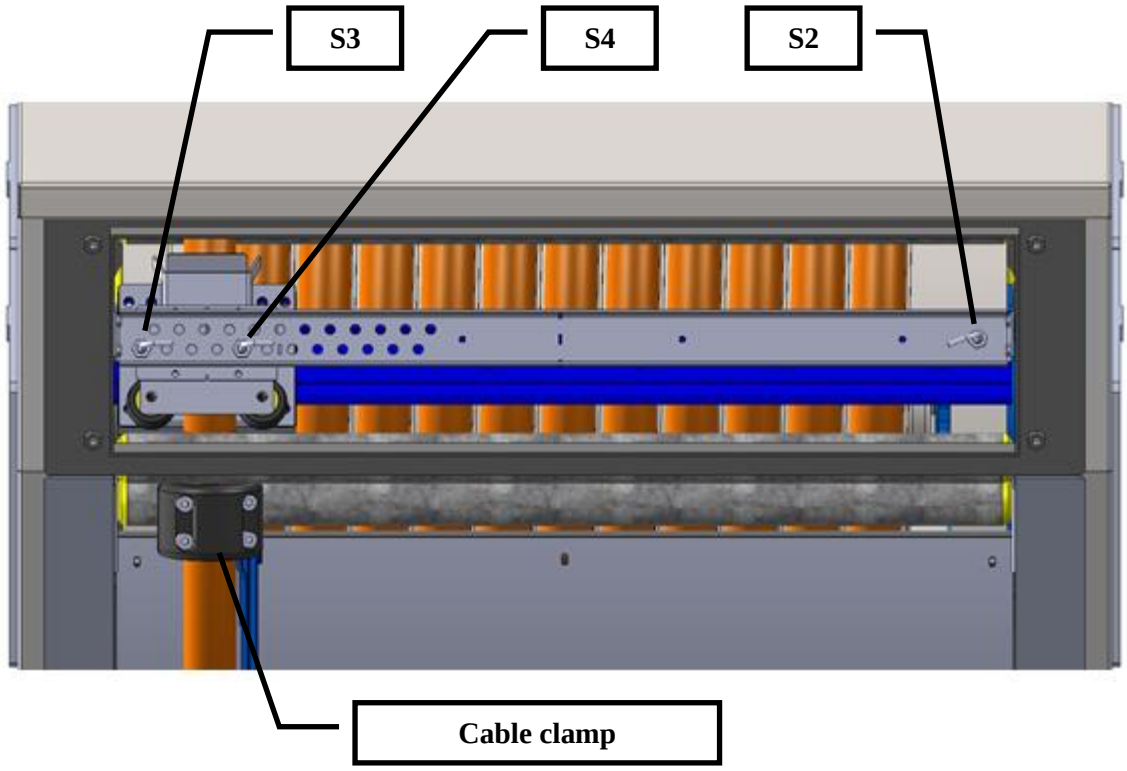
 # Position 09: Limit stop switches:

Verify the position of the limit stop switches by coiling the cable to its end positions.
The following adjustment applies for the three switches:

S3: When activated, the aircraft cable should be fully coiled.
Observe that the cable clamp is touching the cable guidance inlet rollers.

S4: Must be activated shortly before the cable leaves the ground (standard 4 meter cable out).

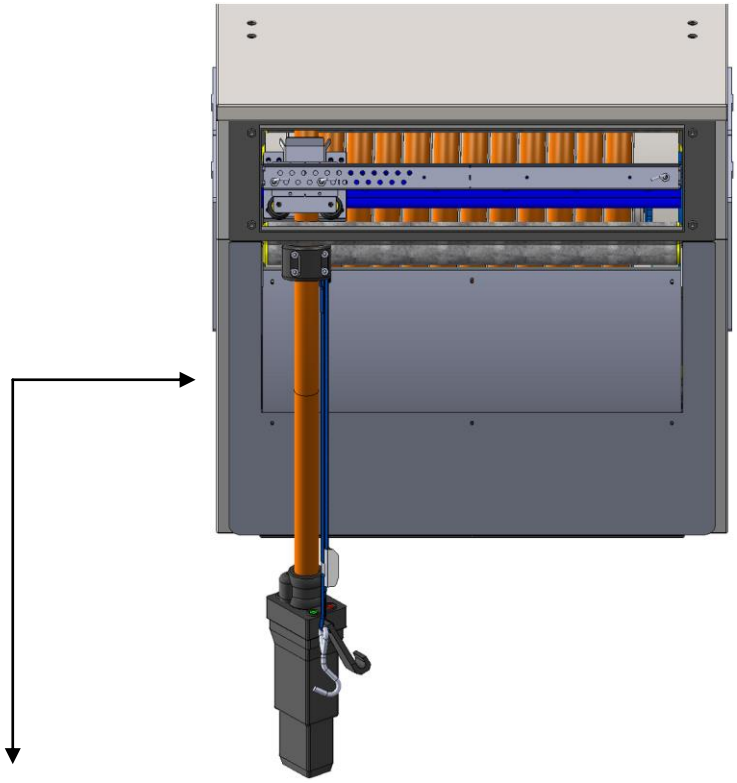
S2: When activated, the output cable should be almost fully uncoiled.

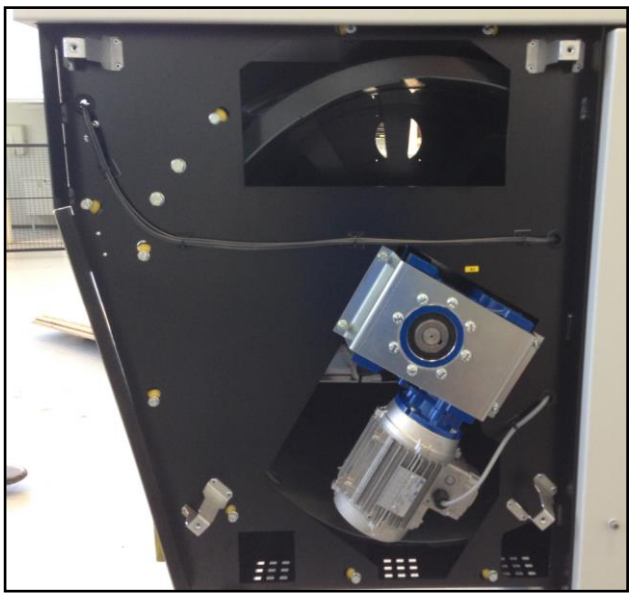


Note:
Position of limit switches S3 & S4 may vary depending on cable length.

 # Position 11: Flexible cable harness & control cables:

Depending on the accessibility of the Power Coil at the point of installation, the visual inspection of the flexible cable harness & control cables inside the drum can be carried out through both side covers. Check the cables for any sign of damage at fixation points, joints and shrink tubes.



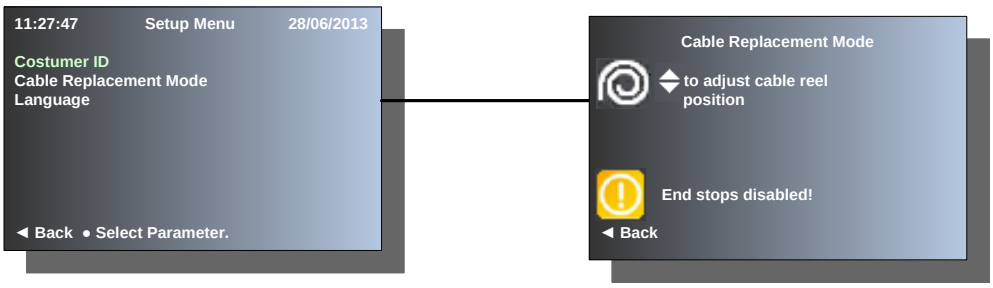


Inspection of the flexible cable harness & control cables via
the removed side panels and through the holes in the drum.

8.2 Cable Replacement Mode

The Hobart 2400 Power Coil has a feature called “Cable Replacement Mode”. The feature enables the maintenance crew to bypass the limit switches and rotate the coil in low speed during inspection of the flexible power & control cables located inside the drum or when changing the output cable on the drum.

The Cable Replacement Mode is accessed via the set-up menu.



1. **The menu can only be accessed when the unit is in standby.**

2. **All limit switches are bypassed and cable is able to coil / uncoil beyond the adjusted stops.**

8.3 Battery back-up & replacement

Situated on the back of the control board, is a coin type lithium battery which ensures that Firmware / Set-up data etc. are not lost during input power drop-outs. The expected life of the battery is approximately 7 years. However, a low battery voltage does not affect the internal safety system of the GPU that monitors the output voltage, among others. Thus aircraft connected to the GPU are not exposed to any danger. To avoid loss of data and Control Board lock up *, we recommend changing the battery after **5 years** of use.

To ensure high reliability of the back-up battery, the only type of battery that can be used on the Control Board is the Panasonic BR-2032

How to change the battery:

Before removing the Control Board and to avoid any static discharge to the Control Board during the replacement of the battery, please take ESD (Electro Static Discharge) precautions.

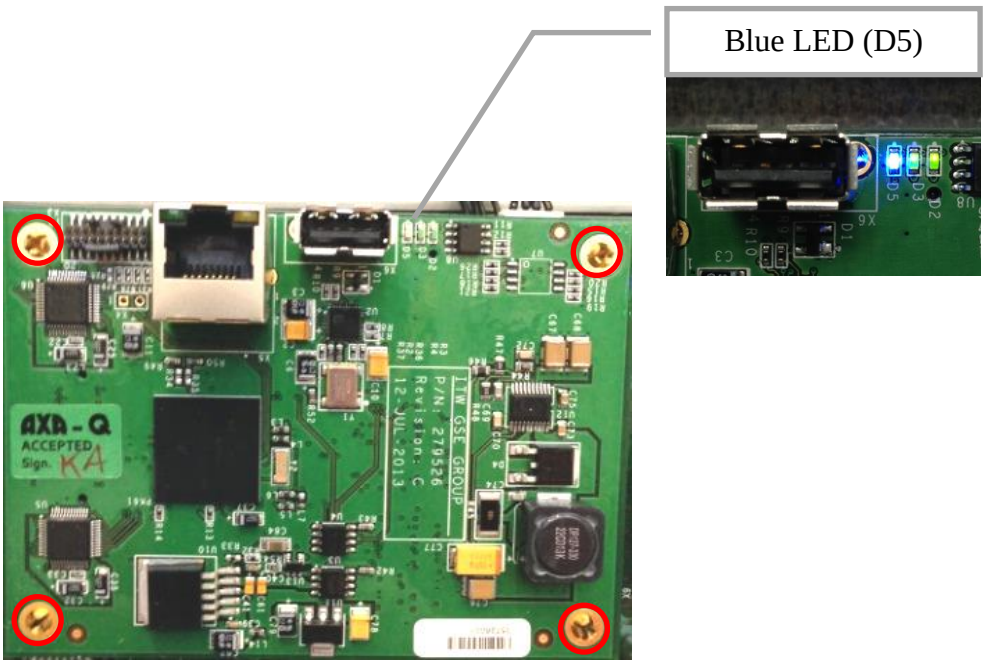


Fig. 8.2.1 Control Board (front view)

To replace the battery, **Switch OFF** the unit by means of Q1. Remove the 4 screws that holds the Control Board, marked with a ○ . Place the PCB on an insulated surface, with the back side face up.

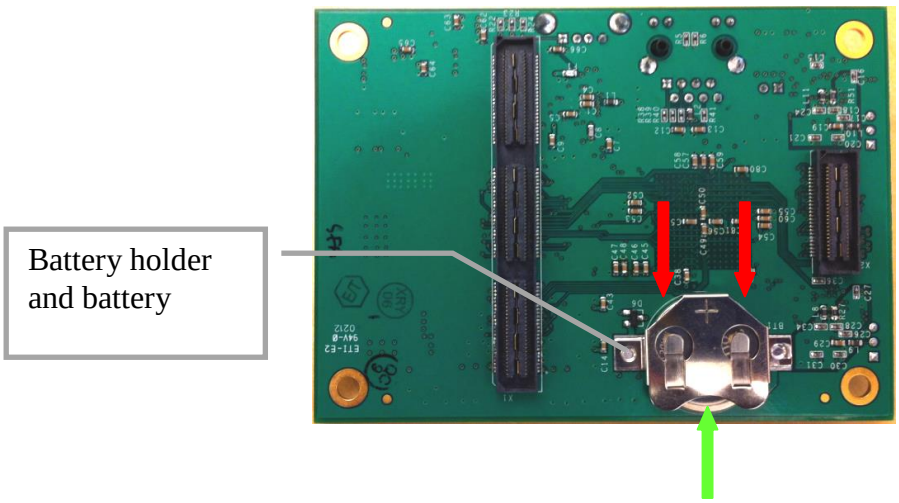


Fig. 8.2.2 Control Board (rear view)

Before you remove the battery from the holder, make sure that the replacement battery is within reach, as the **Control Board must not be without battery power for more than 30 seconds**.
Otherwise, all firmware and the setup data will be erased. *

Remove the battery from the holder using a small insulated screwdriver to push out the battery, direction indicated by the red arrows and insert the new battery in the direction of the green arrow.

Mount the control board on the interface board again by gently pressing the PCB to its rest on the Interface Board. Make sure that all 4 corners are fully pressed towards the Interface Board.

Switch on the unit via the input switch Q1 and close the door. The unit now passes through the initialization test and goes into standby mode.

* Important Note!

If the blue LED on the Control Board (location can be found on the Fig. 8.2.1) flashes with approximate 2 flashes per second and the display reports “Communication Error”, the firmware on the Control Board has been erased.
The Control Board must be sent to ITW GSE to be reprogrammed.

9.0 Trouble Shooting & Repair

Only have qualified personnel remove covers for troubleshooting and repair. Please be aware that the DC capacitors can remain charged to a dangerous voltage **up to 5 minutes** after the mains input power has been disconnected.

Usually the display text provides sufficient information to get the ground power unit into operation again. In case the display is blank, please check Q4 (Circuit Breaker) and fuse F3 at the Interface Board A2 (corresponding LED D8). The following fuses are located on the Interface Board (A2):

Fuse #	Applicable for	Type	Rated voltage	Amp rating
F1 (D24)	I/O Fuse	ATO Blade Fuse	32 V	2 A
F2 (D24)	I/O Fuse	ATO Blade Fuse	32 V	2 A
F3 (D8)	Display Fuse	ATO Blade Fuse	32 V	2 A
F4 (D2)	Interface Fuse	ATO Blade Fuse	32 V	5 A
F5 (D4)	Fan Fuse	ATO Blade Fuse	32 V	10 A

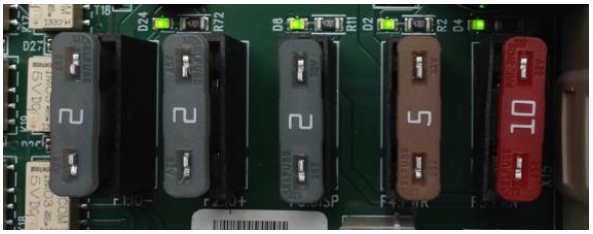


Fig. 9.0.1 Fuses F1-F5 and LED indication (A2 Interface Board)

If the displayed text does not provide sufficient information to solve the problem, Table 1, Table 2 and Table 3 (Section 9.1) suggest corrective actions to be carried out for each error code.
Additional error information regarding the output voltage, overload, covering the error codes area can be derived from the error code according to the following directions:

Output Voltage : 30xx / 31xx / 35xx
Overload : 40xx / 41xx / 42xx / 43xx / 44xx / 45xx / 46xx / 47xx

Phase code:
xx01 = Phase A
xx02 = Phase B
xx03 = Phase A & B
xx04 = Phase C
xx05 = Phase A & C
xx06 = Phase B & C
xx07 = Phase A, B & C

Examples: Error Code 3501 refers to “Output Voltage Too Low” at phase A.
Error Code 4407 refers to “Overload I > 300% - 1 sec.” at all 3 output phases.

9.1 Fault Guidance

In case you need to contact us for further fault guidance, please contact technicalsupport@itwgse.us

List below shows the complete list of error codes and first corrective action:

Error code	Error text in display	Help text	1st. Corrective action
0	NO ERRORS		
100	LOGGING UNSUCCESSFUL		Press start to reset
200	CONTROL BOARD FAILURE	Watchdog Timeout	
201	CONTROL BOARD FAILURE	CRITICAL: Memory Error	
202	WRONG SOFTWARE VERSION		Install correct software version
300	CONTROL VOLTAGE LOW	Control Voltage < 20V (Running)	Press start to reset
301	CONTROL VOLTAGE LOW	Control Voltage < 20V (Standby)	
350	F1 OR F2 FUSE BLOWN		Replace fuse F1 and press start to reset
400	EMERGENCY STOP ACTIVATED		Release emergency stop and press start to reset
800	INPUT VOLTAGE TOO LOW	Voltage < 340V – 500ms	Press start to reset
900	INPUT VOLTAGE TOO HIGH	Voltage > 460V – 500ms	
1000	SOFTSTART ERROR	DC Voltage < 400V	
1100	DC VOLTAGE TOO LOW	DC Voltage < 300V - 30ms	
1200	DC VOLTAGE TOO HIGH	DC Ripple > 10V – 5s	
1201	DC VOLTAGE TOO HIGH	DC Voltage > 800V – 30 s	
1202	DC VOLTAGE TOO HIGH	DC Voltage > 850V - 2.5ms	
1300	DC CAPACITOR SHARING ERROR	DC Voltage > 850V	
1400	DC RIPPLE TOO HIGH	DC Ripple > 20V – 3 minutes	
1450	DC RIPPLE TOO HIGH	DC Ripple > 10V – 5s	
1501	INVERTER TEMP TOO HIGH	IGBT 1 Temperature > 110 °C	
1502	INVERTER TEMP TOO HIGH	IGBT 2 Temperature > 110 °C	
2000	GATE VOLTAGE ERROR	CPLD Unknown Fault	
2000+code	GATE VOLTAGE ERROR	IGBT XY Ready	
2000+code	GATE VOLTAGE ERROR	IGBT XY Fault	
3000	OUTPUT VOLTAGE TOO HIGH	Voltage > 130V - 250ms	
3100	OUTPUT VOLTAGE TOO HIGH	Voltage > 140V - 15ms	
3500	OUTPUT VOLTAGE TOO LOW	Voltage < 104V - 500ms	
4000	OVERLOAD: 100% < I < 125% - 600 s	Phase X	
4100	OVERLOAD: 125% < I < 150% - 60 s	Phase X	
4200	OVERLOAD: 150% < I < 200% - 30 s	Phase X	
4300	OVERLOAD: 200% < I < 300% - 10 s	Phase X	
4400	OVERLOAD: I > 300% - 1 s	Phase X	
4500+code	SHORT CIRCUIT AT OUTPUT	Phase X	
4600+code	FILTER CURRENT TOO LOW	Phase X	
4700+code	FILTER CURRENT TOO HIGH	Phase X	
4800	INVERTER SOFTSTART FAILURE		
5000	TRANSFORMER TEMP TOO HIGH		
5100	EARTH LEAKAGE FAULT AT OUTPUT		
5101	EARTH LEAKAGE FAULT AT OUTPUT		
5200	NEUTRAL VOLTAGE FAULT AT OUTPUT		
6001	EF OUTPUT 1 RIPPLE TOO HIGH	Ripple Voltage Exceeded Limit	
6002	EF OUTPUT 2 RIPPLE TOO HIGH	Ripple Voltage Exceeded Limit	
6101	PLUG 1 TEMPERATURE TOO HIGH		
6102	PLUG 2 TEMPERATURE TOO HIGH		
6201	NEUTRAL CONDUCTOR RUPTURE OUTPUT 1		
6202	NEUTRAL CONDUCTOR RUPTURE OUTPUT 2		
6301	EF SIGNAL DROP OUT - OUTPUT 1	EF Signal Disappeared at Output 1	
6302	EF SIGNAL DROP OUT - OUTPUT 2	EF Signal Disappeared at Output 2	

Table continues on next page

Continued from previous page

Error code	Error text in display	Help text	1st. Corrective action
7000	OUTPUT VOLTAGE TOO HIGH	Voltage > 32V - 4s	Press start to reset
7100	OUTPUT VOLTAGE TOO HIGH	Voltage > 40V - 1s	
7200	OUTPUT VOLTAGE TOO LOW	Voltage < 20V - 4s	
7300	SHORT CIRCUIT AT 28V OUTPUT	>75kW	
7400	28V OUTPUT CURRENT TOO HIGH		
7500	28V RECTIFIER TEMP TOO HIGH		
8000	ACR SUPPLY VOLTAGE MISSING		
8001	ACR ERROR		
8100	CABLE COIL / VFD ERROR	Check Cable Coil, VFD & Motor	
8200	COIL WINDING TIME-OUT	Coil Winding Exceeded 50 s	
8300	FAULT – CABLE HANDLING SYSTEM		
9000	END OF FACTORY TEST		
9100+code	PLUG & PLAY FAILED - OUTPUT X		
9200+code	PLUG & PLAY COMPLETED - OUTPUT X		

List below shows the complete list of error codes and next corrective actions:

Error code	2nd. Corrective action	3rd. Corrective action	4th. Corrective action
0			
100			
200	Replace Control Board A1		
201	Verify ID Chip inserted	Contact ITW GSE AXA Power	
202			
300 - 301	Check input voltage	Check Q4 & G1	
350	Check wires attached to X1 (X2 /X3)		
400	Check emergency stop	Check user EPO (A2:X14)	Replace Control Board A1
1000	Check input voltage	Check DC softstart charging voltage > 400 V	Replace Interface Board A2 Replace Capacitor Module A5 Replace Control Board A1
1100	Check input voltage	Check Q5	Replace Control Board A1 Replace Interface Board A2
1200			
1201	Check input voltage	Replace Control Board A1	Replace Interface Board A2
1202	Check input voltage	Replace Control Board A1	Replace Interface Board A2
1300	Check DC sharing voltage at R1	Replace Control Board A1	Replace Interface Board A2
1400	Check input voltage	Check equal voltage across V1 – V6	Replace Control Board A1 Replace Interface Board A2
1450	Check input voltage	Check equal voltage across V1 – V6	Replace Control Board A1 Replace Interface Board A2
1501	Check fuse F5	Set fans to ”Boost” and check voltage Between + & – and PWM & – at fan terminals (10 V)	Check dust filters Replace Control Board A1 Replace Interface Board A2
1502	Check fuse F5	Set fans to ”Boost” and check voltage Between + & – and PWM & – at fan terminals (10 V)	Check dust filters Replace Control Board A1 Replace Interface Board A2
2000 - 2024	Replace Control Board A1	Replace Interface Board A2	Replace Inverter Module
3000	Check voltage set-up value	Replace Control Board A1	Replace Interface Board A2
3100	Replace Control Board A1	Replace Interface Board A2	
3500	Check voltage set-up value	Replace Control Board A1	Replace Interface Board A2
4000	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4100	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4200	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4300	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4400	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4500+code	Disconnect load / output cable	Replace Control Board A1	Replace Interface Board A2
4600+code	Check output filter capacitors C7-C9	Check output transformer T2	Replace Control Board A1 Replace Interface Board A2
4700+code	Check output filter capacitors C7-C9	Check output transformer T2	Replace Control Board A1 Replace Interface Board A2
4800	Check DC voltage	Check output voltage/feedback voltage	Replace Control Board A1 Replace Interface Board A2 Replace Inverter Module

Table continues on next page

Continued from previous page

Error code	2nd. Corrective action	3rd. Corrective action	4th. Corrective action
5000	Let the unit cool down and press start to reset	Check dust filters and fans	Check(short circuit sensor) replace sensor TH if necessary Replace Control Board A1 Replace Interface Board A2
5100	Check set-up value	Remove load and check output cabling	Replace T5 Replace Control Board A1 Replace Interface Board A2
5101	Check Black Box output voltage values	Phase where the voltage is higher than the set-up value indicates a non functional output capacitor at that phase.	Replace corresponding capacitor.
5200	Check set-up value	Remove load and check output cabling for insulation failure	Replace Control Board A1 Replace Interface Board A2
6001	Check set-up value	Remove load and check output cabling	Replace Control Board A1 Replace Interface Board A2
6002	Check set-up value	Remove load and check output cabling	Replace Control Board A1 Replace Interface Board A2
6101	Remove load and let plug cool down	Check connector / output cabling for any malfunction	Replace Control Board A1 Replace Interface Board A2
6102	Remove load and let plug cool down	Check connector / output cabling for any malfunction	Replace Control Board A1 Replace Interface Board A2
6201	Check / correct installation	Replace NCR Board A10	Replace Control Board A1 Replace Interface Board A2
6202	Check / correct installation	Replace NCR Board A10	Replace Control Board A1 Replace Interface Board A2
6301	Verify that output cable is correct inserted	Check / correct installation	Replace Control Board A1 Replace Interface Board A2
6302	Verify that output cable is correct inserted	Check / correct installation	Replace Control Board A1 Replace Interface Board A2
7000	Check output voltage setup value	Check ARU Module and wiring	
7100	Check output voltage setup value	Check ARU Module and wiring	
7200	Check output voltage setup value	Check ARU Module and wiring	
7300	Remove short circuit	Check output cables	
7400	Remove overload	Replace Control Board A1	Replace Interface Board A2
7500	Let the unit cool down and reset	Check airflow / air filters / fan	Check temp. sensor at rectifier heat sink.
8000	Check ACR Supply Q6		
8001	Reset ACR	Check ACR VFD	
8100	Check Cable Coil, VFD & Motor	Replace Control Board A1	Replace Interface Board A2
8200	Check Cable Coil, VFD & Motor	Replace Control Board A1	Replace Interface Board A2
8300	Check Cable Handling System	Replace Control Board A1	Replace Interface Board A2
9000			
9100+code	Repeat cable Identification		
9200+code			

Note!

Before changing any PCB's / Inverter Module check corresponding connection and wiring. Also use proper ESD practices when touching any PCB

10.0 Illustrated Parts List

Please contact technicalsupport@itwgse.us for recommended list of spare parts, diagrams and drawings.

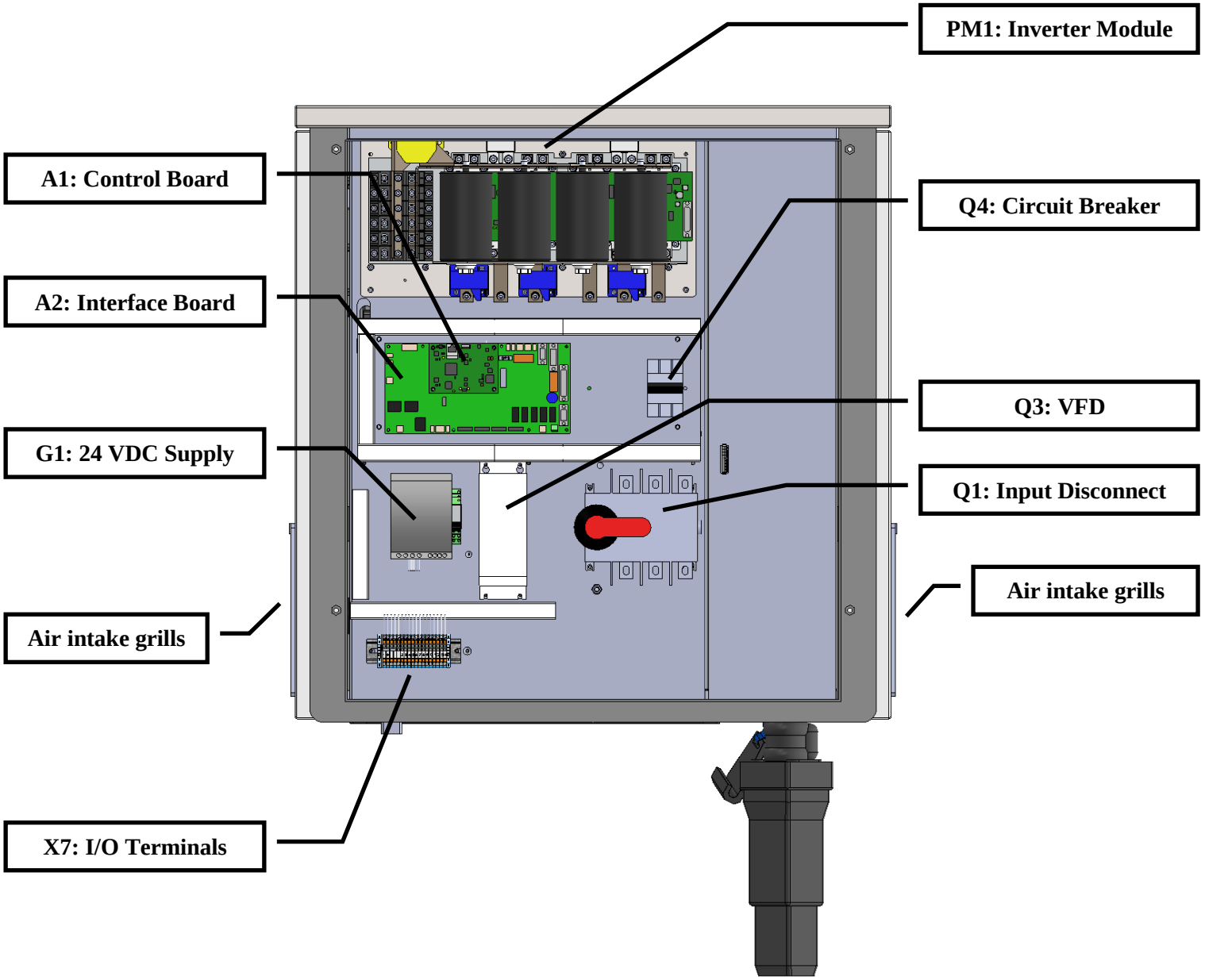


Figure: 10.0.1 Rear View (Electronic Zone)

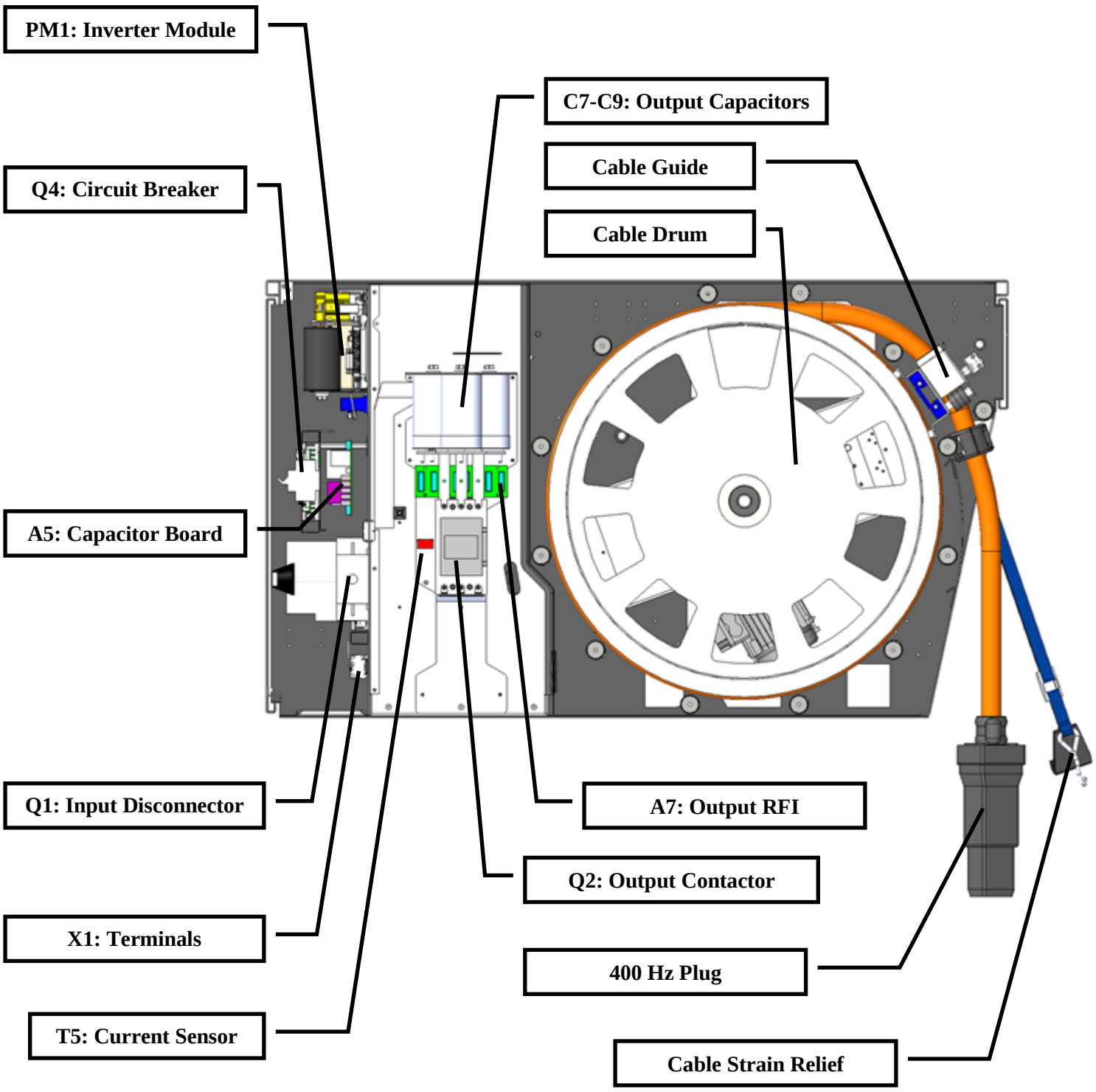


Figure 10.0.2 Left Hand Side View

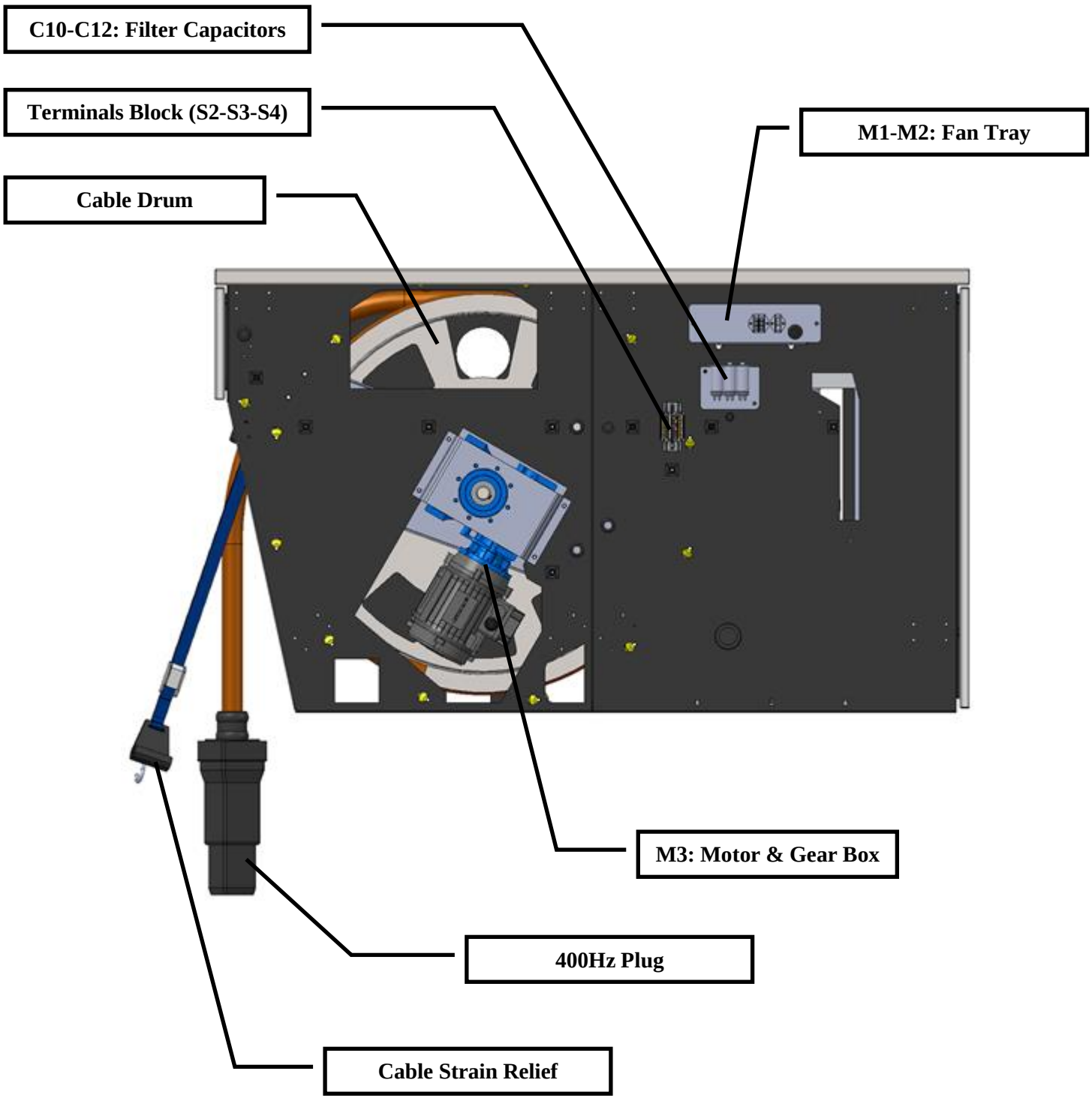


Figure 10.0.3 Right Hand Side View

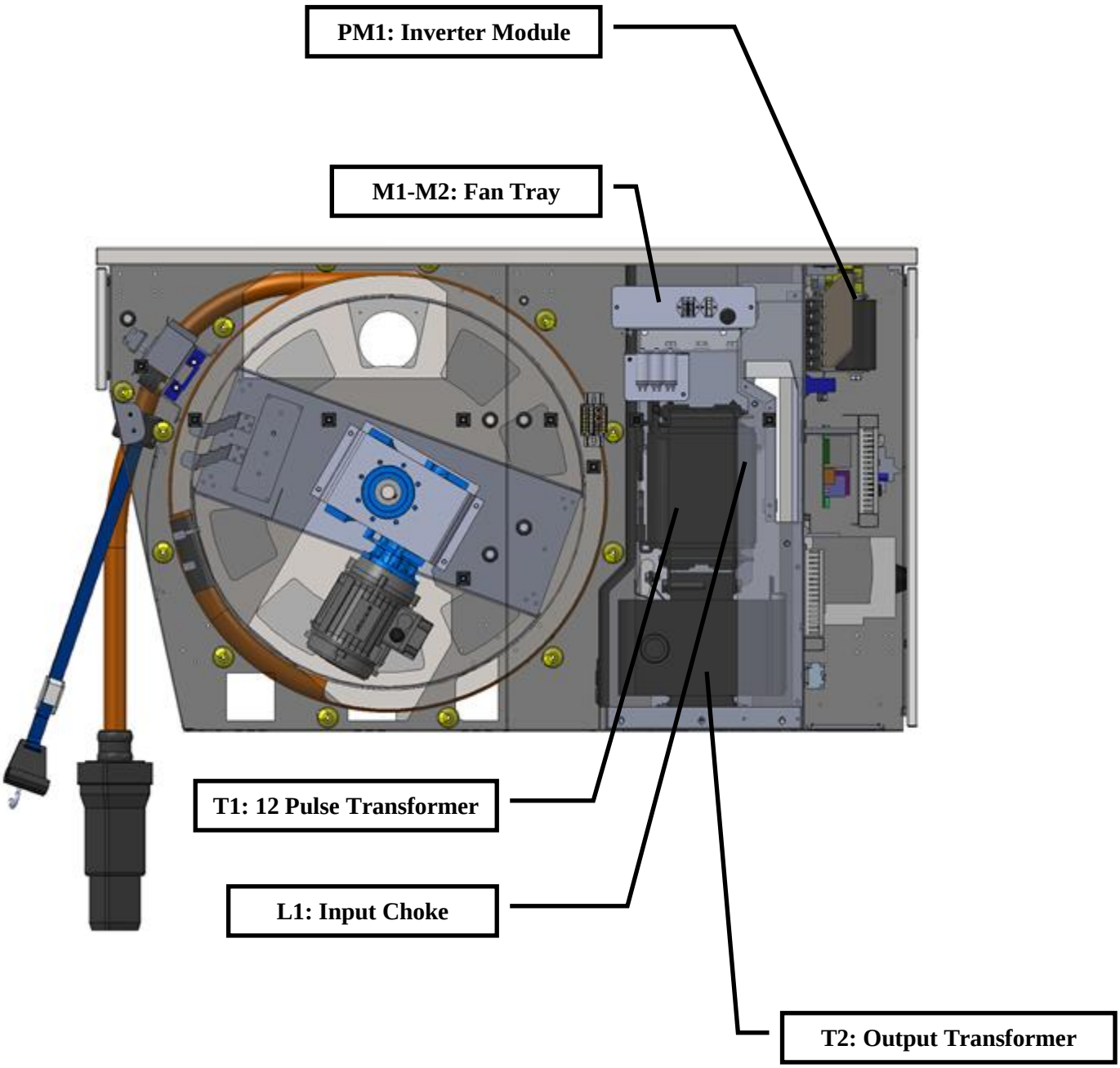
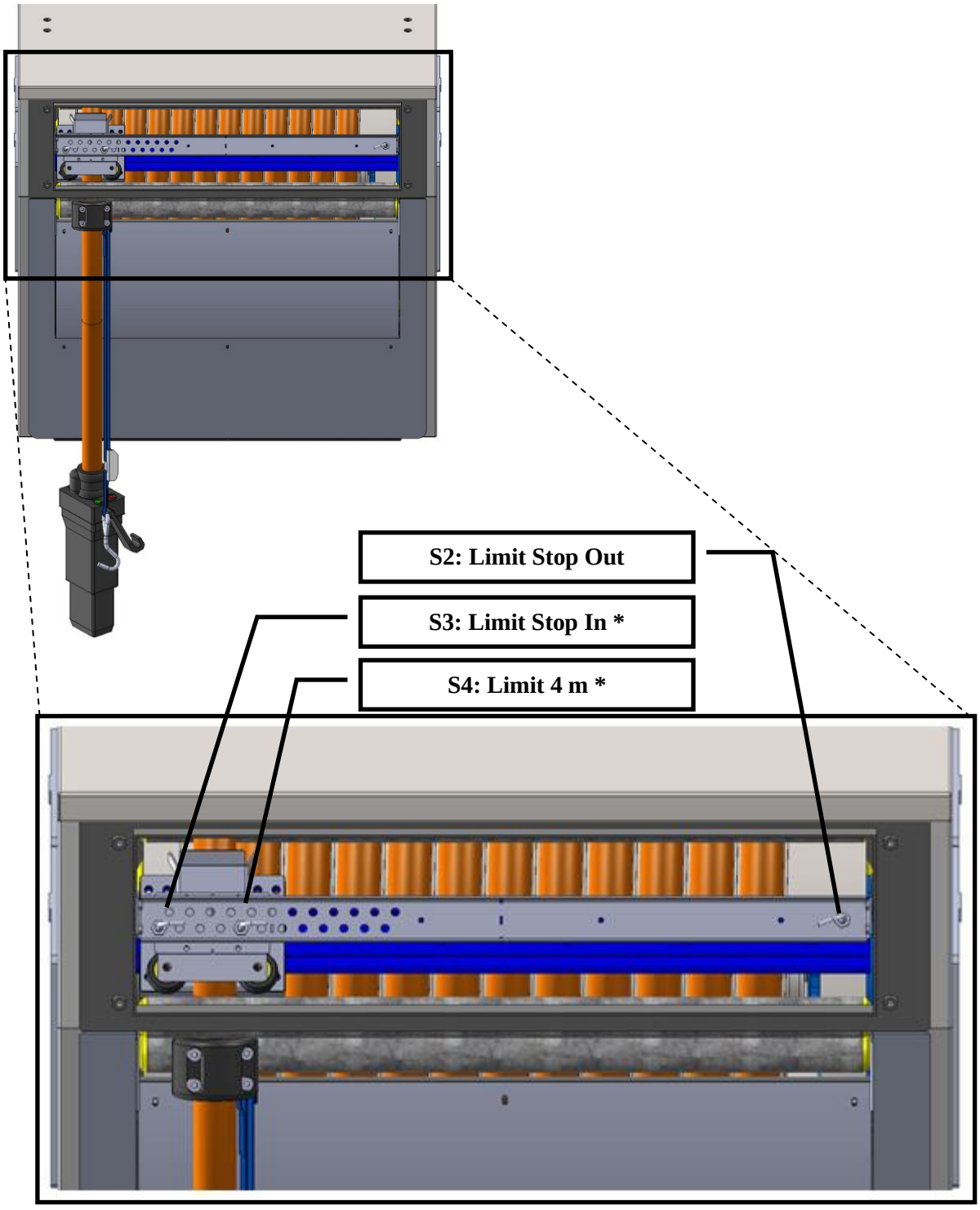


Figure 10.0.4 Right Hand Side View (X-Ray view)



* Position of limit switches S3-S4 may vary depending on cable length.

Figure 10.0.5 Front View

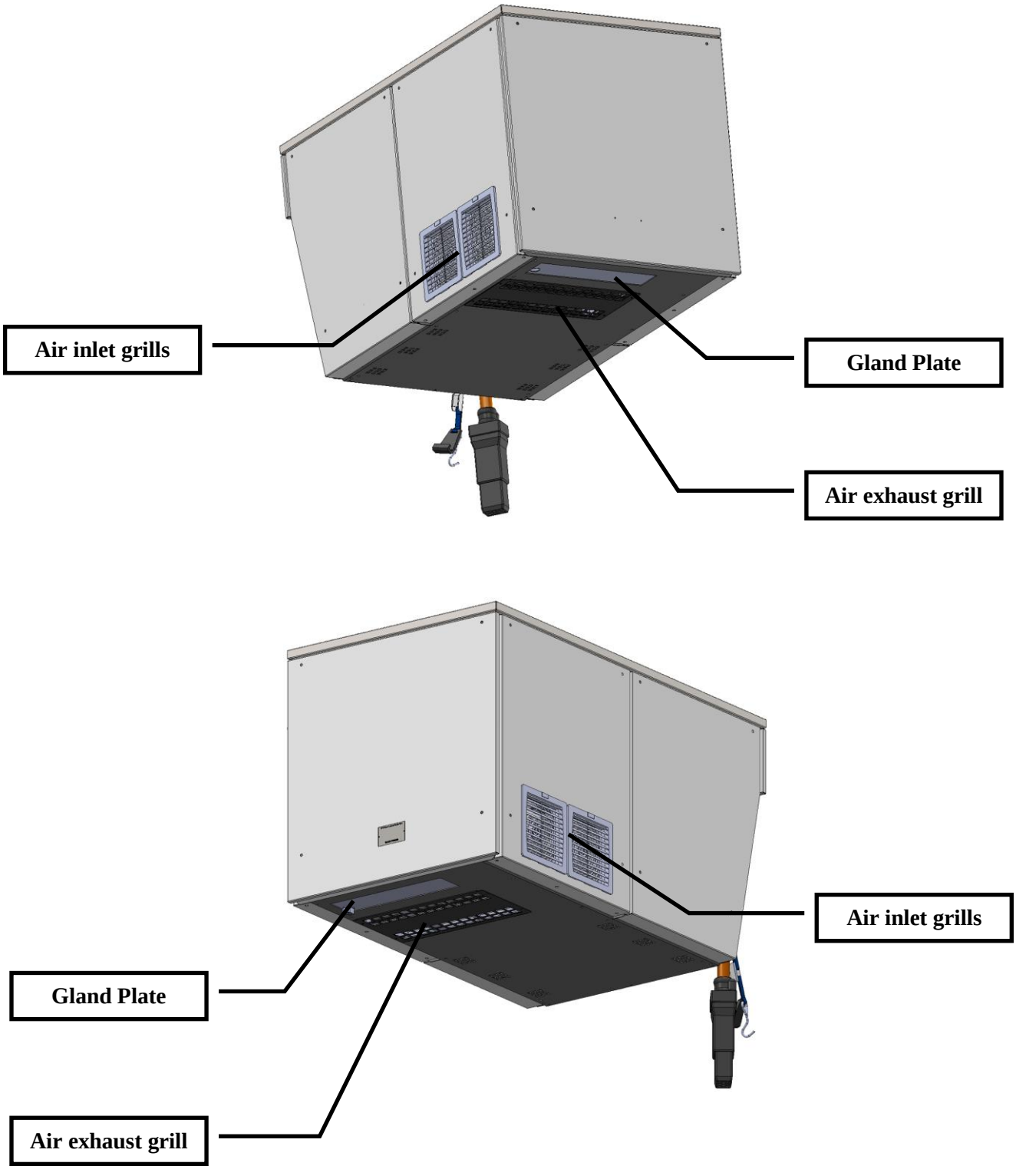
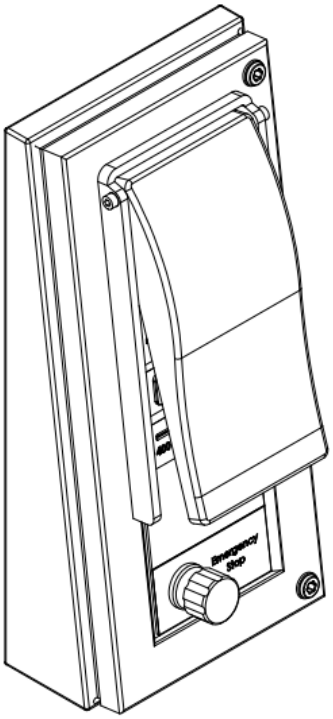

Air inlet grills
Gland Plate
Air exhaust grill
Air inlet grills
Gland Plate
Air exhaust grill

Figure 10.0.6

11.0 Options

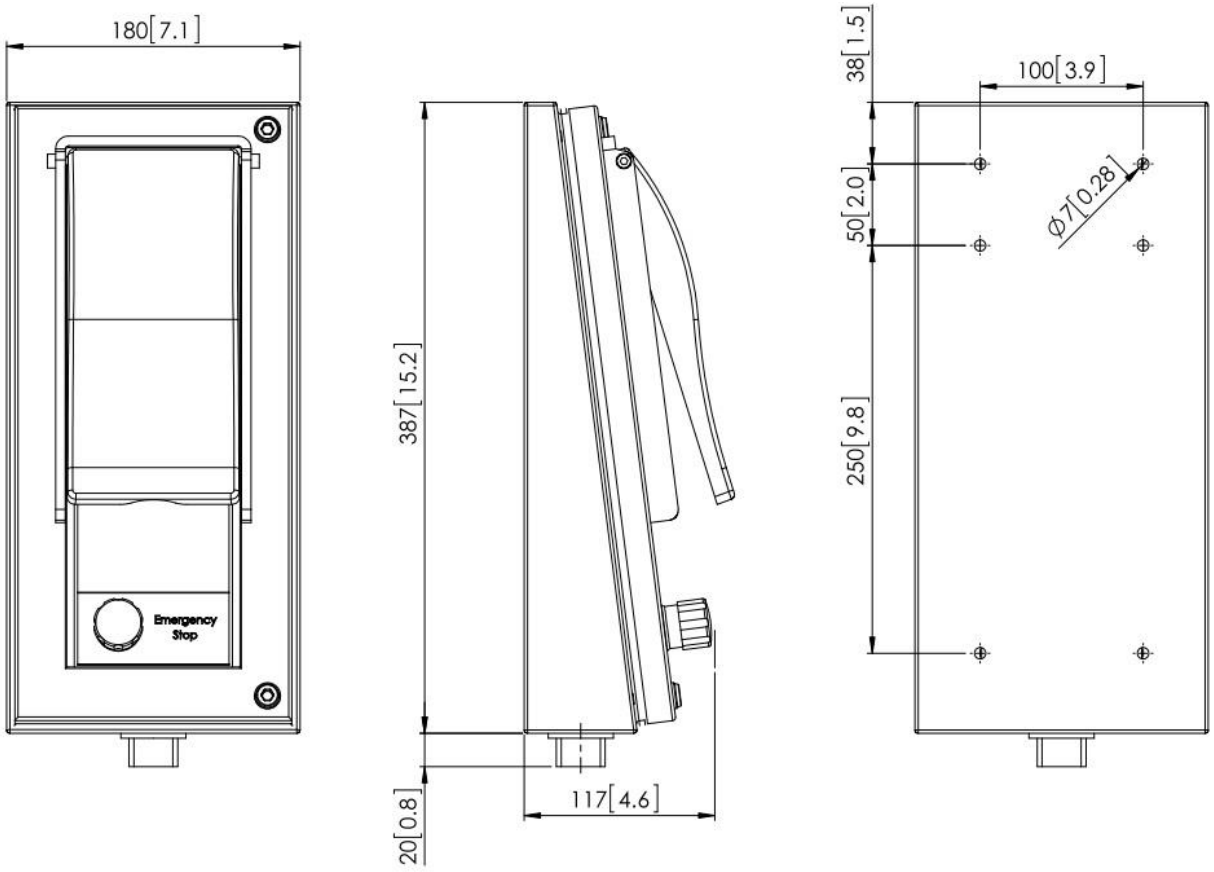
AP-577801 Remote Control Box



The Remote Control Box is used for operation of the Hobart 2400 Power Coil especially if the 400 Hz cable is out of reach, often attached at the passenger boarding bridge.

Note !

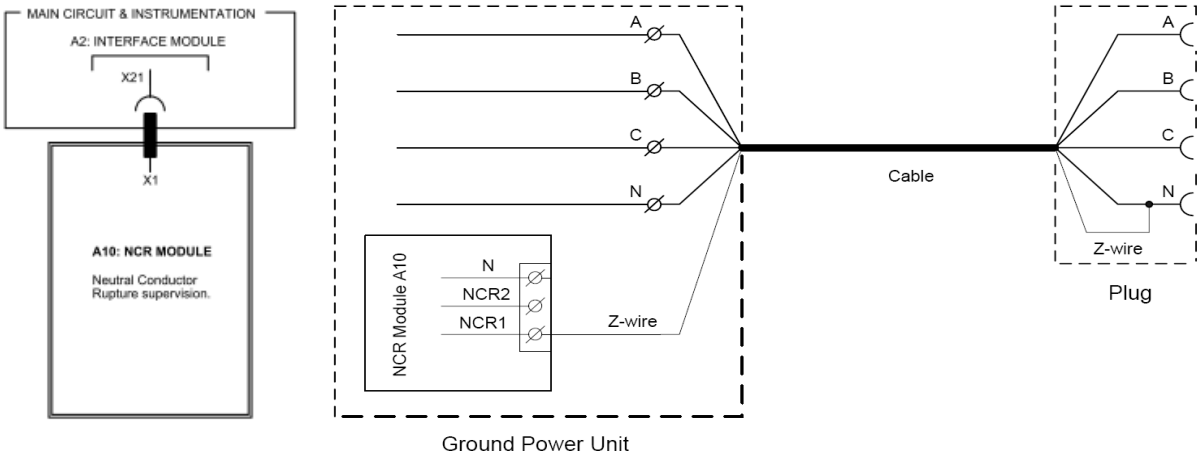
The Remote Control Box must always be supplied and connected to the Hobart 2400 Power Coil, for the unit to be operational.



Size and attachment layout

AP-577802 Neutral Conductor Rupture Supervision

A broken neutral conductor in the 400 Hz cable combined with an unbalanced aircraft load could lead to a destructive phase-neutral voltage in the aircraft and to hazardous voltages between the aircraft chassis and ground. The NCR option ensures that a broken neutral will be detected immediately.



Principle wiring diagram for Neutral Conductor Rupture Supervision

Unbalanced voltage at the aircraft connector due to a broken neutral would add a 400 Hz voltage to the 28 VDC interlock voltage measured at the ground power unit. If the injected AC voltage exceeds approx. 10 VAC the output is disconnected. This type of error is recognised as an interlock failure by the ground power unit. Since the disconnection is a reaction to a heavy unbalanced voltage at the aircraft connector, it means that this type of supervision does **not** protect sensitive equipment in the aircraft. The NCR option protects personnel as well as the aircraft in case of a broken neutral.

Note!
In general ITW GSE does not recommend the NCR option for the following reasons:

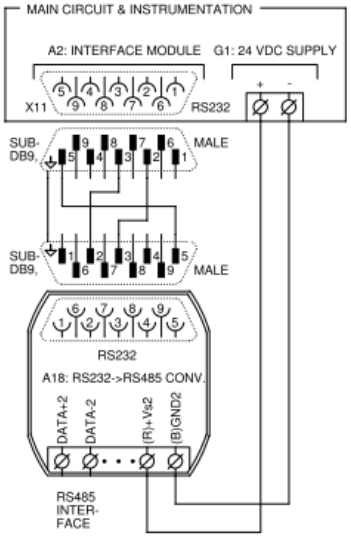
1) The need for an additional control wire, which is likely to be the first to break.

2) The difficulties of implementing the method in existing installations if a free control wire is not present.

3) The standard protections built into the 2400 series are considered adequate to safeguard against hazards related to a broken neutral

AP-577803 RS485 Interface (Diagram 477800)

All units are supplied with connections for RS232. The RS485 Interface option provides a galvanic isolated RS485 connection and allow for multi-point connection.

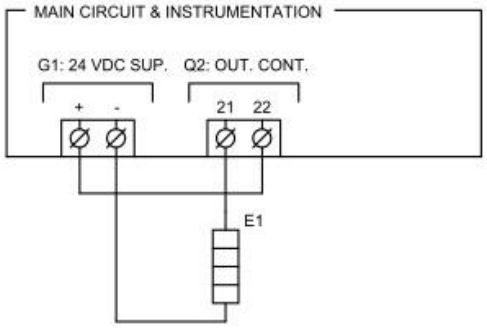


PIN Assignment for RS485 Interface

AP-577804 Anti-Condensation Heater (Diagram 478800)

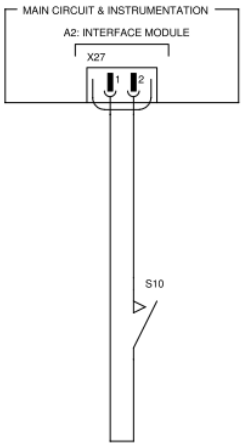
In areas with high relative humidity, temperature drops cause formation of dew inside the enclosure of the GPU. On a long-term basis, this can affect components such as relays, switchgears and printed circuit boards (PCBs). Dew formation can; however, be avoided by installation of heating elements in the GPU.

During operation, the waste heat from the circuits prevents dew from arising. In standby mode where the internal losses are insignificant, one 30 W anti-condensation heater automatically switch on and prevent condensation from arising.



Schematic for Heater connection

AP-577805 Door Switch (Diagram 477800)



The door interlock ensures that the ground power units output contactor(s) open and the unit immediately returns to standby mode if the door is opened.

AP-591100 Auto Calibration Plug

Required for Plug & Play set-up.
See section 7.