



-power in control



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Generator Paralleling Controller, GPC-3 DATA SHEET



Regulation modes

- Load sharing
- Fixed frequency
- Fixed power
- Frequency droop

Generator protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- 9 x NEL groups

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input/output events

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance
- 3 x NEL groups

Display

- Status texts
- Info messages
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

General

- USB interface to PC
- Free PC utility software for commissioning
- Programmable parameter, timer and alarms
- User configurable texts



Application

The Generator Paralleling Controller (GPC-3) 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 is intended for land-based 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 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 binary and analogue I/Os or via serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3m display cable included). Up to 2 additional displays can be installed within 200m.

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

Operation modes

Four different regulation modes can easily be selected through digital inputs on the standard GPC-3, 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, 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.

Self-test

The GPC-3 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).

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.

Engine control and protection

With the engine control and protection option added, the GPC-3 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 shutdown channels in case the main processor fails.

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 GPC-3 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPC-3, 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 5 and 6 for the options available.

Approvals

The GPC-3 is UL/cUL listed.

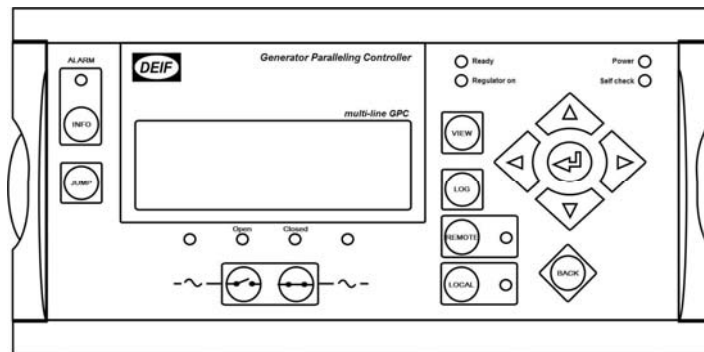


Please refer to www.deif.com for details and certificates.

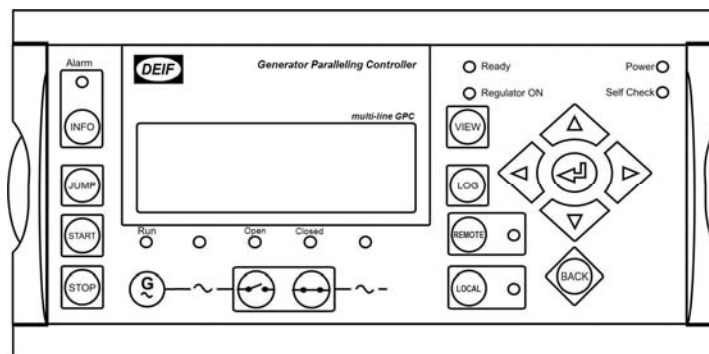


Display layouts

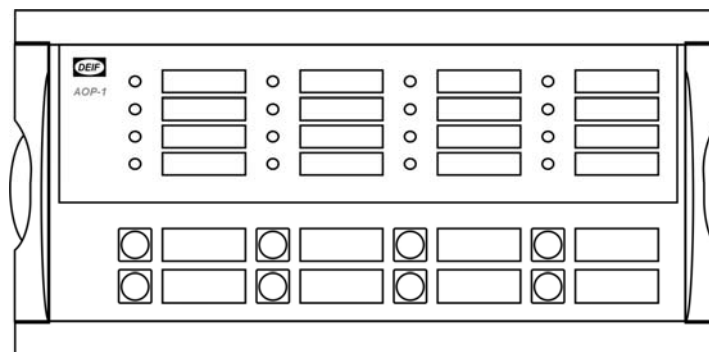
Standard delivery



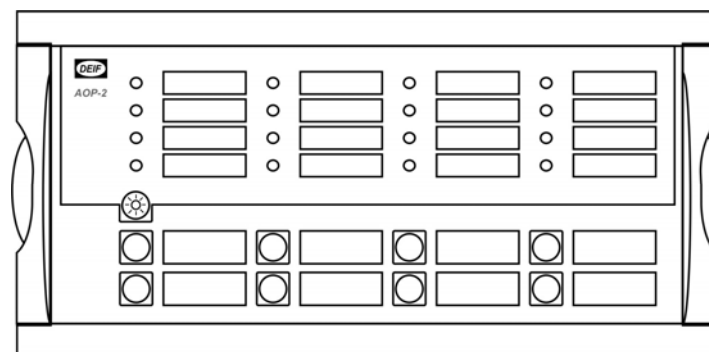
Engine and GB control (option Y1)



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

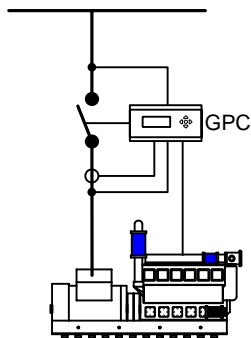


Additional operator's panel - AOP-2 (option X4)

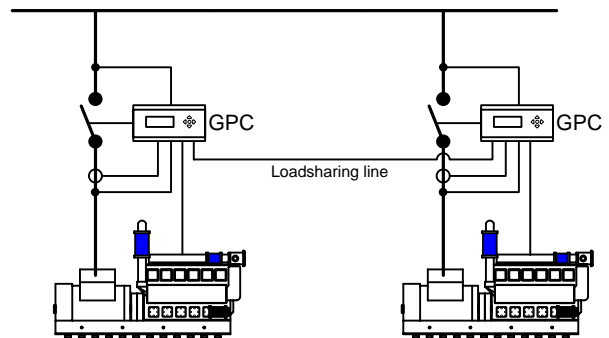


Application examples

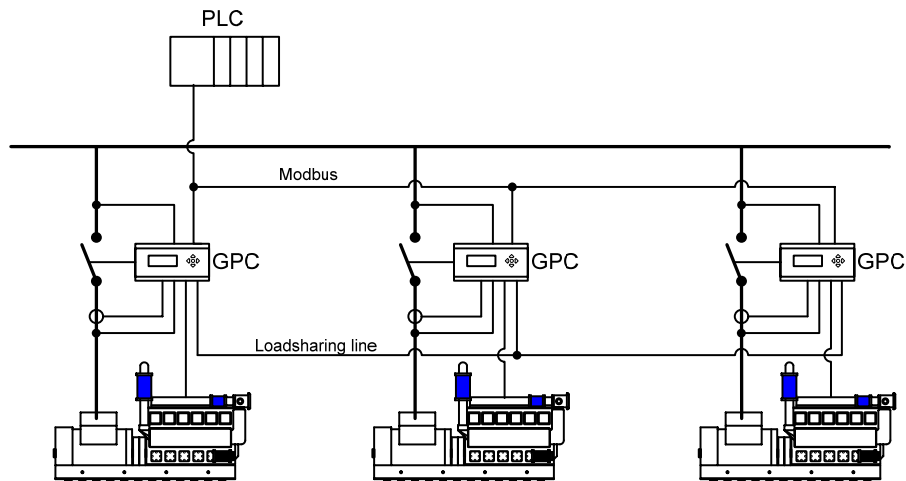
Stand-alone



Load sharing



PLC-controlled system



The GPC-3 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 can be used in all applications.

The GPC-3 is also designed to work with the Uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.



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Available options

Option	Description	Slot no.	Option type	Note
A	Loss of mains protection package			
A1	Vector jump (78) df/dt (ROCOF) (81R) Time dependent undervoltage (27T) Reactive power dependent undervoltage (27Q)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (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/export (40) Inverse time overcurrent (51)		Software	
D	Voltage/VAr/PF 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 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 (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
H	Serial communication			
H2	Modbus RTU/ASCII (RS485)	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 Perkins Cummins CM850/570 Scania (EMS) Detroit Diesel (DDEC) Scania (EMS S6) Deutz (EMR) Volvo Penta (EMS) Iveco (NEF/CURSOR) Volvo (EMS2) John Deere (JDEC)	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 (RS232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2

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



4 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 4 relays.



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Option	Description	Slot no.	Option type	Note
J	Cables			
J2	Display cable with plugs, 6m UL94 (V1) approved		Other	
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3m UL94 (V1) Listed		Other	
J6	PC cable for utility software (USB) 1m UL94 (V1) approved		Other	
J7	PC cable for utility software (USB) 3m UL94 (V1) approved		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	Engine control, binary and analogue I/Os			
M4	Engine control and protection (safety system) OR I/O extension	7	Hardware	
M13.X	7 binary 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
M15.X	4 analogue inputs, configurable, 4...20mA	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	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/ software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			One display per GPC-3 unit is included as standard
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each GPC unit
X3	Additional operator's panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator's panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each GPC unit
Y	Display layout			
Y1	Engine and GB control		Other	Requires M4

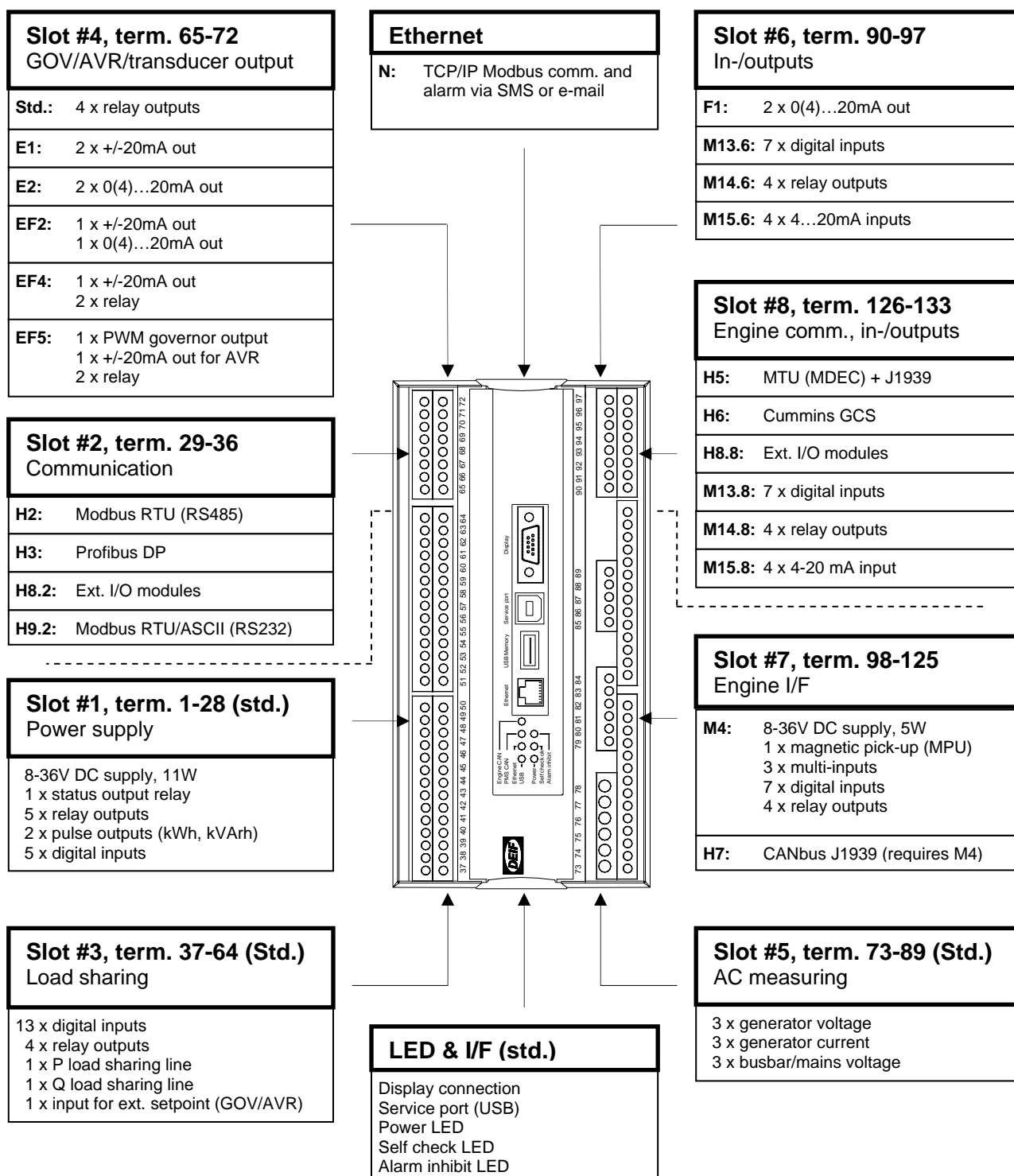


Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the HW options in the unit.



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Hardware overview



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:	<p>Class 1.0</p> <p>Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance</p> <p>Class 1.0 for negative sequence current</p> <p>Fast overcurrent: 3% of 350%*I_n</p> <p>Analogue outputs: Class 1.0 according to total range</p> <p>Option EF4: Class 4.0 according to total range</p> <p>To IEC/EN 60688</p>	Analogue inputs:	<p>0(4)...20mA</p> <p>Impedance: 50Ω</p> <p>Not galvanically separated</p> <p>RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω</p>
Operating temp.:	<p>-25...70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p>	Multi-inputs:	<p>0(4)...20mA: 0-20mA, +/-1% Not galvanically separated</p> <p>Binary: Max. resistance for ON detection: 100Ω Not galvanically separated</p> <p>PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN 60751</p> <p>VDO: 0...1700Ω, +/-2% Not galvanically separated</p> <p>V DC: 0...40V DC, +/-1% Not galvanically separated</p>
Storage temp.:	-40...70°C (-40...158°F)	Relay outputs:	<p>Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)</p> <p>Thermal rating @ 50°C: 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)</p>
Climate:	97% RH to IEC 60068-2-30	Open collector outputs:	Supply: 8...36V DC, max. 10mA
Meas. voltage:	<p>100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)</p>	Analogue outputs:	<p>0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Update rate: Transducer output: 250ms Regulator output: 100ms</p>
Consumption:	Max. 0.25VA/phase	Analogue load sharing lines:	-5...0...+5V DC, Impedance: 23.5 kΩ
Meas. current:	<p>-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p>		
Consumption:	Max. 0.3VA/phase		
Current overload:	<p>4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p>		
Meas. frequency:	30...70Hz		
Aux. supply:	<p>Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption</p> <p>Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption</p> <p>The aux. supply inputs are to be protected by a 2A slow-blow fuse</p> <p>(UL/cUL Listed: AWG 24)</p>		
Binary inputs:	<p>Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC</p>		

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 minimum)	
<i>Busbar:</i>	
Over-/undervoltage:	< 50ms
Over-/underfrequency:	< 50ms
Voltage unbalance:	<200ms
<i>Generator:</i>	
Reverse power:	<200ms
Overcurrent:	<200ms
Fast overcurrent:	< 40ms
Over-/undervoltage:	<200ms
Over-/underfrequency:	<300ms
Overload:	<200ms
Current unbalance:	<200ms
Voltage unbalance:	<200ms
React. power import:	<200ms
React. power export:	<200ms
Overspeed:	<400ms
Digital inputs:	<250ms
Emergency stop:	<200ms
Multi-inputs:	<800ms
Wire failure:	<600ms
<i>Mains:</i>	
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 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Vibration:	3...13.2Hz: 2mm _{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10

	10...60Hz: 0.15mm _{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)
Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class 2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 0.2-4.0 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/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 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)

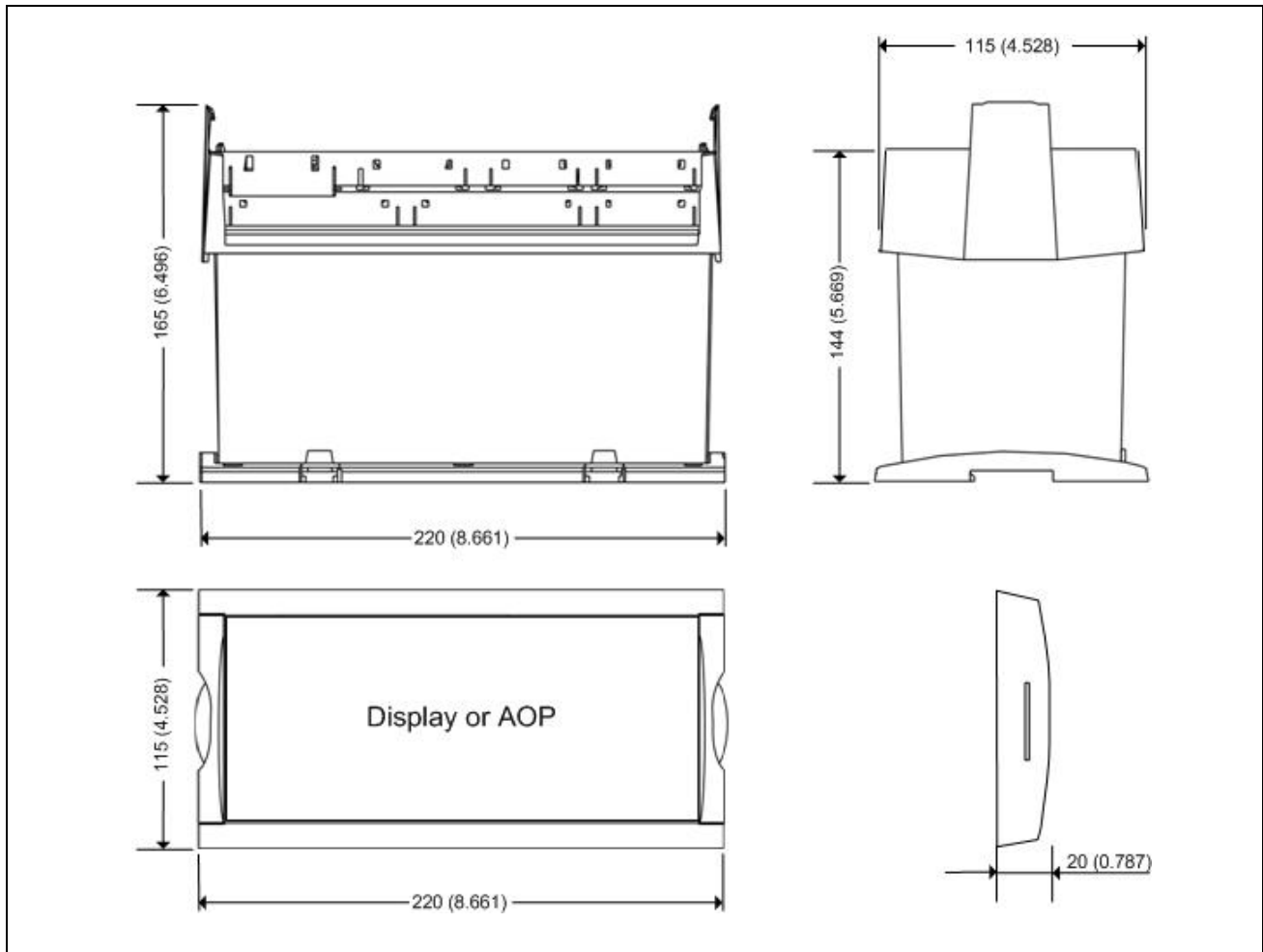
DC/DC converter

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/J6: 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

Order specifications form:

Type: Version: Option: Option: Option: Option: Displays:

Example:

Type: Version: Option: Option: Option: Option: Displays:

Displays:

Total number of displays:

- 1: 1 std. display (always included)
- 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)

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



DEIF A/S



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