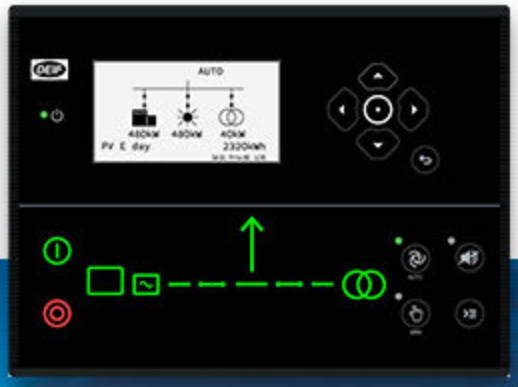
iE 150 Marine Solar

4921240729A

Data sheet

DEIF Improve Tomorrow



1. iE 150 Marine Solar

2. Compatible products

3. Technical specifications

4. Legal information

1. iE 150 Marine Solar

1.1 About

The iE 150 Marine Solar 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).

The iE 150 Marine Solar controller is a fully flexible controller to control and protect a photovoltaic (PV) system with up to 32 inverters.

Use iE 150 Marine Solar as a single controller to add PV power and a shore connection (optional) to an existing vessel.

In a power management system (PMS), use iE 150 Marine Solar for seamless integration of PV power with other power sources (including battery/storage, gensets and/or shore connection). To save fuel, the PMS maximises PV penetration, while making sure that the gensets meet their minimum load requirements. The PMS also makes sure that spinning reserve requirements are met, and responds quickly to load and weather changes.

For vessels with genset and/or shore connection controllers from other suppliers, use iE 150 Marine Solar with open PMS to add solar, battery/storage and/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.

1.1.1 Software packages

The controller must have the **Premium** software package.

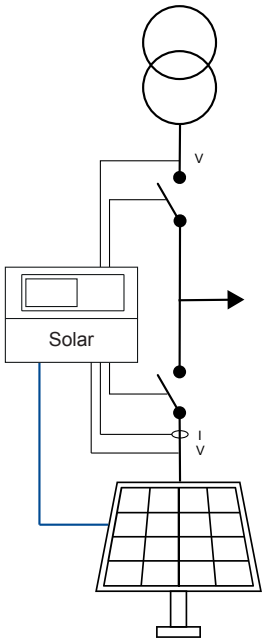
1.2 Single line drawings for single solar controllers

The controller 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 greenfield applications.

Software variants

Single solar controller	Premium
External gensets	16
External shore connection	16
Photovoltaic breaker (PVB) control	●
Shore breaker control (paralleling)	●

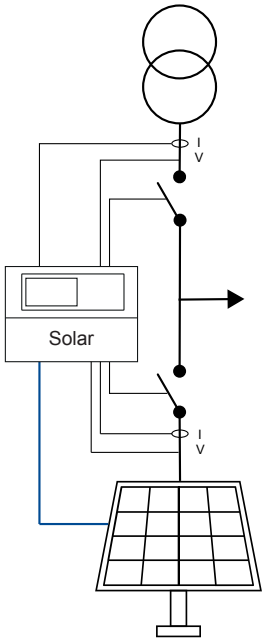
Single solar controller with fixed power



Fixed power: When given a signal, the controller starts, synchronises, and connects the PV. After the breaker closes, the controller ramps up the load to the set point level. When the stop command is given, the PV breaker is de-loaded, opened and the PV is stopped.

The solar controller can also control the shore connection breaker. For fixed power, the controller does not need power measurements from other power sources.

Single solar controller with peak shaving, and mains power export

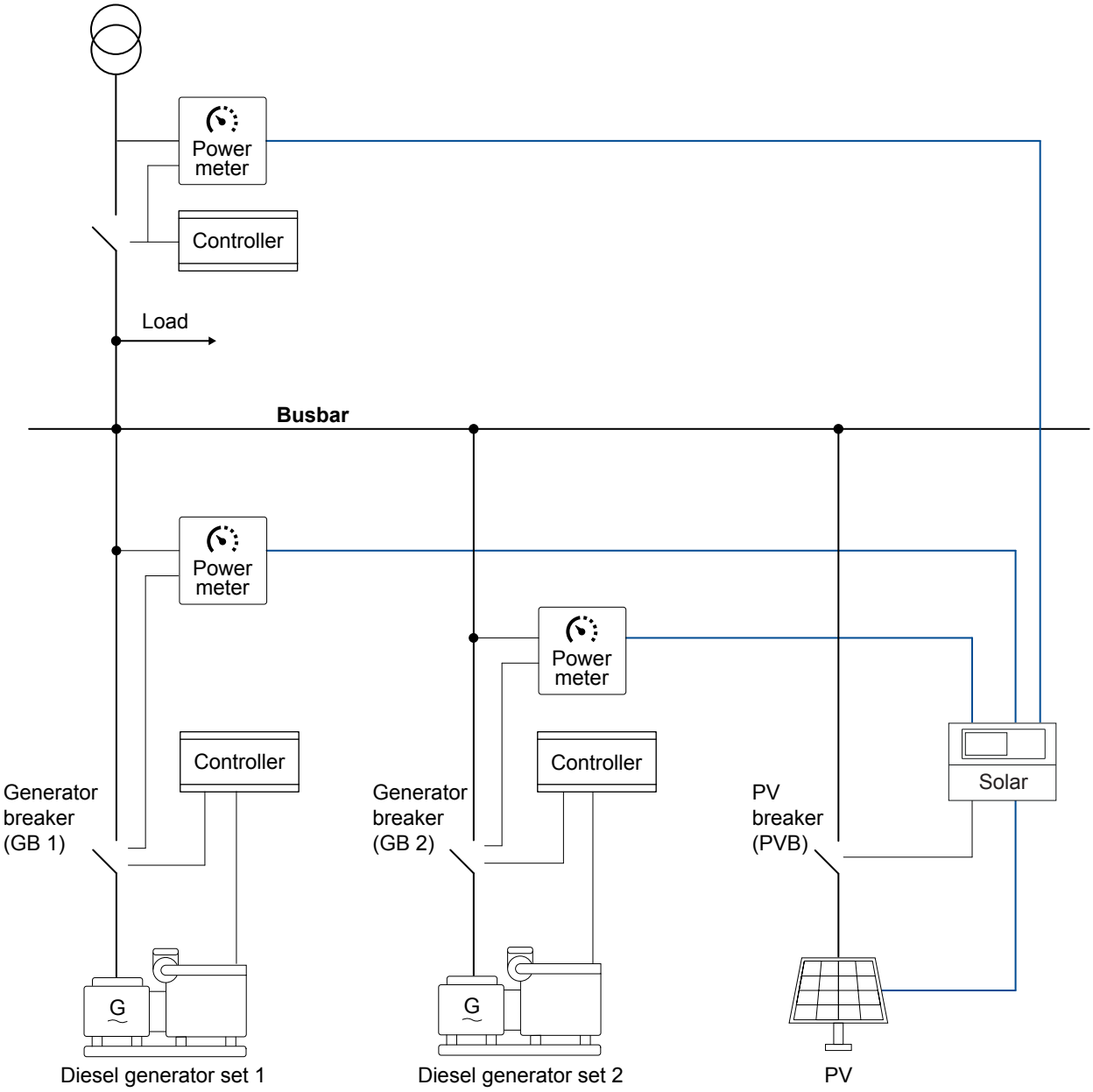


- **Peak shaving**: Power plant where the PV supplies the peak load demand and runs parallel to mains.
- **Mains power export**: PV with fixed kW set point (excluding increasing load).

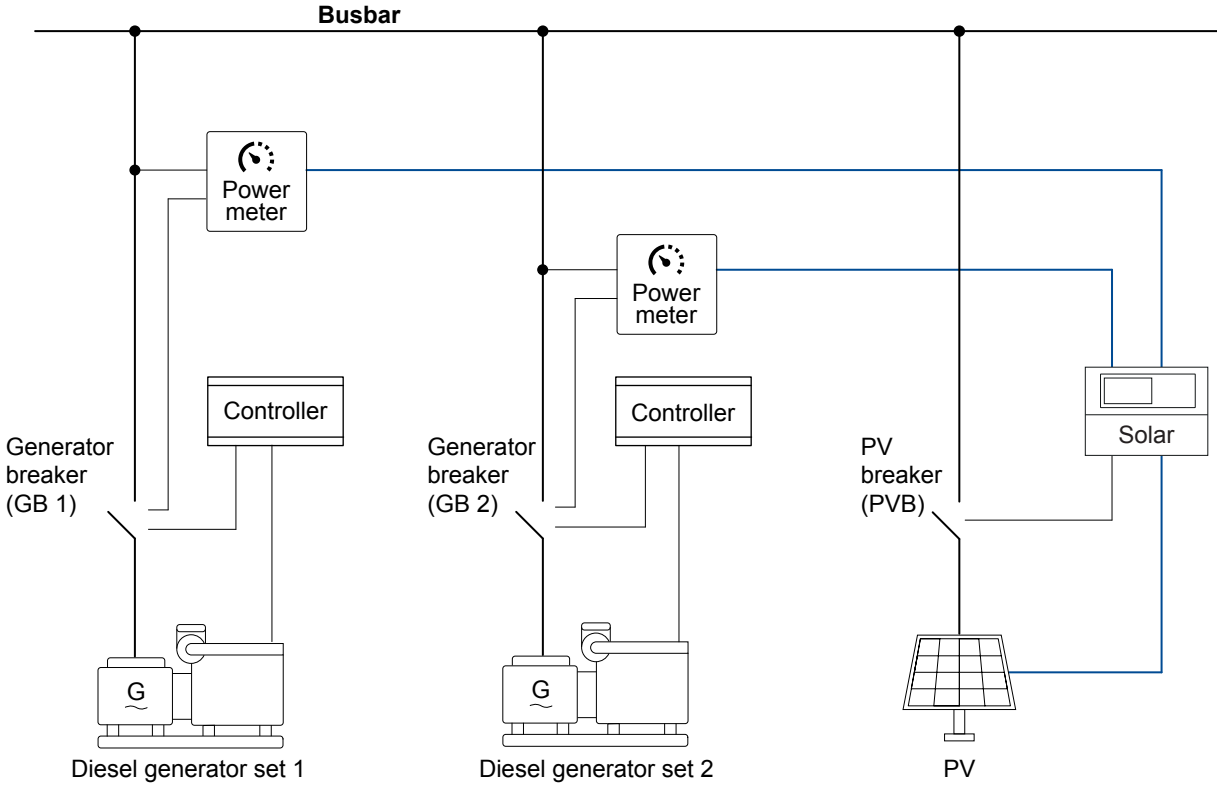
The solar controller calculates the power set points for the PV power plant based on power readings and breaker positions.

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

Adding a single solar controller to an existing vessel with a shore connection (brownfield application)



Adding a single solar controller to an existing vessel (brownfield application)



1.3 Single-line application diagrams for PMS

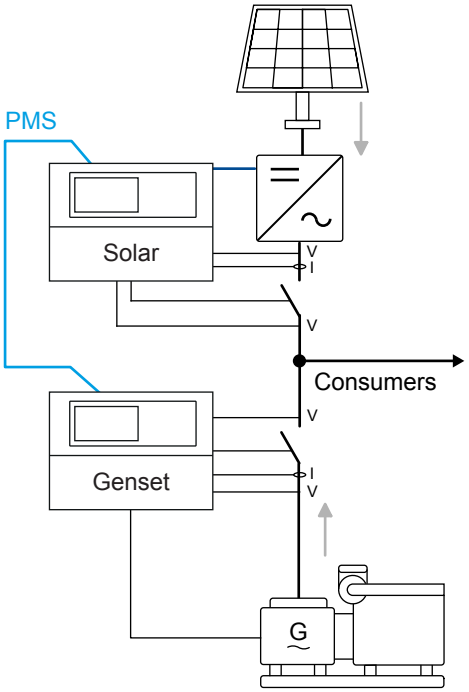
1.3.1 Off-grid power management

The controllers provide flexibility for off-grid applications.

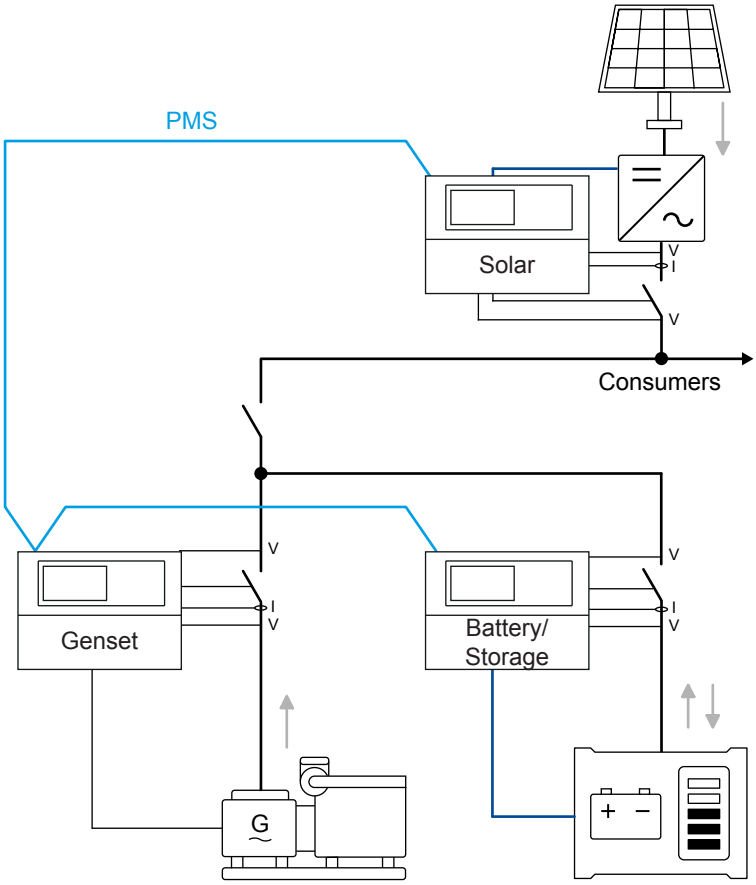
The controller can work with other DEIF controllers to manage the PV power with other power sources. When used with a genset, the controller uses the genset power measurements to calculate the set points for the PV power. When used with battery/storage, the available PV power is combined with the charge/discharge scheme to determine the set point for the PV power.

These controller configurations can be used in greenfield applications. To use these configurations in brownfield applications, all the controllers must be replaced with DEIF controllers.

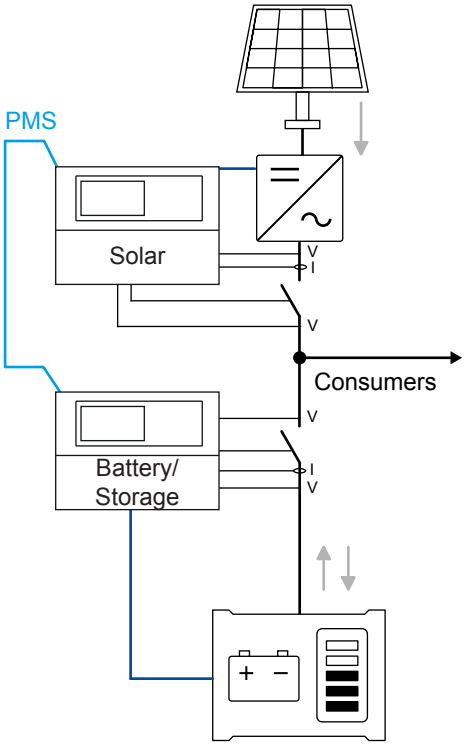
Off-grid with genset(s) and solar



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



Off-grid with solar and battery



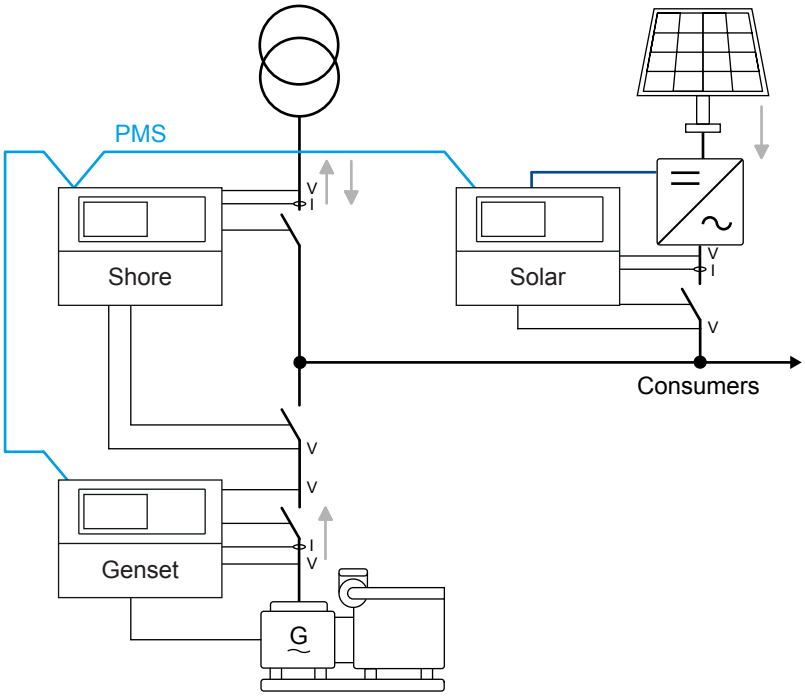
1.3.2 Grid-tied power management

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

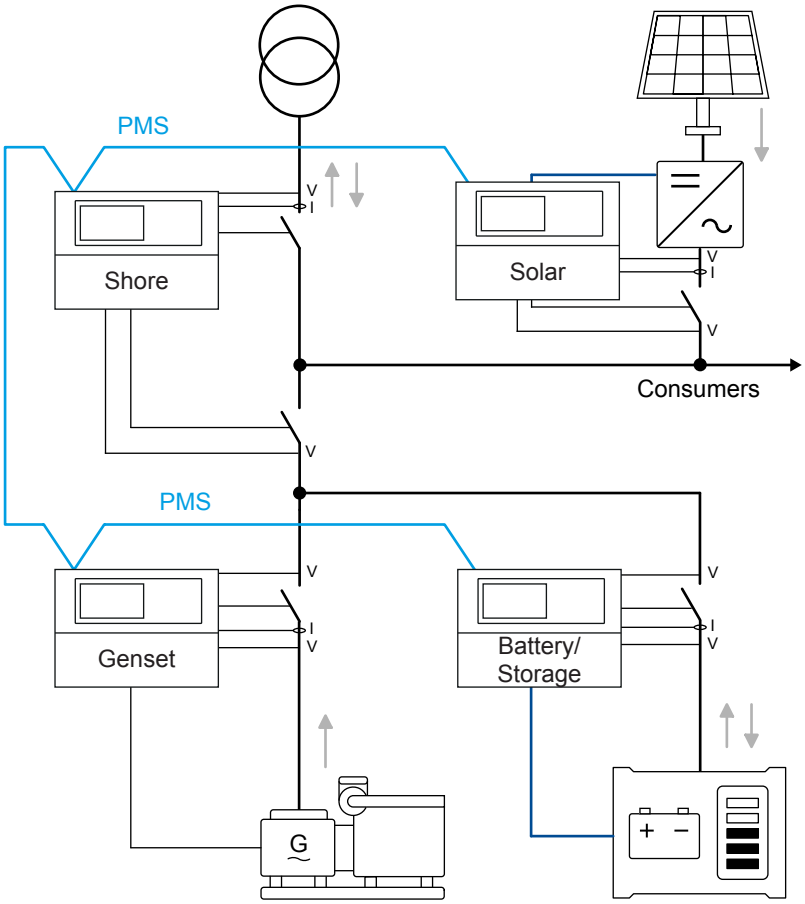
The controller can feed surplus PV energy to the grid, or charge the energy storage system (ESS). Alternatively, the controller can regulate the PV production to match the self-consumption, thereby preventing any feed-in of PV power to the grid.

These controller configurations can be used in greenfield applications. To use these configurations in brownfield applications, all the controllers must be replaced with DEIF controllers.

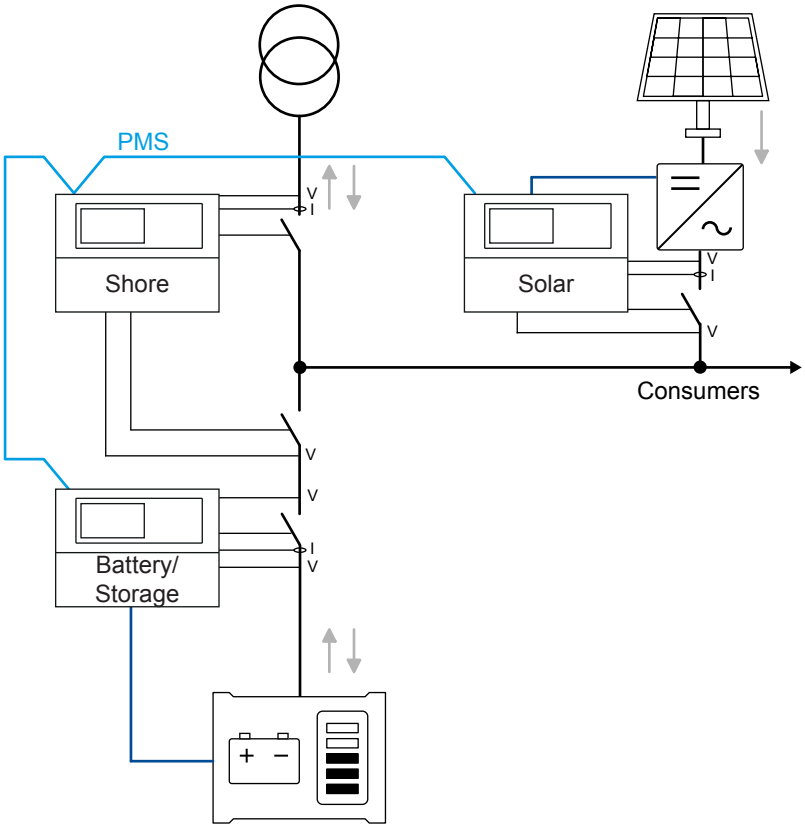
Grid-tied solar and genset



Grid-tied solar, genset and battery



Grid-tied solar and battery



1.4 Power management

1.4.1 Introduction

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

The power management system:

- Automatically maximises PV power
- Automatically starts and stops generators
- Automatically closes and opens breakers
- 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 mains and 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 plant can be divided by one to eight bus tie breakers. This makes it possible to run different sections of the plant in different plant modes. For example, you can use this to test a section, or to divide the load into primary and secondary loads.

1.4.2 Power management plant modes

The plant modes are configurable and can be changed at any time. All modes can be combined with Automatic Mains Failure mode (AMF). You can use the controllers for the following applications:

Standard plant modes	Applications
Island mode	Power plant with synchronising generators.
Automatic Mains Failure	Critical power/emergency standby plants, black start generator.
Fixed power	Power plant with fixed kW set point (including building load).
Peak shaving	Power plant where generator supplies peak load demand paralleled to the mains.
Load take-over	Plant mode where the load is moved from mains to generator. For example, peak demand periods, or periods with a risk of power outages.
Mains power export	Power plant with fixed kW set point (excluding building load).

1.4.3 Power management features

Power management features	Premium
Power management operation: • Number of generator controllers • Number of shore controllers • Number of BTB controllers	 2 1 2

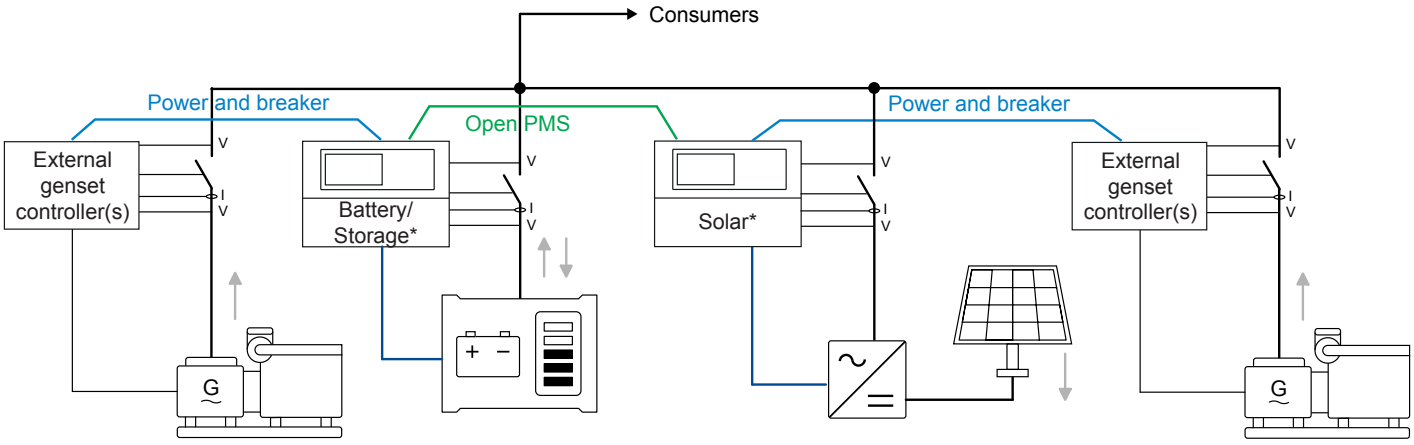
Power management features	Premium
• Number of solar controllers* • Number of battery (BESS) controllers*	2 2
Genset and Battery controllers: Ground relay management	●
Genset load-dependent start and stop	
Secured mode	●
Genset priority selection: • Manual • Running hours • Fuel optimisation	 ● ● ●
Safety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

NOTE * The iE 150 Battery and Solar controllers must have Premium software. You can have a maximum of two battery and/or solar 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 Single-line application diagrams for open PMS

1.5.1 Off-grid open PMS

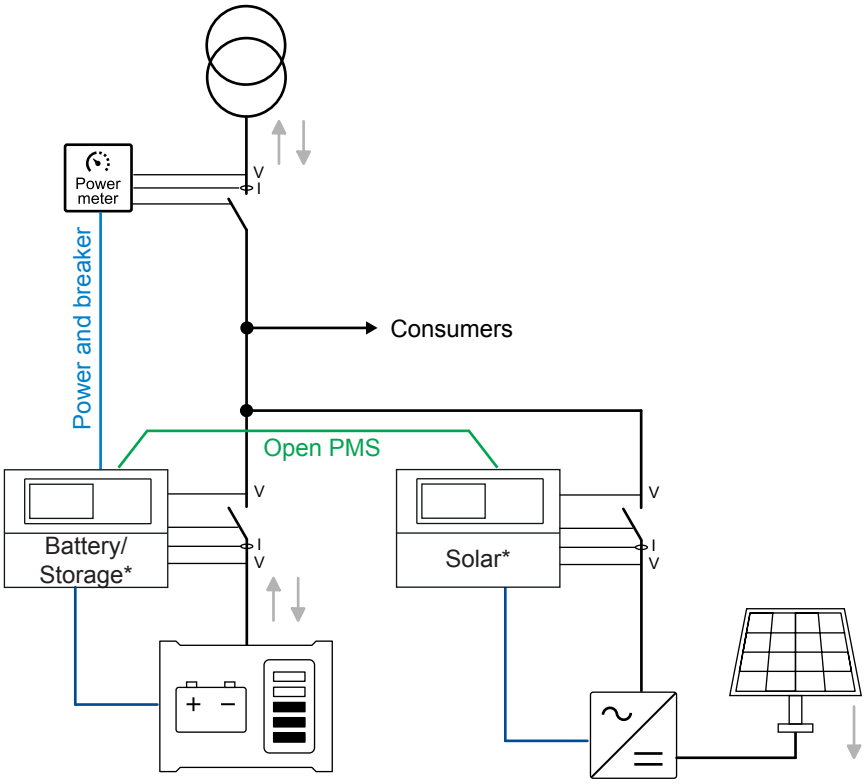
Off-grid solar, battery and external genset(s)



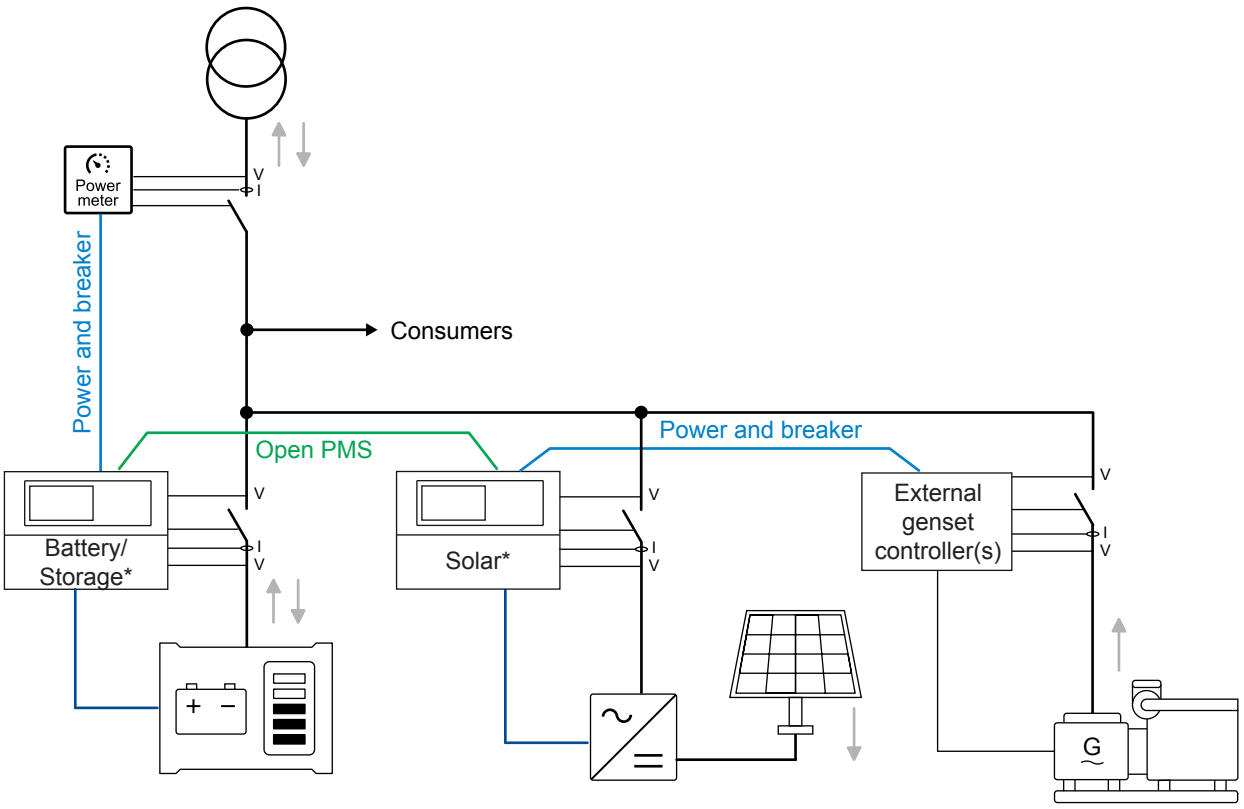
NOTE * You can use multiple controllers in the application. Power measurements can be connected to the closest battery/ storage or solar controller.

1.5.2 Grid-tied open PMS

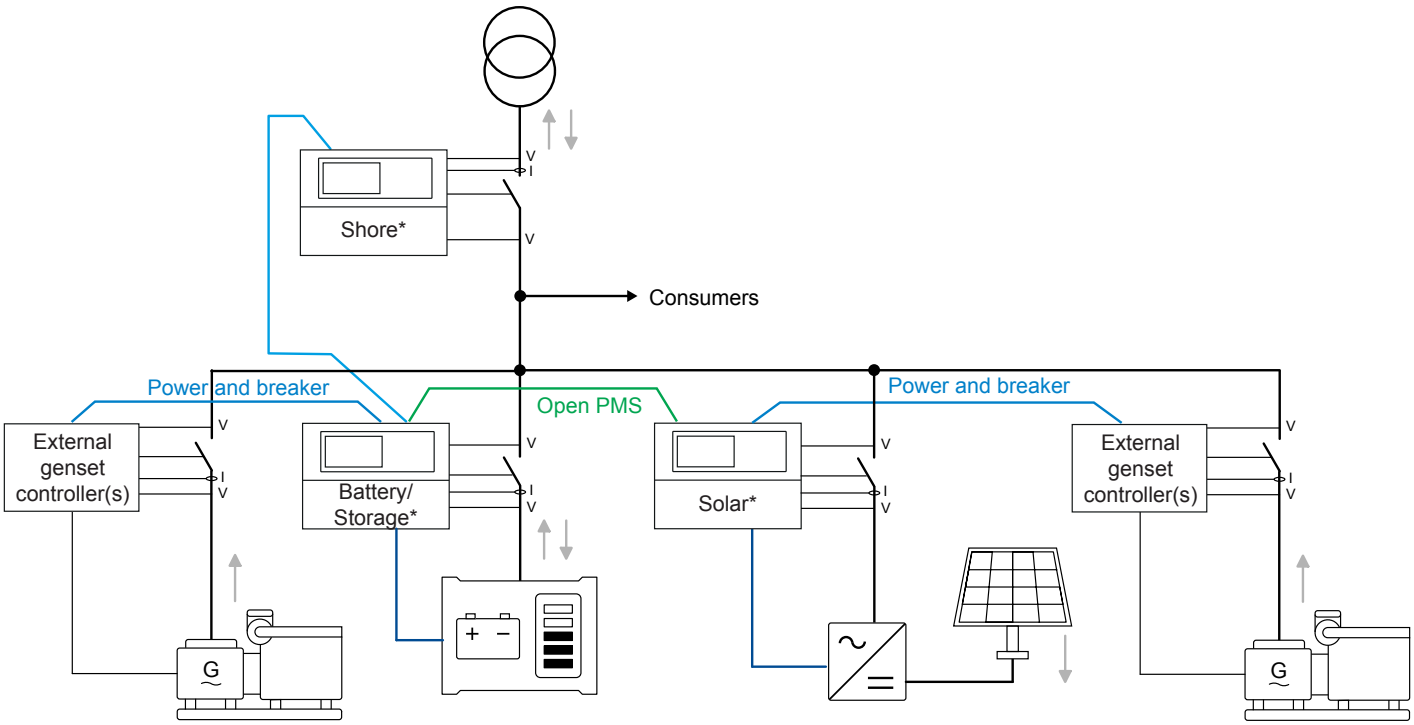
Grid-tied solar, battery and external shore connection



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



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



NOTE * You can use multiple controllers in the application. Power measurements can be connected to the closest battery/ storage or solar controller.

1.6 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

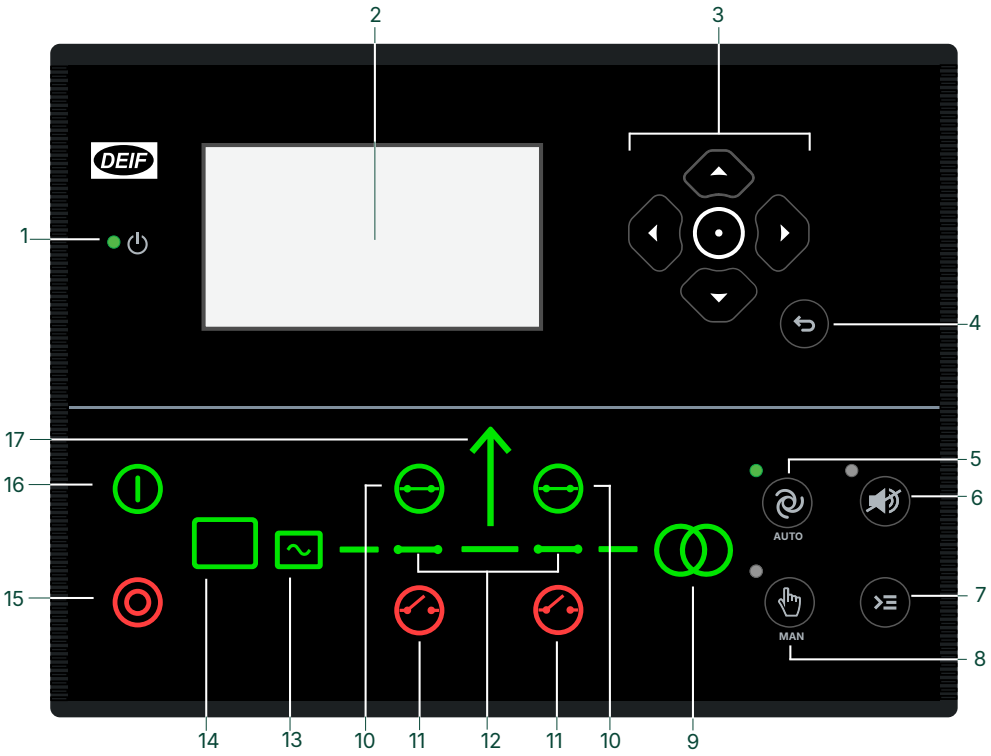
The open PMS operating data can be shown graphically on the controller display. You can also monitor open PMS from a graphical supervision page in the utility software.

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	● ● ●

Open PMS features	Premium
• Minimum and optimal genset load	●
Global or local start of external genset(s)	●

1.7 Display, buttons and LEDs

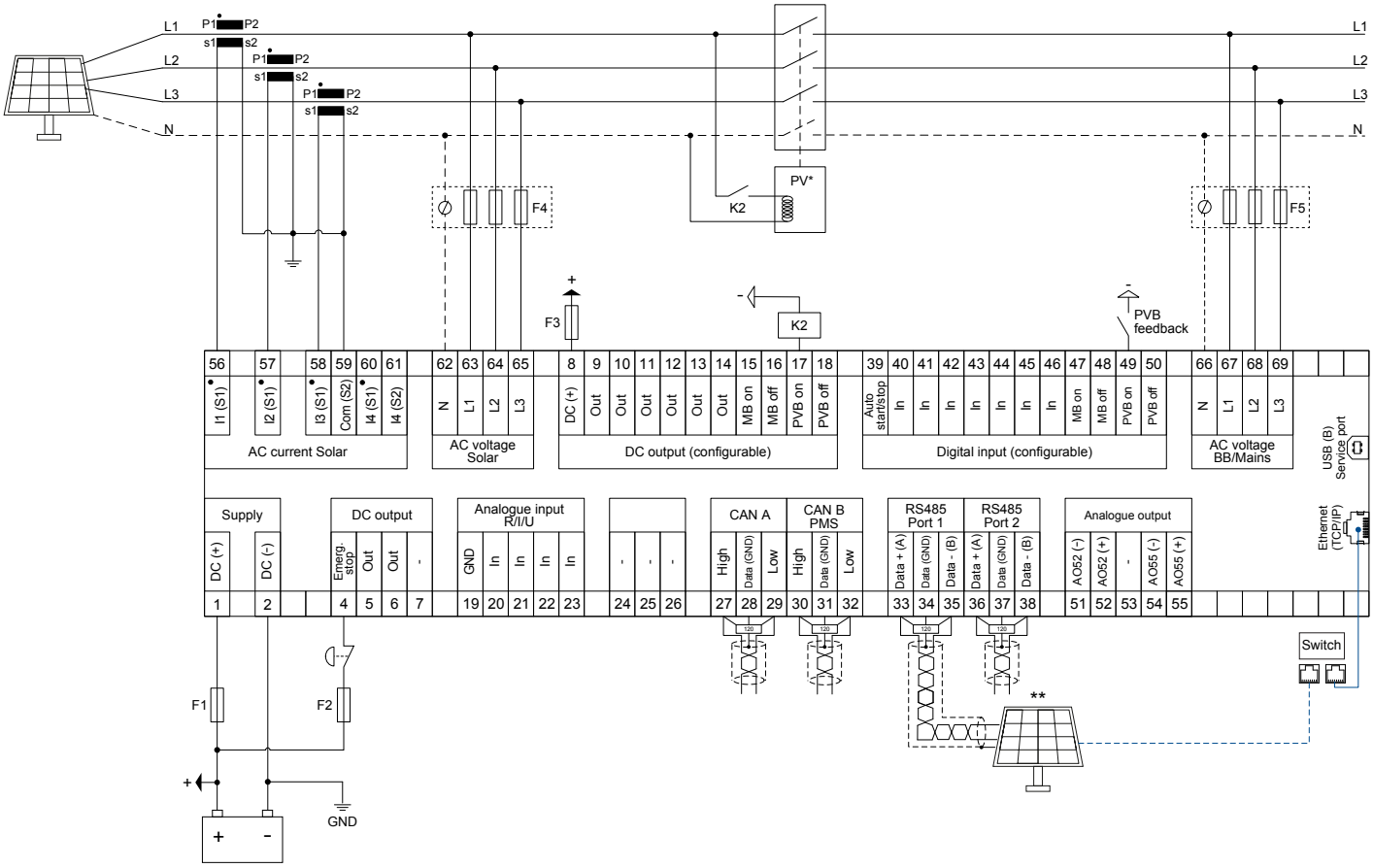


No.	Name	Function
1	Power	Green: The controller power is ON. OFF: The controller power is OFF.
2	Display screen*	Resolution: 240 x 128 px. Viewing area: 88.50 x 51.40 mm. Six lines, each with 25 characters.
3	Navigation	Move the selector up, down, left and right on the screen.
	Enter button	Go to the Menu system. Confirm the selection on the screen.
4	Back button	Go to the previous page.
5	AUTO mode	The controller automatically starts and stops (and connects and disconnects) the PV, and automatically controls the power. No operator actions are needed.
6	Silence horn	Stops an alarm horn (if configured) and enters the Alarm menu.
7	Shortcut menu	Access the General shortcuts, Jump menu, Mode selection, and Lamp test.
8	MANUAL mode	The operator or an external signal can also open and close the PV breaker. Automatic controller actions are not possible. The controller automatically synchronises before closing a breaker, and automatically de-loads before opening a breaker.

No.	Name	Function
9	Shore connection symbol	Green: Shore connection/busbar voltage and frequency are OK. The controller can synchronise and close the breaker. Red: Shore connection/busbar voltage failure.
10	 Close breaker	Push to close the breaker.
11	 Open breaker	Push to open the breaker.
12	Breaker symbols	Green: Breaker is closed. Green flashing: Synchronising or deloading. Red: Breaker failure.
13	Inverter	Green: Inverter voltage and frequency are OK. The controller can synchronise and close the breaker. Green flashing: The inverter voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. Red: The inverter voltage is too low to measure.
14	Photovoltaic	Green: There is solar PV system available feedback. Green flashing: The solar PV system is getting ready. Red: The solar PV system is not running, or there is no availability feedback.
15	 Stop	Stops the PV if MANUAL mode is selected.
16	 Start	Starts the PV if MANUAL mode is selected.
17	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 PV operation.

1.8 Typical wiring for solar controller



NOTE * PV breaker: Optional PV breaker.
NOTE ** Communication with PV inverter: The controller can use RS-485 or Ethernet communication.
NOTE RS-485 port 1 has galvanic isolation, and RS-485 port 2 does not have galvanic isolation. Port 1 is recommended for communication with the solar inverter.

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

1.9 Functions and features

1.9.1 Solar functions

Spinning reserve

If there is a shore connection, the power management system can start and stop the genset(s) to provide a spinning reserve. The spinning reserve can be a percentage of the PV power production or the mains import.

Ideal for self-consumption applications

While in grid parallel mode, the controller can feed surplus PV energy to the grid and generate profit in accordance with grid operator feed-in tariffs. Alternatively, the controller can regulate the PV production to match the self-consumption, thereby preventing any feed-in of PV power to the grid if prohibited by grid operator regulations.

Solar functions	Premium
Number of inverters	32*

Solar functions	Premium
Inverters with TCP/IP communication: • Separate IP addresses and/or multiple inverters at the same node • Select TCP or UDP	● ●
Photovoltaic breaker (PVB) control	●
Power management	●
Irradiance sensor	●
Weather station	●
Reactive power control	●
Inverter monitoring	●
Inverter start/stop logic	●
PV integration	●
Solar power load calculation	●
Ensure a minimum genset load	●
PV power counters (kWh)	●
Shore connection import/export power counters (kWh)	●
Get measurements from a PV power meter (optional)	●
Configurable dynamic power offset for the solar power reference (optional)	●

NOTE * From software version 1.17, the controller can have up to 32 TCP/IP connections, or 32 RTU connections.

More information
If you need to use weather forecasts and/or redundant controllers (option T1), use an **ASC-4 Solar controller**.

1.9.2 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 functions	Premium
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	●

1.9.3 Supported photovoltaic systems

The controller supports a wide range of PV systems, power meters, and weather stations. The controllers are compatible with photovoltaic (PV) systems from a wide range of manufacturers.

SunSpec compliance

All DEIF hybrid controllers are compliant with the SunSpec standards (see sunspec.org). DEIF controllers are therefore compatible with new inverters that use the generic SunSpec protocol.

Testing

Many PV inverter makers use the same protocol for a wide range of their products. New PV inverters often comply with the older protocol. If a specific inverter is not listed, but the maker is listed, there is a good chance that the DEIF controller is compatible.

If your PV inverter is not listed, DEIF can help to confirm compliance using the Modbus protocol documentation.

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.

1.9.4 Emulation

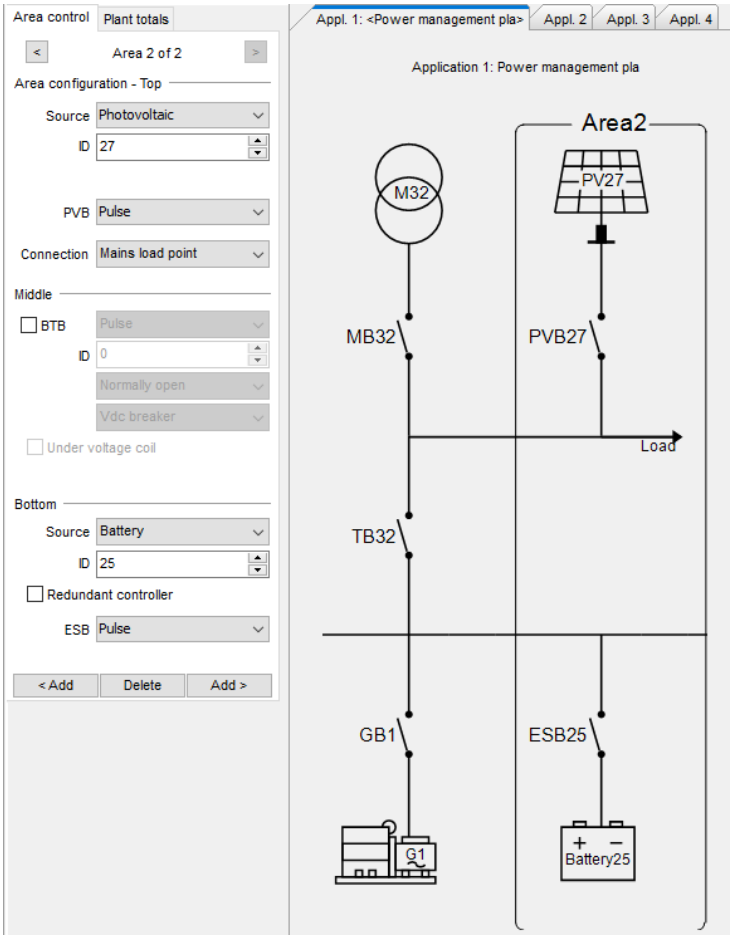
The controller includes an emulation tool to verify and test the functionality of the application, for example plant modes and logics, breaker handling, and generator operation.

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

1.9.5 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.



1.10 Protections overview

Protections	Alarms	ANSI	Operate time
Reverse power	2	32R	<200 ms
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

Protections	Alarms	ANSI	Operate time
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	
PV 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.

2. Compatible products

2.1 Power meters

Power measurements are required in single controller applications, as well as in open PMS applications. The controller can receive measurements from a number of power meters, including 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 and controllers 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.

2.2 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 150 Generator** (www.deif.com/products/agc-150-generator)
- **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.

2.3 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)

2.4 Open PMS

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

- **iE 150 Battery, Solar, Mains** (www.deif.com/products/ie-150)
- **ASC 150 Solar** (www.deif.com/products/asc-150-solar)
- **ASC 150 Storage** (www.deif.com/products/asc-150-storage)
- **AGC 150 Mains** (www.deif.com/products/agc-150-mains)
- **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 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.

2.5 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.

2.6 Additional inputs and outputs

The controller 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.

2.7 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.

2.8 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)

2.9 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	Non-sync 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.

3. Technical specifications

3.1 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

Current measurement	
	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
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
Log book	Data log and trending function
Language	Multi-language display

3.2 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
Vibration	Response: • 10 to 58.1 Hz, 0.15 mmpp • 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)

Operation conditions	
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

3.3 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

3.4 Communication

Communication	
CAN A	**CAN port** You can connect these in a daisy chain (and operate them at the same time): • CIO 116, CIO 208, and CIO 308 • IOM 220 and IOM 230 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:

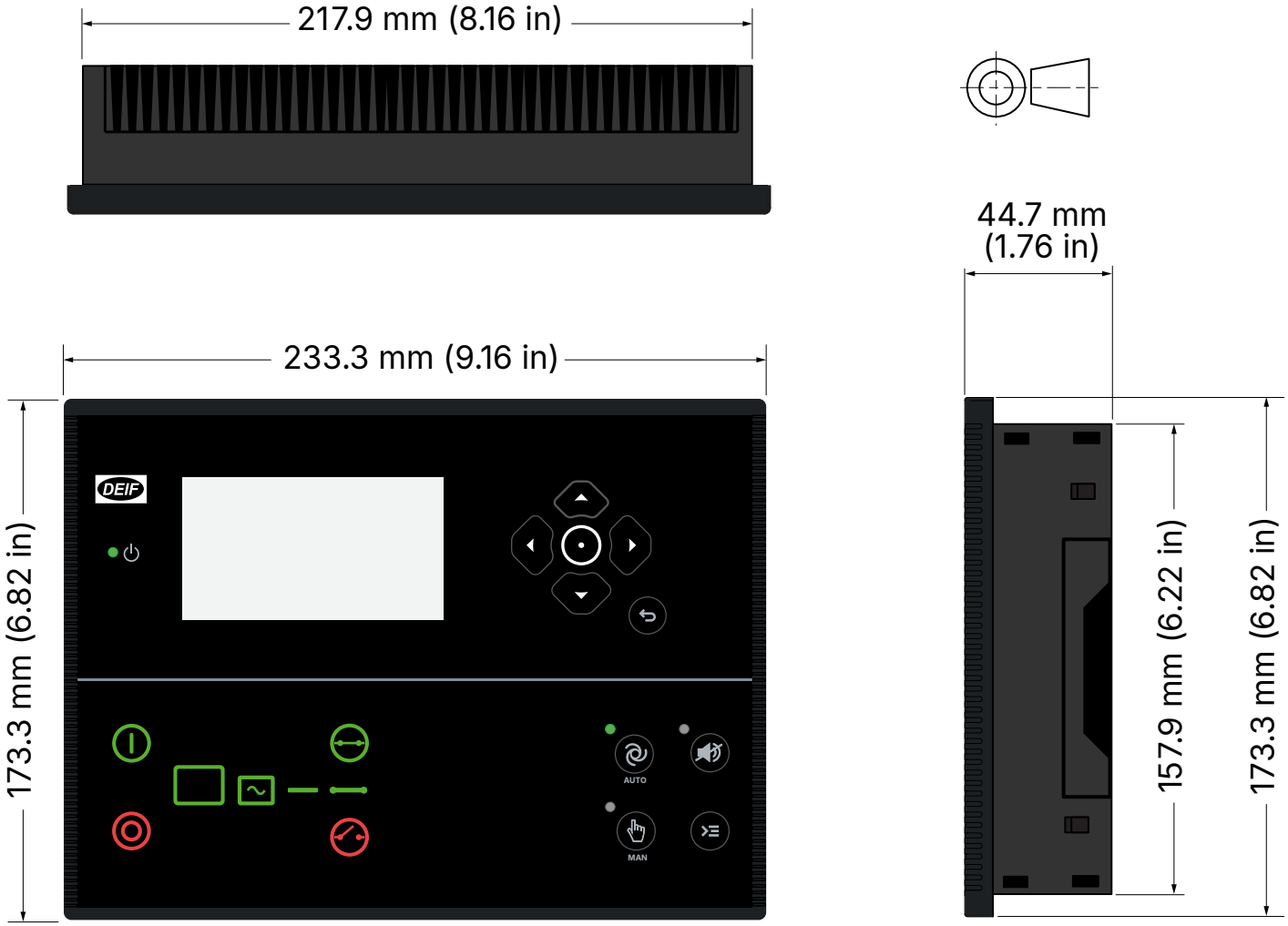
Communication	
	• Modbus master to PV • Modbus master to weather station • Power meters • Modbus RTU, PLC, SCADA, Remote monitoring (Insight) Data connection 2-wire + common, or 3-wire Isolated External termination required (120 Ω + matching cable) 9600 to 115200
RS-485 Port 2	Used for: • Modbus master to PV • Modbus master to weather station • 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 PV • Modbus master to weather station • Modbus to PLC, SCADA, and so on • NTP time synchronisation with NTP servers • Power management system (PMS) communication between AGC 150, ASC 150, and/or iE 150 controllers • PC utility software Isolated Auto detecting 10/100 Mbit Ethernet port
USB	Service port (USB-B)

3.5 Approvals

Standards
CE
UL/ULC Listed to UL6200:2019 1st edition controllers for use in Power Production

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

3.6 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

3.7 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).	

4. Legal information

Disclaimer

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The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

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4.1 Software version

This document is based on iE 150 software version 1.35.