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DATA SHEET

Generator Paralleling Controller, GPC-3 Gas

- Regulation modes
- Generator protection (ANSI)
- M-Logic (Micro PLC)
- Busbar protection (ANSI)
- Display
- General

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1. Contents

1. Contents

1.1 General information

1.1.1 Application

The Generator Paralleling Controller (GPC-3 Gas) is a compact all in one microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPC-3 Gas is intended for gas engine applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel to mains

The GPC-3 Gas can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via digital and analogue I/Os or via serial communication.

1.1.2 Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3 m display cable included). Up to two additional displays can be installed within 200 m.

The display unit shows all measured and calculated values as well as alarms and data from the event log.

1.1.3 Operation modes

Four different regulation modes can easily be selected through digital inputs on the standard GPC-3 Gas, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Frequency droop
4. Load sharing

If the automatic voltage regulator is controlled by the GPC-3 Gas, the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAr
3. Fixed power factor
4. Reactive load sharing
5. Voltage droop

AVR control requires option D1.

1.1.4 Self-test

The GPC-3 Gas automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output (status output).

1.1.5 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.

1.1.6 Engine control and protection

With the engine control and protection option added, the GPC-3 Gas will control the start and stop sequences of the engine and furthermore it can be used as engine protection unit providing full back-up of engine shut-down channels in case the main processor fails.

1.1.7 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/Documentation & Software. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and down-loading of software updates.

1.1.8 Options

In order to perfectly match the product solution to specific applications, the functionality of the GPC-3 Gas can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPC-3 Gas, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic genset controller.

Please refer to the paragraph "Available options" for the options available.

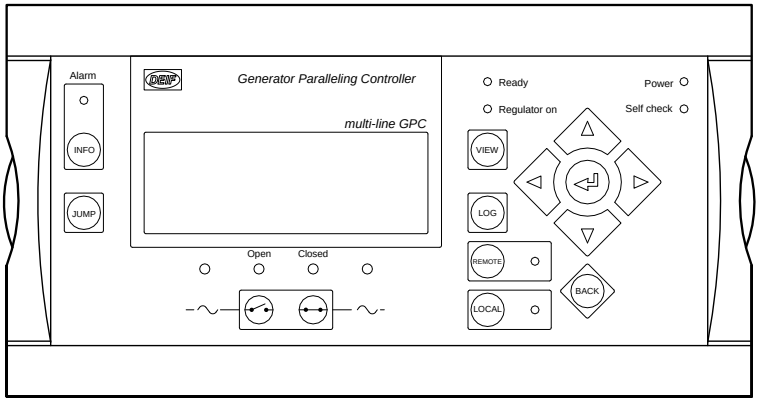
1.1.9 Approvals

The GPC-3 Gas is UL/cUL listed.

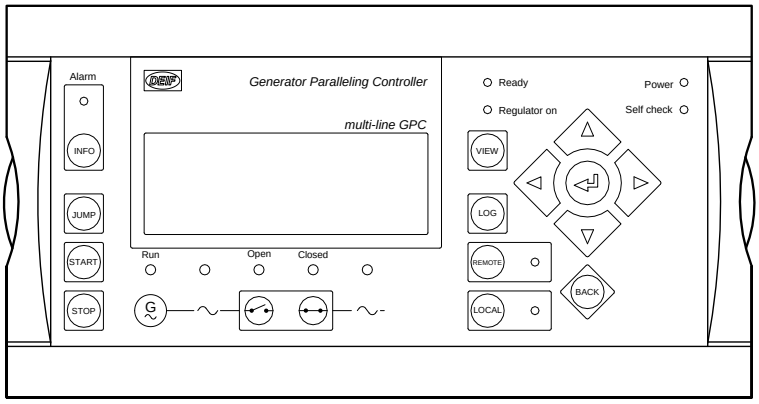
Please refer to www.deif.com for details and certificates.

1.2 Display layouts

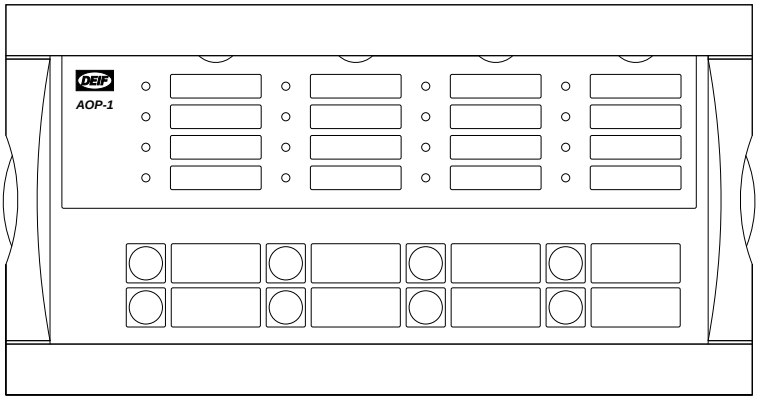
Standard delivery



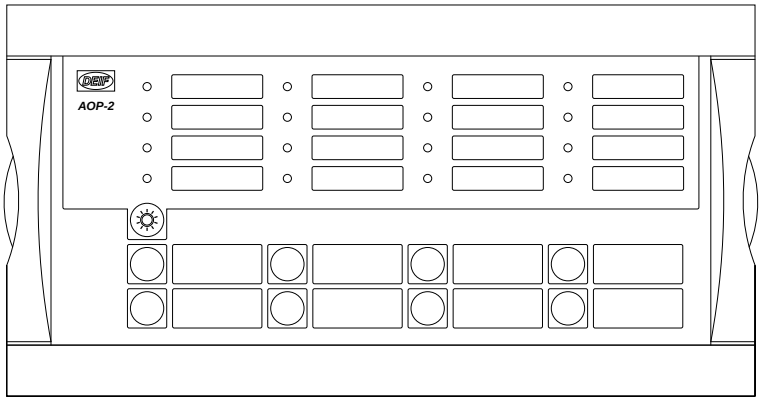
Engine and GB control (option Y1)



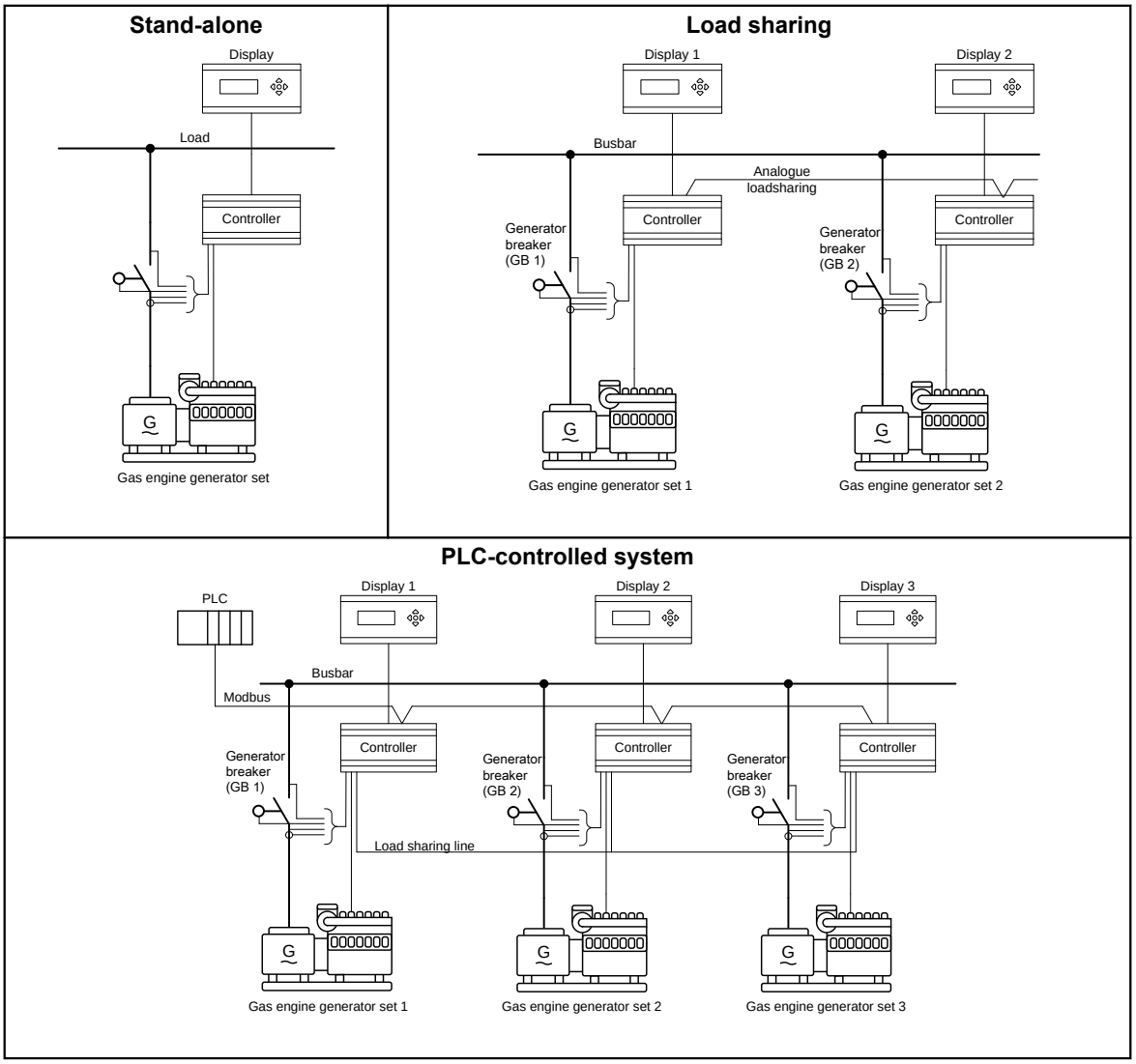
Additional operator's panel - AOP-1 (option X3)



Additional operator’s panel - AOP-2 (option X4)

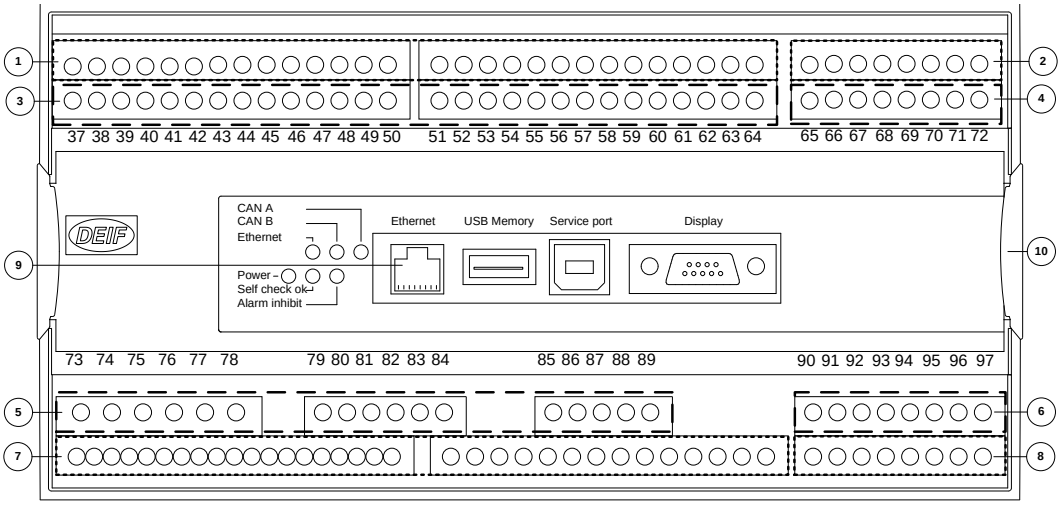


1.3 Application examples



The GPC-3 Gas can be used in simple or complex applications. The above shows some of the applications, but due to the flexible mode selection, the GPC-3 Gas can be used in all applications. The GPC-3 Gas is also designed to work with the Uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.

1.4 Hardware overview



(1) : The numbers in the drawing above refer to the slot numbers indicated in the table below.

Slot #	Option/standard	Description
1		**Terminal 1-28, power supply**
	Standard	8 to 36 V_{dc} supply, 11 W; 1 × status output relay; 5 × relay outputs; 2 × pulse outputs (kWh, kvarh); 5 × digital inputs
2		**Terminal 29-36, communication**
	H2	Modbus RTU (RS-485)
	H3	Profibus DP
	H8.2	External I/O modules
	H9.2	Modbus RTU/ASCII (RS-232)
3		**Terminal 37-64, load sharing**
	Standard	13 × digital inputs; 4 × relay outputs; 1 × P load sharing line; 1 × Q load sharing line; 2 × inputs for ext. set point (GOV/AVR)
4		**Terminal 65-72, GOV/AVR/transducer outputs**
	Standard	4 × relay outputs
	E1	2 × +/-20 mA outputs

Slot #	Option/standard	Description
	E2	2 × 0(4) to 20 mA outputs
	EF2	1 × +/-20 mA output; 1 × 0(4) to 20 mA output
	EF4	1 × +/-20 mA output; 2 × relays
	EF5	1 × PWM output; 1 × +/-20 mA output; 2 × relays
5		**Terminal 73-89, AC measuring**
	Standard	3 × generator voltage; 3 × generator current; 3 × busbar/mains voltage
6		**Terminal 90-97, inputs/outputs**
	F1	2 × 0(4) to 20 mA outputs
	M13.6	7 × digital inputs
	M14.6	4 × relay outputs
	M15.6	4 × 4 to 20 mA inputs
7		**Terminal 98-125, engine I/F**
	M4	8 to 36 V_{dc} supply, 5 W; 1 × magnetic pickup (MPU); 3 × multi-inputs; 7 × digital inputs; 4 × relay outputs
	H7	CANbus J1939 (requires M4)
8		**Terminal 126-133, engine communication, inputs/outputs**
	H5	MTU (MDEC) + J1939
	H6	Cummins GCS
	H8.8	External I/O modules
	M13.8	7 × digital inputs
	M14.8	4 × relay outputs
	M15.8	4 × 4 to 20 mA inputs
9		**LED & I/F**
	Standard	Display connection; service port (USB); power LED; self check LED; alarm inhibit LED; EtherNet (option N) LED
10		**EtherNet**
	N	Modbus TCP/IP; EtherNet/IP; SMS/e-mail alarms

There can only be one hardware option in each slot. For example, it is 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 above, it is possible to select the software options mentioned in the paragraph "Available options".

1.5 Technical information and dimensions

1.5.1 Technical specifications

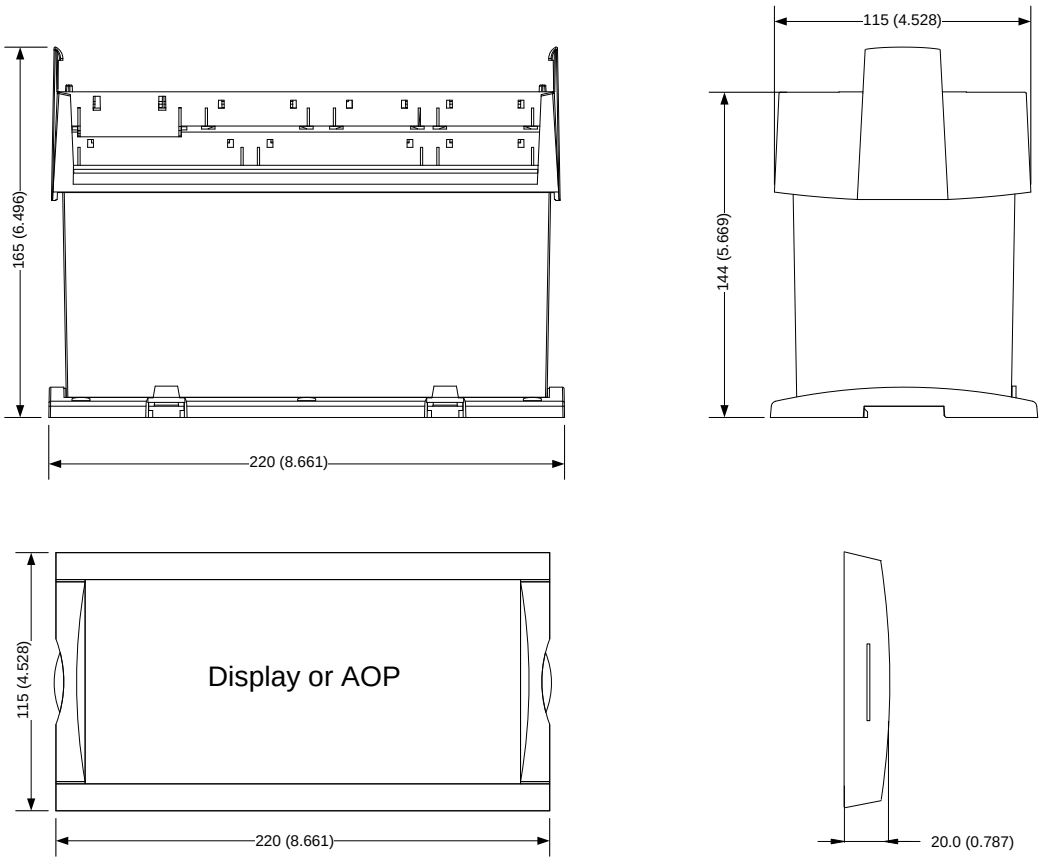
Accuracy	Class 1.0 -25 to 15 to 30 to 70 °C Temperature coefficient: +/-0.2 % of full scale per 10 °C Positive, negative and zero sequence alarms: class 1 within 5 % voltage unbalance Class 1.0 for negative sequence current Fast over-current: 3 % of 350 %*In Analogue outputs: class 1.0 according to total range Option EF4/EF5: class 4.0 according to total range To IEC/EN 60688
Operating temperature	-25 to 70 °C (-13 to 158 °F) With option N: -25 to 60 °C (-13 to 140 °F) (UL/cUL Listed: max. surrounding air temperature: 55 °C/131 °F)
Storage temperature	-40 to 70 °C (-40 to 158 °F)
Climate	97 % RH to IEC 60068-2-30
Operating altitude	0 to 4000 m above sea level Derating 2001 to 4000 m above sea level: Max. 480 V_{ac} phase-phase 3W4 measuring voltage Max. 690 V_{ac} phase-phase 3W3 measuring voltage
Measuring voltage	100 to 690 V_{ac} +/-20 % (UL/cUL Listed: 600 V_{ac} phase-phase) Consumption: max. 0.25 VA/phase
Measuring current	-/1 or -/5 A_{ac} (UL/cUL Listed: from CTs 1-5 A) Consumption: max. 0.3 VA/phase
Current overload	4 × I_n continuously 20 × I_n, 10 sec. (max. 75 A) 80 × I_n, 1 sec. (max. 300 A)
Measuring frequency	30 to 70 Hz
Aux. supply	Terminals 1 and 2: 12/24 V_{dc} (8 to 36 V continuously, 6 V 1 sec.). Max. 11 W consumption Battery voltage measurement accuracy: ±0.8 V within 8 to 32 V_{dc}, ±0.5 V within 8 to 32 V_{dc} @ 20 °C Terminals 98 and 99: 12/24 V_{dc} (8 to 36 V continuously, 6 V 1 sec.). Max. 5 W consumption The aux. supply inputs are to be protected by a 2 A slow-blow fuse (UL/cUL Listed: AWG 24)

Digital inputs	Optocoupler, bi-directional ON: 8 to 36 V_{dc} Impedance: 4.7 kΩ OFF: <2 V_{dc}
Analogue inputs	0(4) to 20 mA Impedance: 50 Ω. Not galvanically separated RPM (MPU): 2 to 70 V_{ac}, 10 to 10000 Hz, max. 50 kΩ
Multi-inputs	0(4) to 20 mA: 0 to 20 mA, +/-1 %. Not galvanically separated Binary: max. resistance for ON detection: 100 Ω. Not galvanically separated Pt100/1000: -40 to 250 °C, +/-1 %. Not galvanically separated. To IEC/EN 60751 VDO: 0 to 1700 Ω, +/-2 %. Not galvanically separated V_{dc}: 0 to 40 V_{dc}, +/-1 %. Not galvanically separated
Relay outputs	Electrical rating: 250 V_{ac}/30 V_{dc}, 5 A. (UL/cUL Listed: 250 V_{ac}/24 V_{dc}, 2 A resistive load) Thermal rating @ 50 °C: 2 A: continuously. 4 A: t_{on} = 5 sec., t_{off} = 15 sec. (Unit status output: 1 A)
Open collector outputs	Supply: 8 to 36 V_{dc}, max. 10 mA
Analogue outputs	0(4) to 20 mA and +/-25 mA. Galvanically separated. Active output (internal supply). Load max. 500 Ω. (UL/cUL Listed: max. 20 mA output) Update rate: transducer output: 250 ms. Regulator output: 100 ms
Analogue load sharing lines	-5 to 0 to +5 V_{dc}. Impedance: 23.5 kΩ
Galvanic separation	Between AC voltage and other I/Os: 3250 V, 50 Hz, 1 min. Between AC current and other I/Os: 2200 V, 50 Hz, 1 min. Between analogue outputs and other I/Os: 550 V, 50 Hz, 1 min. Between binary input groups and other I/Os: 550 V, 50 Hz, 1 min.

Response times (Delay set to min.)	**Busbar:** Over-/under-voltage: <50 ms Over-/under-frequency: <50 ms Voltage unbalance: <200 ms **Generator:** Reverse power: <200 ms Over-current: <200 ms Fast over-current: <40 ms Over-/under-voltage: <200 ms Over-/under-frequency: <300 ms Overload: <200 ms Current unbalance: <200 ms Voltage unbalance: <200 ms React. power import: <200 ms React. power export: <200 ms Overspeed: <400 ms Digital inputs: <250 ms Emergency stop: <200 ms Multi-inputs: <800 ms Wire failure: <600 ms **Mains:** df/dt (ROCOF): <130 ms (4 periods) Vector jump: <40 ms Positive sequence: <60 ms
Mounting	DIN-rail mount or base mount with six screws
Safety	To EN 61010-1, installation category (over-voltage category) III, 600 V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, over-voltage category III, 600 V, pollution degree 2
EMC/CE	To EN 61000-6-2, EN 61000-6-4, IEC 60255-26
Vibration	3 to 13.2 Hz: 2 mm_{pp}. 13.2 to 100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10 10 to 60 Hz: 0.15 mm_{pp}. 60 to 150 Hz: 1 g. To IEC 60255-21-1 Response (class 2) 10 to 150 Hz: 2 g. To IEC 60255-21-1 Endurance (class 2)
Shock (base mount)	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 Endurance (class 2) 50 g, 11 ms, half sine. To IEC 60068-2-27
Bump	20 g, 16 ms, half sine. To IEC 60255-21-2 (class 2)
Material	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections	AC current: 0.2 to 4.0 mm^2 stranded wire. (UL/cUL Listed: AWG 18) AC voltage: 0.2 to 2.5 mm^2 stranded wire. (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2 to 1.5 mm^2 stranded wire. (UL/cUL Listed: AWG 24) Other: 0.2 to 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/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/cUL Listed to UL508. UL/cUL Recognized to UL2200
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: 0.5 Nm (4.4 lb-in) Wire size: AWG 22-14
Weight	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

1.5.2 Unit dimensions in mm (inches)



1.6 Available variants

Type	Variant no.	Description	Item no.	Note
GPC-3 Gas	01	GPC-3 Gas with display	2912010040-01 + A1 + D1	
GPC-3 Gas	02	GPC-3 Gas without display	2912010040-02 + A1 + D1 + F1 + EF4 + N + K2	
GPC-3 Gas	03	GPC-3 Gas without display	2912010040-03	
GPC-3 Gas	04	GPC-3 Gas with display	2912010040-04 + J1	

1.7 Available options

Option	Description	Slot no.	Option type	Note
A	**Mains protection package**			
A1	Time-dependent under-voltage **(27t)** Under-voltage and reactive power low **(27Q)** Vector jump **(78**) df/dt (ROCOF) **(81)**		Software	
A4	Positive sequence (mains voltage low) **(27D)**		Software	
A5	Directional over-current **(67)**		Software	
C	**Generator add-on protection package**			
C2	Negative sequence voltage high **(47)** Negative sequence current high **(46)** Zero sequence voltage high **(59)** Zero sequence current high **(50)** Power-dependent reactive power import/ex-port **(40)** Inverse time over-current **(51)**		Software	
D	**Voltage control**			
D1	Constant voltage control Constant reactive power control Constant power factor control Reactive load sharing Voltage droop		Software	
E and F	**Analogue controller and transducer out-puts**			
E1	2 × +/-25 mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 × 0(4) to 20 mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 × +/-25 mA (GOV/AVR or transducer) 1 × 0(4) to 20 mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 × +/-25 mA (GOV/AVR or transducer) 2 × relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 × PWM (Pulse Width Modulated) output for CAT GOV 1 × +/-25 mA (GOV/AVR or transducer) 2 × relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1

Option	Description	Slot no.	Option type	Note
F1	2 × 0(4) to 20 mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
H	**Serial communication**			
H2	Modbus RTU/ASCII (RS-485)	2	Hardware	Not with H3, H8.2 or H9.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2 or H9.2
H5	Engine comm.: MTU (ADEC/MDEC) and CANbus J1939 (H7)	8	Hardware	Not with H7, H8.8, M13.8, M14.8 or M15.8
H6	Cummins GCS	8	Hardware	Not with H5, H7, H8.8, M13.8, M14.8 or M15.8
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	Requires M4 Not with H5
H8.X	External I/O modules	2, 8	Hardware	**H8.2:** Not with H2, H3, H8.8 or H9.2 **H8.8:** Not with H5, H6, H8.2, M13.8, M14.8 or M15.8
H9.2	Modbus RTU/ASCII (RS-232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2
L	**Display gasket for IP54**		Other	Standard is IP52
M	**Engine control, digital and analogue I/Os**			
M4	Engine control and protection (safety system) OR I/O extension	7	Hardware	
M13.X	7 digital inputs, configurable	6, 8	Hardware	**M13.6:** Not with F1, M14.6 or M15.6 **M13.8:** Not with H5, H6, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	**M14.6:** Not with F1, M13.6 or M15.6 **M14.8:** Not with H5, H6, H8.8, M13.8 or M15.8

Option	Description	Slot no.	Option type	Note
M15.X	4 analogue inputs, configurable, 4 to 20 mA	6, 8	Hardware	**M15.6:** Not with F1, M13.6 or M14.6 **M15.8:** Not with H5, H6, H8.8, M13.8 or M14.8
N	**Ethernet TCP/IP communication**			
N	Modbus TCP/IP EtherNet/IP SMS/e-mail alarms		Hardware/ software	
Q	**Measurement accuracy**			
Q1	Verified class 0.5		Other	
T				
T2	Digital communication to AVR (J1939)	8	Other	Uses option H5 hard-ware
Y	**Display layout**			
Y1	Engine and GB control		Other	Requires M4

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

Four relays are available as standard in slot #4 for GOV/AVR control. If one of the options E1, E2, EF2, EF4 or EF5 is selected, these options will replace the four relays.

Please notice that not all options can be selected for the same unit. Please refer to the para-graph "Hardware overview" in this data sheet for further information about the location of the HW options in the unit.

1.8 Available accessories

Type	Description	Item no.	Note
Accessory for GPC-3 Gas	Additional standard display (X2) with CANbus	2912890030	Max. 2
Accessory for GPC-3 Gas	Operator's panel AOP-1 (X3) 16 LEDs, 8 buttons, 1 status relay, configurable	2912411070	One only
Accessory for GPC-3 Gas	Operator's panel AOP-2 (X4) 16 LEDs, 8 buttons, 1 status relay, configurable. CANbus	2912411060	Max. 5
Accessory for GPC-3 Gas	3 m display cable (J1)	1022040076	1 pc. always included
Accessory for GPC-3 Gas	6 m display cable (J2)	1022040057	
Accessory for GPC-3 Gas	Crossed Ethernet cable for option N programming (J4)	1022040055	
Accessory for GPC-3 Gas	1 m display cable (J6)	1022040064	
Accessory for GPC-3 Gas	3 m USB programming cable (J7)	1022040065	
Accessory for GPC-3 Gas	Designer's Reference Handbook (hard copy) (K1)	4189340587	
Accessory for GPC-3 Gas	CD-ROM complete documentation (K2)	2304230002	

1.9 Order specifications and disclaimer

1.9.1 Order specifications

Variants

Mandatory information			Additional options to the standard variant				
Item no.	**Type**	**Variant no.**	**Option**	**Option**	**Option**	**Option**	**Option**

Example:

Mandatory information			Additional options to the standard variant				
Item no.	**Type**	**Variant no.**	**Option**	**Option**	**Option**	**Option**	**Option**
2912010040-01	GPC-3 Gas	01	M4	Y1	H2		

Accessories

Mandatory information		
Item no.	**Type**	**Accessory**

Example:

Mandatory information		
Item no.	**Type**	**Accessory**
1022040076	Accessory for GPC-3 Gas	3 m display cable (J1)

1.9.2 Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.