



It's all about
connections

Manual

ITW GSE 2400 Compact

400 Hz Ground Power Unit

With 28 VDC outlet (optional)



Serial no.

Type

_____ - _____

IMPORTANT NOTE

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

Refer to section 8.2
for further information

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

Printed: March 2018

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	Electro Static 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
SSFC	Solid State Frequency Converter
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
VFD	Variable Frequency Drive

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Index

INDEX

1.0	Declaration of Conformity	8
2.0	Safety Instructions	9
3.0	General Description	10
3.1	Built-in features / protections	15
4.0	Transport and Installation	17
4.1	Storage Before Installation	17
4.2	Operational and Environmental Conditions after Commissioning	17
4.3	Transport	17
4.4	Installation and fastening instructions	19
4.5	Connection of Cables	23
4.6	Mains/Utility Input	24
4.7	400 Hz Output.....	24
4.8	400 Hz Interlock.....	25
4.9	Control Interface (Remote I/O Terminals).....	25
4.10	TCP/IP On-board Interface	27
5.0	Technical Specifications	28
6.0	Operator's Instructions (Display/LED/Keypad layout)	33
6.1	Using the Display/Keypad.....	34
6.2	Operating the unit	35
6.3	Basic Menu	37
6.3.1	Parameters – Menu structure	38
6.3.2	Setup – Menu structure	42
6.3.3	Black Box – Menu structure	47
6.3.4	Power Log – Menu structure.....	48
6.3.5	Update Software / Save Logs / Load Config File	49
6.3.6	Incompatible Software Version	53
6.4	Default Factory Settings	54
7.0	Setup Lock / Output Mode / Compensation	55
7.1	Preventing changes of setup parameters	55
7.2	Output Voltage.....	55
7.3	Plug & Play Cable compensation.....	55
7.4	Manual Compensation.....	56

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Index

7.5	Output Mode	56
7.6	Fan Control	57
7.7	Remote Stop	57
7.8	EF Interlock	57
7.9	EF Interlock Ripple Level	58
7.10	EF Interlock Delay	58
7.11	Aircraft Connector Insertion	58
7.12	GPU Enable	58
7.13	Door Switch	59
7.14	Cable Temperature	59
7.15	Neutral Voltage Supervision	59
7.16	Earth Leakage Level	59
7.17	Earth Leakage Delay	60
7.18	Real Time Clock Setup	60
7.19	Date/Time Format	60
7.20	Ethernet Configuration	60
7.21	Modbus Slave Address	60
7.22	LED Brightness	61
7.23	Unit of Measure	61
7.24	Customer ID	61
7.25	Battery Replaced	61
7.26	Language	61
8.0	Service, Maintenance, Overhaul	62
8.1	Recommended Maintenance Schedule	62
8.2	Battery back-up & replacement	63
9.0	Troubleshooting & Repair	66
9.1	Fault Guidance	67
10.0	Illustrated Parts List	71
11.0	Options	74
578803 / AP-578803	Base module	74
578804 / AP-578804	Lockable Door (Fixed)	74
5788xx / AP-5788xx	Remote Control Boxes available	74
578806 / AP-578806	1 x 400 Hz Output	74
578818 / AP-578818	2 x 400 Hz Output	74
578819 / AP-578819	1 x 400 Hz & 1 x 28 VDC Output	74

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Index

578820 / AP-578820	1 x 400 Hz Output & controls for Hoist	74
578807 / AP-578807	Additional Output Contactor (Diagram 478801).....	75
578808 / AP-578808	Dry Contacts (Diagram 478801).....	76
578809 / AP-578809	Door Interlock (Diagram 478801).....	76
578810 / AP-578810	Neutral Conductor Rupture Supervision	77
578814 / AP-578814	Terminal Extension	78
578815 / AP-578815	RS485 Interface (Diagram 478801).....	78
578817 / AP-578817	Military Interlock (Diagram 478801).....	79
578829 / AP-578829	Anti-Condensation Heater (Diagram 478801).....	80
591100 / AP-591100	Auto Calibration Plug.....	80
12.0	For GPUs with 28 VDC Active Rectifier Unit.....	81
12.1	General Description	81
12.2	Connection of Cables	83
12.3	Interlock	84
12.4	Operator's Instruction	85
12.5	Operating the unit	85
12.6	Additional menu items for ARU.....	87
12.7	ARU Default Factory Settings.....	88
12.8	28V Voltage	89
12.9	28V Compensation	89
12.10	Current Limit Step Size.....	89
13.0	Specifications.....	90
14.0	Troubleshooting & Repair	91
15.0	ARU illustrated parts list	92

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Index

Types / Rating overview.

Type	Rating	28 VDC	Mounting	Part number	Schematic	Input voltage	CE version	UL version
3GWF-200/87-N	30 kW		Fixed	578.119	478.101	3 x 400 V	X	
3GWF-200/87-N	30 kW	Yes	Fixed	578.159	478.103	3 x 400 V	X	
3GWH-200/87-N	30 kW		Bridge	578.120	478.101	3 x 400 V	X	
3GWH-200/87-S	30 kW	Yes	Skid	578.169	478.103	3 x 400 V	X	
3GWT-200/87-L	30 kW		Mobile	578.121	478.101	3 x 400 V	X	
3GWT-200/87-L	30 kW	Yes	Mobile	578.161	478.103	3 x 400 V	X	
3GWF-200/130-N	45 kW		Fixed	578.116	478.101	3 x 400 V	X	
3GWF-200/130-N	45 kW	Yes	Fixed	578.156	478.103	3 x 400 V	X	
3GWF-200/130-N	45 kW		Fixed	578.656	478.101	3 x 480 V		X
3GWH-200/130-N	45 kW		Bridge	578.117	478.101	3 x 400 V	X	
3GWH-200/130-N	45 kW		Bridge	578.657	478.101	3 x 480 V		X
3GWH-200/130-S	45 kW	Yes	Skid	578.168	478.103	3 x 400 V	X	
3GWT-200/130-L	45 kW		Mobile	578.118	478.101	3 x 400 V	X	
3GWT-200/130-L	45 kW	Yes	Mobile	578.158	478.103	3 x 400 V	X	
3GWF-200/173-N	60 kW		Fixed	578.113	478.101	3 x 400 V	X	
3GWF-200/173-N	60 kW	Yes	Fixed	578.153	478.103	3 x 400 V	X	
3GWH-200/173-N	60 kW		Bridge	578.114	478.101	3 x 400 V	X	
3GWH-200/173-S	60 kW		Skid	578.127	478.101	3 x 400 V	X	
3GWH-200/173-S	60 kW	Yes	Skid	578.167	478.103	3 x 400 V	X	
3GWT-200/173-L	60 kW		Mobile	578.115	478.101	3 x 400 V	X	
3GWT-200/173-L	60 kW	Yes	Mobile	578.155	478.103	3 x 400 V	X	
3GWF-200/260-N	90 kW		Fixed	578.110	478.101	3 x 400 V	X	
3GWF-200/260-N	90 kW	Yes	Fixed	578.150	478.103	3 x 400 V	X	
3GWF-200/260-N	90 kW		Fixed	578.650	478.101	3 x 480 V		X
3GWF-200/260-N	90 kW	Yes	Fixed	578.670	478.103	3 x 480 V		X
3GWH-200/260-N	90 kW		Bridge	578.111	478.101	3 x 400 V	X	
3GWH-200/260-N	90 kW		Bridge	578.651	478.101	3 x 480 V		X
3GWH-200/260-N	90 kW		For Mobile	578.652	478.101	3 x 480 V		X
3GWH-200/260-N	90 kW	Yes	Bridge	578.671	478.103	3 x 480 V		X
3GWH-200/260-S	90 kW		Skid	578.126	478.101	3 x 400 V	X	
3GWH-200/260-S	90 kW	Yes	Skid	578.166	478.103	3 x 400 V	X	
3GWT-200/260-L	90 kW		Mobile	578.112	478.101	3 x 400 V	X	
3GWT-200/260-L	90 kW	Yes	Mobile	578.152	478.103	3 x 400 V	X	

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 : 3GW..... (30 kVA to 180 kVA)

Description : Solid state power supply converting a three-phase mains supply into an isolated three-phase 400 Hz supply. Optionally in the range from 30 kVA to 90 kVA, the unit can be equipped with an additional 28 VDC output. The converter is typically applied as ground power for aircraft.

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:

EN61558-2-6:2009	(LVD – Safety standard)
EN62040-1-1:2009	(LVD – Safety standard)
EN61000-6-2:2005	(EMC – Immunity standard)
EN61000-6-4:2007	(EMC – Emission standards)
EN1915-1:2013	(Machinery – General safety requirements)
EN1915-2:2009	(Machinery – General safety requirements)
EN12312-20:2009	(Machinery – Specific safety requirements)
EN60204-1:2006	(Machinery – Electrical safety requirements)

Odense, Denmark
Place of issue

27.06.2016
Date of issue


Søren R. Dahl, Development Manager

IMPORTANT SAFEGUARDS

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

2.0 Safety Instructions



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

Electric Shock

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

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



Moving Parts

- Keep away from fans.
- Have only qualified people remove covers for maintenance or troubleshooting.



Hot Parts

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



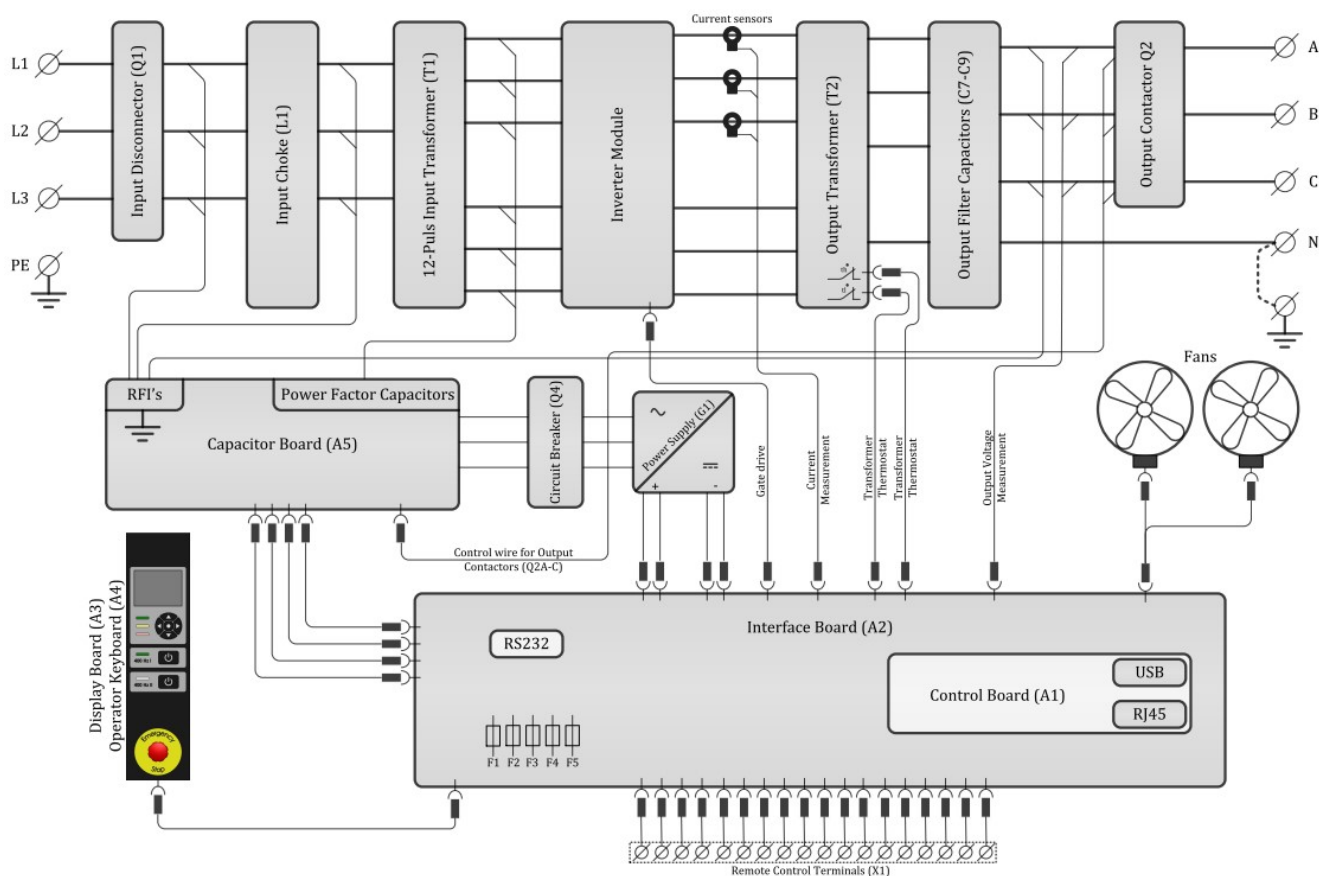
SAVE THESE INSTRUCTIONS!

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

3.0 General Description

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



3.1 Basic Principle

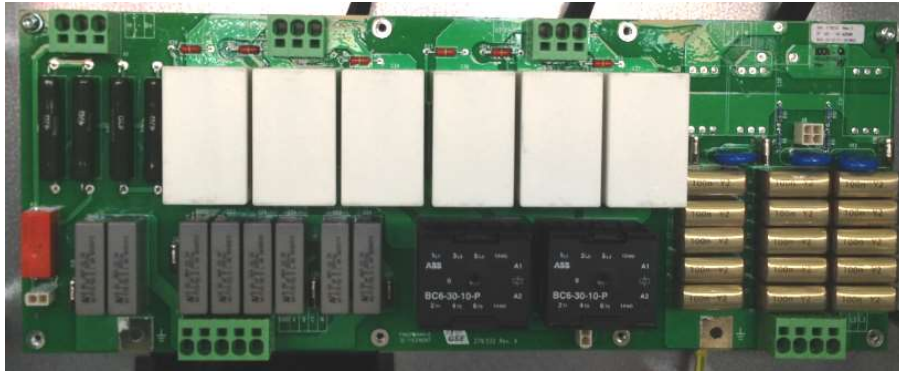
Input Disconnect (Q1):

The Input disconnect/circuit breaker disconnects all power to the ground power unit. Upon closing the switch disconnect/circuit breaker, the ground power unit passes through an initialization test and then into standby mode.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

Capacitor Board (A5):



This module includes the following functions:

- Input and Output RFI filters to reduce the EMI/EMC emission into the mains and output to such a level that surrounding equipment is not disturbed. In addition, the two filters prevent voltage transients from reaching vital parts in the ground power unit.
- Resistors in combination with the soft start contactor (Q5).
- Magnetic Wave shaping circuit.
- Link from the main/utility supply phases L1-L2-L3 to the Supply Module (G1) via the breaker (Q4).
- Coil voltage for the output contactor(s), controlled via A2:Q1 on the Interface Board.

Input Choke & 12-pulse Transformer (L1 / T1):

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

Inverter Module (PM1):

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



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

Output Transformer (T2):

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

AC Filter Capacitors (C7-C9):

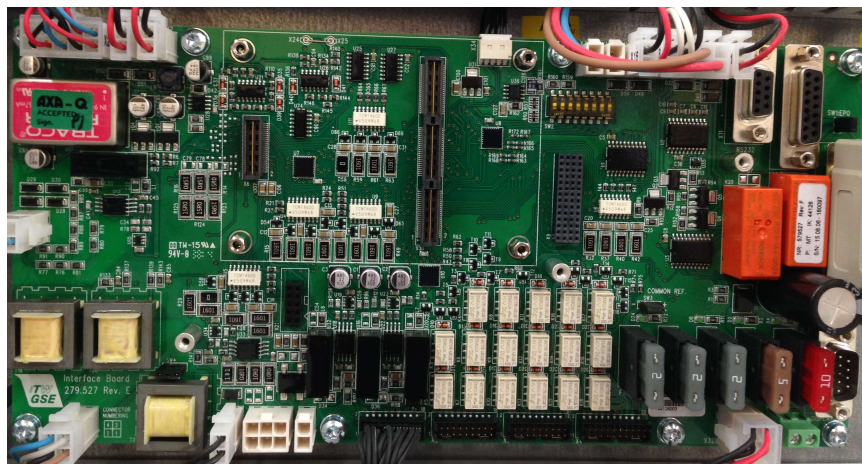
The harmonic content of the inverter voltage is further reduced by means of the AC Filter, resulting in a total voltage distortion of less than 2%. In addition to the filter choke (integrated into the transformer) and the AC capacitors, the ground power unit is equipped with an RFI-filter that reduces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

Output Contactor(s) (Q2-Q3):

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

Interface Board (A2):

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



- Interface to the Display Board (CAN Bus, 24 VDC and EPO)
- Fuse (F1 & F2) of the 24 VDC for I/O connections
- Fuse (F3) for Display Board (A3) and Operator Keyboard (A4)
- Fuse (F4) of the 24 VDC for interface
- Fuse (F5) PWM control (X10) of fans (M1-M2) situated above the magnetics
- User EPO input (X14)
- Measuring transformers for supervision of the 400 Hz output voltage (X26)
- Interface for gate drives situated at the Inverter Module (X13)
- Interface for current sensors situated at the Inverter Module (X23)
- Relay control of output contactor(s) Q2 – Q3 (X16-X17)
- Soft start control of Q5 (X12)
- Input for temperature sensors (X18)
- I/O ports for remote control (Start, Stop etc.), single output (X1)
- I/O ports for remote control (Start, Stop etc.), second output (X2) when installed

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

- Protected interface for interlock signals
- Interface for individual overload protection (X20)
- Neutral Voltage Supervision
- Neutral Conductor Rupture Supervision
- Door Interlock (X27)
- Earth Leakage Failure via (X22) and current sensor on ground wire from 400 Hz neutral
- Interface for RS232
- EEPROM (X34) contains the unique identity key for the ITW GSE 2400 compact

Supply Module (G1):

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



Control Board (A1):

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



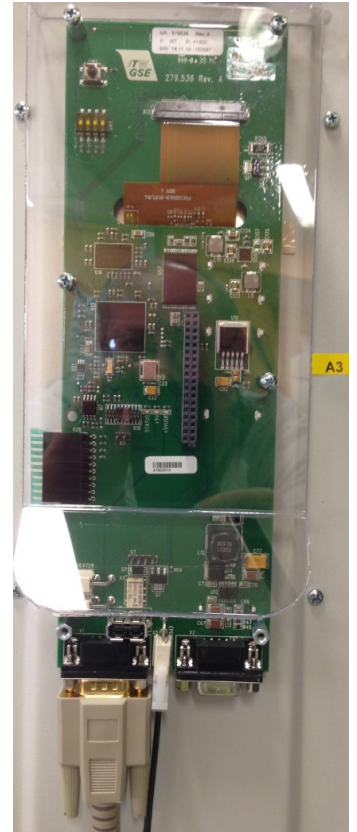
Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

Display Board & Keyboard (A3 / A4):

The display module serves as the interface for daily operation.

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



ID Chip (A6):

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



3.1 Built-in features / protections

No Break Power Transfer:

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

Over/under voltage at input:

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

Over/under voltage at output:

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

Output Voltage $U > 130V - 250ms$

Output Voltage $U > 140V - 15ms$

Output Voltage $U < 104V - 500ms$

Overload:

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

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

Short circuit at output:

The unit has a built-in system to protect itself 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 on the Inverter Module or the Output Transformer, rises above the factory set temperature level, the unit shuts down, reporting either **"INVERTER TEMP TOO HIGH"** or **"TRANSFORMER TEMP TOO HIGH"**

Control voltage error:

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

Aircraft Connector Insertion:

This feature verifies that the 90° switch / split "F" pin in the 400 Hz plug is activated. If not activated, the respective outlet cannot be engaged. This also includes a potential free output showing whether the Aircraft Connector is inserted or not. The feature is valid for ground power units with one or two outlets.

How to Bypass / Activate the function.

Refer to Section 6.3 & 7.11

For detailed information /connection.

Refer to chapter 4.9

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

General Description

Neutral Voltage Supervision (NVS):

As a 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 400Hz neutral and earth/ground.

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

For change of setting, please refer to Section 6.3 & 7.15

Neutral Voltage Displacement Supervision (NVD):

The combination of a grounded converter and an un-grounded aircraft might lead to an energized aircraft chassis. The reason is the neutral voltage displacement caused by an unbalanced load. In case the aircraft frame is or will be grounded during operation, a broken neutral might result in arcing as well as burned ground wires.

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

For change of setting, please refer to Section 6.3 & 7.9

Earth Leakage Supervision (ELS)

In systems where the 400 Hz neutral is grounded and there is a break of the cable's 400 Hz neutral, the ELS system monitors the residual current in the internal neutral /earth connection. The supervision will shut down the unit in case the residual current reaches the pre-set level.

For change of setting, please refer to Section 6.3 & 7.17

Note!

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

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

- 1) The need for an additional control wire which is likely to be the first to break.
- 2) The difficulties of implementing the method in existing installations if a free control wire is not present.
- 3) The standard protections built into the ITW GSE 2400 Compact series are considered adequate to safeguard against hazards related to a broken neutral.

4.0 Transport and Installation

4.1 Storage Before Installation

To secure optimal storage conditions prior to installation, we recommend that the converter is stored inside. This protects the unit from rain and excessive humidity while it is left without power.

Only equipment in seaworthy packing should be stored outside.

For storage conditions, please refer to Section 5.0

4.2 Operational and Environmental Conditions after Commissioning

When the converter has been installed and commissioned, we strongly advise that the unit is always kept with input power on. This provides optimal conditions for the electronic components and prevents humidity in the form of condensed water from reaching vital parts.

If for some reason the converter has been without input voltage for a period of time, a visual inspection should be carried out. If condensation on any internal parts is discovered, the parts have to be dry before the input voltage is again applied.

4.3 Transport

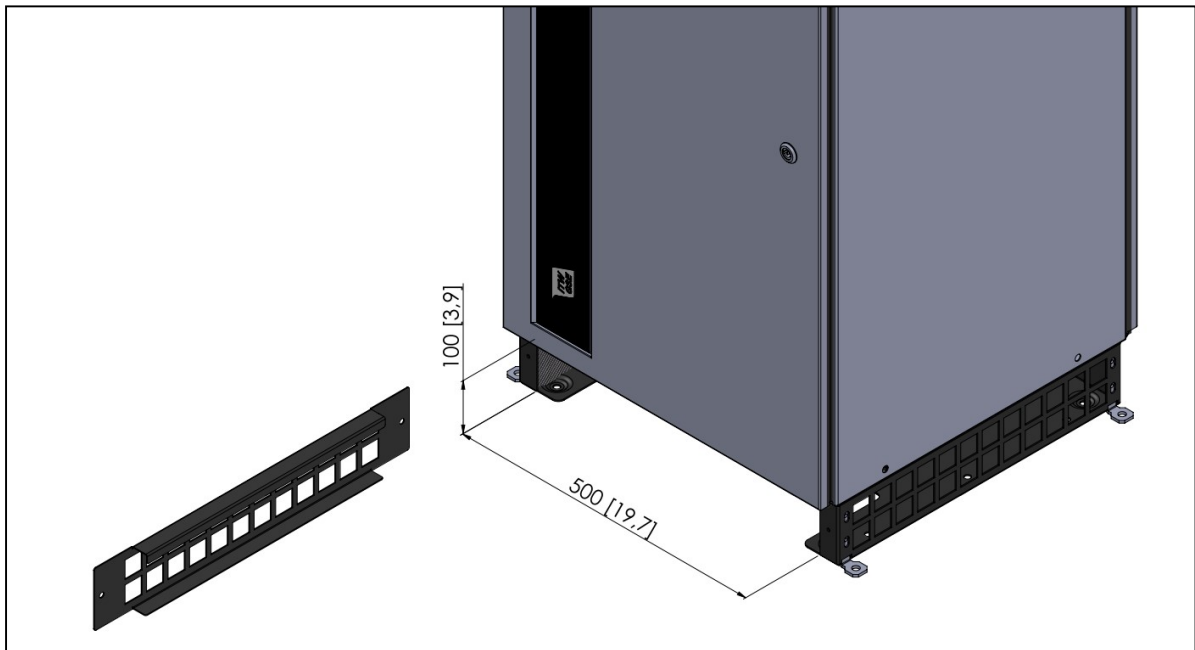
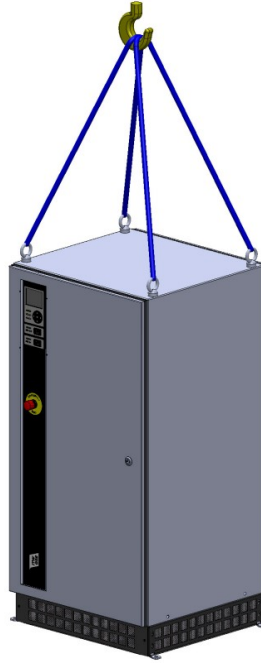


Fig. 4.3.1 Access for fork-lift, truck or similar

Access requires removal of 2 screws.



Adequate lifting gear is not part of the delivery.

Fig. 4.3.2 Lifting with crane
(Place M10 lifting rings at the 4 corners)

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

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



Fig. 4.3.3 Transport and mounting of the ITW GSE 2400 Compact by means of a fork-lift truck

Note!

The ITW GSE 2400 compact must be fastened to the PBB with 4 x M12 bolts of minimum rating of 8.8 steel.

4.4 Installation and fastening instructions

(The installation shall be in accordance with the *Canadian Electric Code, Part 1*)

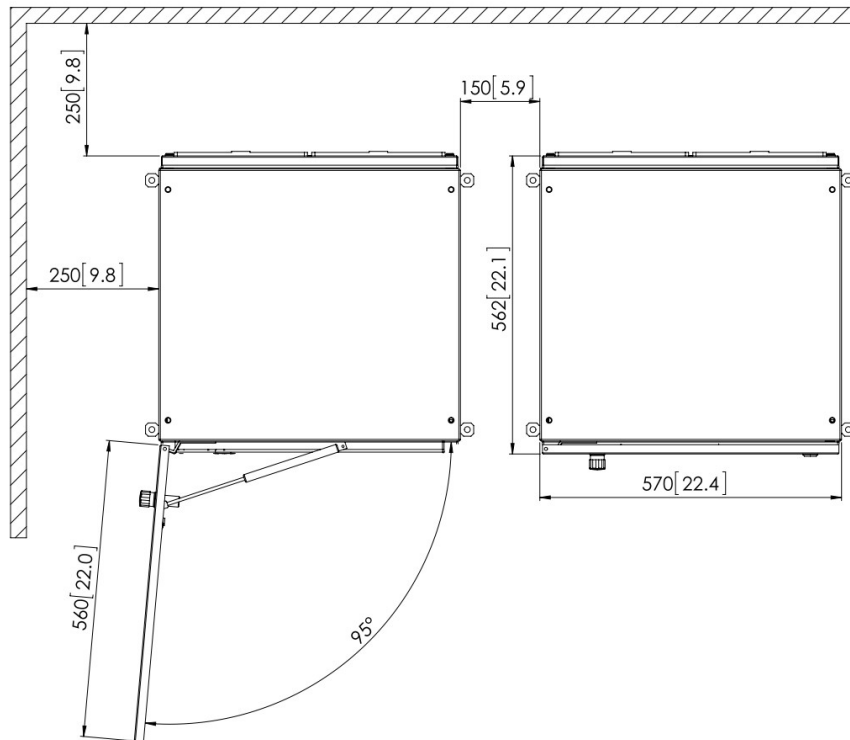


Fig. 4.4.1 Foot Print & Spacing, Fixed Unit

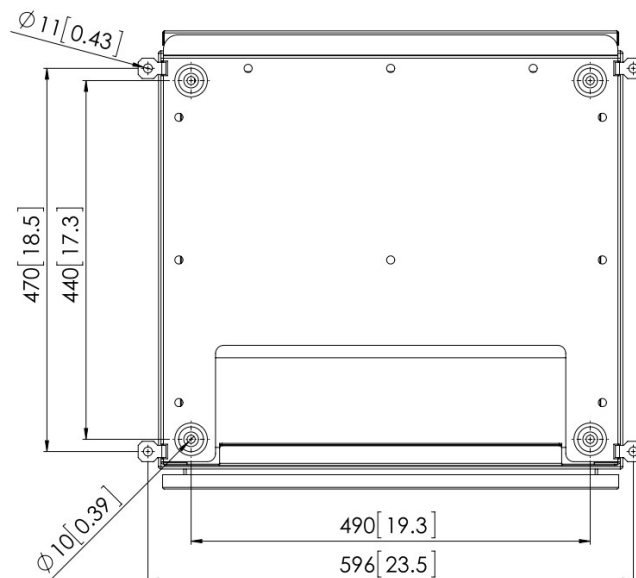


Fig. 4.4.2 Mounting Holes, Fixed Unit

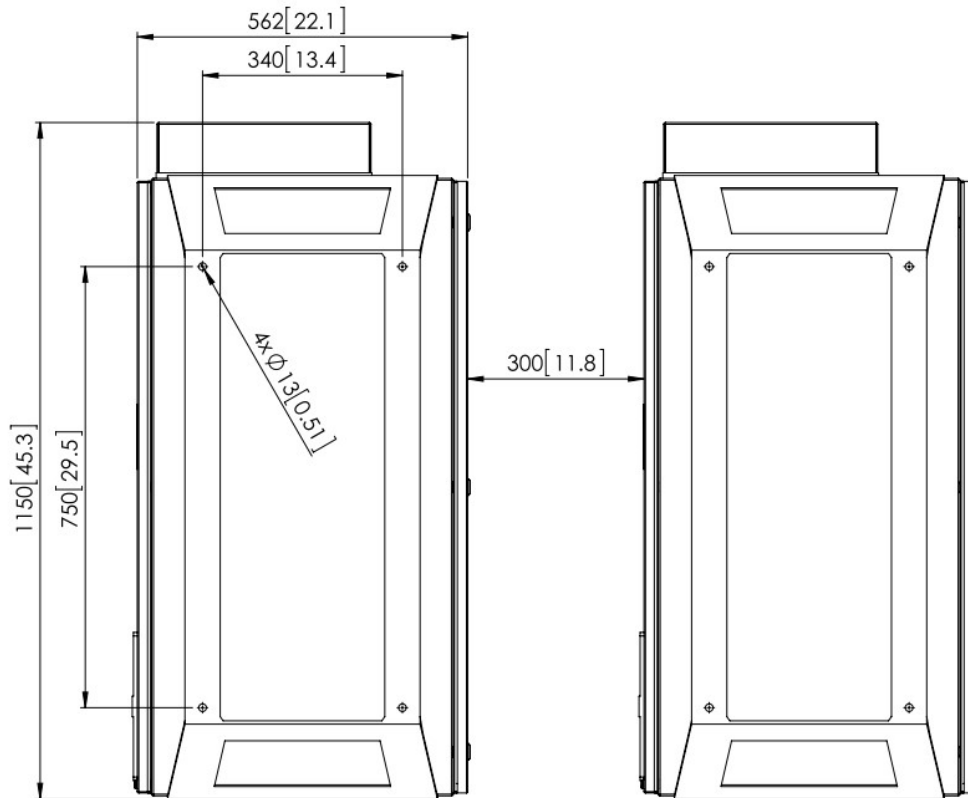


Fig. 4.4.3 Mounting Holes & Spacing, Bridge-Mounted Unit

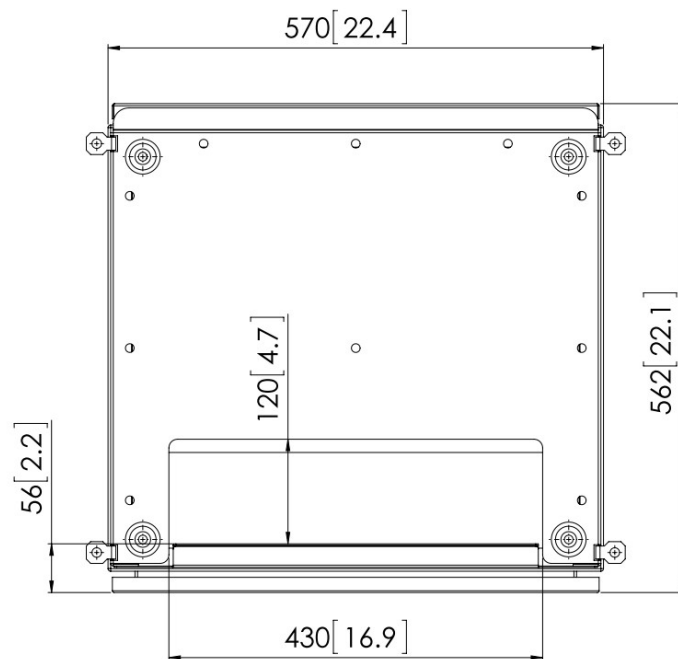


Fig. 4.4.4 Removable gland plate

Made of Aluminium-Zinc alloy coated sheet steel to prevent corrosion at the cable gland holes. Gland plate is situated inside the cubicle and only one is supplied if the unit is with Base Module / ARU.

Center of Gravity

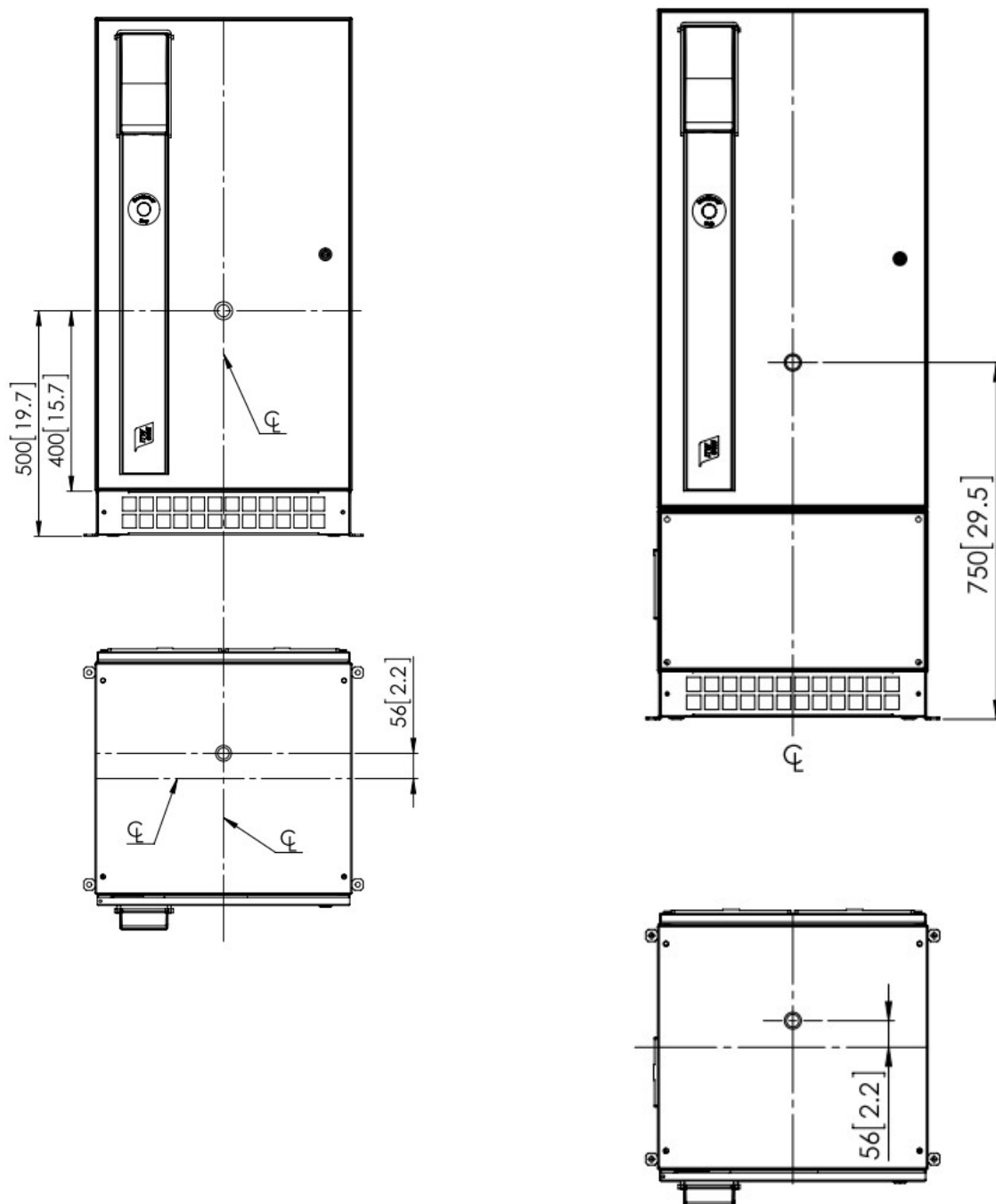


Fig. 4.4.5 Center of Gravity Fixed units

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Transport and Installation

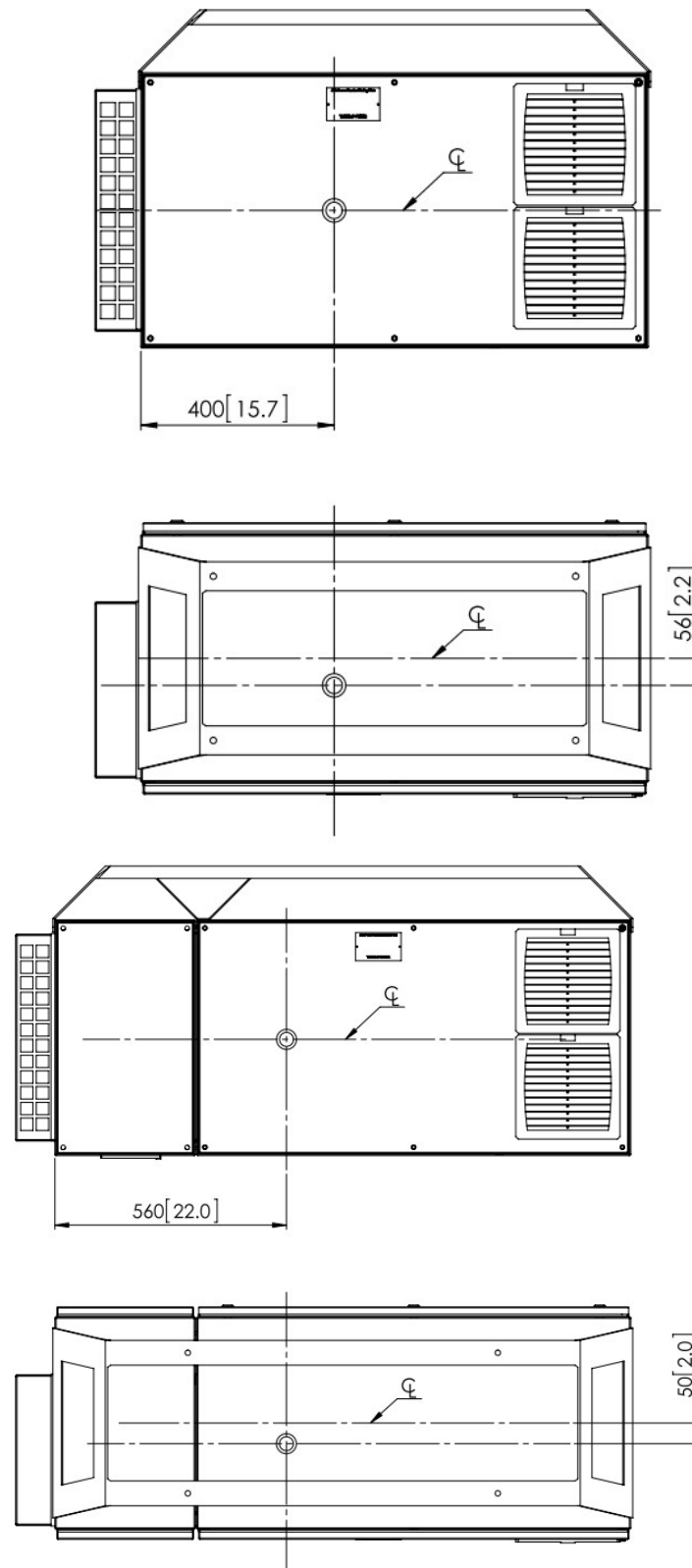
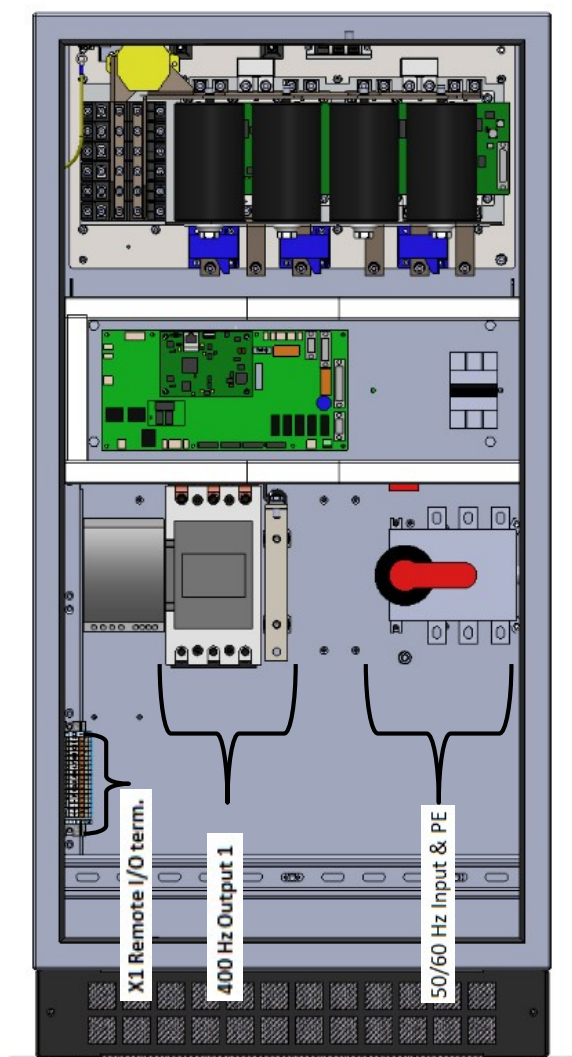


Fig. 4.4.6 Center of Gravity Horizontal units

4.5 Connection of Cables

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



50/60 Hz Input terminals:	3 x M8/25mm (3 x 1/4-20 by 1") 25.4 Nm (225in-lb) (L1–L2–L3) 1 x M10 bolt 50 Nm (444 in-lb) (Ground/PE)
400 Hz Output terminals:	4 x M8 (A–B–C–N) 25.4 Nm (225in-lb)
Remote I/O terminals:	17 x 0.4 - 4 mm ² (AWG 21-11)

Fig. 4.5.1 Connection of Cables

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Transport and Installation

4.6 Mains/Utility Input



Due to personal health and safety, the ITW GSE 2400 Compact unit, must always be protected, by grounding the PE terminal ($\pm$).

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)

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

100% load @ PF 0.8 Aircraft:

Rating	30 kW	45 kW	60 kW	90 kW
Line Current @ 400V/480V	38/32 A	58/48 A	75/63 A	112/94A
Recommended Fuse Size	63 A	63 A	100 A	125 A
Maximum Fuse Size	160 A	160 A	200 A	200 A
Minimum Input wire size	10 mm ² / #8	16 mm ² / #6	25 mm ² / #4	35 mm ² / #2
Minimum Output wire size	16 mm ² / #6	25 mm ² / #4	35 mm ² / #2	70 mm ² / 2/0

*US cable size based on single wire at 30 feet consult the factory for recommendations on different lengths.

100% load @ PF 1.0 Aircraft:

Rating	30 kW	45 kW	60 kW	90 kW
Line Current @ 400V/480V	49/41 A	70/59 A	96/80 A	140/117A
Recommended Fuse Size	63 A	100 A	125 A	160 A
Maximum Fuse Size	160 A	160 A	200 A	200 A
Minimum Input wire size	16 mm ² / #6	25 mm ² / #4	35 mm ² / #2	50 mm ² / #1
Minimum Output wire size	16 mm ² / #6	25 mm ² / #4	35 mm ² / #2	70 mm ² / 2/0

*US cable size based on single wire at 30 feet consult the factory for recommendations on different lengths.

Tightening torques:

Input disconnect: 8 Nm to 17.6 Nm / 72 in-lb. to 156 in-lb.

Input circuit breaker: 14.9 Nm to 21.7 Nm / 132 in-lb. to 192 in-lb.

Output contactor: 17.6 Nm / 156 in-lb.



Due to the RFI filter at the input, the leakage current for the unit is > 40 mA.(will be changed)

4.7 400 Hz Output

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



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

4.8 400 Hz Interlock

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

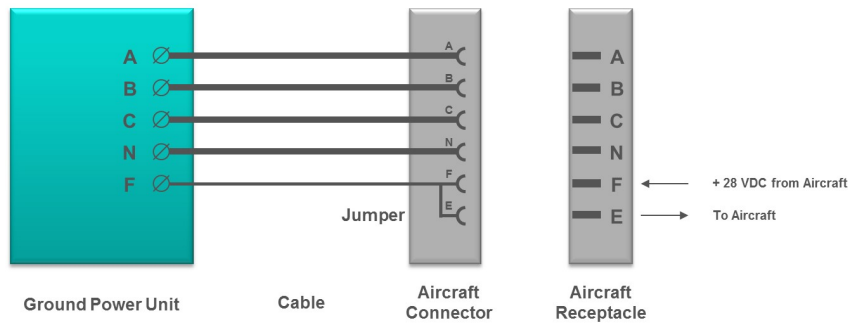


Fig. 4.8.1 Standard wiring diagram for civil aircraft

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



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

4.9 Control Interface (Remote I/O Terminals)

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

- User EPO.
The external EPO input A2: X14 is a 24 VDC input, either by using the internal 24 VDC supply or an external 24 VDC voltage. The SW1 “EPO JUMPER” (at the top right corner of the A2 Module) is then removed. Please refer to Fig. 4.9.1 for connection.
- E & F Interlock F Pin.
- External Start / Stop.
Remote Start must be N.O. The remote Stop may be either N.O. / N.C., this can be selected/changed using the Setup Menu.
- 90 % Insertion Switch / Split “F” pin in aircraft connector.
The 90% Insertion switch (N.O. contact set) in the aircraft connector, supplied with +24 VDC from the ITW GSE 2400 Compact. The voltage is returned once the plug is inserted at least 90% of the way into the aircraft receptacle.
- Aircraft Connector temperature supervision (**Optional - see section 11**).
The 3 x PTC resistors in series (one for each phase) is supplied with +24 VDC from the ITW GSE 2400 Compact. They return a high signal (+24 VDC) to the input as long as the Cable temperature is below the PTC resistors cut-off value.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Transport and Installation

- Neutral Conductor Rupture (**Optional - see section 11**).
Feedback wire from the aircraft plug's 400 Hz Neutral. The input references the 400 Hz neutral internally.
- Key reader, bridge, cable drum etc. provides a contact closure to enable the ITW GSE 2400 Compact to operate via GPU enable (**Optional - see section 11**)
The input can either be supplied from the ITW GSE 2400 Compact as shown below or supplied from an external supply as the input Terminals X1(6&7) are insulated.
Acceptable input range: 24 Volt $\pm$ 20%.
- Indications
Lamps for GPU On, Interlock Present, Aircraft Connector Inserted signal present, GPU Ready & Common Error

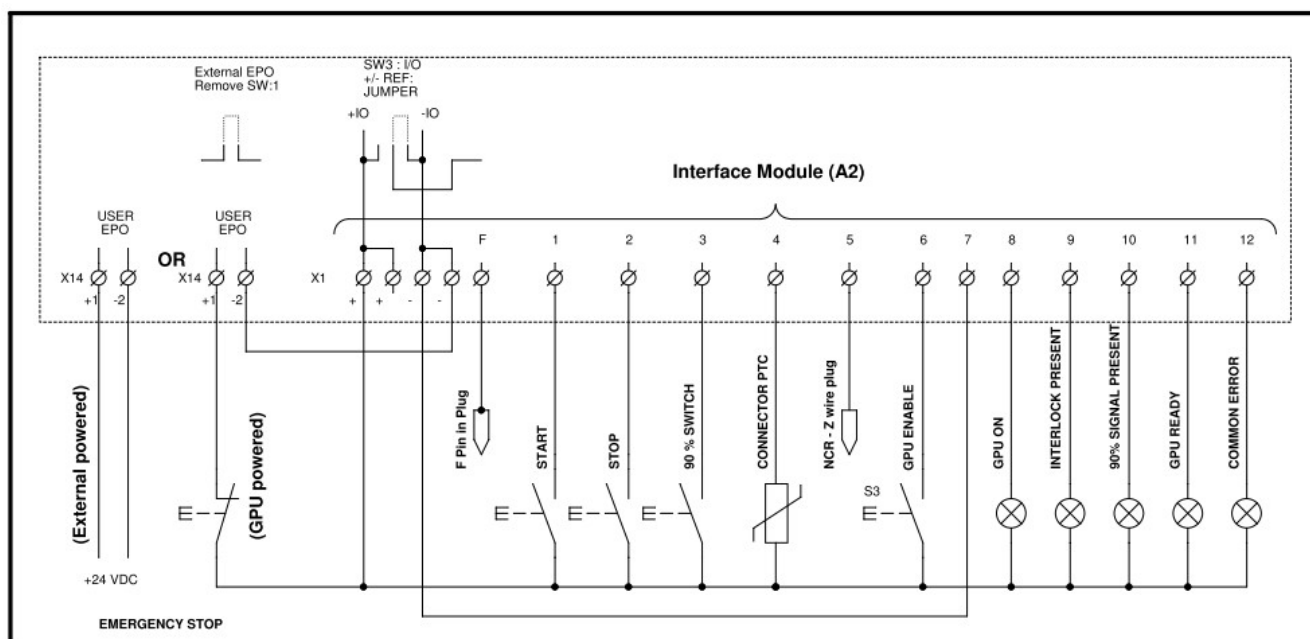


Fig. 4.9.1 Example of wiring for external control via the I/O terminal

From the factory, the jumper SW3 is set to position –IO, which connects the internal minus to the common reference. If the +24 is wanted as reference, the jumper is moved to +IO.

Note!

The terminal block X2 is only installed if the additional output contactor option has been ordered. Terminal block X2 is identical to terminal block X1, except for the GPU enable signal, which is not present at X2. All other connections can be made as shown above.

For Dry Contact relays please refer to (**Optional - see section 11**)

Contacts $V_{max} = 50$ V AC/DC and $I_{max} = 2$ A

4.10 TCP/IP On-board Interface

The ITW GSE 2400 Compact is equipped with a TCP/IP (RJ45) communication port for supervision and monitoring of the GPU e.g. by the means of a central computer. The port is located on the Control Board (A1).

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

Supported Modbus Function Codes

The ITW GSE 2400 Compact implements a subset of the Modbus Application Protocol Specification V.1.1b.

The following function codes are supported in Modbus requests:

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

In the following section, the different kinds of data available are:

- System in use, system in standby and system in fault.
- The GPU provides a comprehensive range of internal and external parameter measurements and information e.g. voltages, currents, temperatures, time, date etc.
- The GPU provides two kinds of logs:
 - The Black Box, which contains the last 100 errors detected together with all relevant parameters and status information available in connection with a 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 999.008, which can be obtained from ITW GSE on request. Please refer to section 6.3 and section 7.20 & 7.21 for communication setup.



RJ45 Connector

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Technical Specifications

5.0 Technical Specifications

Standards:

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

Input:

Rating	Amps (0.8)	Amps (1.0)	Hertz	Voltage	Max. Fuse	Line Current Dist.	PF at nominal load
30 kVA	38 A	49 A	45-65	400 ± 15%	160 A	< 12%	> 0.97
	32 A	41 A	45-65	480 ± 10%			
	26 A	33 A	45-65	600 ± 15%			
45 kVA	58 A	70 A	45-65	400 ± 15%	160 A	< 10%	> 0.99
	48 A	59 A	45-65	480 ± 10%			
	38 A	47 A	45-65	600 ± 15%			
60 kVA	75 A	96 A	45-65	400 ± 15%	200 A	< 9%	> 0.99
	63 A	80 A	45-65	480 ± 10%			
	50 A	64 A	45-65	600 ± 15%			
90 kVA	112 A	141 A	45-65	400 ± 15%	200 A	< 5 %	1
	94 A	117 A	45-65	480 ± 10%			
	75 A	94 A	45-65	600 ± 15%			

Phase	ABC or CBA
Rectification	12-pulse
Inrush current	None
Power interruption	20 ms

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Technical Specifications

Output:

Power	30, 45, 60 or 90 kVA, $\cos(\varphi) = 1$
Voltage	3 x 200/115 V
Power factor	0.7 lagging to 0.95 leading
Voltage regulation	< 0.5 % for balanced load and 30 % unbalanced load
Voltage transient recovery	$\Delta U < 8 \%$ 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 125 % for 10 minutes 150 % for 60 seconds 200 % for 30 seconds 300 % for 10 seconds 400 % for 1 second

Efficiency:

Overall efficiency	0.94 at 35-90 kVA load PF 0.8 0.90 at 25 kVA load PF 0.8
Stand-by losses	65 W
No-load losses	2.2 kW

Protections:

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Technical Specifications

Miscellaneous:

Physical:

Dimensions	Please refer to the outline drawing at following pages
Weight	
Fixed / Bridge-Mount	310 kg / 683 lbs.
Mobile	460 kg / 1014 lbs.
Fixed / Bridge-Mount + ARU	410 kg / 904 lbs.
Mobile + ARU	485 kg / 1069 lbs.

Environmental:

Storage temperature	+10°C to +35°C / 50°F to 95°F & 20 to 70% RH
Operating temperature	-40°C to +56°C / -40°F to 132°F
	-40°C to +45°C / -40°F to 113°F with ARU
Relative humidity	10-100 % (non-condensing)
Noise level	< 65 dB (A) @1m
Ingress protection	IP54 (NEMA 3R) Overall unit
	IP55 (NEMA 4) electronic section

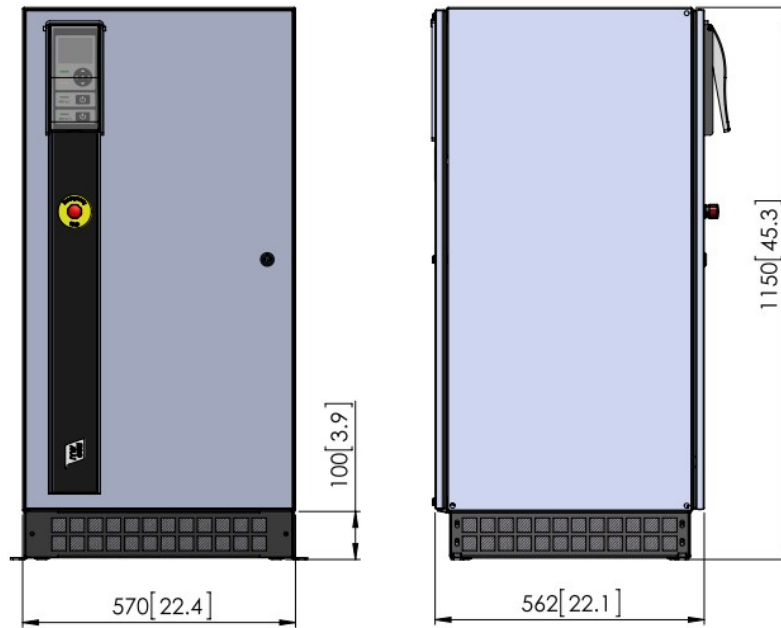
Miscellaneous:

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

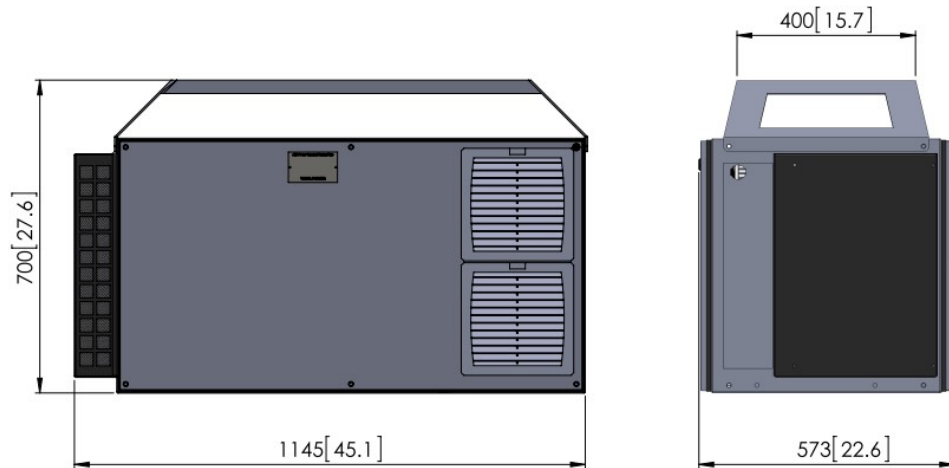
Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Technical Specifications

Fixed



Horizontal



Mobile

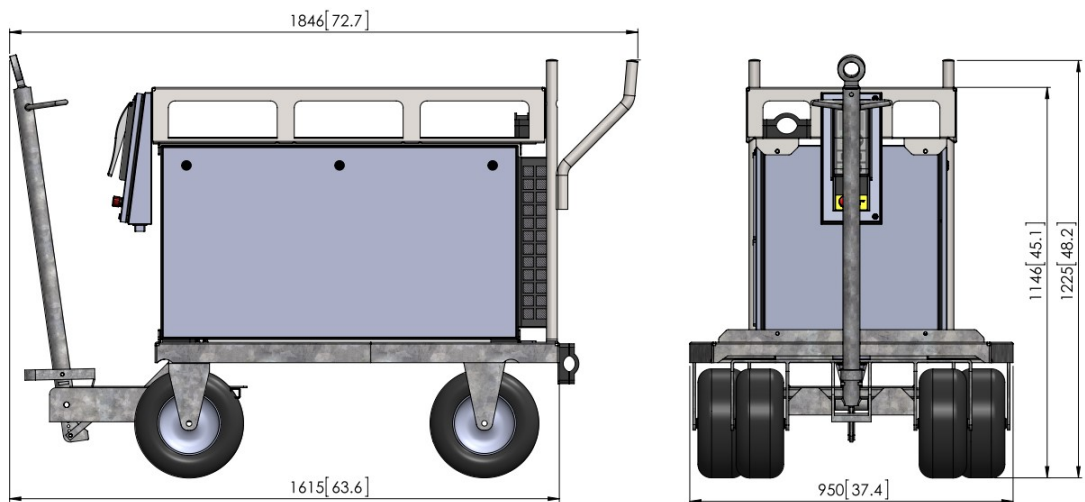


Fig. 5.0.1 Fixed, Bridge-Mounted and Mobile Unit

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Technical Specifications

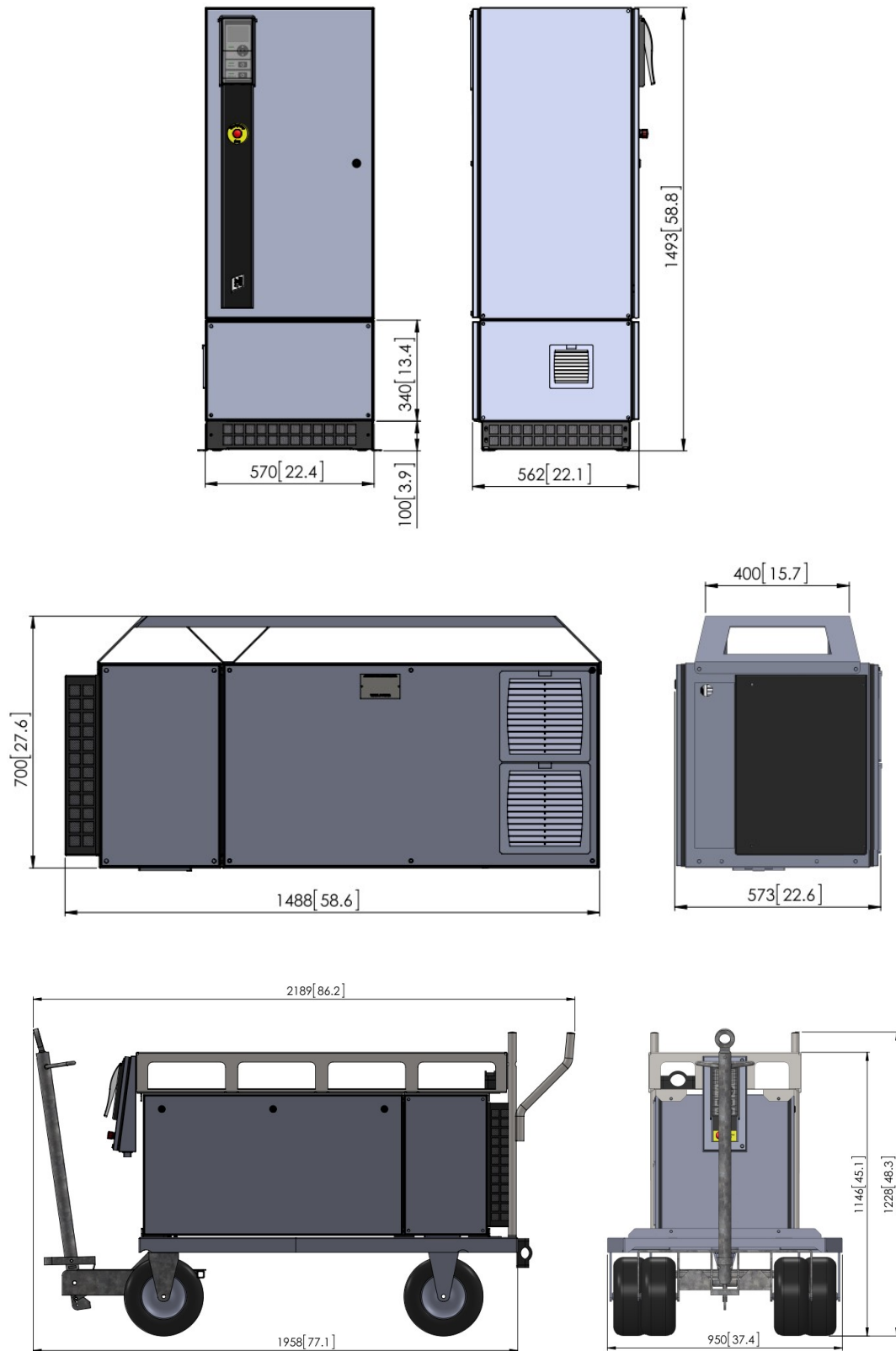
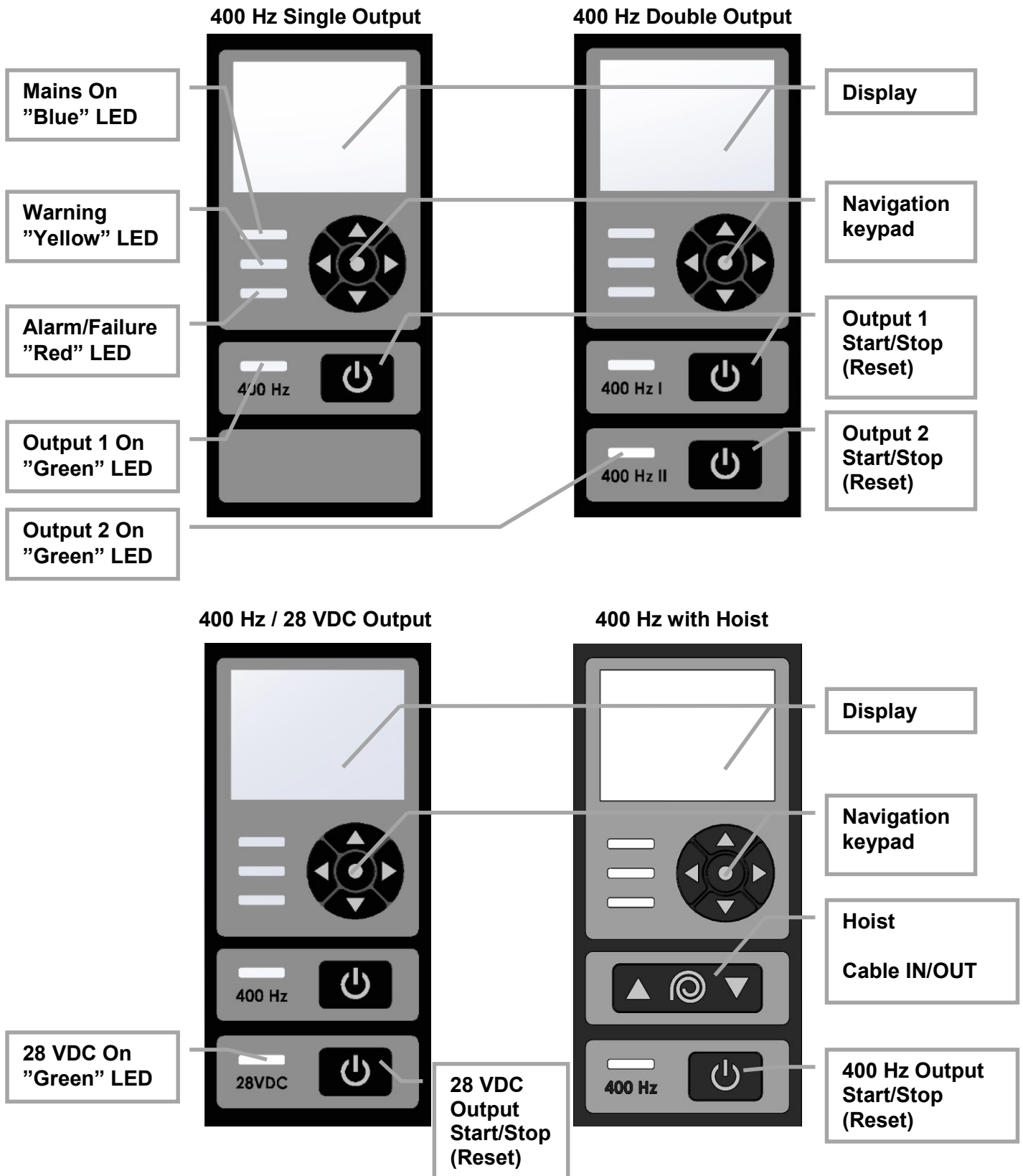


Fig. 5.0.2 Fixed, Bridge-Mounted and Mobile Unit with base Module / ARU

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



6.1 Using the Display/Keypad

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

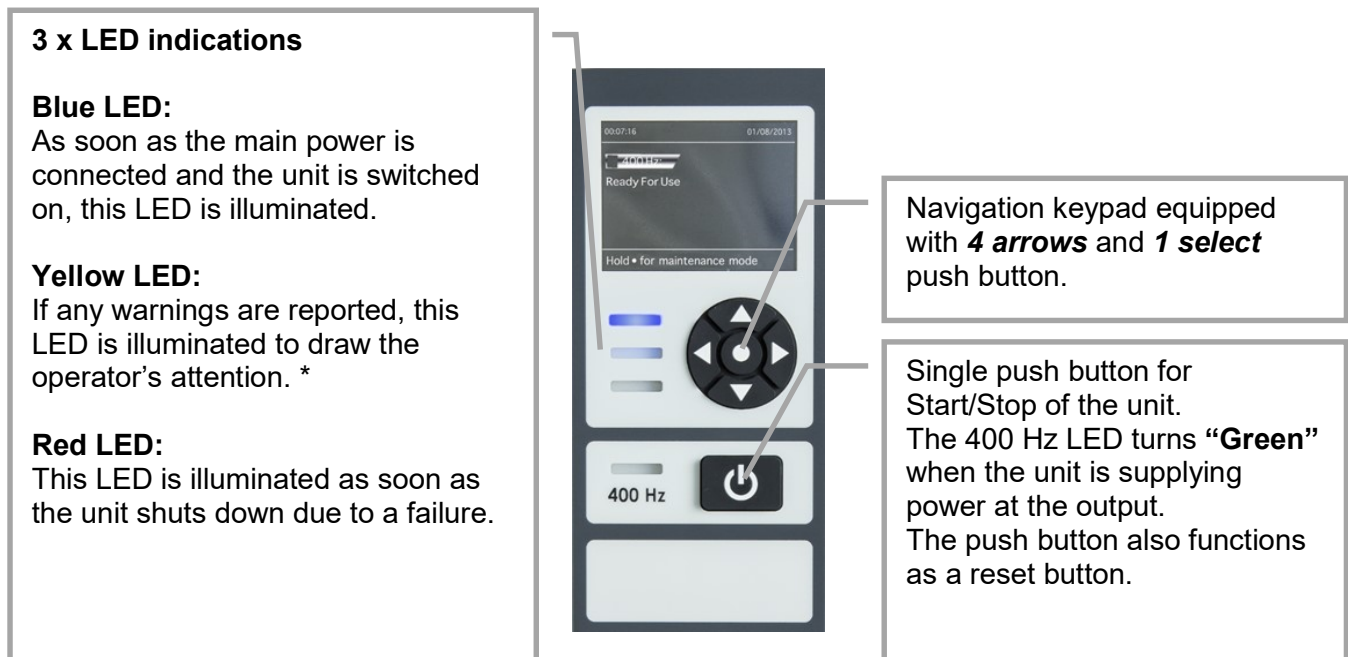


Fig. 6.1.1 Display / Operator panel

Note!

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

*

Warning may arise during operation for the following issues:

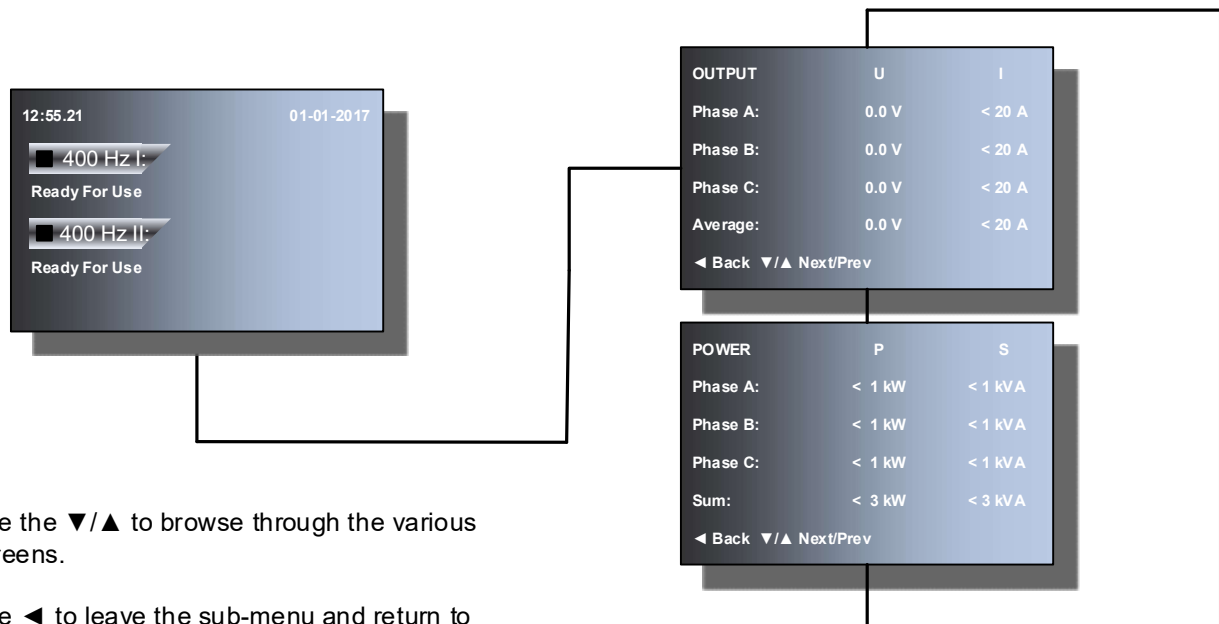
Cable 1 Temperature Too High / Cable 2 Temperature Too High
Neutral Conductor Rupture Output 1 / Neutral Conductor Rupture Output 2
EF Signal Drop Out – Output 1 / EF Signal Drop Out – Output 2
Aircraft Connector not inserted – Output 1 / Aircraft Connector not inserted – Output 2

The unit will report an error if only one output is active and a failure signal present, otherwise it will issue a warning about any of the above issues.

6.2 Operating the unit

- Insert the aircraft cable into the aircraft. Make sure the cable is inserted till 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 not is fully inserted.
- Press the 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 Start/Stop button.  400 Hz 
- If the unit shuts off and is no longer supplying power to the aircraft, this is reported in clear text in the display. Also a corrective action is displayed.
- From the default display screen and during operation, various parameters can be viewed via the display. Use the navigation keys ▼▲ to browse through the available screens:

Default Display Screen Standby



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

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

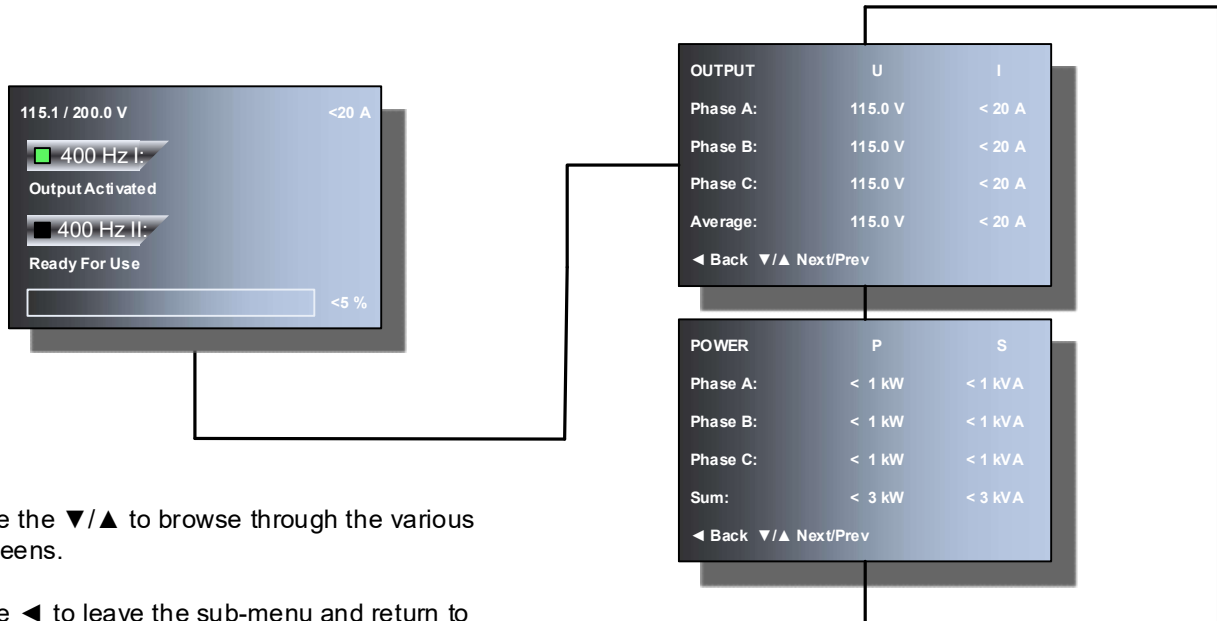
Note!

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Default Display Screen Operating



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

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

Note!

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

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

Press the Start/stop button



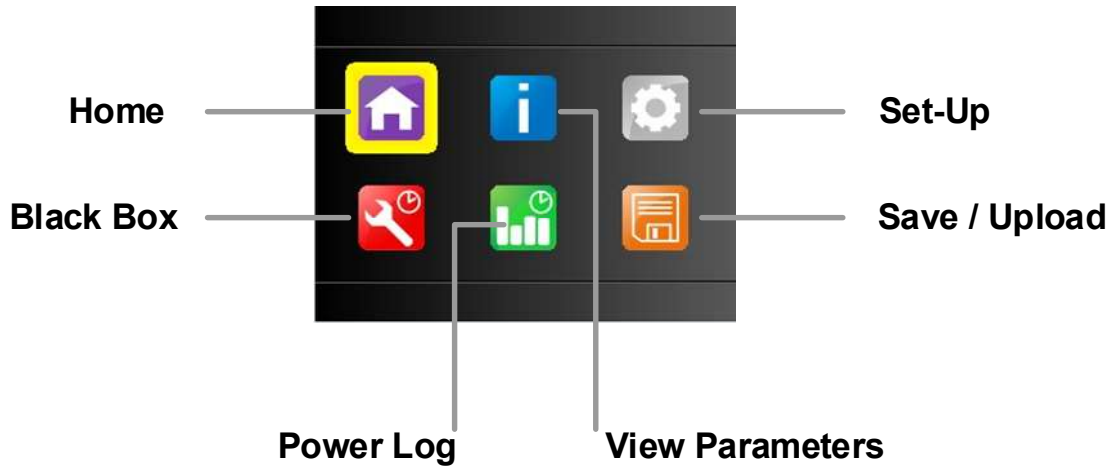
- The aircraft cable can now be removed from the aircraft and placed at the cable rest position.

Note!

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

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

6.3 Basic Menu



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

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

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

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

Icon explanation:



Back to Default screen



Viewing actual converter parameters



Set-up menu for changing converter parameters



Black Box with last 100 failures / errors



Power Log with last 100 operations



Save "Black Box" / "Power Log" records or update software

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

6.3.1 Parameters – Menu structure



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

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

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

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

Note!

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

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:	592 V
DC-Ripple:	2 V

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

SYSTEM	
Control Voltage:	25.2 V
Inv. Temp:	< 40° C < 40° C
Hour Meter:	04:49:36
Consumption:	438 kWh

INPUT	
Voltage:	407 V
Current:	0 A

UNIT INFORMATION	
Display FW:	078100 T
Control FW:	078100 T
Unit Serial:	8529 1/1.1
Unit Rating:	90 kVA
MAC:	C8:02:58:00:00:00
◀ Back ▼/▲ Next/Prev	

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

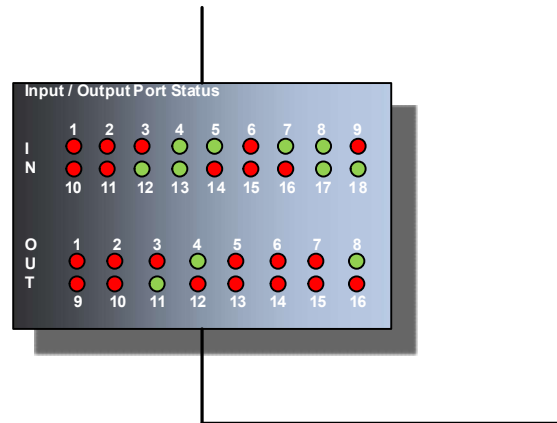
Parameters – Menu structure (continued)

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

● = Active (green)

● = Not Active (red)

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



Note!

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

Standard I/O configuration:

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

Note: please refer to schematic for further information.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Additional I/O port status:

ACR configuration:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1			10			1			9		
2			11			2			10		
3			12			3			11		
4			13			4			12	Not used	X3: O12
5			14	Not used	X2: I14	5			13	400Hz Output 1 On	X4: O13
6			15	Not used	X4: I15	6			14	400Hz Output 2 On	X4: O14
7			16	Not used	X4: I16	7			15	ACR supply voltage present	X4: O15
8			17	ACR supply voltage	X4: I17	8			16	ACR OK / ACR error	X4: O16
9			18	ACR error	X4: I18						

Note: please refer to schematic for further information.

Hoist configuration:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1			10			1			9		
2			11			2			10		
3			12			3			11		
4			13			4			12	Not used	X3: O12
5			14	Not used	X2: I14	5			13	400Hz Output On	X4: O13
6			15	Not used	X4: I15	6			14	Aircraft Connector Signal 1 present	X4: O14
7			16	Cable Down/out	X4: I16	7			15	Cable Down/Out	X4: O15
8			17	Cable Up/In	X4: I17	8			16	Cable Up/In	X4: O16
9			18	Fault	X4: I18						

Note: please refer to schematic for further information.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

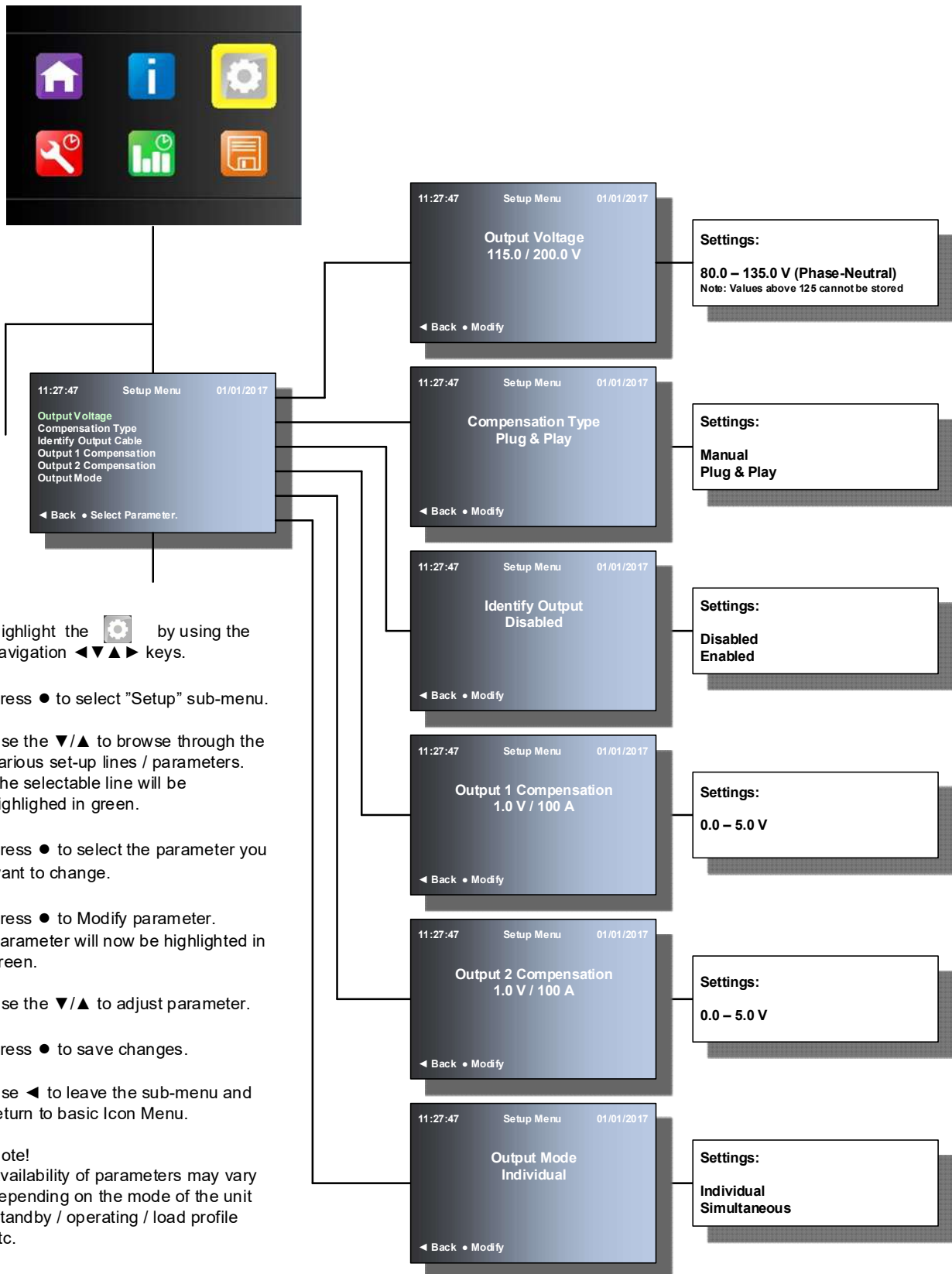
Operator's Instructions

PIT configuration:

Inputs						Outputs					
No	Function	Ref.	No	Function	Ref.	No	Function	Ref.	No	Function	Ref.
1			10			1			9		
2			11			2			10		
3			12			3			11		
4			13			4			12	Not used	X3: O12
5			14	Not used	X2: I14	5			13	Not used	X4: O13
6			15	Pit open Output 1	X4: I15	6			14	Not used	X4: O14
7			16	Pit open Output 2	X4: I16	7			15	Not used	X4: O15
8			17	Not used	X4: I17	8			16	Not used	X4: O16
9			18	Not used	X4: I18						

Note: please refer to schematic for further information.

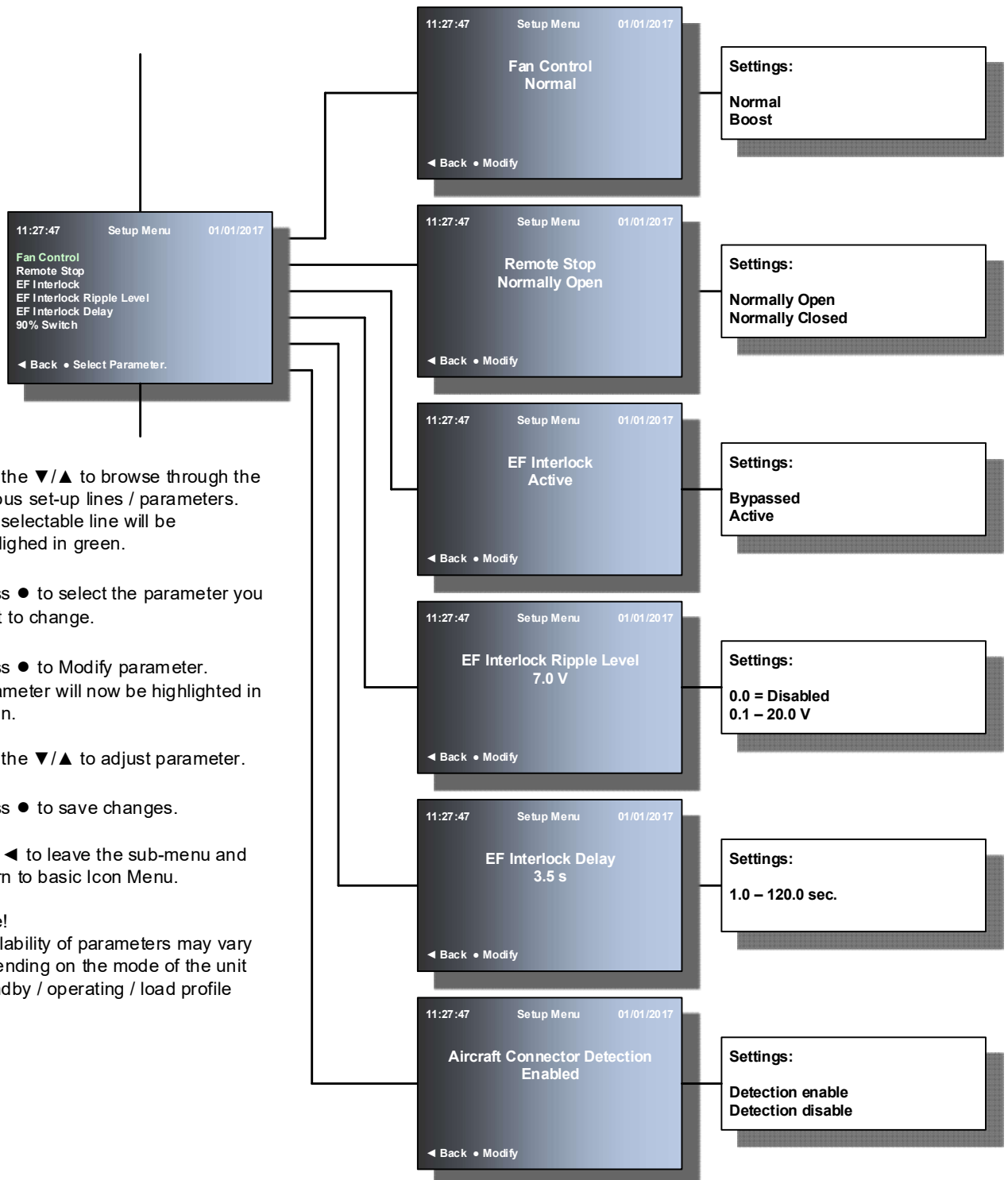
6.3.2 Setup – Menu structure



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Setup – Menu structure (continued)



Use the ▼/▲ to browse through the various set-up 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.

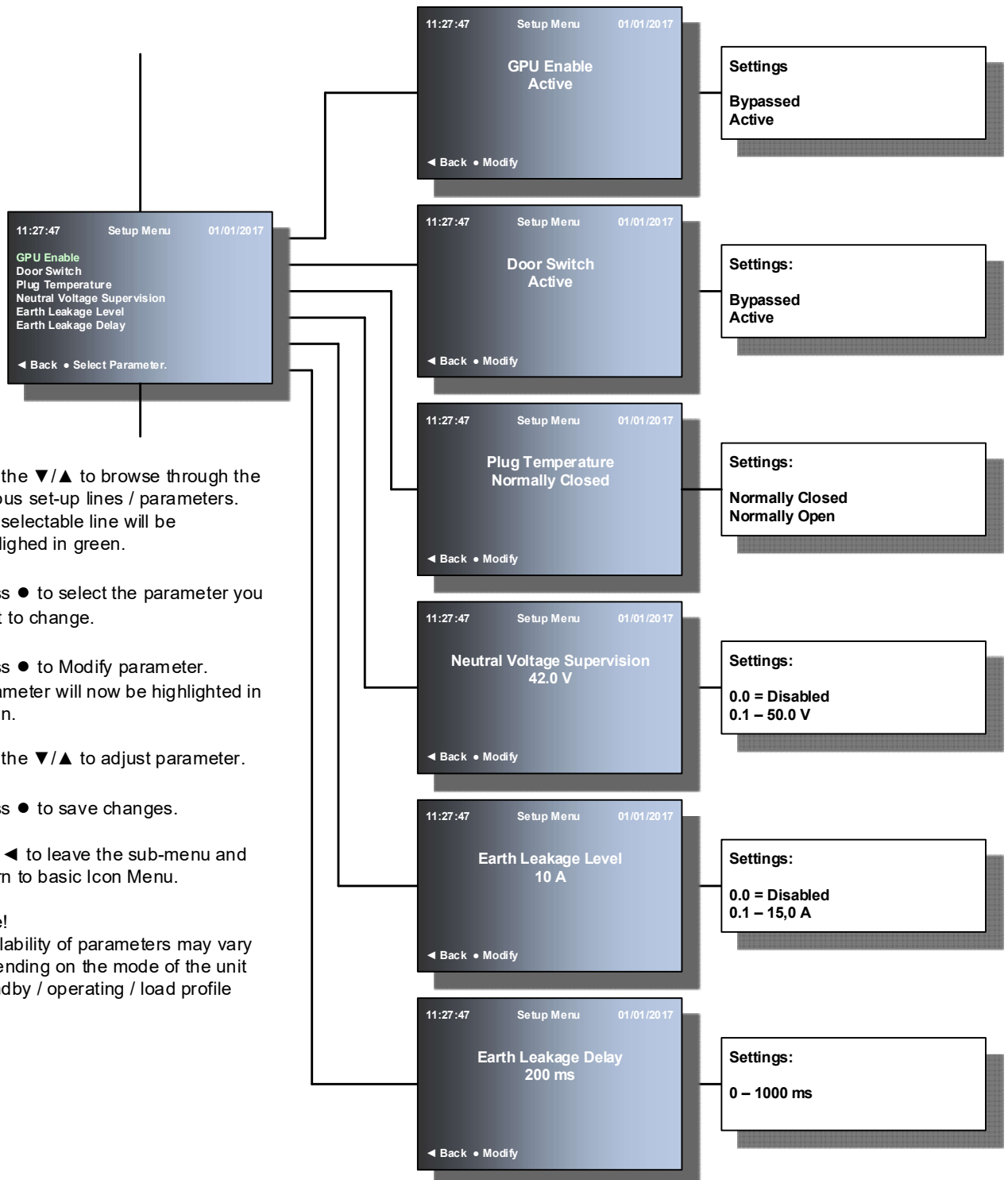
Use ◀ to leave the sub-menu and return to basic Icon Menu.

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Setup – Menu structure (continued)



Use the ▼/▲ to browse through the various set-up 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.

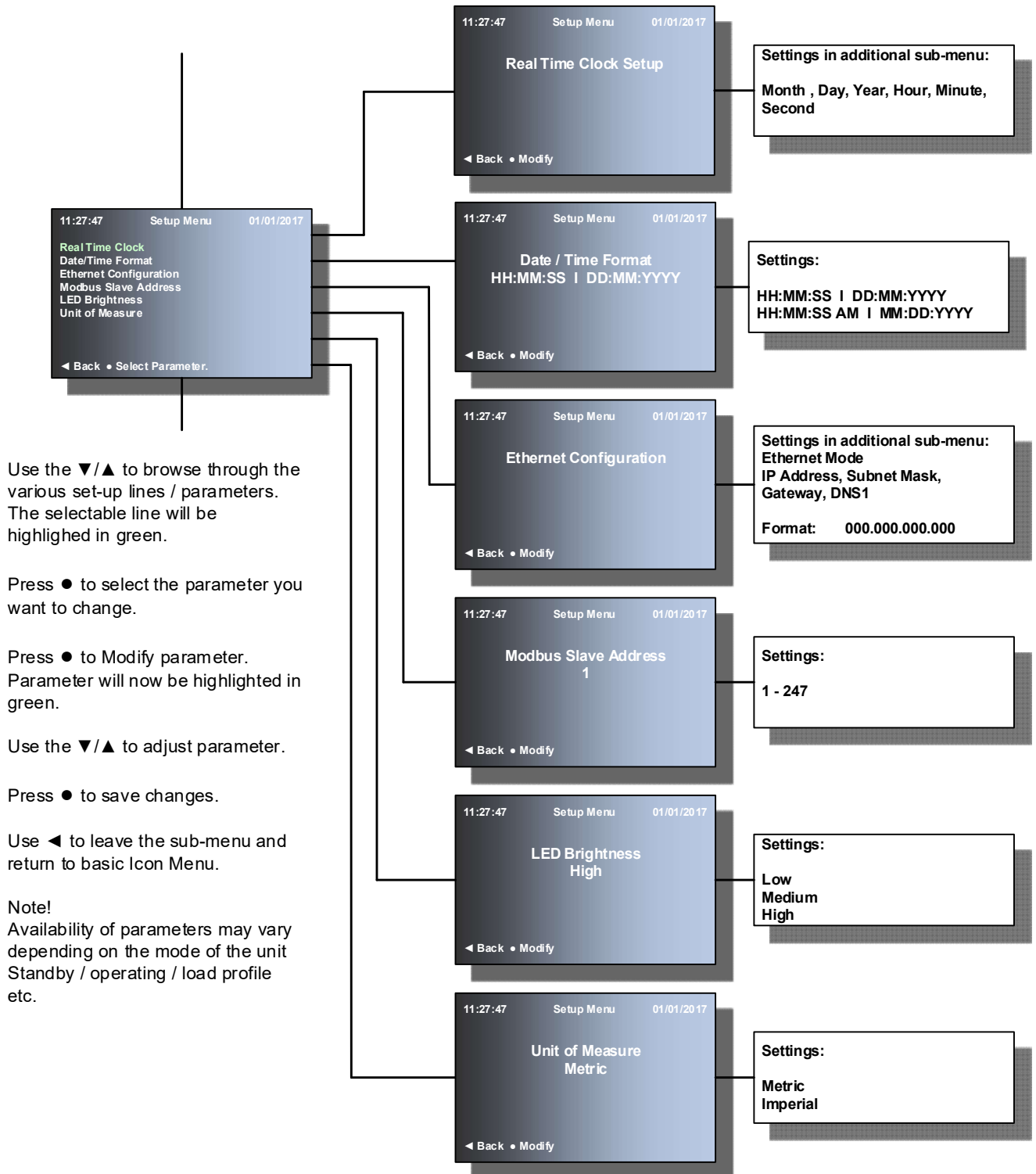
Use ◀ to leave the sub-menu and return to basic Icon Menu.

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

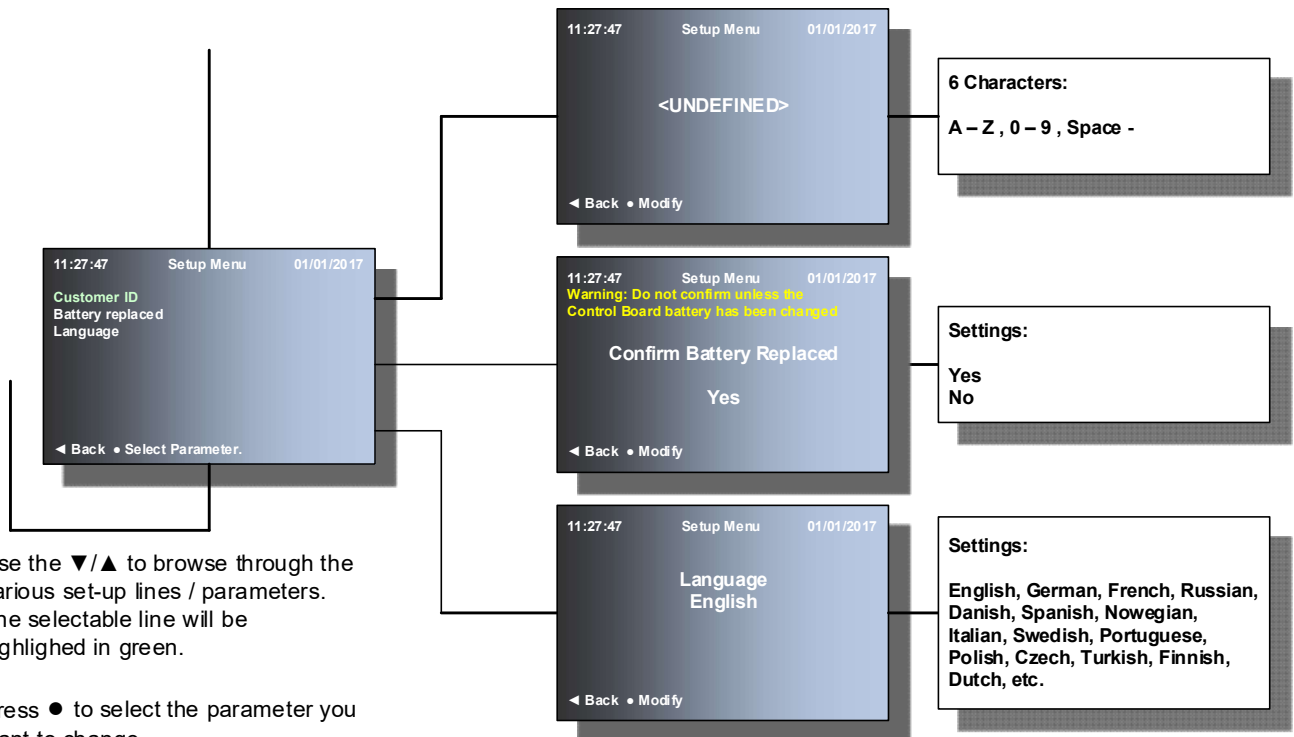
Setup – Menu structure (continued)



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Setup – Menu structure (continued)



Use the ▼/▲ to browse through the various set-up 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.

Note!

◀▶ can be used when entering Customer ID

Press ● to save changes.

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

Note!

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

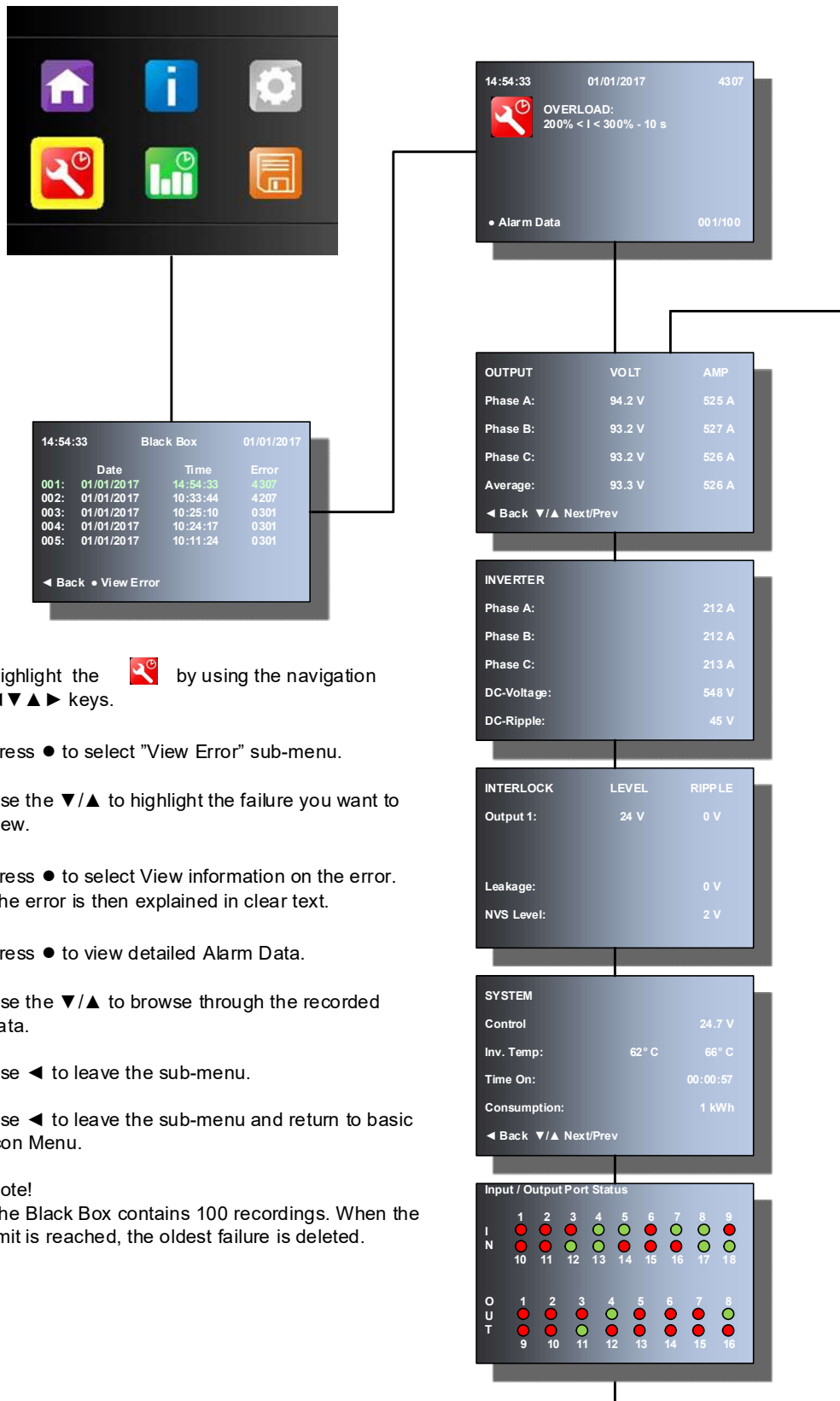
Note!

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 2400 Compact – 30 - 90 kVA

Operator's Instructions

6.3.3 Black Box – Menu structure



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

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

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

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

Press **●** to view detailed Alarm Data.

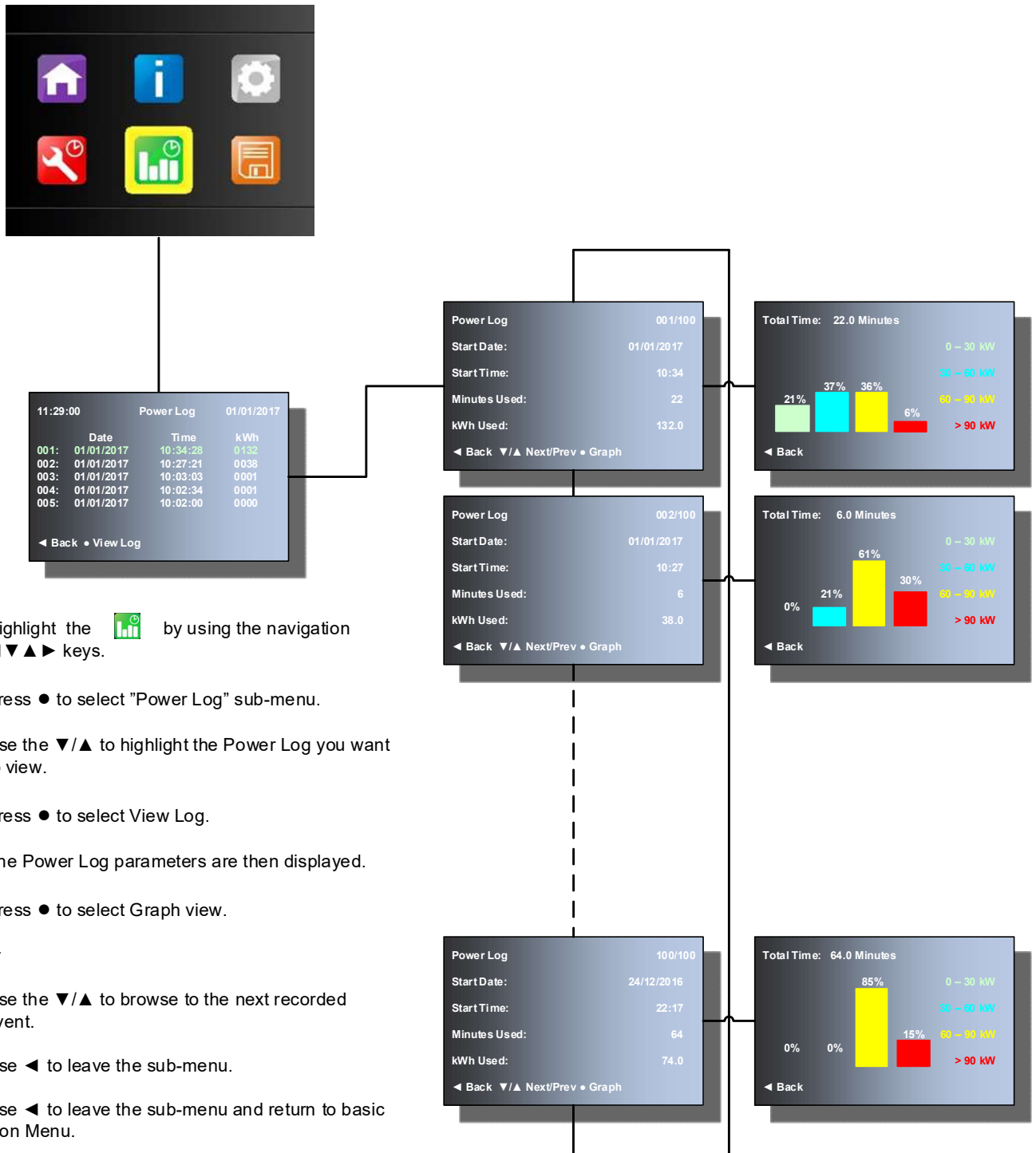
Use the **▼/▲** to browse through the recorded data.

Use **◀** to leave the sub-menu.

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

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

6.3.4 Power Log – Menu structure



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

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

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

Press ● to select View Log.

The Power Log parameters are then displayed.

Press ● to select Graph view.

or

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

Use ◀ to leave the sub-menu.

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

Note!

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

6.3.5 Update Software / Save Logs / Load Config File



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

Press **•** to select "USB Menu" sub-menu.

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

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

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

To Reset the unit, press **•** button.

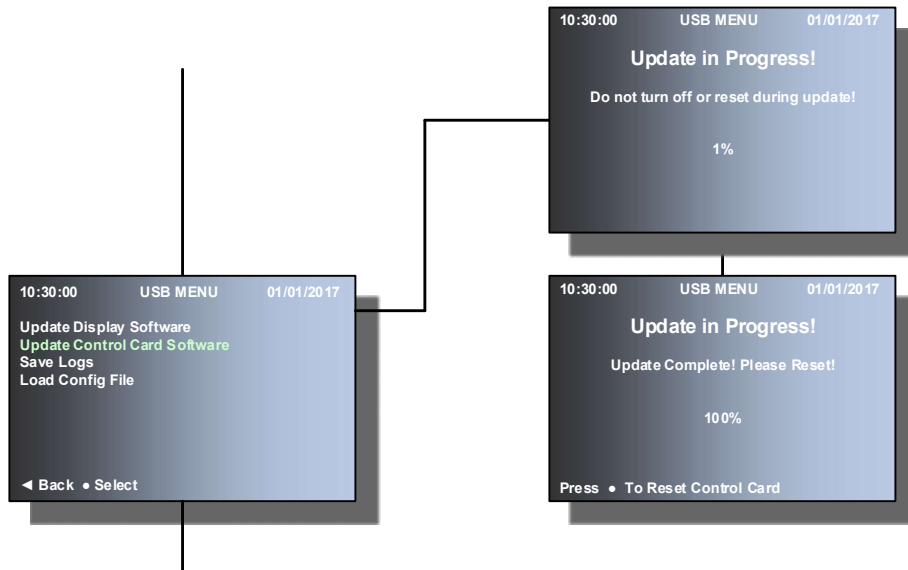


USB connection Display

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Update software / Save Logs / Load Config File (continued)



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

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

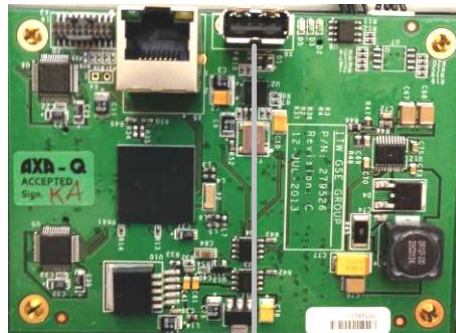
Use the ▼/▲ to highlight the function "Update Control Card software".

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

Press ● to select function and update firmware.

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

To Reset the unit, press ● button.

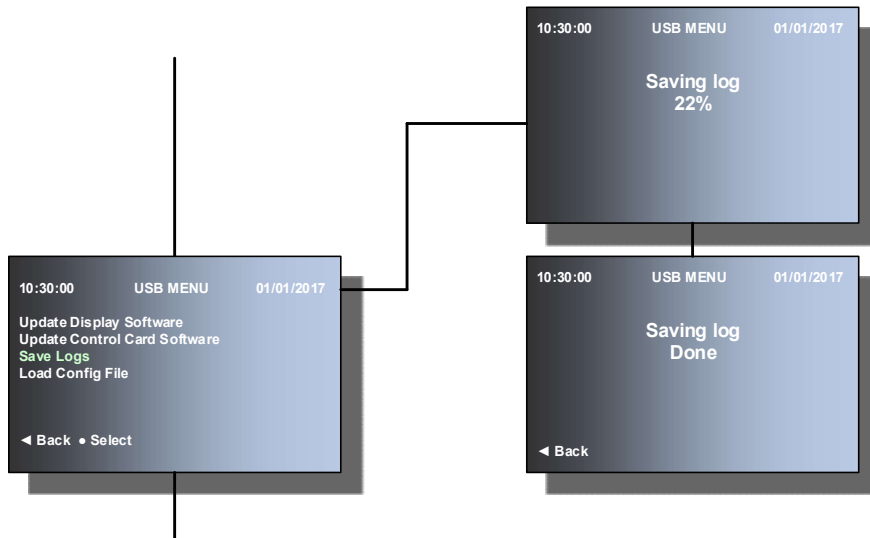


**USB connection
Control card**

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Update software / Save Logs / Load Config File (continued)



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

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

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

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

Press **●** to select function.

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

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

Note!

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

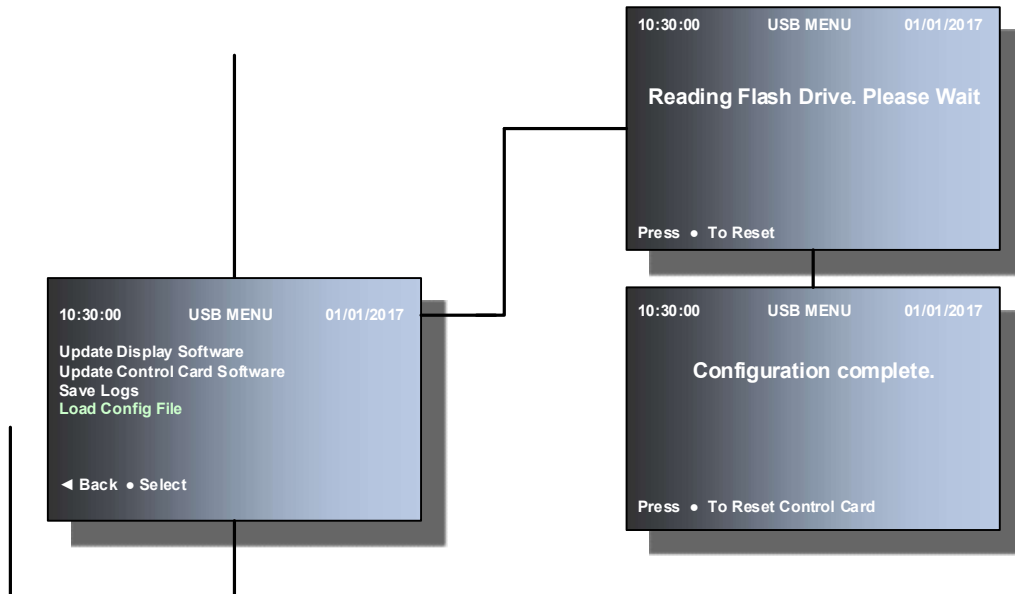


USB connection Display

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

Update software / Save Logs / Load Config File (continued)



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

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

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

Before pressing ● to select Load Config File, please remember to insert a USB stick, with the configuration file you received from ITW GSE, into the USB port on the display (located on back of the front door).

Press ● to select function.

The new configuration of the unit are now uploaded from the USB stick and "Configuration complete" is displayed, when uploading has been completed.

Press ● to reset Control Card.

Note!

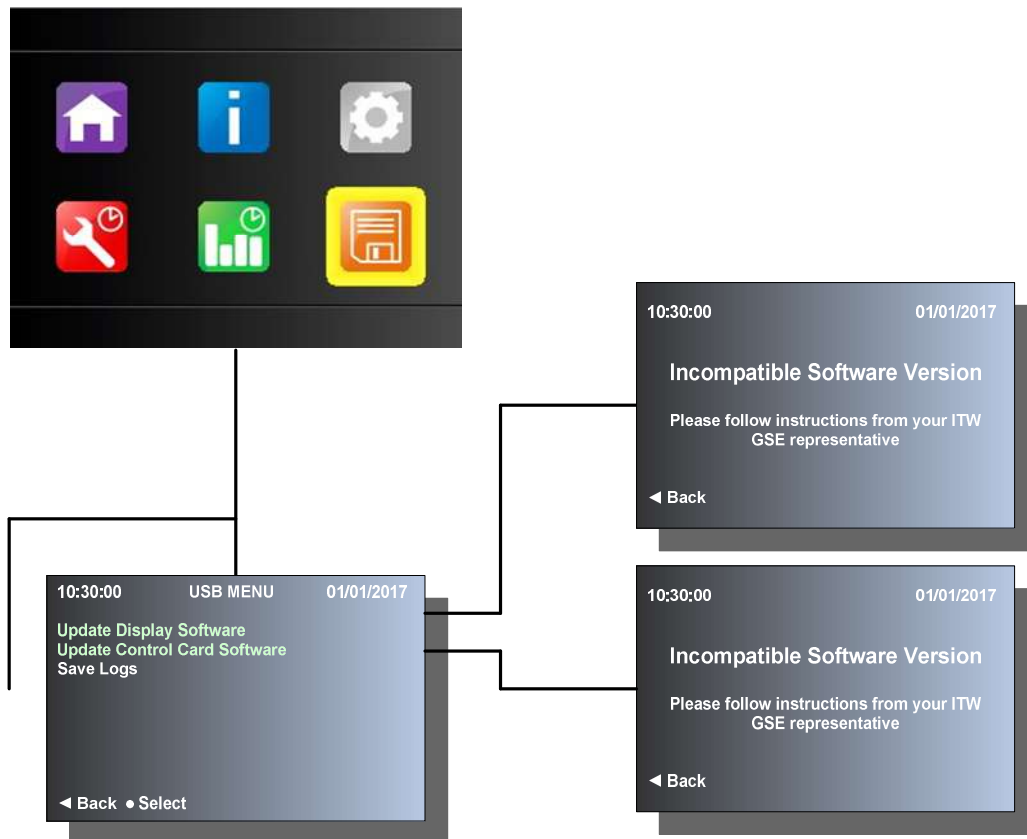
The USB stick can be inserted while the unit is connected to the power.



USB connection Display

6.3.6 Incompatible Software Version

If you try to install **Special Software** (Display Board or Control Card) in a unit with **Standard Software** or vice versa, you will be prompted “**Incompatible Software Version**”.



Before changing software versions consult ITW GSE or if your intention really is to continue, as you already contacted / received the software files from ITW GSE, use below guidance to update software:

1. Press ▼ & ▲ simultaneously for 5 seconds, software will start automatically and will be updated.
2. Repeat step number 1 for updating the other Board / Card.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Operator's Instructions

6.4 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 the GPU are supplied with cable)
Output 2 Compensation (V):	0.0
Output Mode:	Individual (Depending 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)
GPU Enable:	Bypassed
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)
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 (Americas)
Language:	Actual

7.0 Setup Lock / Output Mode / Compensation

7.1 Preventing changes of setup parameters

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

Note!

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

To prevent changes of the setup parameters, move the switch **SW2:1** to the OFF position (DOWN).

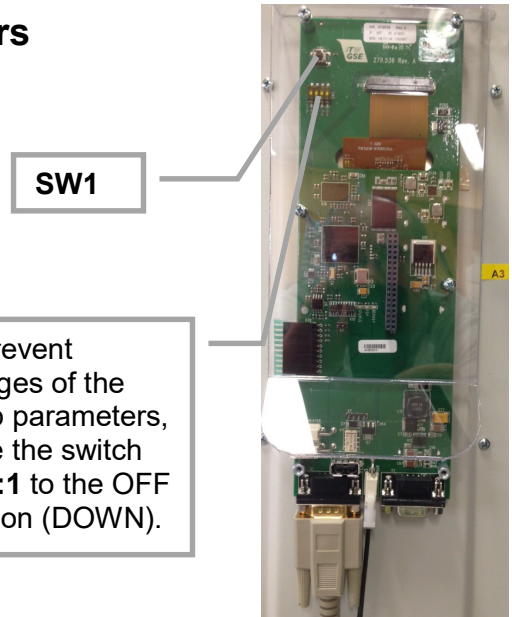


Fig. 7.1.1 Display Board A3

7.2 Output Voltage

This setup submenu allows the output voltage to be adjusted between 80.0 VAC and 135 VAC using the UP and DOWN navigation buttons (Values above 125 volt cannot be stored). Please note that the acceptable voltage range for all commercial aircraft is 115V $\pm$ 3V. This range is even tighter for some aircraft.

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



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Setup Lock / Output Mode / Compensation

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 2 outputs, Plug & Play compensation must be set for each output. Please refer to the previous section regarding Output Mode selection.

7.4 Manual Compensation

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

If the unit is equipped with a second output, repeat the above steps for "OUTPUT 2".

7.5 Output Mode

When the unit has 2 outputs, the "Output Mode" submenu is used to set either "Individual" or "Simultaneous" mode of operation.

If the output mode has been set to "Individual", the outputs can be used individually and the unit uses Plug & Play compensation if it has been set up (See paragraph 7.3).

If the output mode has been set to "Simultaneous", both outputs can be used at the same time. If only 1 output is used, the unit uses Plug & Play compensation. When both outputs are used at the same time, the unit uses manual compensation.

To obtain the correct operation of the voltage compensation, it is essential that both types of compensation (Plug & Play and Manual Compensation) have been set beforehand - and for each output.

Note!

An aircraft requires an input voltage of 115V $\pm$ 3V. The unit can only compensate for a maximum voltage drop of 14 V since the highest output voltage is limited to 129 V. When extremely long 400 Hz distribution cables are used, it might be necessary to use parallel output cables to stay within the required aircraft voltage. Enter the Setup Menu and then scroll up or down to the Output Mode submenu. Press the center ● button to enter the submenu and then press the ● button again to allow

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Setup Lock / Output Mode / Compensation

the value to be changed. Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.6 Fan Control

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

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

7.7 Remote Stop

In the United States the Remote Stop push button contacts must be Normally Closed. This is not the case in other parts of the world. This setting is used to match what is being used at the site.

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

7.8 EF Interlock

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

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

Note!

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

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

7.9 EF Interlock Ripple Level

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

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

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

7.10 EF Interlock Delay

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

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

7.11 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.

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

7.12 GPU Enable

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

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

7.13 Door Switch

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

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

7.14 Cable Temperature

Some aircraft cables have temperature sensors installed in the connector. This submenu allows the unit to accept Normally Opened or Normally Closed temperature sensor switches to be used.

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

7.15 Neutral Voltage Supervision

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

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

7.16 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.

Go into the Setup Menu and then scroll up or down to the Earth Leakage Level submenu. Press the center ● button to enter the submenu and then press the ● button again to allow the value to be changed.

Press the up or down arrow buttons to change the selection. Press the center ● button to record the new value. Press the LEFT arrow button to exit the submenu and return to the submenu list.

7.17 Earth Leakage Delay

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

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

7.18 Real Time Clock Setup

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

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

7.19 Date/Time Format

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

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

7.20 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.

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

7.21 Modbus Slave Address

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

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

7.22 LED Brightness

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

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

7.23 Unit of Measure

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

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

7.24 Customer ID

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

Go into the Setup Menu and then scroll up or down to the 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.

7.25 Battery Replaced

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

Go into 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.

7.26 Language

This submenu is used to change the language that all of the display screens, messages, alarms and reports are displayed in. The unit comes with English, German, French, Russian, Danish, Spanish, Norwegian, Italian, Swedish, Portuguese, Polish, Czech, Turkish, Finnish, Dutch etc. already installed. The default is set to English.

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

8.0 Service, Maintenance, Overhaul

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



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

8.1 Recommended Maintenance Schedule

- | | |
|--|------------------|
| • Check aircraft connector. | Daily / upon use |
| • Check output cable for damaged insulation. | Weekly |
| • Verify function of the Aircraft Connector Switch, if present. | Quarterly |
| • Check air-filters - Wash or change as appropriate. | Quarterly |
| • Check that all fans are running properly.
(use Boost mode in Fan Control setup submenu) | Yearly |
| • Check rubber seals at front door, rear panel. | Yearly |
| • Check internal bolt/screw and wire connections. | Yearly |
| • Visual inspection of PCB's - control unit / gate drive. | Yearly |
| • Verify proper operation of the output contactors' contact sets and coil | Yearly |
| • Verify the output voltage at aircraft connector(s) with and without load | Yearly |

Especially for mobile units

- | | |
|---|-----------|
| • Check tires for wear and tear | Yearly |
| • Check correct air pressure (4.3 Bar = 62 PSI) | Quarterly |

8.2 Battery back-up & replacement

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

Note!

A time stamp is stored in the ID chip (A6) upon production and after 5 years a warning occurs at the display, telling the user/operator to replace the Control Board battery.

It is strongly recommended to change the battery when this message is shown:

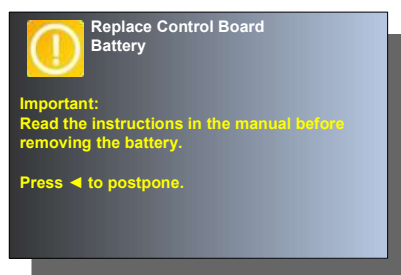


Fig. 8.2.1

To allow the user/operator to use the converter, it is possible to postpone the battery change, by pressing the ◀ (left arrow) push button.

The warning message occurs 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 below failure message will be displayed.

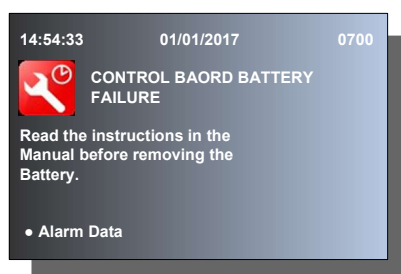


Fig. 8.2.2

The battery has to be changed before the unit can be operated again.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Service, Maintenance, Overhaul



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



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

How to change the battery:

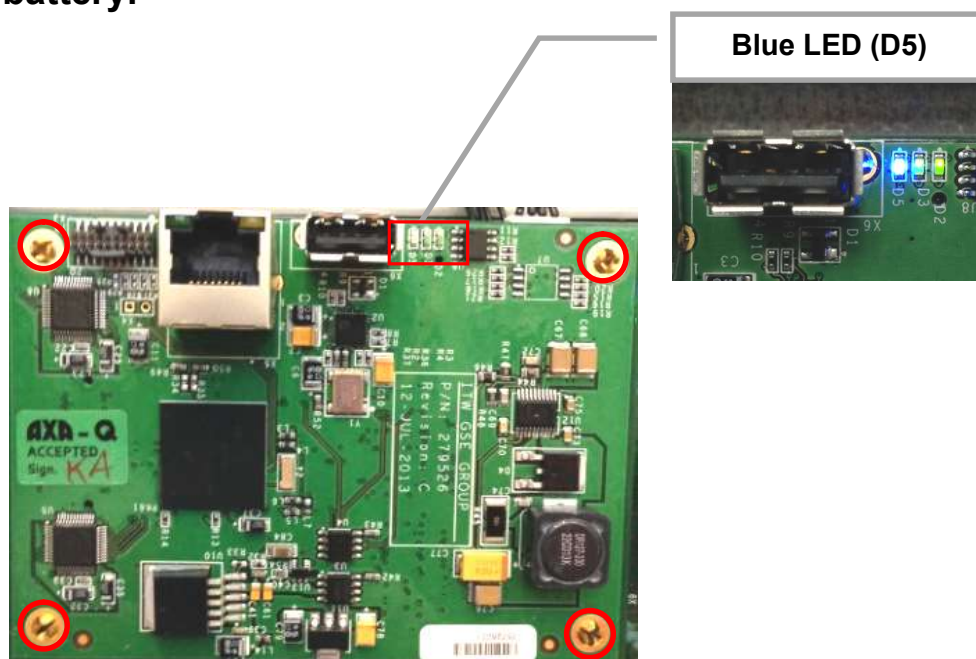


Fig. 8.2.3 Control Board (front view)

To replace the battery, **Switch OFF** the unit by means of Q1. Remove the Control Board from its 4 posts marked with a  in Figure 8.2.3. Place the PCB on an insulated surface, with the back side face up.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Service, Maintenance, Overhaul

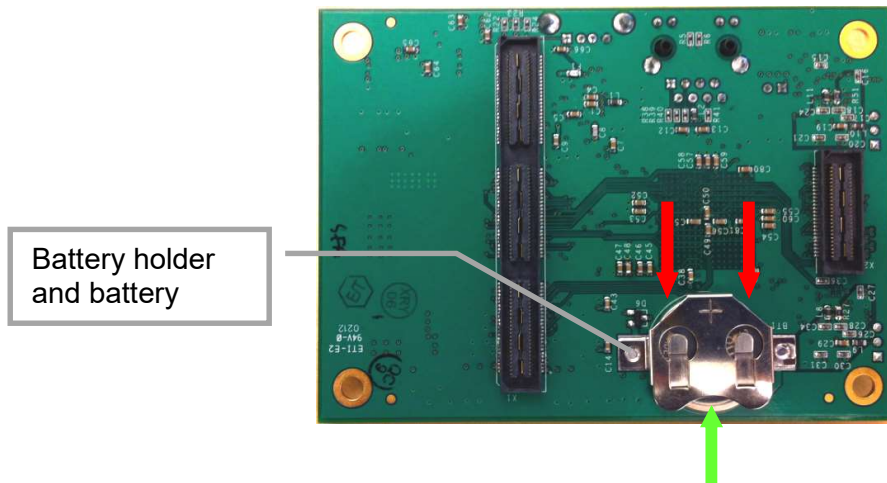


Fig. 8.2.4 Control Board (rear view)

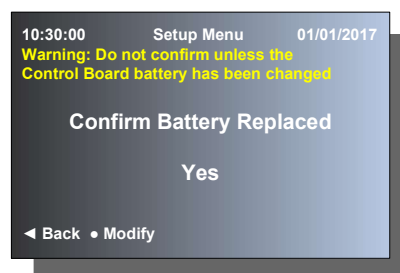
Before you remove the battery from the holder, make sure that the replacement battery is within reach, as the **Control Board must not be without battery power for more than 30 seconds**. Otherwise, all firmware and the setup data will be erased. *

Remove the battery from the holder using a small **insulated** screwdriver to push out the battery, direction indicated by the two red arrows on Figure 8.2.4 and insert the new battery in the direction of the single green arrow on Figure 8.2.4.

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

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

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



* Important Note!

If the blue LED on the Control Board (location can be found on the Fig. 8.2.3) flashes with approximate 2 flashes per second and the display reports “Communication Error”, the firmware on the Control Board has been erased. The Control Board must be sent to ITW GSE to be reloaded.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Troubleshooting & Repair

9.0 Troubleshooting & Repair



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

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

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



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

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

Additional error information regarding the output voltage, overload, covering the error codes area can be derived from the error code according to the following directions:

Output Voltage: 30xx / 31xx / 35xx

Overload: 40xx / 41xx / 42xx / 43xx / 44xx / 45xx / 46xx / 47xx

Phase code:

xx01 = Phase A

xx02 = Phase B

xx03 = Phase A & B

xx04 = Phase C

xx05 = Phase A & C

xx06 = Phase B & C

xx07 = Phase A, B & C

Examples: Error Code 3501 refers to “Output Voltage Too Low” at phase A.

Error Code 4407 refers to “Overload I > 300% - 1 sec.” at all 3 output phases.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Troubleshooting & Repair

9.1 Fault Guidance

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

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

Error code	Error text in display	Help text	1st. Corrective action
0	NO ERRORS		
100	LOGGING UNSUCCESSFUL		Press start to reset
200	CONTROL BOARD FAILURE	Watchdog Timeout	
201	CONTROL BOARD FAILURE	CRITICAL: Memory Error	
202	WRONG SOFTWARE VERSION		Install correct software version
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)	
350	F1 OR F2 FUSE BLOWN		Replace fuse F1/ F2 and press start to reset
400	EMERGENCY STOP ACTIVATED		Release emergency stop and press start to reset
500	CONTROL BOARD ADC0 FAILURE		Press start to reset
600	CONTROL BOARD ADC1 FAILURE		
700	CONTROL BOARD BATTERY FAILURE		
750	REAL-TIME CLOCK NOT SET	Please set to current time and date	Set time & date
800	INPUT VOLTAGE TOO LOW	Voltage < 340V – 500ms	Press start to reset
900	INPUT VOLTAGE TOO HIGH	Voltage > 460V – 500ms	
1000	SOFTSTART ERROR	DC Voltage < 400V	
1100	DC VOLTAGE TOO LOW	DC Voltage < 300V - 30ms	
1200	DC VOLTAGE TOO HIGH		
1201	DC VOLTAGE TOO HIGH	DC Voltage > 800V – 30 s	
1202	DC VOLTAGE TOO HIGH	DC Voltage > 850V - 2.5ms	
1300	DC CAPACITOR SHARING ERROR	DC Voltage > 850V	
1400	DC RIPPLE TOO HIGH	DC Ripple > 20V – 3 minutes	
1450	DC RIPPLE TOO HIGH	DC Ripple > 10V – 5s	
1501	INVERTER TEMP TOO HIGH	IGBT 1 Temperature > 110 °C	
1502	INVERTER TEMP TOO HIGH	IGBT 2 Temperature > 110 °C	
2000	GATE VOLTAGE ERROR	CPLD Unknown Fault	
2000+code	GATE VOLTAGE ERROR	IGBT XY Ready	
2000+code	GATE VOLTAGE ERROR	IGBT XY Fault	
3000	OUTPUT VOLTAGE TOO HIGH	Voltage > 130V - 250ms	
3100	OUTPUT VOLTAGE TOO HIGH	Voltage > 140V - 15ms	
3500	OUTPUT VOLTAGE TOO LOW	Voltage < 104V - 500ms	
4000	OVERLOAD: 100% < I < 125% - 600 s	Phase X	
4100	OVERLOAD: 125% < I < 150% - 60 s	Phase X	
4200	OVERLOAD: 150% < I < 200% - 30 s	Phase X	
4300	OVERLOAD: 200% < I < 300% - 10 s	Phase X	
4400	OVERLOAD: I > 300% - 1 s	Phase X	
4500+code	SHORT CIRCUIT AT OUTPUT	Phase X	
4600+code	FILTER CURRENT TOO LOW	Phase X	
4700+code	FILTER CURRENT TOO HIGH	Phase X	
4800	INVERTER SOFTSTART FAILURE		
5000	TRANSFORMER TEMP TOO HIGH		
5100	EARTH LEAKAGE FAULT AT OUTPUT		
5101	EARTH LEAKAGE FAULT AT OUTPUT		
5200	NEUTRAL VOLTAGE FAULT AT OUTPUT		

Table continues on next page

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Troubleshooting & Repair

Continued from previous page

Error code	Error text in display	Help text	1st. Corrective action
6001	EF OUTPUT 1 RIPPLE TOO HIGH	Ripple Voltage Exceeded Limit	Press start to reset
6002	EF OUTPUT 2 RIPPLE TOO HIGH	Ripple Voltage Exceeded Limit	
6101	CABLE 1 TEMPERATURE TOO HIGH		
6102	CABLE 2 TEMPERATURE TOO HIGH		
6201	NEUTRAL CONDUCTOR RUPTURE OUTPUT 1		
6202	NEUTRAL CONDUCTOR RUPTURE OUTPUT 2		
6301	EF SIGNAL DROP OUT - OUTPUT 1	EF Signal Disappeared at Output 1	
6302	EF SIGNAL DROP OUT - OUTPUT 2	EF Signal Disappeared at Output 2	
6003	EF SIGNAL DROP OUT – 28 V OUTPUT	EF Signal Disappeared at 28 V Output	
7000	OUTPUT VOLTAGE TOO HIGH	Voltage > 32V - 4s	
7100	OUTPUT VOLTAGE TOO HIGH	Voltage > 40V – 150 ms	
7200	OUTPUT VOLTAGE TOO LOW	Voltage < 20V - 4s	
7300	SHORT CIRCUIT AT 28V OUTPUT	>75kW	
7400	28V OUTPUT CURRENT TOO HIGH		
7500	28V RECTIFIER TEMP TOO HIGH		
8000	ACR SUPPLY VOLTAGE MISSING		
8001	ACR ERROR		
8100	CABLE COIL / VFD ERROR	Check Cable Coil, VFD & Motor	
8200	COIL WINDING TIME-OUT	Coil Winding Exceeded 50 s	
8300	FAULT – CABLE HANDLING SYSTEM		
9000	END OF FACTORY TEST		
9100+code	PLUG & PLAY FAILED - OUTPUT X		
9200+code	PLUG & PLAY COMPLETED - OUTPUT X		

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

Error code	2nd. Corrective action	3rd. Corrective action	4th. Corrective action
0			
100			
200	Replace Control Board A1		
201	Verify ID Chip inserted	Contact ITW GSE	
202			
250			
300 - 301	Check input voltage	Check Q4 & G1	
350	Check wires attached to X1 (X2 /X3)		
400	Check emergency stop	Check user EPO (A2:X14)	Replace Control Board A1
500	Check input voltage	Replace Control Board A1	
600	Check input voltage	Replace Control Board A1	
700	Replace battery		
750	Check / Set to current time and date		
800	Check input voltage	Replace Control Board A1 Replace Interface Board A2	
900	Check input voltage	Replace Control Board A1 Replace Interface Board A2	
1000	Check input voltage	Check DC softstart charging voltage > 400 V	Replace Interface Board A2 Replace Capacitor Module A5 Replace Control Board A1
1100	Check input voltage	Check Q5	Replace Control Board A1 Replace Interface Board A2
1200			
1201	Check input voltage	Replace Control Board A1	Replace Interface Board A2
1202	Check input voltage	Replace Control Board A1	Replace Interface Board A2
1300	Check DC sharing voltage at R1	Replace Control Board A1	Replace Interface Board A2
1400	Check input voltage	Check equal voltage across V1 – V6	Replace Control Board A1 Replace Interface Board A2
1450	Check input voltage	Check equal voltage across V1 – V6	Replace Control Board A1 Replace Interface Board A2

Table continues on next page

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Troubleshooting & Repair

Continued from previous page

Error code	2nd. Corrective action	3rd. Corrective action	4th. Corrective action
1501	Check fuse F5	Set fans to "Boost" and check voltage between + & – and PWM & – at fan terminals (10 V)	Check dust filters Replace Control Board A1 Replace Interface Board A2
1502	Check fuse F5	Set fans to "Boost" and check voltage between + & – and PWM & – at fan terminals (10 V)	Check dust filters Replace Control Board A1 Replace Interface Board A2
2000 - 2024	Replace Control Board A1	Replace Interface Board A2	Replace Inverter Module
3000	Check voltage 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	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4100	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4200	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4300	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4400	Remove overload and press start	Replace Control Board A1	Replace Interface Board A2
4500+code	Disconnect load / output cable	Replace Control Board A1	Replace Interface Board A2
4600+code	Check output filter capacitors C7-C9	Check output transformer T2	Replace Control Board A1 Replace Interface Board A2
4700+code	Check output filter capacitors C7-C9	Check output transformer T2	Replace Control Board A1 Replace Interface Board A2
4800	Check DC voltage	Check output voltage/feedback voltage	Replace Control Board A1 Replace Interface Board A2 Replace Inverter Module
5000	Let the unit cool down and press start to reset	Check dust filters and fans	Check(short circuit sensor) replace sensor TH if necessary Replace Control Board A1 Replace Interface Board A2
5100	Check setup value	Remove load and check output cabling	Replace T5 Replace Control Board A1 Replace Interface Board A2
5101	Check / replace output capacitors		
5200	Check setup value	Remove load and check output cabling for insulation failure	Replace Control Board A1 Replace Interface Board A2
6001	Check setup value	Remove load and check output cabling	Replace Control Board A1 Replace Interface Board A2
6002	Check setup value	Remove load and check output cabling	Replace Control Board A1 Replace Interface Board A2
6101	Remove load and let plug cool down	Check connector / output cabling for any malfunction	Replace Control Board A1 Replace Interface Board A2
6102	Remove load and let plug cool down	Check connector / output cabling for any malfunction	Replace Control Board A1 Replace Interface Board A2
6201	Check / correct installation	Replace NCR Board A10	Replace Control Board A1 Replace Interface Board A2
6202	Check / correct installation	Replace NCR Board A10	Replace Control Board A1 Replace Interface Board A2
6301	Verify that output cable is correct inserted	Check / correct installation	Replace Control Board A1 Replace Interface Board A2
6302	Verify that output cable is correct inserted	Check / correct installation	Replace Control Board A1 Replace Interface Board A2
6303	Verify that output cable is correct inserted	Check / correct installation	Replace Control Board A1 Replace Interface Board A2

Table continues on next page

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Troubleshooting & Repair

Continued from previous page

Error code	2nd. Corrective action	3rd. Corrective action	4th. Corrective action
7000	Check output voltage setup value	Check ARU Module and wiring	
7100	Check output voltage setup value	Check ARU Module and wiring	
7200	Check output voltage setup value	Check ARU Module and wiring	
7300	Remove short circuit	Check output cables	
7400	Remove overload	Replace Control Board A1	Replace Interface Board A2
7500	Let the unit cool down and reset	Check airflow / air filters / fan	Check temp. sensor at rectifier heat sink.
8000	Check ACR Supply Q6		
8001	Reset ACR	Check ACR VFD	
8100	Check Cable Coil, VFD & Motor	Replace Control Board A1	Replace Interface Board A2
8200	Check Cable Coil, VFD & Motor	Replace Control Board A1	Replace Interface Board A2
8300	Check Cable Handling System	Replace Control Board A1	Replace Interface Board A2
9000			
9100+code	Repeat cable Identification		
9200+code			

Note!

Before changing any PCB's / Inverter Module check corresponding connection and wiring.

Please observe!



To prevent PCB damage from electrostatic discharge, wear ESD wrist strap when servicing / replacing.

10.0 Illustrated Parts List

Please refer to www.itwgse.com for recommended list of spare parts. It is also possible to find diagrams and drawings of the unit at this website.

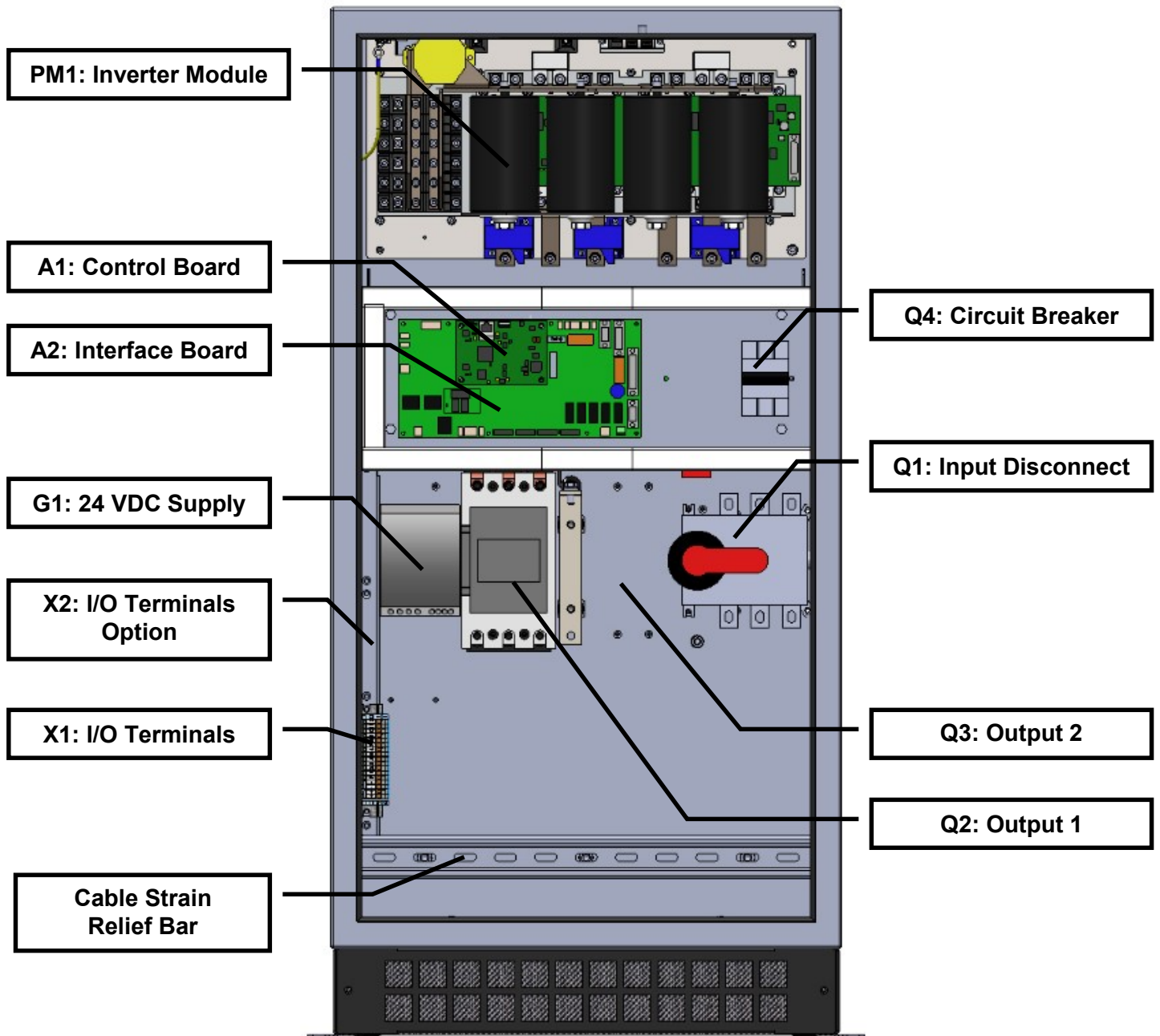


Figure: 10.0.1 Front View

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Illustrated Parts List

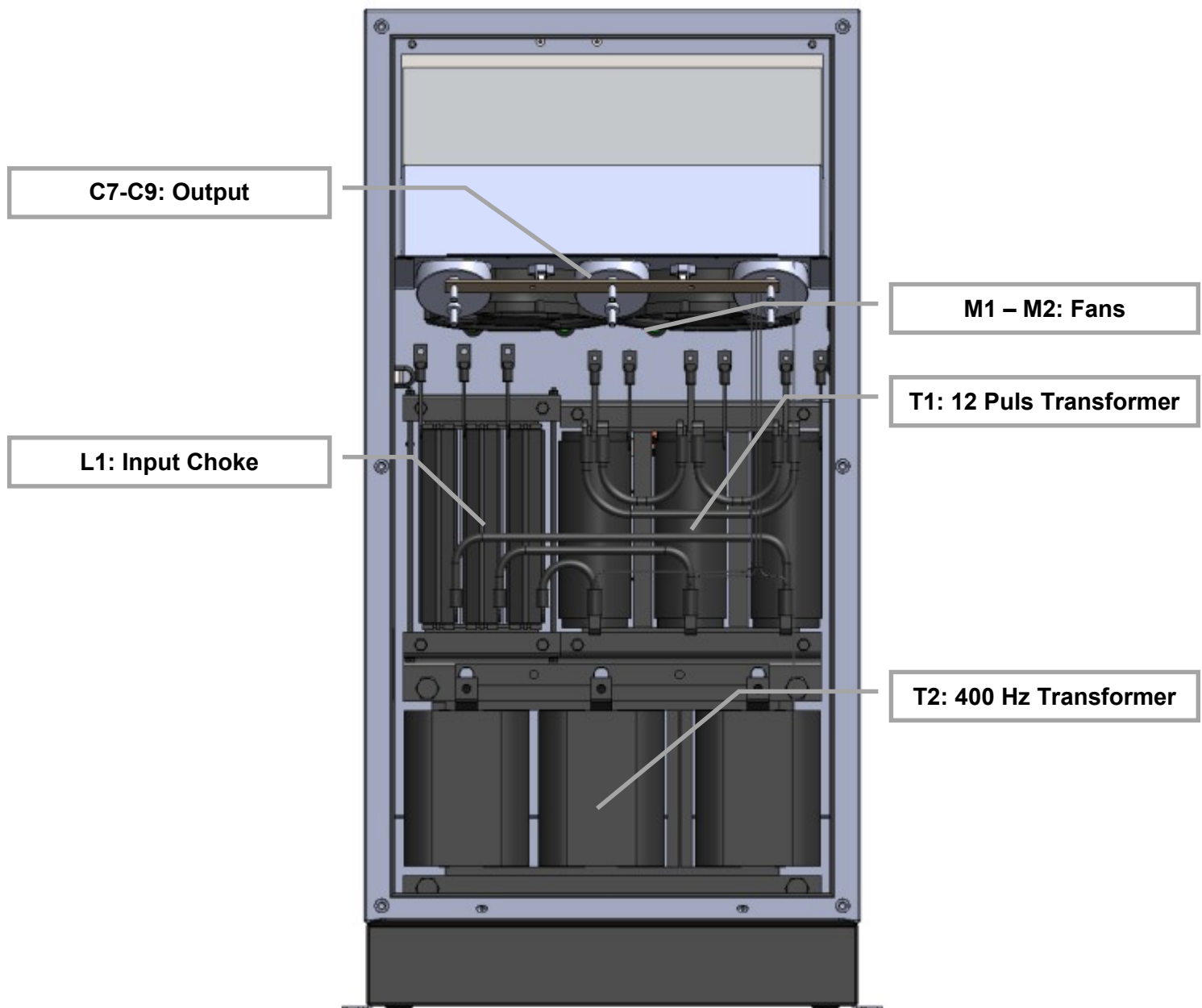


Figure 10.0.2 Rear View

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Illustrated Parts List

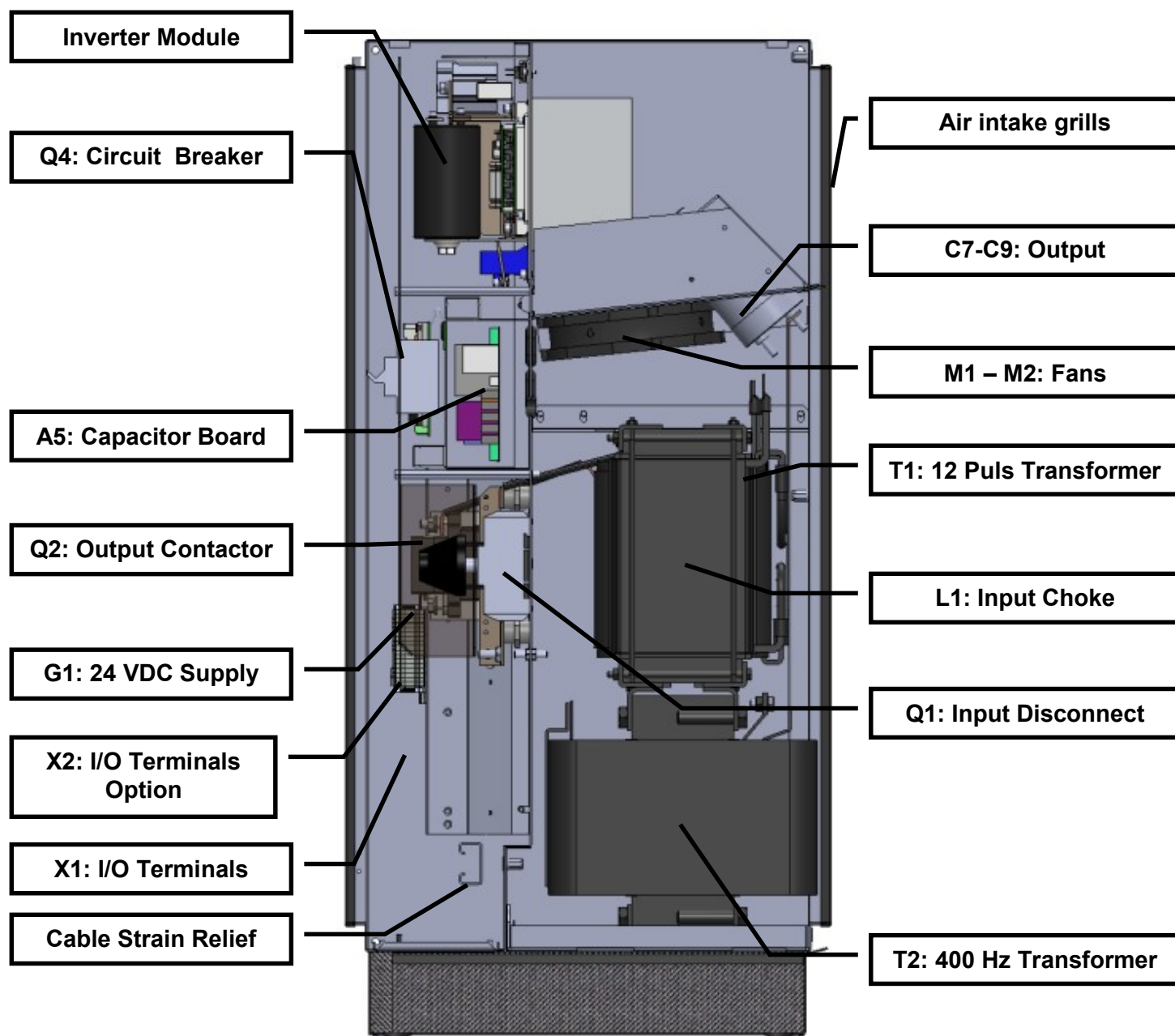


Figure 10.0.3 Side View cut

Note!

In mobile and bridge mounted units, the display module and the emergency stop button are situated in a separate box. (See Section 11.0 Options item 578xxx Remote Control Boxes)

11.0 Options

Note!

For Americas use AP-xxxxxx numbers.

578803 / AP-578803 Base module

Additional base module, extends the height/length of the ground power unit by 340 mm (13.8") and the weight by 20 kg/51 lbs. (Refer to drawings section 5)

578804 / AP-578804 Lockable Door (Fixed)

As a standard, the GPU is supplied with a quarter-turn lock intended for a double bit 5 mm pin key. One key is supplied per ground power unit.

On an optional basis, the ground power unit can be supplied with a lockable swing handle at the front door. The handle is locked by a profile square 6 mm cylinder according to DIN 18252/18254 (depth = 40 mm). Each ground power unit is supplied with 2 identical DIRAK 1333 keys.



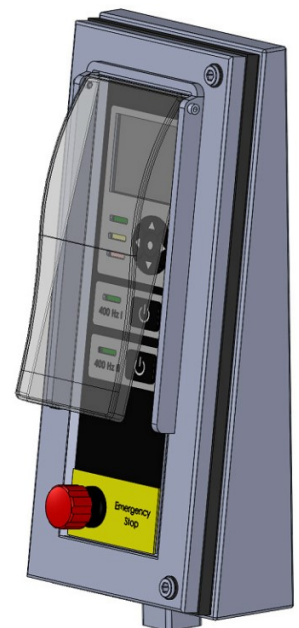
5788xx / AP-5788xx Remote Control Boxes available

578806 / AP-578806 1 x 400 Hz Output

578818 / AP-578818 2 x 400 Hz Output

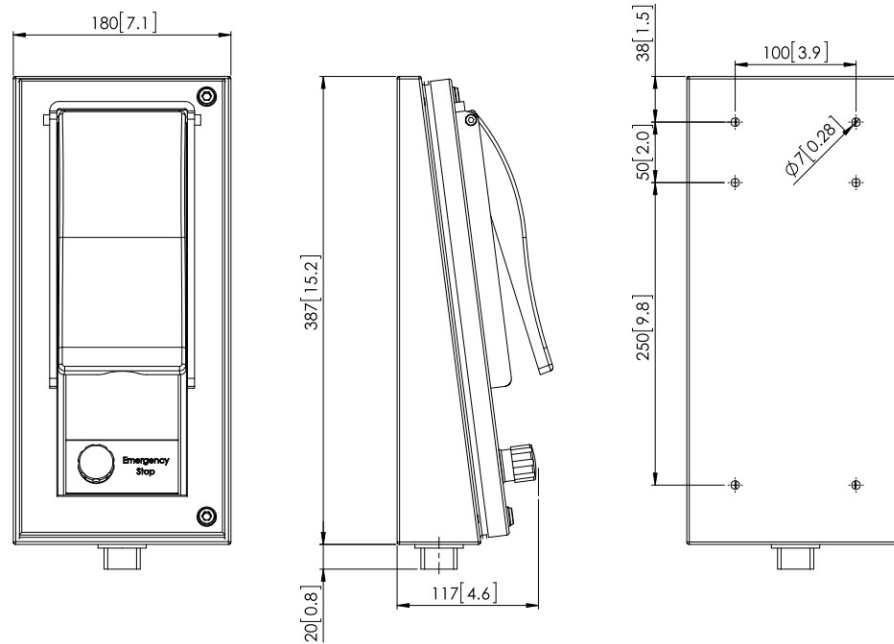
578819 / AP-578819 1 x 400 Hz & 1 x 28 VDC Output

578820 / AP-578820 1 x 400 Hz Output & controls for Hoist



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Options

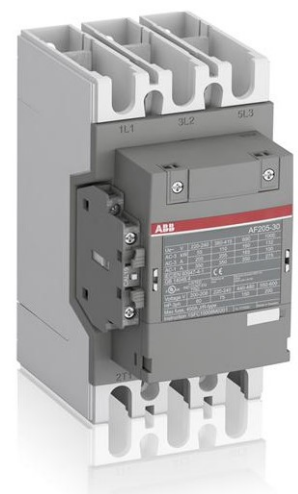
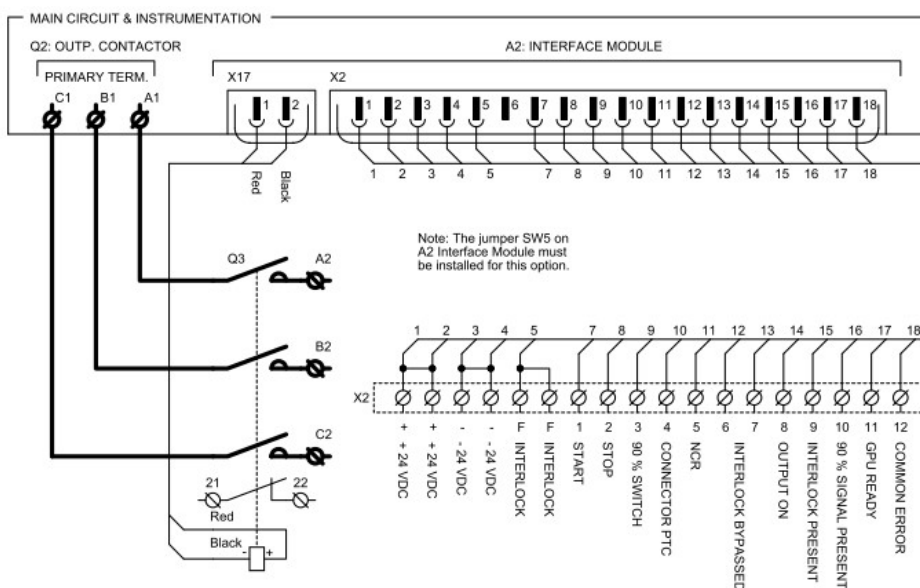


The control box is used for operation of the ground power unit when the GPU is located away from the aircraft parking position, placed under or on the side of a passenger boarding bridge or on a trailer. (Above picture shows the configuration with 2 x 400Hz output).

578807 / AP-578807 Additional Output Contactor (Diagram 478801)

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.



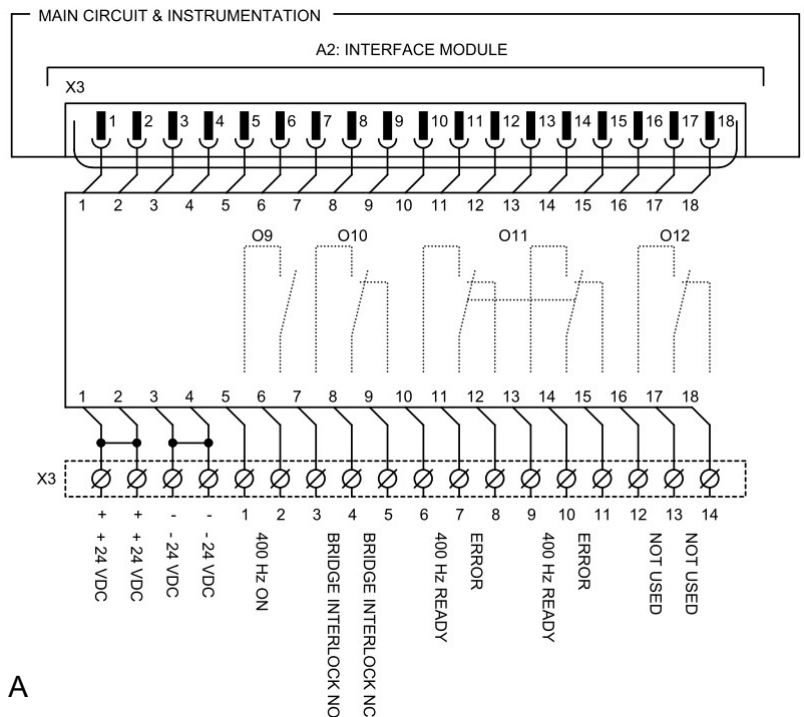
Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Options

578808 / AP-578808 Dry Contacts (Diagram 478801)

If dry contacts are needed for additional indication / to the PBB or to a BMS system, this option offers the following dry contact relays:

Q9	400 Hz On (N.O.)
Q10	Bridge Interlock (N.O.) Bridge Interlock (N.C.)
Q11	400 Hz Ready (N.O.) Error (N.C.)
Q11	400 Hz Ready (N.O.) Error (N.C.)
Q12	Not Used (N.O.) Not Used (N.C.)

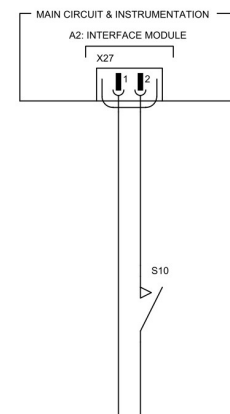


Note!

Contacts $V_{max} = 50 \text{ V AC/DC}$ and $I_{max} = 2 \text{ A}$

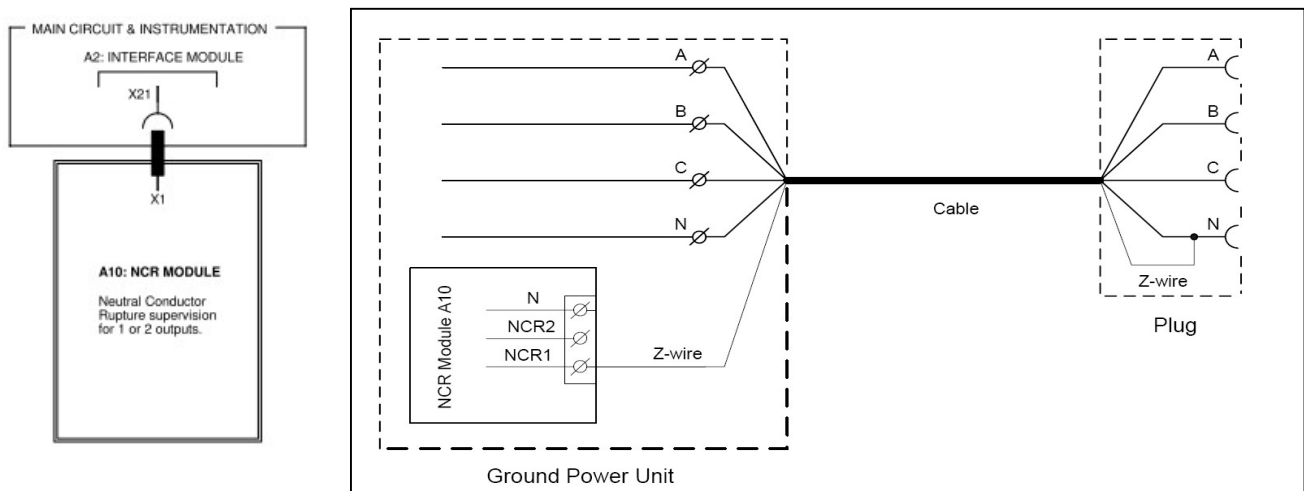
578809 / AP-578809 Door Interlock (Diagram 478801)

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



578810 / AP-578810 Neutral Conductor Rupture Supervision

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



Principle wiring diagram for Neutral Conductor Rupture Supervision

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

Note!

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

- 1) The need for an additional control wire which is likely to be the first to break.
- 2) The difficulties of implementing the method in existing installations if a free control wire is not present.
- 3) The standard protections built into the ITW GSE 2400 series are considered adequate to safeguard against hazards related to a broken neutral.

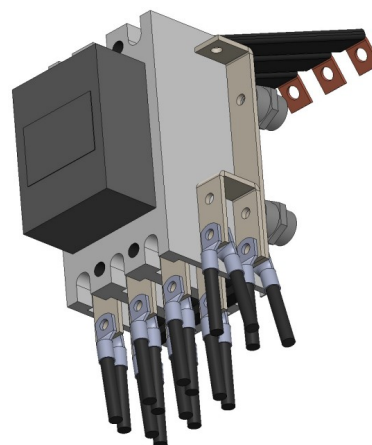
578814 / AP-578814 Terminal Extension

If more than 2 x cables per output phase are needed, for instance 2 ll 7 x 35 mm², the terminal extension allows connection of up to 4 x cables per phase.

The kit consists of:

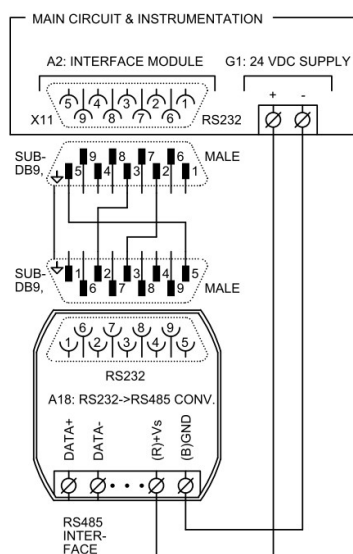
4 x extension bars

Bolts, washers, spring washer and nuts.



578815 / AP-578815 RS485 Interface (Diagram 478801)

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



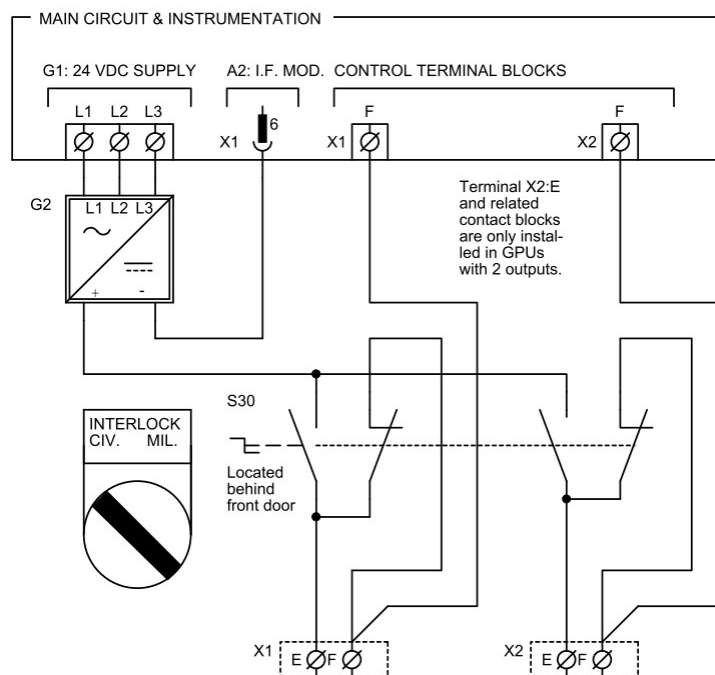
PIN Assignment for RS485 Interface

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

Options

578817 / AP-578817 Military Interlock (Diagram 478801)

For military aircraft, the interlock system must be switched from civilian interlock to military interlock by means of selector switch (S30) behind the front door. The GPU thereafter delivers 28 VDC on the E pin and this voltage is returned to the F pin by the aircraft.



Standard wiring diagram for military interlock

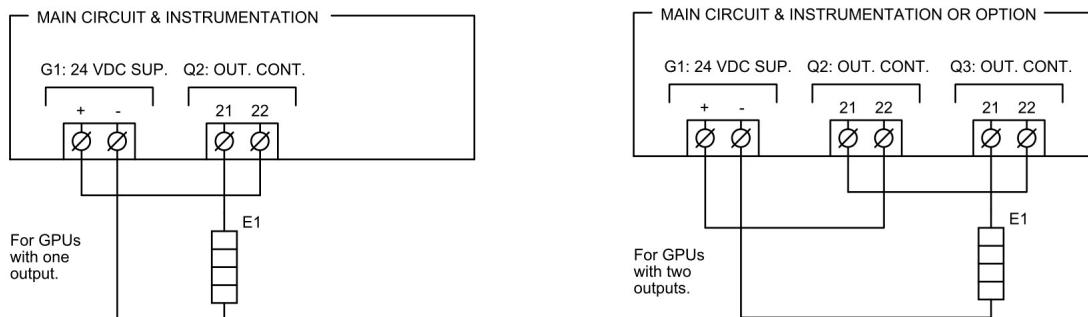
Note!

This option requires a 400 Hz cable **without** the E&F jumper in the connector head.

578829 / AP-578829 Anti-Condensation Heater (Diagram 478801)

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

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



Schematic for Heater connection

591100 / AP-591100 Auto Calibration Plug

Required for Plug & Play setup.
See section 7.



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

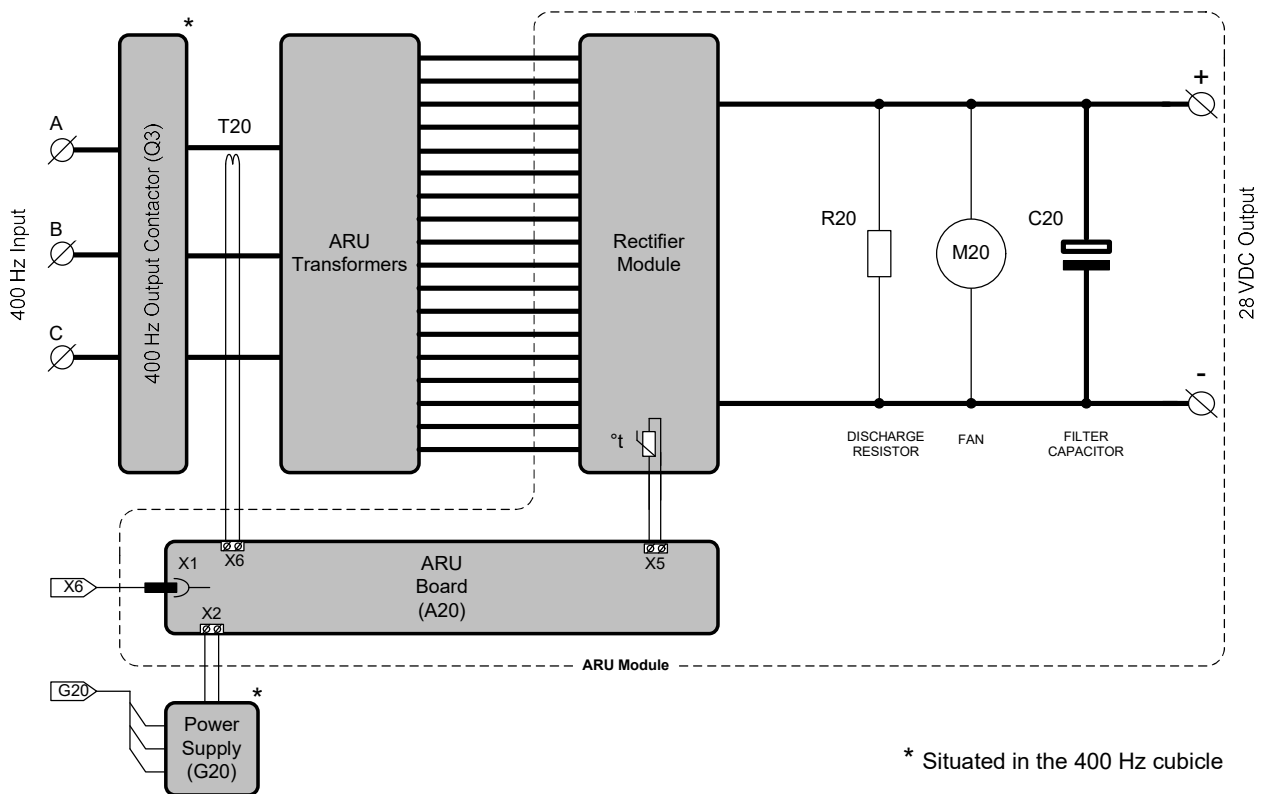
For GPUs with 28 VDC Active Rectifier Unit

12.0 For GPUs with 28 VDC Active Rectifier Unit

All ITW GSE 2400 Compact units from 30 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 calculated as the sum of 400 Hz and 28 VDC output and cannot exceed the total 400 Hz power rating of the unit.

12.1 General Description



12.1.1 Principle of 28 VDC ARU

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

Please refer to section 5.0.2 for outline drawings.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

Input Contactor (Q3):

The 400 Hz input power to the ARU is supplied and controlled via Q3.

Power Supply (G20):

24 VDC / 10 A (Factory adjustment = 25 Volt) regulated control voltage is supplied from the Power Supply G20. This module has a wide input range (340-575 VAC). It is supplied via the capacitor module and pre-fused from the 3-phase circuit breaker Q4 (shared with G1) and located in 400 Hz part.

Refer to Figure 15.0.1 for location layout.

ARU Transformers (T20):

The ARU transformers step down the 3 phase 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 G20 (X2)
- Connection to ARU control input on A2 (X1)
- Control of thyristors.
- Measures the output voltage.
- Interface for heatsink thermostat (X5)
- Input for current transformer T20 (X6)

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)

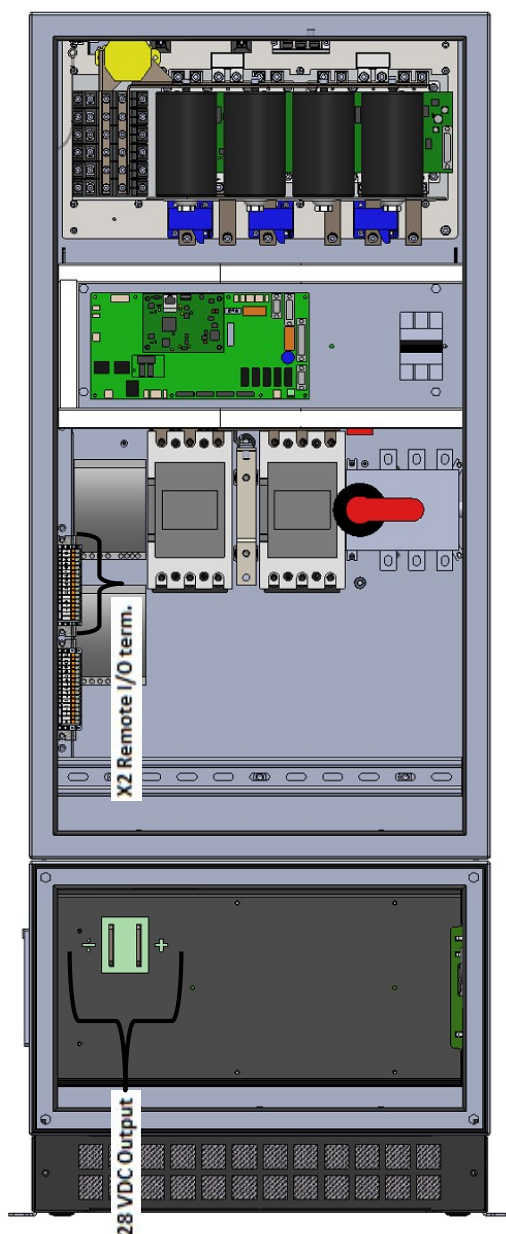
The fan M20 is part of the total forced cooling of the unit, the primary task for the fan is to cool down the rectifier module. The air is drawn in via the filter grill on the left hand side of the base module. The ARU transformers are cooled by the fans located in the 400 Hz part.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

12.2 Connection of Cables

Standard Remote I/O terminals
(Refer to **section 4.9** for connection of I/O terminals)



* THE 90% SWITCH IS AS STANDARD BY-PASSED BY CONNECTING TERMINAL + & 3.

28 VDC Output terminals: 2 x 4 x $\phi 11$ (M10 bolt) 50Nm (444 in-lb)
Remote I/O terminals: 15 x 0.4 - 4 mm² (AWG21 – 11)

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.

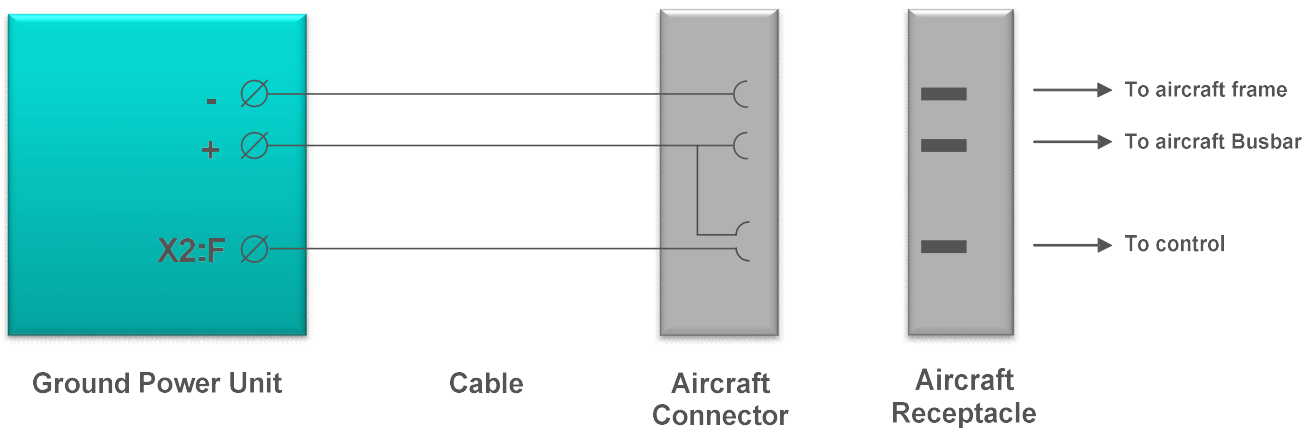
Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

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 28 VDC is present 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 into normal mode once it receives a 28 VDC voltage at terminal F2 e.g. when the plug is connected to an aircraft.

The 28 VDC output can be operated remotely via the I/O terminals related to Output 2.

Please refer to section 4.9

Note!

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

Note!

The 90% switch input is as standard by-passed by connecting terminal + & 3 (X2)

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

12.4 Operator's Instruction

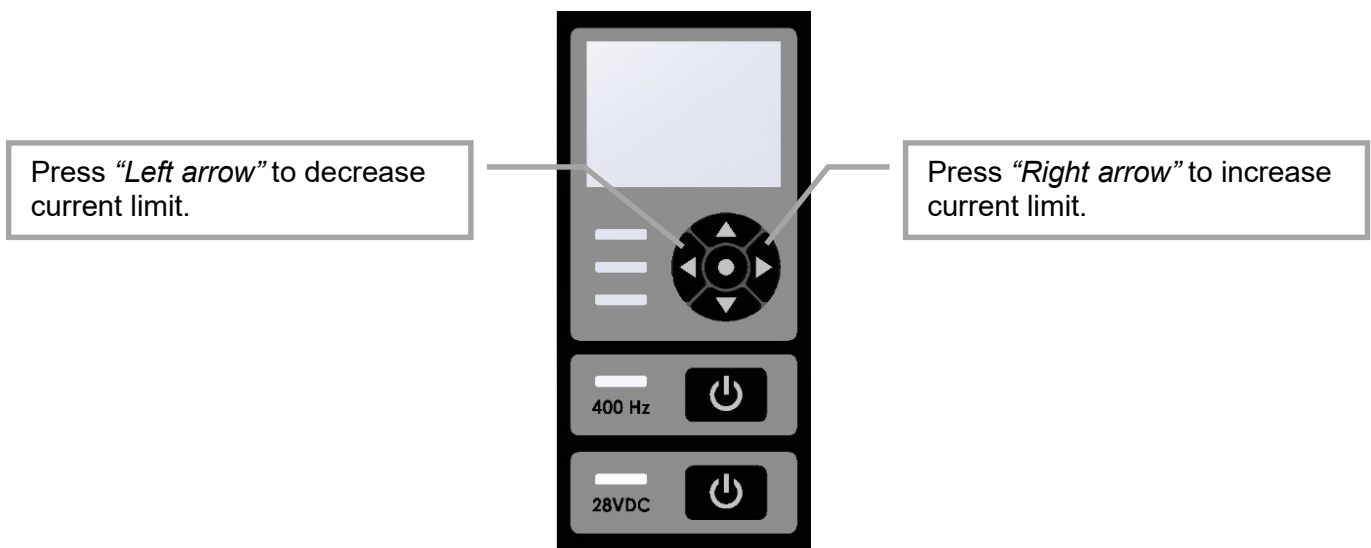
The 28 VDC ARU is operated by means of the Display / Keyboard Interface.

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 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.
- Depending on the rating of the GPU:
400 A rating e.g. 200 to 1600 Amp (in selected increment step)
600 A rating e.g. 300 to 2400 Amp (in selected increment step)

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



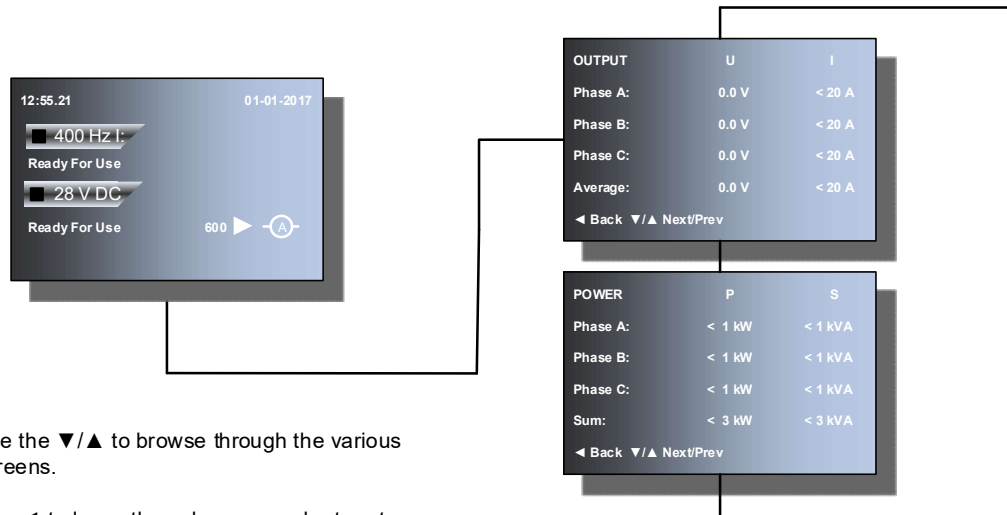
- Insert the aircraft cable into the aircraft. Make sure the cable is inserted till you feel a natural resistance. The plug may be equipped with a 90° switch /split "F" pin. In this case the unit will not function if the plug is not fully inserted.
- Press the 28 VDC Start/Stop  button.
- The unit is 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.  **28VDC** 
- If the unit shuts off and no longer is supplying power to the aircraft, this is reported in clear text in the display. Also a corrective action is displayed.

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

- During operation, various parameters can be viewed via the display. Use the navigation keys ▼▲ to browse through the available screens:

Default Display Screen Standby



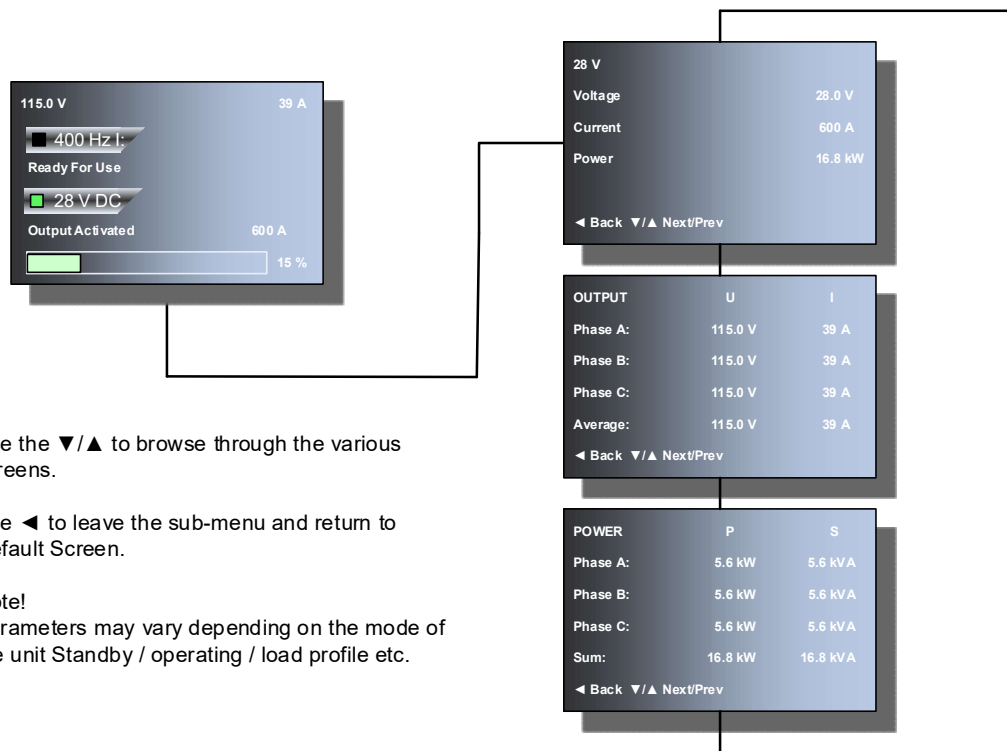
Use the ▼/▲ to browse through the various screens.

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

Note!

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

Default Display Screen Operating



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

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

Note!

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

- After operation, the unit has to 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 at the cable rest position.

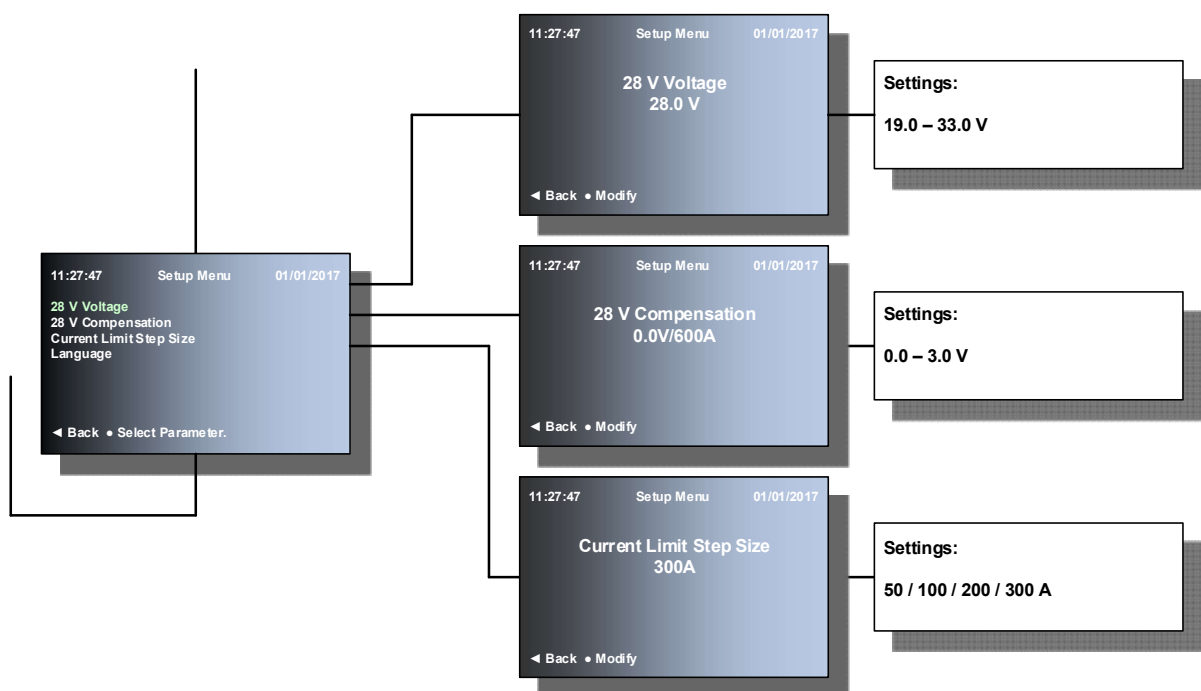
Note!

Please note that the 28 VDC Start/Stop  button also functions as a Reset push button.

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

12.6 Additional menu items for ARU

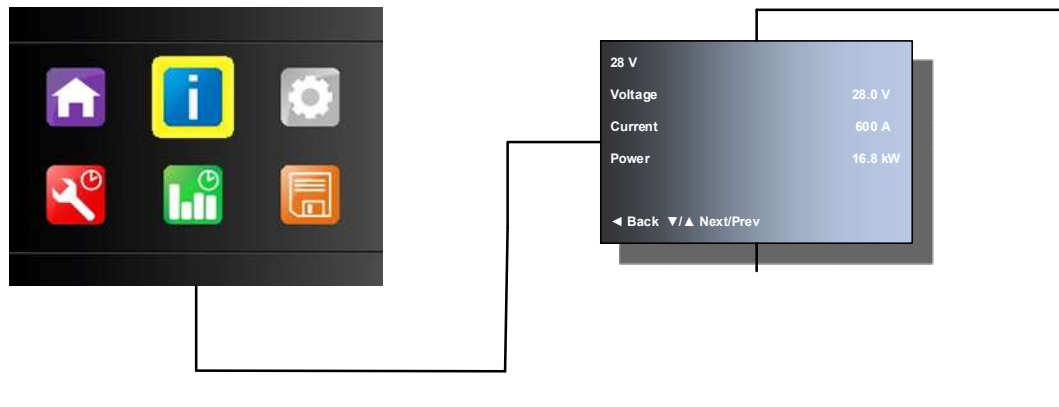
Setup – ARU additional parameters



Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

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).

12.7 ARU Default Factory Settings

28 V Voltage (V):	28.0
28 V Compensation (V/600 A):	0.0 (Set if GPU is supplied with cable)
28 V Current Limit (A):	1600 A (400 A version) 2400 A (600 A version)
Output Mode:	Simultaneous
Fan Control:	Normal
Cable Temperature:	Normally Open

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

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 200 amps to 1600 amps for the 400 amp version of the unit and from 400 amps to 2400 amps for the 600 amp version, current limit can be changed at the standby screen menu. Increment / Decrement 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 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

13.0 Specifications

Output:

Voltage	: 28 VDC	
Current	: 400/600 A continuously	
Voltage regulation	: < 0.5%	
Voltage ripple	: < 2%	
Voltage transient recovery	: Complies with ISO 6858 / MIL-704E	
Overload capability	: 400 A	600 A
	800 A	1200 A for 30 seconds
	1200 A	1800 A for 10 seconds
	1400 A	2100 A for 5 seconds
	1600 A	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	: 200-1600 A in steps of 50/100/200/300 A (400 A version)* 300-2400 A in steps of 50/100/200/300 A (600 A version)*

*Steps depending on chosen value in the setup menu.

Protections:

Rectifier temperature to 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

For dimension please refer to section 5.0.2 (e.g. units equipped with base module).

Ambient:

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

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

14.0 Troubleshooting & Repair

Please refer to section 9.1 for Fault Guidance

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 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

15.0 ARU illustrated parts list

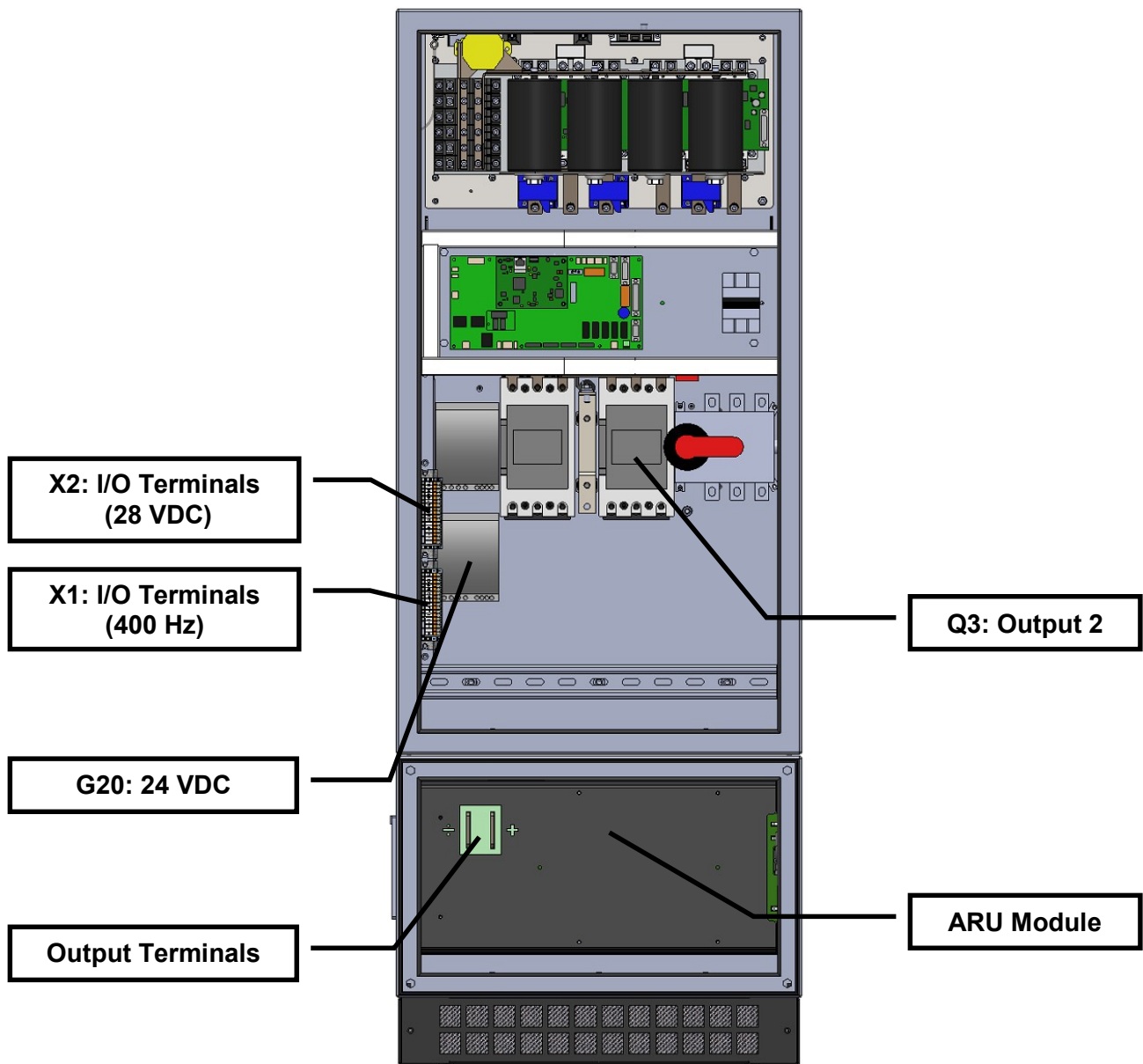


Figure: 15.0.1 Front View (complete unit)

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

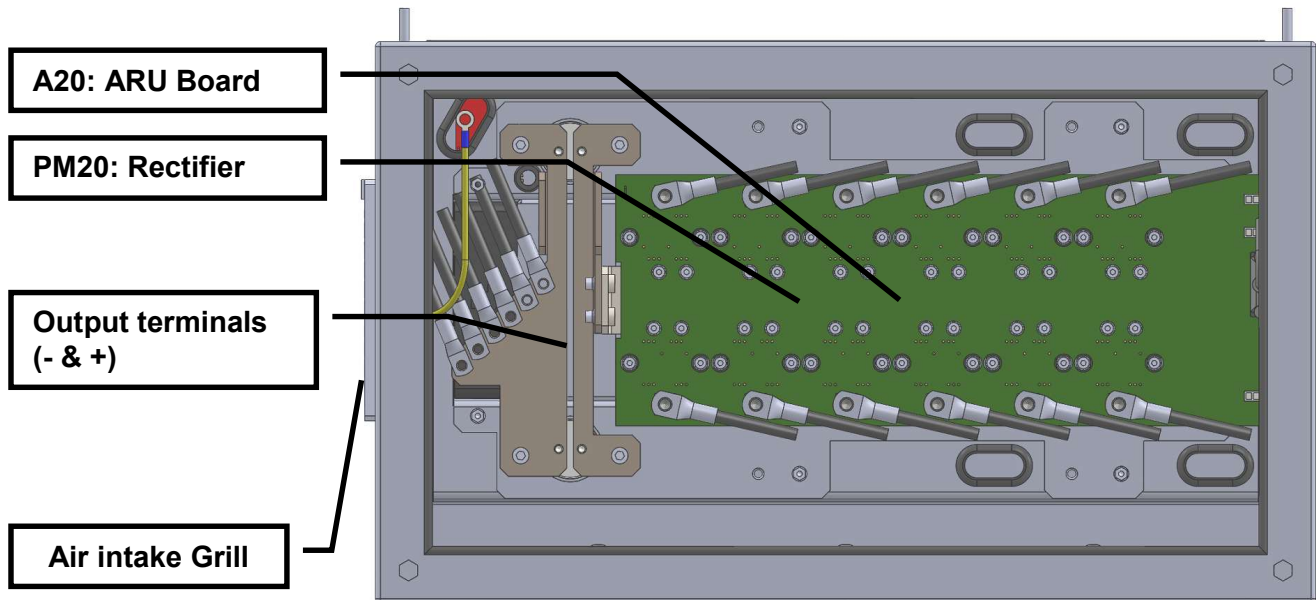


Figure 15.0.2 Front View (ARU)

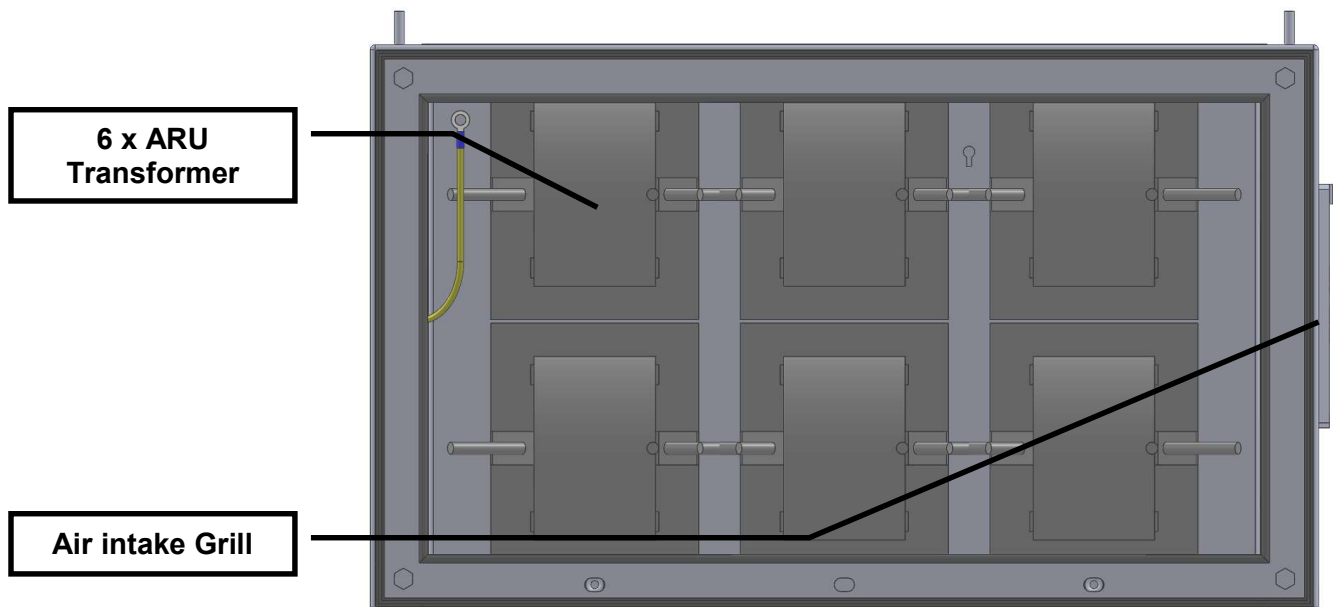


Figure 15.0.3 Rear View (ARU)

Operation Manual – ITW GSE 2400 Compact – 30 - 90 kVA

For GPUs with 28 VDC Active Rectifier Unit

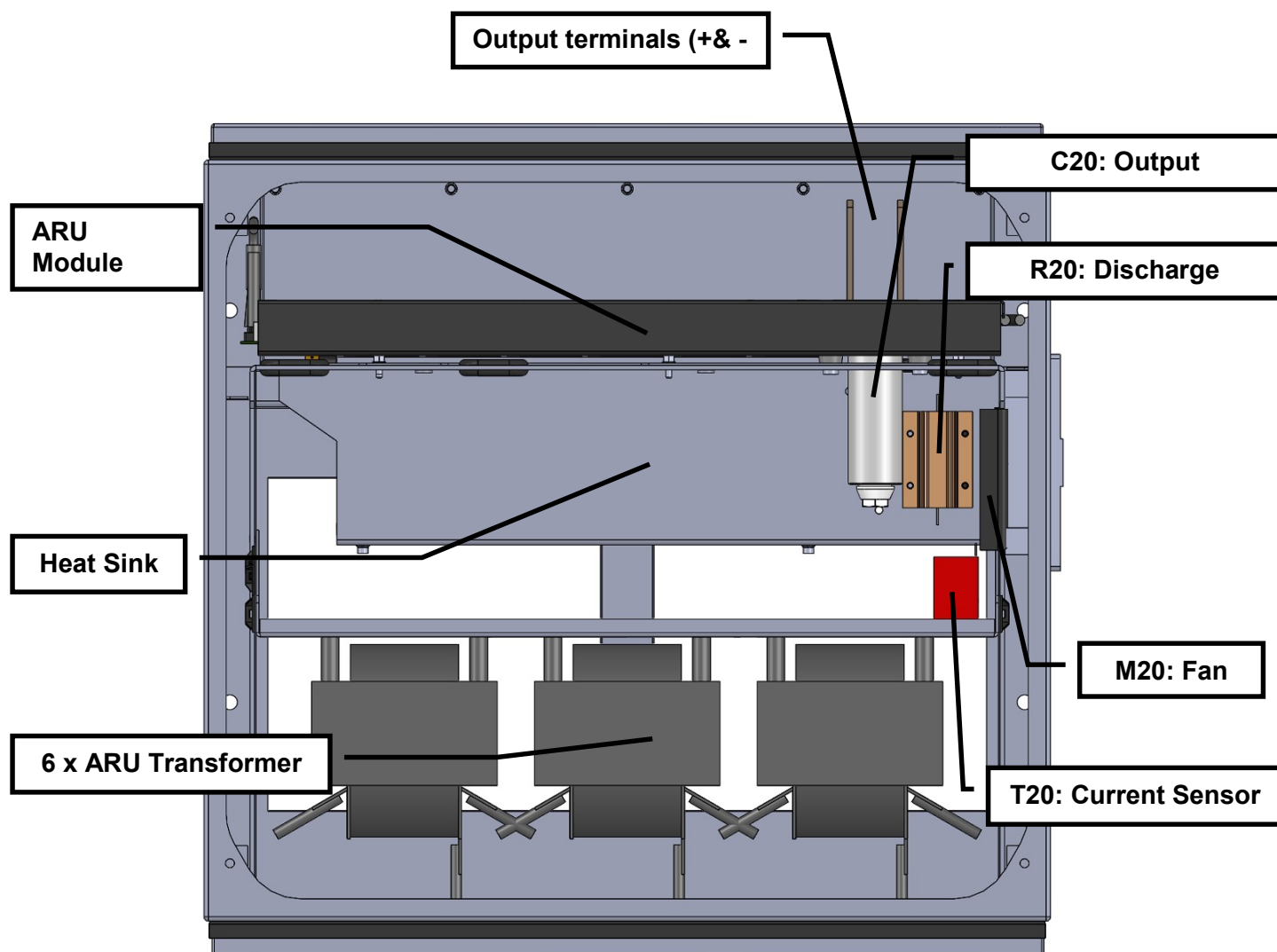


Figure 15.0.4 Top View (ARU)