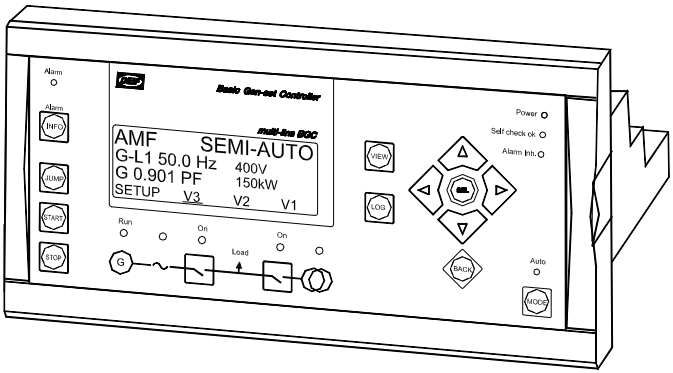
DEIF A/S

Installation Instructions

Basic Gen-set Controller

4189340302G (UK)
SW version 2.1X.X



- *Mounting*
- *Board slot positions*
- *Terminal strip overview*
- *I/O lists*
- *Wiring*

CE

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Table of contents

1. About this document

The purpose of this chapter is to provide general user information about these installation instructions concerning the general purpose, the intended users and the overall structure and contents.

General purpose

This document is the Installation Instructions for DEIF's basic gen-set controller, the BGC. The document mainly includes general product information, mounting instructions, terminal strip overviews, I/O lists and wiring descriptions.

The general purpose of these installation instructions is to give the user important information to be used in the installation of the unit.

Intended users

These installation instructions are mainly intended for the panel builder designer in charge. On the basis of this document, the panel builder designer will give the electrician the information he needs in order to install the BGC, e.g. detailed electrical drawings. In some cases, the electrician may use these installation instructions himself.

Contents/overall structure

This document is divided into seven chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page. The following will outline the contents of each of the seven chapters.

About this document

Chapter 1 includes general information about these installation instructions as a document. It deals with the general purpose and the intended users of the installation instructions. Furthermore, it outlines the overall contents and structure of the document.

Warnings and legal information

Chapter 2 includes information about general legal issues and safety precautions relevant in the handling of DEIF products. Furthermore, it introduces some important definitions, which will be used throughout this document.

General product information

Chapter 3 will deal with the BGC unit in general and its place in the DEIF product range. It will also include information about standard functions and the application types relevant to the BGC.

Mounting

Chapter 4 will provide specific information about correct mounting of the BGC unit.

Hardware

Chapter 5 provides an overview of the individual terminals and slots of the BGC. It also includes terminal strip overviews and complete I/O lists.

Wirings

Chapter 6 will present important information about the wiring of the BGC unit. This will include detailed wiring descriptions.

Technical information

Chapter 7 will present general technical information including technical specifications, unit dimensions and panel cutout information.

2. Warnings and legal information

This chapter includes important information about general legal issues relevant in the handling of DEIF products. Furthermore, some overall safety precautions will be introduced and recommended. Finally, the highlighted notes, which will be used throughout these installation instructions, are presented.

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the generator controlled by the BGC unit, the company responsible for the installation or the operation of the set must be contacted.

The BGC units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the BGC unit implies work with dangerous currents and voltages. Therefore, the installation of the BGC should only be carried out by authorised personnel who understand the risks involved in the working with live electrical equipment.

Notes

Throughout this document a number of notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

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3. General product information

This chapter will deal with the BGC unit in general and its place in the DEIF product range. It will also include information about standard functions and the application types relevant to the BGC.

Introduction

The BGC is a part of the DEIF Multi-line 2 product family. Multi-line 2 is a complete range of multi-function generator protection and control products integrating all the functions you need into one compact and attractive solution.

The product range consists of different basic versions, which can be supplemented with the flexible options needed to provide the optimum solution.

The concept of the BGC is to offer a cost-effective solution to gen-set builders who need a simple generator protection and control unit. Being a part of the Multi-line product family the standard functions of the BGC can be supplemented with a variety of optional functions.

Type of product

The BGC is a micro-processor based control unit containing all necessary functions for protection of a gen-set and of mains and generator breaker control.

The BGC contains all necessary 3-phase measuring circuits and presents all values and alarms on the LCD display. The design of the BGC allows it to be built directly into the engine side panel or the switchboard door.

Standard functions

In the following sections the standard functions of the BGC are listed.

Automatic mains failure

- Engine start up
- Mains to generator at a mains failure
- Generator to mains at mains return

Island operation

- Semi-automatic control of the gen-set
- Semi-automatic control of the breakers

Time dependent start/stop

- Automatic gen-set and breaker control
- 8 different start/stop commands

Engine control

- Start preparation
- Start/stop sequences
- Fuel solenoid selection (coil type)

Protection (ANSI #)

- Overcurrent, 2 levels (51)
- Reverse power (32)
- 3 configurable VDO inputs
- Configurable binary inputs:
  - Circuit breakers used: 5 binary inputs
  - Contactors used: 7 binary inputs

Generator and mains breaker

- Contactor (constant signal)
- Circuit breaker (400 ms pulse)

Note that the five configurable digital inputs can be used as protection inputs or as function inputs.

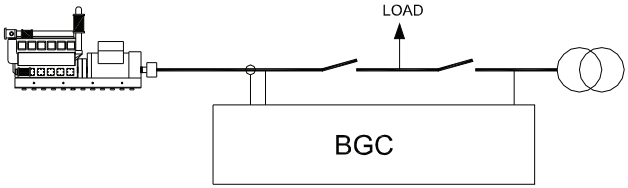
Standard and optional applications

In the following sections the standard and optional applications of the BGC will be presented. In addition, the correct application configuration for the different applications is listed. It is only possible to use the BGC unit for one of the purposes, e.g. AMF (Automatic Mains Failure) operation. The selection must be made on site.

All units are supplied with the following factory setting:

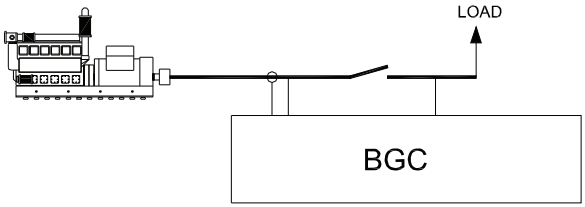
- Automatic mains failure

Automatic mains failure, AMF (no back sync.) (standard)



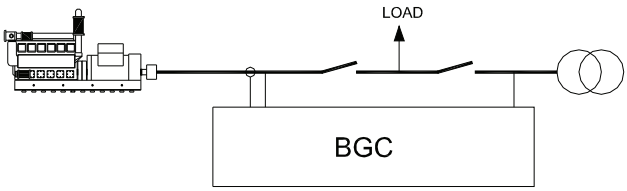
No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	AMF	AMF

Island operation (standard)



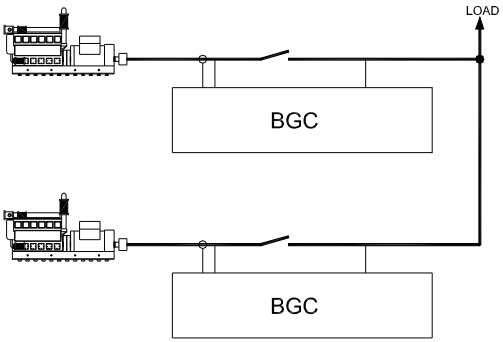
No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	Island operation	Island operation

Fixed power operation to mains (Option G2)



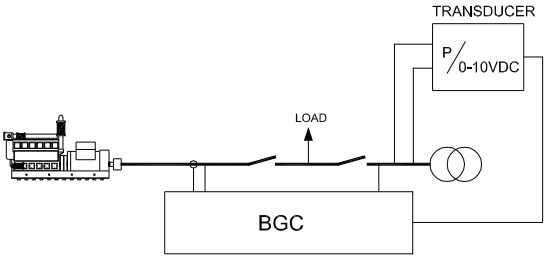
No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	Fixed power	Fixed power

Multiple gen-sets, load sharing (Option G3)



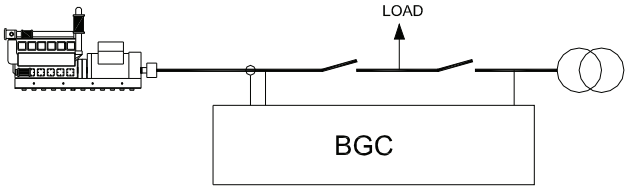
No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	Island operation	Island operation

Peak shaving (Option G2)



No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	Peak shaving	Peak shaving

Automatic mains failure, AMF (back sync.) (Option G2)



No.	Setting		Setting
4320	Gen-set mode	Selection display	-
4321	Gen-set mode	AMF	AMF

4. Mounting

In this chapter specific mounting instructions will be given in order to ensure correct mounting of the BGC unit.

Mounting of the unit

The BGC is designed for direct mounting in the switchboard door. The technical specifications later in this document include detailed information about:

- unit dimensions
- panel cutout
- screw hole positions and dimensions

Panel cutout

In order to ensure optimum mounting the switchboard door must be cut out according to the *panel cutout* illustration presented in chapter 7. Please note the indicated tolerance of the cutout hole.

Mounting instructions

The BGC can be mounted in two different ways:

1. by use of 3.5 mm screws with self-cutting threads, maximum depth in the display is 8 mm

2. by use of the standard fastening clamps. A total of 4 clamps are needed for proper mounting

5. Hardware

This chapter will present information about the individual terminals and slots of the BGC unit. It also includes terminal strip overviews and complete I/O lists.

Board slot positions

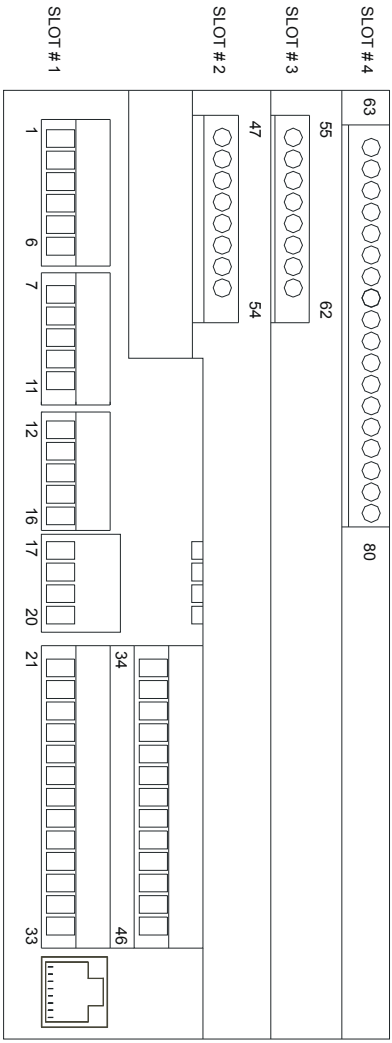
The BGC unit housing is divided into board slot positions. This means that the unit consists of a number of printed circuit boards (PCB) mounted in numbered slots. The green terminal blocks are then mounted in the PCBs. Some of these board slot positions are standard and some are intended for options. The board slot positions are arranged as illustrated below.

Slot type	Option	Slot #1	Slot #2	Slot #3	Slot #4
Terminals		1-46	47-54	55-62	63-80
Main PCB	Standard	X			
Engine communications PCB	H4		Depending		
Serial communications PCB	H1, H2, H3		Depending		
Transducer output PCB	F1		Depending		
Transducer output PCB	F2		Depending		
Load sharing and synchronising PCB	G2/G3				X
7 digital inputs	M13		Depending		
4 relay outputs	M14/G1		Depending		
4 analogue inputs	M15		Depending		

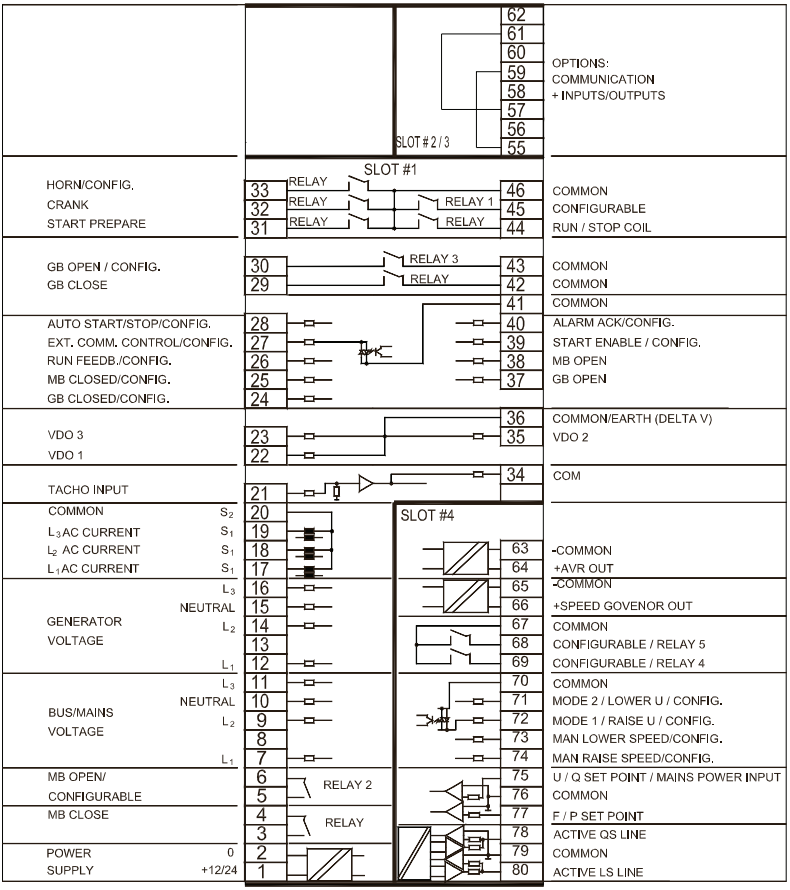
Only hardware options which will affect the hardware of the unit are represented in the table. The software options will be implemented by changing the utility software of the unit. The absent software options can be located in the data sheet.

Unit rear side overview

An overview of the terminals is presented below. The slots are positioned in the unit as follows (seen from the top of the unit):



Terminal strip overview



The terminal 36 must be connected depending on the hardware type of the BGC.

MKII: Terminal 36 should not be connected to earth (Delta V cannot be selected).

MKIII: Terminal 36 must be connected to earth, if the Delta V measuring principle is selected in menu 4950.

Identify the hardware type of the BGC (MKII or MKIII) on the type label which is located on the side of the BGC.

Input/output lists

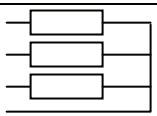
In the I/O lists presented below the following terms will be used in connection with the relay outputs:

NO means Normally Open
NC means Normally Closed
Com. means common terminal

Main PCB, slot #1

The main PCB is a standard board and is therefore always mounted in the unit.

Term.	Function	Technical data	Description
1	+12/24V DC	12 or 24V DC (5-36V DC)	Power supply min. working voltage 5V DC continuously
2	0		
3	NO	Relay 8A, 250V AC 8A, 24V DC	Mains breaker close command Configurable as pulse, continuous or compact
4	Com.		
5	NO	Relay 2 8A, 250V AC 8A, 24V DC	Mains breaker open command If mains breaker is set to continuous: Configurable
6	Com.		
7	U L1 Mains/busbar	Mains (or busbar) L1 voltage	Max. 480V AC phase-phase
8		Not connected	
9	U L2 Mains/busbar	Mains (or busbar) L2 voltage	Max. 480V AC phase-phase
10	U Neutral Mains/busbar	Mains (or busbar) neutral voltage	
11	U L3 Mains/busbar	Mains (or busbar) L3 voltage	Max. 480V AC phase-phase

Term.	Function	Technical data	Description
12	U L1 Generator	Generator L1 voltage	Max. 480V AC phase-phase
13		Not connected	
14	U L2 Generator	Generator L2 voltage	Max. 480V AC phase-phase
15	U N Generator	Generator neutral voltage	
16	U L3 Generator	Generator L3 voltage	Max. 480V AC phase-phase
17	IL1 s1(k)	Generator current L1	1/5A AC
18	IL2 s1(k)	Generator current L2	1/5A AC
19	IL3 s1(k)	Generator current L3	1/5A AC
20	I s2(l) Com.	Generator current L1-L2-L3	Common for current L1, L2, L3 measurements
21	Magn. pickup	0.5-70V AC 10-10.000Hz	RPM (running feedback, overspeed)/ magnetic pickup
34	Magn. pickup.		
22	VDO 1		Configurable (oil pressure)
35	VDO 2		Configurable (water temperature)
23	VDO 3		Configurable (fuel tank level)
36	Com.		Common for VDO inputs and earth on delta V coupling (see wiring diagram)
24	Digital input 1	Optocoupler	Generator breaker closed feedback/ configurable
37	Digital input 2	Optocoupler	Generator breaker open feedback
25	Digital input 3	Optocoupler	Mains breaker closed feedback/configurable

Term.	Function	Technical data	Description
38	Digital input 4	Optocoupler	Mains breaker open feedback
26	Digital input 5	Optocoupler	Engine running feed-back/configurable
39	Digital input 6	Optocoupler	Start enable/ confi-gurable
27	Digital input 7	Optocoupler	Ext. communication control/configurable
40	Digital input 8	Optocoupler	Remote alarm acknow-ledge/configurable
28	Digital input 9	Optocoupler	Auto start/stop/confi-gurable
41	Com.		Common for digital inputs 1-9
29	NO	Relay 8A, 24V DC	Generator breaker close command Configurable as pulse, continuous or compact
42	Com.		
30	NO	Relay 3 8A, 24V DC	Generator breaker open command If generator breaker is set to continuous: Configurable
43	Com.		
31	NO	Relay 2A, 24V DC	Start prepare (preheat/prime)
44	NO	Relay 2A, 24V DC	Fuel solenoid (running coil/stop coil, selectable)
32	NO	Relay 2A, 24V DC	Crank
45	NO	Relay 1 2A, 24V DC	Configurable
33	NO	Relay 2A, 24V DC	Horn/configurable
46	Com.		Common for terminals 31/32/33/44/45

Options, slot #2 and #3

Only two of the presented options (PCBs) can be mounted in each unit. They can be placed in slot #2 (terminals 47-54) or #3 (terminals 55-62).

Option F1, 2 x transducer outputs (slot #3)

Term.	Function	Description
55	Not used	
56	0(4) - 20mA out	Analogue output 1/3, selectable
57	0	
58	Not used	
59	Not used	
60	0(4) - 20mA out	Analogue output 2/4, selectable
61	0	
62	Not used	

Option F2, 4 x transducer outputs (slot #2)

Term.	Function	Description
47	Not used	
48	0(4) - 20mA out	Analogue output 1/3, selectable
49	0	
50	Not used	
51	Not used	
52	0(4) - 20mA out	Analogue output 2/4, selectable
53	0	
54	Not used	

Option H1, Can-open (slot #3)

Term.	Function	Description
55	Can-H	Can-open
56	GND	
57	Can-L	
58	Can-H	
59	GND	
60	Can-L	
61	Not used	
62	Not used	

Option H2, Modbus RTU (slot #3)

Term.	Function	Description
55	DATA + (A)	Modbus RTU, RS485
56	GND	
57	DATA - (B)	
58	Not used	
59	DATA + (A)	
60	Not used	
61	DATA - (B)	
62	Not used	

Option H3, Profibus DP (slot #3)

Term.	Function	Description
55	DATA + (B)	Pin 3 on 9 pole sub-D connector
56	GND	Pin 5 on 9 pole sub-D connector
57	DATA - (A)	Pin 8 on 9 pole sub-D connector
58	DATA + (B)	
59	GND	
60	DATA - (A)	
61	Not used	
62	Not used	

Option H4, Caterpillar CCM engine interface (slot #2)

Term.	Function	Description
47/55	Not used	CAT CCM
48/56	GND	
49/57	Not used	
50/58	TxD	
51/59	Not used	
52/60	RxD	
53/61	Not used	
54/62	Not used	

Option M13, 7 x binary outputs

Term.	Function	Description
47/55	Digital input 11/21	Configurable
48/56	Digital input 12/22	Configurable
49/57	Digital input 13/23	Configurable
50/58	Digital input 14/24	Configurable
51/59	Digital input 15/25	Configurable
52/60	Digital input 16/26	Configurable
53/61	Digital input 17/27	Configurable
54/62	Com.	

Option M14, 4 x relay outputs

Term.	Function	Description
47/55	Relay 6	250V, 8A, configurable
48/56	Com.	
49/57	Relay 7	250V, 8A, configurable
50/58	Com.	
51/59	Relay 8	250V, 8A, configurable
52/60	Com.	
53/61	Relay 9	250V, 8A, configurable
54/62	Com.	

Option M14 can be used as relay output control signal for governor and/or AVR up/down, if required.

Option M15, 4 x 4-20mA analogue inputs

Term.	Function	Description
47/55	4-20mA input 1 (+)	Configurable
48/56	Com. (0)	
49/57	4-20mA input 2 (+)	Configurable
50/58	Com. (0)	
51/59	4-20mA input 3 (+)	Configurable
52/60	Com. (0)	
53/61	4-20mA input 4 (+)	Configurable
54/62	Com. (0)	

Option G1, load dependent relays

Term.	Function	Description
47/55	Relay 6	High load/configurable
48/56	Com.	250V, 8A
49/57	Relay 7	Low load/configurable
50/58	Com.	250V, 8A
51/59	Relay 8	250V, 8A, configurable
52/60	Com.	
53/61	Relay 9	250V, 8A, configurable
54/62	Com.	

Options, slot #4

Option G2, synchronising with analogue lines

Term.	Function	Techn. data	Description
80			Not used
79			Not used
78			Not used
77	-10…0…10V DC	Analogue input	Frequency/active load setpoint. Passive (requires external power supply)
76	Com.	Common	Common for terminals 75 and 77
75	-10…0…10V DC /0…10V DC (peak shaving)	Analogue input	Voltage/VAr/power factor/ reactive load setpoint. Mains power input for peak shaving. Passive (requires external power supply)
74	Digital input 17	Optocoupler	Man. raise speed/ configurable
73	Digital input 18	Optocoupler	Man. lower speed/ configurable
72	Digital input 19	Optocoupler	Man. raise voltage/ configurable
71	Digital input 20	Optocoupler	Man. lower voltage/ configurable
70	Com.	Common	Common for terminals 71-74
69	NO	Relay 4 5A, 250V AC 5A, 24V DC	Configurable
68	NO	Relay 5 5A, 250V AC 5A, 24V DC	Configurable
67	Com.	Common	Common for relay outputs 68-69
66	20-0-20mA out	Speed governor setpoint output	
65	0		
64	20-0-20mA out	AVR setpoint output	
63	0		

Option G3, load sharing and synchronising

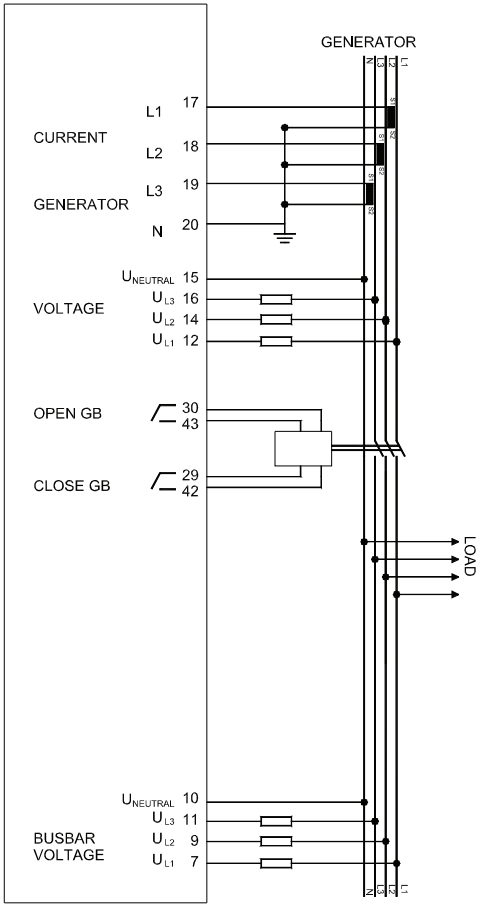
Term.	Function	Techn. data	Description
80	-5…0…5V DC	Analogue I/O	Active load sharing line
79	Com.	Common	Common for load sharing line
78	-5…0…5V DC	Analogue I/O	Reactive load sharing
77	-10…0…10V DC	Analogue input	Frequency/active load setpoint. Passive (requires external power supply)
76	Com.	Common	Common for terminals 75 and 77
75	-10…0…10V DC/0…10V DC (peak shaving)	Analogue input	Voltage/VAr/power factor/ reactive load setpoint. Mains power input for peak shaving. Passive (requires external power supply)
74	Digital input 17	Optocoupler	Man. raise speed/ configurable
73	Digital input 18	Optocoupler	Man. lower speed/ configurable
72	Digital input 19	Optocoupler	Mode 1 (load sharing)/man. raise voltage/configurable
71	Digital input 20	Optocoupler	Mode 2 (fixed power)/man. lower voltage/configurable
70	Com.	Common	Common for terminals 71-74
69	NO	Relay 4 5A, 250V AC 5A, 24V DC	Configurable
68	NO	Relay 5 5A, 250V AC 5A, 24V DC	Configurable
67	Com.	Common	Common for relay outputs 68-69
66	20-0-20mA out	Speed governor setpoint output	
65	0		
64	20-0-20mA out	AVR setpoint output	
63	0		

6. Wiring

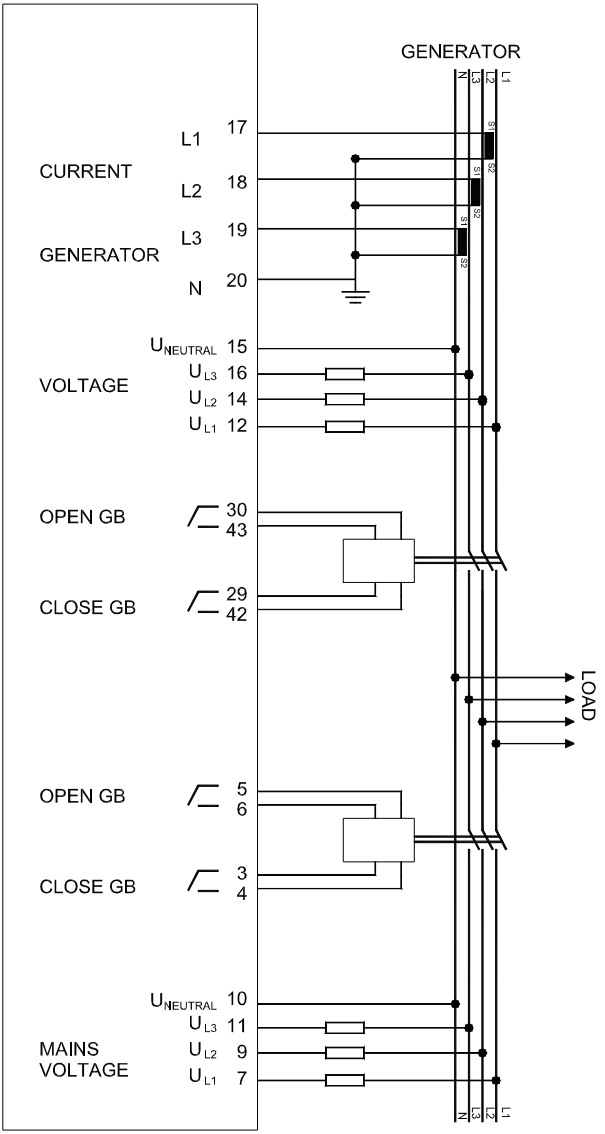
This chapter will present important information about the wiring of the BGC unit and will therefore include detailed wiring descriptions.

AC connections

Island operation

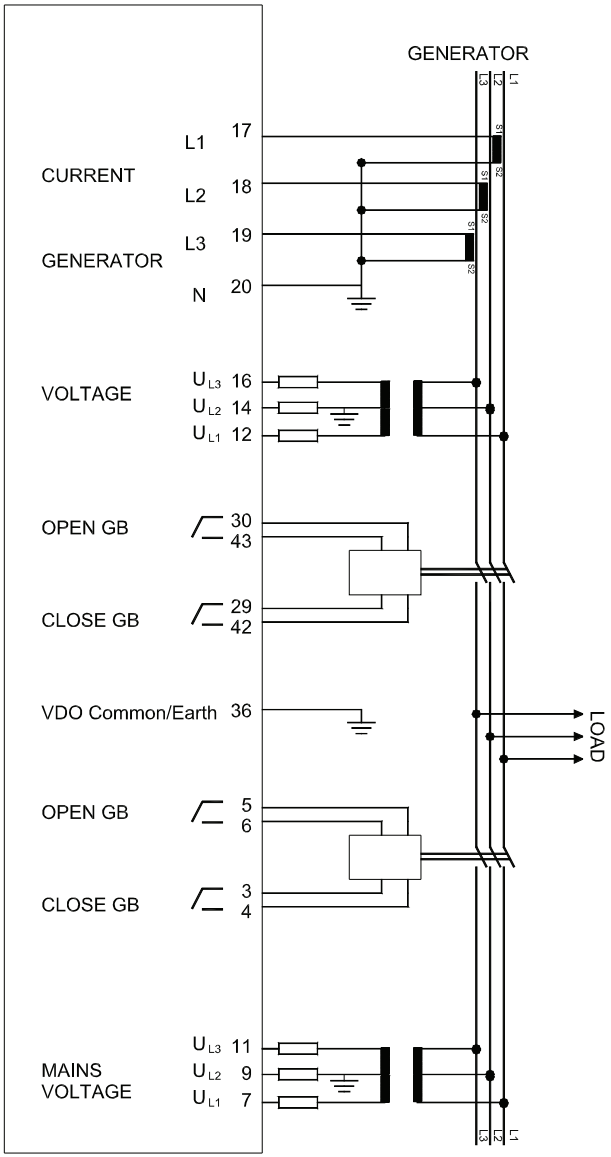


AMF/fixed power/load take over/peak shaving

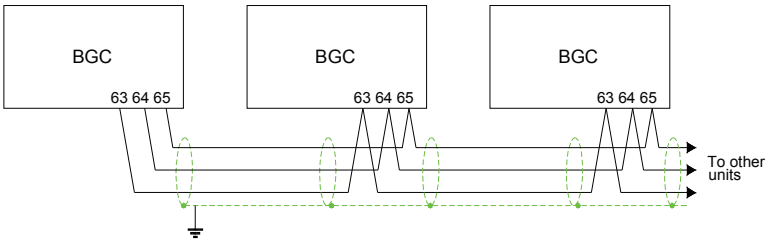


AMF/fixed power/load take over/peak shaving

Delta V connections



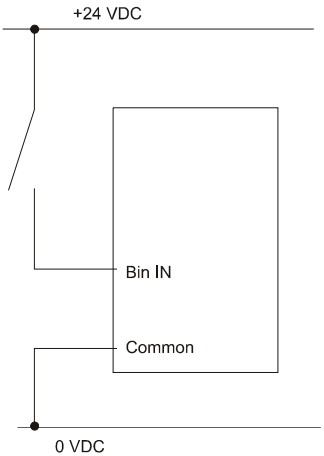
Load sharing lines



DEIF recommends a screened cable, if the cable run is longer than 5 m between units.

Binary inputs

All binary inputs are 24V DC bi-directional optocoupler. Typical input is:

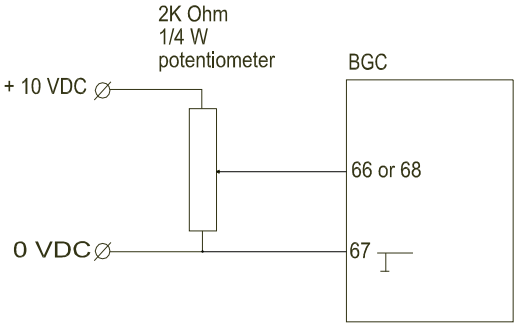


The binary inputs all use fixed signals (not pulse signals).

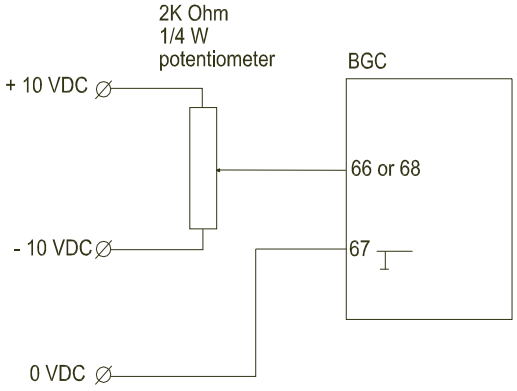
Analogue inputs

The setpoint inputs are passive, i.e. an external power source is needed. This can be an active output from e.g. a PLC, or a potentiometer can be used.

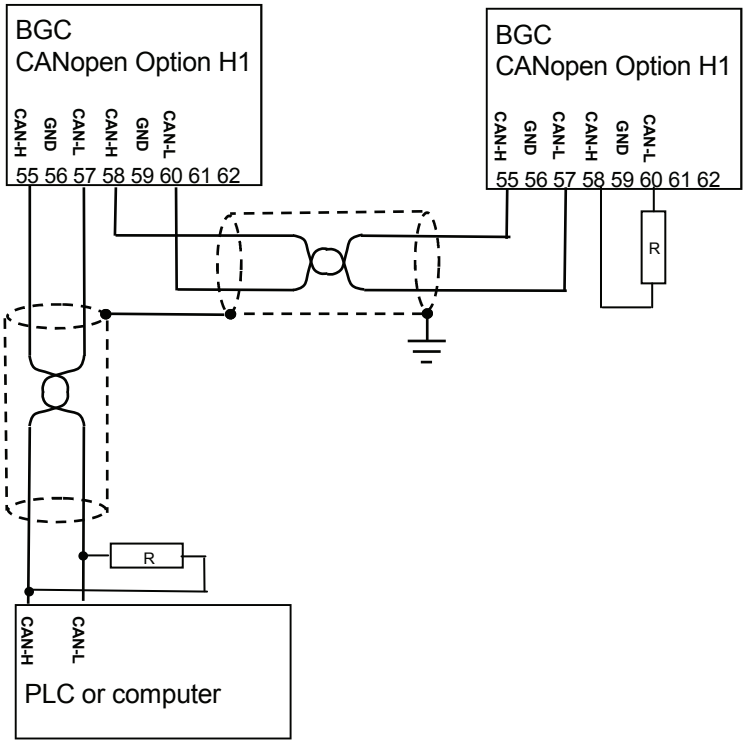
0…10V DC input using potentiometer



+/-10V input using potentiometer



Option H1 (CANopen communication)



ML2 terminal 55 and 58 are internally connected
ML2 terminal 57 and 60 are internally connected

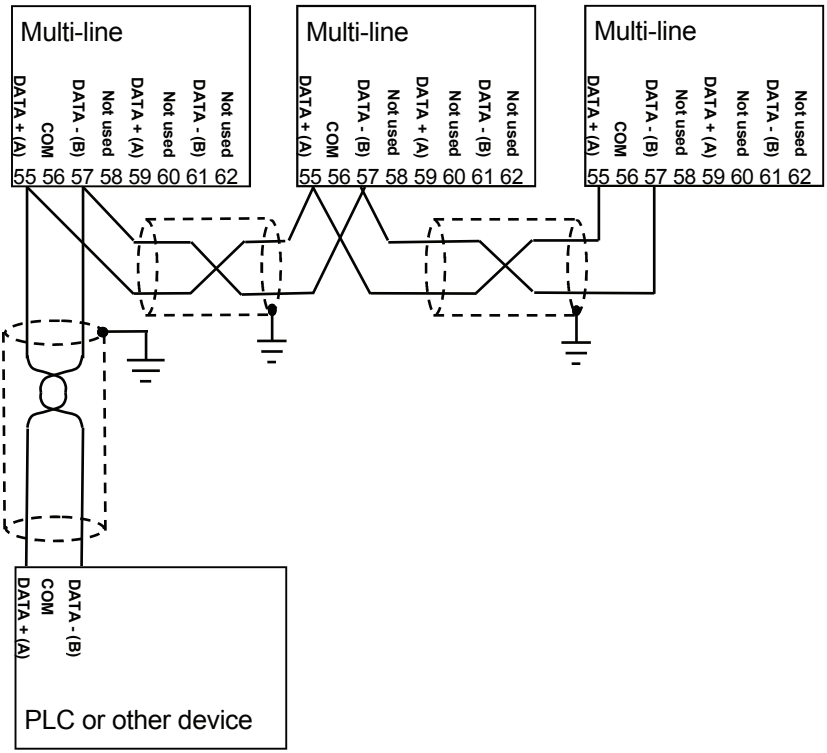
Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

End resistor R = 120 Ohm

Option H2 (Modbus RTU communication)

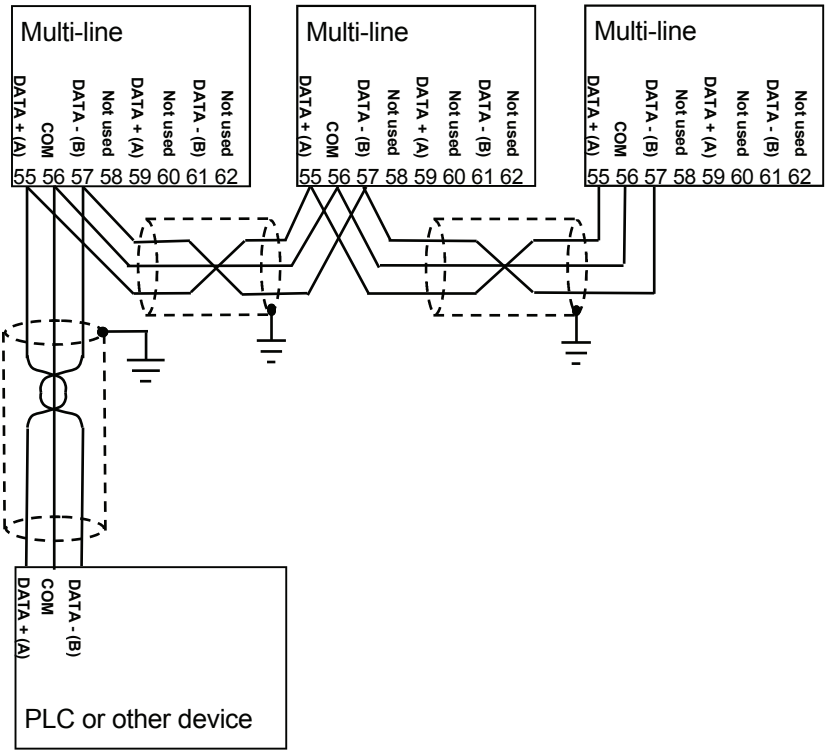
Connection with 2-wire screened cable (recommended):



Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

Connection with 3-wire shielded cable:



This solution is only feasible if the COM line is insulated. Check PLC/other device before connecting.
Non-insulated COM line may result in damage to the equipment.

Use shielded twisted cable

Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

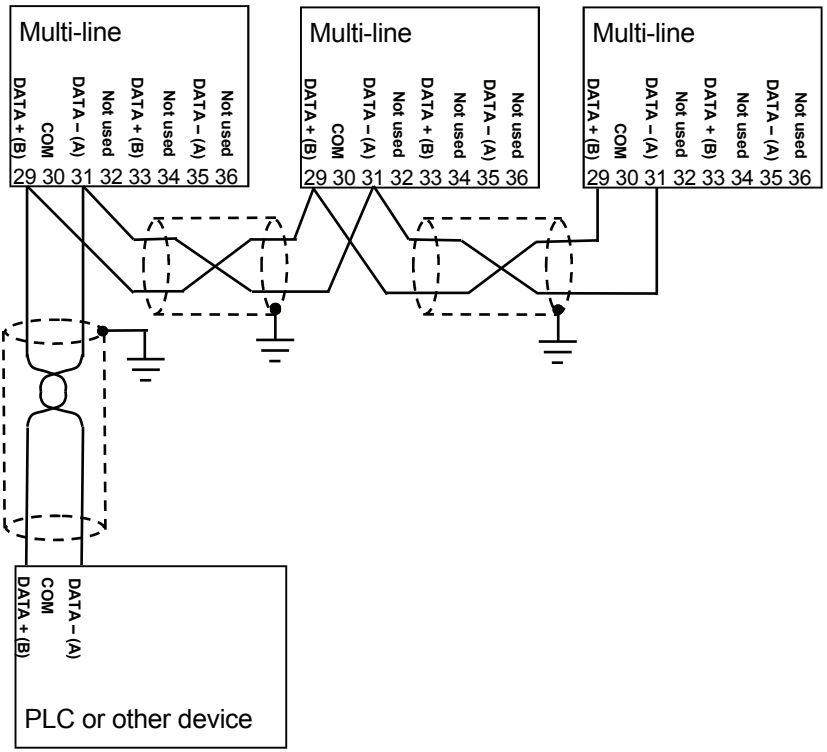
Normally, the Modbus does not need bias resistors (end terminators). These are only needed in case of very long lines and/or many nodes (>32) on the Modbus network. If bias resistors are needed, the calculation should be based on the following data:

- **A line internal pull-up bias resistor: 22 kΩ**
- **B line internal pull-down bias resistor: 22 kΩ**
- **Receiver input sensitivity: +/-200 mV**
- **Receiver input impedance: 12 kΩ**

Cable: Belden 3105A or equivalent. 22 AWG (0.6 mm^2) twisted pair, shielded, <40 mΩ/m, min. 95% shield coverage.

Option H3 (Profibus DP communication)

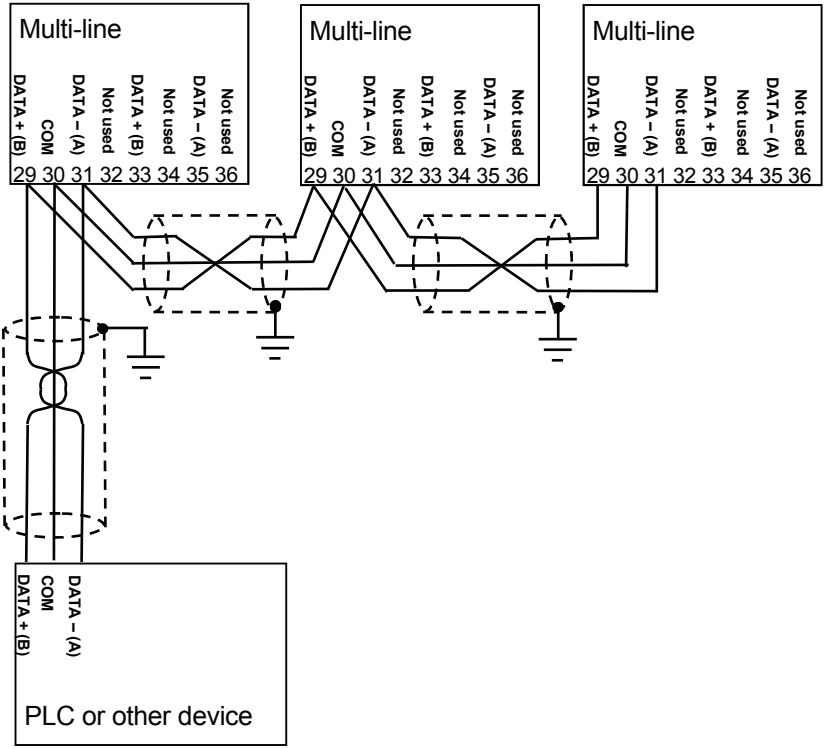
Connection with 2-wire screened cable (recommended):



Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

Connection with 3-wire shielded cable:



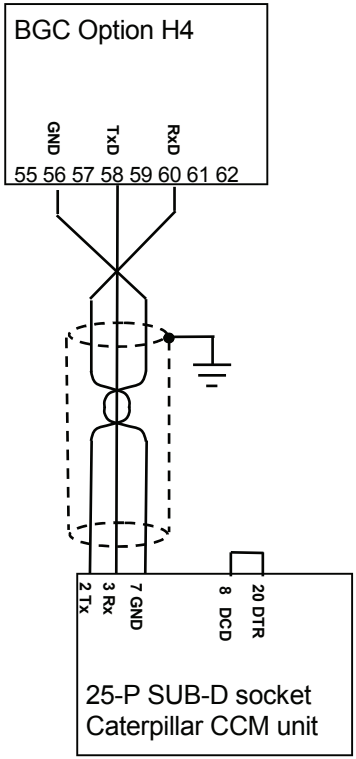
This solution is only feasible if the COM line is insulated. Check PLC/other device before connecting.
Non-insulated COM line may result in damage to the equipment.

Use shielded twisted cable

Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Option H4 (CAT CCM communication)

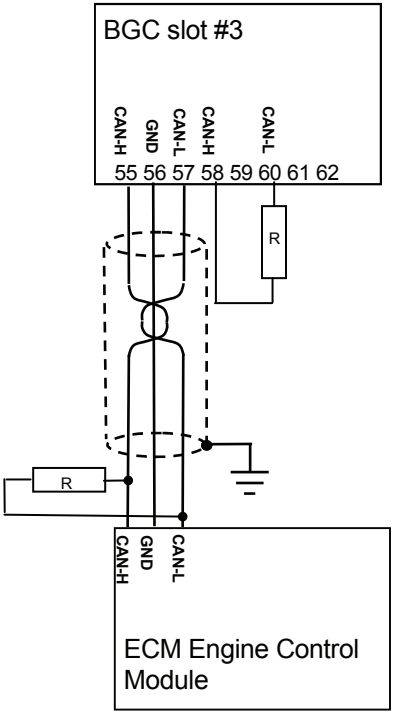
Connection between CCM and BGC



Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

Option H5 (J1939 and MTU MDEC communication)



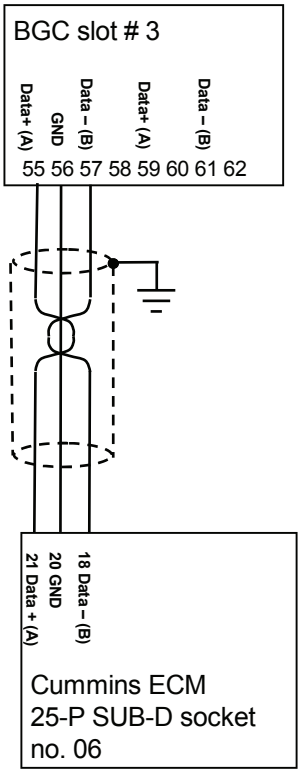
BGC terminal 55 and 58 are internally connected
BGC terminal 57 and 60 are internally connected

Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

End resistor R = 120 Ohm

Option H6 (Cummins communication)



BGC terminal 55 and 59 are internally connected
BGC terminal 57 and 61 are internally connected

Connect shield to ground at one end only. Shield ends must be insulated with tape or insulation tubing.

Use shielded twisted cable

Normally the communication does not need bias resistors (end terminators). These are only needed in case of very long lines between the 2 modules If bias resistors are needed, the calculation should be based on the following data:

- **A line internal pull-up bias resistor: 22 kΩ**
- **B line internal pull-down bias resistor: 22 kΩ**
- **Receiver input sensitivity: +/-200 mV**
- **Receiver input impedance: 12 kΩ**

Cable: Belden 3105A or equivalent. 22 AWG (0.6 mm^2) twisted pair, shielded, <40 mΩ/m, min. 95% shield coverage.

7. Technical information

This chapter will present general technical information including technical specifications, unit dimensions and panel cutout information.

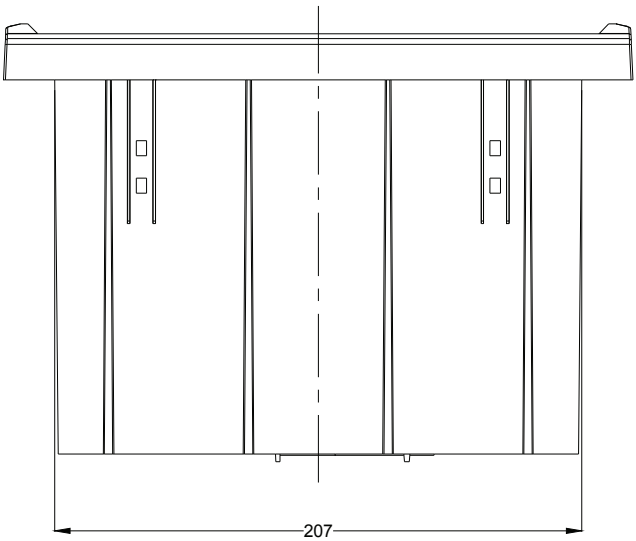
Technical specifications

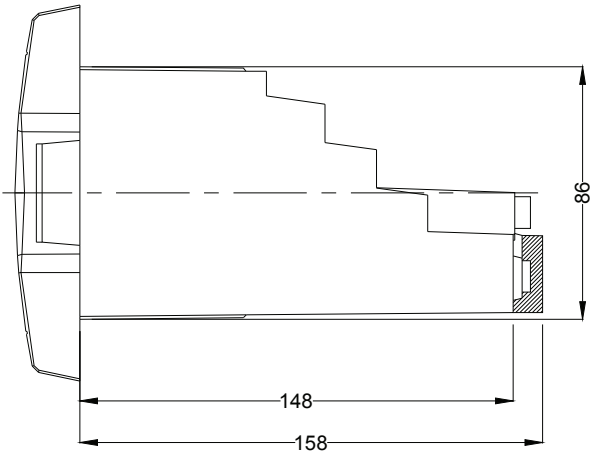
Accuracy:	Class 1.0, to IEC 688
Operating temp.:	-25…70°C
Climate:	Class HSE, to DIN 40040
Meas. voltage:	Max. 480 volt phase to phase, +/-20%
Consumption:	Max. 0.15VA/phase
Meas. current:	-/1 or -/5A AC
Consumption:	Max. 0.3VA/phase
Current overload:	4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)
Meas. frequency:	30…70Hz
Aux. supply:	12/24V DC (5-36V DC) Max. 8W consumption
Binary inputs:	Optocoupler, bi-directional Input voltage Main board: 5…36V DC Load share board: 6…36V DC M13 board: 6…36V DC Impedance max. 4.7kΩ

Relay outputs:	See data in I/O list
Analogue inputs:	-10…0…+10V DC Not galvanically separated Impedance: 100kΩ
Mounting:	Panel mounted
Load sharing lines:	-5…0…+5V DC Galvanically separated
Analogue outputs:	0(4)...20mA Galvanically separated Active output (internal supply) Load max. 500Ω
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2
Galvanic separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and load sharing lines: 500V DC, 1 min. (Contact DEIF support for additional information)
EMC/CE:	To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 4 mm^2 multi-stranded Other: 2.5 mm^2 multi-stranded
PC:	RJ-11 for programming interface with 9-pole Sub-D male

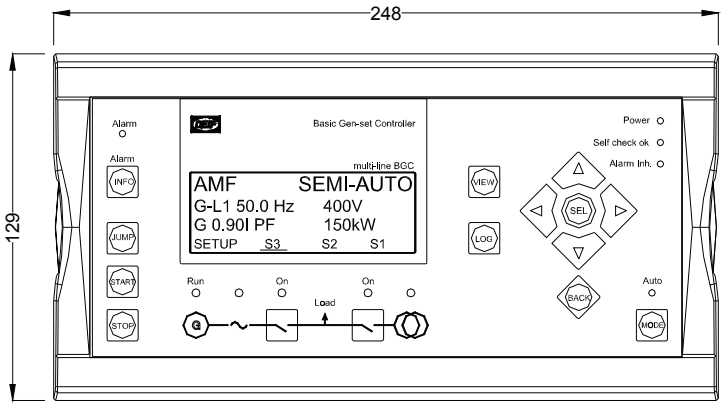
Protection:	Unit: IP20 Display: IP52 To IEC 529 and EN 60529
Weight:	Approx. 1 kg (2.2 lbs)

Unit dimensions

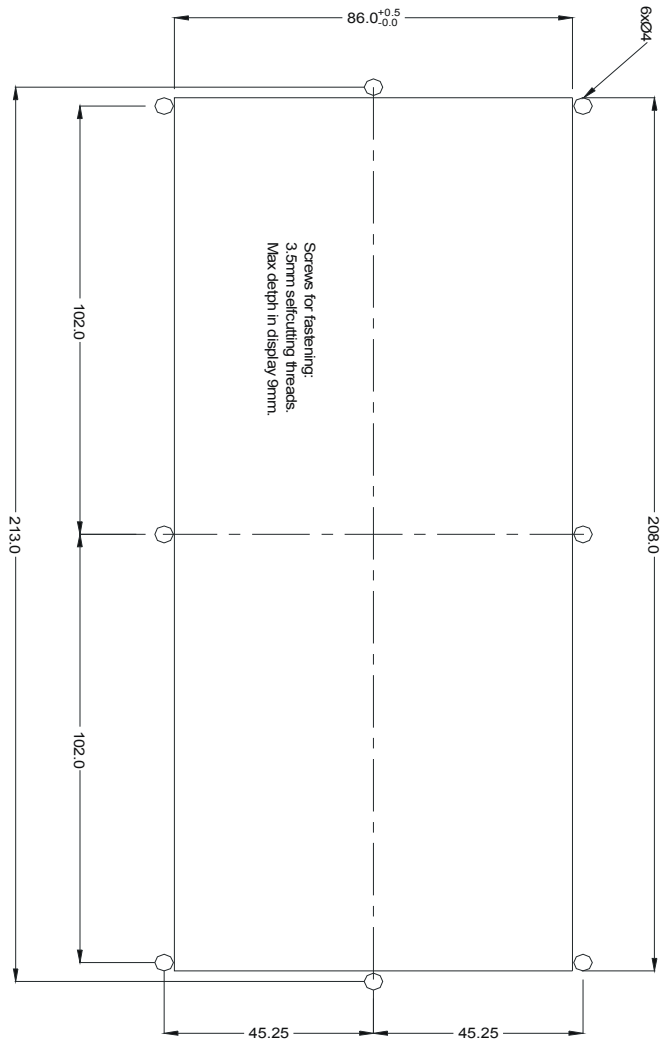




Display dimensions



Panel cutout



DEIF A/S reserves the right to change any of the above.