ASC 150 Storage

4921240624G

Data sheet

Improve Tomorrow

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1. ASC 150 Storage

1.1 About

The ASC 150 Storage controller is a fully flexible controller to control and protect an energy storage system (ESS) with communication to a BMS, BCU, and/or a PCS. Use ASC 150 Storage to add storage to an existing or new site. You can have up to 16 ASC Storage controllers working together.

Use ASC 150 Storage as a single controller to add storage and a mains connection (optional) to an existing site.

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

For sites with genset and/or mains controllers from other suppliers, use ASC 150 Storage with open PMS to add solar, storage and/or mains controllers.

The controller has built-in AC measurements. There are two sets of voltage measurements (three phases, and (optional) the neutral phase), and one set of current measurements (three phases). There is also a 4th current measurement that can be used to measure mains power. The controller can receive power measurements from power meters, genset communication, and/or transducers.

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 ASC 150 Storage controller using the PCS and BCU.

- **Grid-forming**
  Grid-forming is also called island, or V/f mode. For grid-forming (V/f mode) the ASC 150 Storage controller can act as the only energy source. The battery can provide the grid-forming power in island operation, 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. The controller can also suppress genset starts from Solar controller spinning reserve requests.
- **Grid-following**
  Grid-following is also called parallel, or P/Q mode. For grid-following (P/Q mode), the ASC 150 Storage controller is always connected to another grid-forming source, like a mains or genset. The battery can be used as power buffer, providing spinning reserve and peak shaving.
- **Droop mode**
  If the ESS supports this, the ASC Storage controller can run the ESS in droop mode for both Grid-forming and Grid-following. The controller controls the storage 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

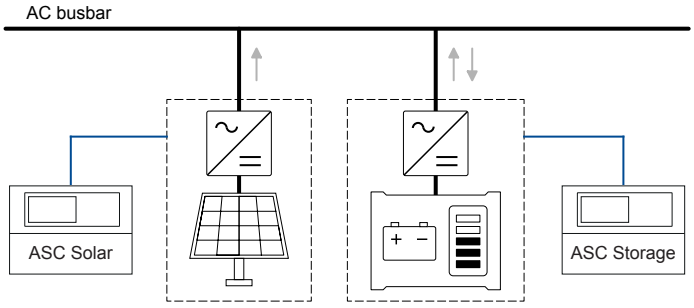
The energy and power source functions determine the source priority. The source functions are not directly related to grid-forming and grid-following.

- **Energy source**
  For the energy source function (plant-leading), the ASC 150 Storage controller prioritises battery power over genset power. As a result, the system uses as much battery power as possible before starting any genset.
- **Power source**
  For the power source function (plant assist), the ASC 150 Storage controller operates parallel to other sources. Genset power is prioritised over battery power. This mode is used to ensure that spinning reserve requirements are met.

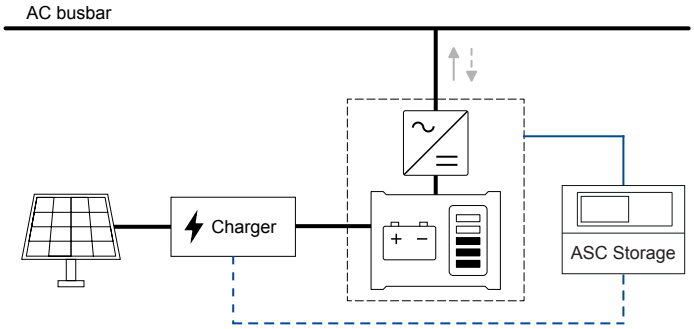
AC- or DC-coupled

The ASC 150 Storage controller can be used 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 mains) 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 ASC 150 Storage controller can communicate with the PV inverter, and limit the current from the PV to the battery.



1.1.1 Software packages

You can choose the **Extended** or **Premium** software package.

1.2 Single storage controller

The ASC 150 Storage 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.

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 ASC 150 Storage controller calculates the charging and discharging set points. The set points are determined by:

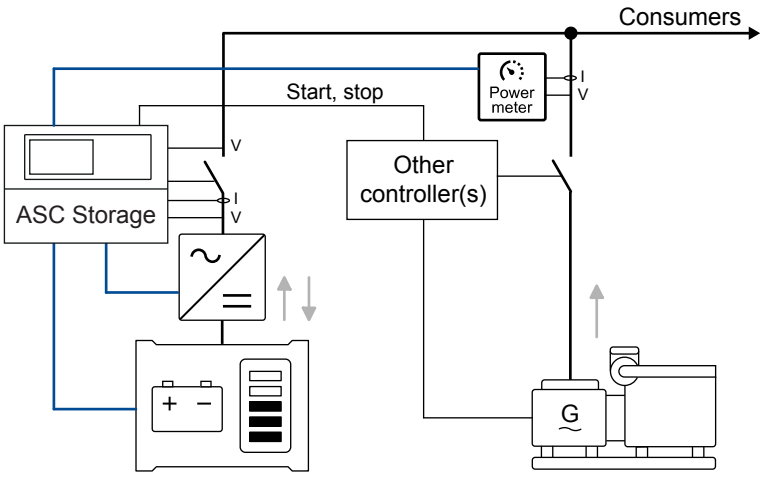
- The operating mode
- The system load and configuration
- The state of charge in the storage
- The power readings from the other power source(s)
- The breaker position(s) of the other power source(s)

Software variants

Single storage controller	Extended	Premium
External gensets	4	16
External mains	0	16
Energy storage breaker (ESB) control	●	●
Mains breaker control (paralleling)		●

Single storage controller	Extended	Premium
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)	●	●

Single storage controller with genset(s)

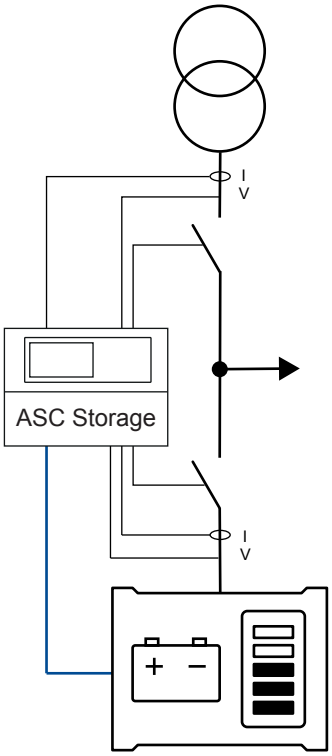


The ASC 150 Storage controller can support the load, so that the genset can run at its optimal load point.

Ideal for ESS rental applications

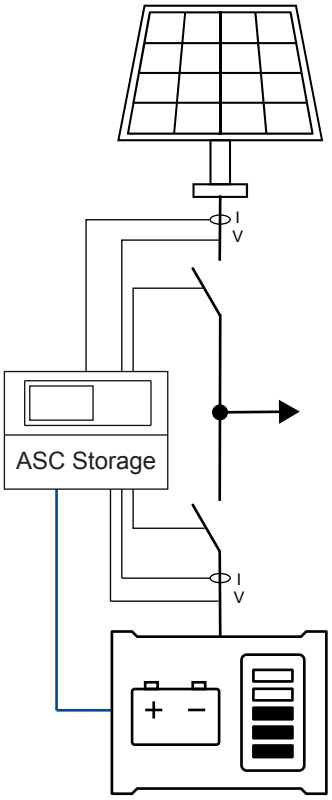
You can use the ASC 150 Storage single controller for emission-free power rental solutions with a single ESS. The controller provides full communication with the ESS. The controller can communicate with a BCU (battery control unit) or directly with a BMS (battery management system) and PCS (power control system) over Modbus. You can use the ASC 150 Storage controller with a wide range of energy storage systems (ESS), and in any rental application.

Single storage controller with one mains



- **Peak shaving**: The storage supplies the peak load demand and runs parallel to mains.
- **Load take-over**: The load is moved from mains to storage, for example, during peak demand periods or periods with a risk of power outages.
- **Mains power export**: The storage produces a fixed kW set point (excluding increasing load).
- **Automatic mains failure**: If there is a significant loss of mains power or a total blackout, the controller automatically changes the supply so that the storage supplies the load.

Single storage controller with PV



1.3 Single-line application diagrams for PMS

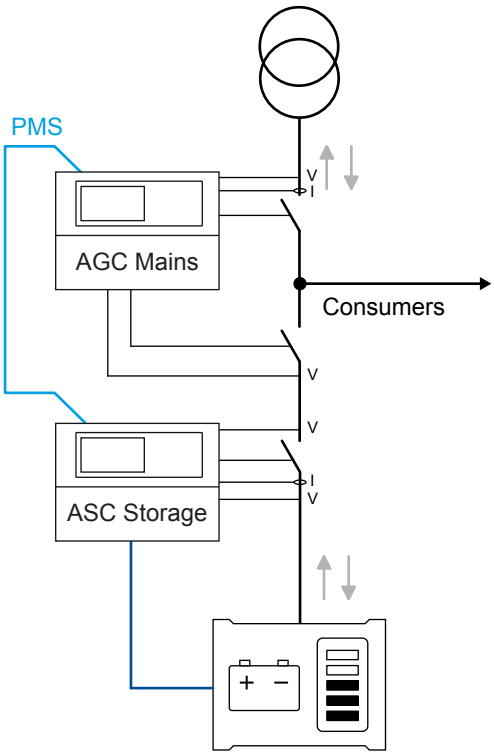
1.3.1 Grid-tied

The ASC 150 Storage controllers can integrate seamlessly into grid-tied applications. This includes power management applications with other DEIF controllers using CAN bus communication.

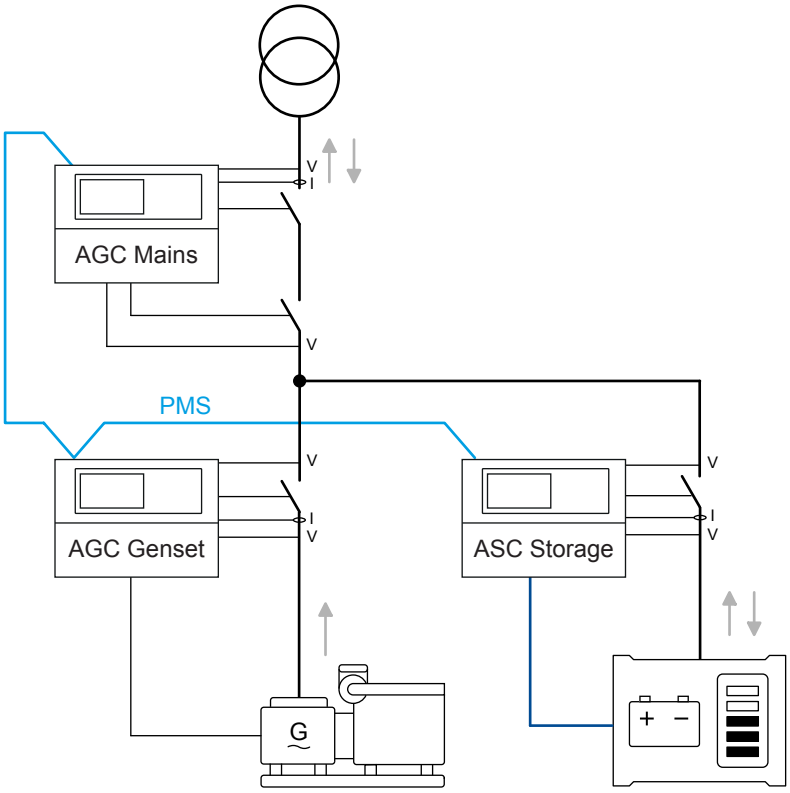
The ASC 150 Storage can control an ESS to take peak loads, provide mains power export, provide fixed power. If there is a mains failure, the controller can run in island mode. The ASC 150 Storage can also provide the spinning reserve for a PV plant, thereby improving the green energy penetration to the grid.

These controller configurations can be used in greenfield applications. To use these configurations in brownfield applications, all the genset, mains, storage and solar controllers must be replaced with DEIF controllers. The DEIF system can treat existing BTB controllers as externally controlled BTBs.

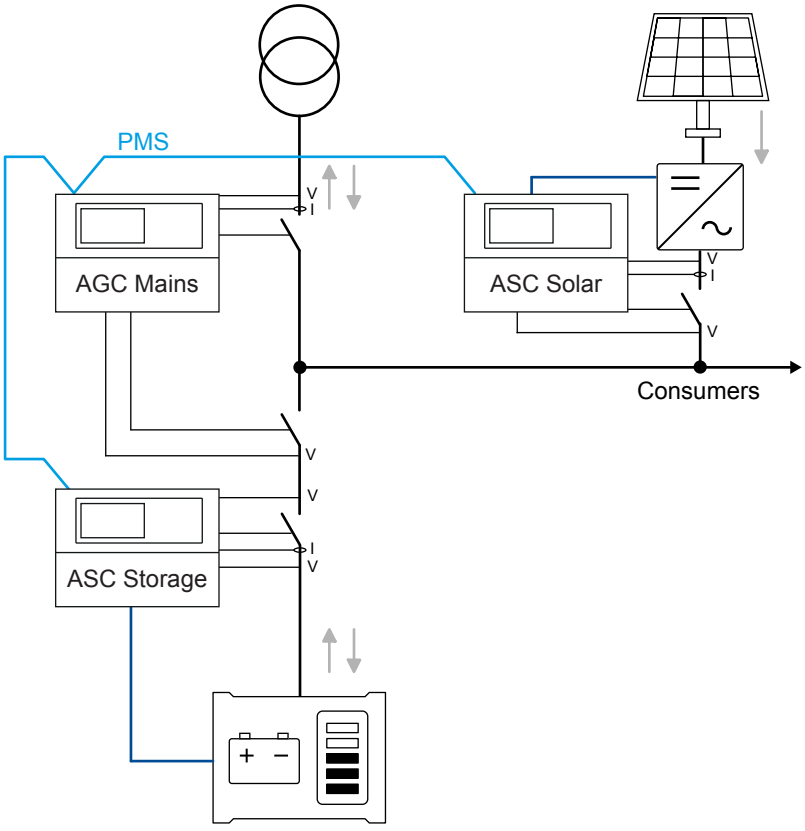
Grid-tied storage



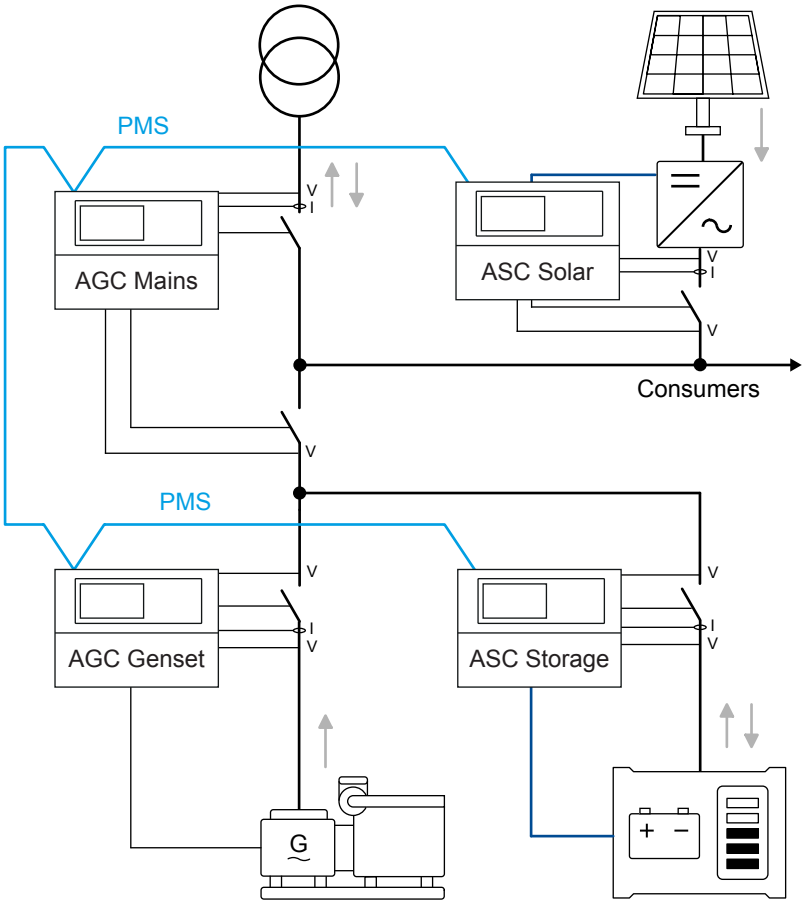
Grid-tied hybrid genset-storage



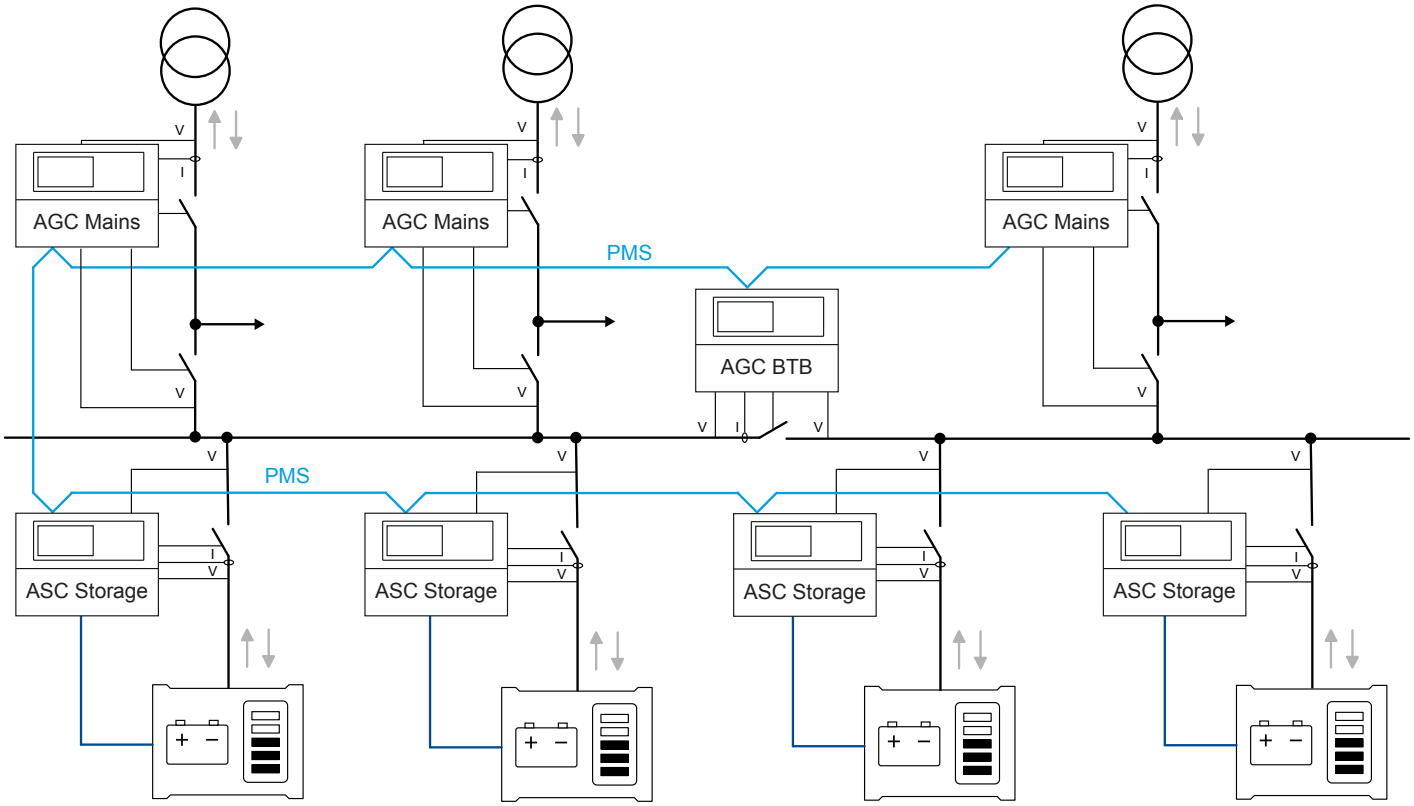
Grid-tied hybrid solar-storage



Grid-tied hybrid solar-genset-storage



Multi-mains with storage

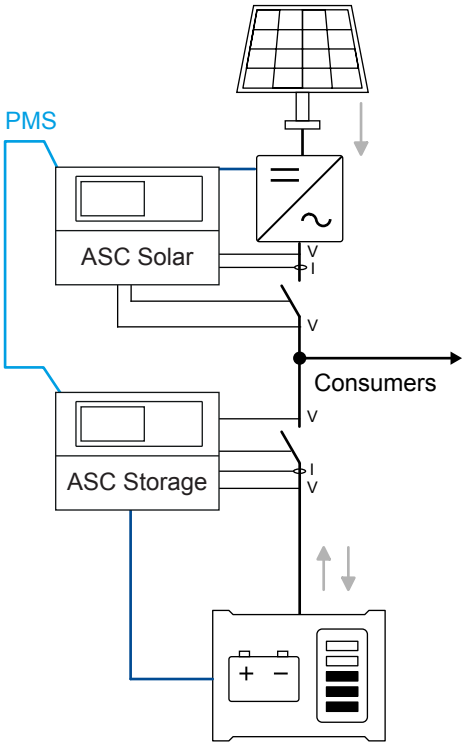


1.3.2 Off-grid

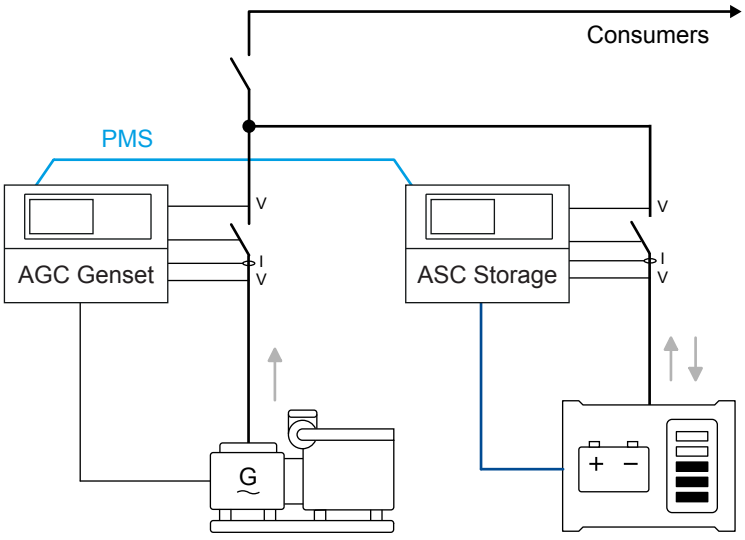
The ASC 150 Storage controllers provide flexibility for off-grid applications.

These controller configurations can be used in greenfield applications. To use these configurations in brownfield applications, all the genset, mains, storage 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 storage

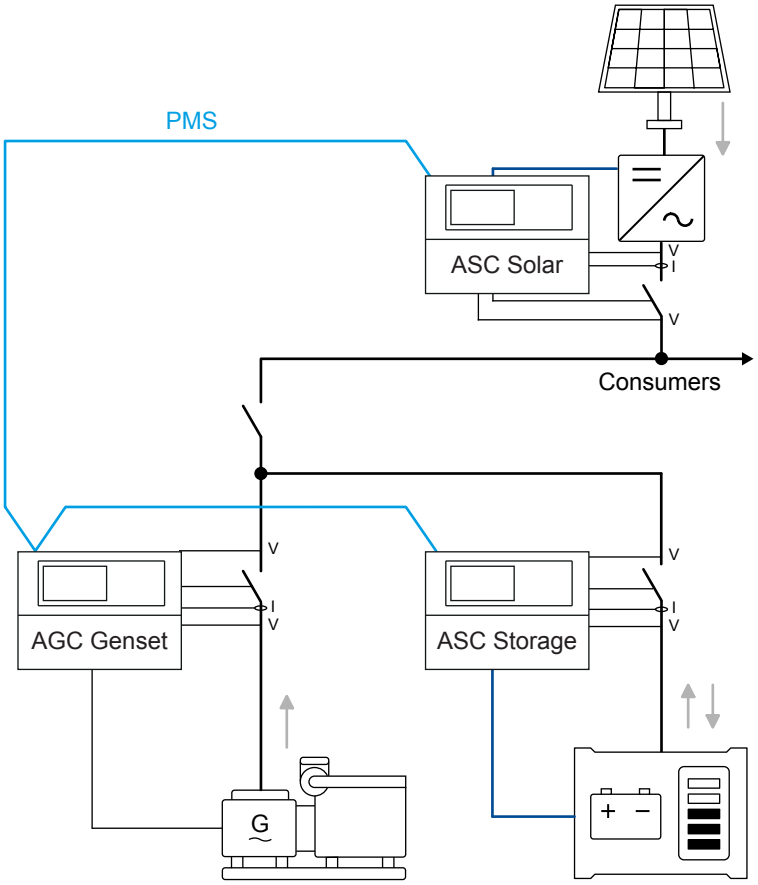


Off-grid with genset(s) and storage



To improve power quality, the ASC 150 Storage can supply peak loads while gensets start. The ASC 150 Storage 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 storage



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 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 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	Extended	Premium
Power management operation*: • Number of generator controllers • Number of mains controllers • Number of BTB controllers • Number of solar controllers • Number of storage (BESS) controllers • Number of load controllers (ALC-4)	 32 32 8 16 16 8	 32 32 8 16 16 8
Hybrid ready (compatible with ASC-4 and ASC 150)	●	●
Genset and Storage controllers: Ground relay management	●	●
Load controller support (compatible with ALC-4)	●	●
Genset load-dependent start and stop	●	●
EasyConnect	●	●
Asymmetrical genset load sharing	●	●
N + X (Secured mode)	●	●
Genset priority selection: • Manual • Running hours • Fuel optimisation	 ● ●	 ● ● ●
Safety stop of genset	●	●

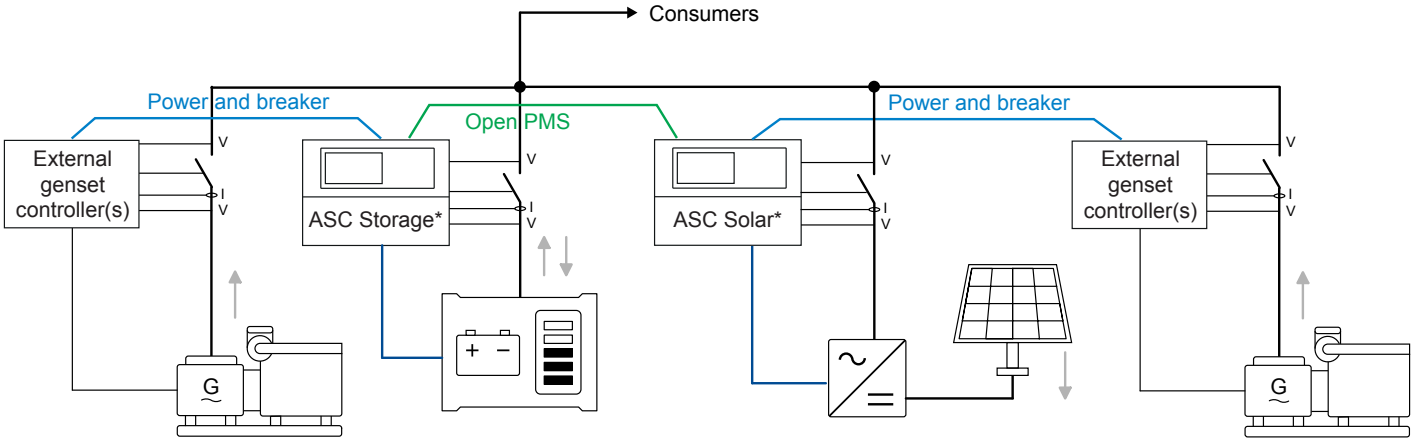
***Restrictions on controllers**

ID 1 to 24	ID 25 to 32	ID 33 to 40
AGC Genset (1 to 32)		
AGC Mains (1 to 32)		
	ASC Solar (25 to 40)	
	ASC Storage/Battery (25 to 40)	
	ALC-4 (25 to 40)	
		AGC BTB (33-40)
		External BTB (33-40)

1.5 Single-line application diagrams for open PMS

1.5.1 Off-grid open PMS

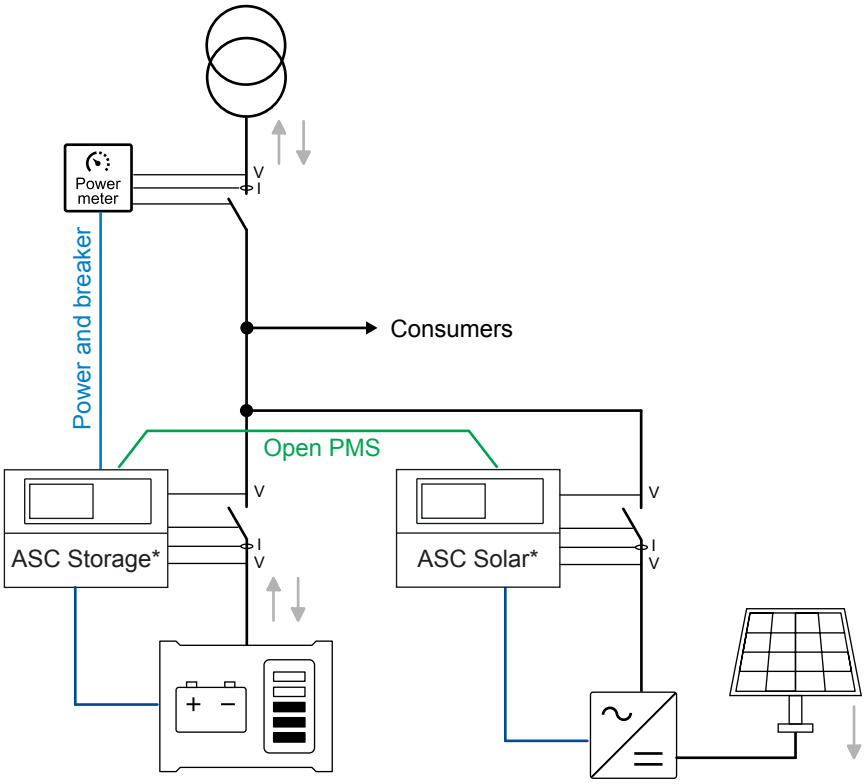
Off-grid solar, storage and external genset(s)



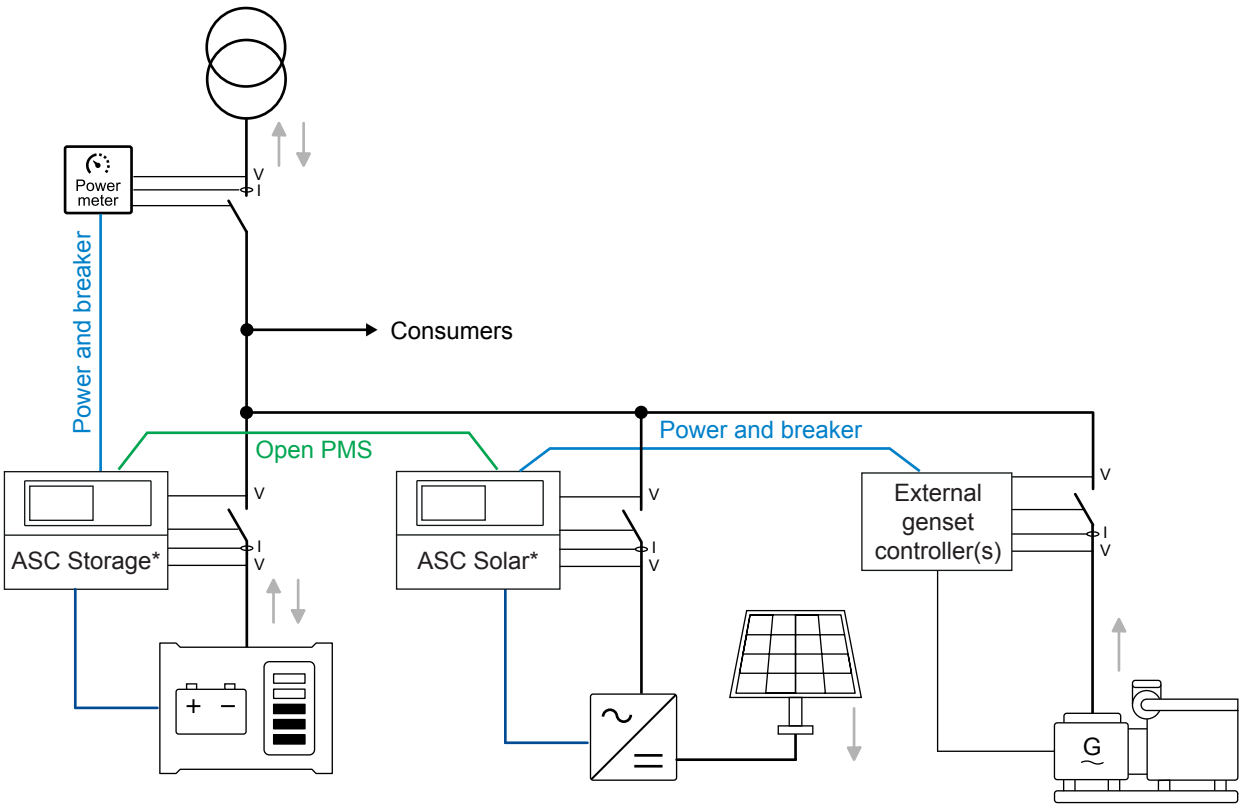
NOTE * You can use multiple controllers in the application. Power measurements can be connected to the closest ASC controller.

1.5.2 Grid-tied open PMS

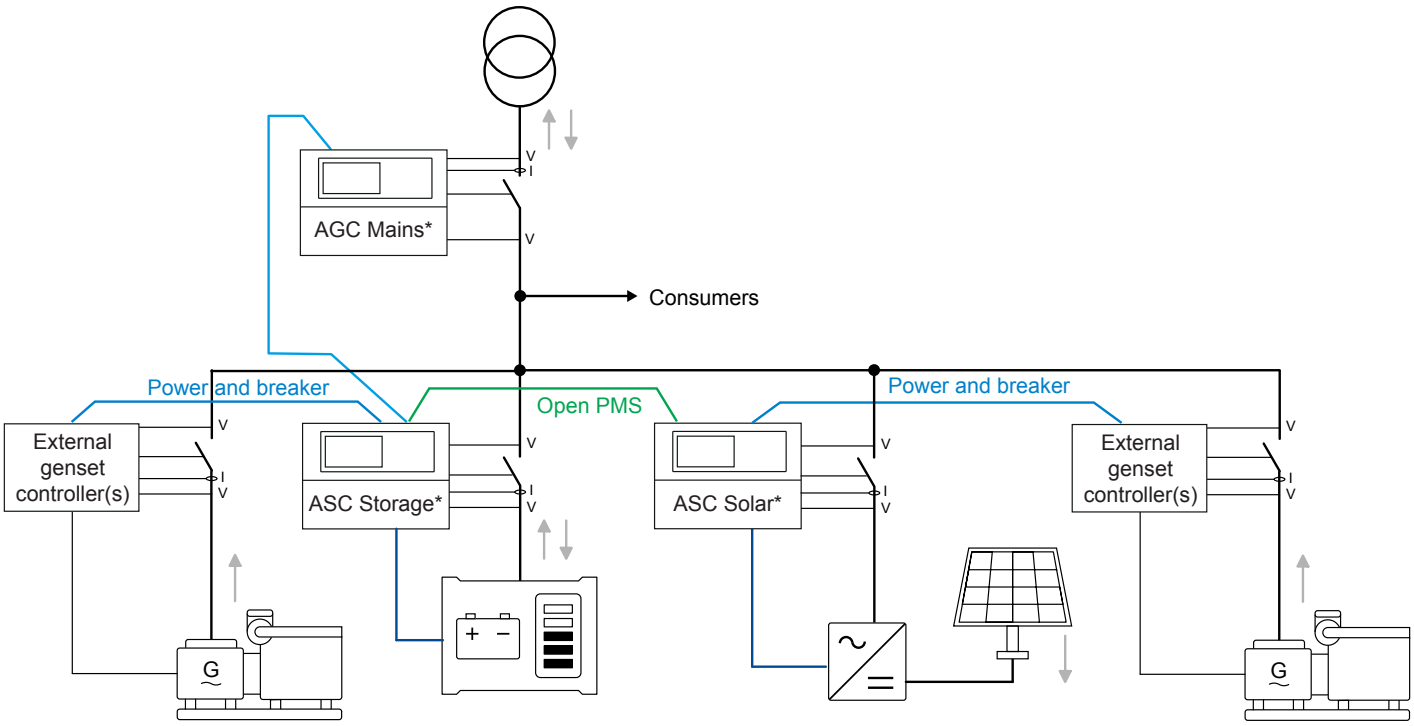
Grid-tied solar, storage and external mains



Grid-tied solar, storage, external genset(s) and external mains



Grid-tied solar, storage, mains and external genset(s)



NOTE * You can use multiple controllers in the application. Power measurements can be connected to the closest ASC controller.

1.6 Open PMS

Open PMS is a power management system that consists of solar and/or storage controllers (ASC 150 and/or ASC-4). Open PMS can also include a mains controller. The ASC 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	Extended	Premium
Power management operation limits:		
• External generator controllers per solar/storage controller	4	16
• Mains controllers*	32	32
• External mains connections	1	1
• Solar controllers*	16	16
• Storage (BESS) controllers*	16	16
EasyConnect	●	●
External sources included in the available power:	●	●
• Supply the busbar load	●	●

Open PMS features	Extended	Premium
• Charge batteries	●	●
• Minimum and optimal genset load	●	●

***Restrictions on controllers**

ID 1 to 24	ID 25 to 32	ID 33 to 40
AGC Mains (1 to 32)		
	ASC Solar (25 to 40)	
	ASC Storage/Battery (25 to 40)	

Plant modes with a mains controller

With a mains controller, open PMS supports:

- Configurable mains power set point
- Configurable mains operating mode
- Auto-start signal for the application to the mains controller
- Standard AGC mains PMS features, including cos phi set points, and mains breaker control

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).

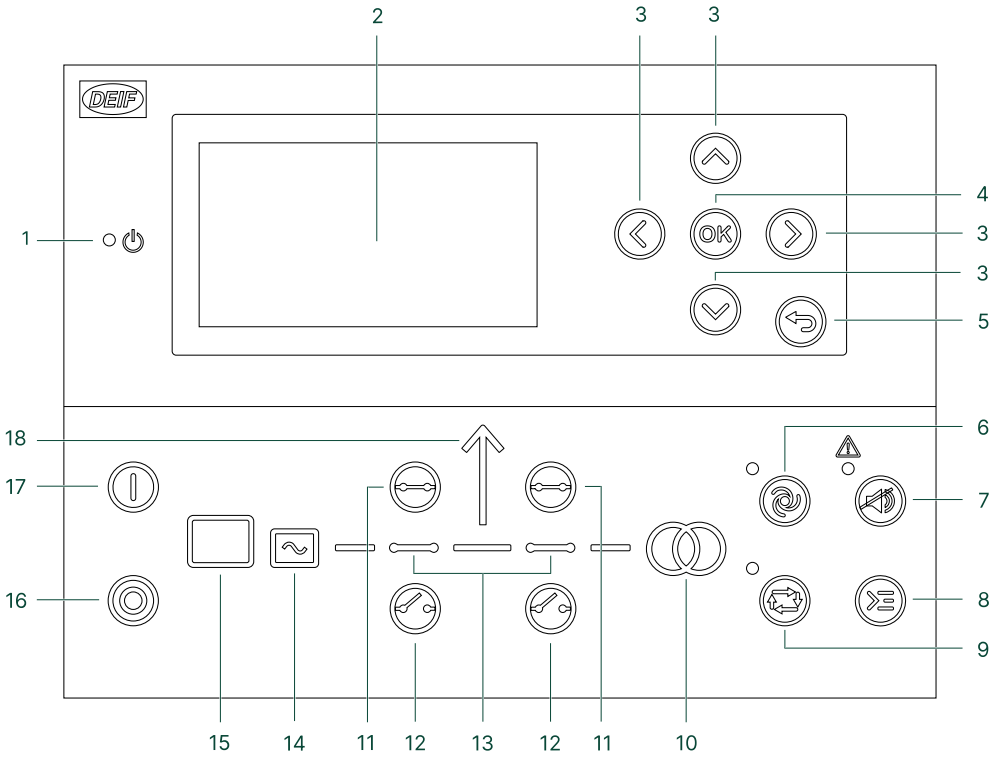
Plant modes with an external mains

The ASC that is connected to the external mains operates as an *AGC mains lite* and controls the mains mode.

Standard plant modes	Applications
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.
Mains power export	Power plant with fixed kW set point (excluding building load).

NOTE For an open external mains breaker, open PMS cannot synchronise so that the mains breaker can close. That is, open PMS runs in island mode and cannot back sync.

1.7 Display, buttons and LEDs

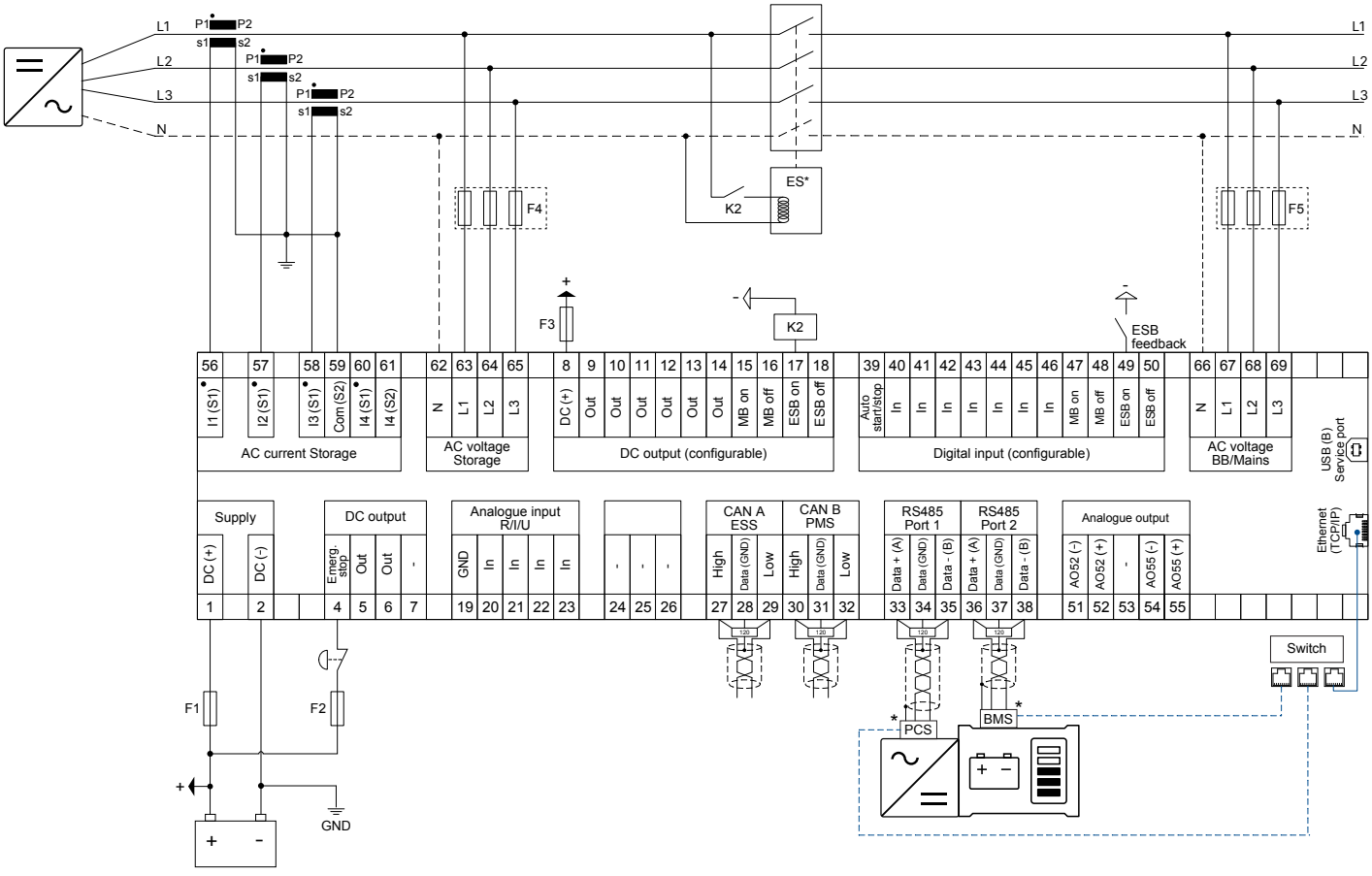


No.	Name	Function
1	Power	Green: The controller power is ON. OFF: The controller power is OFF.
2	Display screen*	Resolution: 240 x 128 px. Viewing area: 88.50 x 51.40 mm. Six lines, each with 25 characters.
3	Navigation	Move the selector up, down, left and right on the screen.
4	OK	Enter the Menu system. Confirm the selection on the screen.
5	Back	Go to the previous page.
6	AUTO mode	The controller automatically starts and stops (and connects and disconnects) the storage system. The controller automatically controls the power to and from the storage system. No operator actions are needed.
7	Silence horn	Turns off an alarm horn (if configured) and enters the Alarm menu.
8	Shortcut menu	Access the Jump menu, Mode selection, Test, Lamp test, and Storage.
9	SEMI-AUTO mode	The operator or an external signal can also start or stop, and open and close the storage breaker. Automatic controller actions are not possible. The controller automatically synchronises before closing a breaker, and automatically de-loads before opening a breaker.
10	Mains symbol	Green: Mains/busbar voltage and frequency are OK. The controller can synchronise and close the breaker. Red: Mains/busbar voltage failure.
11	Close breaker	Push to close the breaker.
12	Open breaker	Push to open the breaker.
13	Breaker symbols	Green: Breaker is closed. Green flashing: Synchronising or de-loading.

No.	Name	Function
		Red: Breaker failure.
14	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.
15	Battery management system	Green: There is storage system available feedback. Green flashing: The storage system is getting ready. Red: The storage system is not running, or there is no availability feedback.
16	Stop	Stops the power converter if SEMI-AUTO is selected.
17	Start	Starts the power converter if SEMI-AUTO is selected.
18	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 storage operation.

1.8 Typical wiring for storage 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 AC 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 Storage functions

Storage functions	Extended	Premium
Power DC-DC system (PDS): DC-coupled solar or DC-charger, current limitation, spinning reserve for the DC-busbar		●
Energy storage breaker (ESB) control	●	●
Energy usage monitoring	●	●
Power management	●	●
Reactive power control		●
Configurable dynamic power offset for the storage power reference (optional)	●	●
Configurable storage-specific PID control (optional)		4
Hotel load	●	●

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

Power converter functions	Extended	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	●	●
Maintenance alarms	●	●
Configurable start signal	●	●
Analogue output power converter control (optional): • Analogue output from the controller • Analogue output from an external module (IOM 230)	 ● ●	 ● ●

Protection packages	Extended	Premium
BMS protection	●	●
Inverter protection	●	●

Power management functions	Extended	Premium
Generator priority selection: • Fuel optimisation • Genset starts automatically for low state of charge		●

Power management functions	Extended	Premium
		●
Optimal load point for the genset(s)	●	●

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

1.9.2 General controller functions

AC functions	Extended	Premium
Sets of nominal settings	4	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 Mains, Genset, or PV	●	●

General functions	Extended	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)	40 lines	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)		4
4 additional analogue outputs (using 2 × IOM 230)		●
Simple load shedding and adding	●	●
Changeable controller type	●	●

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

Display and language functions	Extended	Premium
Supports multiple languages (including Chinese, Russian, and other languages with special characters)	●	●
20 configurable graphical screens	●	●

Display and language functions	Extended	Premium
Graphical display with six lines	●	●
Parameters can be changed on the display unit	●	●

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

1.9.3 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.

1.9.4 Emulation

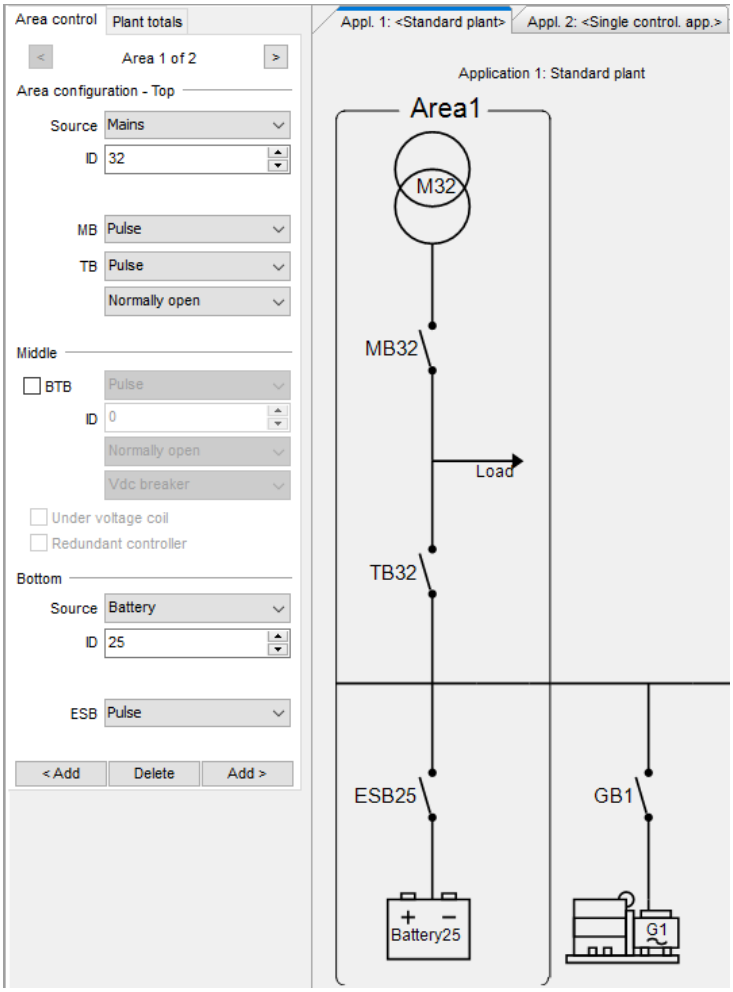
The controller includes an emulation tool to verify and test the functionality of the application, for example plant modes and logics, breaker handling, mains and generator operation.

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
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	-

Protections	Alarms	ANSI	Operate time
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.

2. Compatible products

2.1 Touch display unit: TDU

TDU is a pre-programmed touch screen display (www.deif.com/products/tdu-series). The TDU can be used for these controllers:

- AGC 150 Generator, Mains and BTB
- ASC 150 Solar and Storage
- AGC-4 Mk II Generator, Mains and BTB
- ASC-4 Solar and Battery
- AGC-4 Generator, Mains and BTB

2.2 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.

2.3 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:

- **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.

2.4 Power management

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

- **AGC 150 Generator** (www.deif.com/products/agc-150-generator)
- **AGC 150 Mains** (www.deif.com/products/agc-150-mains)
- **AGC 150 BTB** (www.deif.com/products/agc-150-btb)
- **ASC 150 Solar** (www.deif.com/products/asc-150-solar)
- **ASC 150 Storage** (www.deif.com/products/agc-150-storage)
- **AGC-4 Mk II Genset, Mains, BTB, Group, and Plant** (www.deif.com/products/agc-4-mk-ii)
- **AGC-4 Genset, Mains, BTB, Group, and Plant** (www.deif.com/products/agc-4)
- **ASC-4 Solar** (www.deif.com/products/asc-4-solar)

- **ASC-4 Battery** (www.deif.com/products/asc-4-battery)
- **ALC-4 (Automatic Load Controller)** (www.deif.com/products/alc-4)

2.5 Open PMS

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

- **ASC 150 Solar** (www.deif.com/products/asc-150-solar)
- **ASC 150 Storage** (www.deif.com/products/agc-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 **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.

2.6 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.

2.7 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.

2.8 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.

2.9 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)

2.10 Controller types

Parameter	Setting	Controller type	Minimum software
9101	DG unit	Generator controller	S2
	DG unit	Generator Stand-alone controller	S1
	Mains unit	Mains controller	S2
	BTB unit	BTB controller	S2
	DG HYBRID unit	Genset-Solar hybrid controller	S2
	ENGINE DRIVE unit	Engine drive controller	S1
	Remote unit	Remote display	None
	ENGINE DRIVE MARINE unit	Engine drive controller for marine use	S1
	DG MARINE unit	Stand-alone genset controller for marine use	S1
	ASC 150 Storage*	Battery storage controller	S3
	ASC 150 Solar*	Solar controller	S3
	ATS unit	Automatic transfer switch (open transition)	S1
	ATS unit	Automatic transfer switch (closed transition)	S2
	DG PMS LITE	PMS lite controller	S2

Software packages and controller types

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

- S1 = Stand-alone
  - You can change the controller type to any other controller that uses S1 software.
- S2 = Core
- S3 = Extended
  - You can change the controller type to any other controller type*.
    - * To change to an ASC 150, the controller must have the sustainability option (S10).
- S4 = Premium
  - You can change the controller type to any other controller type*.
    - * To change to an ASC 150, the controller must have the sustainability option (S10).
  - All functions are supported.

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

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 - ESS** 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:

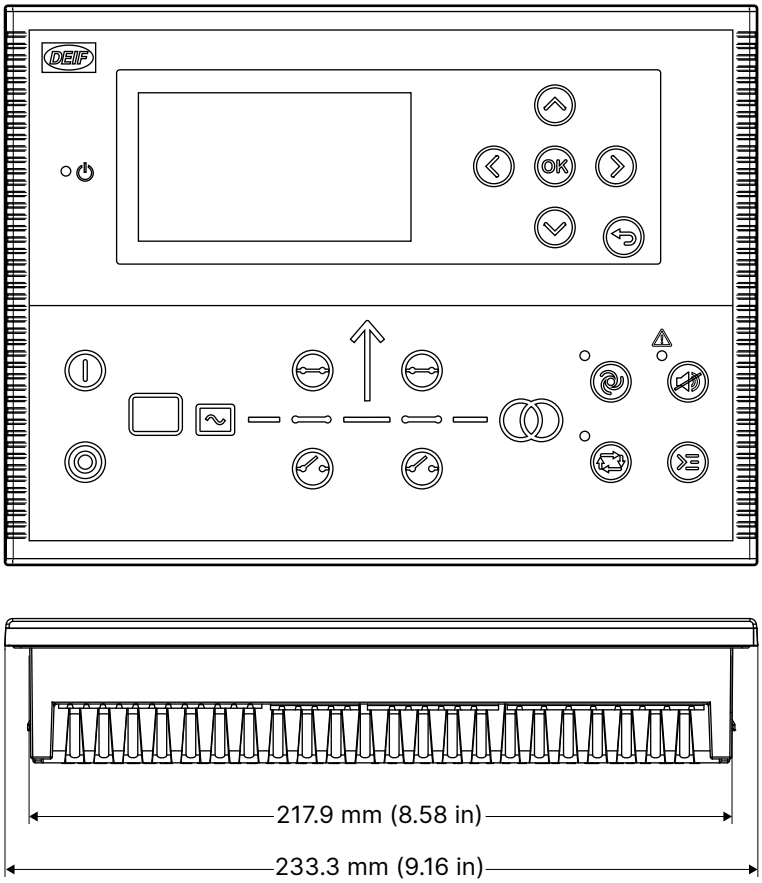
Communication	
	• Modbus master to PCS/BCU, BMS and PDS • Power meters • Modbus RTU, PLC, SCADA, Remote monitoring (Insight) Data connection 2-wire + common, or 3-wire Isolated External termination required (120 Ω + matching cable) 9600 to 115200
RS-485 Port 2	Used for: • Modbus master to PCS/BCU, BMS 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 AGC 150 and ASC 150 controllers • PC utility software Isolated Auto detecting 10/100 Mbit Ethernet port
USB	Service port (USB-B)

3.5 Approvals

Standards
CE
UL/cUL Listed to UL/ULC6200:2019, 1 ed. controls for stationary engine gensets

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

3.6 Dimensions and weight



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 AGC 150 software version 1.20.