AGC Automatic Gen-set Controller
DATA SHEET

Operation modes

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export

Engine control

- Start/stop sequences
- Run and stop coil
- Relay outputs for governor control

Protection (ANSI)

- Overcurrent, 4 levels (51)
- Reverse power, 2 levels (32)
- Multi inputs, 3 configurable
- Oil pressure, 2 levels
- Cooling water, 2 levels
- Fuel level, 2 levels

Display

- Push-buttons for start and stop
- Push-buttons for breaker operations
- Status texts
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

General

- USB interface to PC
- Free PC utility software for commissioning
- Mini SCADA in PC utility software
- 3/2/1-phase monitoring
- Close before excitation

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Application

The Automatic Gen-set Controller is a microprocessor based control unit containing all necessary functions for protection and control of a gen-set. It contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display.

The AGC is a compact all-in-one unit designed for the following applications:

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

Optional applications:

- Multiple gen-sets, load sharing
- Power management (island operation)
- Power management (island operation, split bus)
- Power management (island operation, ring bus)
- Power management (parallel with mains)
- Power management (parallel with mains, split bus)
- Power management (parallel with mains, ring bus)

The AGC can operate in automatic mains failure mode as a secondary mode regardless of the type of application - except the island applications.

The display is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J1 - display cable). Additional displays can be installed within 200m.

The AGC is supplied with an engine interface I/O card with separate power supply and processor. The card is equipped with the following I/Os:

In-/outputs		Available
Multi inputs:	4-20mA Digital inputs PT100 PT1000 VDO 0-40V DC	3 (3)
Digital inputs		7 (6)
RPM (MPU)		1
Relays		4
CANbus comm.		2

The number in parenthesis indicates the number of user configurable in-/outputs.

The two CAN communications are only available, if option G4, G5 or H5 is selected.

Test

The available gen-set modes except island operation include a test mode. The test can be configured in 3 different ways.

Simple: Gen-set starting and running for a preset time. Generator breaker is open during the test.

Load: Gen-set starting, synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power set point parallel to the mains.

Full: Gen-set starting, synchronisation of the generator breaker, de-load and opening of the mains breaker. The test is carried out for a preset period of time after which the load is transferred back to the mains connection.

Setup

Setup is easily done via a menu structure in the display (password protected) or via the USB PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the AGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard AGC, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 8, 9 and 10 for the options available.

Unit definitions

AGC: The standard control unit designed for a number of applications (1-9). An extensive list of hardware and software options is available for the AGC.

AGC mains: A power management control unit used in the parallel with mains power management application (6-9). Several options are available for the AGC mains.

AGC BTB: A power management control unit used in the power management application to split the busbar (8). Several options are available for the AGC BTB.

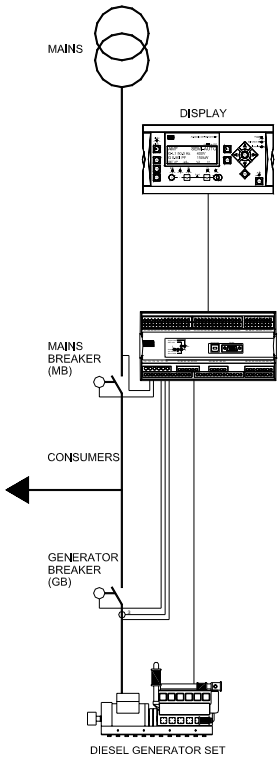
M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

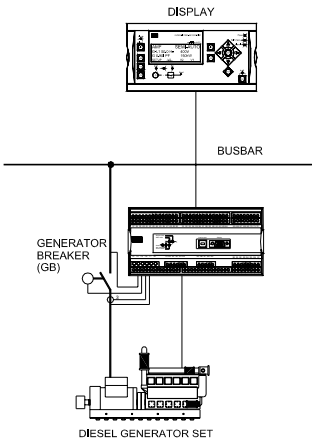
Single line application diagrams

Standard

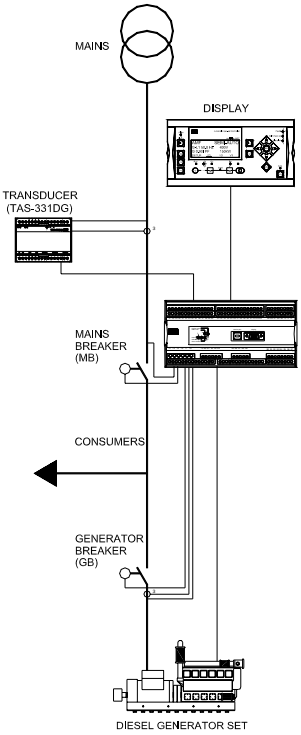
1. Automatic mains failure and fixed power/base load



2. Island

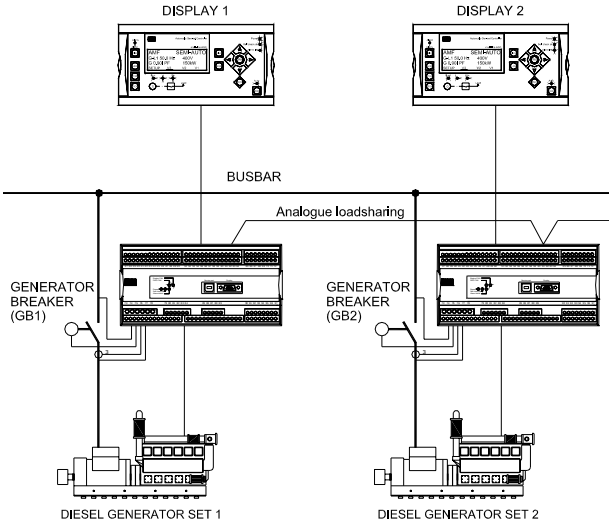


3. Peak shaving, load take over and mains power export



Optional

4. Multiple gen-sets, load sharing



5-9. Power management

See separate page in this data sheet

Power management (option G4/G5)

Description

The AGC can be equipped with a power management option (G4 or G5). Using this possibility, the AGC will be able to handle applications with up to

- 16 mains incoming
- 16 mains breakers
- 16 tie breakers
- 8 bus tie breakers (BTBs)
- 16 generators (256 on request)
- 16 generators
- 16 generator breakers

The basic functions are:

- All 56 breakers can be synchronised by choice
- Load dependent start/stop operation
- Priority selection of gen-sets
- Priority selection of mains
- Redundant communication between the controllers
- Plant divided into sections for individual functionality
- Selectable mains priority and parallel operation
- The plant mains failure sequence can call for support on local plant sections
- Load management
- Quick setup/broadcast
- Asymmetric load sharing
- CAN flags
- Droop frequency/voltage
- Heavy consumer (HC)
- Non-essential load (NEL)/load shedding
- Secured mode
- Base load
- Multi-master system

In a multi-master system, all vital data is broadcasted from all units to all units, giving all units knowledge of their own position in the application. This philosophy makes the application immune to a failing master controller.

Application

The plant modes supported by the power management options are:

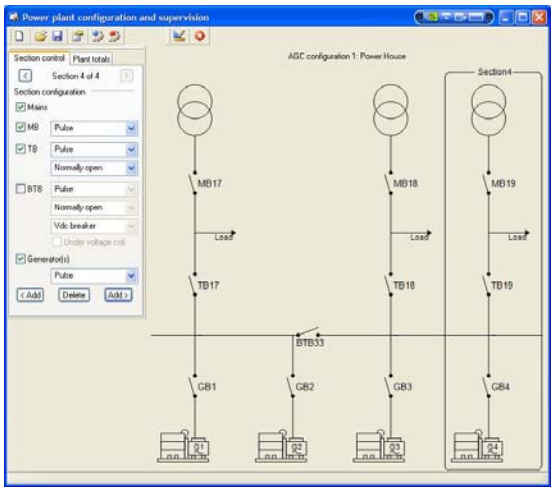
- Automatic mains failure/ATS
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

The plant modes are configurable and it is possible to change the plant mode on the fly both in single gen-set and in power management applications.

The plant can be divided into sections by several bus tie breakers, making it possible to run different plant modes in each section.

Configuration

The setup of the application is easily configured using a computer and the DEIF PC utility software.



Your PC tool visualises it - the AGC realises it.

Load management

The load management is primarily handled by the tie breakers. Functions are available to ensure sufficient power capacity to handle the load either in terms of number of gen-sets or by soft starting the load.

If a certain level of available power on the busbar is required to connect a load group, functions are available both for starting additional generators and relays can be configured to activate when a specific level of available power is reached.

Load dependent operation

The load dependent starting and stopping of the gen-sets is based on a *power available* calculation. The next generator will start when the available power decreases below the adjustable set point. It will stop when too much power is available.

Priority selection

Priority routines are individually made for the mains in the plant sections and for the gen-sets.

The mains priority routines in the AGC mains are:

- Selected primary mains
- Parallel mains

The gen-set priority routines in the AGC are:

- Manual selection based on ID
- Running hours
- Fuel optimising calculating the best combination of generator kW size and the plant load. Works with up to 16 gen-sets

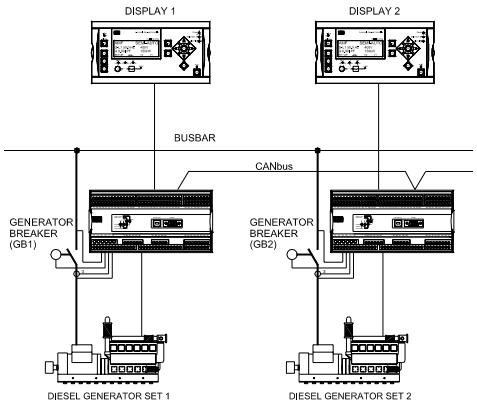
Redundant AGC mains and CANbus

In emergency systems requiring extra operation reliability, redundant AGC mains units and redundant CANbus communication lines can be used to provide back-up.

Redundant AGC mains units are only supported in the application: Dual mains (7).

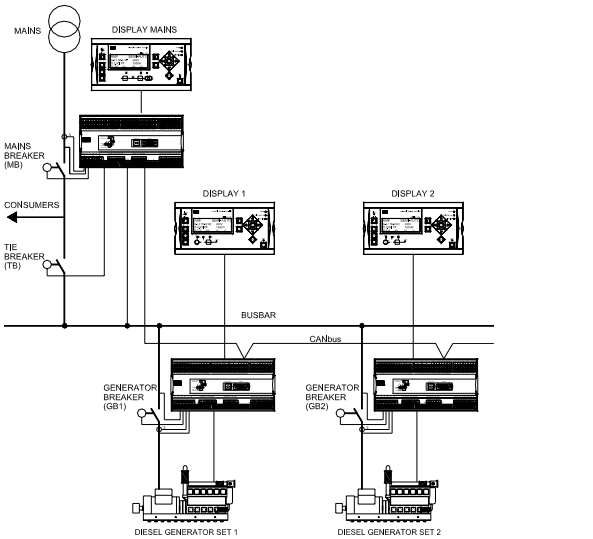
Optional power management applications

5. Island operation



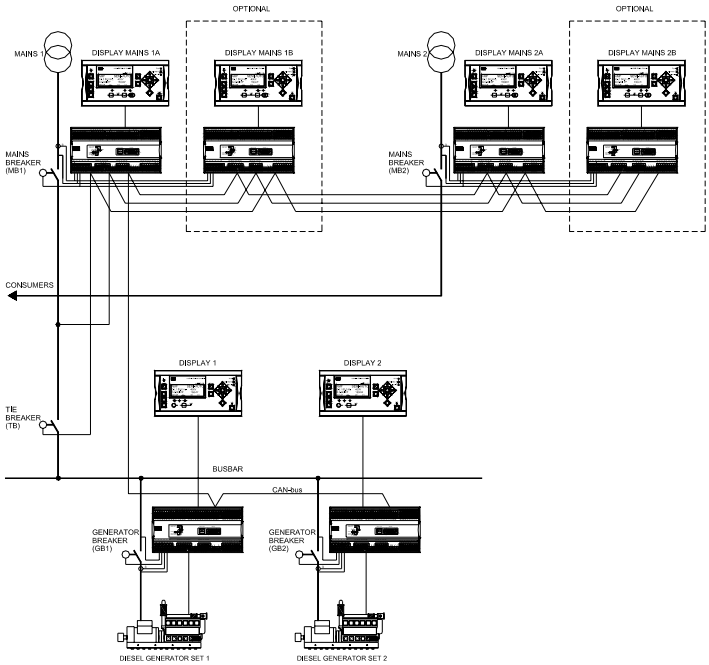
6. Parallel with mains

The tie breaker is selectable depending on applicational needs.



7. Parallel with 2 mains/dual mains application

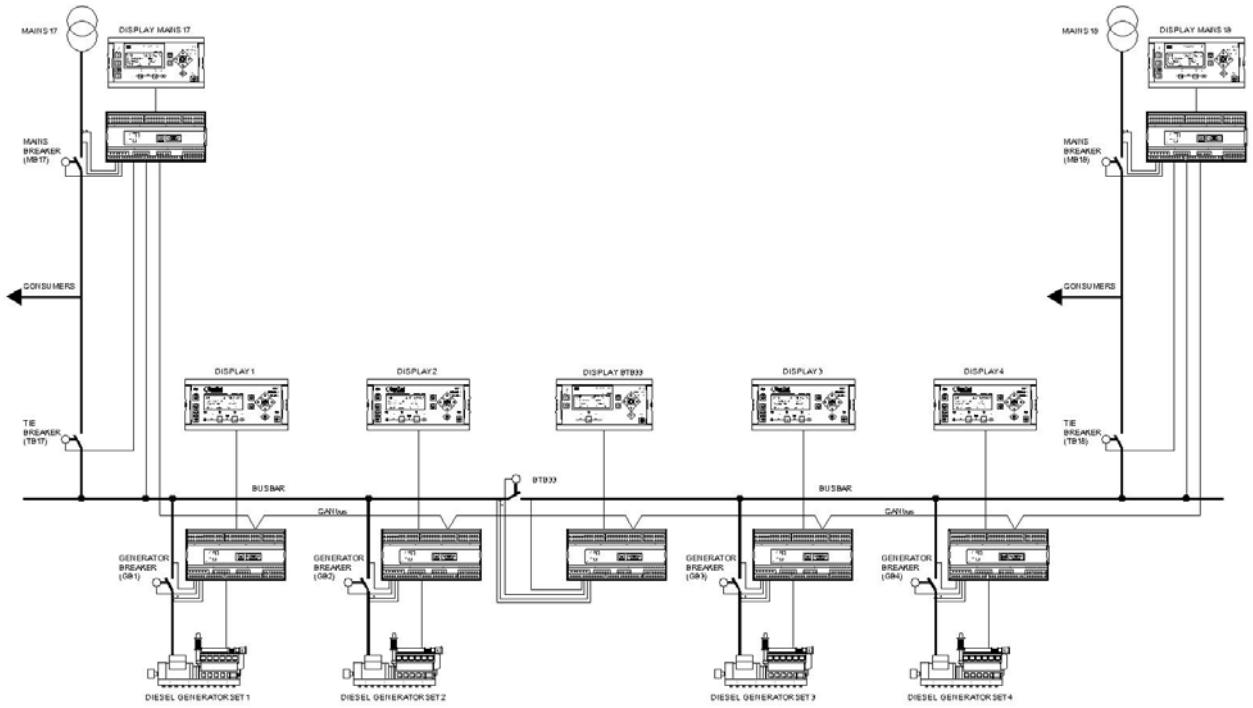
The tie breaker is selectable depending on applicational needs.



Optional power management applications

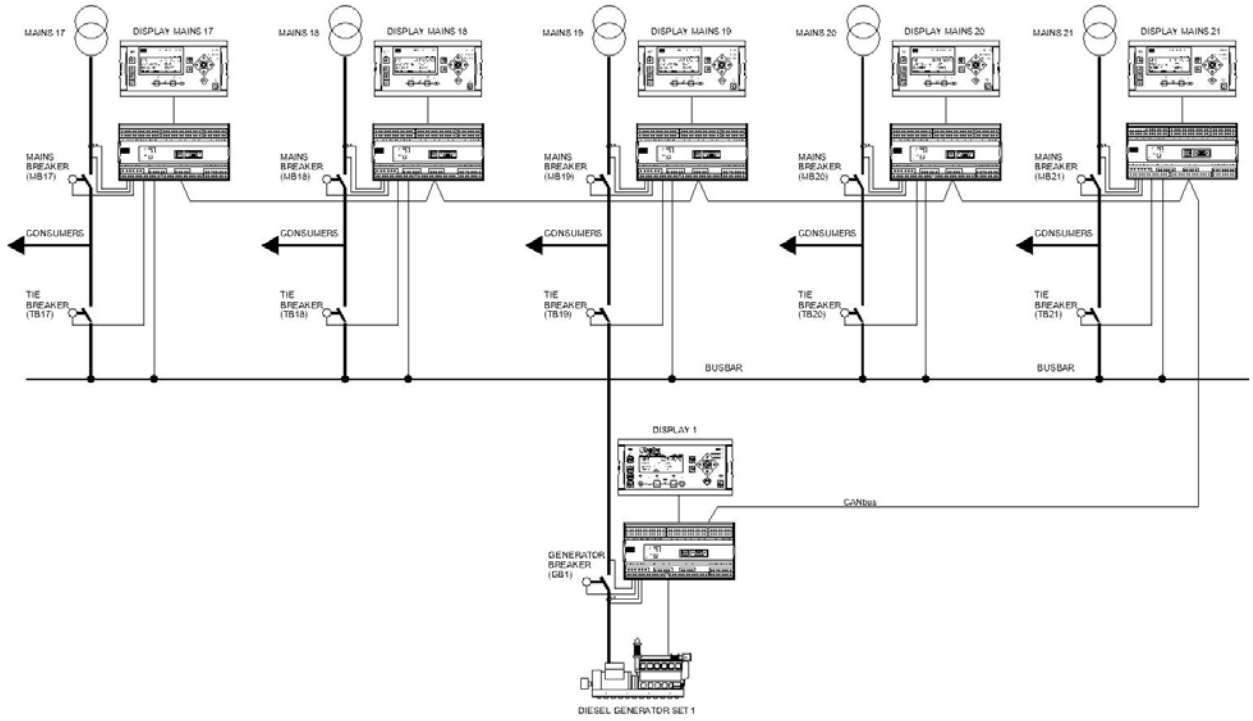
8. H-coupling

The tie breaker controlled by the AGC mains is selectable depending on applicational needs.



9. X mains and 1 DG

The tie breaker controlled by the AGC mains is selectable depending on applicational needs.



Available options

Option	Description	Slot no.	Option type	Note
A	**Loss of mains protection package**			
A1	Over- and undervoltage (generator and busbar/mains) **(27/59)** Over- and underfrequency (generator and busbar/mains) **(81)** Voltage unbalance (busbar) **(60)** Vector jump **(78)** df/dt (ROCOF) **(81)**		Software	
A2	Over- and undervoltage (generator and busbar/mains) **(27/59)** Over- and underfrequency (generator and busbar/mains) **(81)** Voltage unbalance (busbar) **(60)** df/dt (ROCOF) **(81)**		Software	
A3	Over- and undervoltage (generator and busbar/mains) **(27/59)** Over- and underfrequency (generator and busbar/mains) **(81)** Voltage unbalance (busbar) **(60)** Vector jump **(78)**		Software	
A4	Positive sequence (mains voltage low) **(27)**		Software	
A5	Directional overcurrent **(67)**		Software	
B	**Generator/busbar/mains protection package**			
B1	Over- and undervoltage (generator and busbar/mains) **(27/59)** Over- and underfrequency (generator and busbar/mains) **(81)** Voltage unbalance (busbar) **(60)**		Software	
C	**Generator add-on protection package**			
C1	Over- and undervoltage **(27/59)** Over- and underfrequency **(81)** Overload **(32)** Peak current **(50)** Current unbalance **(46)** Voltage unbalance **(60)** Reactive power import (excitation loss) **(40)** Reactive power export (overexcitation) **(40)** Voltage dependent overcurrent **(92)**		Software	
C2	Negative sequence voltage high **(47)** Negative sequence current high **(46)** Zero sequence voltage high **(59)** Zero sequence current high **(50)**		Software	
D	**Voltage/VAr/PF control**			Not available for AGC mains and AGC bus tie
D1	Constant voltage control (stand-alone) Constant reactive power control (parallel with mains) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators)		Software	Not with EF2
E and F	**Analogue controller and transducer outputs**			
E1	2 x +/-25mA (*GOV/AVR or transducer)*	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 x 0(4)...20mA (*GOV/AVR or transducer)*	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 x +/-25mA (*GOV/AVR or transducer)* 1 x 0(4)...20mA (*GOV/AVR or transducer)*	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 x +/-25mA (*GOV/AVR or transducer)* 2 x relay outputs (*GOV/AVR or configurable)*	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 x PWM (Pulse Width Modulated) output for CAT GOV +/-20mA for AVR. 2 x relay outputs for AVR	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20mA (*transducer)*	6	Hardware	Not with H8.2, M13.6, M14.6 or M15

Options E1, E2, EF2 and EF4 are used for GOV/AVR control. 4 relays are used as standard in the AGC for GOV/AVR control. If selected, these options will replace the 4 relays.

Option	Description	Slot no.	Option type	Note
G	**Load sharing/power management**			
G3	Load sharing with analogue lines	3	Hardware/ software	If M12 is present, G3 is a software option Not available for AGC mains and AGC bus tie
G4	Power management, 16 gen-sets, 8 bus tie breakers	7	Software	Not with H7 or G5
G5	Power management, 16 mains, 16 gen-sets, 8 bus tie breakers	7	Software	Not with H7 or G4
H	**Serial communication**			
H2	Modbus RTU (RS485)	2	Hardware	Not with H3, H8.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2
H5	CANbus: MTU (ADEC and MDEC) and all J1939 engine comm.	8	Hardware	Not with H6, H7, M13.8, M14.8, M15.8 or H8.8 Not available for AGC mains and AGC bus tie
H6	Cummins GCS	8	Hardware	Not with H5, H7, M13.8, M14.8, M15.8 or H8.8 Not available for AGC mains and AGC bus tie
H7	CANbus (J1939): Caterpillar Cummins CM850/570 Detroit Diesel (DDEC) Deutz (EMR) Iveco (NEF/CURSOR) John Deere (JDEC) Perkins Scania (EMS) Scania (EMS S6) Volvo Penta (EMS) Volvo (EMS2)	7	Software	Not with H5, H6 or G5 Not available for AGC mains and AGC bus tie
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3 H8.8: Not with H5, H6, M13.8, M14.8 or M15.8
H11	LED I/F card w/RS232 service port		Hardware	Not with N Class 1.0 measurements
J	**Cables**			
J1	Display cable with plugs, 3 m. UL94 (V1) approved		Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved		Other	
J3	PC cable for utility software (RS232) 3 m. UL94 (V1) approved		Other	Only with H11
J4	PC cable for N option programming (Ethernet cable crossed), 3 m. UL94 (V1) approved		Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved		Other	
J7	PC cable for utility software (USB) 3 m. UL94 (V1) approved		Other	Not with H11
J8	Display CAN cable for connection to display in the *Remote Maintenance Box*		Other	
K	**Documentation**			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	**Display gasket for IP54**		Other	Standard is IP52
M	**Binary and analogue I/Os**			
M12	13 binary inputs, 4 relay outputs, configurable	3	Hardware/ software	If G3 is present, M12 is a software option
M13.X	7 binary inputs, configurable	6, 8	Hardware	M13.6: Not with F1, M14.6 or M15 M13.8: Not with H5, H6, M14.8, M15.8 or H8.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	M14.6: Not with F1, M13.6 or M15 M14.8: Not with H5, H6, M13.8, M15.8 or H8.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6, M14.6 or M15.8 M15.8: Not with H5, H6, M13.8, M14.8, H8.8 or M15.6
N	**N-Options (N3)**			
N	- Modbus TCP/IP - SMS/e-mail alarms - Advanced logging		Hardware	
P	**Printer**			
P1	Event and alarm printer software		Software	Only with H11

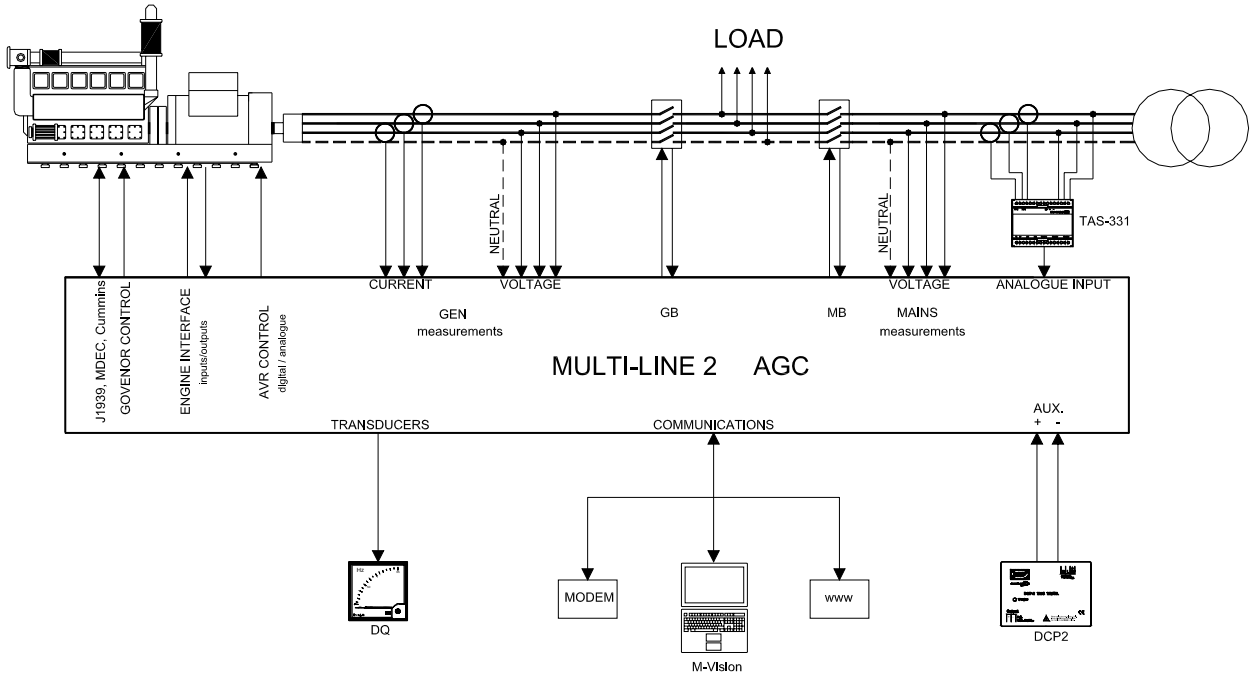
Option	Description	Slot no.	Option type	Note
Q	**Measurement accuracy**			
Q1	Verified class 0.5		Other	Not with H11
X	**Display**			
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each AGC unit Only available if the AGC unit is ordered with a display
X3	Additional operator panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	
X4	Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each AGC unit Only available if the AGC unit is ordered with a display
Y	**Display layout**			
Y1	AGC display for island operation (no mains breaker)		Other	

(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

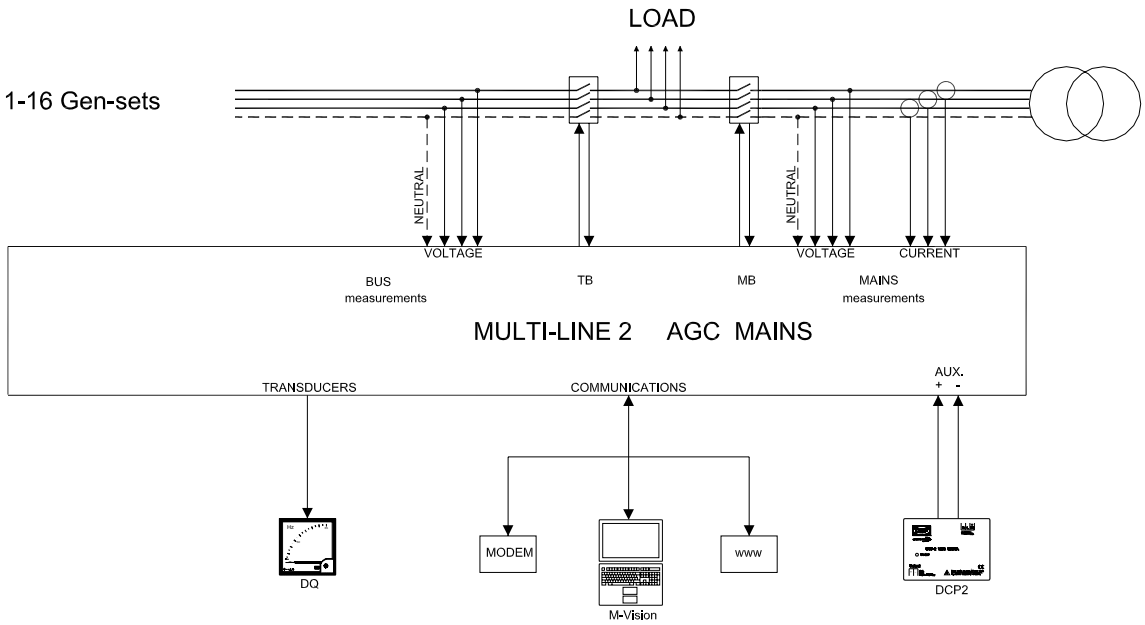
Please notice that not all options can be selected for the same unit. Please refer to page 12 in this data sheet for further information about the location of the options in the unit.

Principle diagrams

AGC



AGC mains



DEIF supplies a complete range of current transformers (DCT range of CTs), power supplies (DCP range), meters (DQ range) and transducers (TAS range) that are suitable for use with our range of generator controls and protection relays - please see www.deif.com for full details.

Hardware overview

Slot #4, term. 65-72
Governor, AVR, in-/outputs

M14.4:	4 x relay (standard)
E1:	2 x +/-20mA out
E2:	2 x 0(4)…20mA out
EF2:	1 x +/-20mA out 1 x 0(4)…20mA out
EF4:	1 x +/-20mA out 2 x relay
EF5:	1 x +/-20mA out 1 x PWM out 2 x relay

LED I/F

N:	Modbus TCP/IP SMS/e-mail alarms Advanced logging

Slot #6, term. 90-97
In-/outputs

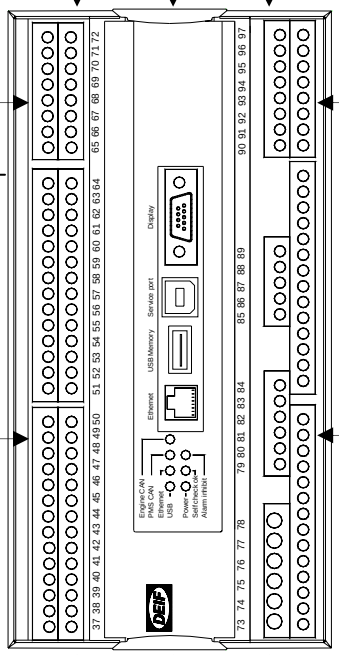
F1:	2 x 0(4)…20mA out, transducer
M13.6:	7 x digital inputs
M14.6:	4 x relay outputs
M15.6:	4 x 4…20mA inputs

Slot #8, term. 126-133
Engine comm., in-/outputs

H5:	MTU (MDEC) + J1939 (option H7)
H6:	Cummins GCS
H8.8:	Ext. I/O modules
M13.8:	7 x digital inputs
M14.8:	4 x relay outputs
M15.8:	4 x 4…20mA inputs

Slot #2, term. 29-36
Communication

H2:	Modbus RTU (RS485)
H3:	Profibus DP
H8.2:	Ext. I/O modules



Slot #1, term. 1-28
Power supply (std.)

8-36V DC supply, 11W
1 x status output relay
5 x relay outputs
2 x pulse outputs (kWh, kVArh)
5 x digital inputs

Slot #7, term. 98-125
Engine I/F (std.)

8-36V DC supply, 5W
1 x magnetic pick-up (MPU)
3 x multi inputs
7 x digital inputs
4 x relay outputs

G4/G5:	Power management
H7:	J1939

Slot #3, term. 37-64
In-/outputs/load sharing

M12:	13 x digital inputs 4 x relay outputs
G3:	Active power load sharing Reactive power load sharing (requires D1)

LED I/F

H11:	RS232 service port

Slot #5, term. 73-89
AC measuring (std.)

3 x generator voltage
3 x generator current
3 x busbar/mains voltage

There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:
Class 1.0
Class 0.5 with option Q1

Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance

Class 1.0 for neg. seq. current

Fast overcurrent:
3% of 350%*In

Analogue outputs:
Class 1.0 according to total range

Option EF4: Class 4.0 according to total range

To EN60688/IEC 688

Operating temp.: -25…70°C (-13...158° F)
(UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)

Storage temp.: -40…70°C (-40...158° F)

Climate: Class HSE, to DIN 40040

Meas. voltage: 100-690V AC +/-20%
(UL/cUL Listed: 480V AC phase-phase)

Consumption: Max. 0.25VA/phase

Meas. current: -/1 or -/5A AC
(UL/cUL Listed: From CTs 1-5A)

Consumption: Max. 0.3VA/phase

Current overload: 4 x I_n continuously
20 x I_n, 10 sec. (max. 75A)
80 x I_n, 1 sec. (max. 300A)

Meas. frequency: 30…70Hz

Aux. supply: Terminals 1 and 2:
12/24V DC (8...36V continuously, 6V 1 sec.)
Max. 11W consumption

Terminals 98 and 99:
12/24V DC (8...36V continuously, 6V 1 sec.)
Max. 5W consumption

The aux. supply inputs are to be protected by a 2A slow blow fuse
(UL/cUL Listed: AWG 24)

Binary inputs: Optocoupler, bi-directional
ON: 8…36V DC
Impedance: 4.7kΩ
OFF: <2V DC

Analogue inputs: -10…+10V DC:
Not galvanically separated
Impedance: 100kΩ

0(4)…20mA:
Impedance: 50Ω
Not galvanically separated

RPM (MPU): 2…70V AC, 10…10000Hz, 250…3000Ω

Multi inputs: 0(4)…20mA:
0-20mA, +/-1%
Not galvanically separated

Binary:
Max. resistance for ON detection: 100Ω
Not galvanically separated

PT100/1000:
-40…250°C, +/-1%
Not galvanically separated
To IEC 751 and EN60751

VDO:
0…1700Ω, +/-2%
Not galvanically separated

V DC:
0…40V DC, +/-1%
Not galvanically separated

Relay outputs: Electrical rating:
250V AC/30V DC, 5A
(UL/cUL Listed: 250V AC/24V DC, 2A resistive load)

Thermal rating @ 50°C:
2A: Continuously
4A: t_{ON} = 5 sec., t_{OFF} = 15 sec.

(Unit status output: 1A)

Open collector outputs: Supply: 8…36V DC, max. 10mA

Analogue outputs: 0(4)...20mA and +/-25mA
Galvanically separated
Active output (internal supply)
Load max. 500Ω
(UL/cUL Listed: Max. 20mA output)

Update rate:
Transducer output: 250 ms
Regulator output: 100 ms

Load sharing lines: -5…0…+5V DC,
Impedance: 23.5 kΩ

Galv. separation: Between AC voltage, AC current and other I/Os:
3250V AC, 50Hz, 1 min.

Between analogue outputs and other I/Os:
500V DC, 1 min.

Between binary input groups and other I/Os:
500V DC, 1 min.

Response times:
(Delay set to min.)

Busbar:

Over-/undervoltage:	< 50ms
Over-/underfrequency:	< 50ms
Voltage unbalance:	<250ms

Generator:

Reverse power:	<250ms
Overcurrent:	<250ms
Fast overcurrent:	< 40ms
Directional overcurrent	<100ms
Over-/undervoltage:	<250ms
Over-/underfrequency:	<350ms
Overload:	<250ms
Current unbalance:	<250ms
Voltage unbalance:	<250ms
React. power import:	<250ms
React. power export:	<250ms
Voltage dep. I>:	<250ms
Negative sequence I:	<500ms
Negative sequence U:	<500ms
Zero sequence I:	<500ms
Zero sequence U:	<500ms
Overspeed:	<500ms
Digital inputs:	<250ms
Emergency stop:	<200ms
Multi inputs:	<800ms
Wire failure:	<600ms

Mains:

df/dt (ROCOF):	<130ms (4 periods)
Vector jump:	< 40ms
Positive sequence:	< 60ms

Mounting: DIN-rail mount or base mount with 6 screws

Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2
To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2

EMC/CE: To EN 61000-6-1/2/3/4
SS4631503 (PL4) and
IEC 255-3

Material: All plastic materials are self-extinguishing according to UL94 (V1)

Plug connections:

AC current:
0.2-4.0 mm^2 stranded wire
(UL/cUL Listed: AWG 18)

AC voltage:
0.2-2.5 mm^2 stranded wire
(UL/cUL Listed: AWG 20)

Relays:
(UL/cUL Listed: AWG 22)

Terminals 98-116:
0.2-1.5 mm^2 stranded wire
(UL/cUL Listed: AWG 24)

Other:
0.2-2.5 mm^2 stranded wire
(UL/cUL Listed: AWG 24)

Display:
9-pole Sub-D female

Service port:
USB A-B

Protection: Unit: IP20
Display: IP52 (IP54 with gasket: Option L)
(UL/cUL Listed: Type Complete Device, Open Type)

To IEC 529 and EN 60529

Governors: Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at
www.deif.com

Approvals: UL and cUL

UL markings: Wiring:
Use 60/75°C copper conductors only

Mounting:
For use on a flat surface of type 1 enclosure

Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

AOP-2: Maximum ambient temperature:
60°C

Wiring:
Use 60/75°C copper conductors only

Mounting:
For use on a flat surface of type 3 (IP54) enclosure
Main disconnect must be provided by installer

Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

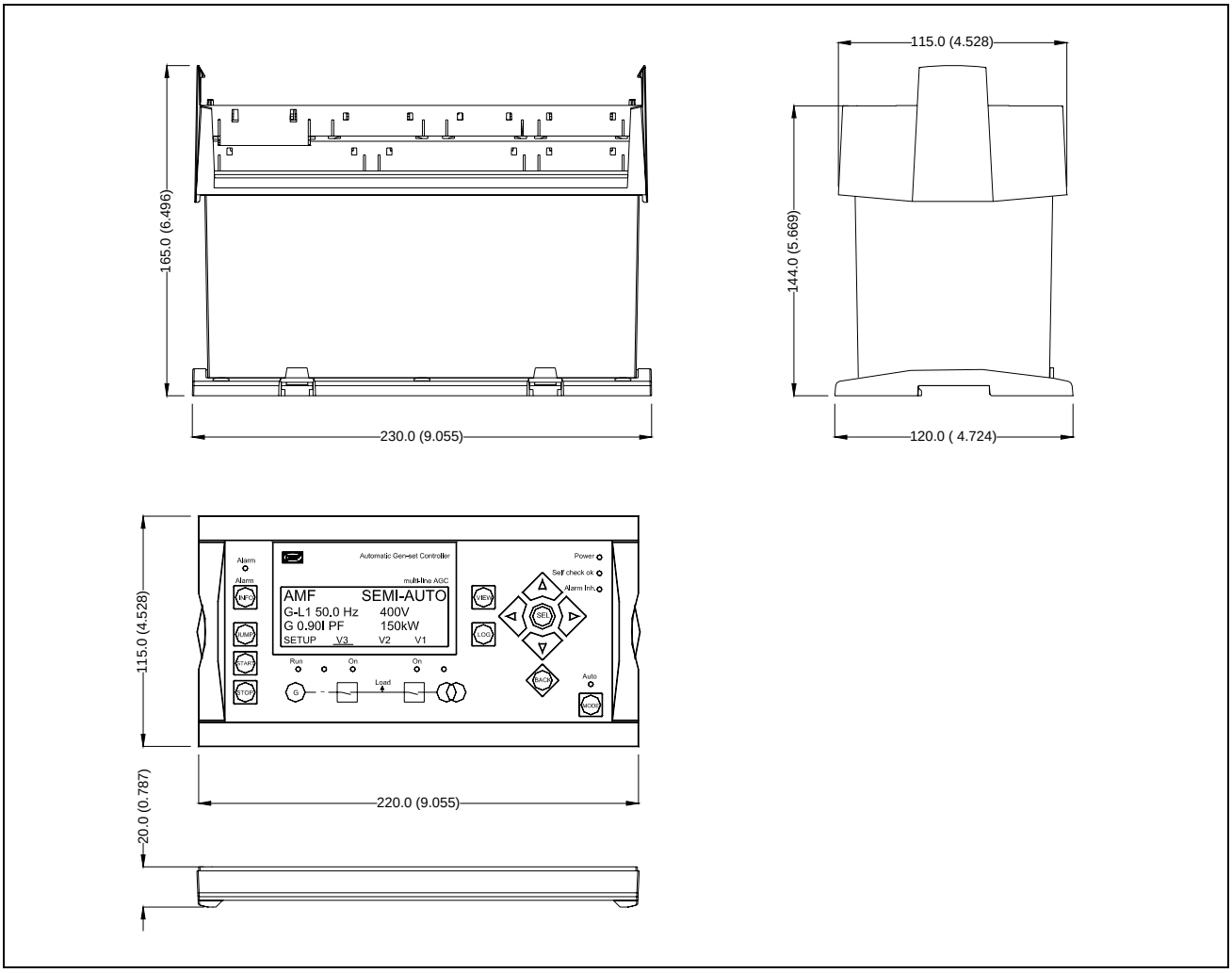
DC/DC converter for AOP-2:

Tightening torque:	0.5Nm (4.4lb-in)
Wire size:	AWG 22-14

Weight:

Base unit:	1.6 kg (3.5 lbs.)
Option J1/J3/ J4/J6/J7:	0.2 kg (0.4 lbs.)
Option J2:	0.4 kg (0.9 lbs.)
Display:	0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications

TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays
AGC						

Example

TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays
AGC	3.x	C1	E1	H5		213

TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays
AGC mains		G5				

Example

TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays
AGC mains	3.x	G5	M13.6	M14.8		105

Displays: 213

Total number of displays:
0: No display
1: 1 Std. display
2: 1 Std. + 1 add. display (Option X2)
3: 1 Std. + 2 add. displays (Option X2)

Total number of AOP-1 (Option X3)

Total number of AOP-2 (Option X4)

The AGC mains unit is only usable with option G5, this option is already included when ordered. The AGC bus tie unit is only usable with option G4 or G5.

Specify the AGC type: DG/mains/BTB.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

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