iE 150 Marine Battery

Data sheet

DEIF — Improve Tomorrow

1. iE 150 Marine Battery

1. iE 150 Marine Battery

1.1   About the controller

The iE 150 Marine Battery controller provides reliable asset control and energy management on pleasure crafts and non-ocean going vessels, for example, tugs, workboats, crew boats, and riverboats. Several iE 150 Marine controllers can work together to make a power management system (PMS).

Use the iE 150 Marine Battery as a single controller to add battery and a shore connection (optional) to an existing site.

In an energy management system, use the controller for seamless integration of electrical storage with other power sources (including PV and gensets). You can prioritise the energy sources for supplying the load, and recharging the battery. The iE 150 Marine Battery controller includes a configurable charge scheme.

For sites with genset or shore connection controllers from other suppliers, use the iE 150 Marine Battery with open PMS to add solar, battery or shore connection controllers.

Operators can easily control the system from the display unit. Alternatively, use the communication options to connect to an HMI/SCADA system.

Grid-forming or grid-following
These modes are controlled by the iE 150 Marine Battery controller using the power control system (PCS) and battery control unit (BCU).

- **Grid-forming**
  For grid-forming (V/f), the iE 150 Marine Battery controller can act as the only energy source. The battery can provide the grid-forming power and work together with non-grid-forming sources, like solar and wind.
  If the system includes gensets, these are stopped if the load level, battery capacity, and state of charge conditions are fulfilled. When the battery is discharged or the load increases beyond the battery capacity, the gensets are reconnected.
- **Grid-following**
  For grid-following (P/Q), the controller is always connected to another grid-forming source, like a shore connection or genset. Use the battery as power buffer and providing spinning reserve.
- **Droop mode**
  If the energy storage system (ESS) supports this, the controller can run the ESS in droop mode for both grid-forming and grid-following. The controller controls the battery charge and discharge using V/f or P/Q set points from the configured droop curve (that is, like a virtual synchronous generator (VSG)).

Energy source or power source
The energy and power source functions determine the source priority. The source functions are not directly related to grid-forming and grid-following.

- **Energy source**
  For the energy source function (plant-leading), the controller prioritises battery power over genset power. As a result, the system uses as much battery power as possible before starting a genset.
- **Power source**
  For the power source function (plant assist), the controller operates parallel to other sources. Genset power is prioritised over battery power. This mode is used to make sure that spinning reserve requirements are met.

AC- or DC-coupled
You can use the iE 150 Marine Battery controller for both AC- and DC-coupled ESS applications.

For AC-coupled systems, you can define battery charging and discharging scheme. Using the charge scheme, in DEIF power management, you'll also be able to define the energy sources (gensets, PV, or shore) that you allow for charging purposes.
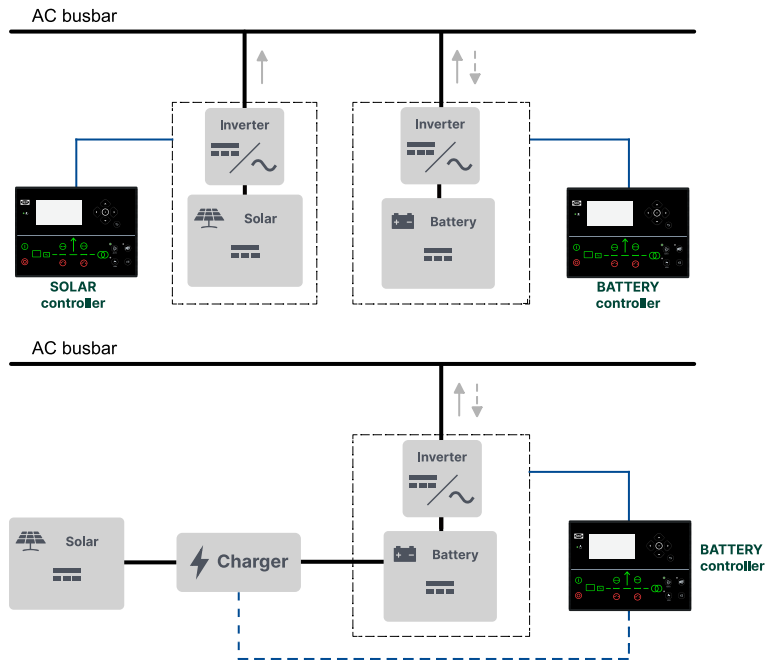
For DC-coupled systems, the battery is charged by its own PV bus. Depending on the PV-Battery system and supplier, the iE 150 Marine Battery controller can communicate with the PV inverter, and limit the current from the PV to the battery.

1.1.1 Software versions

The information in this document relates to software version:

Software	Details	Version
iE 150	Controller application	1.34.0

You can select the **Premium** software package, which is the only software package that includes the Battery functionalities.

1.1.2 Display layout

No.	Name	Function
1	Power	Green: The controller power is ON. OFF: The controller power is OFF.
2	Display screen*	Resolution: 240 x 128 px. Viewing area: 88.50 x 51.40 mm. Six lines, each with 25 characters.
3	Navigation buttons	Move the selector up, down, left and right on the screen.
	Enter button	Confirms the selection.
4	Back button	Go to the previous page.
5	AUTO mode	The controller automatically starts and stops (and connects and disconnects) the battery system. The controller automatically controls the power to and from the battery system. No operator actions are needed.
6	Silence horn	Stops an alarm horn (if configured) and enters the Alarm menu.
7	Shortcut menu	Access the Jump menu, Mode selection, Test, Lamp test, and Battery.
8	Manual mode	The operator or an external signal can also start or stop, and open and close the battery breaker. Automatic controller actions are not possible. The controller automatically synchronises before closing a breaker, and automatically de-loads before opening a breaker.
9	Breaker symbol	Green: Breaker is closed. Green flashing: Synchronising or de-loading. Red: Breaker failure.
10	Open breaker	Push to open the breaker.
11	Close breaker	Push to close the breaker.
12	Power converter	Green: Power converter voltage and frequency are OK. The controller can synchronise and close the breaker. Green flashing: The power converter voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. Red: The power converter voltage is too low to measure.
13	Battery management system	Green: There is battery system available feedback. Green flashing: The battery system is getting ready. Red: The battery system is not running, or there is no availability feedback.
14	Stop	Stops the power converter if manual is selected.
15	Start	Starts the power converter if manual is selected.
16	Load symbol	OFF: Power management application Green: The supply voltage and frequency are OK. Red: Supply voltage/frequency failure.

NOTE * You can use the display to monitor the battery operation.

1.1.3 Emulation

The controller includes an emulation tool to verify and test the functionality of the application, for example plant modes and logics, breaker handling, and generator operation.

Application emulation is useful for training, customising plant requirements and for testing basic functionality that needs to be set up or verified.

1.1.4 Easy configuration with the utility software

Set up an application easily with a PC and the utility software. You can also use the utility software to quickly configure the inputs, outputs, and parameters.

1.2 Functions and features

1.2.1 Battery functions

Battery functions	Premium
Power DC-DC system (PDS): DC-coupled solar or DC-charger, current limitation, spinning reserve for the DC-busbar	●
Energy battery breaker control	●
Energy usage monitoring	●
Power management	●
Reactive power control	●
Configurable dynamic power offset for the battery power reference (optional)	●
Configurable battery-specific PID control (optional)	6
Hotel load	●

Battery management system functions	Premium
BMS communication	●
Derate based on BMS state	●
Temperature-dependent derate	●
Energy usage monitoring	●
Maintenance alarms	●
Maintenance charge	●
DC breaker control	●

Power converter functions	Premium
PCS and BCU communication	●
Derate power converter output based on BMS maximum charge/discharge and state of charge (SOC)	●
Power ramp up and down control • Parameters to force ramp, override ramp, and adjust ramp change intervals	●
SOC balancing between parallel batteries (optional)	●
Off-grid isochronous master for reactive power regulation (optional)	●
Maintenance alarms	●
Configurable start signal	●
Analogue output power converter control (optional): • Analogue output from the controller	●

Protection packages	Premium
BMS protection	●
Inverter protection	●

Power management functions	Premium
Command schedulers	●
Generator priority selection: • Fuel optimisation • Genset starts automatically for low state of charge	● ●
Optimal load point for the genset(s) • Dynamic genset start/stop	●

NOTE   If you need to use redundant controllers (option T1), use an ASC-4 Battery controller.

1.2.2   General controller functions

AC functions	Premium
Sets of nominal settings	4
Select the AC configuration: • 3-phase/3-wire • 3-phase/4-wire • 2-phase/3wire (L1/L2/N or L1/L3/N) • 1-phase/2-wire L1	● ● ● ●
100 to 690 V AC (selectable)	●
CT -/1 or -/5 (selectable)	●
4th current measurement: Power from a Shore connection, Genset, or PV	●

General functions	Premium
Emulation for testing and front load commissioning	●
Built-in test sequences (Simple test, Load test, Full test, and Auxiliary supply test)	●
PLC logic (M-Logic)	80 lines
Counters, including: • Breaker operations • kWh meter (day, week, month, total) • kvarh meter (day, week, month, total)	● ● ● ●
General purpose PID regulators (2 × built-in analogue outputs can use these PID regulator references)	6
Simple load shedding and adding	●
Changeable controller type	●

Setting and parameter functions	Premium
User permission level	●
Password-protected setup	●
Trending on USW	●
Event logs with password, up to 500 entries	●

Display and language functions	Premium
Supports multiple languages (including Chinese, Russian, and other languages with special characters)	●
20 configurable graphical screens	●
Graphical display with six lines	●
Parameters can be changed on the display unit	●

Modbus functions	Premium
Modbus RS-485	●
Modbus TCP/IP	●
Configurable Modbus area	●

1.2.3 BMS, BCU and PCS communication

The controller supports a wide range of BMS, BCU and PCS protocols.

Implementing new protocols

Since new systems are launched every year, DEIF developers continuously implement new protocols. If your system is not listed, please contact DEIF. We can work with you to quickly implement the required protocol.

More information
See **Application note, DEIF hybrid controller compatibility** for the list of the supported protocols.

1.3   Alarms and protections

Protections	Alarms	ANSI	Operate time
Fast over-current	2	50P	<40 ms
Over-current	4	50TD	<200 ms
Voltage-dependent over-current	1	50V	
Over-voltage	2	59	<200 ms
Under-voltage	3	27P	<200 ms
Over-frequency	3	81O	<300 ms
Under-frequency	3	81U	<300 ms
Unbalanced voltage	1	47	<200 ms
Unbalanced current	1	46	<200 ms
Under-excitation or reactive power import	1	32RV	<200 ms
Over-excitation or reactive power export	1	32FV	<200 ms
Overload*	5	32F	<200 ms
IEC/IEEE inverse time over-current	1	51	-
Neutral inverse time over-current	1	50N	-
Earth inverse time over-current	1	50G	-
Busbar over-voltage	3	59P	<50 ms
Busbar under-voltage	4	27P	<50 ms
Busbar over-frequency	3	81O	<50 ms
Busbar under-frequency	4	81U	<50 ms
Emergency stop	1		<200 ms
Low auxiliary supply	1	27DC	
High auxiliary supply	1	59DC	
ES breaker external trip	1		
Synchronisation failure alarms	1/breaker		
Breaker open failure	1/breaker	52BF	
Breaker close failure	1/breaker	52BF	
Breaker position failure	1/breaker	52BF	
Phase sequence error	1	47	
De-load error	1		
Hz/V failure	1		
Not in Auto	1		
Vector shift	1	78	<40 ms
ROCOF (df/dt)	1	81R	<130 ms

NOTE   * You can configure these protections for overload or reverse power.

1.4 Applications

1.4.1 Grid-tied power management system

The iE 150 Marine Battery controller can integrate seamlessly into grid-tied applications. This includes power management applications with other DEIF controllers using CAN bus communication.

Use these configurations in new-build applications. To use the configurations in brownfield applications, all the genset, shore, battery and solar controllers must be replaced with DEIF controllers. The DEIF system can treat existing BTB controllers as externally controlled BTBs.

Grid-tied battery
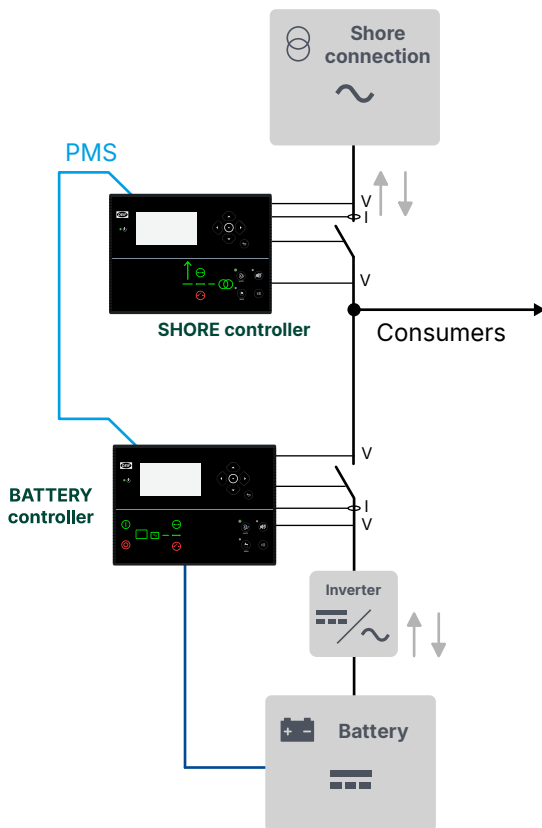
Grid-tied genset and battery
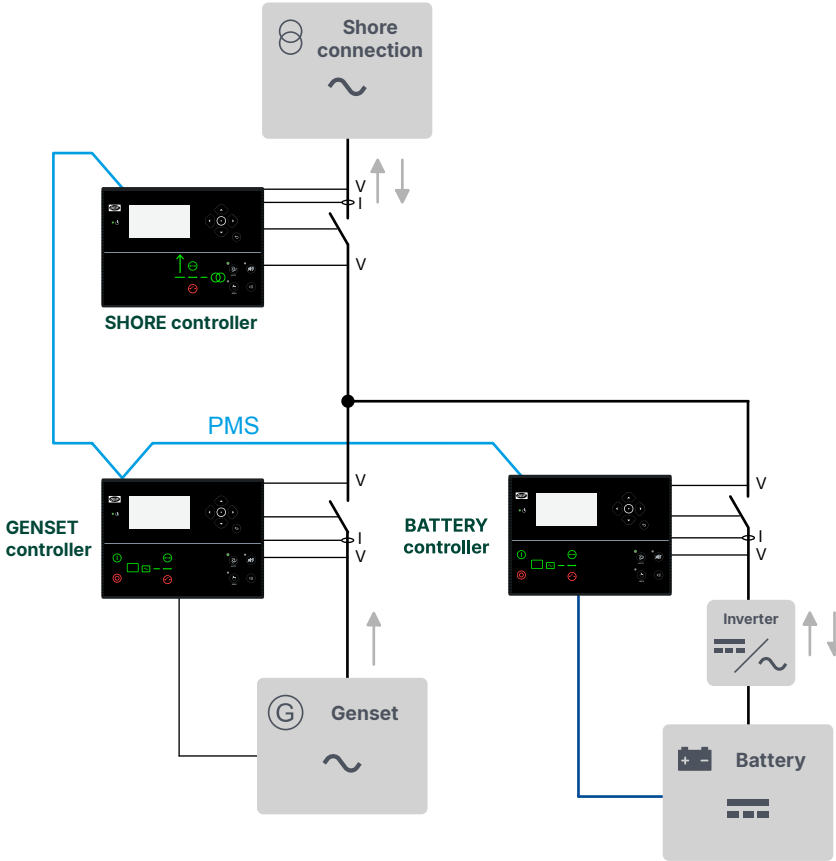
Grid-tied solar, genset, and battery
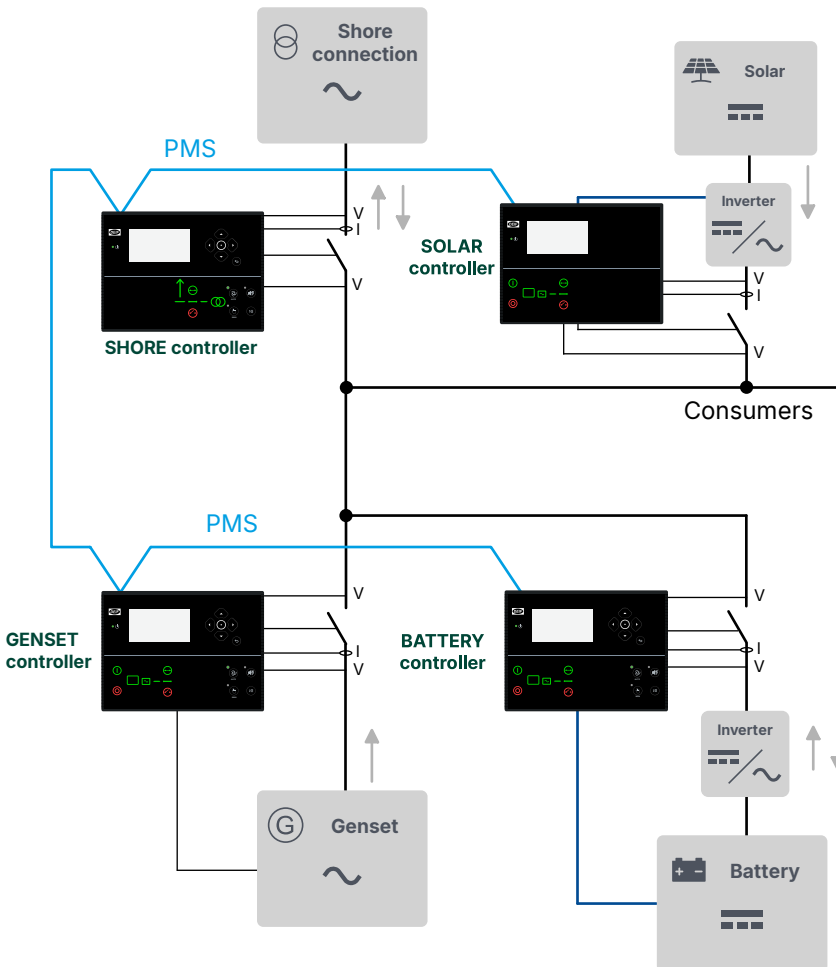
1.4.2 Off-grid power management system

The iE 150 Marine Battery controllers provide flexibility for off-grid applications.

You can use these controller configurations in new-build applications. To use these configurations in brownfield applications, all the genset, battery, and solar controllers must be replaced with DEIF controllers. Existing BTB controllers can be replaced, or treated as externally controlled BTBs.

Off-grid with solar and battery
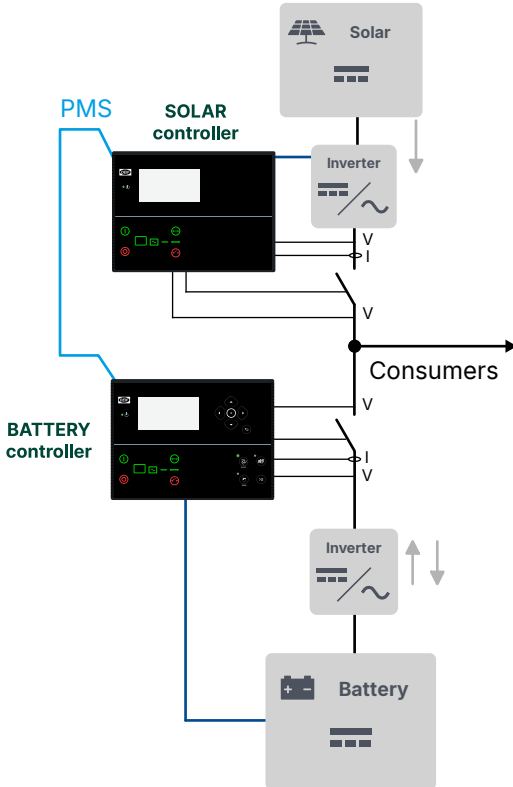
Off-grid with genset(s) and battery
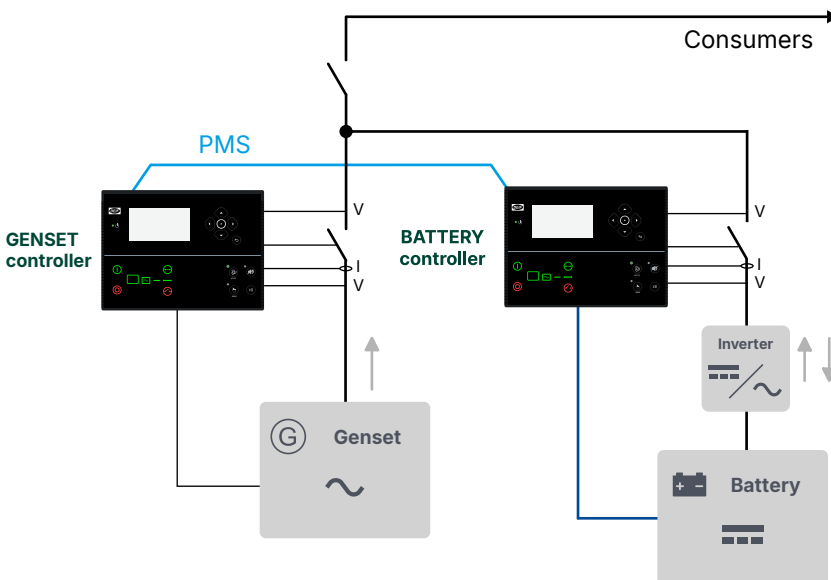
To improve power quality, the controller can supply peak loads while gensets start. The controller can support the load, so that the genset can run at its optimal load point. If the ESS is designed to supply the busbar load, the ESS can be the only source connected to the busbar.

Off-grid with genset(s), solar and battery
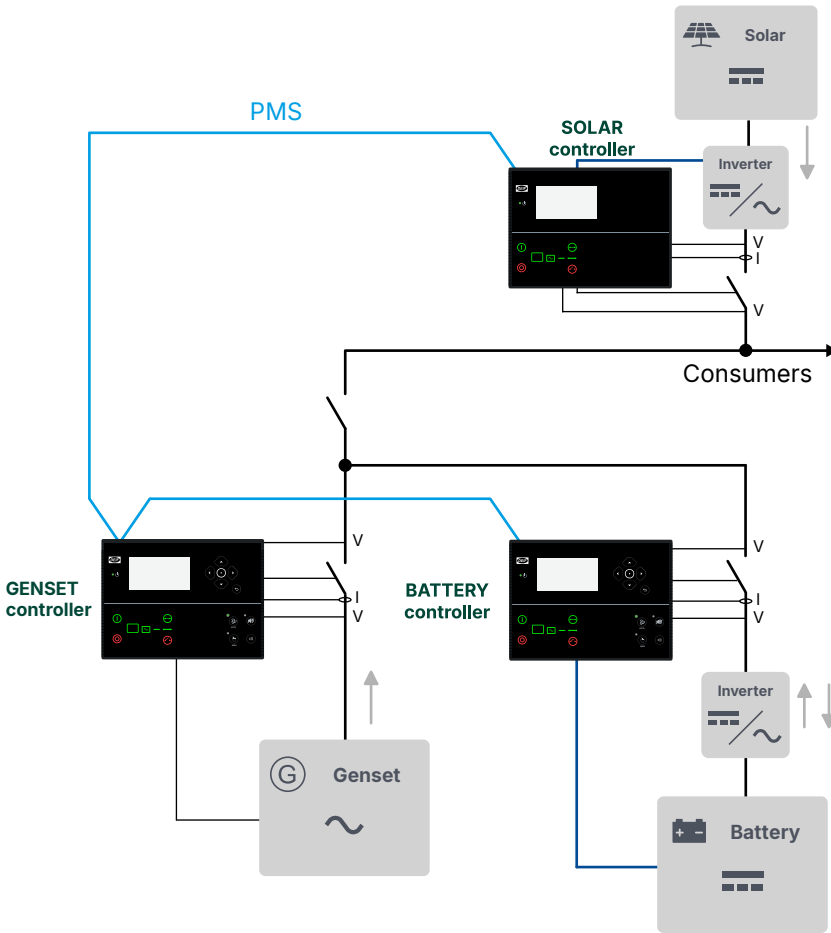
1.4.3   Open PMS

In an open power management system (PMS), the iE 150 Marine Battery controllers get power measurements from the externally controlled power source. You can therefore use open PMS to add power management to a brownfield application with third party gensets.

Off-grid solar, battery, and external genset(s)
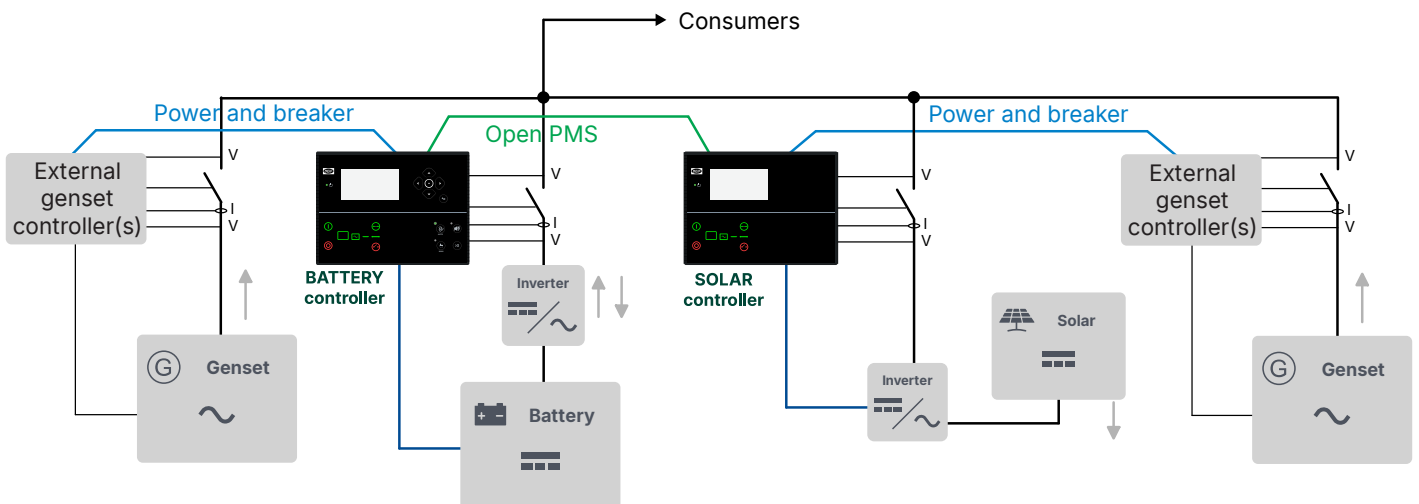
Grid-tied solar, battery and external shore connection

Shore connection

Power meter

Power and breaker

Consumers

Open PMS

BATTERY controller

SOLAR controller

Inverter

Solar

Inverter
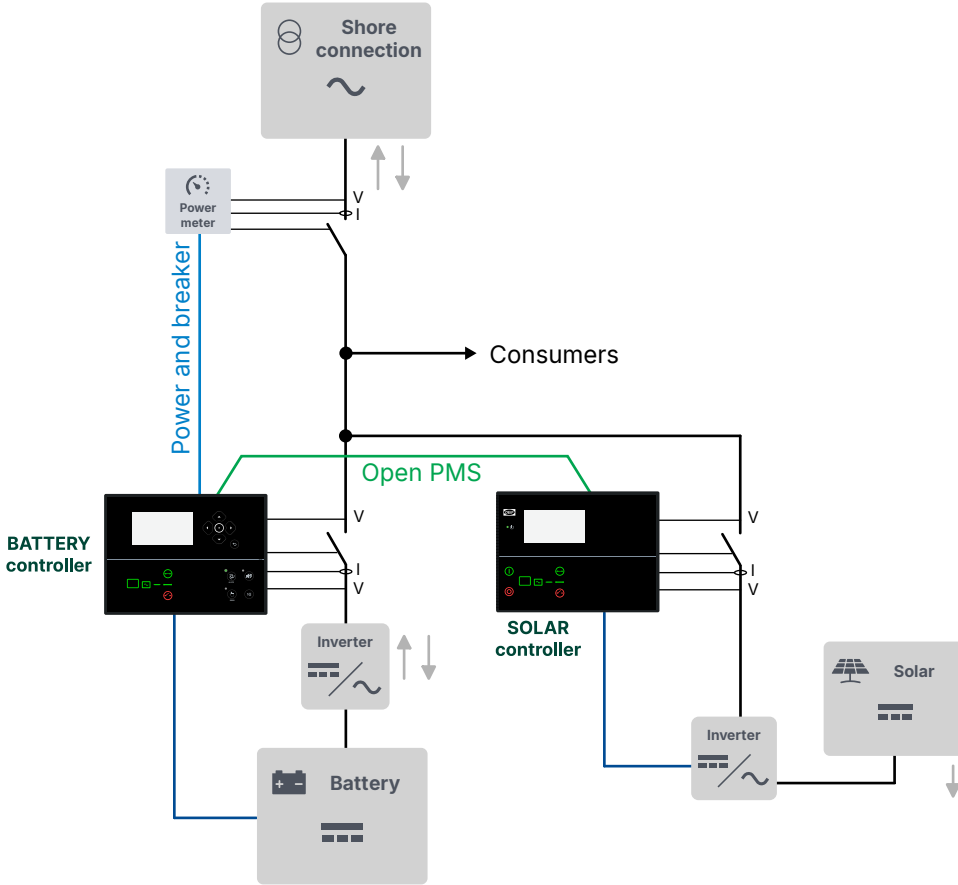
Battery

Grid-tied solar, battery, external genset(s) and external shore connection

Shore connection

Power meter

Power and breaker

Consumers

Open PMS

Power and breaker

BATTERY controller

SOLAR controller

External genset controller(s)

Inverter

Solar

Inverter

Genset

Battery

Grid-tied solar, battery, shore connection and external genset(s)
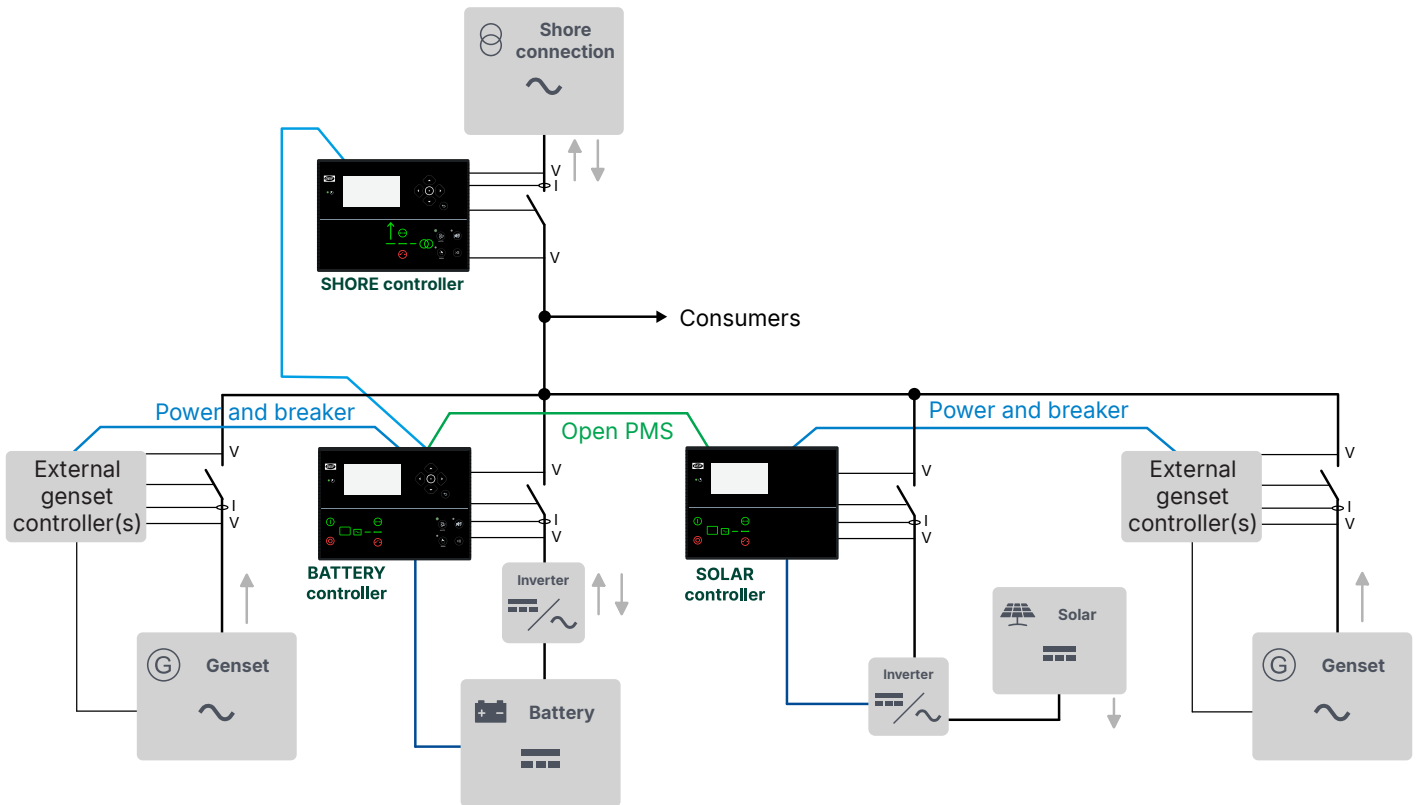
1.4.4 Single battery controller

Single battery controller with genset(s)

The iE 150 Marine Battery controller can support the load, so that the genset can run at its optimal load point.

Single battery controller with one shore connection

Single battery controller with PV

1.5 Power management

1.5.1 Introduction

The power management system automatically supplies the power that is necessary for the load efficiently, safely and reliably.

The power management system:
- Automatically charges and discharges the ESS
- Automatically uses the ESS as spinning reserve for PV and microgrids
- Automatically starts and stops generators
- Automatically closes and opens breakers
- Optimises the diesel genset load for high efficiency and low carbon footprint
- Optimises the fuel consumption
- Balances the loads in the system
- Deploys plant logic
- Makes sure that the system is safe

You can monitor the complete power management system from a graphical supervision page in the utility software. You can also see running status, hours in operation, breaker status, the condition of the busbars, fuel consumption, and so on.

Multi-master system

The power management system is a multi-master system, for increased reliability. In a multi-master system all vital data is transmitted between the controllers, so that all the controller know the power management status (calculations and position) in the application. As a result, the application does not have a single master controller.

Busbar sections

The system can be divided by up to two bus tie breakers. This makes it possible to control one section of the busbar without affecting the other sections.

1.5.2 Power management features

Power management features	Premium
Power management operation: • Number of generator controllers • Number of shore controllers • Number of BTB controllers • Number of solar controllers* • Number of battery (BESS) controllers*	2 1 2 2 2
Genset and Battery controllers: Ground relay management	●
Genset load-dependent start and stop	
Secured mode	●
Genset priority selection: • Manual • Running hours • Fuel optimisation	● ● ●
Safety stop of genset	●

NOTE   * The iE 150 Solar and Battery controllers must have the Sustainability (S10) option. Select the Premium software, which has S10 included. You can have a maximum of two sustainable controllers in the system. For example, if you have two battery controllers in the system, you cannot add a solar controller. If you have one battery controller in your system, you can add another battery controller or a solar controller.

1.5.3 Open PMS

Open PMS is a power management system that consists of solar and/or battery controllers. Open PMS can also include a shore connection controller. The iE 150 Marine Battery or Solar controller(s) get power measurements from the externally controlled power source(s). You can therefore use open PMS to add power management to a brownfield application with third party gensets.
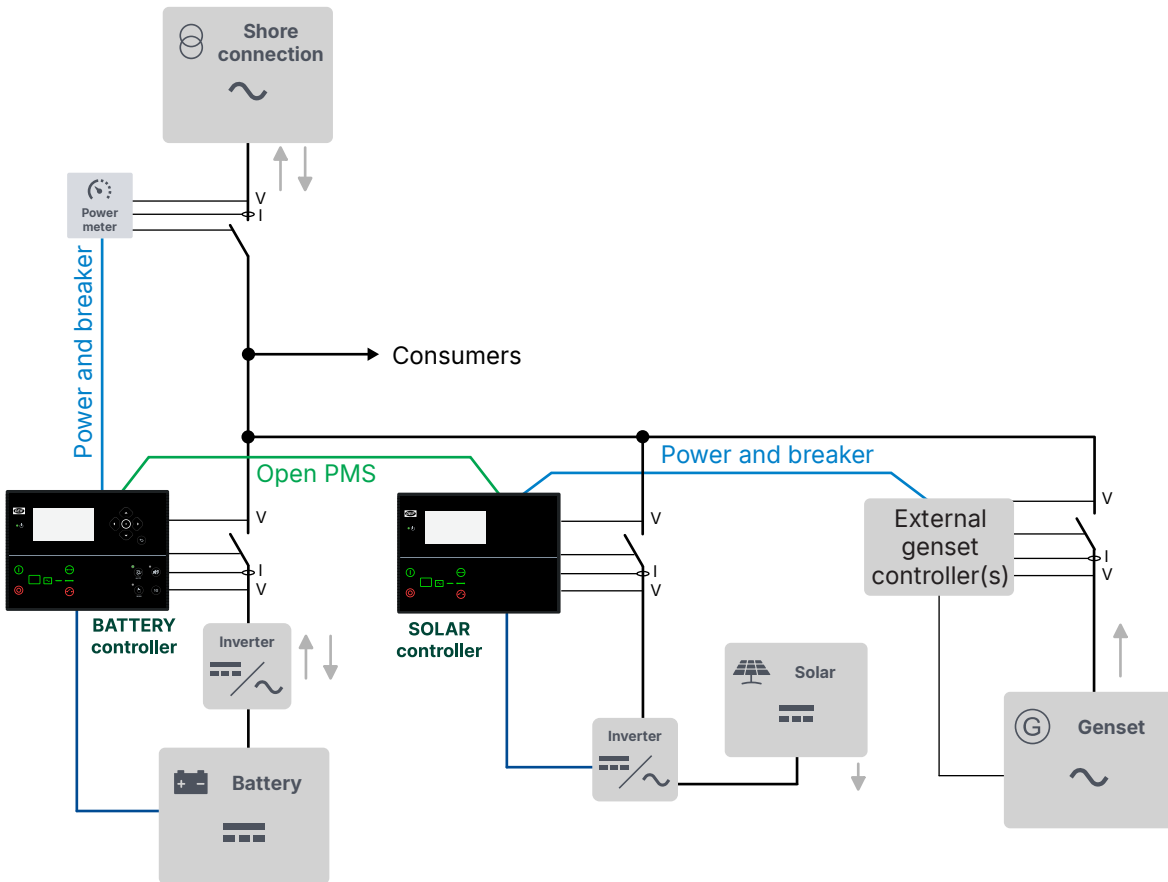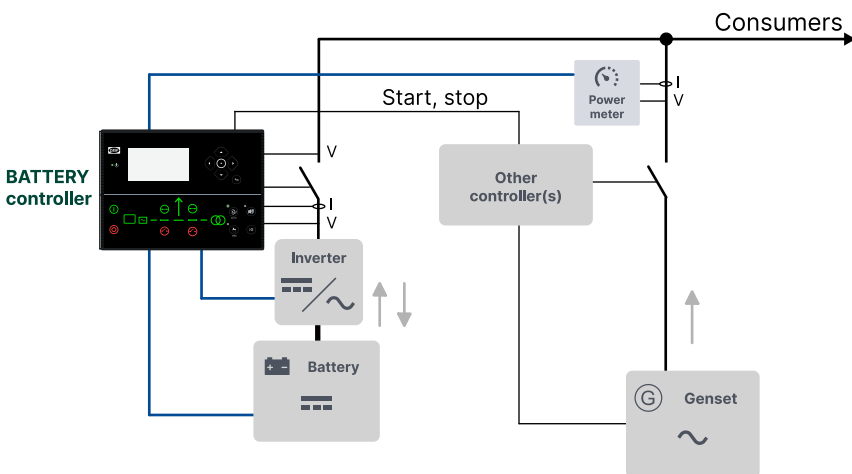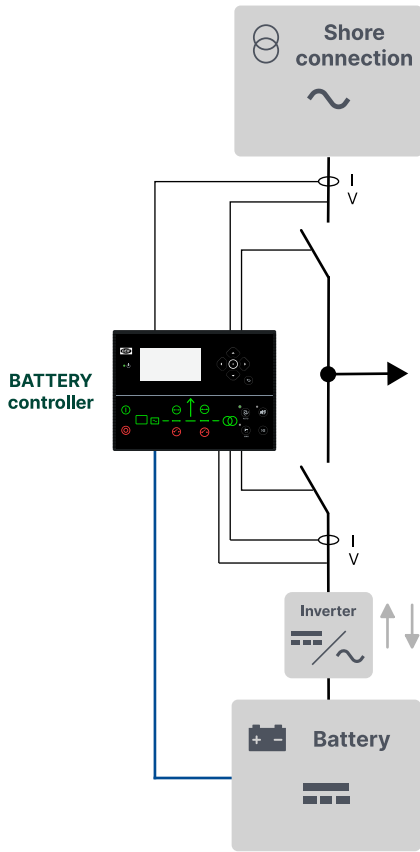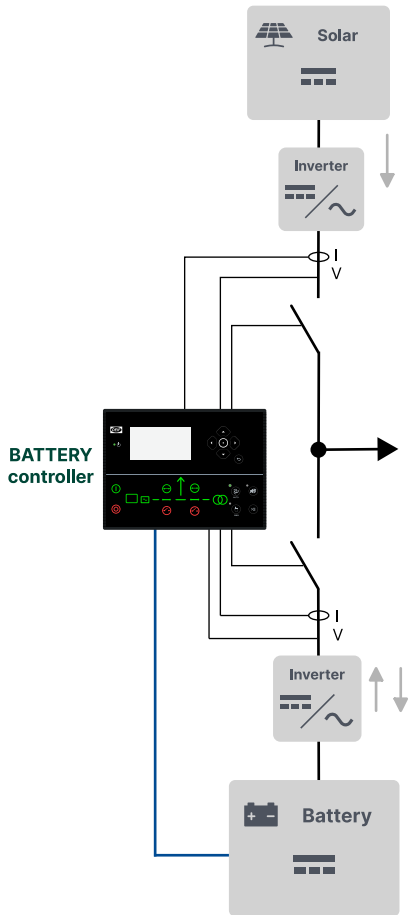
Open PMS automatically supplies the power that is necessary for the load efficiently, safely and reliably:

- Automatically maximises PV power
- Automatically optimises ESS power
- Automatically closes and opens breakers
- Balances the loads in the system
- Deploys logic

The open PMS operating data can be shown graphically on the controller display. You can also monitor open PMS from a graphical supervision page in the utility software.

Open PMS features

Open PMS features	Premium
Power management operation limits: • External generator controllers per solar/battery controller • Shore connection controllers • External shore connections • Solar controllers • Battery (BESS) controllers	16 1 1 2 2
External sources included in the available power: • Supply the busbar load • Charge batteries • Minimum and optimal genset load	● ● ● ●
Global or local start of external genset(s)	●

1.6 Single battery controller

The iE 150 Marine Battery can operate as a single controller, that is, without power management communication to other controllers. Single controllers are particularly useful for brownfield applications. Single controllers can also be used in new-build applications.

The single controller must get the power measurements and breaker positions for the power sources in the rest of the application.

- **Only one other power source**: You can use the controller's 4th current transformer terminals to measure the power.
- **Multiple other power sources**: You must use genset communication, power meters, or transducers.

The controller calculates the charging and discharging set points. The set points are determined by:

- The operating mode
- The system load and configuration
- The state of charge in the battery
- The power readings from the other power source(s)
- The breaker position(s) of the other power source(s)

Software variants

Single battery controller	Premium
External gensets	16
External shore connection	16
Energy battery breaker control	●
Shore breaker control (paralleling)	●
External power source (for example, genset) start and stop by an external relay, based on: • State of charge (SOC) • System load	●
Optimal load point for the genset(s)	●

1.7 Compatible products

1.7.1 Power meters

Power measurements are required in single controller applications, as well as in open PMS applications. The controller can receive measurements from these DEIF power meters:

- **MIB 8000C** (www.deif.com/products/mib-8000c)
- **MIC-2 MKII** (www.deif.com/products/mic-2-mkii)
- **MTR-4** (www.deif.com/products/mtr-4)

> **More information**
> See **Application note, DEIF hybrid controller compatibility** for supported power meters from other suppliers.

NOTE   Alternatively, you can use the USW to set up the controller to use Modbus to read values from your power meter. The controller can read P, Q, and up to four digital inputs.

1.7.2 Power measurements from gensets

Power measurements are required in single controller applications, as well as in open PMS applications. The controller can receive measurements from these DEIF genset controllers:

- **iE 150 Generator** (www.deif.com/products/ie-150)
- **AGC-4 Mk II Genset** (www.deif.com/products/agc-4-mk-ii)
- **AGC-4 Genset** (www.deif.com/products/agc-4)
- **CGC 400** (www.deif.com/products/cgc-400)

> **More information**
> See **Application note, DEIF hybrid controller compatibility** for supported power measurements from other genset suppliers.

1.7.3 Power management

You can use these controllers together in a power management system:

- **iE 150 Marine Generator** (www.deif.com/products/ie-150-marine)
- **iE 150 Marine Shore** (www.deif.com/products/ie-150-marine)
- **iE 150 Marine BTB** (www.deif.com/products/ie-150-marine)
- **iE 150 Marine Battery** (www.deif.com/products/ie-150-marine)
- **iE 150 Marine Solar** (www.deif.com/products/ie-150-marine)

1.7.4   Open PMS

You can use these controllers together in an open power management system:

* **iE 150 Solar** (www.deif.com/products/ie-150)
* **iE 150 Battery** (www.deif.com/products/ie-150)
* **iE 150 Mains** (www.deif.com/products/ie-150)
* **iE 150 Marine Solar** (www.deif.com/products/ie-150-marine)
* **iE 150 Marine Battery** (www.deif.com/products/ie-150-marine)
* **iE 150 Marine Shore** (www.deif.com/products/ie-150-marine)
* **ASC-4 Solar** (www.deif.com/products/asc-4-solar)
* **ASC-4 Battery** (www.deif.com/products/asc-4-battery)
* **AGC-4 Mk II Mains** (www.deif.com/products/agc-4-mk-ii)

You can also use **iE 150 Generator**, **AGC-4 Mk II Genset** and/or **AGC-4 Genset** as external gensets. That is, the genset controllers are not part of the open PMS. They can send their power measurements to the open PMS controllers over CAN bus.

1.7.5   Remote monitoring service: Insight

Insight is a responsive remote monitoring service (www.deif.com/products/insight). It includes real-time genset data, a customisable dashboard, GPS tracking, equipment and user management, email and/or SMS alerts, and cloud data management.

1.7.6   Additional inputs and outputs

iE 150 uses CAN bus communication with these:

* **CIO 116** is a remote input expansion module (www.deif.com/products/cio-116)
* **CIO 208** is a remote output expansion module (www.deif.com/products/cio-208)
* **CIO 308** is a remote I/O module (www.deif.com/products/cio-308)
* **IOM 220** and **IOM 230** each have two analogue outputs. These can be used for general PID control (www.deif.com/products/iom-200230/)

1.7.7   Additional operator panel, AOP-2

The controller uses CAN bus communication to the additional operator panel (AOP-2). Configure the controller using M-Logic. On the AOP-2, the operator can then:
* Use the buttons to send commands to the controller.
* See LEDs light up to show statuses and/or alarms.

You can configure and connect two AOP-2s if the controller has the premium software package.

1.7.8   Other equipment

DEIF has a wide variety of other equipment that is compatible. Here are some examples:

* **Synchroscopes**
  * **CSQ-3** (www.deif.com/products/csq-3)
* **Battery chargers/power supplies**
  * **DBC-1** (www.deif.com/products/dbc-1)
* **Current transformers**
  * **ASK** (www.deif.com/products/ask-asr)

- **KBU** (www.deif.com/products/kbu)
- **Transducers**
  - **MTR-4** (www.deif.com/products/mtr-4)

1.7.9   Controller types

MARINE configurations

Parameter	Setting	Controller type	Minimum software package
9101	Engine Drive Marine unit	Engine drive controller for marine use	Core
	Genset Marine unit	Core genset controller for marine use	Core
	Genset Marine unit	Genset controller for marine use	Power management
	Shore Marine unit	Shore controller for marine use	Power management
	BTB Marine unit	BTB controller for marine use	Power management
	Battery Marine unit	Battery controller for marine use	Premium
	Solar Marine unit	Solar controller for marine use	Premium

Software packages and controller types

The controller software package determines which functions the controller can use.

- **Core (Stand-alone)**
- **Power management (PM)**
  - You cannot change the controller type to any other controller type.
- **Premium**
  - You can change the controller type to any other controller type.
  - All functions are supported.

You can select the controller type under `Basic settings > Controller settings > Type`.

NOTE   For iE 150 controllers for land, see www.deif.com/products/ie-150.

2. Technical specifications

2.1 Dimensions
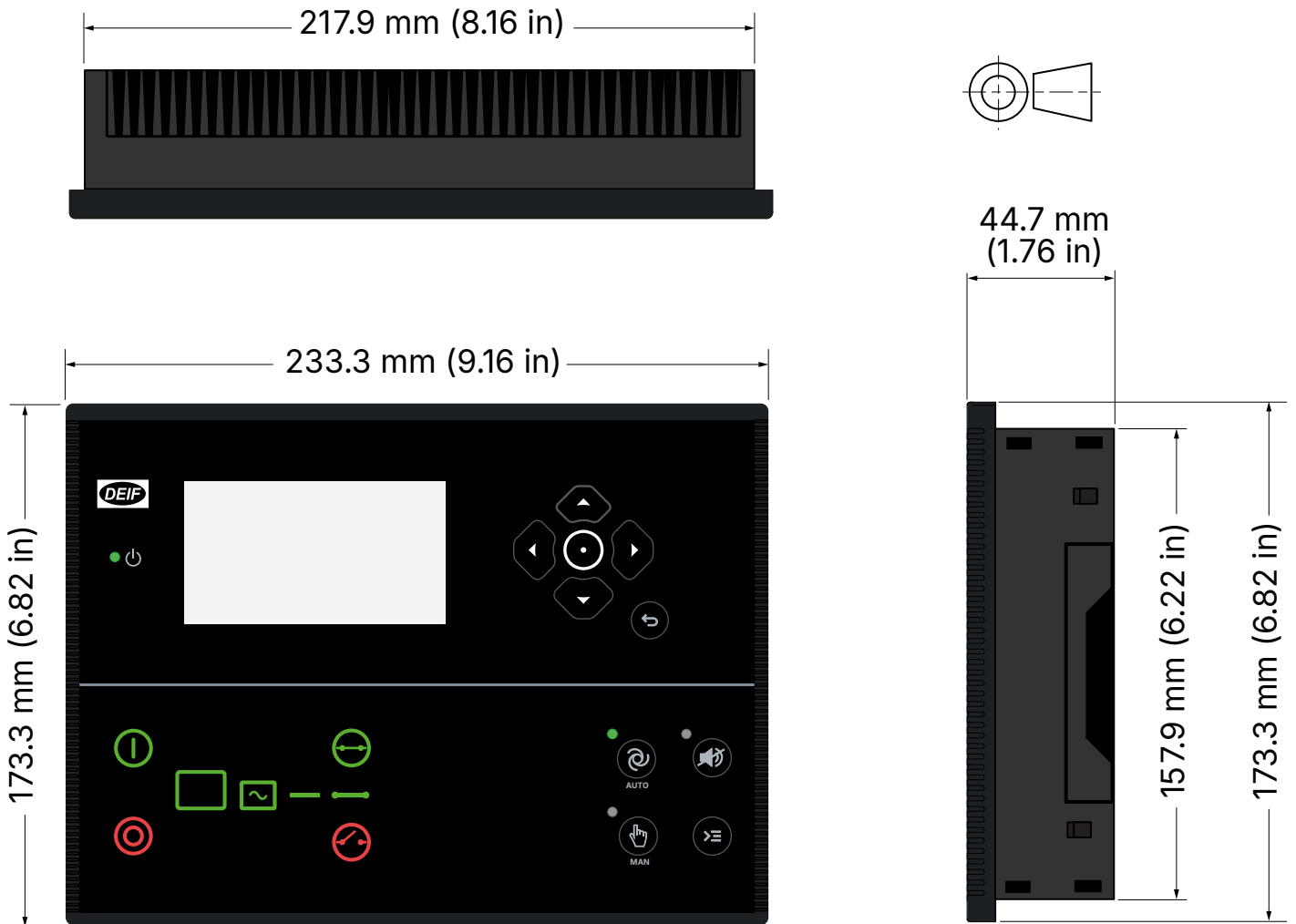
Dimensions and weight	
Dimensions	Length: 233.3 mm (9.16 in) Height: 173.3 mm (6.82 in) Depth: 44.7 mm (1.76 in)
Panel cutout	Length: 218.5 mm (8.60 in) Height: 158.5 mm (6.24 in) Tolerance: ± 0.3 mm (0.01 in)
Max. panel thickness	4.5 mm (0.18 in)
Mounting	UL/cUL Listed: Type complete device, open type 1 UL/cUL Listed: For use on a flat surface of a type 1 enclosure
Weight	0.79 kg

2.2 Mechanical specifications

Operation conditions	
Vibration	Response: • 10 to 58.1 Hz, 0.15 mmpp

Operation conditions	
	• 58.1 to 150 Hz, 1 *g*. To IEC 60255-21-1 (Class 2) Endurance: • 10 to 150 Hz, 2 *g*. To IEC 60255-21-1 (Class 2) Seismic vibration: • 3 to 8.15 Hz, 15 mmpp • 8.15 to 35 Hz, 2 *g*. To IEC 60255-21-3 (Class 2)
Shock	10 *g*, 11 ms, half sine. To IEC 60255-21-2 Response (Class 2) 30 *g*, 11 ms, half sine. To IEC 60255-21-2 Withstand (Class 2) 50 *g*, 11 ms, half sine. To IEC 60068-2-27, test Ea Tested with three impacts in each direction in three axes (total of 18 impacts per test)
Bump	20 *g*, 16 ms, half sine IEC 60255-21-2 (Class 2) Tested with 1000 impacts in each direction on three axes (total of 6000 impacts per test)
Galvanic separation	CAN port 2 (CAN B): 550 V, 50 Hz, 1 minute RS-485 port 1: 550 V, 50 Hz, 1 minute Ethernet: 550 V, 50 Hz, 1 minute Analogue output 51-52 (GOV): 550 V, 50 Hz, 1 minute Analogue output 54-55 (AVR): 3000 V, 50 Hz, 1 minute Note: No galvanic separation on CAN port 1 (CAN A) and RS-485 port 2
Safety	Installation CAT. III 600 V Pollution degree 2 IEC/EN 60255-27
Flammability	All plastic parts are self-extinguishing to UL94-V0
EMC	IEC/EN 60255-26

2.3 Environmental specifications

Operation conditions	
Operating temperature (incl. display screen)	-40 to +70 °C (-40 to +158 °F)
Storage temperature (incl. display screen)	-40 to +85 °C (-40 to +185 °F)
Accuracy and temperature	Temperature coefficient: 0.2 % of full scale per 10 °C
Operating altitude	0 to 4000 m with derating
Operating humidity	Damp Heat Cyclic, 20/55 °C at 97 % relative humidity, 144 hours. To IEC 60255-1 Damp Heat Steady State, 40 °C at 93 % relative humidity, 240 hours. To IEC 60255-1
Change of temperature	70 to -40 °C, 1 °C / minute, 5 cycles. To IEC 60255-1
Protection degree	IEC/EN 60529 • IP65 (front of module when installed into the control panel with the supplied sealing gasket) • IP20 on terminal side

2.4 Controller

2.4.1 Typical wiring for battery controller
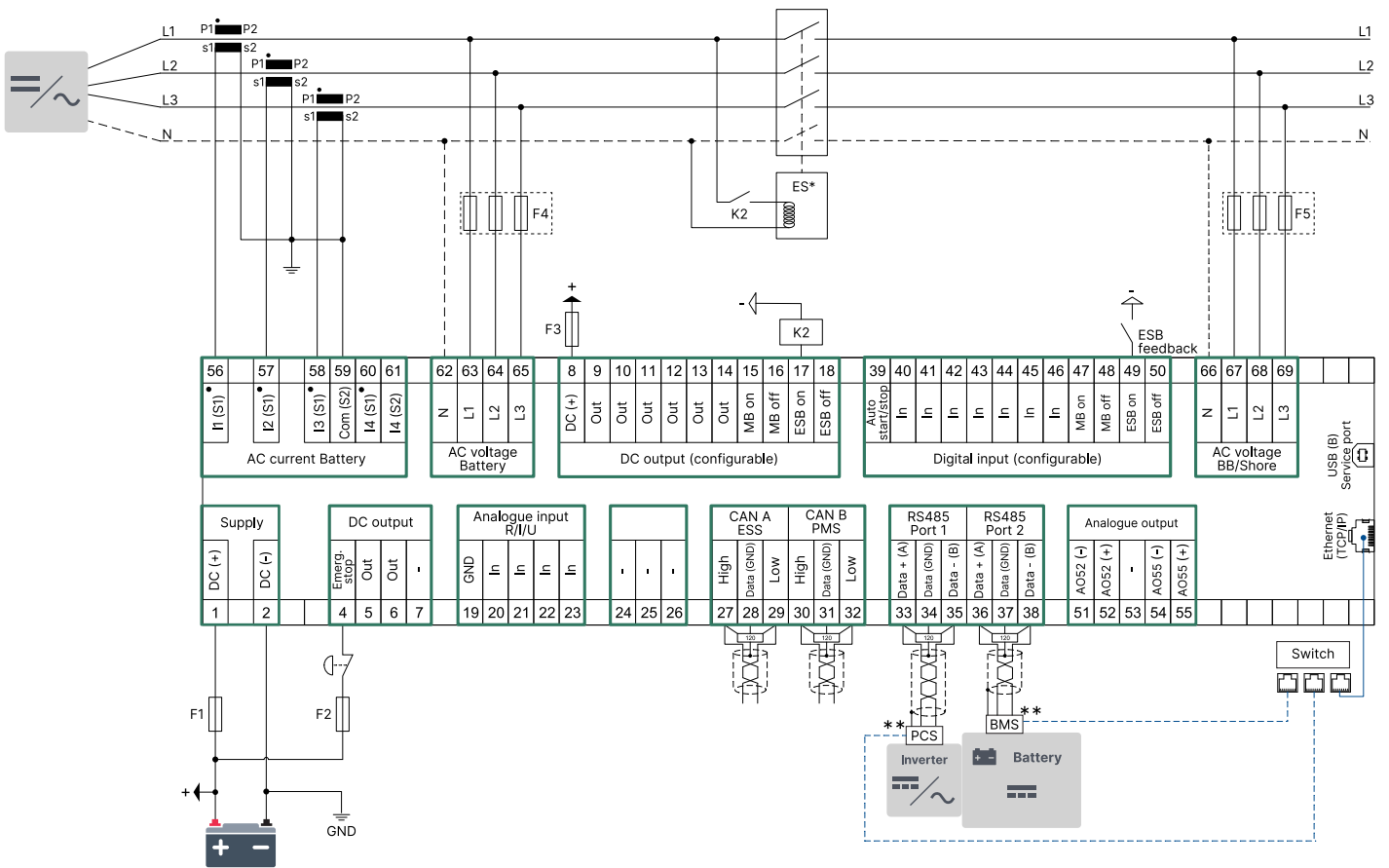
NOTE   * ES: Optional ES breaker.

** BMS and PCS: The controller can use RS-485 or Ethernet communication. The RS-485 communication can be daisy chained from one port.

Fuses:

- F1: 2 A DC max. time-delay fuse/MCB, c-curve
- F2: 6 A DC max. time-delay fuse/MCB, c-curve
- F3: 4 A DC max. time-delay fuse/MCB, b-curve
- F4, F5: 2 A AC max. time-delay fuse/MCB, c-curve

2.4.2 Electrical specifications

Power supply	
Power supply range	Nominal voltage: 12 V DC or 24 V DC Operating range: 6.5 to 36 V DC
Voltage withstand	Reverse polarity
Power supply drop-out immunity	0 V DC for 50 ms (coming from min. 6 V DC)
Power supply load dump protection	Load dump protected according to ISO16750-2 test A
Power consumption	5 W typical 12 W max.
RTC clock	Time and date backup

Supply voltage monitoring

Measuring range	0 V to 36 V DC Max. continuous operating voltage: 36 V DC
Resolution	0.1 V
Accuracy	±0.35 V

Voltage measurement

Voltage range	Nominal range: 100 to 690 V phase-to-phase (above 2000 m derate to max. 480 V)
Voltage withstand	U_n +35 % continuously, U_n +45 % for 10 seconds Measuring range of nominal: 10 to 135 % Low range, nominal 100 to 260 V: 10 to 351 V AC phase-to-phase High range, nominal 261 to 690 V: 26 to 932 V AC phase-to-phase
Voltage accuracy	±1 % of nominal within 10 to 75 Hz +1/-4 % of nominal within 3.5 to 10 Hz
Frequency range	3.5 to 75 Hz
Frequency accuracy	±0.01 Hz within 60 to 135 % of nominal voltage ±0.05 Hz within 10 to 60 % of nominal voltage
Input impedance	4 MΩ/phase-to-ground, and 600 kΩ phase/neutral

Current measurement

Current range	Nominal: -/1 A and -/5 A Range: 2 to 300 %
Number of CT input	4
Max. measured current	3 A (-/1 A) 15 A (-/5 A)
Current withstand	7 A continuous 20 A for 10 seconds 40 A for 1 second
Current accuracy	From 10 to 75 Hz: • ±1 % of nominal from 2 to 100% current • ±1 % of measured current from 100 to 300 % current From 3.5 to 10 Hz: • +1/-4 % of nominal from 2 to 100 % current • +1/-4 % of measured current from 100 to 300 % current
Burden	Max. 0.5 VA

Power measurement

Accuracy power	±1 % of nominal within 35 to 75 Hz
Accuracy power factor	±1 % of nominal within 35 to 75 Hz

Digital inputs

Number of inputs	12 x digital inputs Negative switching
Maximum input voltage	+36 V DC with respect to plant supply negative

Digital inputs

Minimum input voltage	-24 V DC with respect to plant supply negative
Current source (contact cleaning)	Initial 10 mA, continuous 2 mA

DC outputs

Number of 3 A outputs	2 x outputs 15 A DC inrush and 3 A continuous, supply voltage 0 to 36 V DC Endurance tested according to UL/ULC6200:2019 1.ed: 24 V, 3 A, 100000 cycles (with an external freewheeling diode)
Number of 0.5 A outputs	10 x outputs 2 A DC inrush and 0.5 A continuous, supply voltage 4.5 to 36 V DC
Common	12/24 V DC

Analogue inputs

Number of inputs	4 x analogue inputs
Electrical range	Configurable as: • Negative switching digital input • 0 V to 10 V sensor • 4 mA to 20 mA sensor • 0 Ω to 2.5 kΩ sensor
Accuracy	Current: • Accuracy: ±20 uA ±1.00 % rdg Voltage: • Range: 0 to 10 V DC • Accuracy: ±20 mV ±1.00 % rdg RMI 2-wire LOW: • Range: 0 to 800 Ω • Accuracy: ±2 Ω ±1.00 % rdg RMI 2-wire HIGH: • Range: 0 to 2500 Ω • Accuracy: ±5 Ω ±1.00 % rdg

Analogue outputs

Output type	Isolated DC voltage output
Voltage range	-10 to +10 V DC
Resolution	Less than 1 mV
Maximum voltage	Output 52: ±550 V Output 55: ±3 kV
Minimum load	500 Ω
Accuracy	±1 % of setting value

Display unit

Type	Graphical display screen (monochrome)
Resolution	240 x 128 pixels
Navigation	Five-key menu navigation

Display unit	
Log book	Data log and trending function
Language	Multi-language display

2.4.3 Communication

Communication	
CAN A	**CAN port - ESS** You can connect these in a daisy chain (and operate them at the same time): • CIO 116, CIO 208, and CIO 308 Data connection 2-wire + common, or 3-wire Not isolated External termination required (120 Ω + matching cable)
CAN B	**CAN port - PMS** Used for: • Power management communication • AOP-2 Data connection 2-wire + common, or 3-wire Isolated External termination required (120 Ω + matching cable) PMS 125 kbit and 250 kbit
RS-485 Port 1	Used for: • Modbus master to PCS/BCU, BMS and PDS • Power meters • Modbus RTU, PLC, SCADA, Remote monitoring (Insight) Data connection 2-wire + common, or 3-wire Isolated External termination required (120 Ω + matching cable) 9600 to 115200
RS-485 Port 2	Used for: • Modbus master to PCS/BCU, BMS and PDS • Power meters • Modbus RTU, PLC, SCADA, Remote monitoring (Insight) Data connection 2-wire + common, or 3-wire Not isolated External termination required (120 Ω + matching cable) 9600 to 115200
RJ45 Ethernet	Used for: • Modbus master to PCS/BCU, BMS and PDS • Modbus to PLC, SCADA, and so on • NTP time synchronisation with NTP servers • Power management system (PMS) communication between iE 150 controllers • PC utility software Isolated Auto detecting 10/100 Mbit Ethernet port
USB	Service port (USB-B)

2.5   Approvals

Standards
CE
Pending: DNV approval

NOTE   Refer to www.deif.com for the most recent approvals.

2.5.1   UL/cUL Listed

Requirements	
Installation	To be installed in accordance with the NEC (US) or the CEC (Canada)
Enclosure	A suitable type 1 (flat surface) enclosure is required Unventilated/ventilated with filters for controlled/pollution degree 2 environment
Mounting	Flat surface mounting
Connections	Use 90 °C copper conductors only
Wire size	AWG 30-12
Terminals	Tightening torque: 5-7 lb-in.
Current transformers	Use Listed or Recognized isolating current transformers
Communication circuits	Only connect to communication circuits of a listed system/equipment

2.6   Spare parts and accessories

Name	Details	Included with controller
Connector kit	A set of terminal blocks.	●
Fixing clamps	Clamps for mounting the controller.	●
J4	PC Ethernet cable crossed, 3 m. UL94 (V1) approved. Weight 0.2 kg (0.4 lbs).	
J7	PC cable for utility software (USB), 3 m. UL94 (V1) approved. Weight 0.2 kg (0.4 lbs).	

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