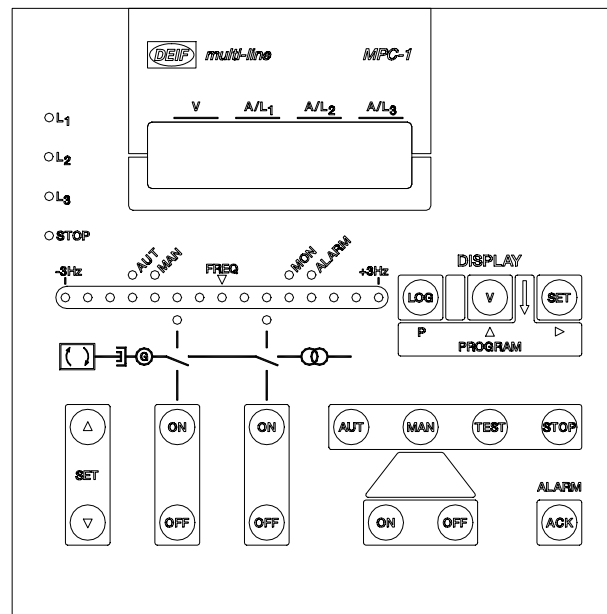# Installation Manual

DEIF

Multi Power Controller MPC-1
multi-line
4189340102D

- *Complete control system in one package:*
  - *island operation*
  - *parallel with mains operation*
  - *emergency generator control*

- *3-phase AC measurements*

- *Calculation of complex AC values*

- *Generator and mains supervision and protection*

- *Prime mover start/supervision/stop*

- *Breaker syncronisation*

C E

DEIF A/S

List of contents

THIS INSTALLATION MANUAL RELATES TO MPC-1 VERSION 1.0X (VERSIONS 1.01...1.09)

For further information, see "User's manual, multi power controller MPC-1 ref. no. 4189340101" and "Programming manual, multi power controller MPC-1 ref. no. 4189340103".

1. Warnings, legal information and notes to CE-marking

This manual gives general guidelines on how to install and operate a gen-set using the product MPC-1. Installing and operating a gen-set implies generation of dangerous current and voltages, and therefore this should only be done by qualified personnel. DEIF takes no responsibility for operation or installation of gen-sets or other systems using the described methods in this manual. If there is any doubt about how to install or operate the gen-set the company responsible for installation or operation must be contacted.

MPC-1 is CE-marked with respect to the EMC directive for residential, commercial and light industry plus industrial environment.

MPC-1 is CE-marked with respect to the low-voltage directive for 300 V class systems, protection class III and pollution degree 2.

Take precautions against electrostatic discharges when service or installation operations are done. The unit is protected against electrostatic discharge in normal operating situations, but service or installation operations can cause unforeseen electrostatic discharges.

2. Terminal list

The figure shows an overview of the terminals. Further explanations on the next pages.

Group	Terminal	Description
CAN-BUS OR ANALOG OUT	X5	ANALOG OUT 2 0/4..20mA
	X4	OUT+
	X3	NC
	X2	ANALOG OUT 1
	X1	OUT+ 0/4..20mA
POWER MANAGEMENT (OPTION E)	X5	CAN-L
	X4	CAN-H
	X3	GND
	X2	CAN-L
	X1	CAN-H
ENGINE CONTROL	46 / 45	STARTER
	44 / 43	DIESEL: RUNNING/STOP COIL GAS: GAS VALVE
	38 / 37	DIESEL: PREGLOW GAS: IGNITION ON
CURRENT MEASUREMENTS	28 k / 27 l L1	MAINS CURRENT (OPTION F)
	32 k / 31 l L3	GENERATOR CURRENT
	30 k / 29 l L2	GENERATOR CURRENT
	26 k / 25 l L1	GENERATOR CURRENT
VOLTAGE MEASUREMENTS	52 L3	MAINS VOLTAGE
	51 L2	MAINS VOLTAGE
	50 L1	MAINS VOLTAGE
	24 L2	BUSBAR VOLTAGE
	23 L1	BUSBAR VOLTAGE
	22 L3	GENERATOR VOLTAGE
	21 L2	GENERATOR VOLTAGE
	20 L1	GENERATOR VOLTAGE
MAINS BREAKER	40 / 39	MCB OPEN COMMAND (OPTION A)
	17 / 16	MCB CLOSE COMMAND (OPTION A)
MODE SELECT/ MAINS BREAKER FEEDBACK	54	ISLAND RUNNING/ MCB OPEN FEEDBACK (OPTION A)
	53	PARALLEL W. MAINS/ MCB AVAILABLE (OPTION A)
GENERATOR BREAKER CONTOL	42 / 41	GCB OPEN COMMAND
	15 / 14	GCB CLOSE COMMAND
	4	GCB OPEN FEEDBACK
AVR CONTROL	13	VOLTAGE DOWN
	12	VOLTAGE UP
	11	VOLTAGE COMMON
SPEED GOVENOR CONTROL	10	RPM DOWN
	9	RPM UP
	8	RPM COMMON
	7	COMM. (TERM.3,4,5,6,53,54)
COMMAND INPUTS	6	SHUTD. INHIBIT
	5	AUTO 2
	3	AUTO 1
POWER SUPPLY	2	0 VDC
	1	+ 24 VDC
	0	MEASURING ZERO

Terminal	Description
	RS232 COMMUNICATION
	ANALOG INPUT 7 Pt 100
	ANALOG INPUT 6 Pt 100
	ANALOG INPUT 5 PTC (0..15 kOHM)
	ANALOG INPUT 4 0/4...20 mA
	ANALOG INPUT 3 0/4...20 mA
	ANALOG INPUT 2 0/4...20 mA
	ANALOG INPUT 1 0/4...20 mA
	RPM PICKUP INPUT TYPE PNP
	AUX. RELAY 5 (RELAY MANAGER)
	AUX. RELAY 4 (RELAY MANAGER)
	AUX. RELAY 3 (RELAY MANAGER)
	AUX. RELAY 2 (RELAY MANAGER)
	AUX. RELAY 1 (RELAY MANAGER)
	ALARM INPUT 16
	ALARM INPUT 15
	ALARM INPUT 14
	ALARM INPUT 13
	ALARM INPUT 12
	ALARM INPUT 11
	ALARM INPUT 10
	ALARM INPUT 9
	ALARM INPUT 8
	ALARM INPUT 7
	ALARM INPUT 6
	ALARM INPUT 5
	MAINS FAILURE
	COMMON
	ALARM INPUT 3
	ALARM INPUT 2
	EMERGENCY STOP
	COMMON
	HORN
	SYSTEM OK

Signal	Terminal	Group
TxD	Y5	RS232 COMMUNICATION
CTS	Y4	
GND	Y3	
RTS	Y2	
RxD	Y1	
	113	
	112	
	111	Pt 100
	110	
	109	
	108	Pt 100
	106	GENERATOR TEMPERATURE
	105	
GND	103	
+	102	
GND	100	CONFIGUARBLE ANALOG INPUTS
+	99	
GND	97	
+	96	
GND	94	EXT. POWER SETPOINT
+	93	
0	92	
+12	91	ENGINE SPEED PICKUP
+24	90	
	83 / 82	
	81 / 80	CONFIGURABLE RELAY OUTPUTS
	79 / 78	
	77 / 76	
	75 / 74	
	73	CONFIGURABLE ALARMINPUTS
	72	
	71	
	70	
	69	
	68	
	67	
	66	
	65	
	64	
	63	
	62	
	61	
	60	COM. TERMINAL
	36	CONFIGURABLE ALARM INPUTS
	35	
	34	
	33	COM. TERMINAL
	48 / 47	RELAY OUTPUTS
	19 / 18	

In the following, these terminologies will be used:

CC = Closed contact   OC = Open contact

Binary inputs are considered ON (CC) if input voltage between input terminal and common (- / 0) is 18...250 VDC or VAC. The binary inputs are divided in 3 groups. The 3 groups are galvanically separated from each other and the rest of the unit. In this manner, a power source other than the 24 VDC power supply may be used, if needed.

Terminal no.	In/Out	I/O Type	Signal name	Description
0 (spade connector next to term. no. 1)		0	AC ZERO GROUND	0 (star point) connection for 3-phase 4-wire AC systems. **It is essential, that that the generator star point (0) is connected to this terminal and to GROUND. Other-wise, false voltage readings may occur.**
1 2	+ 0	Supp.	Supply	Power supply 24 VDC +/- 50% 10W
3 Group 1	In	Binary in	Auto 1	Auto 1 = CC. Auto running with setp.1.
4 Group 1	In	Binary in	GB open	Gen. breaker open = CC
5 Group 1	In	Binary in	Auto 2	Auto 2 = CC. Auto running with setp. 2.
6 Group 1	In	Binary in	Shutdown inhibit	Shutdown inhibit running = CC. See paragraph 5.4.2. **WARNING. THIS MODE DISABLES ENGINE PRO-TECTIONS**
7 com. 1	Com.	Com.	Common	Term. 3, 4, 5, 6, 53, 54 inputs
8	Com.	Comm.	Common	Term. 9, 10 outputs
9	Out	Relay	Increase speed	increase speed = Term. 8-9 CC[*1]
10	Out	Relay	Decrease speed	Decrease speed = Term. 8-10 CC[*1]
11	Com.	Com.	Common	Terminal 12, 13 outputs[*1]
12	Out	Relay	Increase volta-ge	Increase voltage = Term. 11-12 CC[*1]
13	Out	Relay	Decrease voltage	Decrease voltage = Term. 11-13 CC[*1]
14 15		Relay output	Close GB	Close generator breaker = CC
16 17		Relay output	Close MB	Close mains breaker = CC (Option A)
18		Relay	Ready	Engine ready for service =

19		output		CC
20 21 22	L1 L2 L3	AC V input	Generator voltage	3-phase generator voltage, 100/110 or 250...400 VAC.
23 24	L1 L2	AC V input	Busbar voltage	2-phase busbar voltage, 100/110 or 250...400 VAC.

*1 : Analog output if option B is chosen:

8 9	Io Uo	Analog out	Current out Voltage out	Speed govenor analog output option B1/ B3. ±20 mA or ± 5/10 V DC
10	0	--do--	0 V/mA out	Speed govenor analog output 0
11 12	Io Uo	Analog out	Current out Voltage out	AVR govenor analog output option B2/B3. ±20 mA or ± 5/10 V DC
13	0	--do--	0 V/mA out	AVR govenor analog output 0

In the following section, the inputs named "Alarm x" (x is the number) are freely selectable for warnings, stop functions or shutdowns (eg. for lube oil pressure, water temperature, overspeed etc.)

Terminal no.	In/Out	I/O Type	Signal name	Description
25 26	S2 S1	AC I input	Generator current phase L1	/1 or /5 A current transformer input
27 28	S2 S1	AC I input	Mains current phase L1	/1 or /5 A current transformer input (Option F)
29 30	S2 S1	AC I input	Generator current phase L2	/1 or /5 A current transformer input
31 32	S2 S1	AC I input	Generator current phase L3	/1 or /5 A current transformer input
33 Group 2	Com	Common		common terminal for term. 34, 35 and 36.
34 Group 2	In	Binary	Emergency stop	Pre-selected function
35 Group 2	In	Binary	Alarm 2	Alarm message 2 ON = CC/OC Configurable.
36 Group 2	In	Binary	Alarm 3	Alarm message 3 ON = CC/OC Configurable.
37	Out	Relay	Ignition/	Ignition(gas engine) / Preglow

38			Preglow	(diesel engine) command = CC (selectable)
39 40	Out	Relay	Open MB	Mains breaker open command = CC (Option A)
41 42	Out	Relay	Open GB	Gen. breaker open commend = CC
43 44	Out	Relay	Running (stop) valve / gas valve	Activate running valve (or engine stop signal, selectable) (diesel engine) / gas valve (gas engine) = CC (selectable)
45 46	Out	Relay	Start	Start command = CC
47 48	Out	Relay	Horn	Horn output = CC
50 51 52	L1 L2 L3	ACV input	Mains voltage	3-phase mains voltage, 100/-110 or 250 ...440 VAC. **NOTE: If mains breaker (option A) is not chosen, the mains voltage measurement must be connected to the busbar. If mains breaker (option A) is chosen, mains voltage is measured on mains side of the breaker.**
53 Group 1	In	Binary	Parallel w. mains/MB free (Option A)	Parallel w. mains / MB free to operate (Option A) : U 53-7 18 V
54 Group 1	In	Binary	Island operation / MB open (Option A)	Island operation / Mains breaker open (Option A): U 53-7 18 V

Terminal no.	In/Out	I/O Type	Signal name	Description
60 com 3	In	Com.	Common	Term. 61 to 73 inputs
61 Group 3	In	Binary	Mains fail	Mains fail externally detected.
62 Group 3	In	Binary	Alarm 5	Alarm message 5 ON = CC/OC Configurable.
63 Group 3	In	Binary	Alarm 6	Alarm message 6 ON = CC/OC Configurable.
64 Group 3	In	Binary	Alarm 7	Alarm message 7 ON = CC/OC Configurable.
65 Group 3	In	Binary	Alarm 8	Alarm message 8 ON = CC/OC Configurable.

66 Group 3	In	Binary	Alarm 9	Alarm message 9 ON = CC/OC Configurable.
67 Group 3	In	Binary	Alarm 10	Alarm message 10 ON = CC/OC Configurable.
68 Group 3	In	Binary	Alarm 11	Alarm message 11 ON = CC/OC Configurable.
69 Group 3	In	Binary	Alarm 12	Alarm message 12 ON = CC/OC Configurable.
70 Group 3	In	Binary	Alarm 13	Alarm message 13 ON = CC/OC Configurable.
71 Group 3	In	Binary	Alarm 14	Alarm message 14 ON = CC/OC Configurable.
72 Group 3	In	Binary	Alarm 15	Alarm message 15 ON = CC/OC Configurable.
73 Group 3	In	Binary	Alarm 16	Alarm message 16 ON = CC/OC Configurable.
74 75	Out	Relay	Config relay 1	Relay manager controlled output. Configurable.
76 77	Out	Relay	Config relay 2	Relay manager controlled output. Configurable.
78 79	Out	Relay	Config relay 3	Relay manager controlled output. Configurable.
80 81	Out	Relay	Config relay 4	Relay manager controlled output. Configurable.
82 83	Out	Relay	Config relay 5	Relay manager controlled output. Configurable.
90 91 92	+24V +12V GND	Pick-up	Engine RPM	Engine RPM pulse input. Configurable.

*3: Analog output if option C is chosen

Terminal no.	In/Out	I/O Type	Signal name	Description
93 94 95	1+ 2 gnd NC	0/4..20mA	Pset	Power production external setpoint.
96 97 98	1+ 2 gnd NC	0/4..20mA	Analog 2	Configurable analog input.
99	1+	0/4..20mA	Analog 3	Configurable analog

100	2 gnd			input.
101	NC			
102	1+	0/4..20mA	Analog 4	Configurable analog
103	2 gnd			input.
104	NC			
105	1	PTC	Generator stator temp.	PTC 0..15 k input
106	2			
107	NC			
108	1	Pt 100	Temperature 2	3-wire temp. input
109	2			
110	3			
111	1	Pt 100	Temperature 3	3-wire temp. input
112	2			
113	3			
Y1		RxD	Communication	Serial comm. RS 232
Y2		RTS		(Option D)
Y4		CTS		
Y5		TxD		
X1		CAN-H	Communication	CAN-bus
X2		CAN-L		communication for load
X3	NC			sharing (Option E)
X4		CAN-H		
X5		CAN-L		

Option C configuration:

Terminal no.	In/Out	I/O Type	Signal name	Description
X1	Out+	0/4..20mA	Analog out 1	Analog output, configurable via analog manager
X2	GND			
X4	GND	0/4..20mA	Analog out 2	Analog output, configurable via analog manager
X5	Out+			

3. Wiring diagrams

3.1.1 AC inputs with mains breaker (Option A)
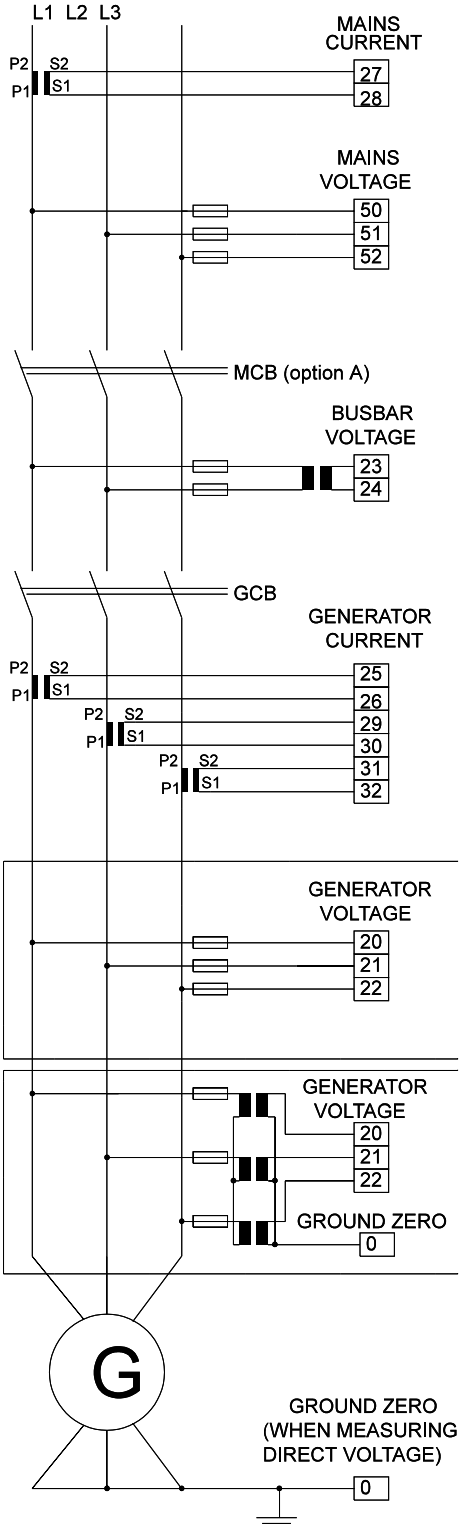
NOTE: Fuse in all AC voltage connections: Max. 2A slow-blow

Mains voltage connection shown is direct, 460 VAC max. Higher voltages requires voltage transformers, see generator voltage connection, transformers.

NOTE: If there are no mains breaker (option A) the mains voltage measurement and the busbar voltage measurement are both to be connected to the busbar. If not, the unit will fail to synchronise.

Busbar voltage shown is via voltage transformer. Direct voltage measurement (max. 460 VAC) is done by connecting term. 23 to L1 and term. 24 to L2.

Direct voltage measurement. Max. 460 VAC.

Indirect voltage measurement. Generator voltage > 460 VAC.

3.2 AC inputs without mains breaker (option A)
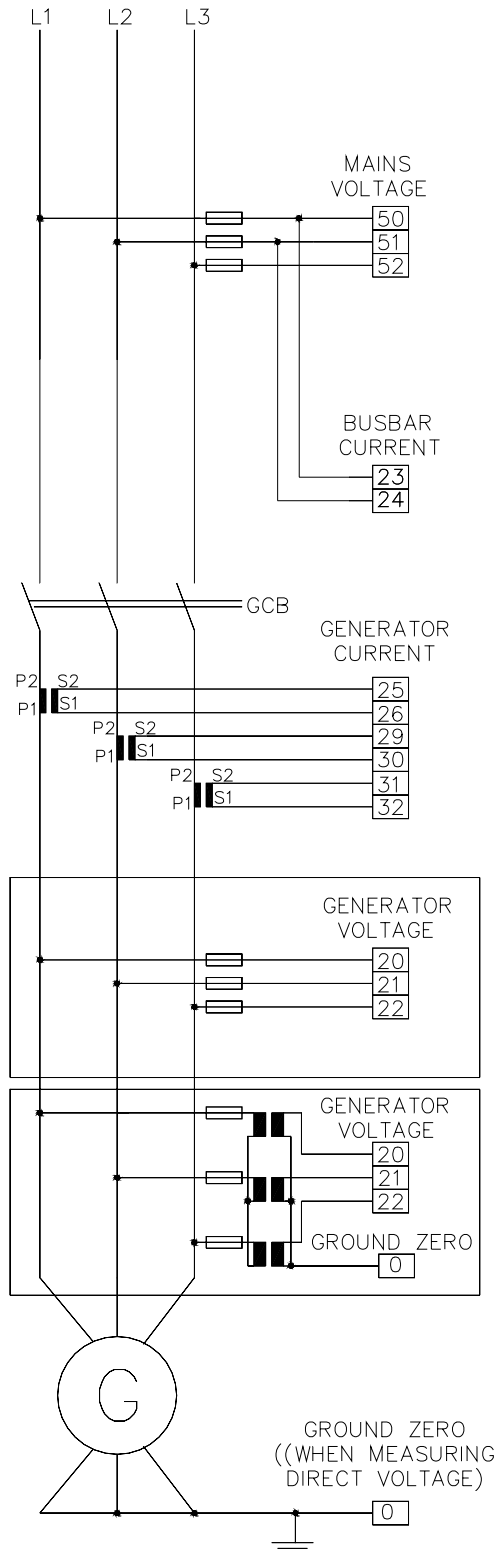
NOTE: Fuse in all AC voltage connections: Max. 2A slow-blow.

Mains/busbar voltage connection shown is direct, 460 VAC max. Higher voltages requires voltage transformers, see generator voltage connection, transformers.

Direct voltage measurement. Max. 460 VAC.

Indirect voltage measurement. Generator voltage > 460 VAC.

3.3 Breaker control with mains breaker (option A)

NOTE: The mains breaker control I/O's are only used for the breaker if option A is implemented. This includes the "mains breaker free" (dotted lines) feedback. If this feedback is not active (voltage on terminal 53>18V AC/DC), the mains breaker will not be activated by the MPC-1.

If "mains breaker" (option A) is **not** implemented, the inputs are used for choise of "parallel with mains mode" and "island operation mode".
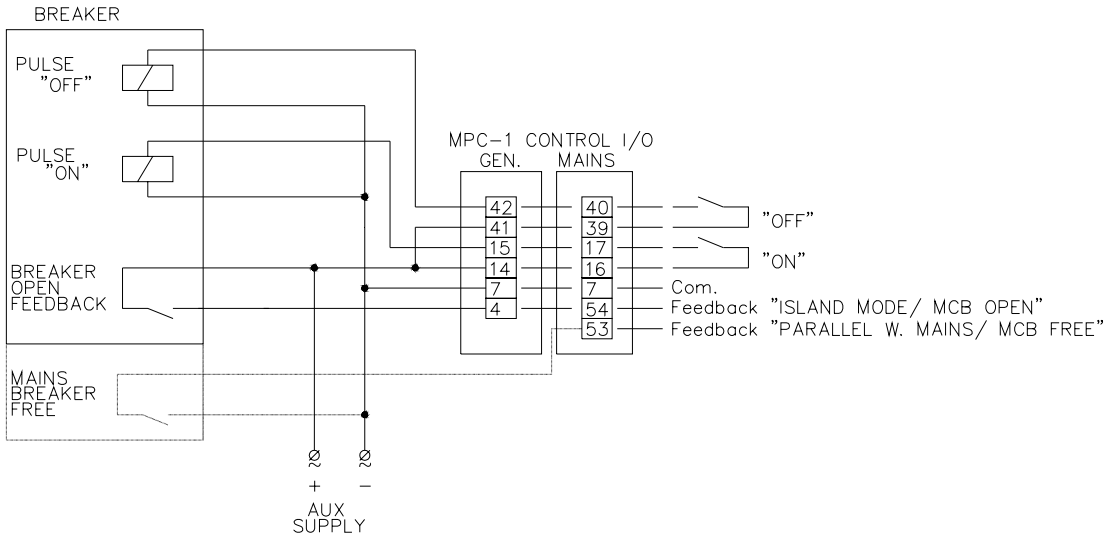
3.3.1 Breaker control without mains breaker (option A)
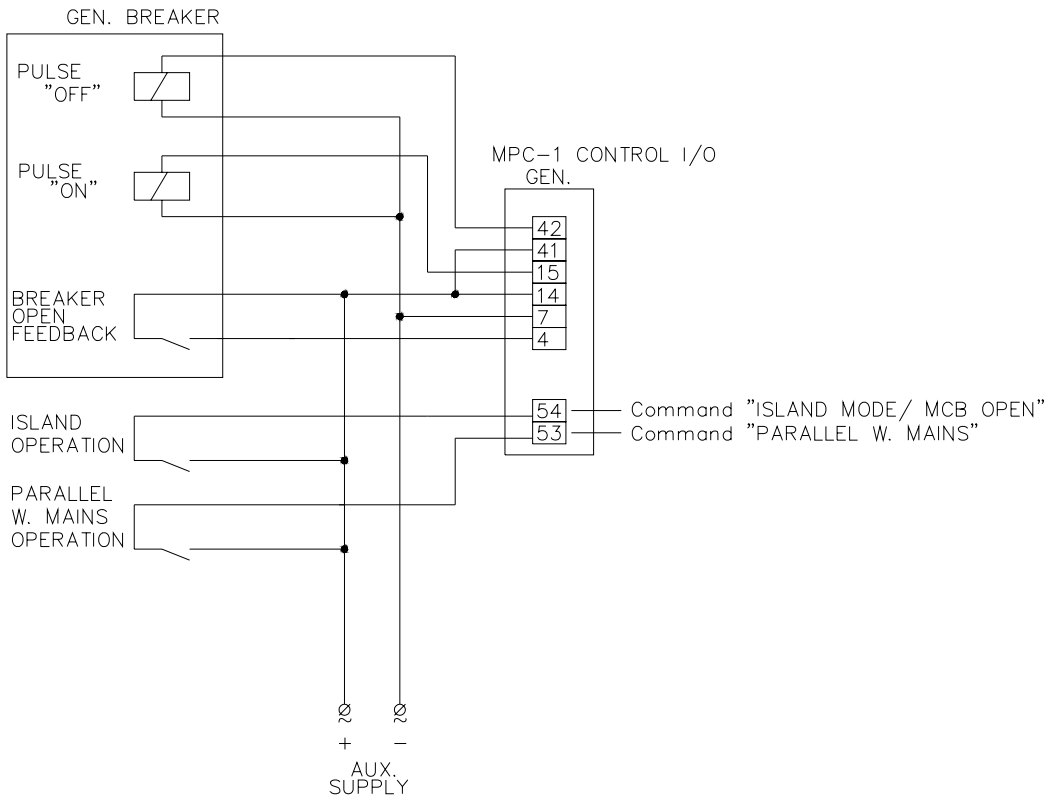
3.4 Speed governor and AVR control
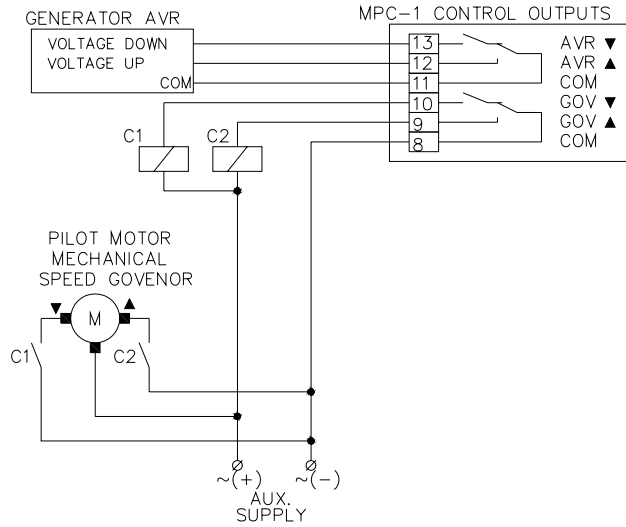
3.5 Binary inputs
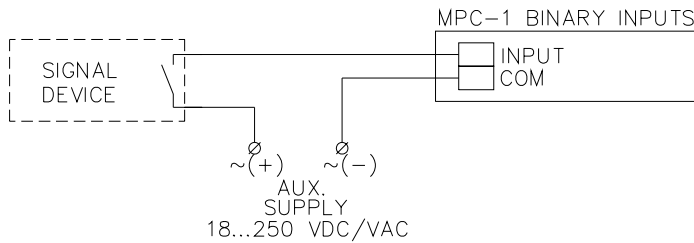
Internal input resistance: 68 kΩ

3.6 Relay outputs
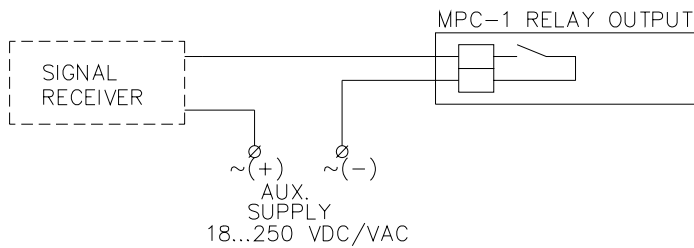
Max. load 5 A, 250 VAC
Govenor outputs, however
max. load 8 A, 250 VAC.

3.7 Analog inputs
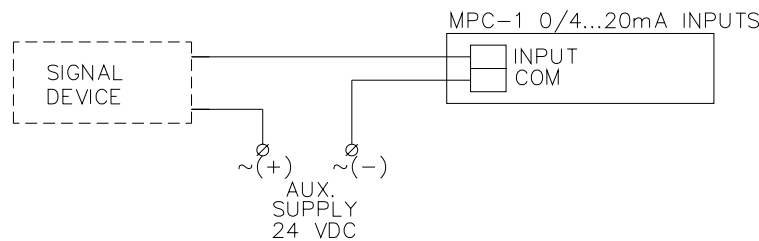
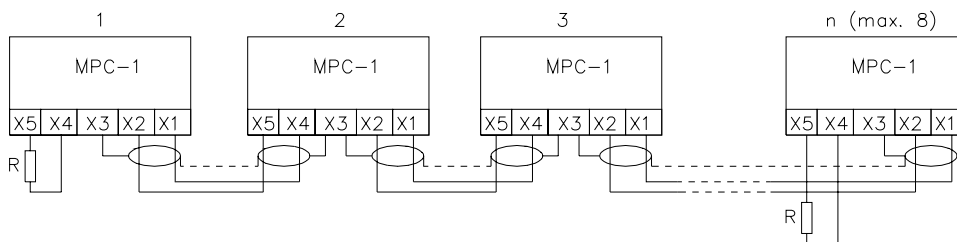### 3.8 Pt 100 inputs
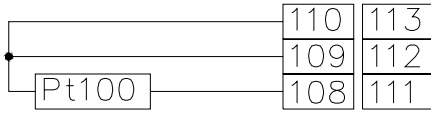
3.9 Analog outputs
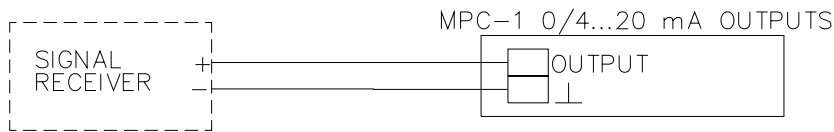
3.10 RPM pickup input

Pickup type: PNP
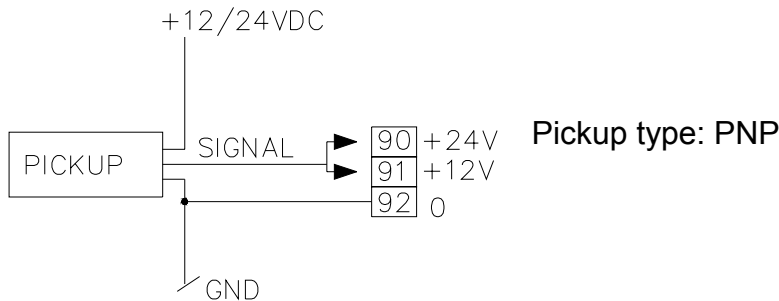
3.11 Load sharing communication

End terminal resistor R = 80...120
CABLE: Shielded twisted pair, min. 0.25 mm^2.

4.   Commissioning

Before commissioning: Check phases for correct voltage and correct rotary field. Emergency stop must be functioning.

Warning: Missing or incorrect voltage and other input fails may lead to malfunction and damage to the unit.

For further explanations regarding setpoints and their functions : Refer to paragraph 5 "parameter reference list" and paragraph 6 "Generator and engine protection parameter menu".

1. To avoid unwanted closing of breakers: Remove the wires "breaker on command" at the breaker terminals.

2. Connect 24 VDC power supply

3. Push the buttons "V" and "SET" simultaneously to swap between "auto" mode and "parameter" mode. Follow the instructions to change any parameter needed. Push the buttons "V" and "SET" again to return to "auto" mode.

4. Check all measured values. Check breaker feedback(s).

5. Use running mode "hand" to check start/stop of engine and control generator measurements. Check failure inputs.

6. Use running mode "test-run" to test automatic start sequence. Test breaker trip functions.

7. Go to "auto" mode. Check rotary field direction of mains and generator. Check correct "generator breaker on" command pulse e.g. with a synchronoscope.

8. Use "auto1" set to 25% to run a parallel with mains. Check displayed measured and calculated values.

9. (Only option A) check "mains breaker on" as described in pos. 7.

10. Check "emergency run".

NOTE: The feedbacks from breakers are "breaker open" feedbacks, i.e. the signal MUST be 0 V by closed breaker. These feedbacks MUST be correctly connected.
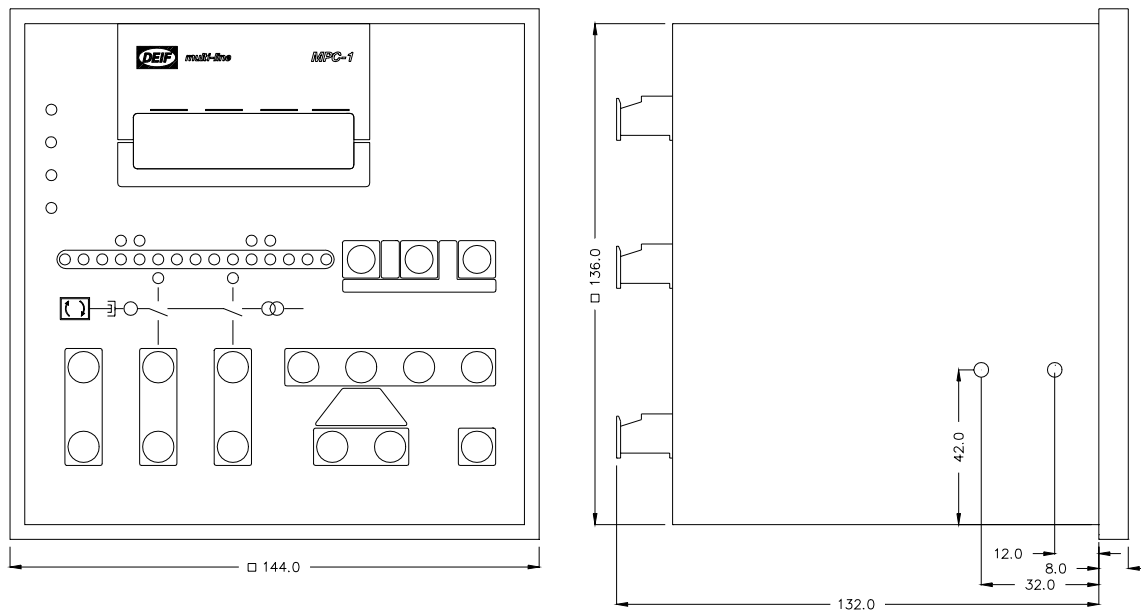
5. Technical data

Accuracy: Class 1.0 acc. to IEC 688 and EN 60688

Operating temp: -20...+70 $^{\circ}$C (LCD display, however: -20...+60 $^{\circ}$C

Climate: Class HSE, to DIN 40040

Measuring voltage: 100/110 VAC to 400 VAC ± 20%
consumption approx. 0.15 VA per phase

Measuring current: ../1 or ../5 A, impedance < 0.1 / phase
max. overcurrent 2 x I_{nom}.
Galvanically separated, 2000 V_{eff} test voltage

Measuring frequency: 50Hz (60Hz)

Aux. supply: 24 VDC +30/-25 %

Binary inputs: Galvanically separated in groups, 2000 V_{eff} test voltage
input voltage 18...250 VDC or VAC
input impedance 68 kΩ

Relay outputs: Contact rating 5 A @250 VAC
(Govenor output relays : 8 A @250 VAC)
max. voltage 380 VAC
lifetime min. 100.000 changeovers
Galvanically separated, 2000 V_{eff} test voltage, >1000 MΩ
@500 VDC

Analog inputs: Free scaleable, 10 bit
Gnd. terminals internally high-ohmic connected to terminal 0.
- PTC: 15 kΩ
- Pt 100 :   DIN IEC 751
- 0/4...20 mA   Max. impedance 400 Ω

Analog outputs: Free scaleable, 12 bit
Galvanically separated, 700 V_{DC} test voltage
- 0/4..20 mA: Max load 400 Ω @ 24 VDC

Housing: DIN 43700, WxHxD: 144x144x116, cutout 138x138 mm

Connections: Max. 2.5 mm^2, multi stranded. 4 mm^2, single stranded

Protection: IP 21, however, front IP 54

Weight: Dependent on version, approx. 1 kg

EMC: To EN 50081-1/2, EN 50082-1/2

6. Dimensions

All dimensions in mm

Errors and changes excepted.