



It's all about
connections

Original User Manual ITW GSE 7400 (Mark II) Battery Powered (3 or 4 Leaf Battery Packs)

400 Hz Ground Power Unit

With 28 VDC outlet (optional)



Serial No. _____

Type

3GWB - / _____

IMPORTANT NOTE

Only qualified personnel may carry out Service/Troubleshooting/Maintenance/Repair of the ITW GSE 7400 GPU.

Refer to ITW GSE's website
<https://itwgse.com/>
or
contact ITW GSE
for further information.

IMPORTANT NOTE

We recommend that the battery that stores the GPU settings etc.
is changed **after 5 years** of use in order to prevent data loss.

Refer to Section 8.2
for further information.

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

About this user manual

INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR ITW GSE 7400 GROUND POWER UNITS.

This manual provides information about the ITW GSE 7400 Ground Power Unit.
The manual covers the range of the 7400 series and options described in section 11.

If you have any questions regarding this manual please contact your local agent, or contact details can be found at www.itwgse.com



Manufacturer and contact details

North / South America

ITW GSE Inc.
11001 US Highway 41 North
Palmetto, FL 34221
USA
DUNS: 05-127-1278

Tel: (+001) 941 721 1000
Mail: support@itwgse.us
Web: <https://itwgse.com>

Europe - Asia/Pacific - Middle East - Africa

ITW GSE Aps
Smedebakken 31-33
DK-5270 Odense N
Denmark
CVR / VAT number: DK7421 8814
DUNS: 305 939 290

Tel: (+45) 63 18 60 00
Mail: support@itwgse.com
Web: <https://itwgse.com>

Abbreviations

ACR	Advanced Cable Retriever
ARU	Active Rectifier Unit
AWG	American Wire Gauge
BMS	Building Management System
CAN	Controller Area Network
DIP	Dual In-Line Package
DSP	Digital Signal Processor
ELS	Earth Leakage Supervision
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPO	Emergency Power Off
ESD	Electrostatic Discharge
GPU	Ground Power Unit
GSE	Ground Support Equipment
IGBT	Insulated Gate Bipolar Transistor
I/O	Input & Output
ITW	Illinois Tool Works
LED	Light-Emitting Diode
MMI	Man Machine Interface
MTBF	Mean Time Before Failure
MTTR	Mean Time To Repair
NCR	Neutral Conductor Rupture
NC	Normally Closed
NO	Normally Open
NVD	Neutral Voltage Displacement
NVS	Neutral Voltage Supervision
PBB	Passenger Boarding Bridge
PCB	Printed Circuit Boards
PWM	Pulse Width Modulation
PE	Protective Earth
PF	Power Factor
RFI	Radio Frequency Interference
RTU	Remote Terminal Unit
PTC	Positive Temperature Coefficient
QR	Quick Response
RCB	Remote Control Box
RH	Relative Humidity
SoC	State of Charge
SSFC	Solid State Frequency Converter
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
VFD	Variable Frequency Drive

Pictograms used in manual



General warning sign



Electricity hazard



Crushing of hands



Hot surface



Battery



Electrostatic sensitive devices

Overview of Types and Ratings

Type	Rating	Capacity	Number of battery packs	Part number	Schematic	Charger voltage (Input Main/Utility Voltage)
3GWB-90/160I	90 kW	160 kWh	4	575410	575400	3 x 400 V $\pm$ 30% (280-520 V)
3GWB-68/120I	68 kW	120 kWh	3	575420	575400	3 x 400 V $\pm$ 30% (280-520 V)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Content

CONTENT

About this user manual	3
Manufacturer and contact details	3
Abbreviations	4
Pictograms used in manual	5
Overview of Types and Ratings	5
1.0 Declaration of Conformity	10
2.0 Safety Instructions	11
3.0 General Description	13
3.1 Built-In Features/Protections	22
3.2 50/60 Hz & 400 Hz Tow Bar Interlock	24
4.0 Transportation and Installation	25
4.1 Storage Before Installation	25
4.2 Disposal of packaging material	25
4.3 Disposal of unit (End of life)	25
4.4 Operating and Environmental Conditions after Commissioning	25
4.5 Transportation	26
4.6 Preparation before use	29
4.7 Connection of Cables	30
4.8 Mains/Utility Input	32
4.9 400 Hz Output	32
4.10 400 Hz Interlock	33
4.11 400 Hz Input	33
4.12 TCP/IP On-Board Interface	34
5.0 Technical Specifications & Warranty	35
5.1 Technical specifications and information	35
5.2 7400 Battery Warranty Conditions	38
6.0 Operator's Instructions (Display/LED/Keypad Layout)	39
6.1 Using the Display/Keypad	41
6.2 Charging the Unit	42
6.3 Operating the Unit	43
6.4 Operating the Unit as 400 Hz Pass Through	45
6.5 Basic Menu	46
6.5.1 Parameters – Menu Structure	47

Operation Manual – ITW GSE 7400 Battery Powered GPU

Content

6.5.2	I/O Configuration.....	50
6.5.2.1	1 x 400Hz output:.....	50
6.5.2.2	2 x 400Hz output:.....	51
6.5.2.3	1 x 400Hz & 1 x 28 VDC output:	52
6.5.3	Setup – Menu Structure	53
6.5.4	Black Box – Menu Structure	58
6.5.5	Power Log – Menu Structure	60
6.5.6	Update Software/Save Logs/Load Config File	61
6.5.7	Incompatible Software Version	65
6.6	Default Factory Settings	66
7.0	Setup Lock/Output Mode/Compensation	67
7.1	Preventing Changes to Setup Parameters	67
7.2	Output Voltage.....	68
7.3	Plug & Play Cable Compensation.....	68
7.4	Manual Compensation.....	69
7.5	EF Interlock	69
7.6	EF Interlock Ripple Level.....	70
7.7	EF Interlock Delay	70
7.8	Aircraft Connector Insertion	70
7.9	GPU Enable.....	70
7.10	Neutral Voltage Supervision	71
7.11	Earth Leakage Level.....	71
7.12	Earth Leakage Delay	71
7.13	Minimum SoC (State of Charge) to Start	71
7.14	Max Grid Current	72
7.15	Real Time Clock Setup.....	72
7.16	Date/Time Format.....	72
7.17	Ethernet Configuration.....	72
7.18	Modbus Slave Address.....	72
7.19	LED Brightness.....	73
7.20	Unit of Measure	73
7.21	28V Voltage	73
7.22	28V Compensation	73
7.23	Current Limit Step Size	73

Operation Manual – ITW GSE 7400 Battery Powered GPU

Content

7.24	28V EF Interlock	74
7.25	Customer ID.....	74
7.26	Reset Service Interval.....	74
7.27	Battery Replaced (Control Board).....	74
7.28	Language.....	74
8.0	Service, Maintenance, Overhaul	76
8.1	Lockout/Tagout procedure	76
8.2	Recommended Maintenance Schedule	77
8.2.1	Daily / upon use	77
8.2.2	Quarterly	78
8.2.3	Yearly	79
8.3	Battery Backup & Replacement.....	81
9.0	Troubleshooting & Repair	84
9.1	PCB Fuses & Battery Fuses	84
9.2	Fault Guidance / Error Codes	87
10.0	Illustrated Parts List.....	91
10.1	Components placement.....	91
10.2	Labels placement (CE version).....	97
10.3	Labels placement (UL version)	102
11.0	Options	107
575810 / AP-575810	Active Rectifier Unit (Diagram 475810)	107
575811 / AP-575811	Additional Output Contactor (Diagram 475801)	107
575812 / AP-575812	NBPT Contactor (Diagram 475801)	108
575813 / AP-575813	TrackUnit (Diagram 475801)	108
575814 / AP-575814	Yellow Beacon	110
575815 / AP-575815	Blue Beacon.....	110
575816 / AP-575816	Red Beacon	110
575817 / AP-575817	Green Beacon.....	110
575818 / AP-575818	Lockable Towbar Interlock (Diagram 475801)	111
575819 / AP-575819	Towbar w/DIN40 Towing Eye.....	111
575820 / AP-575820	White Clearance Light (Diagram 475801)	112
575821 / AP-575821	Forklift pockets for transport.....	112
591100 / AP-591100	Auto-Calibration Plug	113

Operation Manual – ITW GSE 7400 Battery Powered GPU

Content

12.0	For GPUs with 28 VDC Active Rectifier Unit	114
12.1	General Description	114
12.2	Connection of Cables	116
12.3	Interlock	117
12.4	Operator's Instruction	118
12.5	Operating the unit	118
12.6	Additional menu items for ARU	121
12.7	ARU Default Factory Settings	123
12.8	28V Voltage	123
12.9	28V Compensation	123
12.10	Current Limit Step Size	123
13.0	Specifications	124
14.0	Troubleshooting & Repair	125
15.0	ARU illustrated parts list	126

1.0 Declaration of Conformity



EU Declaration of Conformity

ITW GSE ApS
Smedebakken 31-33
5270 Odense N
Tel. +45 6318 6000

We declare under our sole responsibility that the following product type:

Designation : 400 Hz Ground Power Unit.
Type : ITW GSE 7400 Series: 3GWB-68/120I - 3GWB-90/160I
Description : Mobile ground power unit converting DC-Voltage supplied from Li-Ion Batteries into an isolated three-phase 400 Hz output intended for Ground Power supply of aircraft's.

Is in conformity with the following directives:

2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility Directive
2006/42/EC	Machinery Directive

Conformity attained by complying with:

- | | |
|-----------------------------|--|
| ○ EN 62040-1:2009+A1:2013 | (LVD - Safety standard) |
| ○ EN 61558-2-6:2009 | (LVD - Safety standard) |
| ○ EN 62619:2017 | (Battery safety standard) |
| ○ EN 61000-6-2:2005 | (EMC - Immunity standard) |
| ○ EN 61000-6-4:2007+A1:2011 | (EMC - Emission standard) |
| ○ EN 1915-1:2013 | (Machinery – General safety requirements) |
| ○ EN 1915-2:2001+A1:2009 | (Machinery – General safety requirements) |
| ○ EN 12312-20:2005+A1:2009 | (Machinery – Specific safety requirements) |

Odense, Denmark
Place of issue

12.11.2019
Date of issue


Søren R. Dahl, Development Manager

IMPORTANT SAFEGUARDS

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

2.0 Safety Instructions



This unit is only intended to be installed, operated and maintained by qualified 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 fulfill 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 a  label.



- Keep all panels and covers securely in place.
- Only allow **qualified** people to 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, and repair/replace if necessary.

Moving Parts

- Keep away from fans. Running fans can cause injury to your hands.
- Only allow **qualified** people to remove covers for maintenance or troubleshooting.



Hot Parts

- Do not touch hot magnetics. Hot surfaces can cause severe burns.
- Allow parts to cool off before performing maintenance.



KEEP THESE INSTRUCTIONS!

Battery

- On-board battery packs that are sealed must not be opened and are maintenance free.
- Only use the same type of Leaf Batteries, and only ITW GSE or service engineers appointed by ITW GSE are allowed to change the batteries.
- Safety Data sheets on Lithium-ion battery modules can be obtained from ITW GSE on request.



CAUTION
RISK OF EXPLOSION IF, BATTERY IS REPLACED
BY AN INCORRECT TYPE.
DISPOSE OF USED BATTERIES ACCORDING
TO THE INSTRUCTIONS.

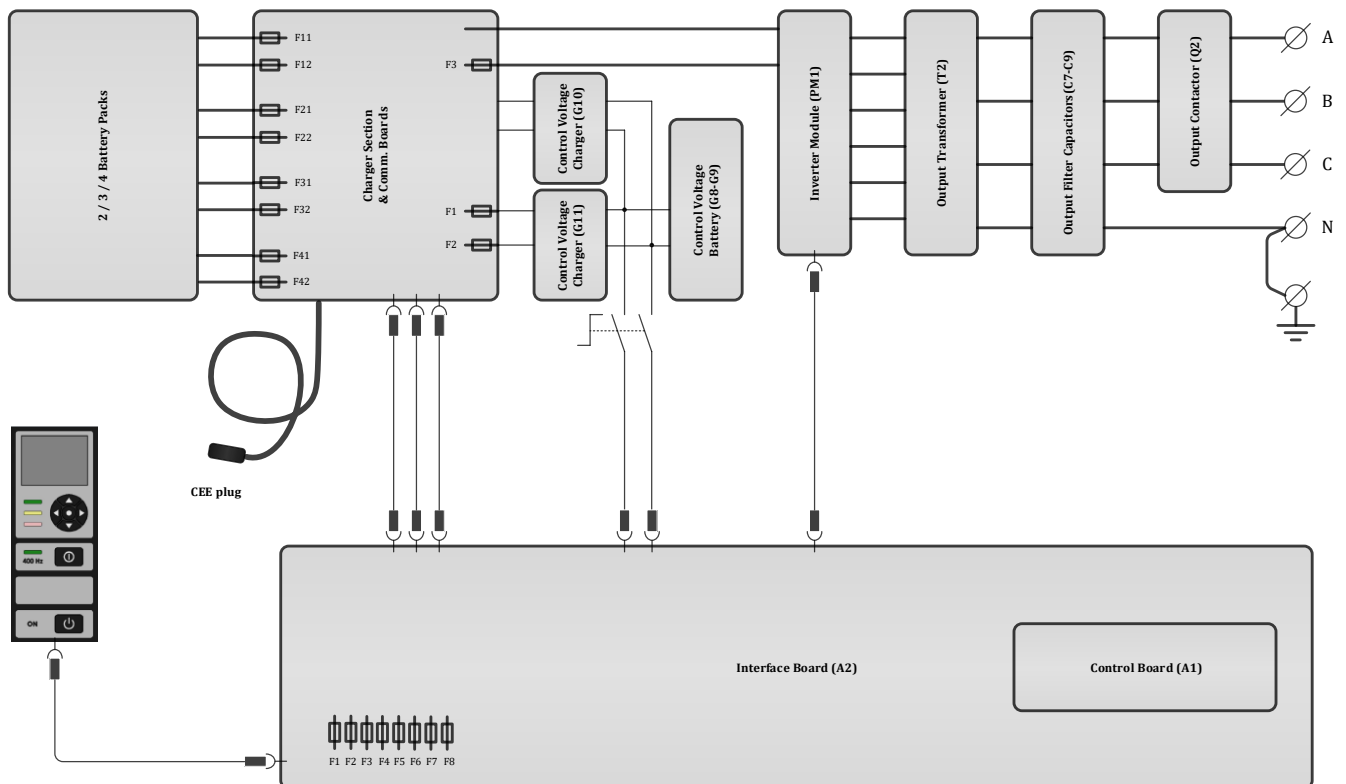
KEEP THESE INSTRUCTIONS

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

3.0 General Description

The figure below shows the basic principle of the ITW GSE 7400 Compact Power Unit. This unit includes the feature that it can be charged & deliver 400 Hz (28 VDC) simultaneously. Connected to 50/60 Hz main/utility input and supplying power to the aircraft will depend on the load, and it will charge the batteries as well. The DC is switched by means of the IGBT as PWM to the primary of the isolation output transformer, and the 400 Hz is then fed to the output, via output contactor Q2.



3.1 Basic Principle (Refer to schematic for details)

Main/Utility Input Contactor (Q1):

The input contactor disconnects all power to chargers G1–G4 and is controlled by the unit.

Service Switch (Q3):

Disconnects the batteries from the inverter (PM1).

Battery Charger MCB's (Q11, Q21, Q31, Q41):

The four charger inputs are protected by the MCBs.

Battery Packs (B1, B2, B3, B4):

The ITW GSE 7400 consists of up to four battery packs. The battery pack voltage is 400 VDC nominal, and the capacity of each pack is 40 kWh. For intercommunication and supervision of each battery, an internal BMS system monitors the batteries. They are linked together by the CAN bus and via communication boards in one string, and fed back to the interface board.

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Control Voltage Charger (G10, G8 & G9, Q6):

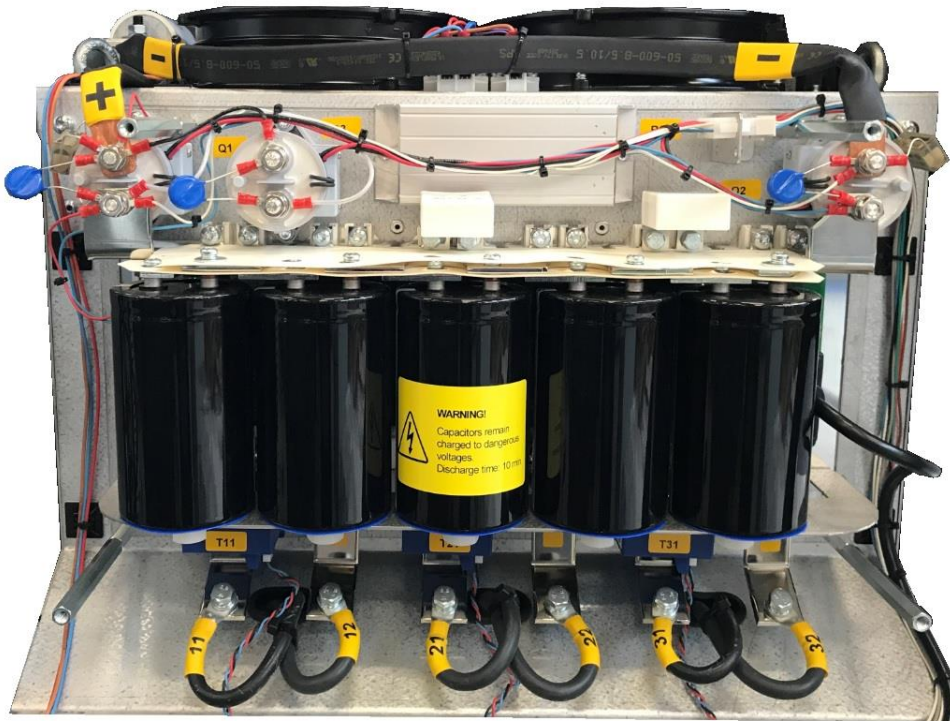
When connected to the 50/60 Hz supply, charger G10 charges batteries G8 and G9. This battery voltage is used as internal control voltage. The control voltage for the internal supply is fed through control voltage battery MCB Q6.

Control Voltage Charger (G11, G8 & G9, Q6):

If **not** connected to the 50/60 Hz supply, charger G11 charges batteries G8 and G9. This battery voltage is then used as internal control voltage. The control voltage for the internal supply is fed through control voltage battery MCB Q6.

Inverter Module (PM1):

The inverter module includes the soft-start circuit (Q3 & R2) and main circuit (Q1 + Q2) controlled via X21. The gate drive (GD1) used to interface between the control unit and the IGBTs. In addition, there are three current sensors (T11/T21/T31) for measuring the current flow to the primary of the output transformer integrated on the module. Voltage supervision of the DC-filtering capacitors (C1–C5) is also performed via X21.



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 (3x 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:

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 RFI filter that reduces high-frequency emissions from the ground power unit or aircraft.

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Output Contactor (Q2):

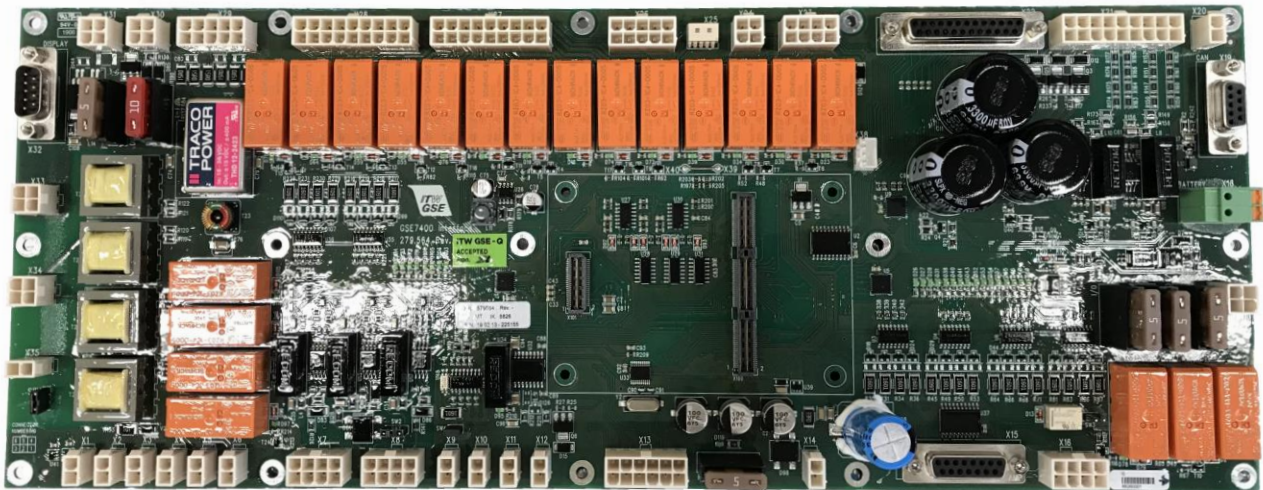
The GPU is equipped with a three-phase output contactor. The contactor is engaged, when the output “ON” push button is pressed and is disengaged when the “stop” push button is activated, or a system error occurs. If the interlock voltage provided by the aircraft is not returned to the ground power unit within the delay settings (refer to Section 6.3), the contactor will also disengage.

400 Hz Input socket & Contactor (Q8):

Units including the option 575812 (NBPT contactor/inlet socket) add the feature of applying an additional 400 Hz GPU to this input if it turns out that the turnaround time is longer than expected and the unit may run out of power. This enables the already attached ITW GSE 7400 connected to the aircraft to pass through the added 400 Hz power via the first GPU. Automatically switching off the first GPU and applying the second GPU to the output. This ensures that the aircraft is supplied with non-interrupted 400 Hz power.

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:

- NBPT option Interlock (X1)
- ELS current Transformer input (X2)
- NBPT contactor control (X3)
- Contactor output 1 control (X4)
- Contactor output 2 control (X5)
- ARU Contactor (X6)
- Output 1 to terminals X1 (X7)
- Output 2 to terminals X2 (X8)
- External EPO input (X9)
- Grid Voltage Present input (X10)
- 50/60 Hz contactor Coil Control (X12)
- GPS unit (X13)
- Grid Current input from T4 (X14)

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

- Connection to ARU (X15)
- ARU inputs (X16)
- 24 VDC supply & EPO to Comm. Boards (X17)
- Control Battery input (X18)
- CANBUS to Comm. Boards (X19)
- Busbar temperature input from T1 (X20)
- Power Module inputs & outputs (X21)
- Gate Drive (X22)
- Beacons Control (X23)
- Transformer thermostat inputs (X24)
- Connection for A6 EEPROM (X25)
- Not used (X26)
- Additional Outputs (X27)
- Additional Inputs (X28)
- Current Measurements from Inverter (X29)
- Fan Control (X30)
- Smoke Detector (X31)
- Interface to the display board, CAN bus, 24 VDC, and EPO (X32)
- Output Voltage Feedback (X34)
- NBPT synchronization Voltage input (X35)

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

AUX Board (A5):

This board is an additional interface board, which contains input for door sensors, beacons, siren, power supplies, control voltage batteries and more.



The AUX board includes the following functions:

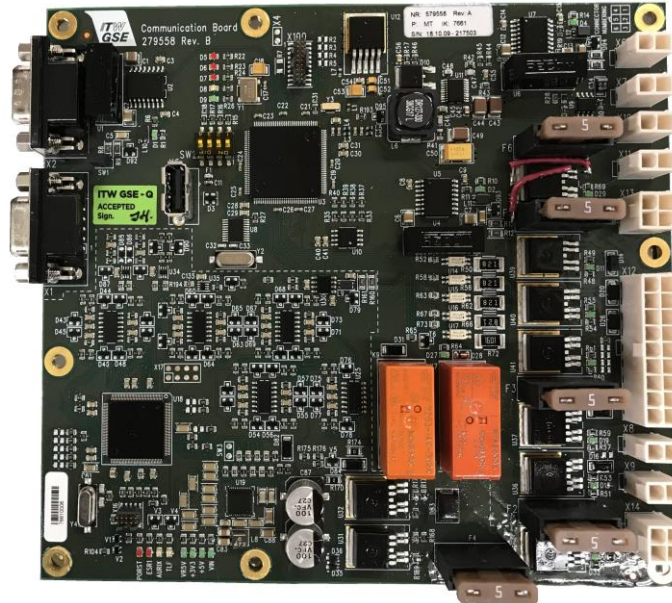
- Left door sensor S2 (X1) & Right door sensor (X2)
- Spare (X3)
- Towbar sensor S4 (X4)
- +24 VDC input for Towbar magnet (X5)
- Grid Voltage Present (X6)
- Power Supplies G10 & G11 (X7)
- Batteries G8–G9 (X8)
- Control Voltage output to Interface Board A2 via MCB Q6 (X9)
- 24 VDC Aux Power & fused by F2 (X10)
- EPO Active Warning Signal (X11)
- Warning Beacon Input Signal (X12)
- Warning Beacon (X13)
- Warning Siren (X14)
- Towbar magnet (X15)

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Communication Boards (A12, A22, A32, A42):

This board is used to interface between the control board and the battery packs/battery chargers via the CAN bus. The communication board includes the following functions:



- CAN bus “in” (X2) and “out” (X1) connection, last board in chain terminated by R11
- EPO “in” (X9) and “out” (X8) connection, last board in chain left open
- 24 VDC supply “in” (X11) and “out” connection, last board in chain left open
- CAN bus connection to chargers G11, G21, G31, G41 (X6)
- Control of battery contactors Q12, Q21, Q32, Q42 (X14)
- Leaf battery pack temperature sensors S11, S21, S31, S41 (X7)
- CAN bus and signals to and from battery packs B13, B23, B33, B43 (X12)
- 24 VDC to 12 VDC DC/DC converters G11, G21, G31, G41 (X13)
- Fuses F2 – F3 – F4 – F5 – F6 (5 Amp.)
- DIP switch for Board Setup:



Note

Depending on the number of battery packs installed, some identification numbers might not be applicable.

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Supply Module 10 A (G10):

Charges internal batteries G8 & G9 when mains/utility power is connected (factory-set to 28 V).

This module has a wide input range (180–550 VAC).

It is supplied directly from the input connector and pre-fused via the two-phase circuit breaker Q4.



Supply Module 20 A (G11):

Charges internal batteries G8 & G9 when no mains/utility power is available, and the battery packs are enabled (factory-set to 28 V).

The module has a wide input range (254–780 VDC).

It is supplied directly from the Leaf batteries and is pre-fused via the two-phase circuit breaker Q5.



Charger Module (G1/G2/G3/G4):

The three/four Leaf battery packs (B1–B4) are charged Individually by a charger with a 15-kW capacity.

The charger has a wide AC input range (260–530 V).

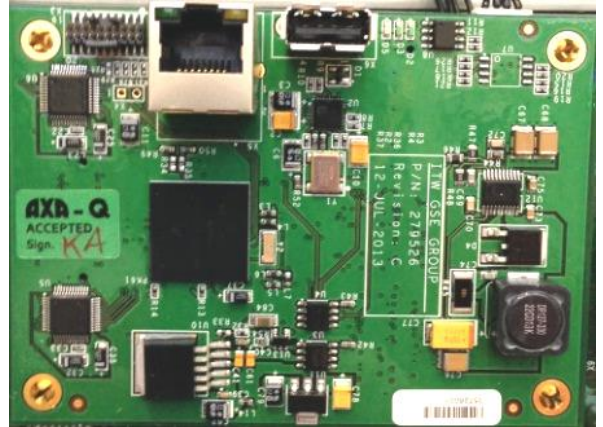


Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Control Board (A1):

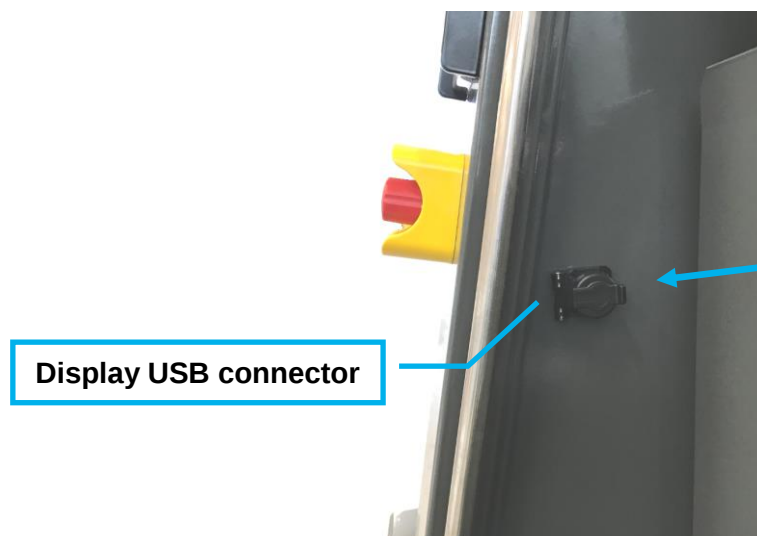
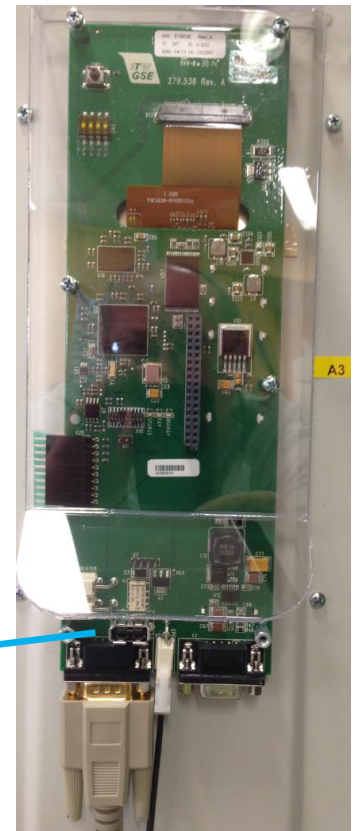
The control board is based on a microcontroller. Regulate, supervise, and diagnose possible external and internal faults as soon as the ground power unit is connected to the mains/utility power, and constantly during normal operation. The control board runs through a self-check program, which checks all the internal functions of the ground power unit. If an internal or external error is detected, the display shows the type of error. All immediate parameters related to a shutdown are stored in the ground power unit's memory. The control board has an on-board Ethernet RJ45 connector, used to communicate with the BMS and USB host Type A connection to retrieve data from the converter or to update the software.



Display Board & Keyboard (A3/A4):

The display module serves as the interface for daily operation and is an integrated part of the unit. Furthermore, the display module includes a USB connection, used to download the black box and power logs, and for updating the display software.

As the USB connection on the back of the display is difficult to reach, the USB outlets are moved and are now located in the 400 Hz cable compartment on the right-hand side.

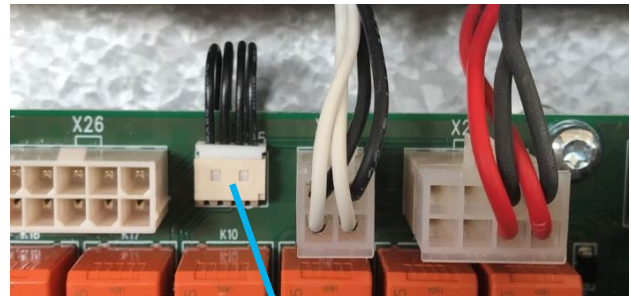


Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

ID Chip (A6):

The ID chip is connected to interface board A2 (X25) and is fixed to the I/O zone plate. It contains information on the GPU configuration and stores all setup values, black box and power log records.



Indication Beacons – Unit Operation/Charging (H1) & Warning/Low Battery (H2):

Depending on the layout of the unit, various beacons/labels may be located on top of the canopy of the unit.



Picture shows standard color configuration.

Please refer to Section 11.0 for beacons colors.

Please refer to Sections 6.5 and 7.13 for low battery percentage indication setup.

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

3.1 Built-In Features/Protections

No-Break Power Transfer:

The unit is protected against phase angle misalignment during no-break power transfer.

Over/Under DC Voltage:

The DC voltage supervision monitors the battery's DC voltage. The supervision ensures that the unit does not trip if one of the battery packs has low voltage, as the unit will automatically disconnect the battery pack. This of course presupposes that the 400 Hz output level and quality required by the aircraft can be maintained. If the total battery DC level goes too low or too high, the unit trips to protect the battery packs and itself.

Over/Under Voltage during Output:

If the output voltage exceeds or falls 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 & B787 inrush, the unit shuts down to protect itself and the Leaf batteries:

- 110% for 600 seconds
- 125% for 300 seconds
- 140% for 10 seconds
- 200% for 2 seconds

Short Circuit during Output:

The unit has a built-in system to protect itself and the output cables if the unit's output(s) are short-circuited for some reason.

Internal High Temperature:

If for some reason the internal temperature of the inverter module or 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 G8 & G9 is < 20 VDC, the unit shuts down and reports "Control Voltage Too Low"

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

Aircraft Connector Insertion:

This feature verifies that the 90% switch/split “F” pin in the 400 Hz plug is activated.

If not activated, the respective outlet cannot be engaged.

To bypass/activate this function, see Sections 6.5 and 7.8.

Neutral Voltage Supervision (NVS):

As standard, the unit is delivered with a jumper wire between the 400 Hz neutral and earth/ground. If the jumper wire is removed for any reason (e.g. local regulation), the unit monitors the voltage between the 400 Hz neutral and earth/ground.

If this voltage exceeds 42 V (factory setting), the unit shuts down and reports “**NVS FAILURE**”.

To change this setting, see Sections 6.5 and 7.10.

Neutral Voltage Displacement (NVD):

(Requires that the GPU is grounded)

The combination of a grounded converter and an ungrounded aircraft can lead to an energized aircraft chassis. The reason is the neutral voltage displacement caused by an unbalanced load. If the aircraft frame is or becomes grounded during operation, a broken neutral might result in arcing as well as burnt ground wires.

The neutral voltage displacement of the aircraft chassis is measured as AC voltage imposed on the EF interlock signal.

Earth Leakage Supervision (ELS)

(Requires that the GPU is grounded)

In systems where the 400 Hz neutral is grounded and there is a break in 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 the event the residual current reaches the preset level.

To change this setting, see Sections 6.5 and 7.11.

Operation Manual – ITW GSE 7400 Battery Powered GPU

General Description

3.2 50/60 Hz & 400 Hz Tow Bar Interlock

The unit is always equipped with a 50/60 Hz & 400 Hz tow bar interlock feature. Which automatically Lights/Flashes the warning light (depending on customer's configuration) and sounds an acoustic signal, when the operator lowers the tow bar and tries to move the unit, before both the 50/60 Hz & 400 Hz (28 VDC) cables are in the cable compartment and the doors are closed.

Note

In the event of an emergency, push the EPO.

Remember to unplug the input / output cables, if the unit is towed further away than the cable length.



Fig 3.2.1a Cable Compartment, 50/60 Hz
(open)



Fig 3.2.2a Cable Compartment, 400 Hz
(open)



Fig 3.2.1b Cable Compartment, 50/60 Hz
(closed)



Fig 3.2.2b Cable Compartment, 400 Hz
(closed)

Please refer to Section 11.0 for option 575818, Lockable Towbar Interlock.

4.0 Transportation and Installation

4.1 Storage Before Installation

To guarantee optimal storage conditions prior to installation, we recommend that the ITW GSE 7400 is stored indoors. This protects the unit from rain and excessive humidity while it is unwrapped and not being used.

Only equipment in rainproof packing should be stored outside.

For storage conditions, please refer to Section 5.0.

4.2 Disposal of packaging material

The ITW GSE 7400 Ground Power Unit is supplied with cardboard, plastic and wooden packaging. These materials can be recycled and must be disposed according to the applicable laws and regulations in each country. All wood used in the packaging of the ITW GSE 7400 are in compliance with ISPM-15 and is not subjected to any chemical conservation treatment.

4.3 Disposal of unit (End of life)

The ITW GSE 7400 consists of metal (steel plates), nonferrous metals (copper and aluminum), fiber glass (canopy), LI-ION batteries (Leaf battery package), electronic components (PCB's, capacitors, fuses, chargers, MCB's and contactors), wires and cables.

In general, the ITW GSE 7400 has a relatively long service life. However, when they must be discarded,

ITW GSE recommends shipping the ITW GSE 7400 unit back to the factory for proper recycling.

The ITW GSE 7400 unit, may be discarded locally.

No-recyclable materials should be disposed of at industrial landfills according to applicable environmental laws and regulations in each country, or co-processed in cement kilns or incinerated.

The recycling service providers, the disposal in industrial landfills, the waste co-processing or incineration process must be properly authorized by state environmental agencies to carry out these activities.

4.4 Operating and Environmental Conditions after Commissioning

When the ITW GSE 7400 has been installed and commissioned, we strongly advise that the unit is always kept charged and ready to use.

For operating conditions, please refer to Section 5.1

For warranty conditions, please refer to section 5.2

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

4.5 Transportation

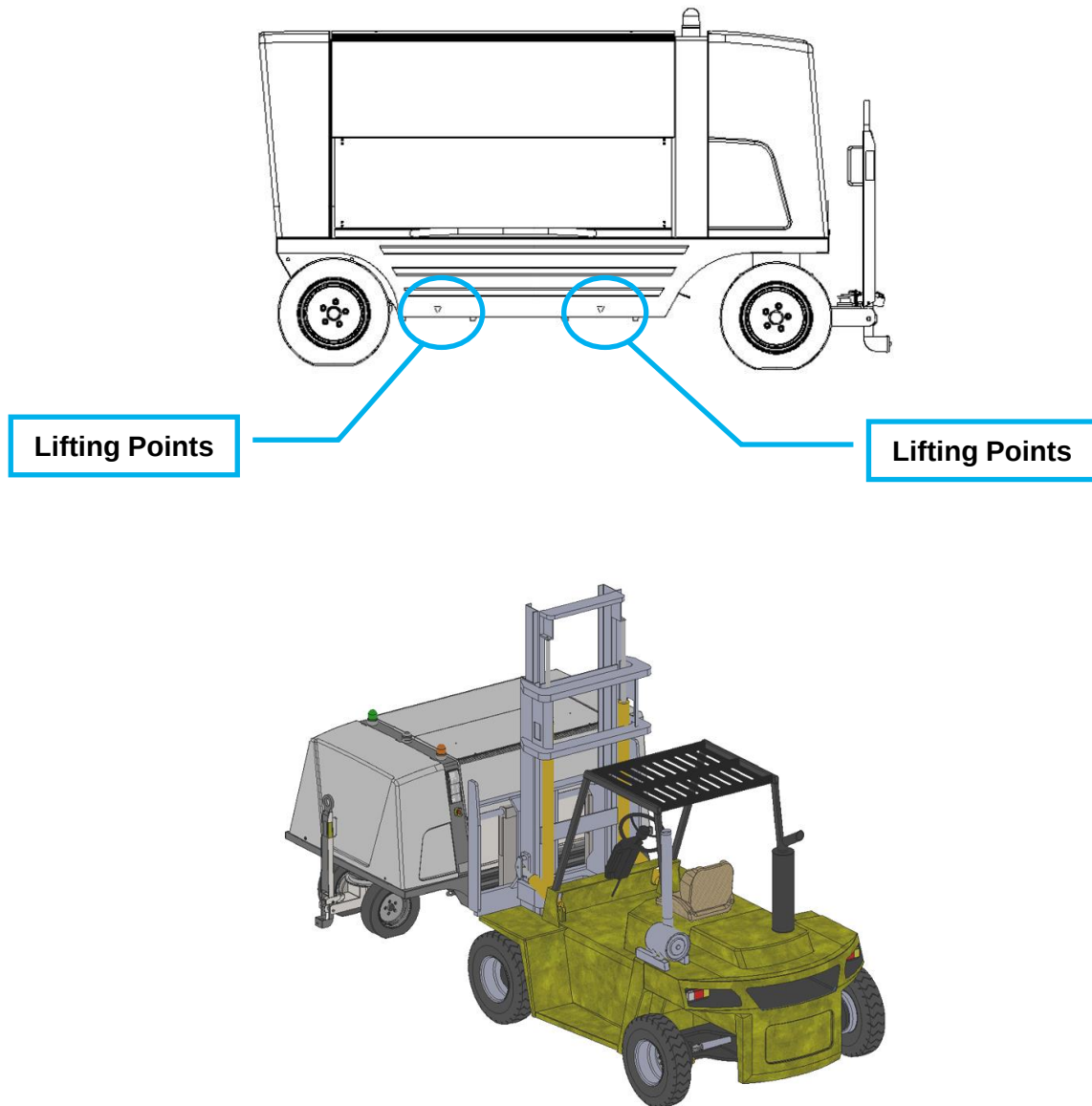


Fig. 4.5.1 Access for Forklift, Truck, or Similar

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

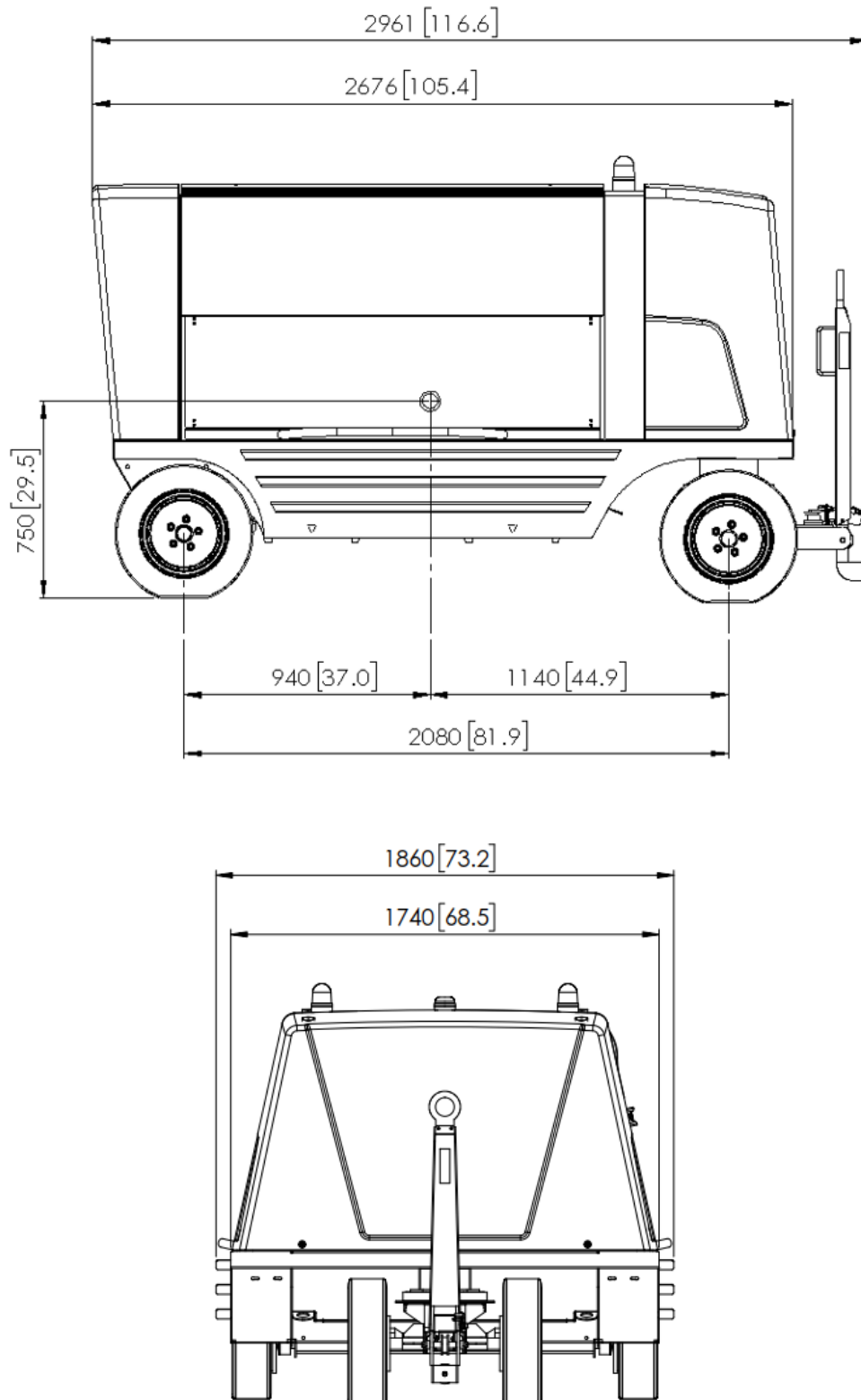


Fig. 4.5.2 Center of Gravity

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

Steering wheel angle is more than $\pm 90^\circ$ from neutral to allow a minimum turning radius of 2.1 m.

5.2 meters between curbs is required to turn.

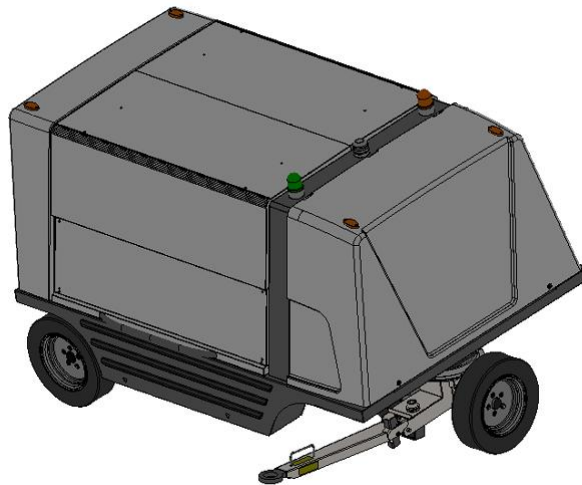
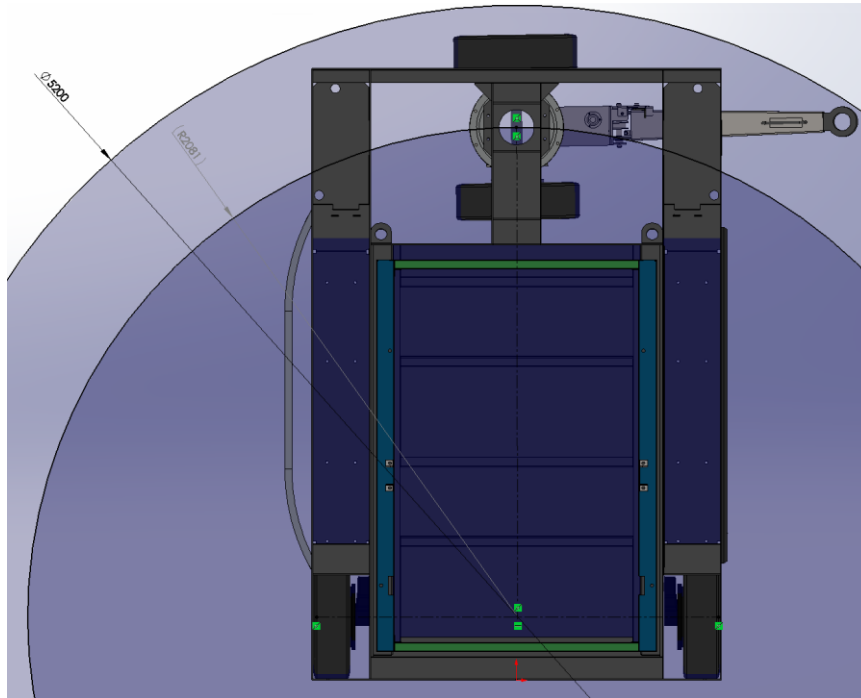


Fig. 4.5.3 Turning radius & steering wheel angle

Note

Maximum towing speed is 20 or 30 km/h and clearly marked on the front of canopy.

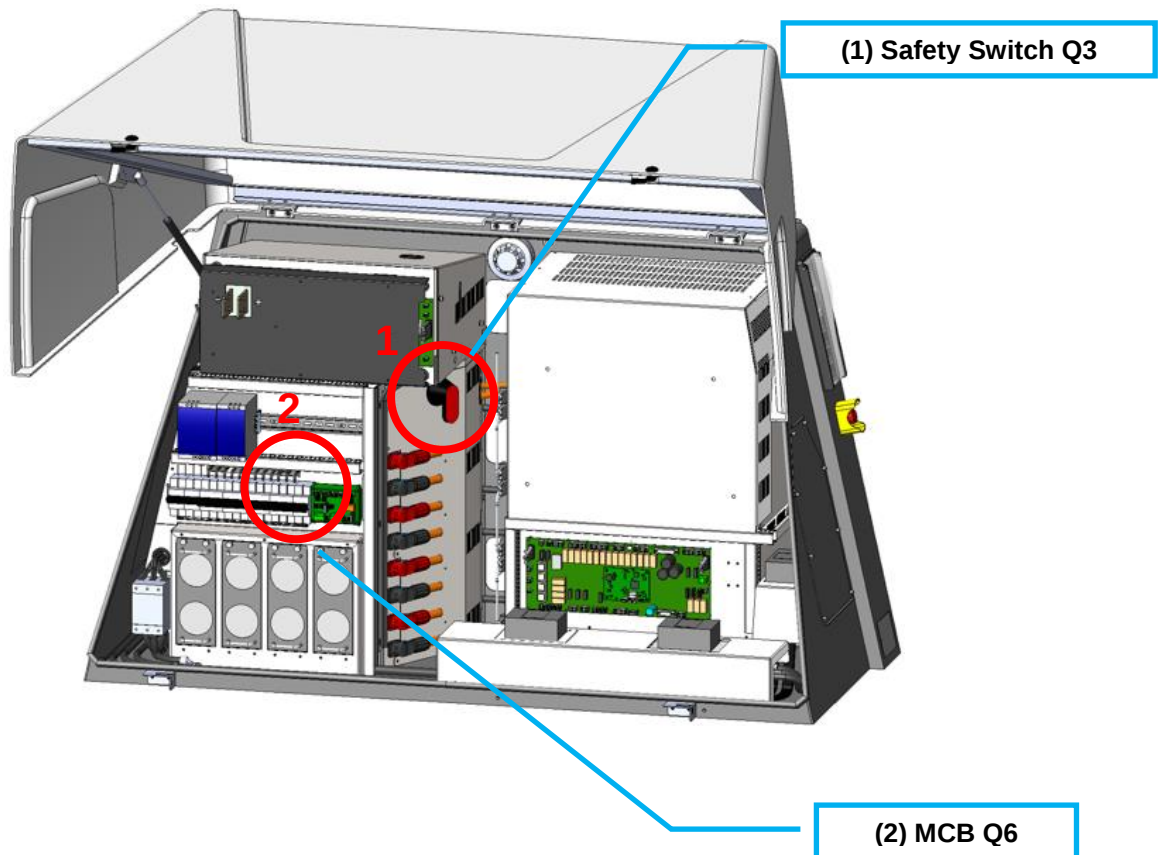
The mobile unit version is equipped with a front wheel parking brake, which can tolerate parking on a slope of at least 7 degrees.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

4.6 Preparation before use

Before the ITW GSE 7400 can be released for operation, the unit must be prepared. The ITW GSE 7400 is delivered with a switched off Q6.



1. Verify that the “Safety Switch Q3” is in the “ON” position; if not, switch it “ON” (Circle 1).
2. Switch “ON” the breaker Q6 by moving the operating lever up (Circle 2).
3. The unit goes through initialization and, after 10-15 seconds, the unit is now ready for operation.

Fig. 4.6.1 Breaker Q6 / Safety Switch Q3

Note

It will automatically go into sleep mode if not used for 15 minutes.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

4.7 Connection of Cables



Before connecting any cables to either the input or output, ensure that the ITW GSE 7400 is switched off.

Switch OFF breakers (Q3 shipped in ON position) in the following sequence:

1. Switch off the **“Control Voltage Battery MCB – Q6”** located behind the front canopy on the left-hand side of the ITW GSE 7400.
2. Switch off the **“Service Switch – Q3”** located behind the front canopy on the right-hand side of the ITW GSE 7400.

Note

Switch back ON breakers in reverse order.



1

2

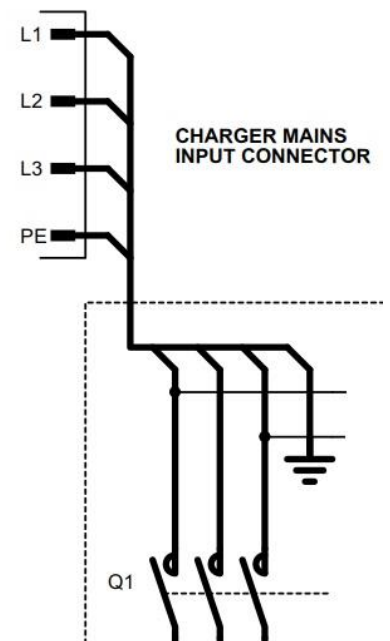
Fig. 4.7.1 Location of breakers Q6 & Q3 in Electronic zone

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

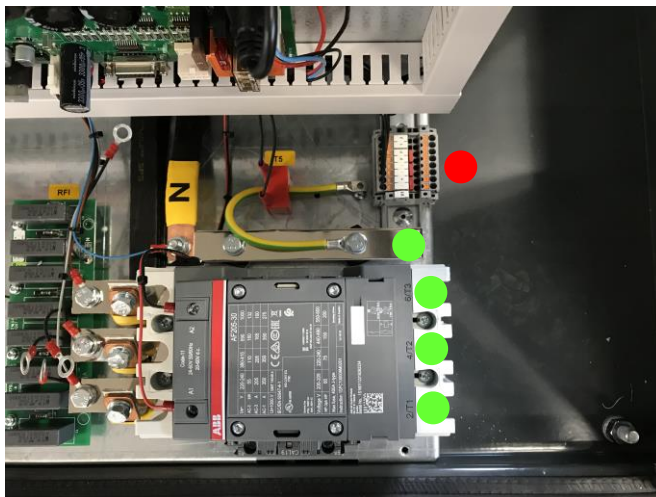


Standard input connections

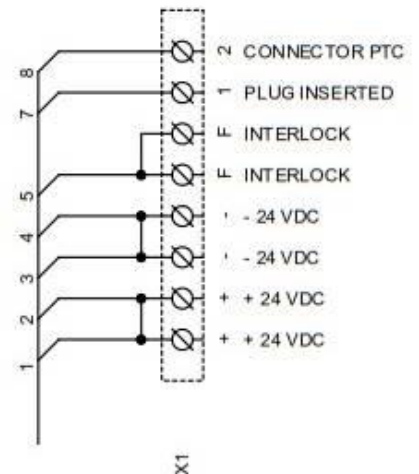


50/60 Hz input terminals: 3 x M8 (3x 1/4-20 by 1") 6 Nm (53.1 in-lb.) (L1, L2, L3) ●
1 x M10 bolt 50 Nm (444 in-lb) (Ground/PE) ●

Fig. 4.7.2 Input cable termination



Standard remote I/O terminals



400 Hz output terminals: 4 x M8 (A, B, C, N) 25.4 Nm (225in-lb) ●
Remote I/O terminals: 8 x 0.4 - 4 mm² (AWG 21-11) ●

Fig. 4.7.3 Output cable termination

Note

Remember to switch both breakers to "ON" after cable(s) have been installed.
Remember the sequence: Q3 and then Q6.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

4.8 Mains/Utility Input



For reasons of personal health and safety, the ITW GSE 7400 unit must always be protected by grounding the PE terminal ($\perp$) during charging.

NOTE: The minimum ground wire size is 16 mm² / #6 AWG.

Consult local authorities to ensure this meets local requirements.

(Specifically in accordance with *Canadian Electrical Code, Part 1* where applicable)

Note

We strongly recommend using a CEE-type outlet with interlocking switch to prevent disconnection while in use/charging.

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

Outlet Size	16 A	32 A	63 A	125 A
Charging Line Current @ 3x 400V	16 A	32 A	63 A	125 A

Note

Maximum grid power ampere (in steps of 1 A) can be set, according to the available mains/utility outlet, please refer to section 6.5.2 for further information.

4.9 400 Hz Output

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



Regardless of installation method, local regulations and legislation must be followed to ensure personal health and safety.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

4.10 400 Hz Interlock

The interlock safety system ensures that the output contactor stays engaged for 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.

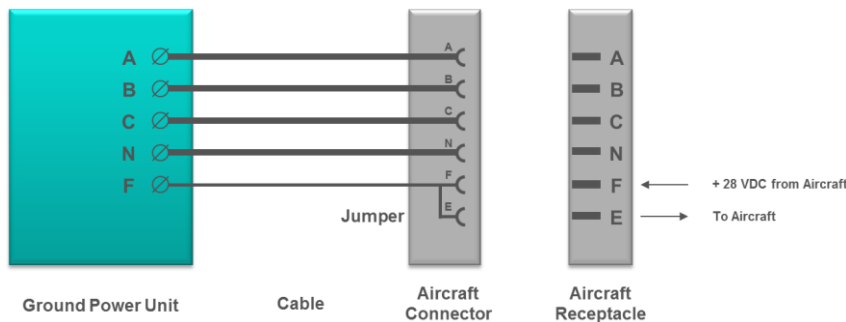


Fig. 4.10.1 Standard Wiring Diagram for Civil Aircraft

For service, maintenance and testing purposes, the interlock system can be bypassed 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 testing by qualified personnel.

4.11 400 Hz Input

The ITW GSE 7400 may be optionally equipped with a 400 Hz input, which is located on the left-hand side of the ITW GSE 7400 (see picture on page 39), if the ITW GSE 7400 is expected to run out of energy during a supply state. An additional 400 Hz Ground Power Unit can be attached to this inlet and started. The ITW GSE 7400 will then automatically switch to the external 400 Hz by means of an NBPT (No Break Power Transfer) and supply the aircraft attached to the output 1 with 400 Hz pass-through power. As the ITW GSE 7400 switches the external GPU by using NBPT, no power interruption to the attached aircraft will occur.

Note

This is only applicable for 400 Hz output no. 1.

All other outputs are terminated. If the unit has additional 400 Hz or 28 VDC outputs, they are turned off and power to those outputs will be lost, as soon as the unit recognizes an external 400 Hz connected to the 400 Hz inlet.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Transportation and Installation

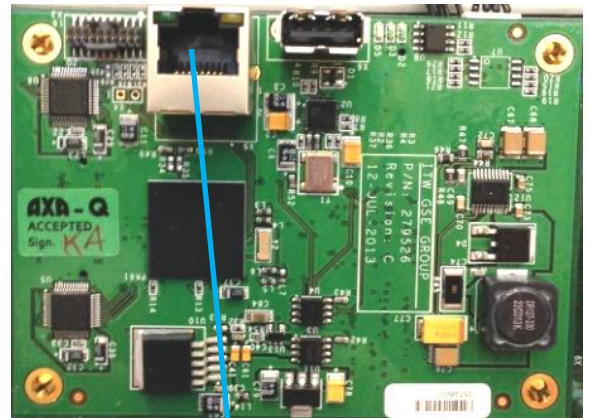
4.12 TCP/IP On-Board Interface

The ITW GSE 7400 is equipped with a TCP/IP (RJ45) communication port for supervision and monitoring of the GPU by a central computer, for example. The port is located on the control board (A1).

The protocol is limited to Modbus TCP/IP. The Data available from the ITW GSE 7400 is comprehensive and should meet most requirements.

Supported Modbus Function Codes

The ITW GSE 7400 implements a subset of the Modbus Application Protocol Specification V.1.1b.



RJ45 Connector

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:

- System in use, system on standby, and system fault.
- The GPU provides a comprehensive range of internal and external parameter measurements and information, e.g. voltages, currents, temperatures, time and date.
- 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 shutdown.
 - 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 be found in the document 999.012, which can be obtained from ITW GSE on request. Please refer to Section 6.3 and Sections 7.16 and 7.17 for communications setup.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Technical Specifications & Warranty

5.0 Technical Specifications & Warranty

5.1 Technical specifications and information

Standards:

ISO 6858:2017(E)	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-STD-704F	Aircraft electrical 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
EN 62619	Safety requirements for secondary lithium cells and batteries, for use in industrial applications

Input:

Charging Time (Based on charging only):

	Pre-Fuse			
	16 A	32 A	63 A	125 A
3 x Battery Packs	< 11h	< 6h	< 3h	< 3h
4 x Battery Packs	< 15h	< 8h	< 4h	< 3h

Values based on 3 x 400 V and 20°C ambient.

Phase	ABC
Inrush current	None
Power interruption	20 ms

Output:

Turnarounds as Function of Time and Aircraft:

Based on average measured consumption. Subject to aircraft configuration.					3 Packs (120 kWh)			4 Packs (160 kWh)		
					Time at Gate in Minutes			Time at Gate in Minutes		
					40	60	80	40	60	80
Narrow-Body Aircraft 1x 90 kVA Unit	CRJ-900LR				12	8	6	16	11	8
	A320-200				12	8	6	15	10	9
	A321-200				6	4	3	8	5	4
	B737-800				7	5	4	10	6	5
Wide-Body Aircraft 2x 90 kVA Unit	A340					5	4		6	5

Note

Depending on ambient conditions and usage, the capacity can be expected to decrease by up to 30% over 10 years.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Technical Specifications & Warranty

Power	90 kVA, $\cos(\varphi) = 1$, continuous (4 battery packs) 68 kVA, $\cos(\varphi) = 1$, continuous (3 battery packs)
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	$\Delta U < 8\%$ 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	$1.414 \pm 3\%$
Voltage modulation	<1.0%
Phase angle symmetry	$120^\circ \pm 1^\circ$ for balanced load $120^\circ \pm 2^\circ$ for 30% unbalanced load
Frequency	400 Hz $\pm 0.1\%$
Overload	100% continuous 110% for 10 minutes 125% for 5 minutes 140% for 10 seconds 200% for 2 seconds & B787 inrush current

Efficiency (400 Hz converter):

Charger & 400 Hz converter	>0.95
----------------------------	-------

Protections:

- Battery 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
- Neutral Voltage Displacement

Miscellaneous:

Physical:

Dimensions (LxWxH)	2961 x 1860 x 1579 mm / 116.6 x 73.2 x 62.2 inches
Mobile unit (3 battery packs)	2125 kg / 4.685 lb (without cables / options)
Mobile unit (4 battery packs)	2475 kg / 5.456 lb (without cables / options)

Operation Manual – ITW GSE 7400 Battery Powered GPU

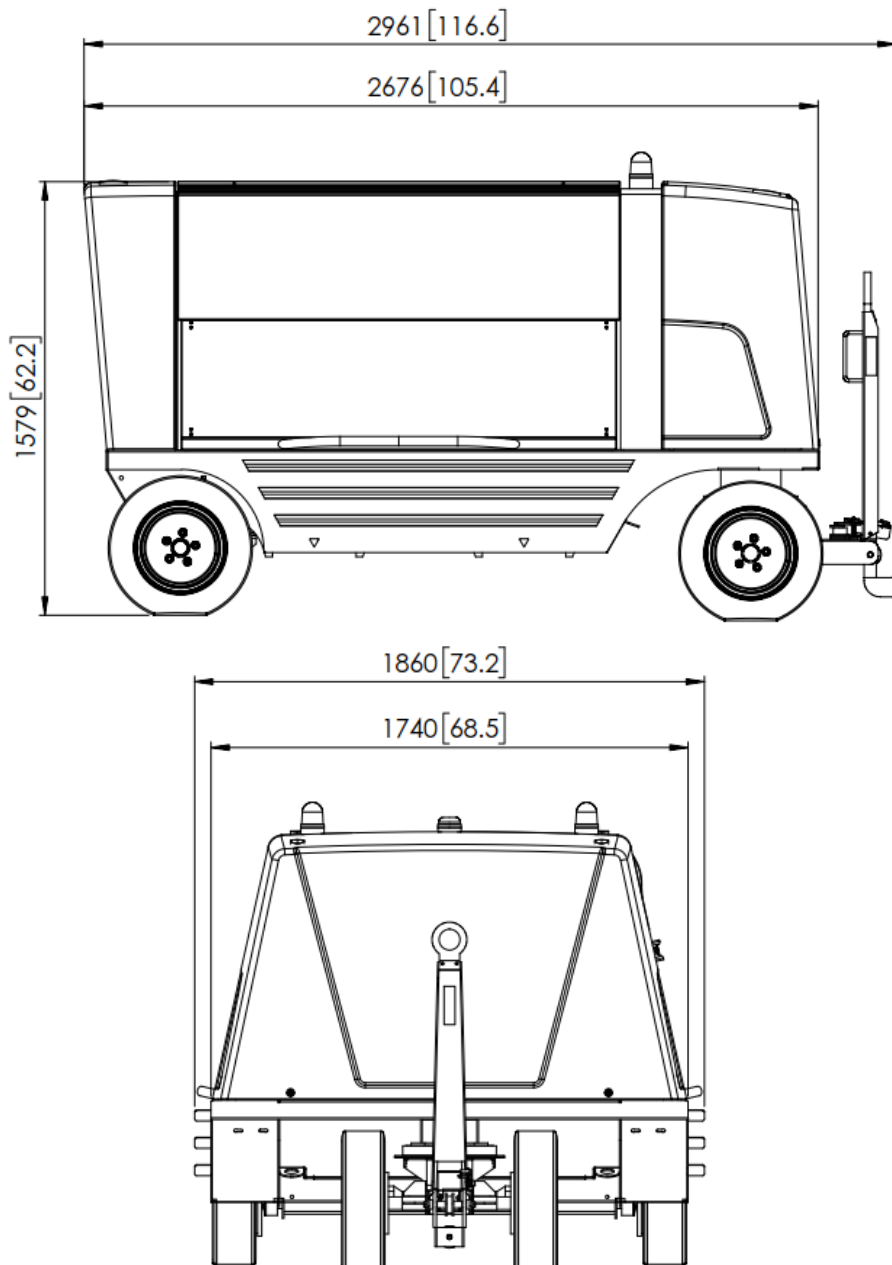
Technical Specifications & Warranty

Environmental:

Storage temperature	+10°C to +35°C / 50°F to 95°F & 20 to 70% RH
Operating temperature	-10°C to +45°C / 14°F to 113°F
Relative humidity	10-100% (noncondensing)
Noise level	<65 dB (A) @1m
Ingress protection	IP23 (NEMA 3R) battery section IP55 (NEMA 4) electronic section

Miscellaneous:

Color	RAL 7035 standard, other colors on request
MTTR (converter/charger)	Max. 20 minutes



Operation Manual – ITW GSE 7400 Battery Powered GPU

Technical Specifications & Warranty

5.2 7400 Battery Warranty Conditions

The ITW GSE 7400 battery is warranted for **5 years** against capacity loss below 72% of a new battery. The Lithium-ion batteries are designed to operate in avg. temperatures of 0°C (32F) to 35°C (95F).

- As a condition of this warranty, you are responsible for properly using, maintaining and caring for your ITW GSE 7400.
- You are required to perform semiannual (½ Year) battery usage reports at intervals of 6 months, 12 months, 18 months, 24 months, 30 months, 36 months, 42 months, 48 months, 54 months and 60 months.
These battery usage reports shall be performed by ITW GSE or any other certified partner/agent/distributor/person, which are appointed by ITW GSE.
- You are also required to provide consent to give ITW GSE access to data stored on ITW GSE 7400 systems for the purpose of ITW GSE 7400 diagnosis and repair. Failure to do so will likely result in denial of warranty coverage.
- To assist you in keeping appropriate maintenance records, the maintenance logbook can be retrieved from ITW GSE and be used along with supporting repair invoices, receipts and other such records.

This warranty does not cover damage or failures resulting from or caused by:

- Exposing the ITW GSE 7400 to ambient temperatures above 49°C (120F) for over 24 hours coherent.
- Storing the ITW GSE 7400 in temperatures below -25°C (-13F) for over seven days coherent.
- Leaving your ITW GSE 7400 for over 14 days where the lithium-ion battery reaches a zero or near zero state of charge.
- Physically damaging the lithium-ion battery or intentionally attempting to reduce the life of the lithium-ion battery.
- Exposing the lithium-ion battery to contact with a direct flame.
- Immersing any portion of the lithium-ion battery in water or fluid.
- Opening the lithium-ion battery enclosure or having it serviced by someone other than an ITW GSE certified technician.
- Consequential damage caused by the failure to repair an existing problem.



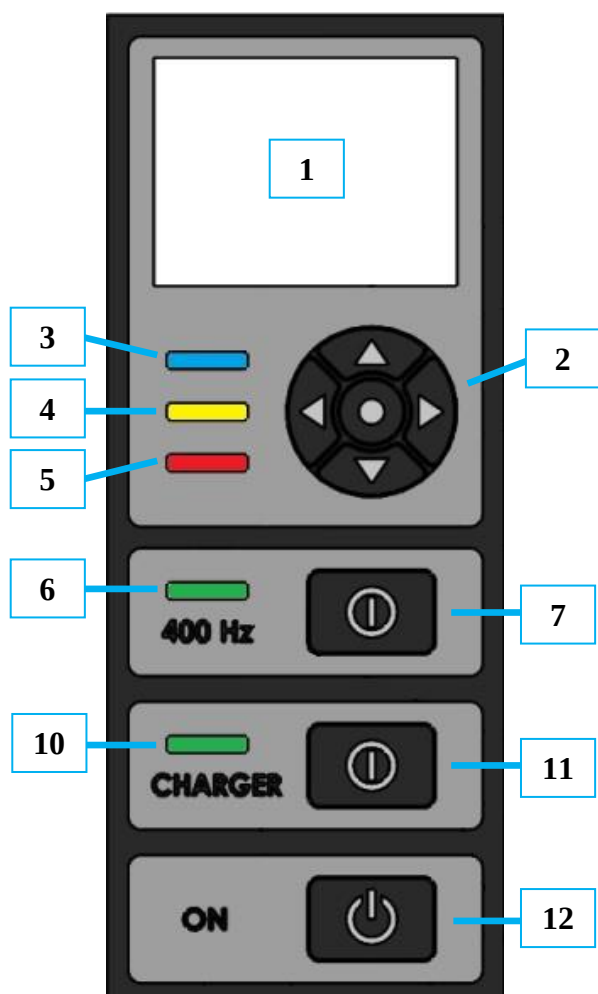
Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

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

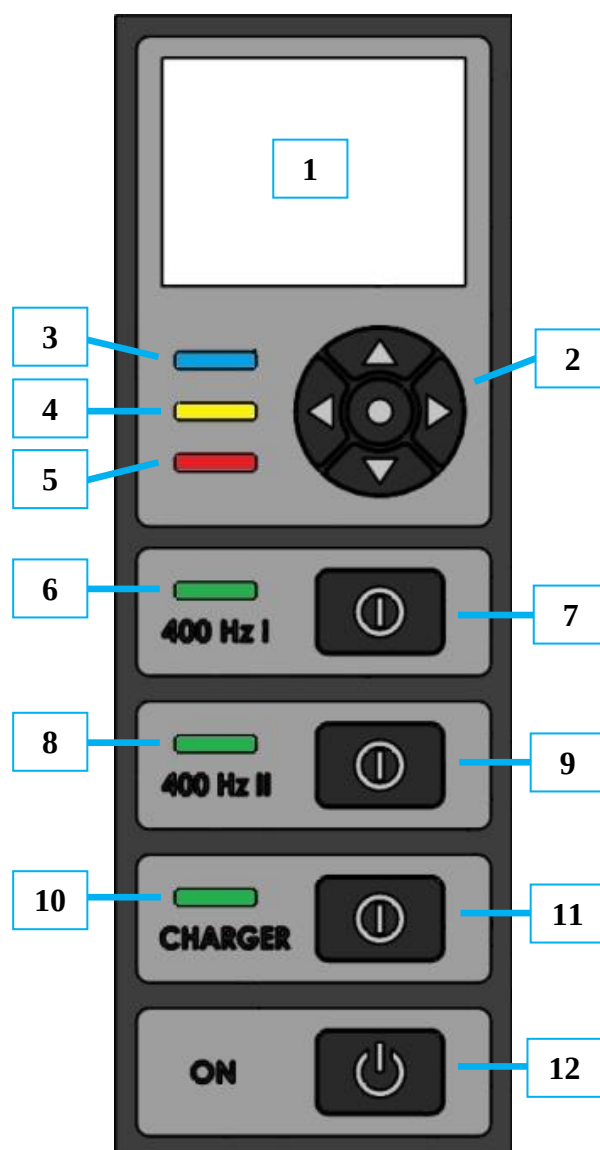
Depending on the ITW GSE 7400 layout, the different types of operator panels are as shown below:

1 x 400 Hz output



- 1: LED Graphic Display
- 2: Navigation Keypad
- 3: Power ON "Blue" LED
- 4: Warning "Yellow" LED
- 5: Failure "Red" LED
- 6: Output 1 ON (400 Hz) "Green" LED

2 x 400 Hz output

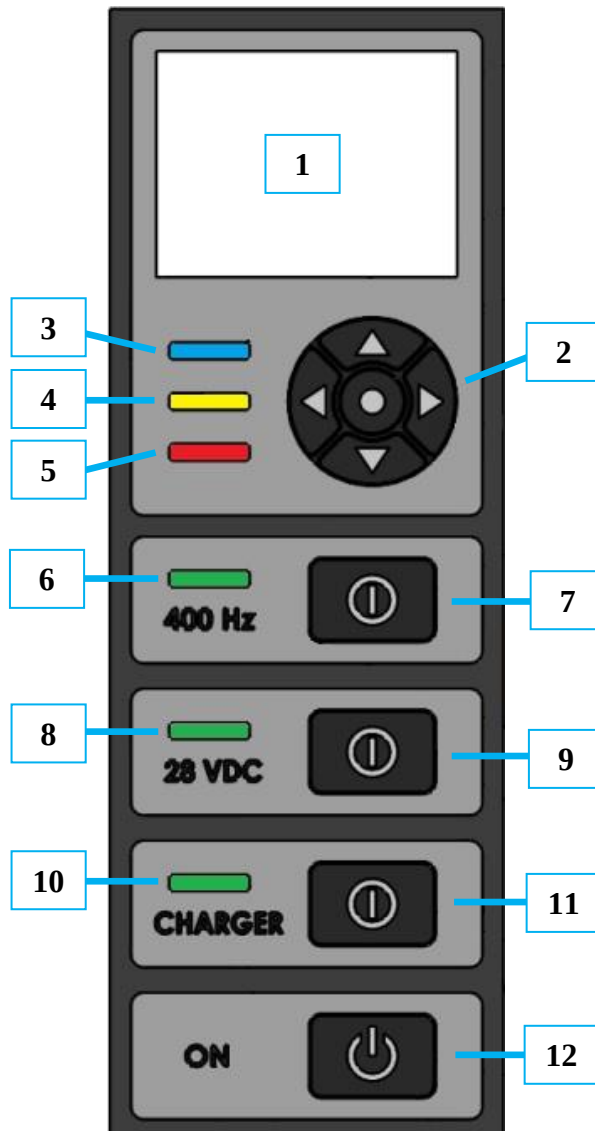


- 7: Output 1 (400 Hz) ON/OFF
- 8: Output 2 ON (400 Hz) "Green" LED
- 9: Output 2 (400 Hz) ON/OFF
- 10: Charger "Green" LED
- 11: Charger ON/OFF
- 12: Power ON/OFF

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

1 x 400 Hz & 1 x 28 VDC output



- 1: LED Graphic Display
- 2: Navigation Keypad
- 3: Power ON "Blue" LED
- 4: Warning "Yellow" LED
- 5: Failure "Red" LED
- 6: Output 1 ON (400 Hz) "Green" LED

- 7: Output 1 (400 Hz) ON/OFF
- 8: Output 2 ON (28 VDC) "Green" LED
- 9: Output 2 (28 VDC) ON/OFF
- 10: Charger "Green" LED
- 11: Charger ON/OFF
- 12: Power ON/OFF

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.1 Using the Display/Keypad

To enable smooth and easy operation, the operator control panel has a simple layout. The LED display is located at the top and provides information during operation, service, and maintenance. Depending on GPU status, the display shows operational data, warnings, or failure information in plain text, combined with a timestamp and a 4-digit code which, in combination with the manual, shows more detailed information on the reported message.

Note

Refer to previous pages for exact operator's keypad layout.

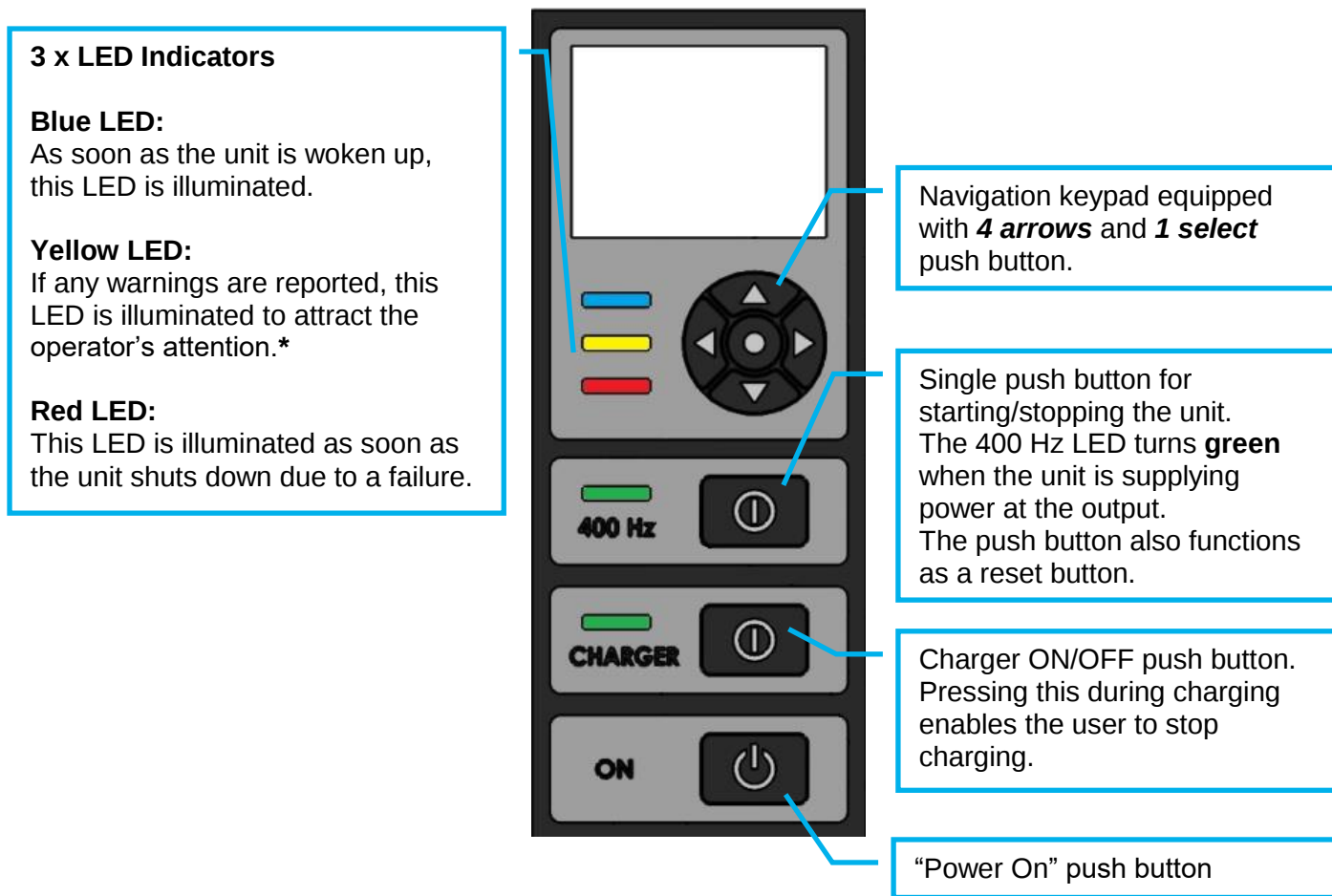


Fig. 6.1.1 Display/Operator Panel

***A warning may appear during operation for the following issues:**

Cable 1 Temperature Too High

Cable 2 Temperature Too High (optional, only if the unit is equipped with 2 outputs)

EF Signal Dropout – Output 1

EF Signal Dropout – Output 2 (optional, only if the unit is equipped with 2 outputs)

Aircraft Connector Not Inserted – Output 1

Aircraft Connector Not Inserted – Output 2 (optional, only if the unit is equipped with 2 outputs)

Operation Manual – ITW GSE 7400 Battery Powered GPU

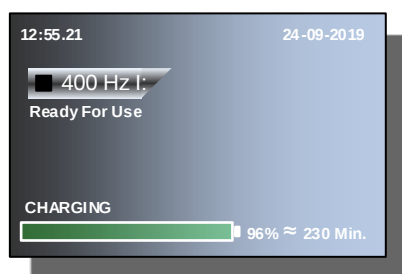
Operator's Instructions

6.2 Charging the Unit

Connect the 50/60 Hz inlet plug to an appropriate mains/utility outlet. Depending on the configuration of the inlet charging cable and plug, it is possible to connect to a 16 A, 32 A, 63 A, or 125 A outlet*. After connecting and switching on the mains/utility power, the charging starts automatically and is indicated with the “Green” charger LED.

When charging is completed or stopped by pressing the charger On/Off push button. Switch off the main/utility power, remove the input cable and store it in the cable compartment. The unit will go into sleep mode after 15 minutes.

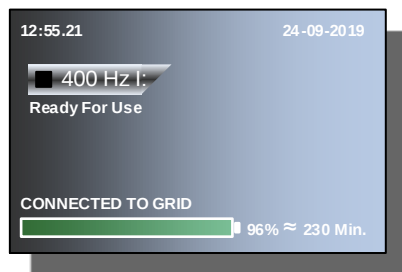
Default Screen Charging Display:



If, for some reason, the charging needs to be terminated before the batteries are fully charged:

- Press the Charger (On/Off)  button to stop charging.

This screen appears:



- Switch off mains/utility power and remove the supply cable from the outlet. Stow the inlet cable in the cable tray of the ITW GSE 7400 unit.

Or

- Press the Charger (On/Off)  button to continue charging.

Note

*See Section 6.4 to limit the charging current, to protect cable / pre-fuse.

See Section 5.0 for approximate charging time.

Charging and supplying 400 Hz is possible simultaneously.

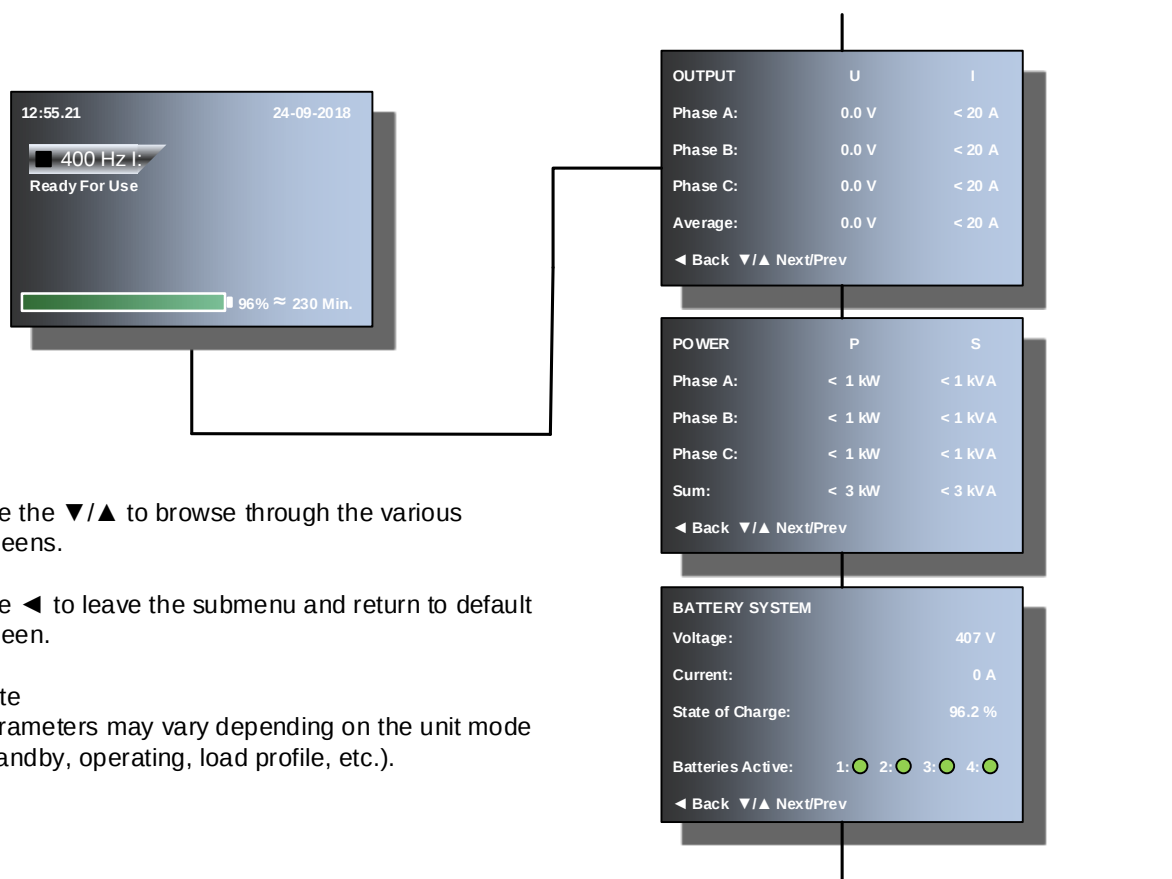
Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.3 Operating the Unit

- Press the On/Off  button to power up the GPU if it is not already under power.
- Insert the aircraft cable/plug into the aircraft. Make sure the plug is fully inserted until you feel a natural resistance. The plug may be equipped with a 90° switch/split “F” pin. If so, the unit will not function if the plug is not fully inserted.
- After initializing, press the corresponding  to start the unit.
- The unit is now in operation and ready to supply the aircraft with power. Indicated with the green LED located next to the Start/Stop button.  
- If the unit shuts off and is no longer supplying power to the aircraft, this will be reported in clear text on the display. A corrective action will also be 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.

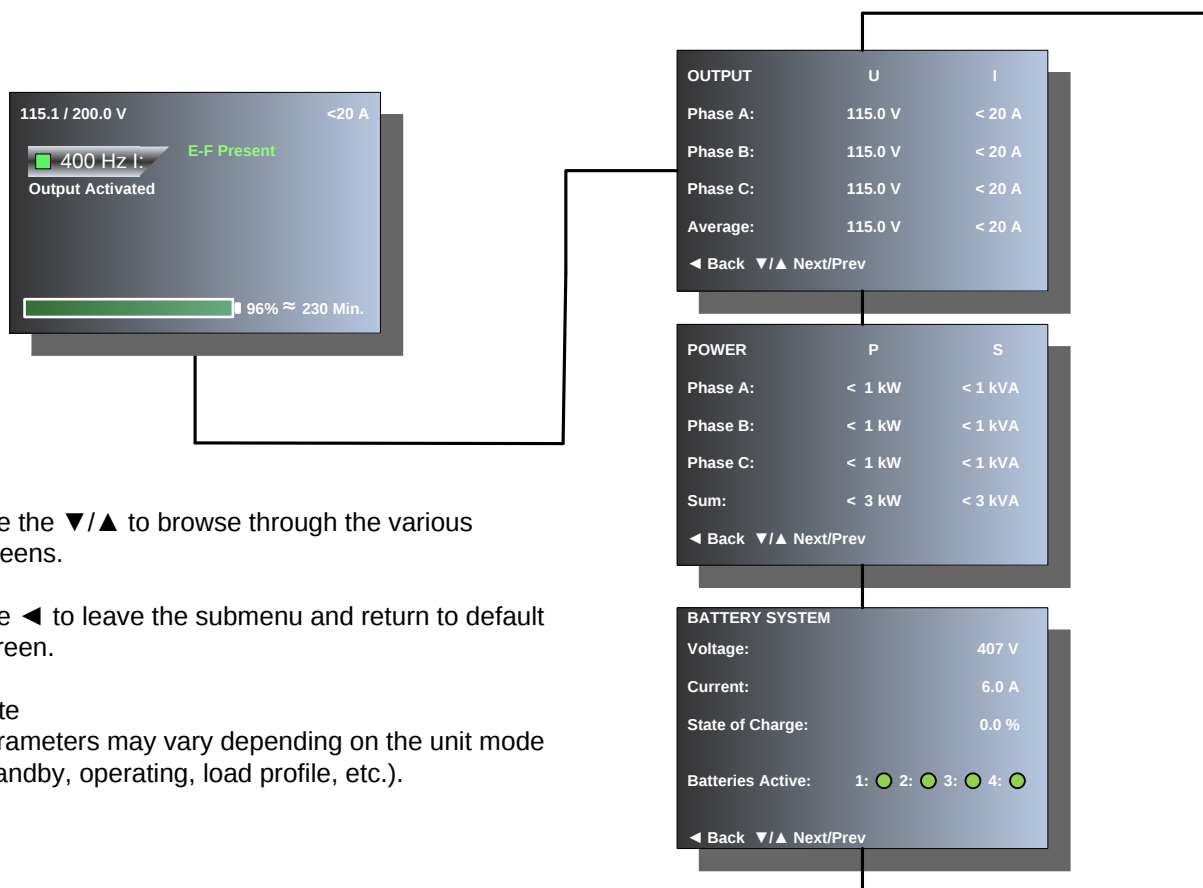
Use ◀ to leave the submenu and return to default screen.

Note
Parameters may vary depending on the unit mode (standby, operating, load profile, etc.).

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Default Display Screen, Operating



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

Use ◀ to leave the submenu and return to default Screen.

Note
Parameters may vary depending on the unit mode (standby, operating, load profile, etc.).

- After operation, press the Start/stop button  before removing the aircraft plug.
- Place aircraft cable in the cable compartment and close the door.
- The unit will automatically go back into sleep mode after 15 minutes.

Note

Please note that the Start/Stop  button also functions as a Reset button.

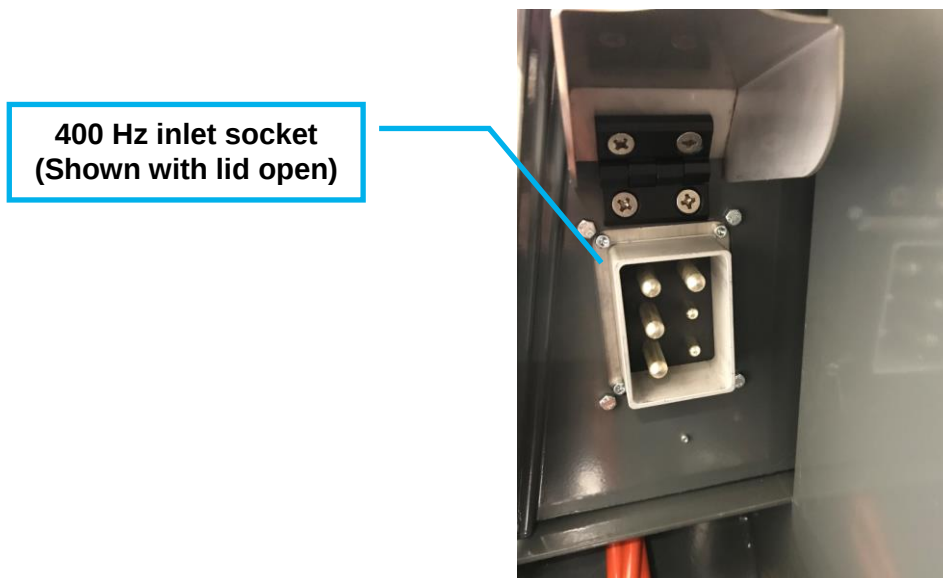
If, for some reason, the unit stops due to an error or failure, press Start/Stop/Reset to reset the unit.

6.4 Operating the Unit as 400 Hz Pass Through

Note

Using the 400 Hz inlet will **switch off output 2** (400 Hz or 28 VDC).

- Before attaching the additional Ground Power Unit, make sure the rating of the external GPU can handle the power request from the aircraft.
- Insert the additional 400 Hz plug into the inlet socket. The socket is located in the cable compartment on the right side of the ITW GSE 7400 GPU.



- Start the additional 400 Hz Ground Power Unit and make sure it is supplying 400 Hz.
- The ITW GSE 7400 automatically switches to the external 400 Hz and supplies the aircraft via the already connected cable/plug from the ITW GSE 7400. The switchover is done as an NBPT; no power interruption will arise on the connected aircraft.
- After operation, press the Start/Stop button  on the ITW GSE 7400 before removing the aircraft plug.
- Press the stop button on the external Ground Power Unit and remove the cable.
- Place the ITW GSE 7400 output cable in the cable compartment and close the door.
- The unit will automatically go back into sleep mode after 15 minutes.

Note

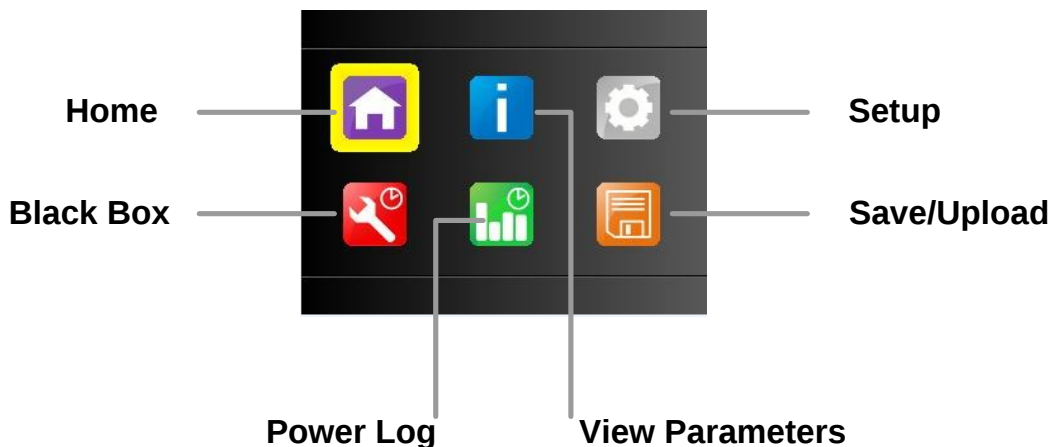
Please note that the Emergency button on the ITW GSE 7400 is still active.

Pressing the ITW GSE 7400 EPO during operation will switch off the NBPT contactor and disconnect 400 Hz output power to the aircraft.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5 Basic Menu



The basic icon menu is shown above with the available submenus.

To enter the icon menu, press the **•** from the default menu and hold it down for approximately 10 seconds.

To select a submenu, simply use the navigation keys **◀▼▲▶** to highlight the icon and then press the **•** to enter the submenu.

To leave the icon menu highlight the “Home” icon and press **•**

Legend:



Back to default screen



View current converter parameters



Setup 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 updating the software can be found in the document 699.135, which can be obtained from ITW GSE on request.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.1 Parameters – Menu Structure



Highlight the  by using the navigation **◀▼▲▶** keys.

Press **●** to select "View Parameters" submenu.

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

Use **◀** to leave the submenu and return to basic icon menu.

Note

Parameters may vary depending on the unit mode (standby, operating, load profile, etc.).

OUTPUT	U	I
Phase A:	0.0 V	< 20 A
Phase B:	0.0 V	< 20 A
Phase C:	0.0 V	< 20 A
Average:	0.0 V	< 20 A
◀ Back ▼/▲ Next/Prev		

POWER	P	S
Phase A:	< 1 kW	< 1 kVA
Phase B:	< 1 kW	< 1 kVA
Phase C:	< 1 kW	< 1 kVA
Sum:	< 3 kW	< 3 kVA
Power Factor:	0.00	

INVERTER	
Phase A:	< 20 A
Phase B:	< 20 A
Phase C:	< 20 A
DC-Voltage:	400 V
DC-Input:	400 V

INTERLOCK	LEVEL	RIPPLE
Output 1:	0 V	0 V
Leakage:		0 V
NVS Level:		2 V

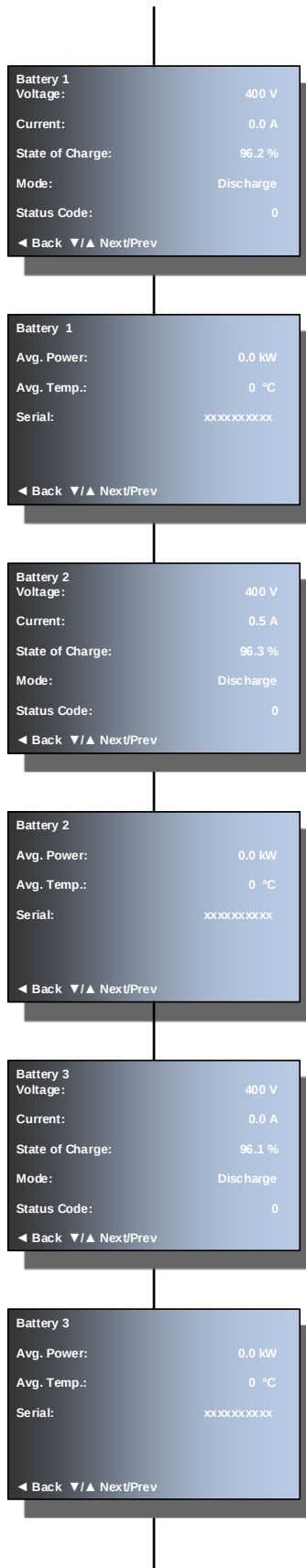
SYSTEM	
Control Voltage:	27.0 V
Inv. Temp:	< 40° C
Hour Meter:	02:31:11
Consumption:	138 kWh
Next Service	2-2020

BATTERY SYSTEM	
Voltage:	400 V
Current:	0 A
State of Charge	96.2 %
Batteries Active:	1: 2: 3: 4:
	● ● ● ●
◀ Back ▼/▲ Next/Prev	

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Parameters – Menu Structure (Continued)



Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Parameters – Menu Structure (Continued)

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

● = Active (green)

● = Not Active (red)

Use ◀ to leave the submenu and return to basic icon menu.

Note

I/O port status may vary depending on the unit mode (standby, operating, load profile, etc.).

Battery 4	
Voltage:	391 V
Current:	0.0 A
State of Charge:	96.2 %
Mode:	Discharge
Status Code:	0
◀ Back ▼/▲ Next/Prev	

Battery 4	
Avg. Power:	0.0 kW
Avg. Temp.:	0 °C
Serial:	xxxxxxxxxx
◀ Back ▼/▲ Next/Prev	

UNIT INFORMATION	
Display FW:	075202 -
Control FW:	075202 -
Unit Serial:	97232/1.1
Unit Rating:	90 kVA
MAC:	C8:02:58:00:14:B4
◀ Back ▼/▲ Next/Prev	

Input / Output Port Status																											
I	1	2	3	4	5	6	7	8	9	10	11	12	13	14													
N	●	●	●	●	●	●	●	●	●	●	●	●	●	●													
	15	16	17	18	19	20	21	22	23	24	25																
O	1	2	3	4	5	6	7	8	9	10	11	12	13	14													
U	●	●	●	●	●	●	●	●	●	●	●	●	●	●													
T	●	●	●	●	●	●	●	●	●	●	●	●	●	●													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28													

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.2 I/O Configuration

6.5.2.1 1 x 400Hz output:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1	Connector 1 PTC	X7:I1	15	Not Used	X16:I15	1	Not Used	X27:O1	15	Not Used	X27:O15
2	Not Used	X8:I2	16	Grid Connector Interlock	X11:I16	2	Not Used	X27:O2	16	+ I/O (F6)	X18:O16
3	Not Used	X16:I3	17	External EPO *	X9:I17	3	Run/Charge Beacon	X23:O3	17	PM -INV	X21:O17
4	Not Used	X16:I4	18	Start/Reset Output 1	X28:I18	4	Warning Beacon Input	X23:O4	18	PM +INV	X21:O18
5	Smoke Detector	X31:I5	19	Stop Output 1	X28:I19	5	Not Used	X23:O5	19	Soft Start	X21:O19
6	Plug 1 Inserted	X7:I6	20	Not Used	X28:I20	6	Not Used	X23:O6	20	Coil Control Output 1	X4:O20
7	Not Used	X8:I7	21	Not Used	X28:I21	7	Control battery	X18:O7	21	Not Used	X5:O21
8	Grid Voltage Present	X10:I8	22	Not Used	X28:I22	8	Not Used	X27:O8	22	NBPT Control	X3:O22
9	Busbar Temperature	X20:I9	23	Not Used	X28:I23	9	Not Used	X27:O9	23	50/60 Hz Q1 Coil	X12:O23
10	Transf. TL °	X24:I10	24	Not Used	X28:I24	10	Not Used	X27:O10	24	Not Used	X6:O24
11	Transf. TH °	X24:I11	25	GPS Unit	X13:I25	11	Not Used	X27:O11	25	GPS Unit	X13:O25
12	Not Used	X16:I12				12	Smoke Detector	X31:O12	26	GPS Unit	X13:O26
13	GPU Enable	X28:I13				13	Not Used	X27:O13	27	GPS Unit	X13:O27
14	Not Used	X28:I14				14	Not Used	X27:O14	28	GPS Unit	X13:O28

*

When using the External EPO, please remember to remove SW4 on the Interface Board (A2)

Note

Please refer to the schematic for further information.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.2.2 2 x 400Hz output:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1	Connector 1 PTC	X7:I1	15	Not Used	X16:I15	1	Not Used	X27:O1	15	Not Used	X27:O15
2	Connector 2 PTC	X8:I2	16	Grid Connector Interlock	X11:I16	2	Not Used	X27:O2	16	+ I/O (F6)	X18:O16
3	Not Used	X16:I3	17	External EPO *	X9:I17	3	Run/Charge Beacon	X23:O3	17	PM -INV	X21:O17
4	Not Used	X16:I4	18	Start/Reset Output 1	X28:I18	4	Warning Beacon Input	X23:O4	18	PM +INV	X21:O18
5	Smoke Detector	X31:I5	19	Stop Output 1	X28:I19	5	Not Used	X23:O5	19	Soft Start	X21:O19
6	Plug 1 Inserted	X7:I6	20	Start/Reset Output 2	X28:I20	6	Not Used	X23:O6	20	Coil Control Output 1	X4:O20
7	Plug 2 Inserted	X7:I7	21	Stop Output 2	X28:I21	7	Control Battery	X18:O7	21	Coil Control Output 2	X5:O21
8	Grid Voltage Present	X10:I8	22	Not Used	X28:I22	8	Not Used	X27:O8	22	NBPT Control	X3:O22
9	Busbar temperature	X20:I9	23	Not Used	X28:I23	9	Not Used	X27:O9	23	50/60 Hz Q1 Coil	X12:O23
10	Transf. TL °	X24:I10	24	Not Used	X28:I24	10	Not Used	X27:O10	24	Not Used	X6:O24
11	Transf. TH °	X24:I11	25	GPS Unit	X13:I25	11	Not Used	X27:O11	25	GPS Unit	X13:O25
12	Not Used	X16:I12				12	Smoke Detector	X31:O12	26	GPS Unit	X13:O26
13	GPU Enable	X28:I13				13	Not Used	X27:O13	27	GPS Unit	X13:O27
14	Not Used	X28:I14				14	Not Used	X27:O14	28	GPS Unit	X13:O28

*

When using the External EPO, please remember to remove SW4 on the Interface Board (A2)

Note

Please refer to the schematic for further information.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.2.3 1 x 400Hz & 1 x 28 VDC output:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1	Connector 1 PTC (400Hz)	X7:I1	15	Not Used	X16:I15	1	Not Used	X27:O1	15	Not Used	X27:O15
2	Connector 2 PTC (28VDC)	X8:I2	16	Grid Connector Interlock	X11:I16	2	Not Used	X27:O2	16	+ I/O (F6)	X18:O16
3	Not Used	X16:I3	17	External EPO *	X9:I17	3	Run/Charge Beacon	X23:O3	17	PM -INV	X21:O17
4	Not Used	X16:I4	18	Start/Reset Output 1	X28:I18	4	Warning Beacon Input	X23:O4	18	PM +INV	X21:O18
5	Smoke Detector	X31:I5	19	Stop Output 1	X28:I19	5	Not Used	X23:O5	19	Soft Start	X21:O19
6	Plug 1 Inserted	X7:I6	20	Start/Reset Output 2	X28:I20	6	Not Used	X23:O6	20	Coil Control Output 1	X4:O20
7	Plug 2 Inserted	X7:I7	21	Stop Output 2	X28:I21	7	Control battery	X18:O7	21	Coil Control Output 2	X5:O21
8	Grid Voltage Present	X10:I8	22	Not Used	X28:I22	8	Not Used	X27:O8	22	NBPT Control	X3:O22
9	Busbar Temperature	X20:I9	23	Not Used	X28:I23	9	Not Used	X27:O9	23	50/60 Hz Q1 Coil	X12:O23
10	Transf. TL °	X24:I10	24	Not Used	X28:I24	10	Not Used	X27:O10	24	ARU Control	X6:O24
11	Transf. TH °	X24:I11	25	GPS Unit	X13:I25	11	Not Used	X27:O11	25	GPS Unit	X13:O25
12	Not Used	X16:I12				12	Smoke Detector	X31:O12	26	GPS Unit	X13:O26
13	GPU Enable	X28:I13				13	Not Used	X27:O13	27	GPS Unit	X13:O27
14	Not Used	X28:I14				14	Not Used	X27:O14	28	GPS Unit	X13:O28

*

When using the External EPO, please remember to remove SW4 on the Interface Board (A2)

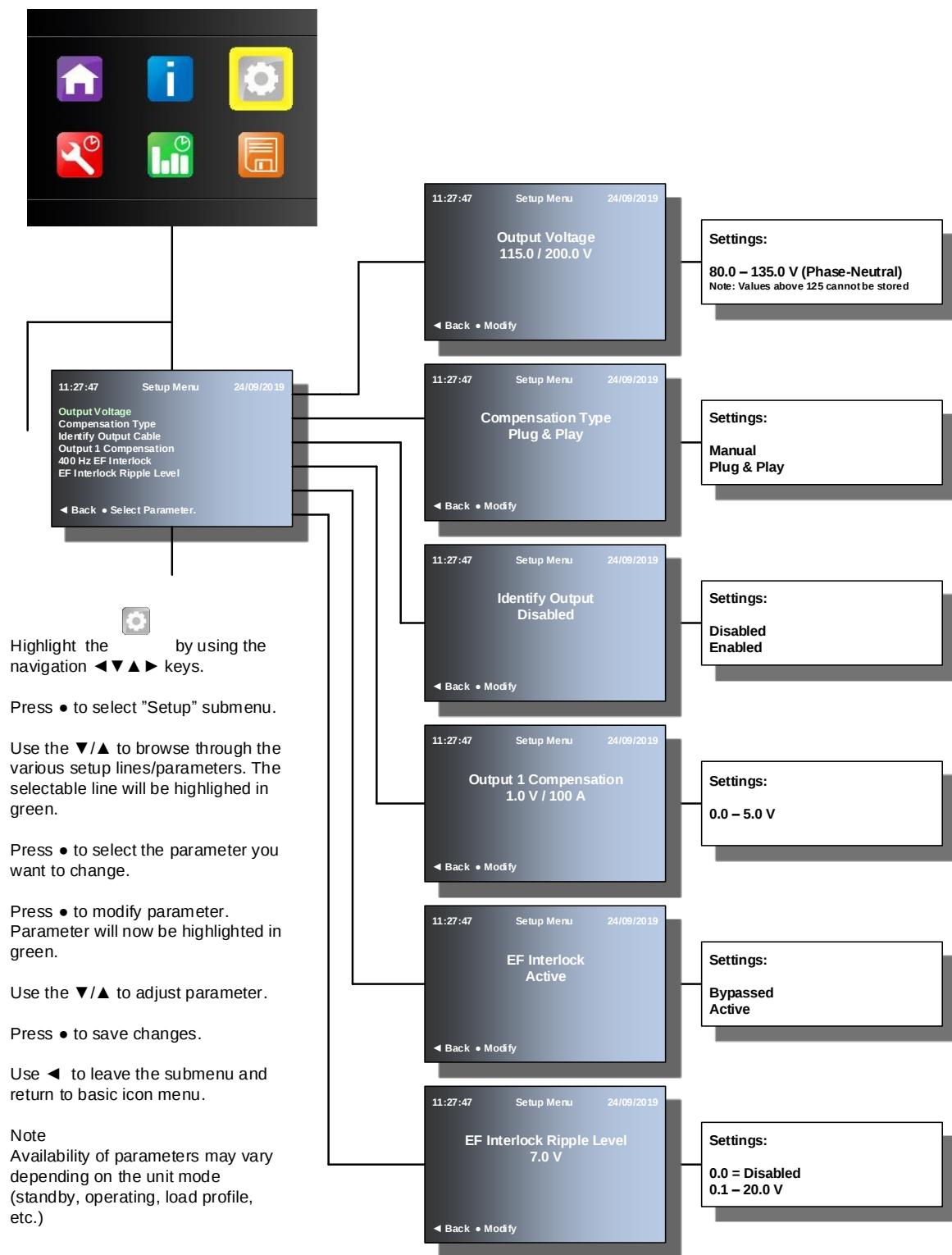
Note

Please refer to the schematic for further information.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

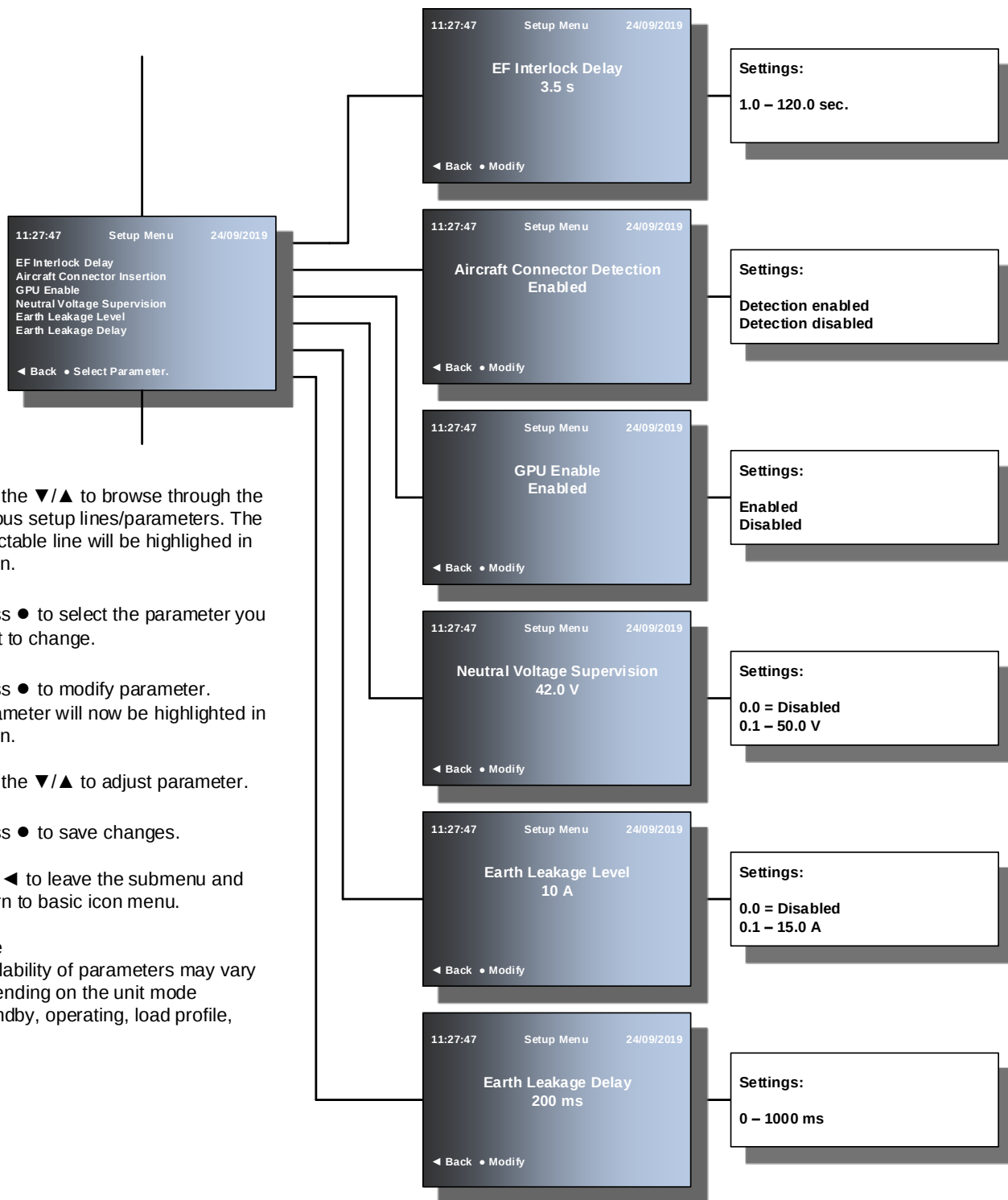
6.5.3 Setup – Menu Structure



Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Setup – Menu Structure (Continued)



Use the ▼/▲ to browse through the various setup lines/parameters. The selectable line will be highlighted 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.

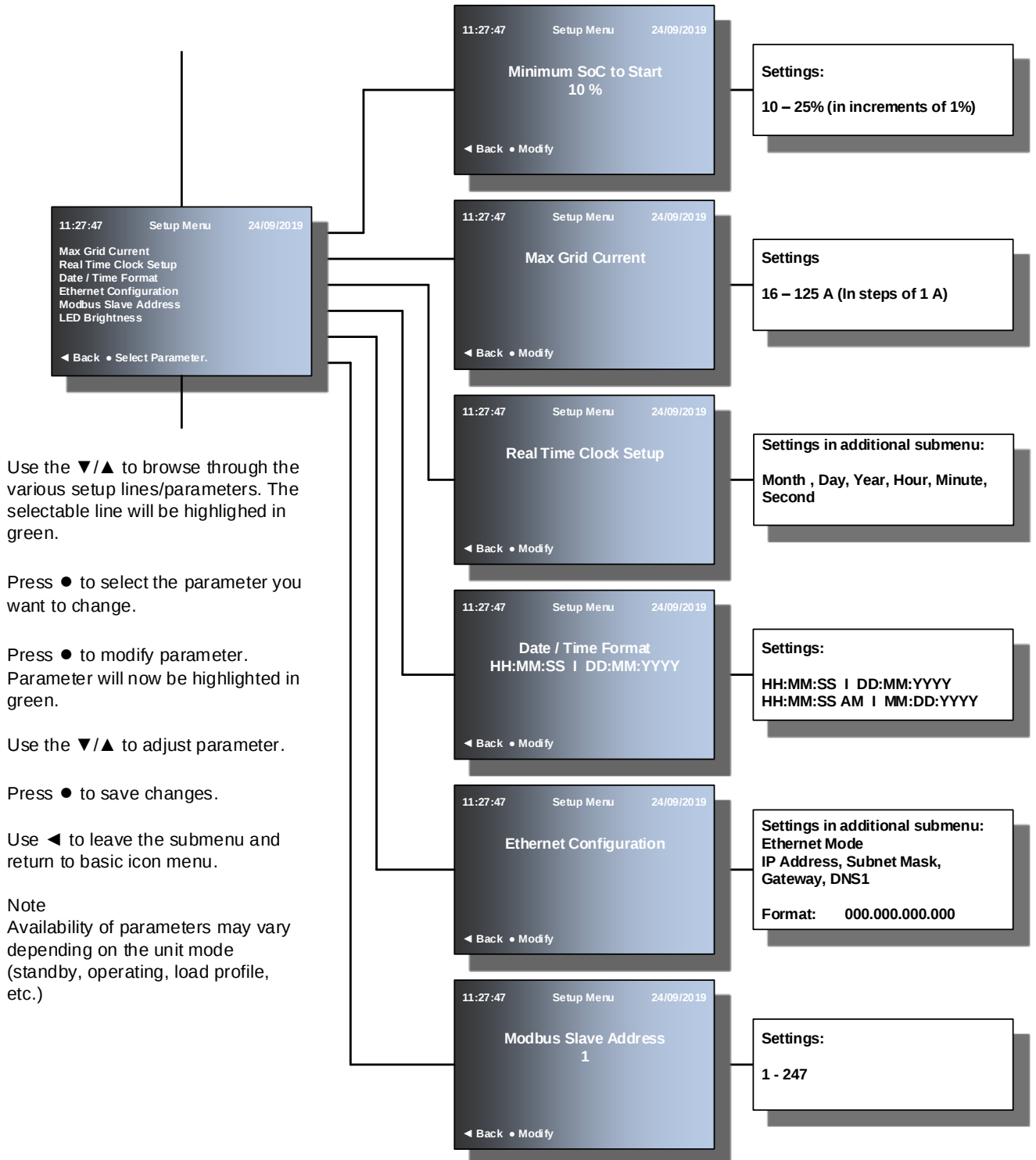
Use ◀ to leave the submenu and return to basic icon menu.

Note
Availability of parameters may vary depending on the unit mode (standby, operating, load profile, etc.)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

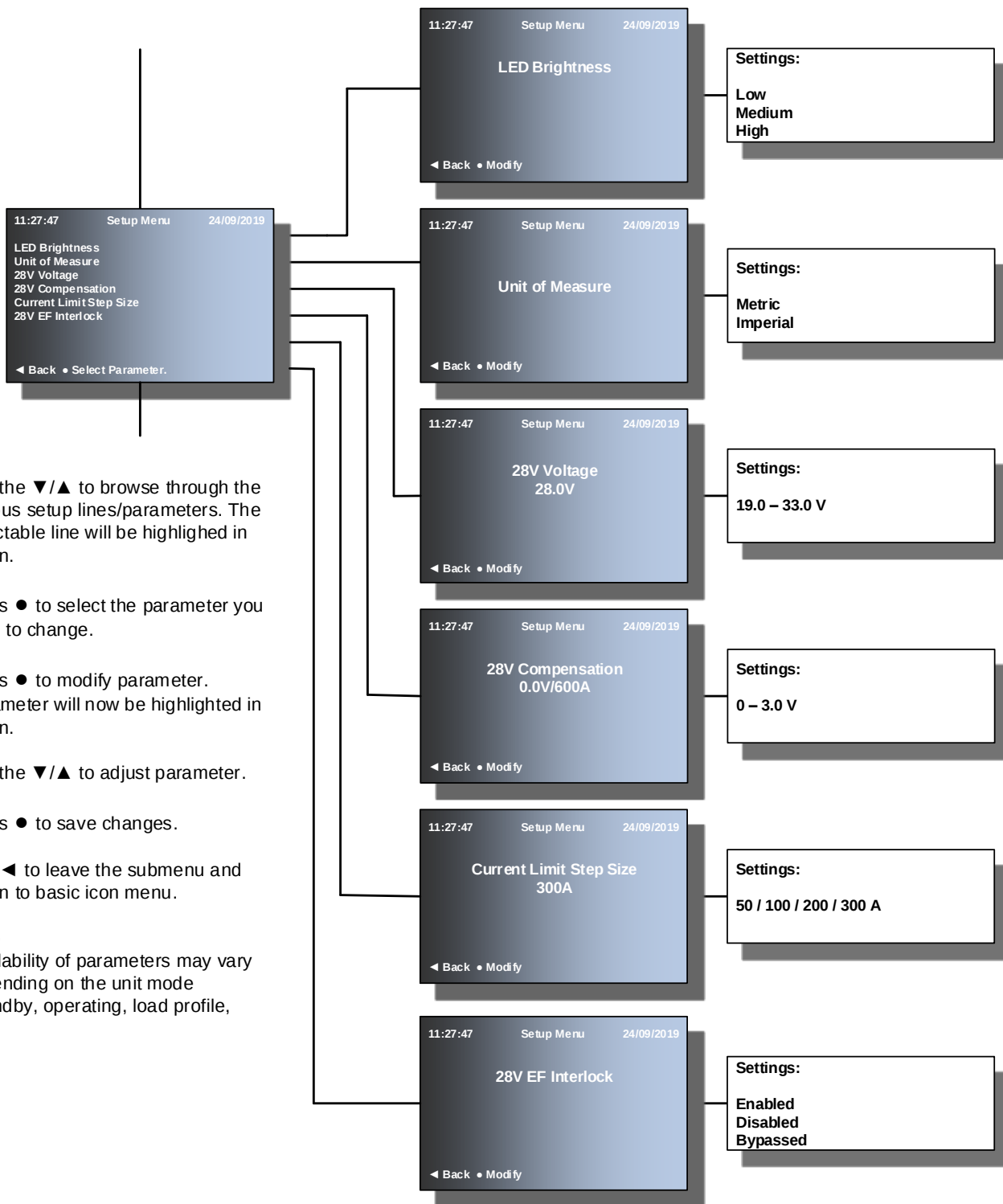
Setup – Menu Structure (Continued)



Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Setup – Menu Structure (Continued)



Use the ▼/▲ to browse through the various setup lines/parameters. The selectable line will be highlighted 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.

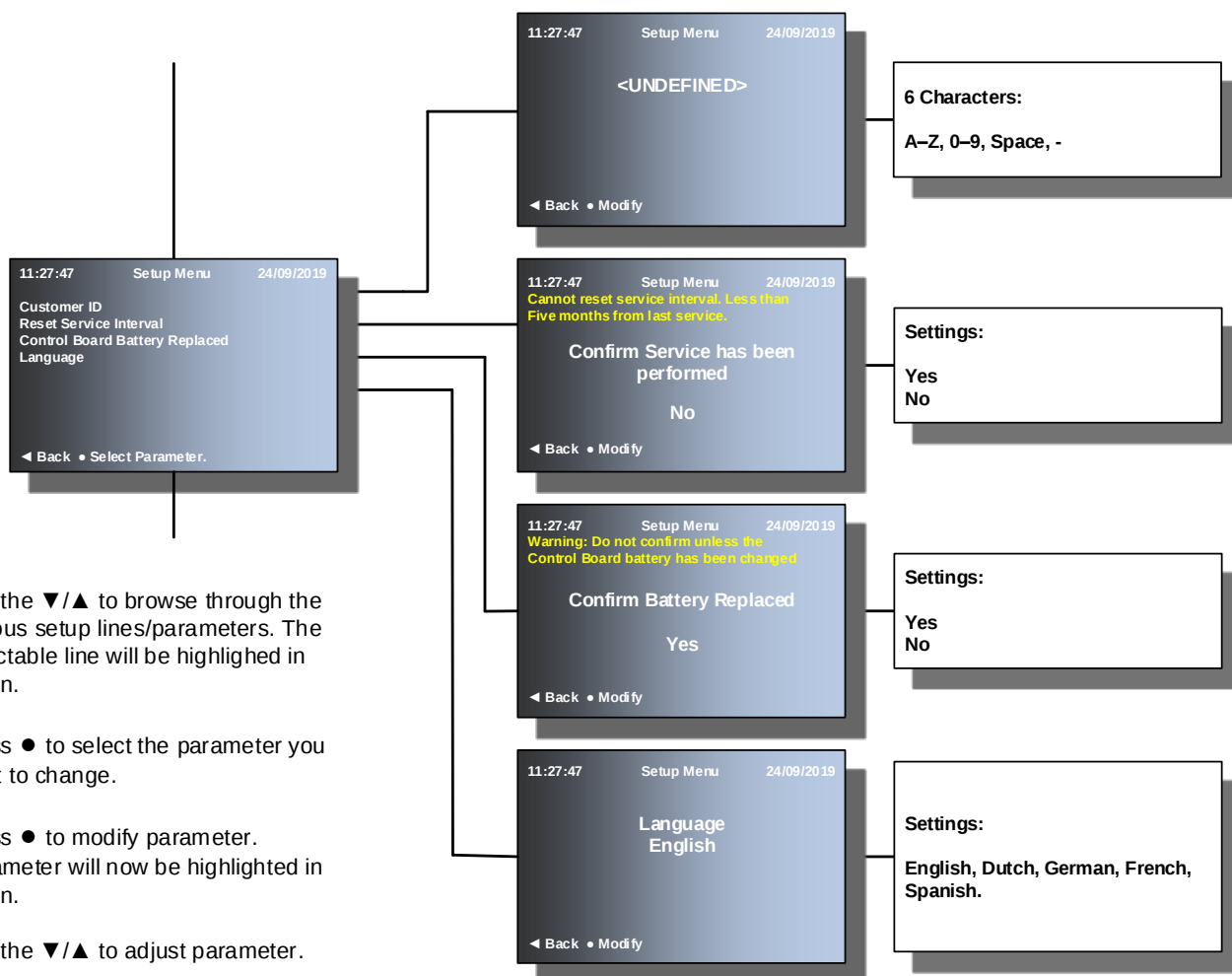
Use ◀ to leave the submenu and return to basic icon menu.

Note
Availability of parameters may vary depending on the unit mode (standby, operating, load profile, etc.)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Setup – Menu Structure (Continued)



Use the ▼/▲ to browse through the various setup lines/parameters. The selectable line will be highlighted 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 submenu and return to basic icon menu.

Note
Availability of parameters may vary depending on the unit mode (standby, operating, load profile, etc.)

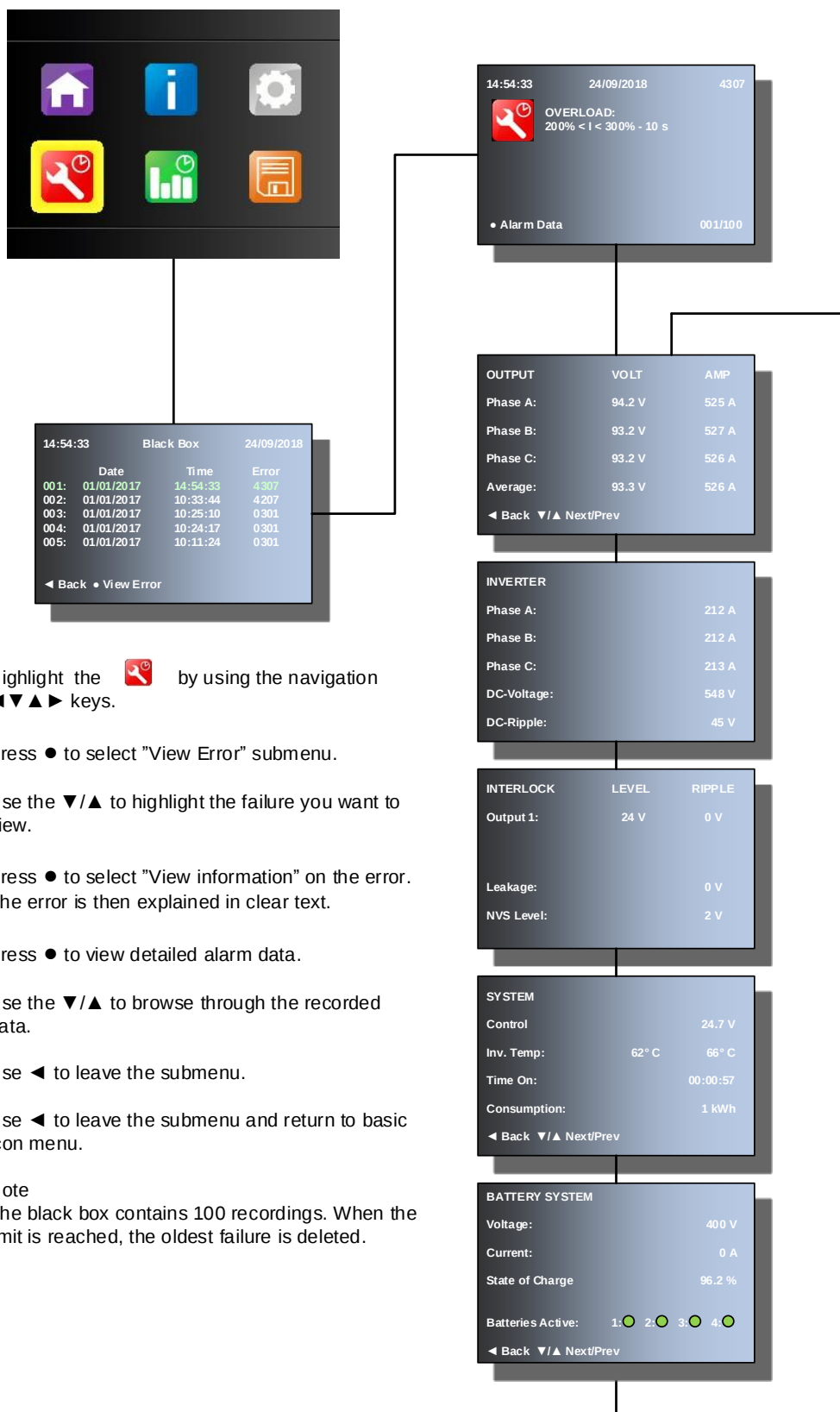
Note

Values changed in the setup menu are not stored in non-volatile memory before you exit the setup menu. If you disconnect power to the unit without first exiting the setup menu, any changes will be lost.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.4 Black Box – Menu Structure



Highlight the  by using the navigation **◀▶▲▶** keys.

Press **●** to select "View Error" submenu.

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 submenu.

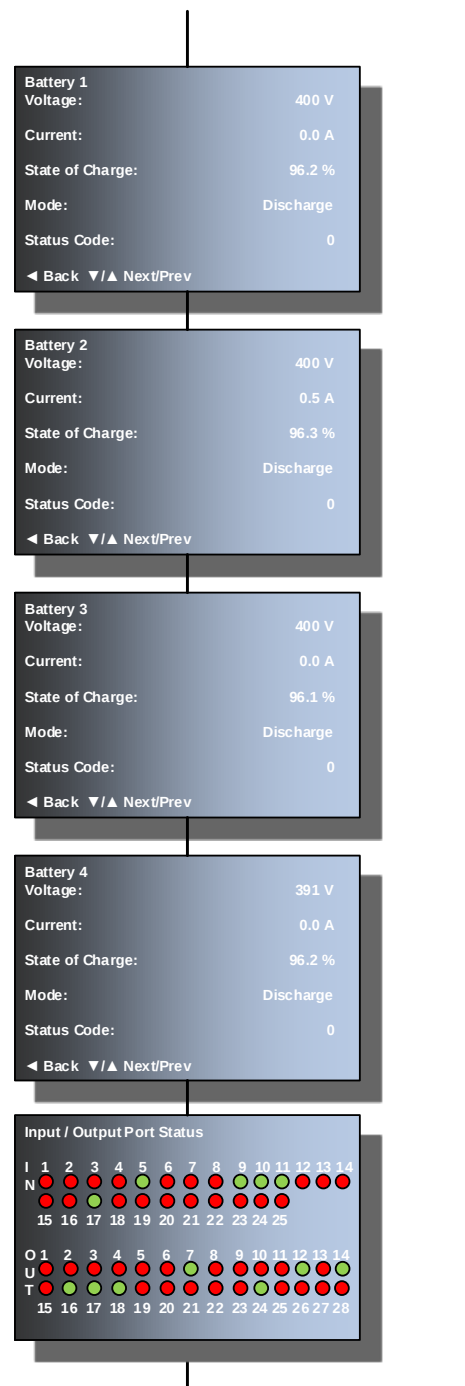
Use **◀** to leave the submenu and return to basic icon menu.

Note
The black box contains 100 recordings. When the limit is reached, the oldest failure is deleted.

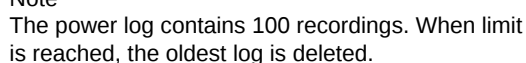
Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Black Box – Menu Structure (Continued)



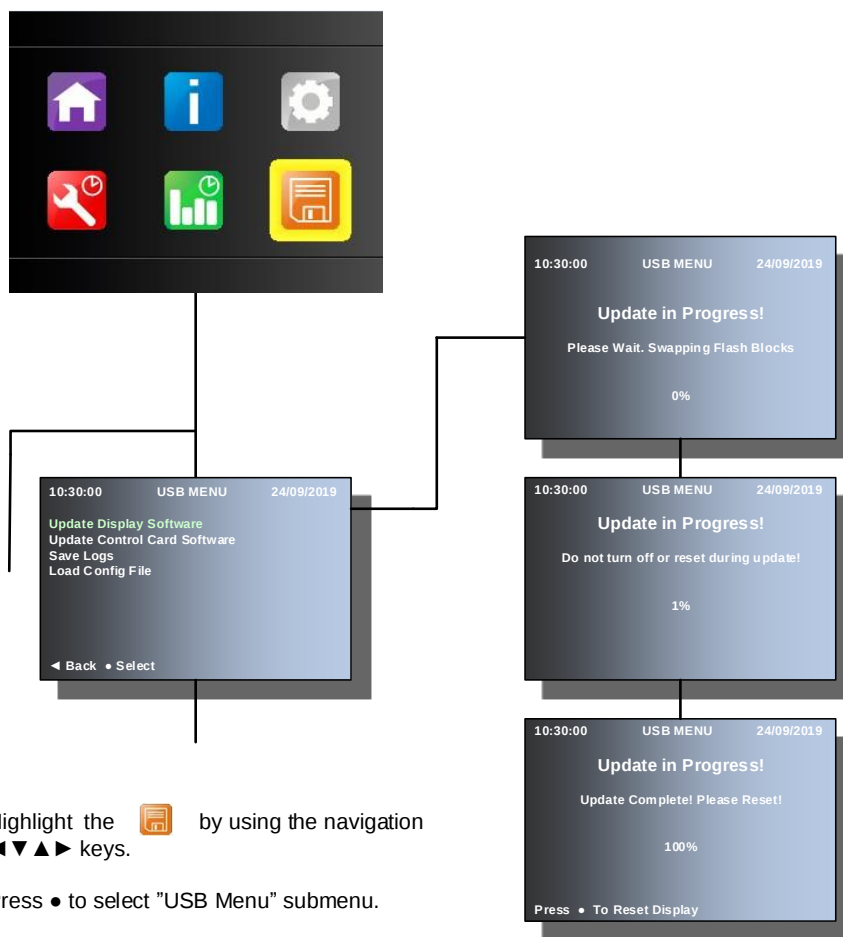
Operator's Instructions



Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.5.6 Update Software/Save Logs/Load Config File



Highlight the  by using the navigation **◀▶▲▼** keys.

Press **•** to select "USB Menu" submenu.

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

Insert a USB stick into the USB port from display (located 400 Hz compartment).

Press **•** to select function and update firmware.

The firmware is now being uploaded to the display card. The upload percentage will count from 0% to 100% and "Update Complete! Please Reset" will be displayed when the update is complete.

To reset the unit, press the button **•**

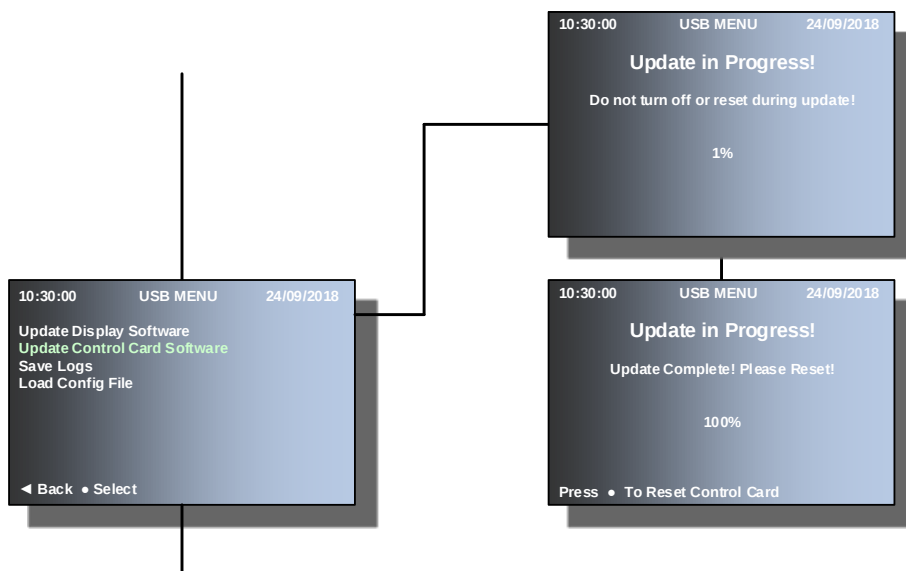


USB Connection Display

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Update Software/Save Logs/Load Config File (Continued)



Highlight the  by using the navigation ◀▼▲▶ keys.

Press ● to select "USB Menu" submenu.

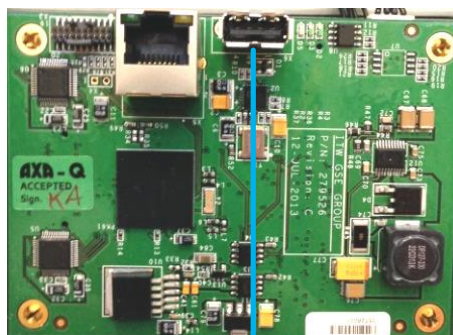
Use the ▼/▲ to highlight the function "Update Control Card software".

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

Press ● to select function and update firmware.

The firmware is now being uploaded to the control card. The upload percentage will count from 0% to 100% and "Update Complete! Please reset" will be displayed when the update is complete.

To reset the unit, press the button ●

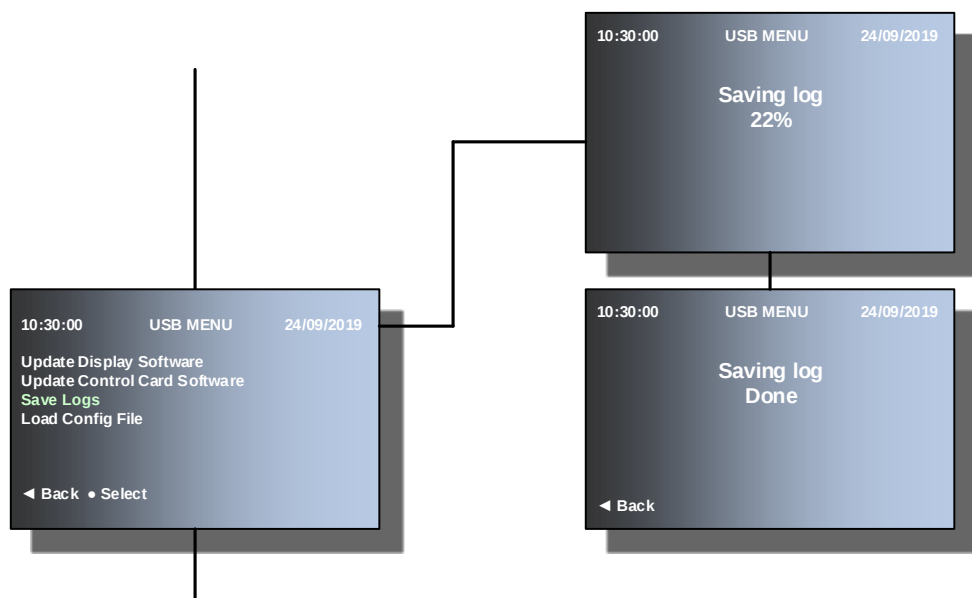


**USB Connection
Control Card**

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Update Software/Save Logs/Load Config File (Continued)



Highlight the  by using the navigation ◀▼▲▶ keys.

Press ● to select "USB Menu" submenu.

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

Insert a USB stick into the USB port from display (located 400 Hz compartment).

Press ● to select function.

The logs are now saved to the USB stick. The log save percentage will count from 0% to 100% and "Done" will be displayed when saving is complete.

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.

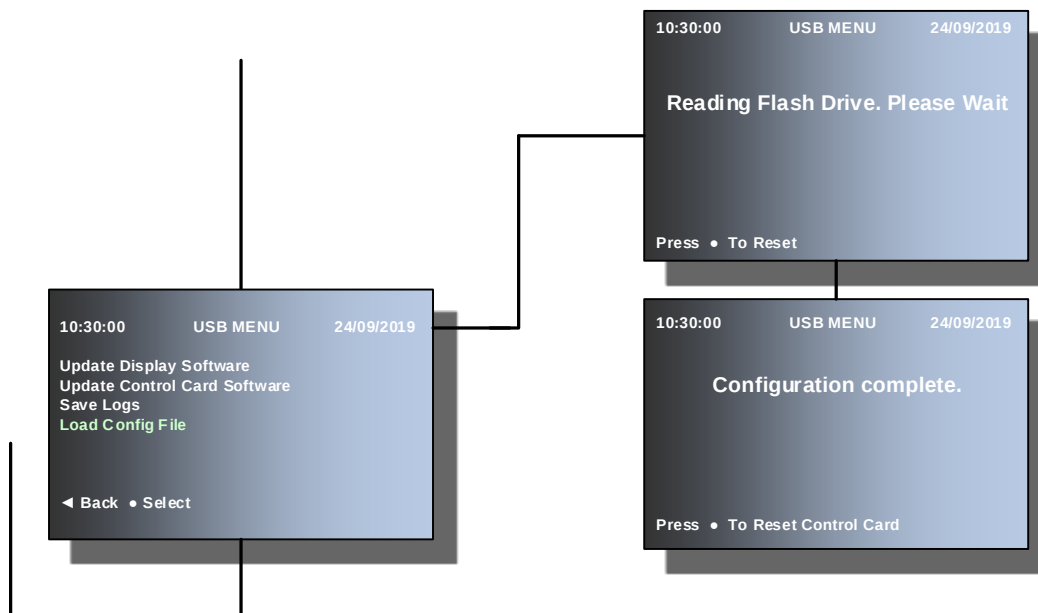


USB Connection Display

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

Update Software/Save Logs/Load Config File (Continued)



Highlight the  by using the navigation ◀▼▲▶ keys.

Press ● to select "USB Menu" submenu.

Use the ▼/▲ to highlight the function "Load Config File".

Insert a USB stick into the USB port from display (located 400 Hz compartment).

Press ● to select function.

The new unit configuration will now be uploaded from the USB stick and "Configuration complete" will be displayed when the upload is complete.

Press ● to reset control card.

Note

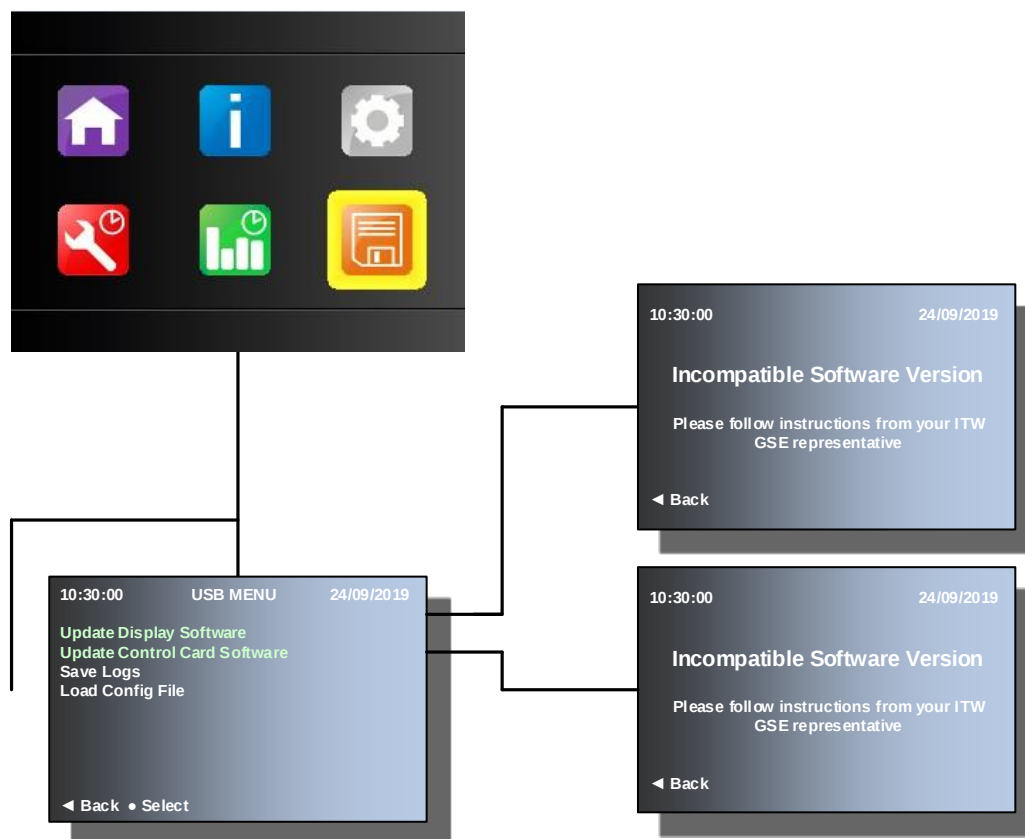
The USB stick can be inserted while the unit is connected to the power.



USB Connection Display

6.5.7 Incompatible Software Version

If you try to install **Special Software** (for the display board or control card) on a unit with **Standard Software** or vice versa, the error “**Incompatible Software Version**” will be displayed.



Before changing software versions, consult ITW GSE. Alternatively, if you intend to proceed because you have already contacted or received the software files from ITW GSE, use the guidelines below to update the software:

1. Press ▼ and ▲ simultaneously for 5 seconds. The software will start automatically and will be updated.
2. Repeat Step 1 to update the other board or card.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Operator's Instructions

6.6 Default Factory Settings

Output Voltage (V):	115.0/200.0
Compensation Type:	Manual (Plug & Play if GPU supplied with cable)
Output 1 Compensation (V):	0.0 (set if GPU supplied with cable)
Output Mode:	Individual (depends on configuration)
Fan Control:	Normal
Remote Stop:	Normally Open
EF Interlock:	Bypassed (active if GPU supplied with cable)
EF Interlock Ripple Level (V):	20.0
EF Interlock Delay (Sec.):	3.5
Aircraft Connector Detection:	Disabled (Enabled if supplied with cable & 90% switch/split "F" pin)
Door Switch:	Bypassed (active with option 578809)
Cable 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)
Min. Charge to Start:	20%
Max. Grid Current:	Depends on supplied cable/plug (16-125 A in steps of 1A)
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:	Metric (International) / Imperial (USA)
Language:	Actual

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.0 Setup Lock/Output Mode/Compensation

7.1 Preventing Changes to Setup Parameters

To avoid unintentional modification of the setup parameters, it is possible to block access to setup mode by means of a DIP switch located on display board A3.

Note

If the DIP switch is set to blocked, pressing SW1 allows the user to enter the setup menu for 10 seconds. When the time has elapsed, the menu will be locked again.

To prevent changes to the setup parameters, move the switch **SW2:1** to the Off position (down).

SW1

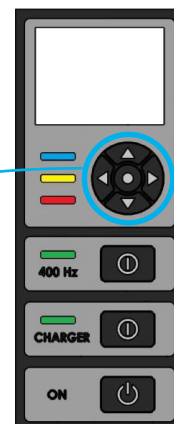
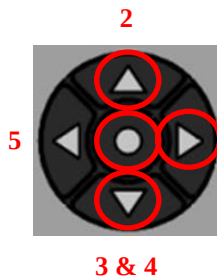


Fig. 7.1.1 Display Board A3

Note

The display is placed very close to the inverter module and not easy to reach. A combination of push button commands is used instead. To enter a locked display without pressing the SW1, simply push the buttons in the sequence below:

1. Press arrow “Right”
2. Press arrow “Up”
3. Press arrow “Down”
4. Press arrow “Down”
5. Press and hold “Center”



Now you can enter the menu similarly to pushing the SW1 button.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

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 (values above 125 V cannot be stored).

Please note that the acceptable voltage range for all commercial aircraft is 115V $\pm$ 3V. This range is even narrower 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 to the submenu list.

7.3 Plug & Play Cable Compensation

The unique plug & play compensation system automatically identifies all relevant cable parameters to keep the voltage at the aircraft connector constant, at all aircraft loads.

1. With the output off, short circuit the aircraft connector using the auto-calibration plug (P/N 591100).
2. Enter the Compensation Type submenu and select "PLUG & PLAY".
3. Enter the "IDENTIFY OUTPUT" submenu and select "ENABLE".
4. Initiate the cable identification process by pressing the ground power unit's Start button.
5. 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.



Note

If the unit is equipped with two outputs (2 x 400 Hz), Plug & Play compensation must be set for each output.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.4 Manual Compensation

This is the traditional method of cable compensation. The output voltage is increased in proportion to the load current (voltage / 100 A). This method is used where the impact of asymmetrical cables, unbalanced loads and varying power factors may be neglected, or the auto-calibration tool isn't available. Manual compensation is typically used for ground power units equipped with two outputs that are used at the same time.

1. Apply full load to output 1.
2. Enter the Compensation Type submenu and select "MANUAL".
3. Enter the "OUTPUT 1 COMPENSATION" submenu. Press the center button to allow the value to be adjusted.
4. Adjust the compensation using the vertical arrow buttons until the voltage at the aircraft connector equals the no-load value. Press the ● button to accept this value.

Note

If the unit is equipped with a second output, repeat the above steps for "OUTPUT 2" (2 x 400 Hz).

Note

For units with 28 VDC ARU, please refer to section 7.22 & 12.3 for further information.

7.5 EF Interlock

The EF interlock is a personnel and equipment safety feature that is found in all commercial aircraft. This 28 VDC 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 aircraft's tolerance limits, it will then close a relay in the aircraft to provide a 28 VDC 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 must be bypassed. Do not set this value to Bypassed for normal operation with aircraft. This setting must only 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.

Enter 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.6 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 added to the EF DC signal.

This submenu sets the tripping level for the AC ripple on the DC EF interlock signal. The default value is 20.0 V and a setting of 0.0 V disables the function.

Enter 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.

7.7 EF Interlock Delay

Some of the newer aircraft take a longer time between the 400 Hz power being supplied to the aircraft and the aircraft returning the 28 VDC EF Interlock signal. This setting allows the adjustment of the amount of time the unit will wait until determining that there is no EF signal and the output power is shut off. The default value is 3.5 seconds.

Enter 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.

7.8 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 submenu value to Enable when such a cable is connected to the unit. The default value is set to Disable.

Enter 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.

7.9 GPU Enable

This set of submenus allows the user to set whether GPU Enable is active or not. If set to “Enabled” the GPU looks for a high input signal on X28:I13, which will enable the GPU to be used. If set to “Disabled”, the GPU does not look for any signal and can be used immediately.

Enter 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.10 Neutral Voltage Supervision

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

Enter 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.

7.11 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 submenu), 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.

Enter 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.

7.12 Earth Leakage Delay

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

Enter 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.

7.13 Minimum SoC (State of Charge) to Start

This set of submenus allows the user to adjust the minimum battery capacity percentage value at which the user can start the unit.

Enter the Setup menu, and then scroll up or down to the Minimum SoC to Start 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.14 Max Grid Current

This set of submenus allows the user to adjust the Maximum Grid current, depending on the current available for charging the ITW GSE 7400 GPU and the installed charger cable/plug.

Enter the Setup menu, and then scroll up or down to the Max Grid Current 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 Real Time Clock Setup

This set of submenus allows the user to adjust the internal clock to the correct local time.

Enter 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.

7.16 Date/Time Format

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

Enter 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.

7.17 Ethernet Configuration

This set of submenus 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.

Enter 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 is part of an RS-485 Modbus RTU BMS/RMS monitoring system, it must be assigned a Modbus slave address. This submenu allows the user to enter the slave address.

Enter 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.19 LED Brightness

The unit status LEDs have three brightness levels. The default is set to medium.

Enter 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 Unit of Measure

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

Enter 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.

7.21 28V Voltage

This setup submenu allows the output voltage to be adjusted between 19.0 VAC and 33.0 VAC using the up and down navigation buttons.

Enter the Setup menu, and then scroll up or down to the 28V 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 to the submenu list.

7.22 28V Compensation

This is the traditional method of cable compensation. The output voltage is increased in proportion to the load current (voltage / 600 A).

The compensation can be set from 0.0 to 3.0 V

Enter the Setup menu, and then scroll up or down to the 28V Compensation 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 Current Limit Step Size

This submenu is used to set the current step size, by pressing the current increase / decrease push button on the Standby menu screen. The step size can be set to 50 / 100 / 200 / 300 A

Enter the Setup menu, and then scroll up or down to the Current Limit Step Size 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

7.24 28V EF Interlock

This submenu is used to set the appearance of the GPU for the 28 VDC interlock signal. The signal can be set to either Enabled / Disabled / Bypassed.

Enter the Setup menu, and then scroll up or down to the 28V 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.

7.25 Customer ID

This submenu allows the user to assign a name to the unit for reporting purposes when black box or power log files are saved to a USB stick or drive.

Enter the Setup menu, and then scroll up or down to the Customer 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. Use the right arrow to advance to the next character. Press the center ● button to record the new value. Press the left arrow button to exit the submenu and return to the submenu list.

7.26 Reset Service Interval

This setup submenu allows the maintenance personnel to reset the service interval when service has been performed on the unit.

Enter the Setup menu, and then scroll up or down to the Reset Service Interval 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.

7.27 Battery Replaced (Control Board)

Use this submenu to reset the battery replacement timer after finishing the procedure described in Section 8.2.

Enter the Setup menu, and then scroll up or down to the Battery Replacement 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.

7.28 Language

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

Enter 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Setup Lock / Output Mode / Compensation

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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

8.0 Service, Maintenance, Overhaul

To ensure the unit is always ready for use, it must be maintained on a regular basis.



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

8.1 Lockout/Tagout procedure

Lockout/Tagout Procedure				
ID:	ITW GSE 7400	Description: 400Hz/28VDC Battery Ground Power Unit		
Created:	Nov. 12 - 2019			
Revised:	-			
5	Lockout Points	Note: This document is an ITW GSE standard procedure. Should local conditions and rules require additional lockout/tagout safety measures, it falls under the responsibility of the equipment owner to amend this procedure.		
Lockout Application Process				
1. Notify affected personnel. 2. Properly shut down unit. 3. Isolate all energy sources. 4. Apply lockout devices & tags. 5. Verify de-energization of all sources.				
Step	Energy source	Location	Method	Photo
	REMOTE PANEL	Right side	If the unit is in operation, push the STOP buttons, marked with ⏻ Verify that "Ready for Use" is displayed.	
	ELECTRICAL 400/480V	Input cable	Disconnect input cable	
	ELECTRICAL 400V	Electrical panel, center	Disconnect Q6 to the OFF position and lockout.	
	ELECTRICAL 400V	Electrical panel, center	Disconnect Q3 to the OFF position and lockout.	
	DC capacitors	Electrical panel, power module	Wait for 10 min. to discharge.	
Lockout Removal Process				
1. Ensure all tools and items have been removed. 2. Confirm all people are safely located. 3. Verify all controls are in neutral. 4. Remove lockout devices and reenergize the unit. 5. Notify affected personnel that servicing is completed.				

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

8.2 Recommended Maintenance Schedule

8.2.1 Daily / upon use

Maintenance Instruction for ITW GSE 7400	
Daily / upon use	
This inspection does not in any way suspend local / airport rules and regulations	
01.	Visual check of aircraft connector(s). Depending on type (Brand / 400 Hz type / 28 VDC type) check: Connector housing for damage / cracks and wear & tear. Power Pins (A-B-C-N) for damage and wear & tear Control Pins (E-F) for damage and wear & tear Push buttons for correct function (if applicable) LED / Lamps for correct indication (if applicable)
02.	Visual check of output cable(s) for damaged insulation. The insulation is intact, and cable(s) do not show any sign of cracks / damage.
03.	Visual check of input charging cable and connector. Check that the input cable insulation is intact, and cable(s) do not show any sign of cracks / damage. Check the input connector & pins for damage / cracks and wear & tear
04.	Visual check of tires for wear and tear. Check all 4 tires for damage / cracks and wear & tear
05.	Visual check of all reflectors / beacons / siren. Check reflectors for damage / function Check beacons for damage / function Check siren for damage / function

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

8.2.2 Quarterly

Maintenance Instruction for ITW GSE 7400

Quarterly

This inspection does not in any way suspend local / airport rules and regulations

01.	Check aircraft connector(s).
	Depending on type (Brand / 400 Hz type / 28 VDC type) check: Connector housing for damage / cracks and wear & tear. Power Pins (A-B-C-N) for damage and wear & tear Control Pins (E-F) for damage and wear & tear Push buttons for correct function (if applicable) LED / Lamps for correct indication (if applicable) Aircraft Insertion Switch for correct function (if applicable) Note Load banks can be used to check the above
02.	Check output cable(s) for damaged insulation.
	The insulation is intact, and cable(s) do not show any sign of cracks / damage. Check output cable(s) using a load bank
03.	Check input charging cable and connector.
	Check the input cable insulation is intact, and cable(s) do not show any sign of cracks / damage. Check the input connector & pins for damage / cracks and wear & tear Check charging function, by connecting to 50/60 Hz grid
04.	Check tires for wear and tear.
	Check all 4 tires for damage / cracks and wear & tear Check for correct air pressure (6.8 bar = 99 psi).
05.	Check all reflectors / beacons / siren.
	Check reflectors for damage / function Check beacons for damage / function Check siren for damage / function

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

8.2.3 Yearly

Maintenance Instruction for ITW GSE 7400

Yearly

This inspection does not in any way suspend local / airport rules and regulations

01.	Check aircraft connector(s).
	Depending on type (Brand / 400 Hz type / 28 VDC type) check: Connector housing for damage / cracks and wear & tear Power Pins (A-B-C-N) for damage and wear & tear Control Pins (E-F) for damage and wear & tear Push buttons for correct function (if applicable) LED / Lamps for correct indication (if applicable) Aircraft Insertion Switch for correct function (if applicable) Verify the output voltage at aircraft connector(s) with and without load Verify proper operation of the output contactor contact sets (max. 0.5 V voltage drop) and coil. Note Load bank can be used to check the above
02.	Check output cable(s) for damaged insulation.
	The insulation is intact, and cable(s) do not show any sign of cracks / damage Check output cable(s) using a load bank
03.	Check input charging cable and connector.
	Check the input cable insulation is intact, and cable(s) do not show any sign of cracks / damage Check the input connector & pins for damage / cracks and wear & tear Check charging function by connecting to 50/60 Hz grid
04.	Check of tires for wear and tear.
	Check all 4 tires for damage / cracks and wear & tear Check correct air pressure (6.8 bar = 99 psi).
05.	Check all reflectors / beacons / siren.
	Check reflectors for damage / function Check beacons for damage / function Check siren for damage / function

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

	Check all fans
06.	Check that Inverter fans (400 Hz) are running properly Check that ARU fans (28 VDC) are running properly (if applicable)
	Check rubber seals
07.	Check that all rubber seals are intact by the front door, front panel
	Check bolts / screws / wires
08.	Check internal bolts/screws and wire connections
	Visual inspection of PCB's
09.	Visual inspection of all PCB's such as Control Board, Interface Board, gate Drive, AUX board, etc.
	Grease front wheel turntable
10.	Grease front wheel turntable with grease; apply to the oiler of the turntable, see picture below. Turn front wheels to both sides to get access to the oilers. Grease points / oilers marked with red circles.
	

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

8.3 Battery Backup & Replacement

Situated on the back of the control board is a coin-type lithium battery, which ensures that firmware, setup data, etc. are not lost during grid power dropouts. The expected life of the battery is approximately 7 years. Note that low battery voltage does not affect the internal safety system of the GPU that monitors the output voltage etc., so that aircraft connected to the GPU are not exposed to any danger. However, to avoid loss of data and control board lock-up*, we recommend changing the battery after **5 years** of use.

Note

A timestamp is stored in the ID chip (A6) during production. After 5 years, a warning appears on the display telling the user/operator to replace the control board battery.

It is strongly recommended that the battery is replaced when this message is shown:

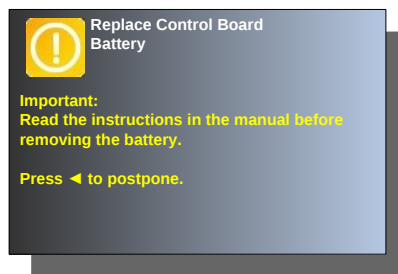


Fig. 8.3.1

To allow the user/operator to use the converter, the battery replacement can be postponed by pressing the ◀ (left arrow) push button.

The warning message appears 90 seconds after the unit is powered on or the output contactor(s) are opened (the unit is in standby mode). If this message is ignored for 6 months, the controls will be locked out and the following failure message will be displayed.

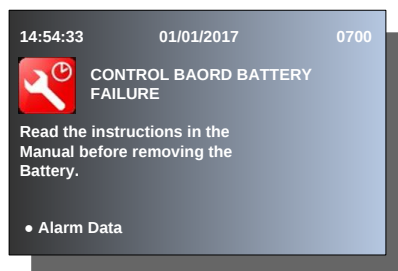


Fig. 8.3.2

The battery must be replaced before the unit can be operated again.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul



To ensure a high level of reliability of the backup battery, the only battery type that can be used on the control board is the Panasonic BR-2032.



Before removing the control board, and to avoid any static discharge to the control board during the replacement of the battery, please take ESD (electrostatic discharge) precautions.

How to Replace the Battery:

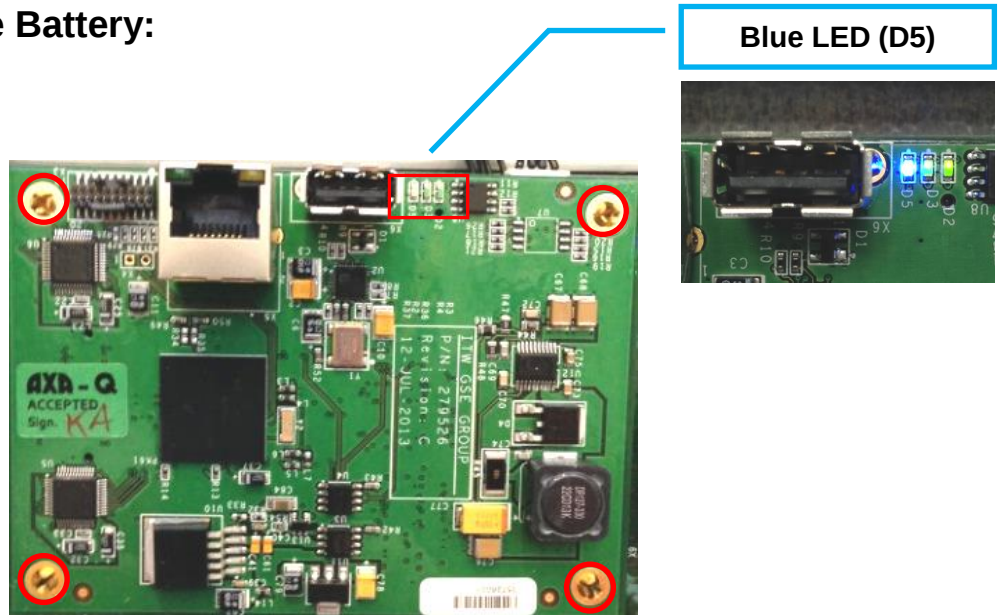


Fig. 8.3.3 Control Board (Front View)

To replace the battery, **switch off** the unit by means of Q1. Remove the control board from the 4 posts marked with a  in Figure 8.3.3. Place the PCB on an insulated surface, with the back side facing up.

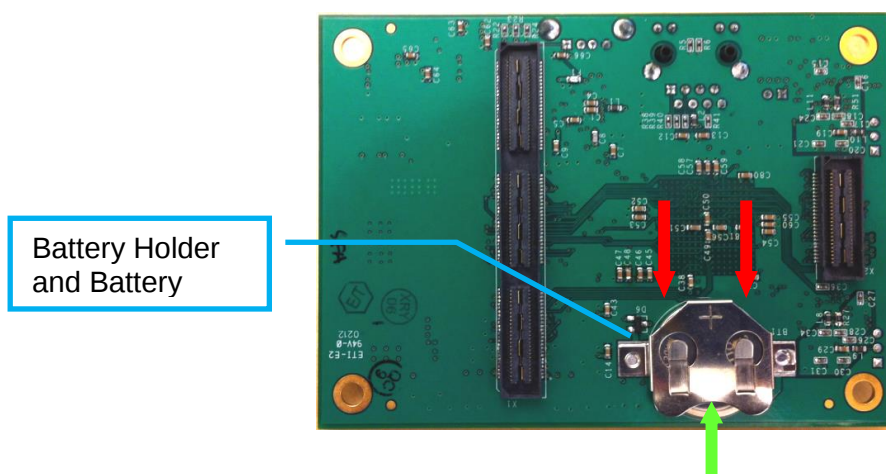


Fig. 8.3.4 Control Board (Rear View)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Service, Maintenance, Overhaul

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**.

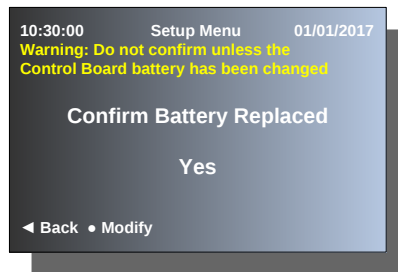
Otherwise, all firmware and setup data will be erased.*

Remove the battery from the holder using a small **insulated** screwdriver to push out the battery. The direction is indicated by the two red arrows in Figure 8.3.4. Insert the new battery in the direction of the single green arrow in Figure 8.3.4.

Mount the control board on the interface board again by gently pressing the PCB onto its rest on the interface board. Ensure that all four corners are fully pressed onto the interface board.

Switch the unit on via the input switch Q1 and close the door. The unit will now go through an initialization test, and then enter standby mode.

Enter the setup menu and select the “Battery Replaced” menu item to confirm installation of a new battery.



*Important Note

If the blue LED on the control board (located in Fig. 8.3.3) flashes approximately twice 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 reloaded.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

9.0 Troubleshooting & Repair



Allow only **Safety-Certified** personnel to remove covers for troubleshooting and repair.

Please be aware that the DC capacitors can remain charged with a dangerous voltage **up to 10 minutes** after the battery power has been disconnected.

9.1 PCB Fuses & Battery Fuses

Usually the display text provides sufficient information to get the ground power unit into operation again. If the display is blank, please check Q6 (MCB) and fuses F1 on interface board A2.

The following fuses are located on the interface board A2:

Fuse #	Applies to	Type	Rated Voltage	Amp Rating
F1	Display fuse	ATO Blade Fuse	32 V	2 A
F2	EPO fuse	ATO Blade Fuse	32 V	5 A
F4	Fan fuse	ATO Blade Fuse	32 V	10 A
F5	Comm. board	ATO Blade Fuse	32 V	10 A
F6	IO fuse	ATO Blade Fuse	32 V	5 A
F7	GPS unit fuse	ATO Blade Fuse	32 V	5 A

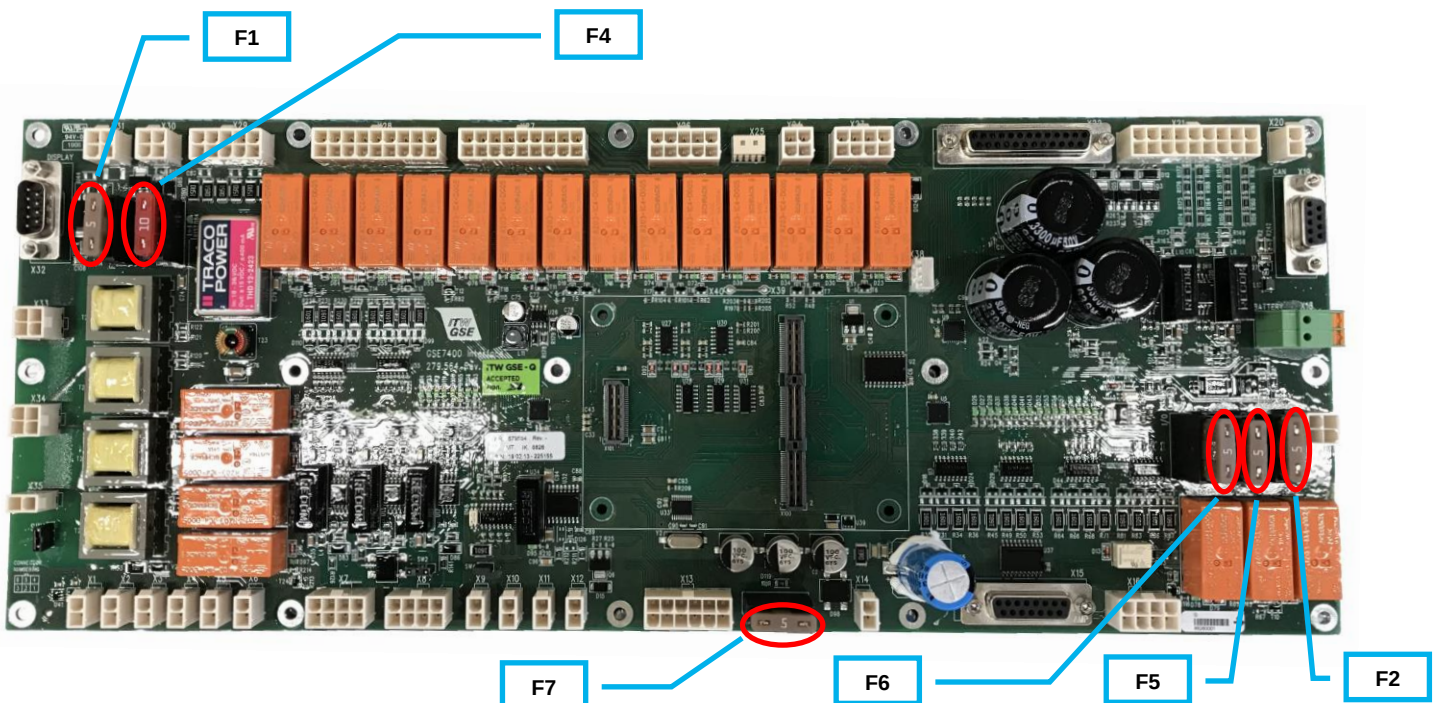


Fig. 9.1.1 Fuses F1–F7 (A2 Interface Board)

If the displayed text does not provide sufficient information to solve the problem, Tables 1, 2, and 3 (Section 9.1) suggest corrective actions to be carried out for each error code.

Additional error information regarding the output voltage, overload and area covered by the error code can be derived from the error code as follows:

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

Output Voltage: 30xx / 31xx / 35xx
Overload/Short Circuit/Filter Current: 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 4007 refers to “Overload I > 100% - 10 min.” at all 3 output phases.

The following fuses are located on the Communication Boards A12...A42:

Fuse #	Applies to	Type	Rated Voltage	Amp Rating
F2	Charger - Ignition	ATO Blade Fuse	32 V	5 A
F3	Ignition	ATO Blade Fuse	32 V	5 A
F4	Relay Control	ATO Blade Fuse	32 V	5 A
F5	Leaf Pack Comm.	ATO Blade Fuse	32 V	5 A
F6	5V Power Supply	ATO Blade Fuse	32 V	5 A

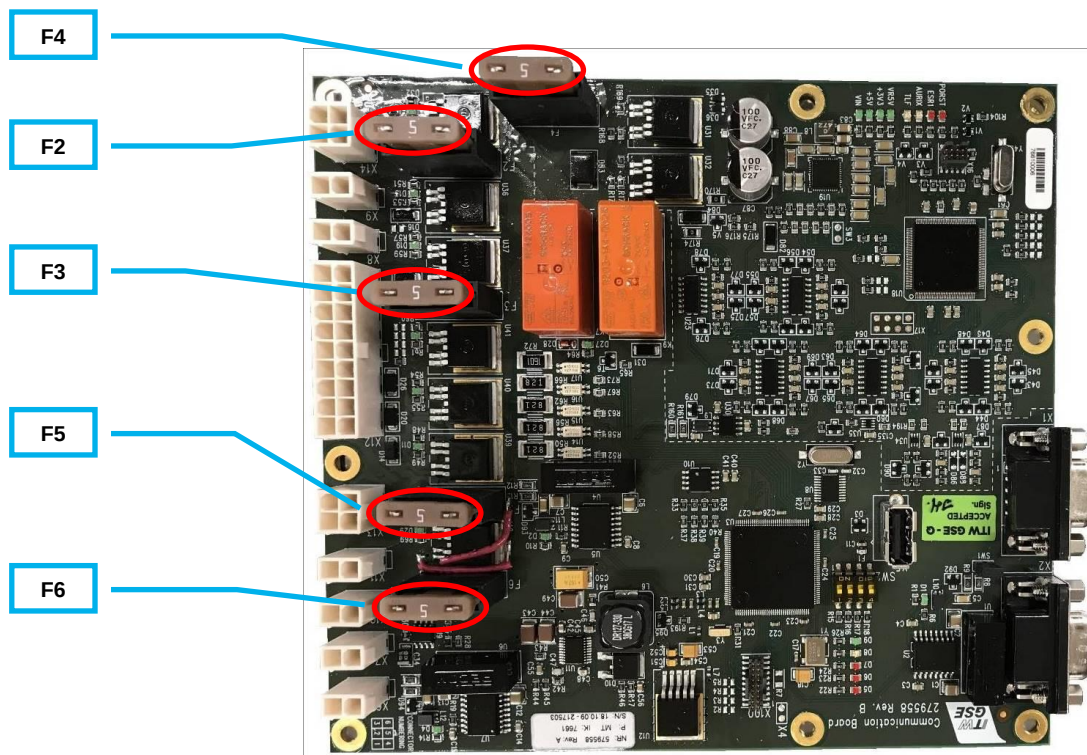


Fig. 9.1.2 Fuses F2–F6 (A12...A42 Communication Boards)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

The following fuses are located on the AUX Board A5:

Fuse #	Applies to	Type	Rated Voltage	Amp Rating
F1	24 V Supply	ATO Blade Fuse	32 V	2 A
F2	24 V AUX Output	ATO Blade Fuse	32 V	2 A

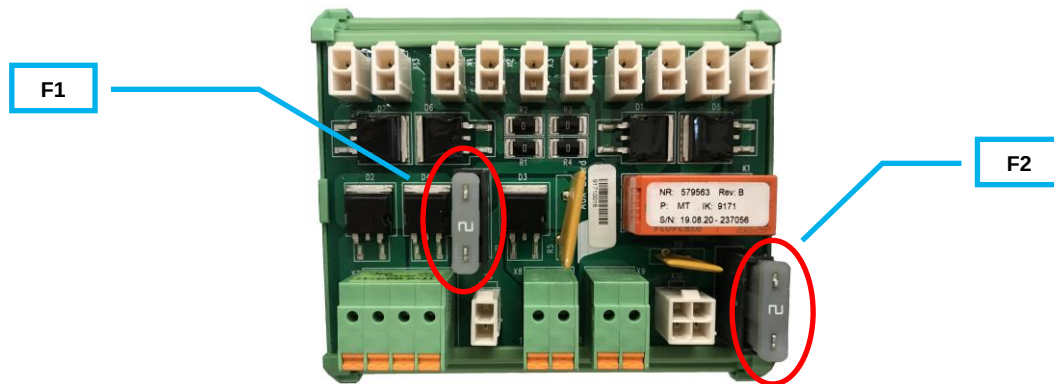


Fig. 9.1.3 Fuses F1 & F2 (A5 AUX Board)

Fuse #	Applies to	Type	Rated Voltage	Amp Rating
F11....F42	External Battery Fuses	Bussmann (FWP)	750 V	250 A

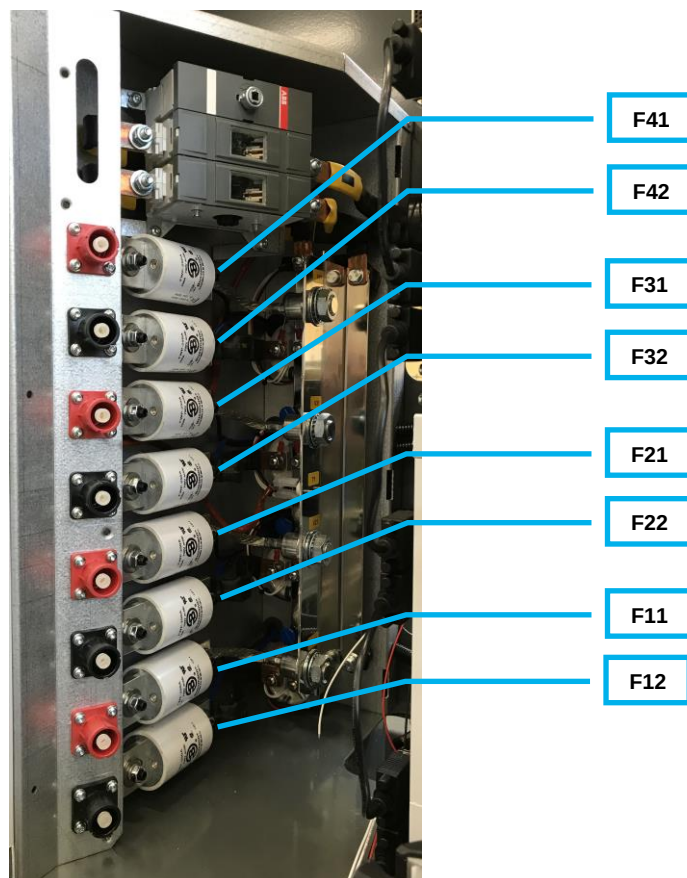


Fig. 9.1.4 External Battery Fuses (Located behind cover of Charger section)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

9.2 Fault Guidance / Error Codes

In the event you need to contact us for further fault guidelines, please do not forget to enter the serial number of the GPU (found on the rating plate) and the actual error code on the fault-finding form that can be downloaded from www.itwgse.com

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

Error Code	Error Text on Display	Help Text	First Corrective Action
100	LOGGING UNSUCCESSFUL		Press start to reset
200	CONTROL BOARD FAILURE	Watchdog Timeout	
201	CONTROL BOARD FAILURE	CRITICAL: Memory Error	Verify ID chip inserted
202	WRONG SOFTWARE VERSION		Install correct software version
250	UPDATE FAILED		Please retry operation
300	CONTROL VOLTAGE LOW	Control Voltage <20V (Running)	Press start to reset
301	CONTROL VOLTAGE LOW	Control Voltage <20V (Standby)	
400	EMERGENCY STOP ACTIVATED		Release emergency stop and press start to reset
500	CONTROL BOARD ADC0 FAILURE		Press start to reset
700	CONTROL BOARD BATTERY FAILURE		
750	REAL-TIME CLOCK NOT SET	Please set to current time and date	Set time and date
1000	SOFTSTART ERROR		Press start to reset
1100	DC VOLTAGE TOO LOW	DC Voltage <300V – 30ms	
1201	DC VOLTAGE TOO HIGH	DC Voltage >420V – 30s	
1202	DC VOLTAGE TOO HIGH	DC Voltage >430V – 2.5ms	
1450	BATTERY VOLTAGE TOO HIGH	Voltage >420V – 2.5ms	
1500	DC RIPPLE TOO HIGH	DC Ripple >20V – 3 minutes	
1601	INVERTER TEMP TOO HIGH	IGBT 1 Temperature >110°C	
1602	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 <110% - 600 s	Phase X	
4050	OVERLOAD: 100% <P <140% - 600 s	Phase X	
4100	OVERLOAD: 110% <I <125% - 300 s	Phase X	
4150	OVERLOAD: 140% <P <160% - 2 s	Phase X	
4200	OVERLOAD: 125% <I <140% - 10 s	Phase X	
4250	OVERLOAD: P> 160%	Phase X	
4300	OVERLOAD: 140% <I <200% -2 s	Phase X	
4400	OVERLOAD: I > 200%	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	ELC FAULT @ OUTPUT		
5200	NVS LEVEL TOO HIGH		
5300	DIODE TEMP TOO HIGH		
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		
6103	28 VDC PLUG TEMPERATURE TOO HIGH		
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	
6303	EF SIGNAL DROP OUT – 28 VDC	EF Signal Disappeared at 28 VDC	

Continues on next page

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

Continued from previous page

Error Code	Error Text on Display	Help Text	First Corrective Action
7000	OUTPUT VOLTAGE TOO HIGH	Voltage > 32 V – 4 sec.	Press start to reset
7100	OUTPUT VOLTAGE TOO HIGH	Voltage > 40 V – 150 ms	
7200	OUTPUT VOLTAGE TOO LOW	Voltage < 20 V – 4 sec.	
7300	SHORT CIRCUIT AT 28 V OUTPUT		Remove short circuit and press start to reset
7400	28 V OUTPUT CURRENT TOO HIGH		Remove load and press start to reset
7500	RECTIFIER TEMP TO HIGH		Press start to reset
8000	BATTERY VOLTAGE TOO LOW	Battery Level must be greater than % setup value in menu to start	Charge unit
8050	BATTERY VOLTAGE TOO LOW		Charge unit
8300	BATTERY WAKE UP FAULT		Press start to reset
8301	BATTERY WAKE UP FAULT		
8302	BATTERY WAKE UP FAULT		
8350	SAFETY BREAKER OPEN	Close breaker	
8400	NO PACKS ACTIVE		
8500	NO PACKS CHARGING		
8600	BATTERY OVERLOAD		
8700+code	BATTERY OVER VOLTAGE		
8800	DC ELECTRIC SYSTEM FAULT		Open left-hand side panel and check for smoke.
8900	SMOKE DETECTED		
9000	END OF FACTORY TEST		Press start to reset
9100+code	PLUG & PLAY FAILED - OUTPUT X		
9200+code	PLUG & PLAY COMPLETED - OUTPUT X		

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

Error Code	Second Corrective Action	Third Corrective Action	Fourth Corrective Action
100			
200	Replace control board A1		
201	Contact ITW GSE		
202	Contact ITW GSE		
250	Contact ITW GSE		
300	Check input voltage at S10	Check Q4 & G10	
301	Check input voltage at S10	Check Q4 & G10	
400	Check emergency stop	Check user EPO (A2:X14)	Replace control board A1
500	Check input voltage	Replace control board A1	
700	Replace control board battery		
750	Check/set to current time and date		
1000	Check battery voltage	Check DC soft start charging voltage >400 V	Replace interface board A2 Replace capacitor module A5 Replace control board A1
1100	Check battery voltage	Replace control board A1	Replace interface board A2
1201	Check battery voltage	Replace control board A1	Replace Interface Board A2
1202	Check battery voltage	Replace control board A1	Replace Interface Board A2
1450	Check battery voltage	Check equal voltage across V1–V6	Replace control board A1 Replace interface board A2
1500	Check setup value	Check DC ripple	Replace control board A1 Replace interface board A2
1601-1602	Checks fans are running	Check air-ducting for restrictions	Replace control board A1 Replace interface board A2
2000 - 2024	Replace inverter module	Replace control board A1	Replace interface board A2
3000	Check voltage setup value	Replace control board A1	Replace interface board A2
3100	Replace control board A1	Replace interface board A2	
3500	Check voltage setup value	Replace control board A1	Replace interface board A2
4000-4407	Remove overload and press start	Replace control board A1	Replace interface board A2
4500+code	Disconnect load/check output cable	Replace control board A1	Replace interface board A2

Continues on next page

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

Continued from previous page

Error Code	Second Corrective Action	Third Corrective Action	Fourth Corrective Action
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 battery voltage	Check output voltage/feedback voltage	Replace control board A1 Replace interface board A2 Replace inverter module
5000	Let the unit cool down and press start to reset	Check fans / air-ducting for restrictions	Check normally closed sensor/replace sensor TH if necessary Replace control board A1 Replace interface board A2
5100-5101	Check setup value	Check output installation	
5200	Check setup value	Check voltage between N & Earth	
5300	Check diodes V11-V41	Check T1 sensor/replace if necessary	
6001-6002	Check setup value	Remove load and check output cabling	Replace control board A1 Replace interface board A2
6101-6103	Remove load and allow plug to cool down	Check connector/output cabling for any malfunction	Replace control board A1 Replace interface board A2
6301-6302	Verify that output cable is correctly inserted	Check/correct installation	Replace control board A1 Replace interface board A2
7000	Check setup value		
7100	Check setup value		
7200	Check setup value		
7300	Check output cable		
7400	Check output cable		
7500	Check T1 at diode busbar	Check diode V11...V41	Contact ITW GSE
8000	Check status of correct charging	Replace control board A1	Replace corresponding Comm. board A12 - A22 - A32 - A42
8050	Check status of correct charging	Replace control board A1	Replace corresponding Comm. board A12 - A22 - A32 - A42
8300	Check Can-Bus cabling from battery to Comm. Boards	Contact ITW GSE	
8301	Check Can-Bus cabling from battery to Comm. Boards	Contact ITW GSE	
8302	Check Can-Bus cabling from battery to Comm. Boards	Contact ITW GSE	
8350	Check fuse F3	Check Q1 / Q2 and DC voltage at PM1	Replace control board A1 Replace interface board A2
8400	Check Can-Bus cabling from battery to Comm. Boards	Contact ITW GSE	
8500	Check MCB Q11...Q41 & Q1	Check Can-Bus cabling from battery to Comm. Boards	Contact ITW GSE
8600	Check status of batteries via display	Contact ITW GSE	
8700+code	Check battery voltages Code 1 = Battery 1 / Code 2 = Battery 2 Code 4 = Battery 3 / Code 8 = Battery 4	Contact ITW GSE	
8800	Contact ITW GSE		
8900	Press start to reset	Contact ITW GSE	
9000			
9100+code	Repeat cable identification		
9200+code			

Operation Manual – ITW GSE 7400 Battery Powered GPU

Troubleshooting & Repair

Communication Board error/warning codes

All codes from 10...60 may be added 256,512 and 1024

Code		
10	Watchdog Reset	Watchdog was triggered
11	Watchdog Init	Could not successfully initialize watchdog
20	Init	Comm. Board did not initialize within time limit
21	Init Address	Detected another Comm. Board with identical board address
25	Failsafe	The failsafe monitor was triggered
30	Battery CAN	Error on Leaf battery CAN bus.
31	Battery Init	Leaf battery did not initialize within time limit.
32	Battery Fail	Leaf battery LB_FAIL or LB_STATUS process A.
33	Battery Allow Contacts	Leaf battery does not allow contactors to be engaged.
34	Battery Interlock	Leaf battery interlock failure.
35	Battery System Voltage	Over discharge or overcharge protection.
36	Battery Main Relay Off Request	LB_STATUS process. A triggered main relay off.
37	Battery Isolation	Leaf battery isolation voltage failure.
38	Battery Discharge Current	Discharge current too high.
39	Battery ALU response	Leaf battery did not respond correctly to ALU safety question.
40	Charger CAN	Charger CAN bus failure.
41	Charger Fail	Charger reports error.
42	Charger Voltage High	Charger voltage too high.
50	Control Board CAN	Control board CAN bus failure.
60	Safety Controller	Safety controller error.
128 + code	1: Ignition	Relay/contactor in wrong state
	2: Charge - Ignition	
	4: Failsafe	
	8: DC contactor (external)	
	16: Leaf battery DC Plus	
	32: Leaf battery DC minus	
	64: Leaf battery Soft start	

Examples:

Code 572 is read thus:

$572 - 512 = 60$ (60) which leaves you with the error code 60

60 = Safety controller error

Code 131 is read thus:

$131 - 128 = 3$ (1 + 2) which leaves you with the error codes 1 & 2

1 = Failure of Ignition relay

2 = Charge – Ignition relay

Note

Before replacing any PCBs or the inverter module, check the corresponding connections and wiring.

Caution



To prevent PCB damage from electrostatic discharge, wear an ESD wrist strap during service or replacement.

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List

10.0 Illustrated Parts List

Please refer to www.itwgse.com for a recommended list of spare parts. Diagrams and drawings of the unit can also be found on this website.

10.1 Components placement

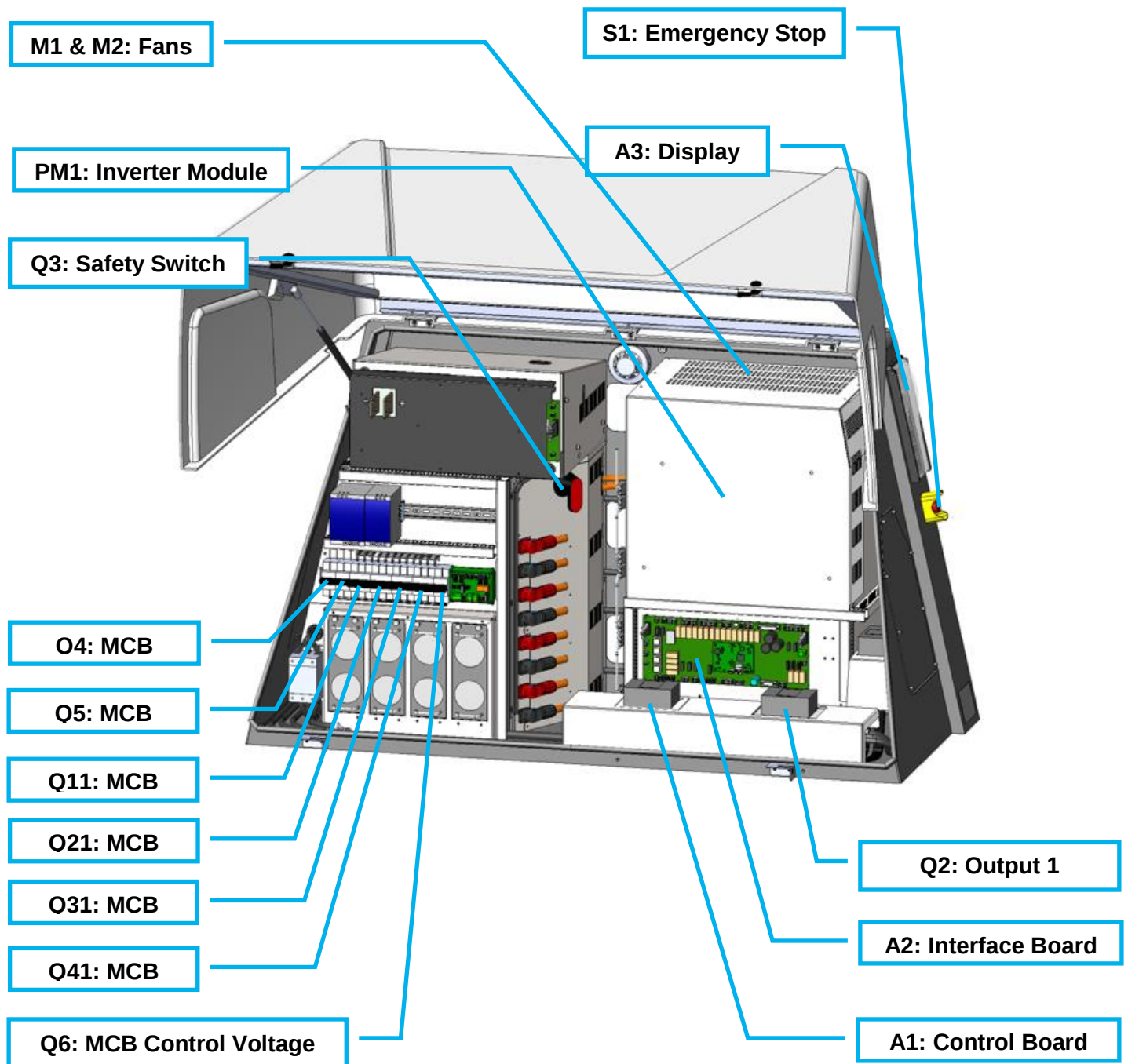


Fig. 10.1.1 Electronical Cubicle

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List

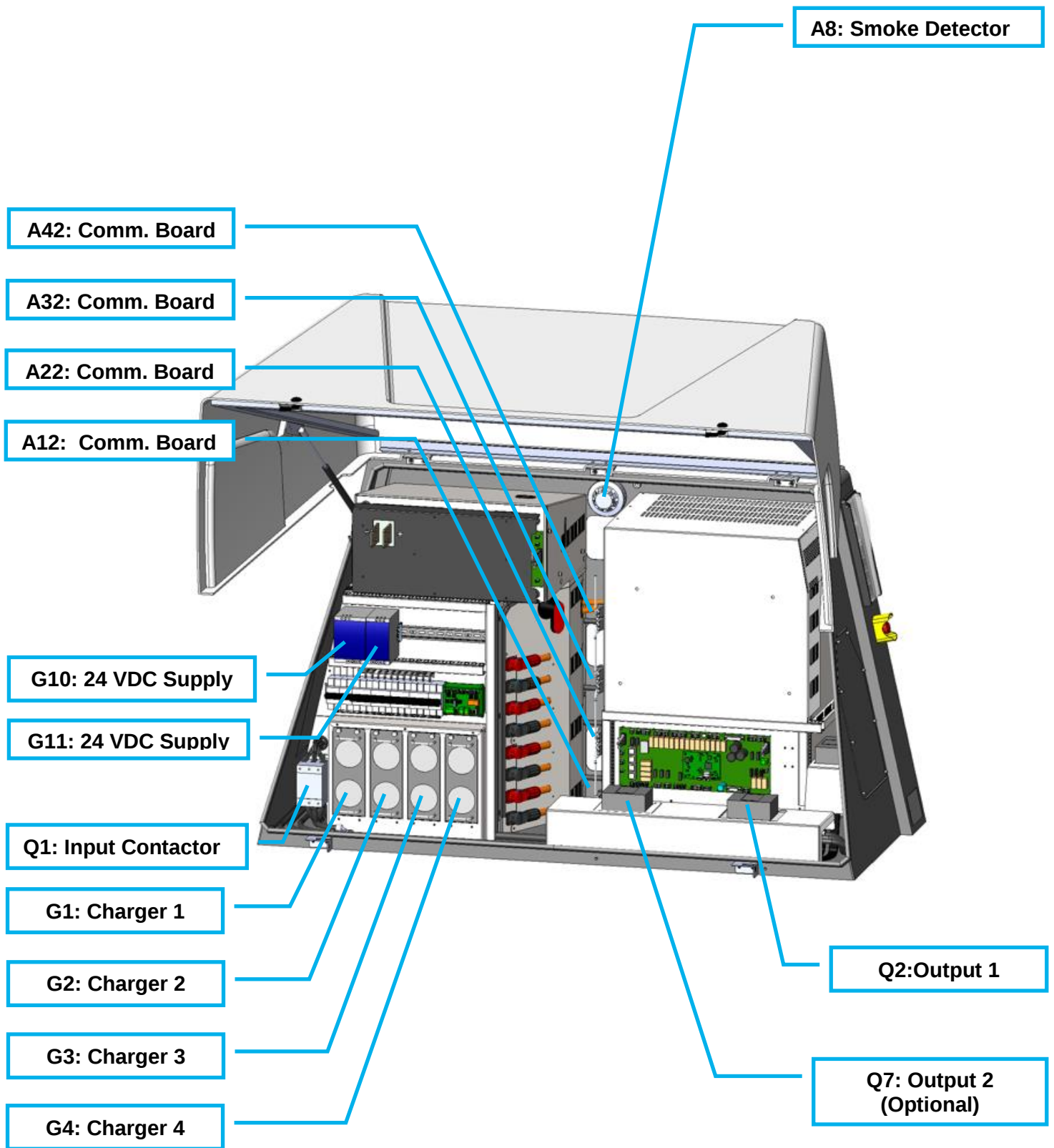


Fig. 10.1.2 Electrical Cubicle

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List

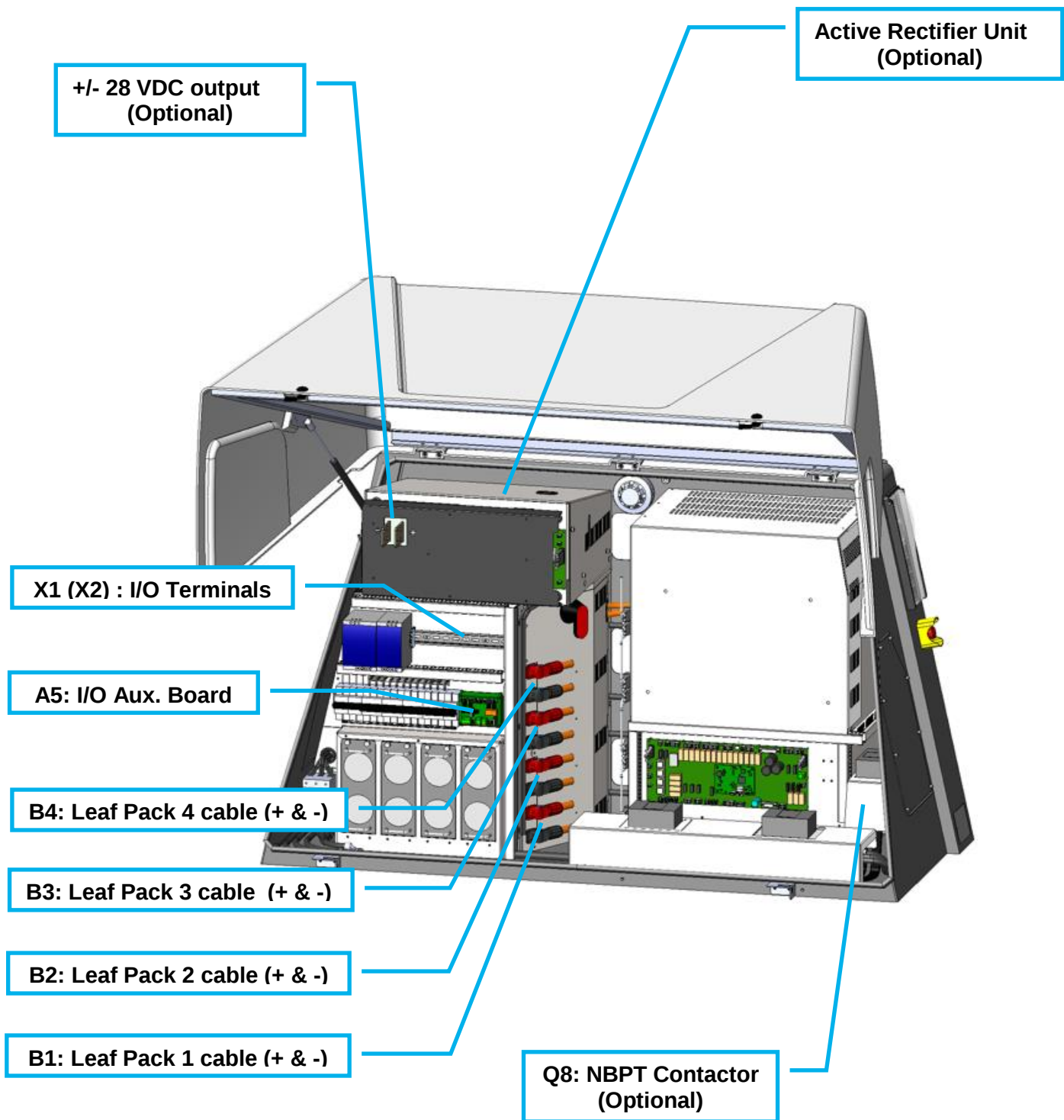


Fig. 10.1.3 Electrical Cubicle

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List

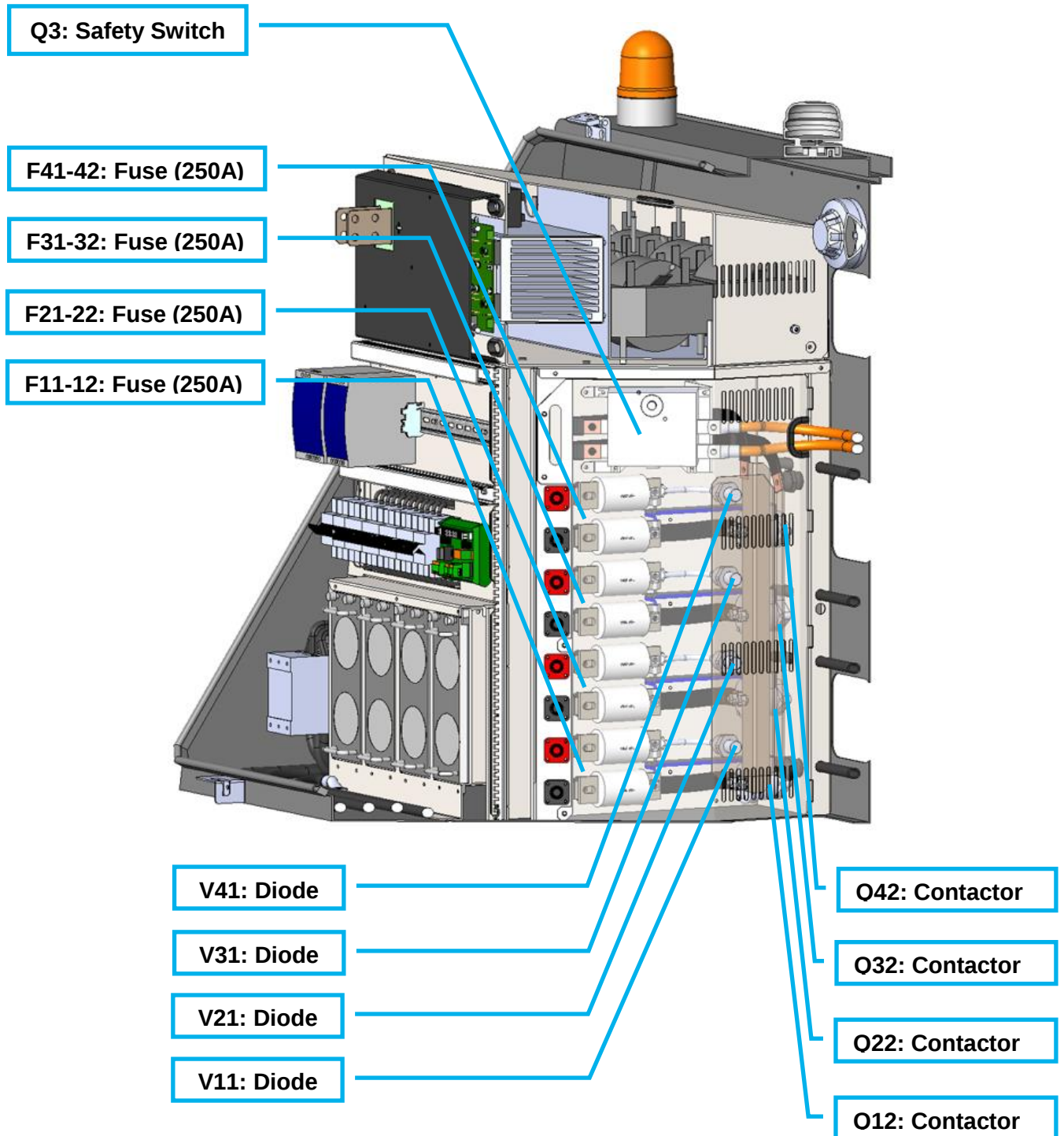
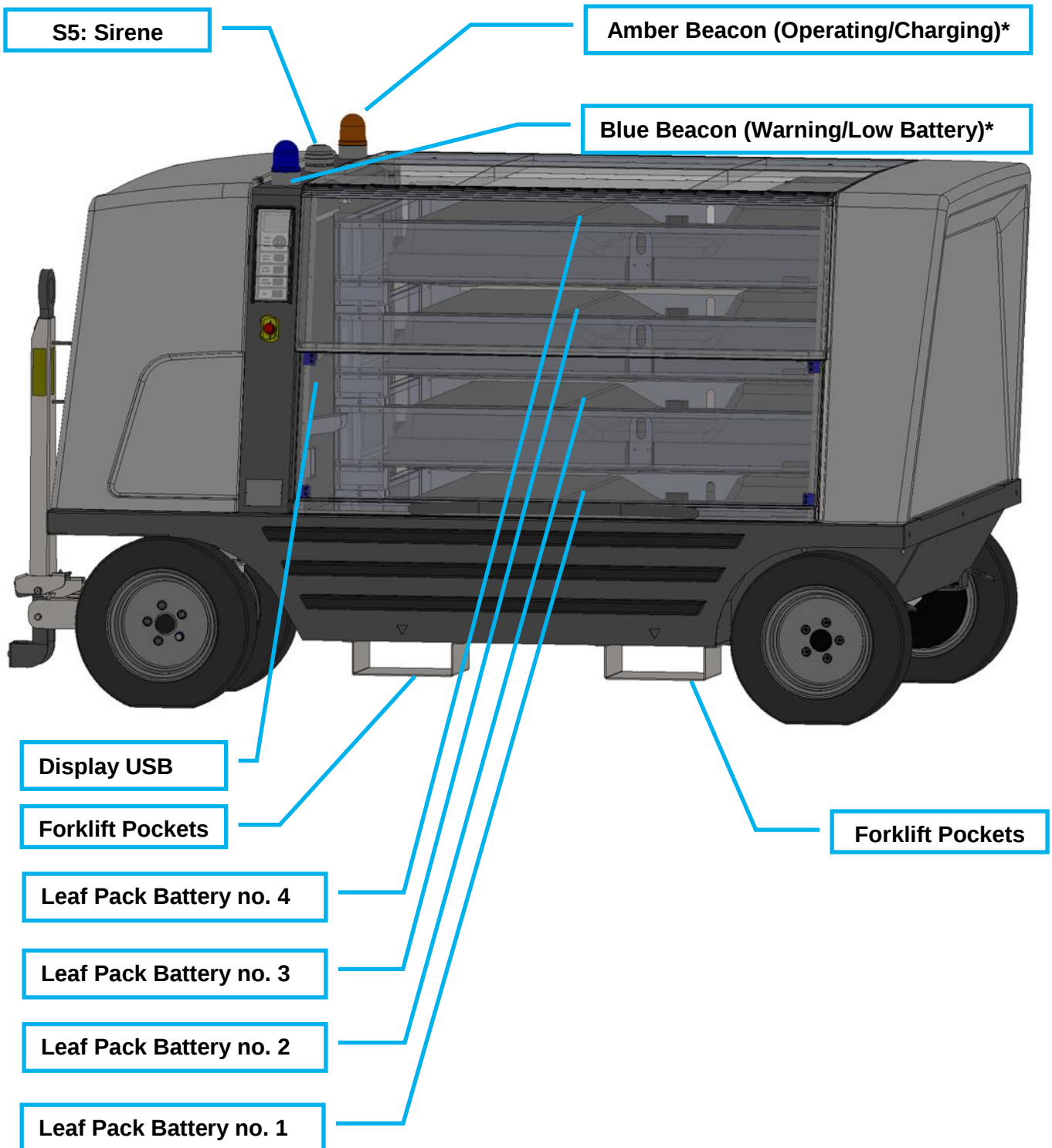


Fig. 10.1.4 Behind cover at charger section

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List



*Beacon colors may vary depending on client specifications.

Fig. 10.1.5 Right side View

Operation Manual – ITW GSE 7400 Battery Powered GPU

Illustrated Parts List

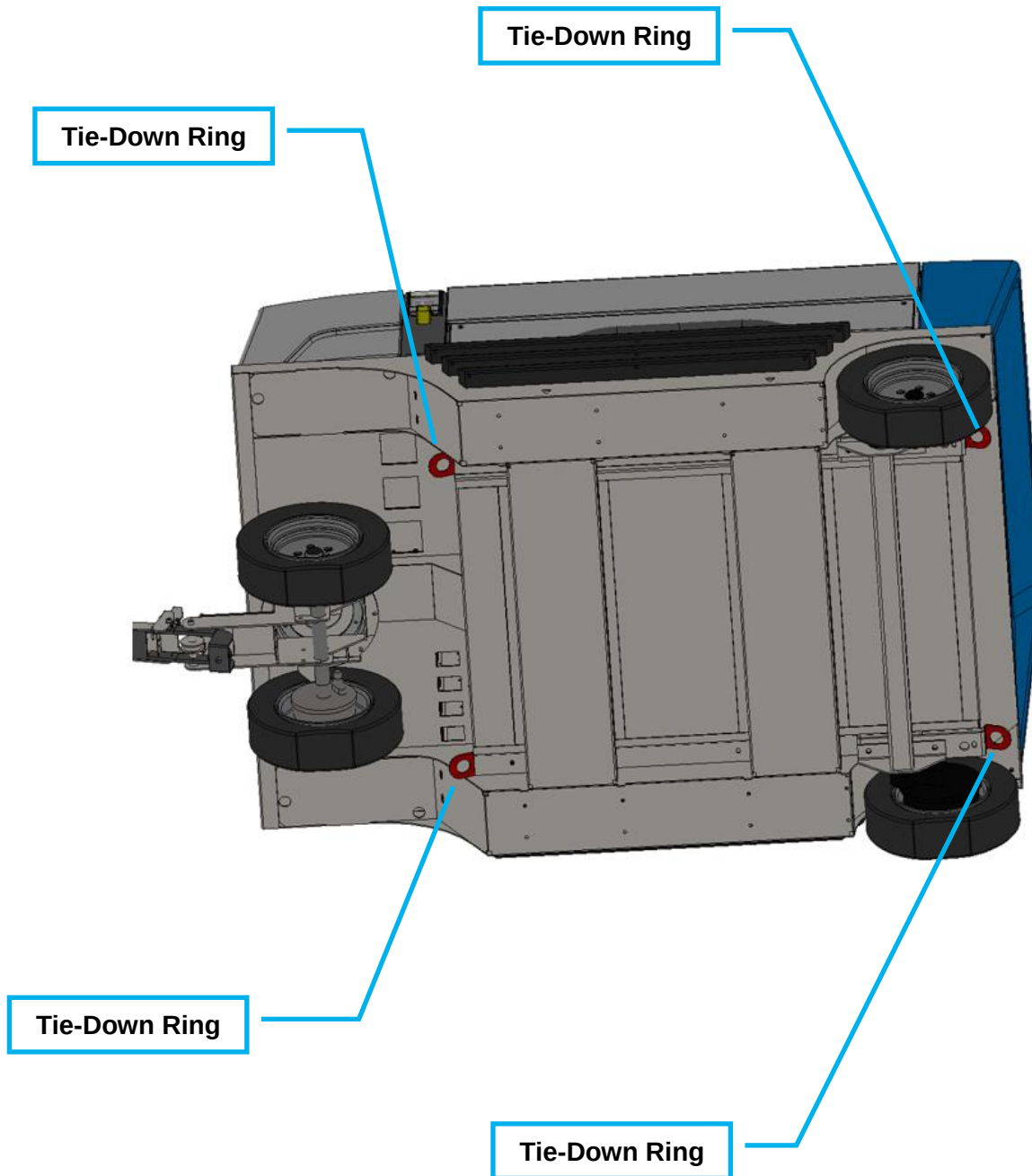


Fig. 10.1.7 Bottom view (4 x Tie-Down rings)

10.2 Labels placement (CE version)

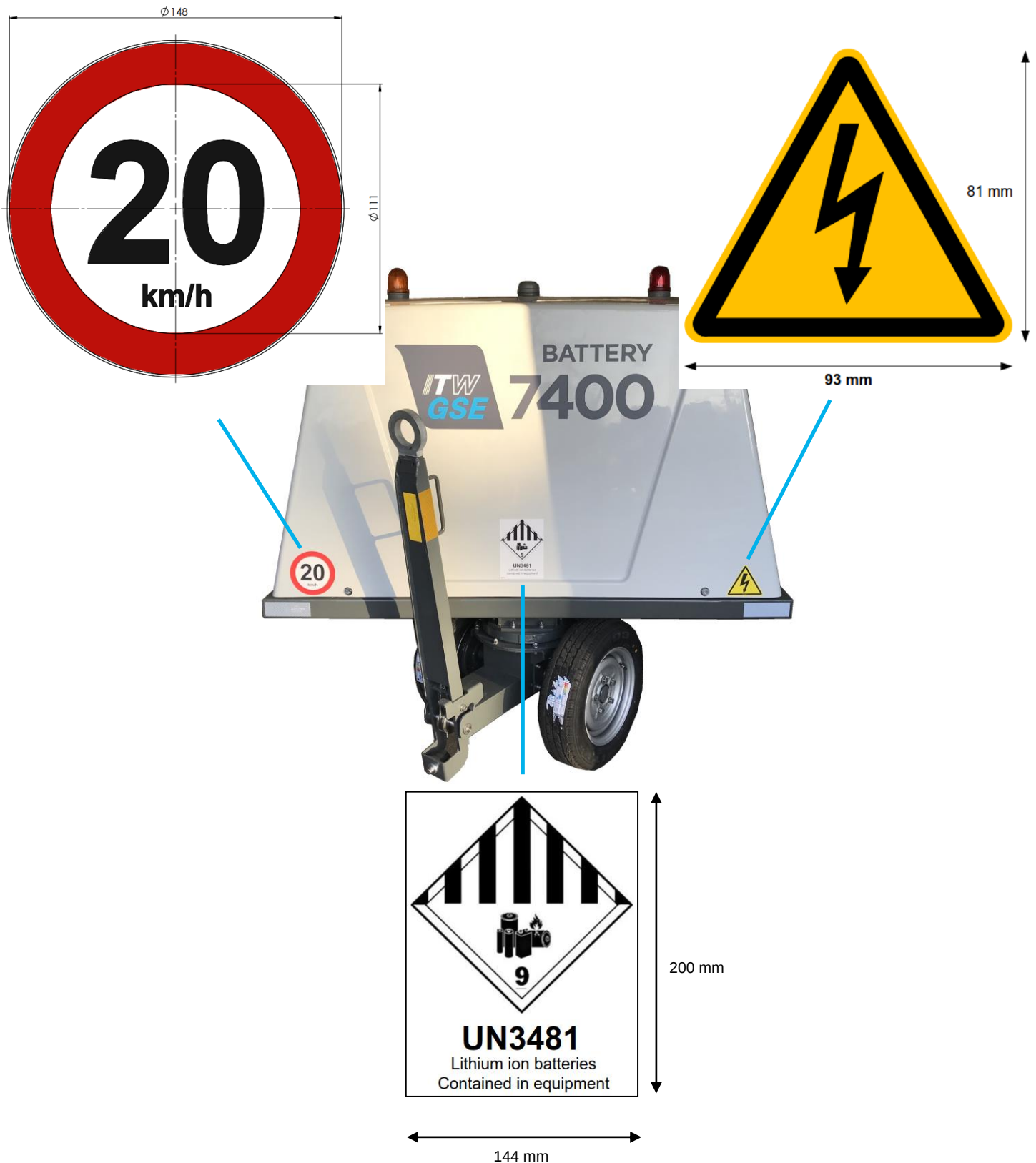


Fig. 10.2.1 Front View (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

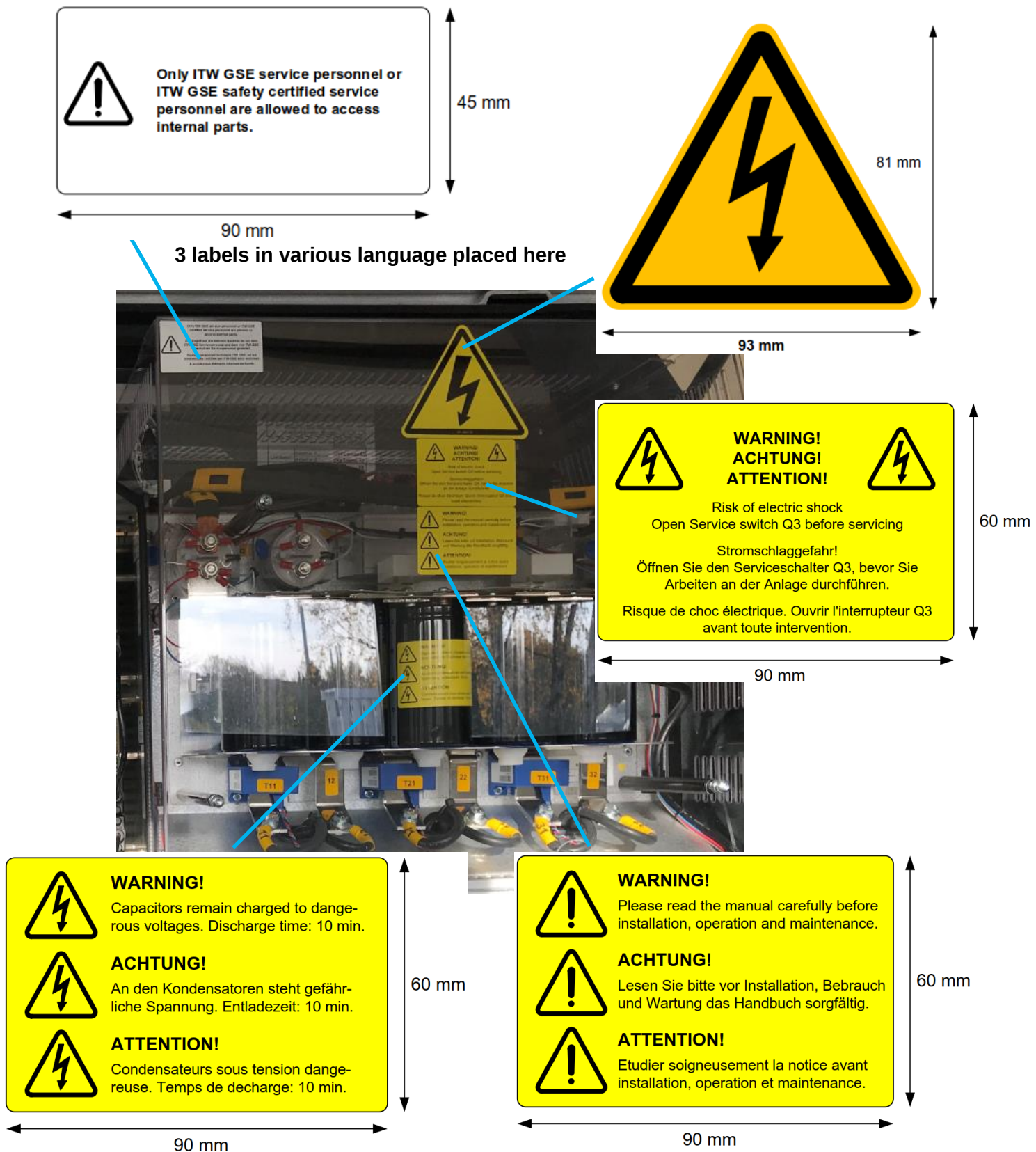


Fig. 10.2.2 Inside View Converter cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

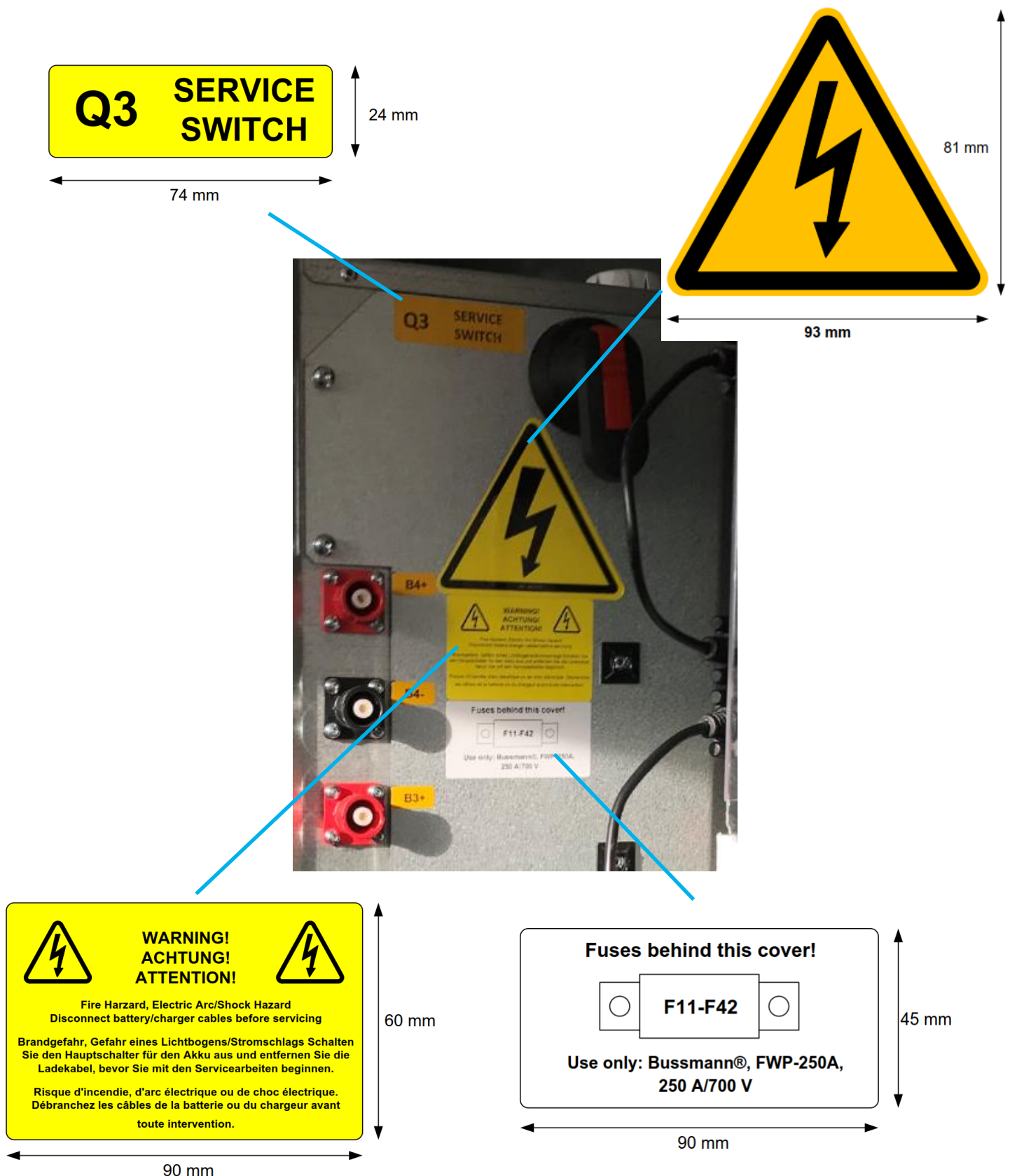
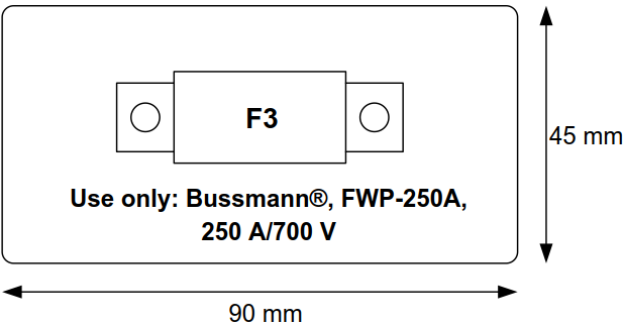


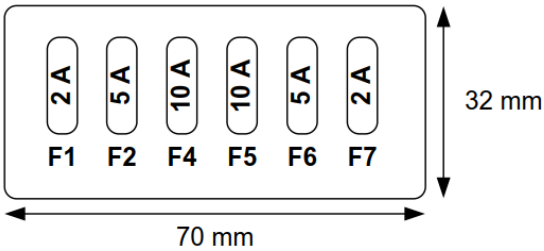
Fig. 10.2.3 Inside View Fuse cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

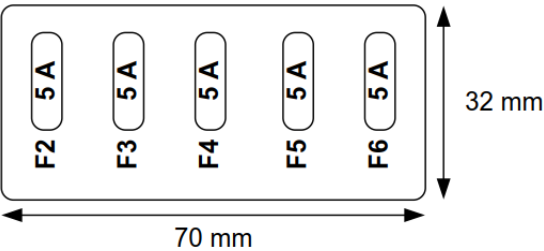
Options



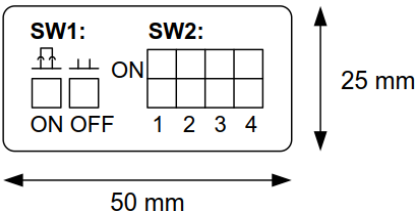
Placed on Electronic Zone back-plate.
(Behind the Fuse F3).



Placed horizontally to the right of the
Interface Board, lower end.



Placed horizontally next to each
Communication Board.



Placed next to each Communication Board.

Fig. 10.2.4 Inside View Fuse cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

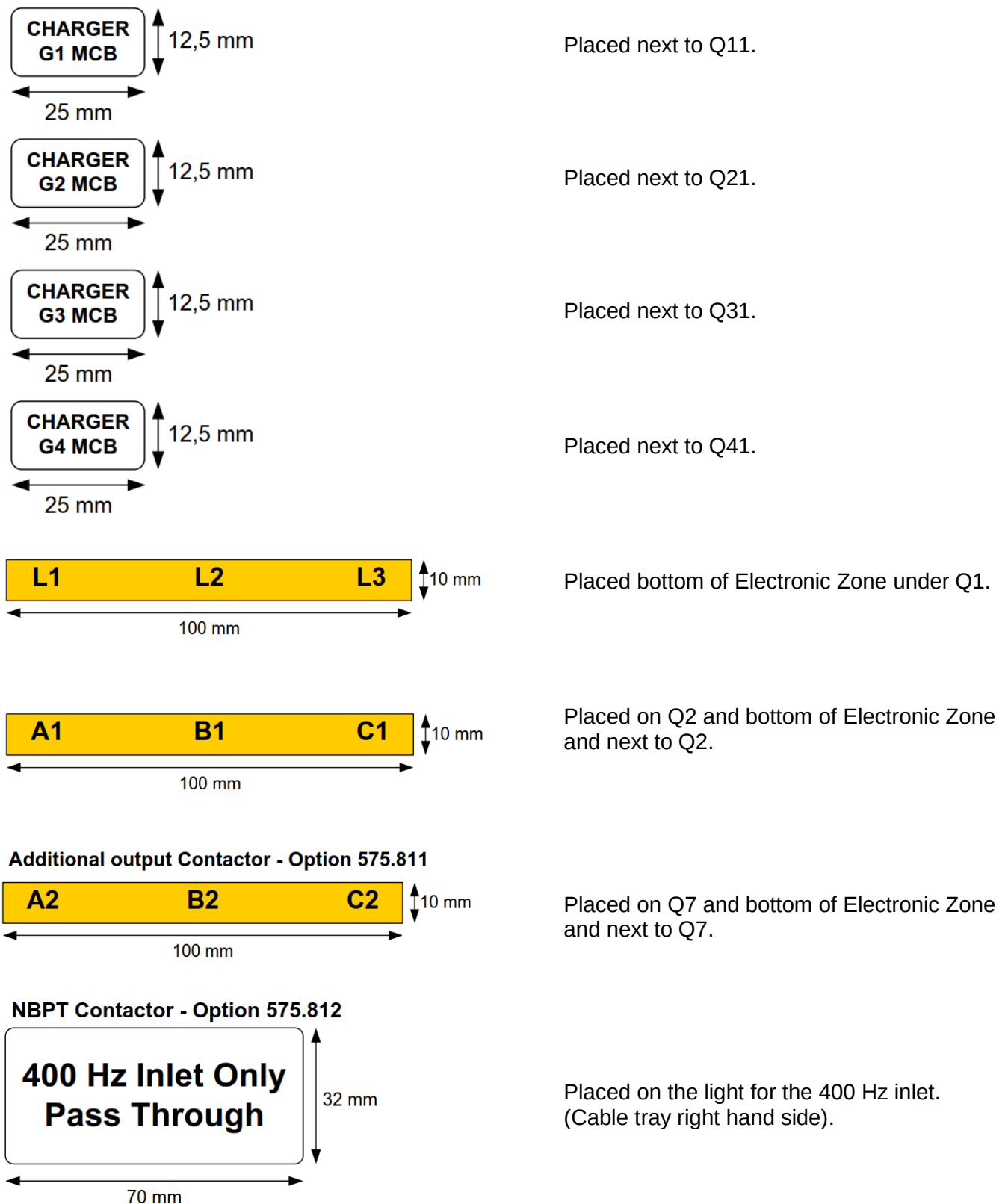


Fig. 10.2.5 Inside View Fuse cover labels (language may vary)

10.3 Labels placement (UL version)

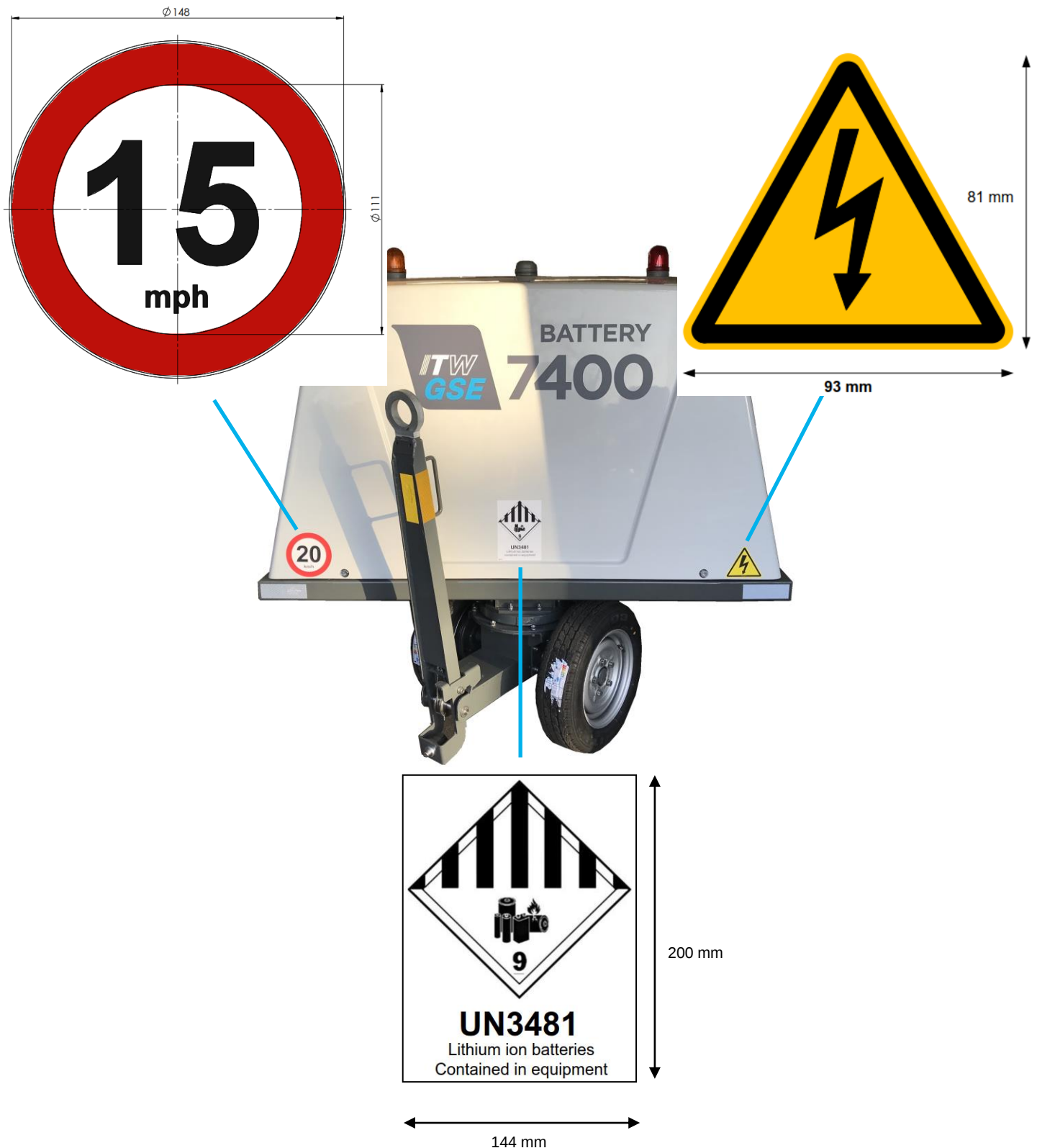


Fig. 10.3.1 Front View (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

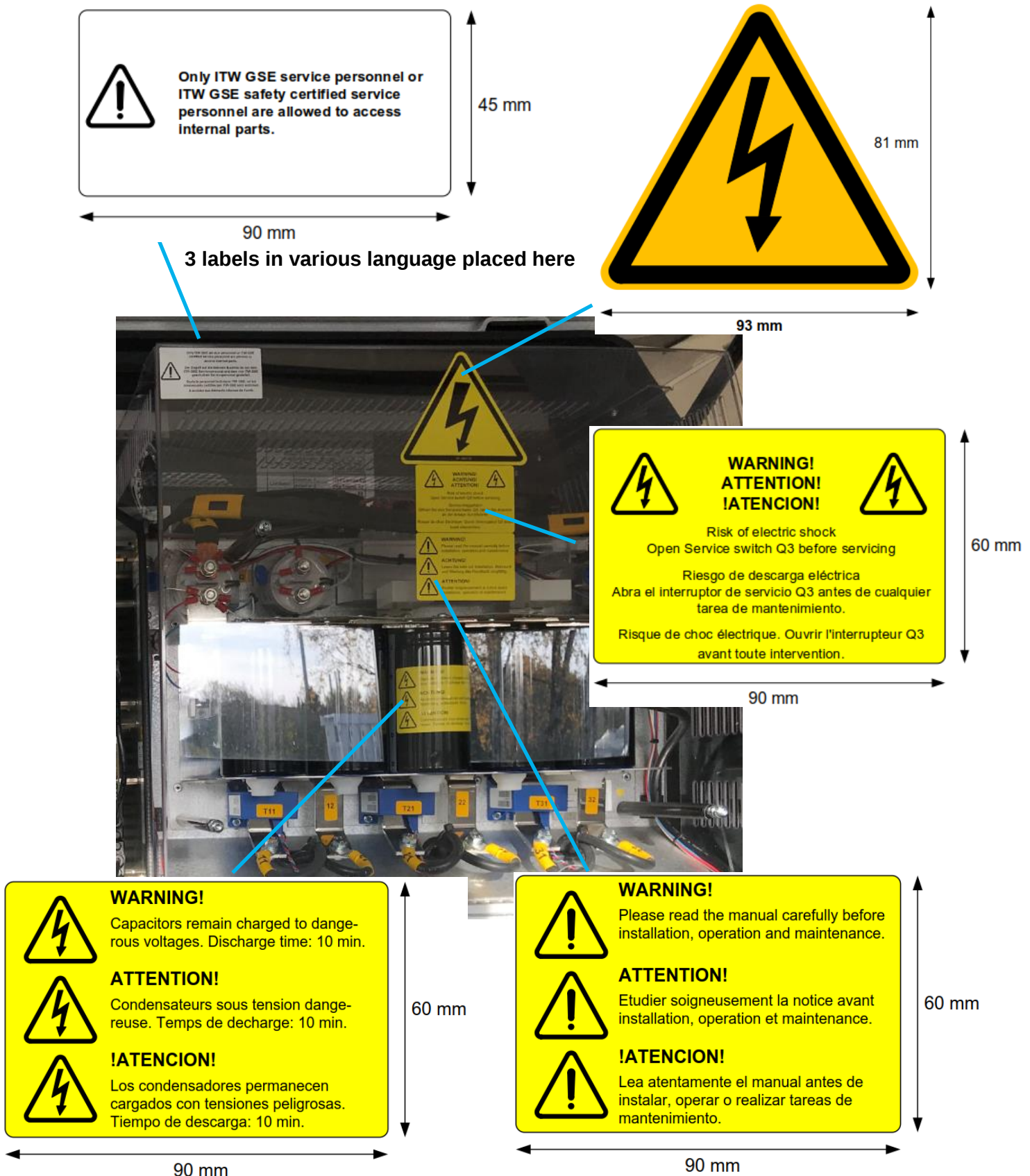


Fig. 10.3.2 Inside View Converter cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

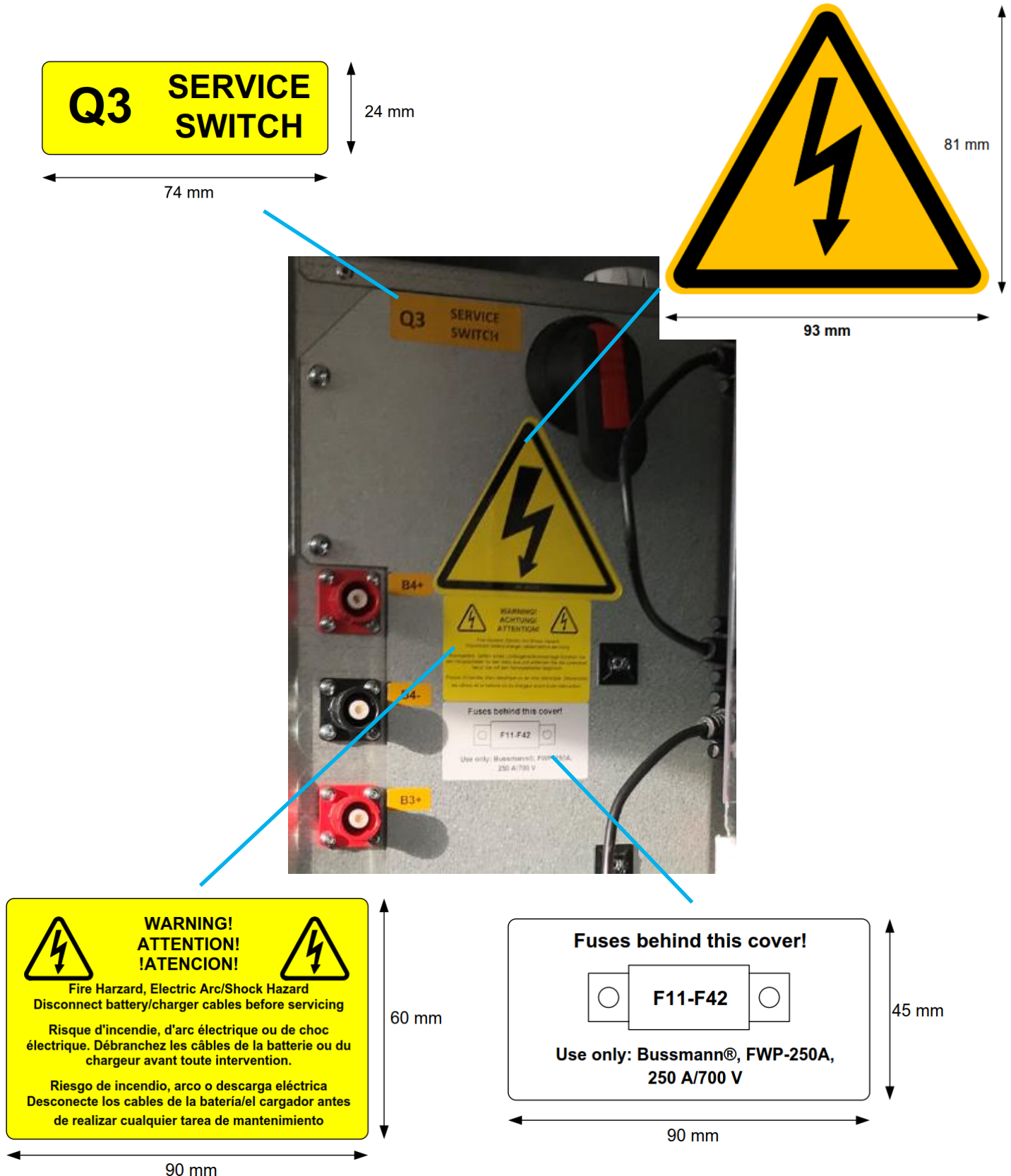
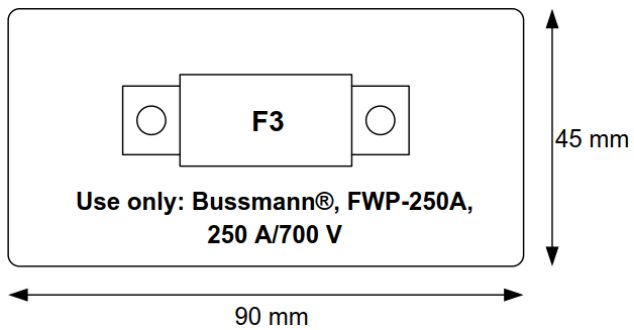


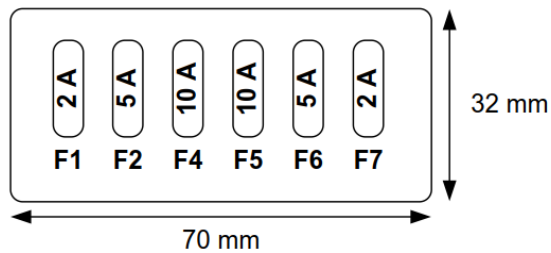
Fig. 10.3.3 Inside View Fuse cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

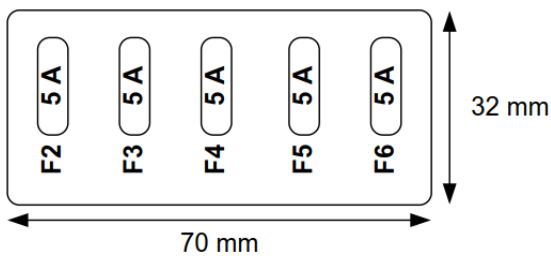
Options



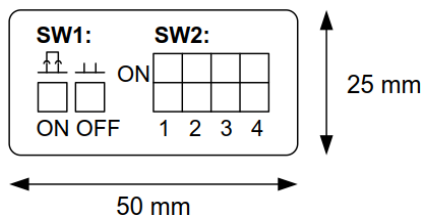
Placed on Electronic Zone back-plate.
(Behind the Fuse F3).



Placed horizontally to the right of the
Interface Board, lower end.



Placed horizontally next to each
Communication Board.



Placed next to each Communication Board.

Fig. 10.3.4 Inside View Fuse cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

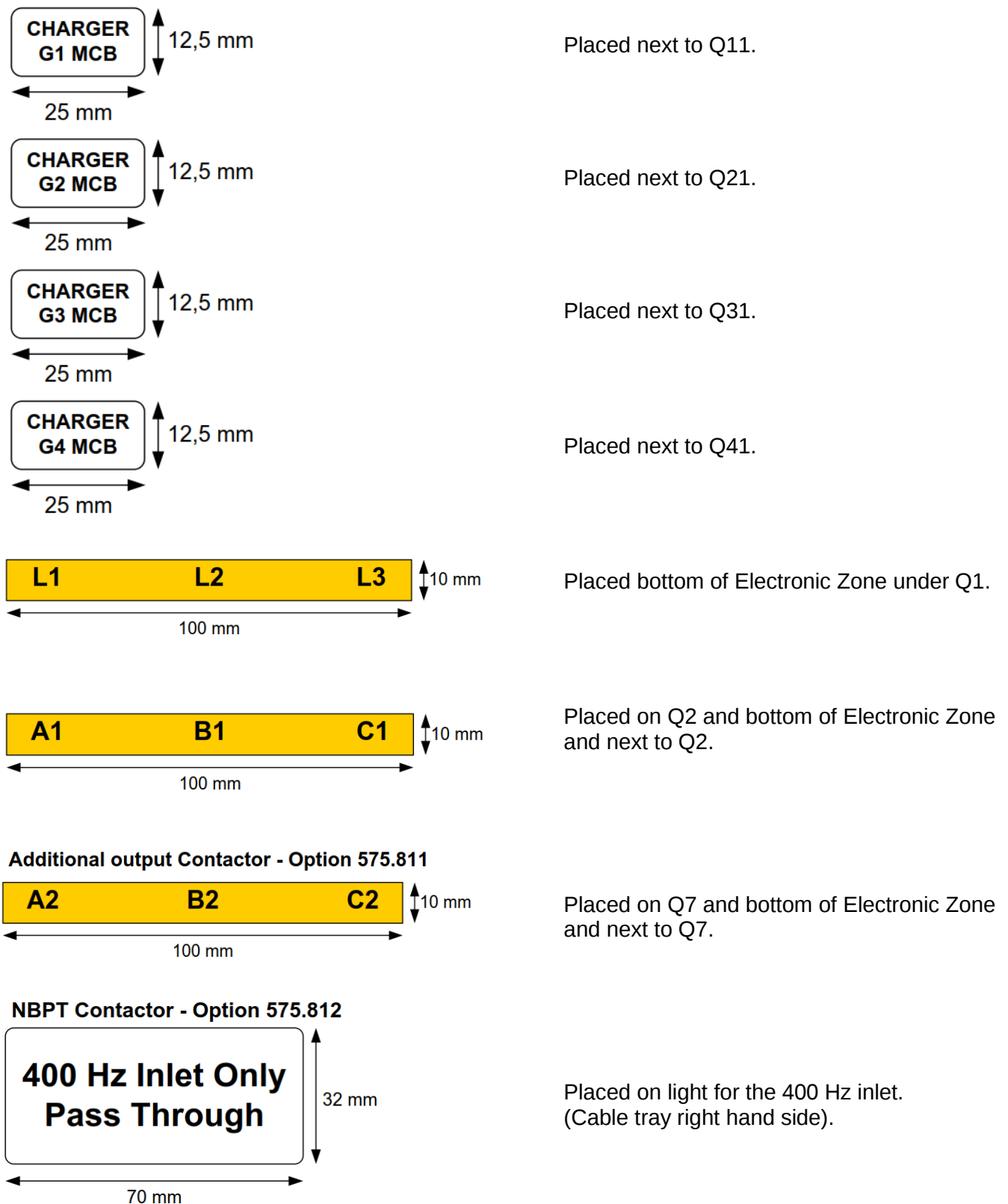


Fig. 10.3.5 Inside View Fuse cover labels (language may vary)

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

11.0 Options

Note

For the Americas use AP-xxxxxx numbers.

575810 / AP-575810 Active Rectifier Unit (Diagram 475810)

The ITW GSE 7400 can be equipped with a 28 VDC **Active Rectifier Unit (ARU)**. This option adds an additional 28 VDC / 600 A output. Both 400 Hz & 28 VDC can be used simultaneously. Total continuous amount of power is 45 kW (AC) + 300 A (DC).

The ARU option is installed on top of the charger section.

The 28 VDC output cable is located in the left-hand side cable compartment of the ITW GSE 7400.

Refer to schematic 575.810 & section 12.0 for further information

Note

ARU excludes option 575811 (Additional Output Contactor)

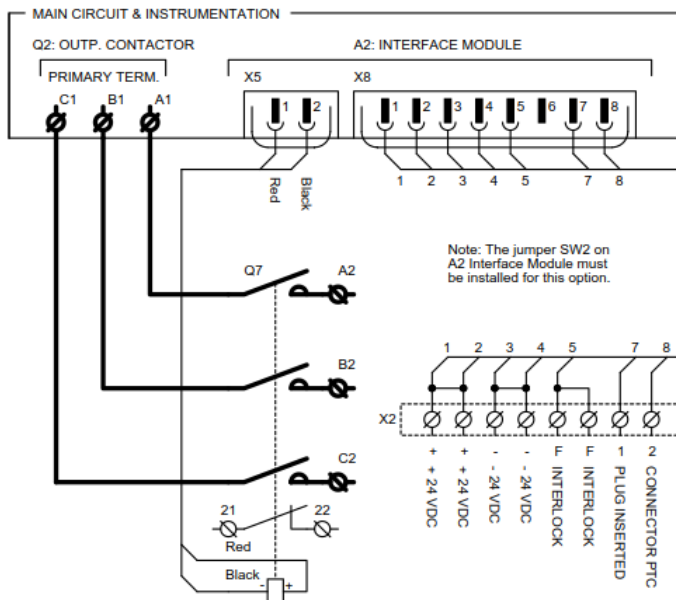
575811 / AP-575811 Additional Output Contactor (Diagram 475801)

All units are equipped with one output contactor.

All models are, however, prepared for an additional output contactor and I/O terminal block X2.

Please refer to section 7.0 for Output Mode / Compensation possibilities.

OPTION 575.811: ADDITIONAL OUTPUT CONTACTOR



Note

Additional Output Contactor excludes option 575810 (ARU)

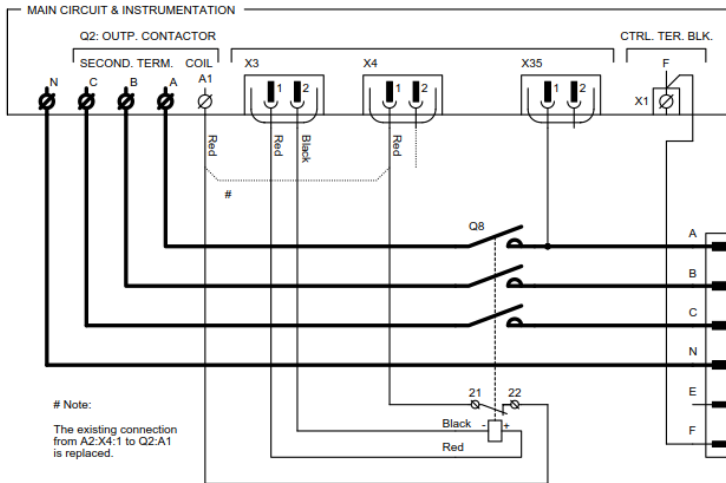
Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

575812 / AP-575812 NBPT Contactor (Diagram 475801)

Adds a 400 Hz inlet, located in the right-hand side of the cable compartment and towards the front of the ITW GSE 7400. Protected by a lid and with an NBPT feature, which allow the ITW GSE 7400 to pass through any additional 400 Hz connected to this input in the event of unexpected long turnaround time.

OPTION 575.812: NBPT CONTACTOR



Note

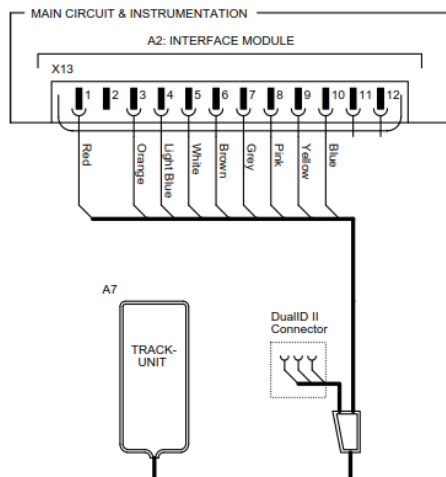
Only allows passthrough and 400 Hz power to output no. 1, all other outputs are turned off.

575813 / AP-575813 TrackUnit (Diagram 475801)

For GPS location/monitoring parameters and unit status, a TrackUnit® with integrated antenna & SIM card is installed.

Data can be retrieved on the fly, through TrackUnit® Cloud via your account.

OPTION 575.813: TRACK UNIT



Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

Parameters available from TrackUnit®:

Type	Unit	Description / Information
Last known status		Shows list of last known statuses of the 7400
Active fault code	Number	Shows the active fault code. Refer to section 9.0 for further information.
Battery Charge Current	Ampere	Shows the charge current to the batteries.
Battery Discharge Current	Ampere	Shows the discharge current to the batteries
Battery Voltage	Volt	Shows the battery voltage.
Estimated Battery time to empty	Minutes	Shows the remaining time before the battery is empty (load depending)
GPU Status	Number	0 = INIT, 1 = STANDBY, 2 = RUN, 4 = ERROR
Historical Average Discharge Power Battery 1	kW	Shows the historical average discharge power from battery no. 1
Historical Average Discharge Power Battery 2	kW	Shows the historical average discharge power from battery no. 2
Historical Average Discharge Power Battery 3	kW	Shows the historical average discharge power from battery no. 3
Historical Average Discharge Power Battery 4	kW	Shows the historical average discharge power from battery no. 4
Historical Average Temperature Battery 1	°C	Shows the historical average temperature of battery no. 1
Historical Average Temperature Battery 2	°C	Shows the historical average temperature of battery no. 2
Historical Average Temperature Battery 3	°C	Shows the historical average temperature of battery no. 3
Historical Average Temperature Battery 4	°C	Shows the historical average temperature of battery no. 4
Next service	Days	Shows remaining days before service
Output Power	kW	Shows output power consumption from 7400
State of Charge	%	Shows State of Charge in % on the 7400
Status Battery 1	Number	Shows battery 1 status (0 = OFF, 1 = ON, 2 = ERROR)
Status Battery 2	Number	Shows battery 2 status (0 = OFF, 1 = ON, 2 = ERROR)
Status Battery 3	Number	Shows battery 3 status (0 = OFF, 1 = ON, 2 = ERROR)
Status Battery 4	Number	Shows battery 4 status (0 = OFF, 1 = ON, 2 = ERROR)
Total time of low voltage battery 1	Hours	Shows the total time that battery no. 1 has been in low voltage
Total time of low voltage battery 2	Hours	Shows the total time that battery no. 2 has been in low voltage
Total time of low voltage battery 3	Hours	Shows the total time that battery no. 3 has been in low voltage
Total time of low voltage battery 4	Hours	Shows the total time that battery no. 4 has been in low voltage

Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

575814 / AP-575814 Yellow Beacon

Depending on client specification, the color of the beacons can be changed.
The beacon may either be continuously lit or flashing.



575815 / AP-575815 Blue Beacon

Depending on client specification, the color of the beacons can be changed.
The beacon may either be continuously lit or flashing.



575816 / AP-575816 Red Beacon

Depending on client specification, the color of the beacons can be changed.
The beacon may either be continuously lit or flashing.



575817 / AP-575817 Green Beacon

Depending on client specification, the color of the beacons can be changed.
The beacon may either be continuously lit or flashing.



Note

Beacon LED light, permanent use connection X1 on Beacon
Beacon LED light flashing, use connection X2 on Beacon
Refer to Main Circuit and Instrumentation schematic 475.400

Operation Manual – ITW GSE 7400 Battery Powered GPU

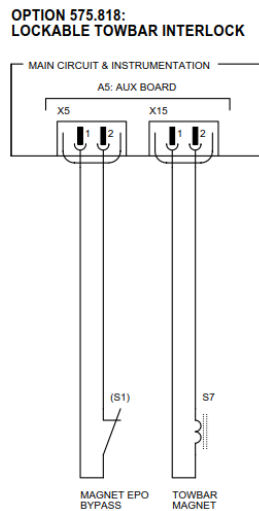
Options

575818 / AP-575818 Lockable Towbar Interlock (Diagram 475801)

This option adds a magnet lock to the towbar. Unless the cables are in the corresponding compartments, the towbar is mechanically locked and cannot be lowered.

Note

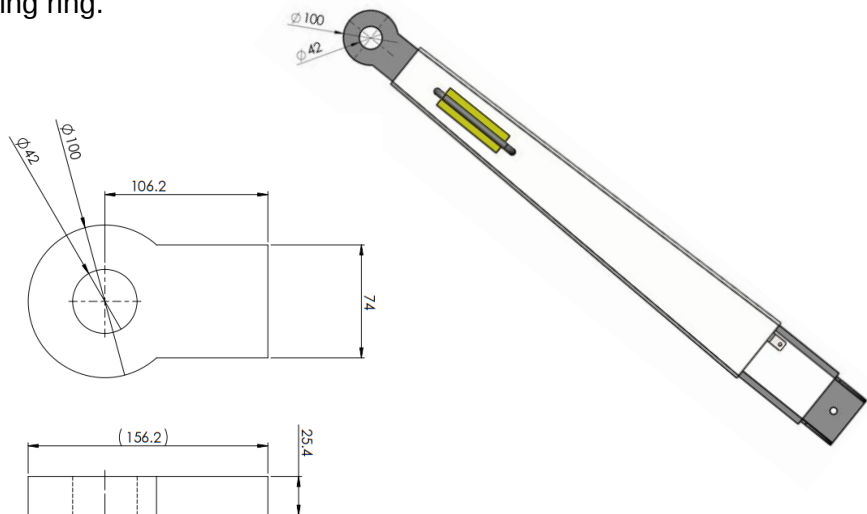
In the event of an emergency, push the EPO, which enables the operator to move the unit. Remember to unplug the input / output cables, if the unit is towed further away than the cable's length.



575819 / AP-575819 Towbar w/DIN40 Towing Eye

This option replaced the original towbar, with a towbar with a $\varnothing 40$ mm towing ring.

Inner diameter $\varnothing 42$ mm
Outer diameter $\varnothing 100$ mm
Eye thickness 25.4 mm



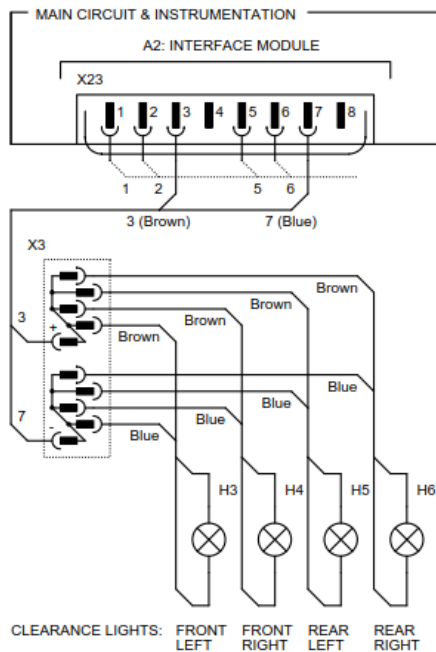
Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

575820 / AP-575820 White Clearance Light (Diagram 475801)

Adding four white clearance lights, one on each corner of the unit, makes the equipment more visible on the apron and in hangers.

OPTION 575.820: CLEARANCE LIGHT



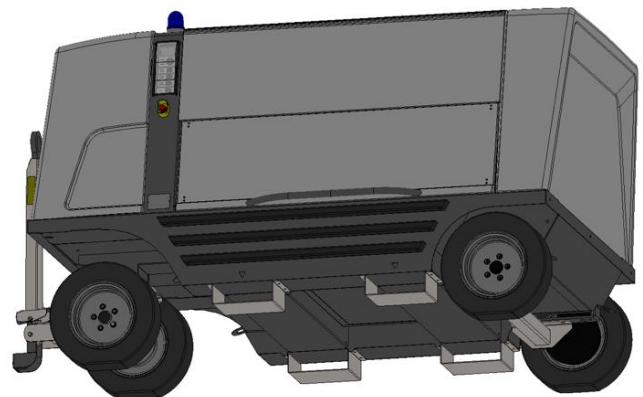
575821 / AP-575821 Forklift pockets for transport

Forklift pockets have been added to the unit for more secure transport.

The forklift pockets can be dismantled after the transport has been completed and stored for the next transport or just left on the unit.

Note

Leaving the forklift pocket attached to the unit will decrease the center headroom to 140 mm above the ground of the ITW GSE 7400.



Operation Manual – ITW GSE 7400 Battery Powered GPU

Options

591100 / AP-591100 Auto-Calibration Plug

Required for plug & play setup.
See Section 7.3



Operation Manual – ITW GSE 7400 Battery Powered GPU

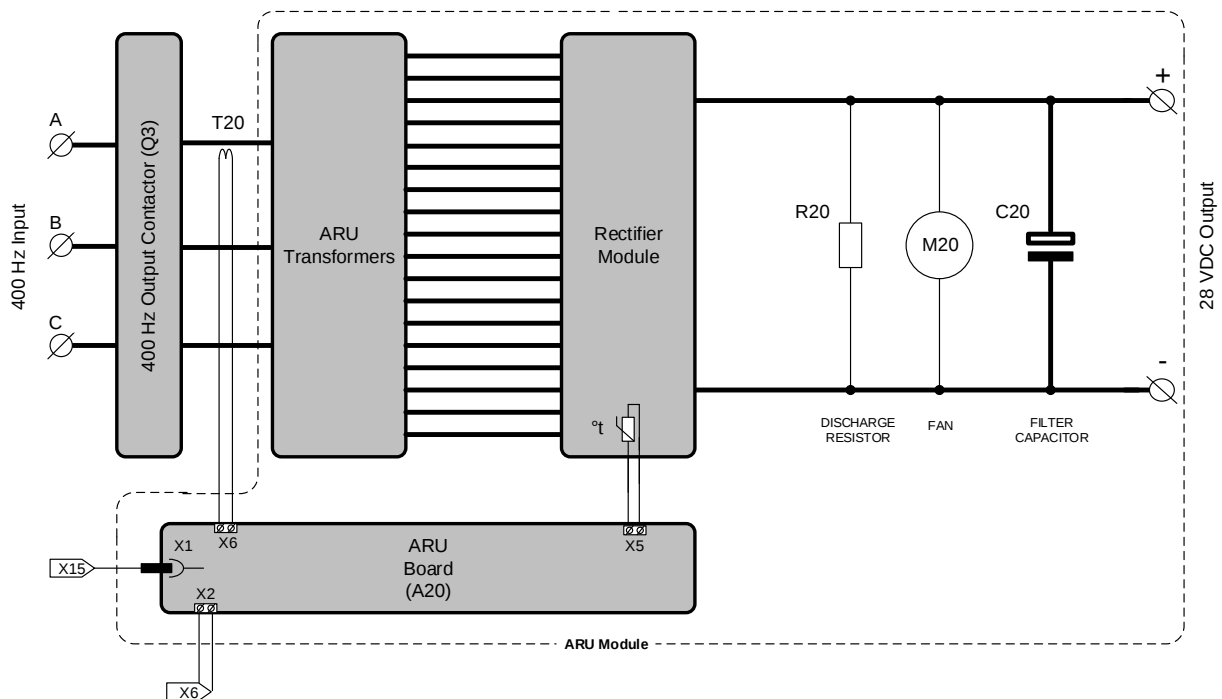
For GPUs with 28 VDC Active Rectifier Unit

12.0 For GPUs with 28 VDC Active Rectifier Unit

All ITW GSE 7400 units from 68 kVA to 90 kVA can be equipped with a 28 VDC **Active Rectifier Unit** (ARU) output.

Both 400 Hz & 28 VDC outputs can be used simultaneously. The total continuous amount of power from the unit is 45 kW (AC) and 300 A (DC).

12.1 General Description



* Situated above the charger section

12.1.1 Principle of 28 VDC ARU

The 28 VDC section is an Active Rectifier Unit and supplied from the 400 Hz section, where the 28 VDC output voltage is regulated regardless of the varying 400 Hz input voltage. The DC output current is calculated, very precisely based on the 400 Hz parameters and via the current transformer T20, located in phase A at the 400 Hz main power input.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

Input Contactor (Q7):

The 400 Hz input power to the ARU is supplied and controlled via Q7.

ARU Transformers (Ty1/Ty2/Ty3/Tz1/Tz2/Tz3)

The ARU transformers step down the 3 phases 400 Hz voltage (3 x 200 Vac) to an appropriate level for obtaining 28 VDC at the output.

ARU Rectifier (PM20):

The output voltage is kept at 28 VDC by using thyristors, regardless of the input voltage level and the load.

ARU Board (A20):

The ARU Board interfaces with the processor board and the rest of the 28 VDC unit.

- Supplied from Interface Board (X2)
- Connection to ARU control input on A2 (X15)
- Controls thyristors
- Measures the output voltage
- Interface for ARU Contactor (Interface Board A2-X5)
- Input for current transformer T20 (X6)
- Input for heatsink thermostat (X5)

Resistor (R20):

The discharge resistor R20 is part of the output filter stage and discharges the capacitor C20, when the unit is turned off.

Filter Capacitors (C20)

The output filter capacitors are also part of the output filter stage and ensures that the AC ripple is kept to a minimum, less than 2% at the output.

Fan (M20)

The fan M20 is part of the total forced cooling of the unit, the primary task for the fan is to cool down the rectifier module. The air is drawn in via the left hand side of the ARU module.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

12.2 Connection of Cables

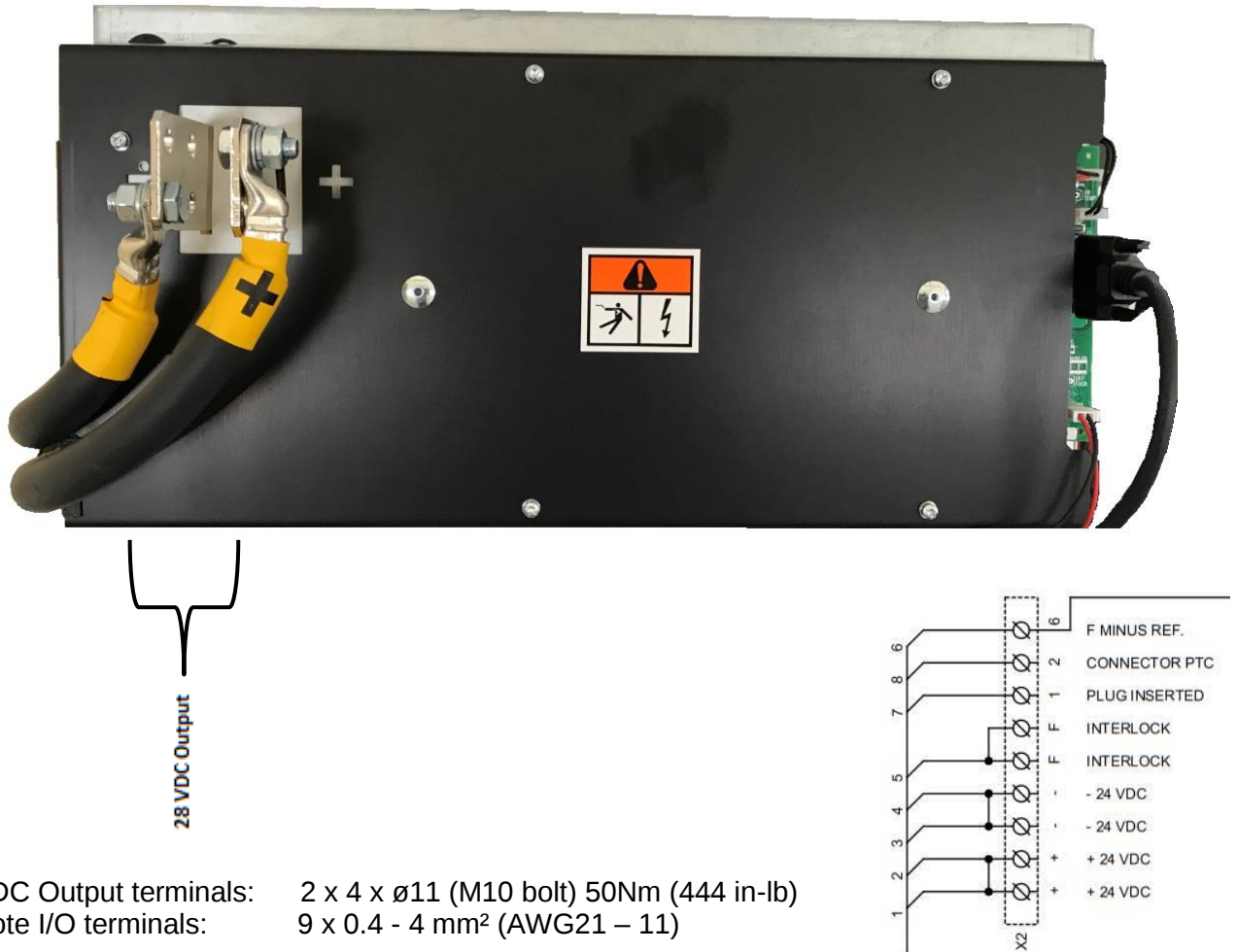


Fig. 12.2.1 Connection of cables

Note

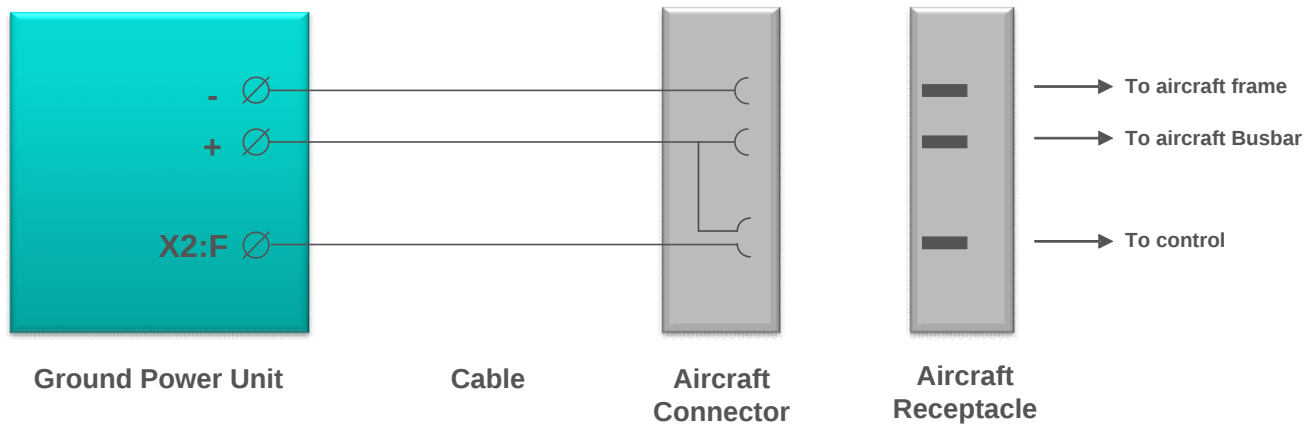
Recommended output cable dimension to the aircraft is 2 x 120 mm² to minimize the voltage drop.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

12.3 Interlock

To ensure personnel health and safety, the converter is equipped with an interlock system. The system ensures that the output only stays engaged as long as the plug is inserted into the aircraft receptacle. I.e. as long as there is 28 VDC at terminal X2:F.



12.3.1 Standard wiring diagram

For service, maintenance and test purposes, the interlock system can be by-passed via the display setup. To ensure personnel health and safety, the converter automatically returns to normal mode once it receives a 28 VDC voltage at terminal F2; e.g. when the plug is connected to an aircraft.

Note

Converters for the Americas require a “split-C” connector, which is typically a special order from most aircraft manufactures.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

12.4 Operator's Instruction

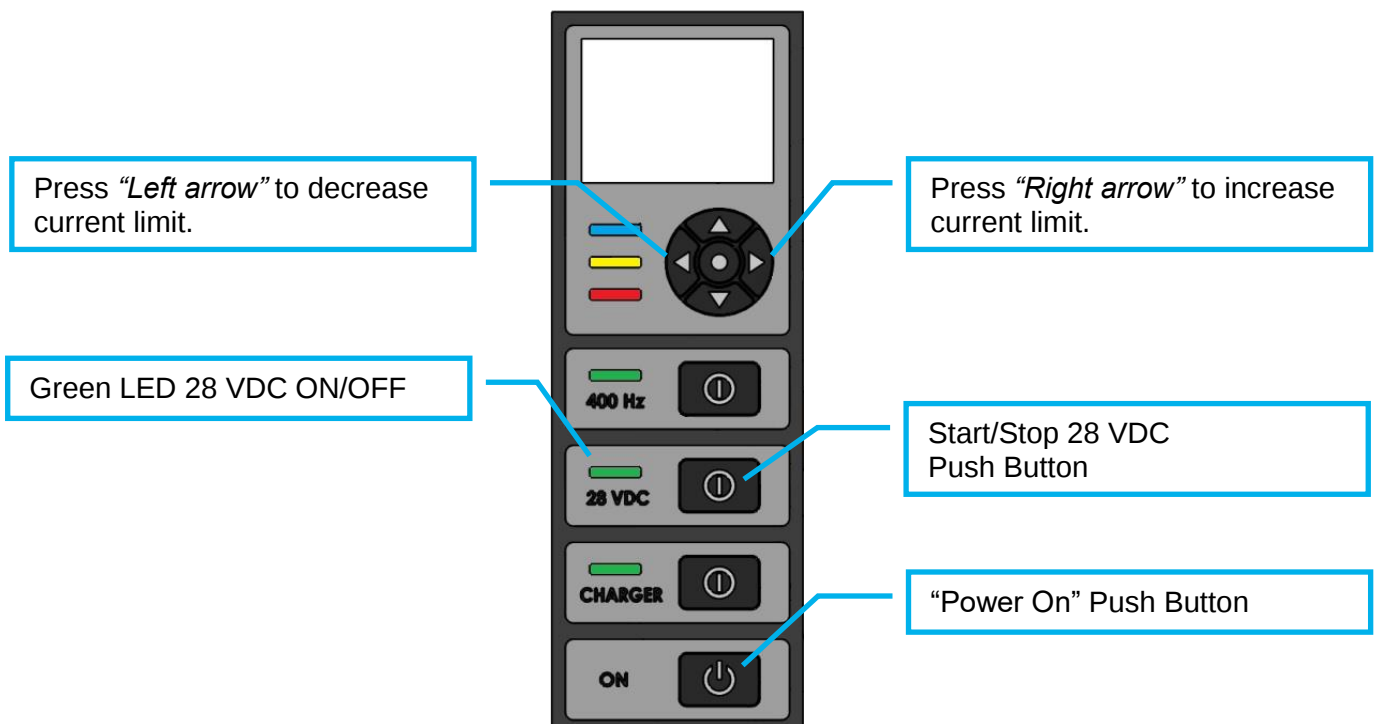
The 28 VDC ARU is operated by means of the Display / Keyboard Interface.

Please refer to section **6.0** (Operators Instructions) and **6.1** (Using the Display/Keypad).

12.5 Operating the unit

- To adapt the 28 VDC output power to different types of aircraft, it is possible to set a maximum DC current level, 300 to 2400 Amp in steps of 50/100/200/300 A (step size can be set via the setup menu). With the output off, decrease the current limit by using the left navigation arrow and use the right navigation arrow to increase current limit.

To ensure hassle-free starting of the aircraft engine, the current limit function is delayed by 0.7 seconds.

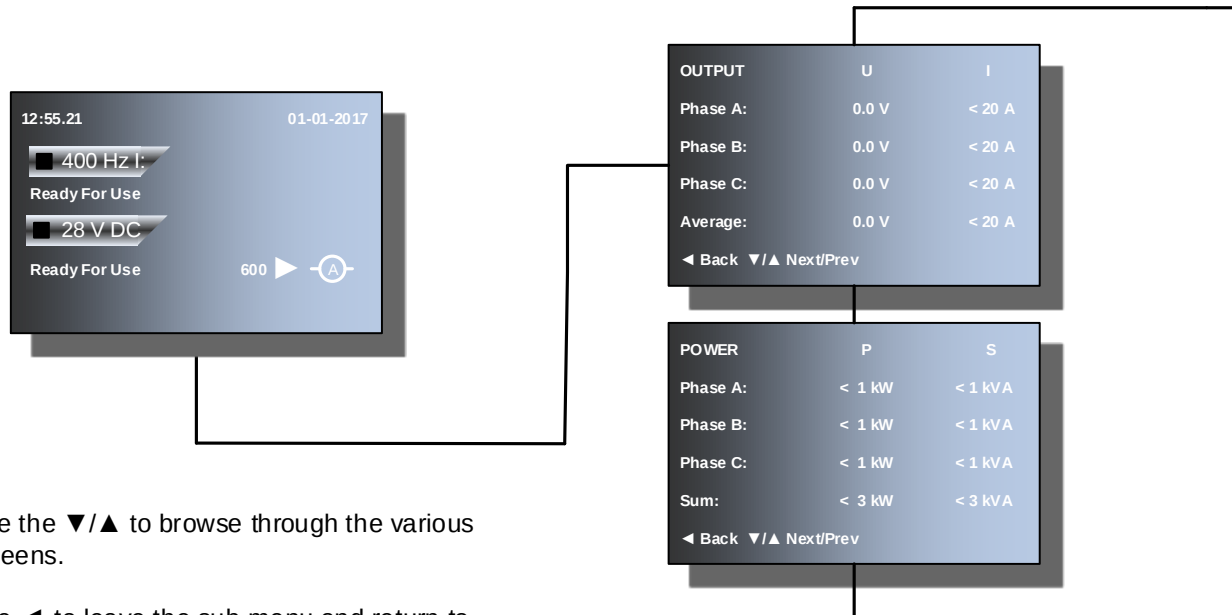


Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

- Press the On/Off  button to power up the GPU if it is not already awake.
- Insert the 28 VDC aircraft cable into the aircraft. Make sure the cable is inserted until you feel a natural resistance. The plug may be equipped with a 90° switch /split “F” pin. In this case the unit will not function if the plug is not fully inserted.
- Press the 28 VDC Start/Stop  button.
- The unit is now in operation and ready to supply the aircraft with power. This is also indicated via the green LED located close to the 28 VDC Start/Stop button.  **28 VDC** 
- If the unit shuts off and is no longer supplying power to the aircraft, this is reported in clear text on the display. A corrective action is also displayed.
- 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.

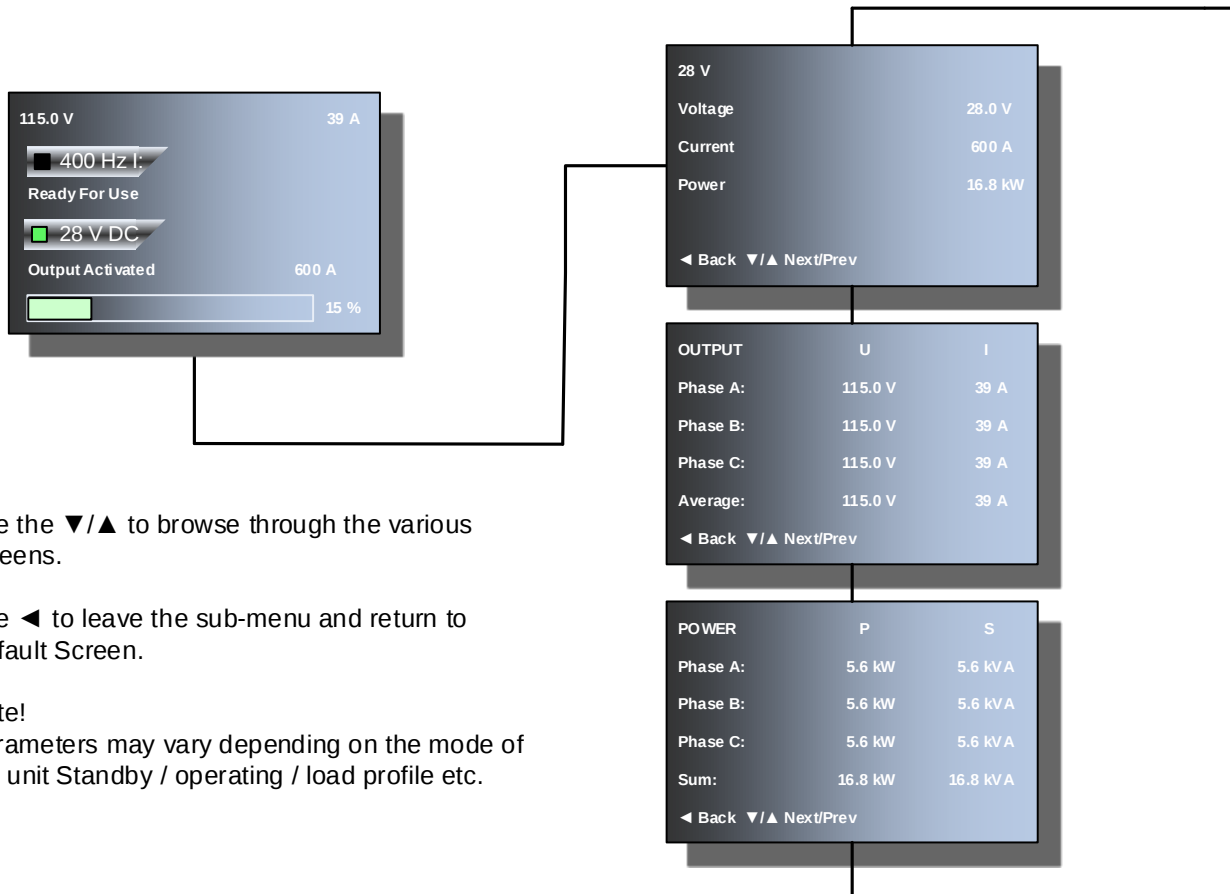
Note!

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

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

Default Display Screen Operation



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 must be turned off before removing the aircraft plug.

Press the 28 VDC Start/Stop button



- The aircraft cable can now be removed from the aircraft and placed in the cable rest position.

Note

Please note that the 28 VDC Start/Stop button



also functions as a Reset button.

If, for some reason, the unit stops due to an error / failure, press the Start/Stop/Reset to reset the unit, once the fault number and message have been recorded and reported to maintenance. Note that this will remove the fault message from the screen if it is no longer active.

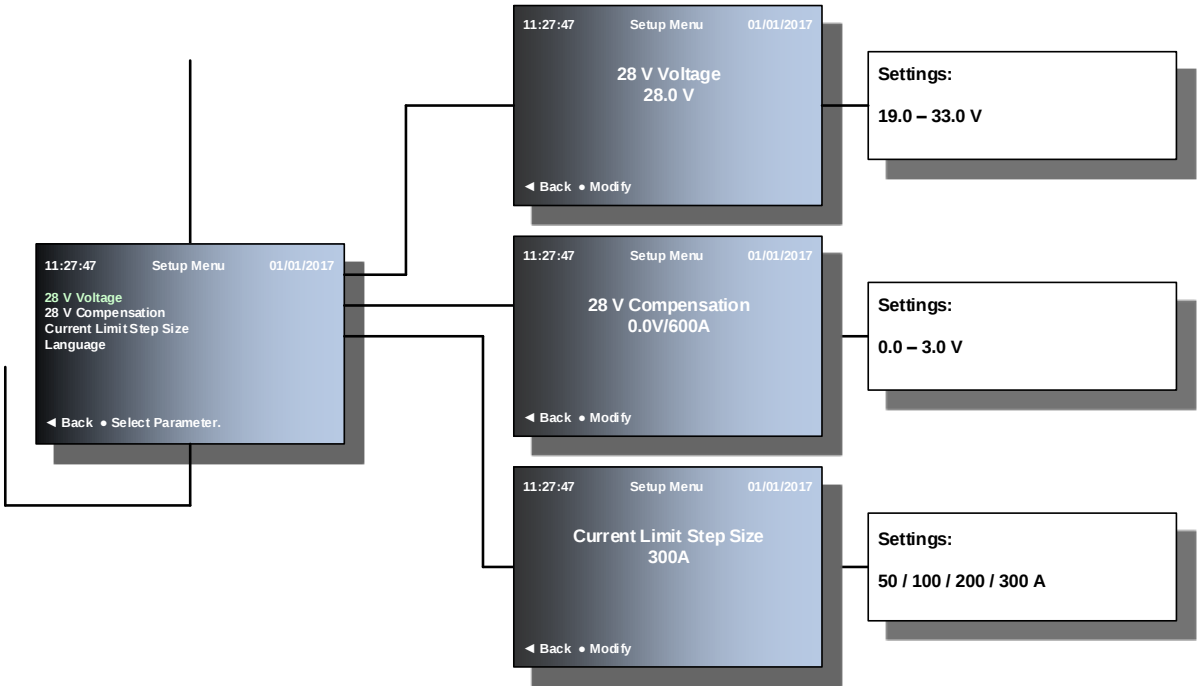
(The Black Box will still have a record of the actual fault)

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

12.6 Additional menu items for ARU

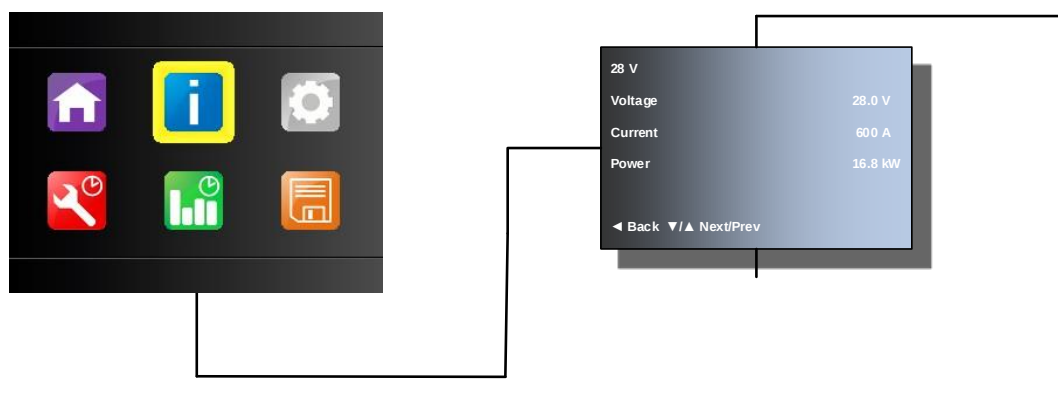
Setup – ARU additional parameters



Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

Parameters – ARU additional parameters



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.

Please refer to section **6.1** (Using the Display/Keypad).

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

12.7 ARU Default Factory Settings

28V Voltage (V):	28.0
28V Compensation (V/600 A):	0.0 (Set if GPU is supplied with cable)
28V Current Limit (A):	2400 A
Output Mode:	Simultaneous
Fan Control:	Normal
Cable Temperature:	Normally Open

12.8 28V Voltage

This Setup submenu allows the 28-volt output to be adjusted between 19.0 VDC and 33.0 VDC using the UP and DOWN navigation buttons. (Please note that the acceptable voltage range for all commercial DC powered aircraft is 26V to 29V).

Enter the Setup Menu and then scroll up or down to the 28V 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 to the submenu list.

12.9 28V Compensation

DC voltage drops quickly as the current increases over a given length of cable. This Setup submenu allows the 28-volt output to be automatically adjusted as the load increases. The allowed setting is between 0.0 and 3.0 VDC at the rated continuous load of the unit. Note that the maximum output voltage of the unit is 33 VDC.

Enter the Setup Menu and then scroll up or down to the 28V Compensation 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.

12.10 Current Limit Step Size

This Setup submenu is used to set the default current limit step size in steps of 50 / 100 / 200 / 300 A. The current limit settings are from 300 amps to 2400 amps, current limit can be changed from the standby screen menu. Increases/decreases of the current limit depend on the selected steps in the setup menu.

Enter the Setup Menu and then scroll up or down to the Current Limit Step Size 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.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

13.0 Specifications

Output:

Voltage	: 28 VDC
Current	: 600 A continuously (300 A simultaneously with 400 Hz)
Voltage regulation	: < 0.5%
Voltage ripple	: < 2%
Voltage transient recovery	: Complies with ISO 6858 / MIL-704E
Overload capability	: 1200 A for 30 seconds 1800 A for 10 seconds 2100 A for 5 seconds 2400 A for 2 seconds

To protect the aircraft, the output voltage is decreased by 1 V per 300 A in the overload range (600-2400 A).

Setup:

Output voltage	: 19-33 V
Voltage compensation	: 0-3 V per 600 A
Current limit	: 300-2400 A in steps of 50/100/200/300 A*

*Steps depending on chosen value in the setup menu.

Protections:

Rectifier temperature too high

Short circuit at output

Over-and under voltage at output in case:

U < 20 VDC for more than 4 seconds

U > 32 VDC for more than 4 seconds

U > 40 VDC for more than 150 ms

Physical:

Additional weight to 400 Hz unit: 100 kg / 220 pound

Ambient:

Operating ambient for the 400 Hz and 28 VDC combination unit is -10°C to 45°C / -40 F to 113 F.

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

14.0 Troubleshooting & Repair

Please refer to section 9.1 for Fault Guidelines

Additional 28 VDC ARU related failures:

6102	Cable 2 temperature too high
6302	EF signal drop out – Output 2
6303	EF signal drop out – 28 V Output
7000	Output voltage too high (>32 V – 4 sec.)
7100	Output voltage too high (>40 V – 150 ms.)
7200	Output voltage too low (<20 V – 4 sec.)
7300	Short circuit at 28 V output
7400	28 V output current too high
7500	28 V rectifier temp. too high

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

15.0 ARU illustrated parts list

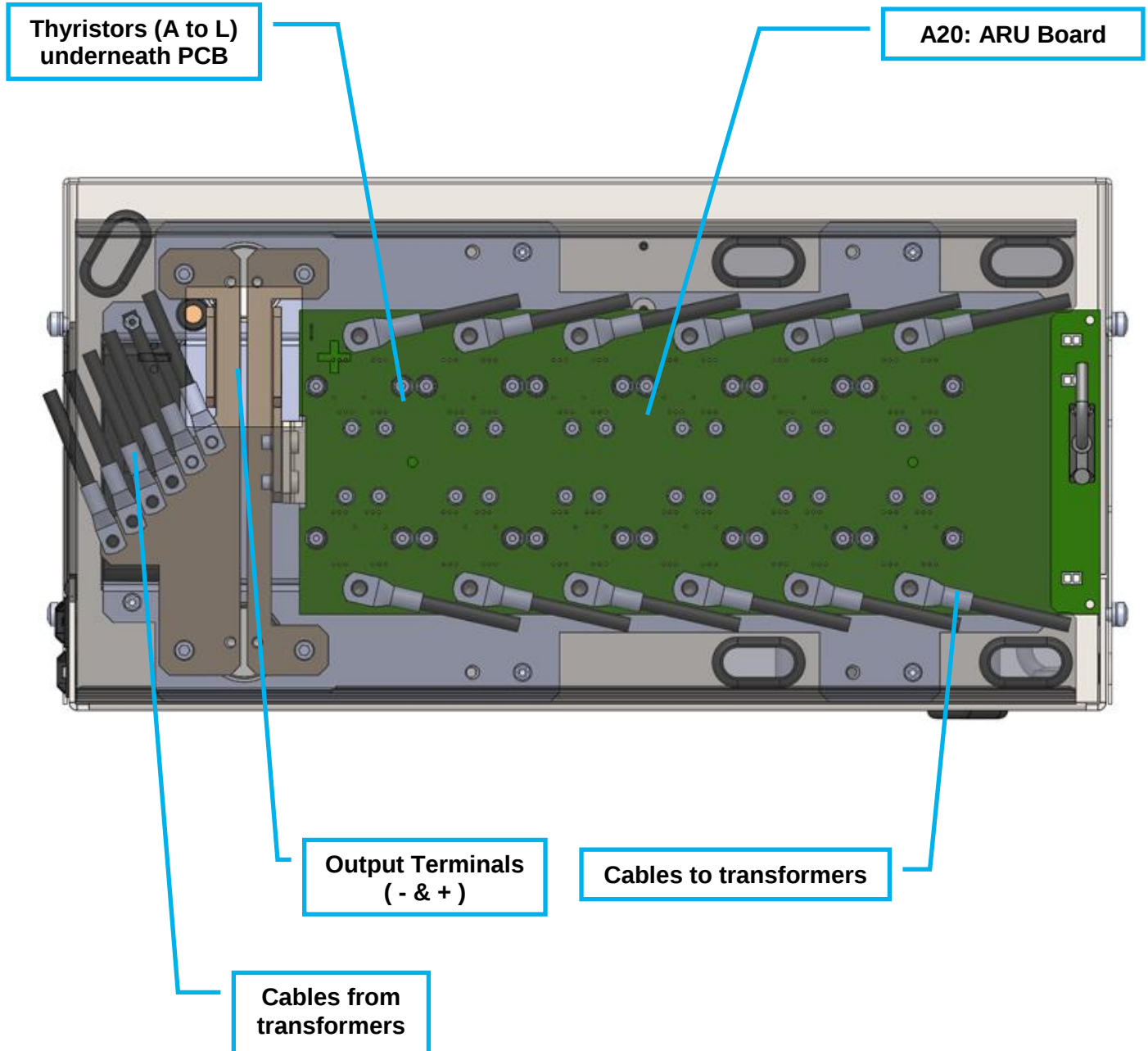


Figure 15.0.1 Front view (ARU cover removed)

Operation Manual – ITW GSE 7400 Battery Powered GPU

For GPUs with 28 VDC Active Rectifier Unit

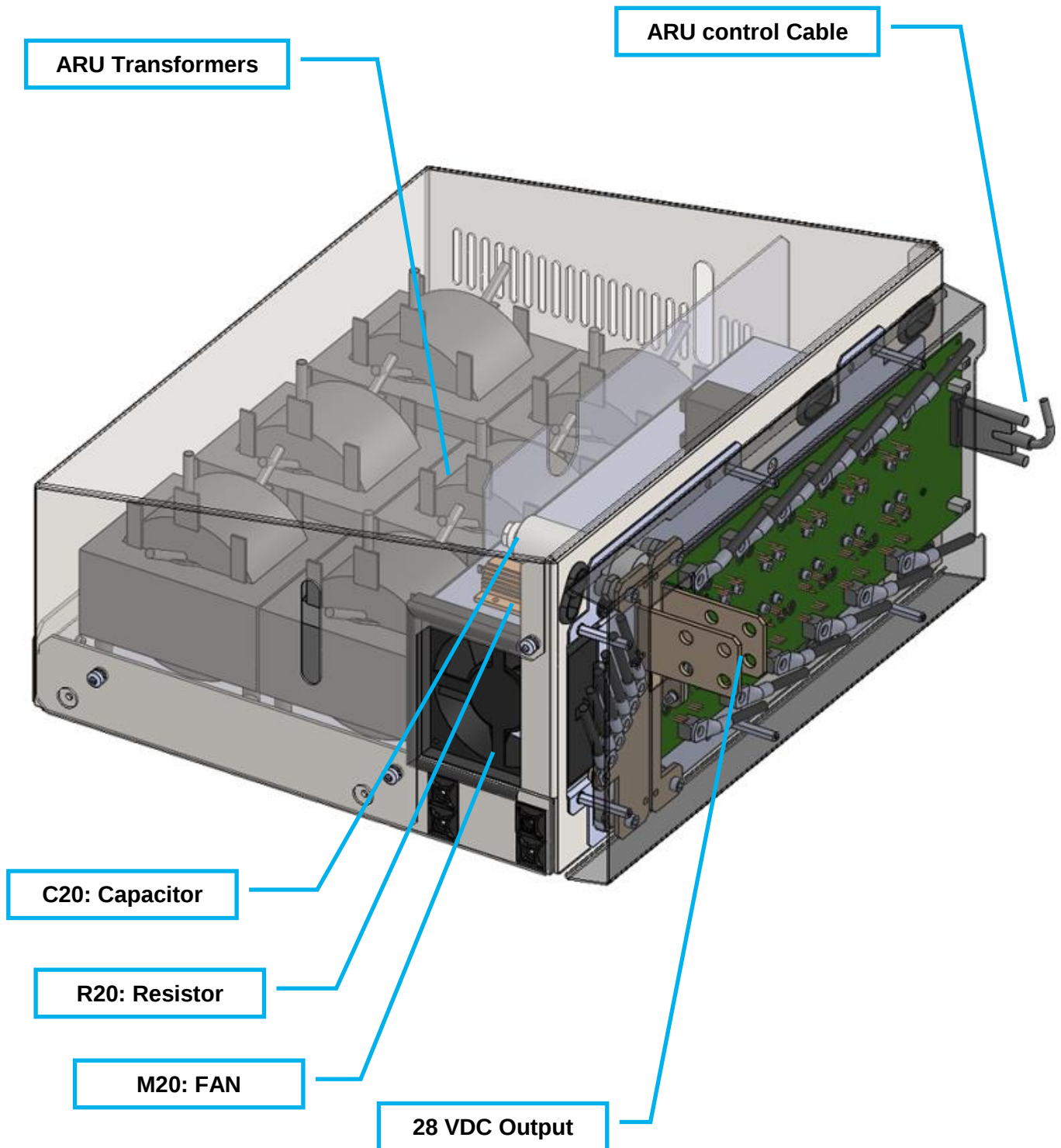


Figure 15.0.2 Side view (X-ray ARU cover)