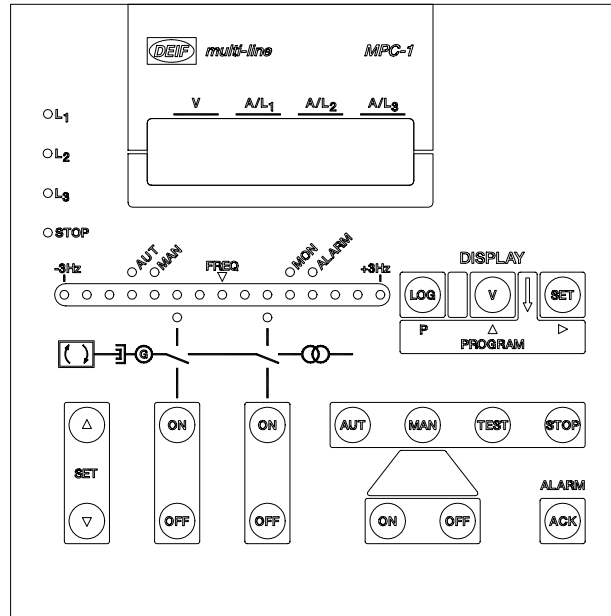


## Multi power controller type MPC-1 multi-line 4189340101F



- 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 synchronisation



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This manual relates to MTR-1 version 1.0x (versions 1.01....1.09)

## 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. Applications

The multi power controller MPC-1 is a microprocessor-based control unit containing all necessary functions to control a synchronous- or asynchronous generator set running in island or parallel with mains operation. MPC-1 can control drive engines fuelled by diesel, vegetable oil or gas.

Excluding external measuring transformers it contains all necessary measuring circuits and presents all values on an LCD display. Values and messages are presented in clear text and all measuring values are presented in engineering units.

The MPC-1 is flexible and menu-programmed, enabling the user to match the unit to the engine, generator and application in question. Programming is password protected.

The MPC-1 is designed for complete engine and generator control for gensets:

- island operation
- parallel with mains
- emergency generator sets

The MPC-1 executes a cyclical self-test, with error messages if any occurs.



## 2.1 Standard functions

The unit is designed for control of an engine and generator running in island or parallel with mains operation.

## 2.2 Measured and calculated values

- generator:
  - voltage (3-phase U)
  - current (3-phase I)
  - frequency (f through engine RPM pickup or generator voltage)
  - active power (kW)
  - energy production (kWh) counter (not for custody transfer)
  - reactive power (kvar)
  - phase angle ( $\cos \varphi$ )
  
- engine:
  - running hour counter
  - no. of starts
  - service interval hours counter
  - RPM measurement via magnetic pickup
  - temperatures/pressures/other state inputs
  - alarm and shutdown control, e.g.:
    - low lubricating oil pressure warning and shutdown
    - high cooling water temperature warning and shutdown
    - overspeed warning and shutdown
  
- mains:
  - voltage (3-phase U)
  - current (3-phase I)
  - phase angle ( $\cos \varphi$ )
  - power consumption/production from/to mains (kW) (Option F)
  - reactive power (var)
  
- aux.:
  - battery voltage
  - 4 x 3-wire Pt 100 temperatures
  - 16 alarm inputs, 2 fixed functions, 14 programmable
  - 3 control inputs
  - 11 output relays
  - 1 pickup/binary input, engine RPM / running
  - 2 auto setpoints (power) binary inputs
  - Serial communication RS232, Siemens 3964 standard protocol

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### 2.3 Measured and calculated values

- user defined values for a diesel-, vegetable oil- or gas engine start/stop sequence
- speed governor and voltage control via relays

### 2.4 Synchronisation

- Dynamic synchronisation of generator breaker (GB) to busbar/mains
- GB ON pulse at dynamic synchronisation point:
- Differential frequency matching
- Voltage matching
- GB delay time programmable

### 2.5 Load control

- Load dependent start/stop in island operation mode
- Frequency and voltage control in island operation mode
- External setpoint for mains active power (parallel with mains mode operation F)

### 2.6 Mains supervision

- 3 phase overvoltage ( $U_{<}$ ) (min. 30 ms)
- 3 phase overvoltage ( $-U_{>}$ ) (min. 30 ms)
- vector jump ( $d\phi/dt$ ), 2 periods selectable
- frequency change ( $df/dt$ ) selectable

### 2.7 Engine/generator protection function

- Overload ( $P_{>}$ )
- Reverse power ( $-P_{<}$ )
- Overcurrent ( $I_{>}$ )
- Overspeed/frequency ( $rpm_{>} / f_{>}$ )
- Underspeed/frequency ( $rpm_{<} / f_{<}$ )
- Overvoltage ( $U_{>}$ )
- Undervoltage ( $U_{<}$ )
- Battery voltage ( $U_{batt_{<}}$ )
- 14 user-definable binary inputs for warnings/shutdowns (e.g. lubricating oil pressure low shutdown)

### 2.8 Status indications and control

- Generator breaker position
- Mains breaker position (Option A)
- Auto/man. Input selector
- LED indicators: Stop, auto man., GB on, monitoring on, fail, frequency bar-graph
- Alarm and condition indication in clear text on LC display
- AC values on LC display



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## 2.9 Control pushbuttons

- Generator breaker ON/OFF
- Mains breaker ON/OFF (Option A)
- Auto
- Man. engine start/stop
- Manual frequency and voltage regulation
- Test
- Acknowledge of alarms

## 2.10 Breaker control

### 2.10.1 Breaker closing with synchronisation

The MPC-1 will synchronise the generator breaker, when all following conditions are fulfilled:

- "Auto" mode is chosen
- One of the inputs "auto 1/2" is activated
- Feedback signal "mains breaker closed" is present
- The pushbar is live
- The genset is running, and generator voltage is OK

### 2.10.2 Breaker closing without synchronisation

The MPC-1 will close the generator breaker without synchronisation, when all following conditions are fulfilled:

- "Auto" mode is chosen or "emergency" mode occurs during "test-run"
- One of the inputs "auto 1/2" is activated or "emergency run" is activated
- Signal "mains breaker ready" is not present
- Signal "generator breaker ready" is present
- Feedback "mains breaker closed" is not present
- The pushbar is black
- The genset is running, and generator voltage is OK

### 2.10.3 Breaker opening

The MPC-1 will open the generator if:

- A failure of class 2 (opening of breaker, stop after cooling down period) or 3 (opening of breaker, immediate shutdown) occurs
- No "auto" input is present, or "emergency run" is terminated
- Running mode "stop" is activated

---

#### **2.10.4 Mains breaker (Option A) closing with synchronisation**

The MPC-1 will synchronise the mains breaker (Option A) when all following conditions are fulfilled:

- Running mode "auto" is chosen, or emergency mode occurs during "test-run"
- One of the "auto 1/2" inputs is activated, or "emergency run" is terminated by return of remains
- Feedback signal "generator breaker closed" is present
- Feedback signal "mains breaker free" is present
- The busbar is alive
- Mains voltage is OK

#### **2.10.5 Mains breaker (Option A) closing without synchronisation**

The MPC-1 will close the mains breaker (Option A) without synchronisation, when all following conditions are fulfilled:

- Running mode "auto" is chosen
- The signal "mains breaker ready" is present
- The parameter "MCB control" is ON
- The signal "generator breaker ready" is not present
- Feedback signal "mains breaker free" is present
- The pushbar is black
- Mains voltage is OK

#### **2.10.6 Mains breaker (Option A) opening**

The MPC-1 will open the mains breaker, if:

- A mains failure occurs, and both breakers are closed
- Mains is lost and "emergency run" is activated

### **3. Options**

Option A: Mains circuit breaker

- dynamic synchronisation of mains breaker with voltage matching

Option B: Analog speed/AVR control

- analog signal  $\pm 5$  V to replace relay outputs

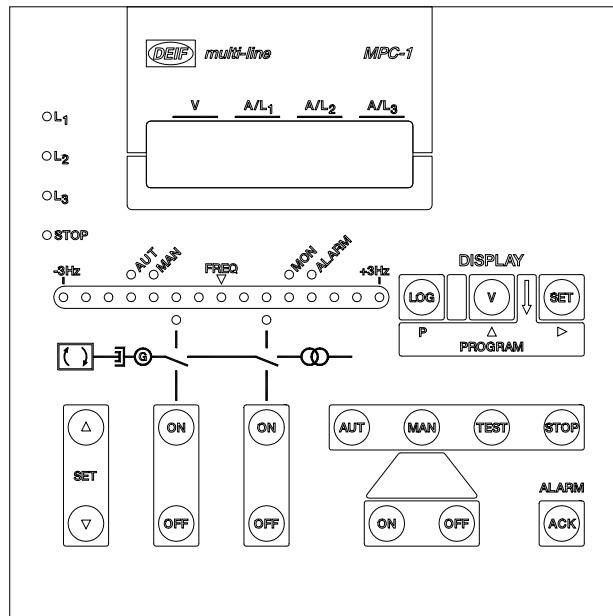
B1: Analog speed governor output  
B2: Analog AVR  
B3: Analog speed governor and AVR

Option C: Analog transducer outputs

- 2 x 4 20mA output representing chosen values  
(not available if Option E is chosen)

- Option D: Remote control
- RS 232 remote control of the MPC-1 with Siemens 3964 standard protocol
- Option E: Power management  
(Not available if Option C is chosen)
- Automatic start/stop/connection/disconnection of up to 8 gensets in parallel
  - equal load sharing between running generators
  - no. of gensets running dependent on mains power transport (Option F only)
  - no. of gensets running dependent on power consumption, island operation
- Option F: Mains power transport
- mains kW calc. Based on single phased current (3-phased symmetrical load)

## 4. Display and LED's



### 4.1 LCD display

2-line green LC display : Auto: Values, running conditions and alarm messages.  
Param/test.: Adjustment of parameters

The LCD display contrast/brightness can be adjusted by the potentiometer placed on the left side of the MPC-1. It is accessible without opening the unit.



## 4.2 LED's

Stop:	Red:	Genset is stopped or being stopped
Auto:	Yellow:	Auto running mode
Man:	Yellow:	Manual running mode
GCB:	Green:	Generator breaker is closed
MCB:	Green:	Mains breaker is closed (Option A)
Al.sys:	Green:	Engine supervision and protection is active
Alarm:	Red:	Alarm condition active
L1, L2, L3:	Green:	Voltage shown on LC-display
15 LED's:	3-colour:	Generator frequency indication

## 4.3 Frequency indication

The 15 LED's in vertical line are indicating the present generator frequency in the range  $-3...f_{nom}...+3$  Hz, where  $f_{nom}$  is the keyed-in generator nominal frequency.

In case of over frequency or under frequency, the end LED (high end or low end) will flash.

NOTE: During synchronisation the LED line will function as an LED synchroscope, if the "service display" is used (see later).

## 5. Common pushbuttons, normal operation

### 5.1 "LOG"

Scrolling through

- Alarm messages	- Service hour countdown counter
- Generator power	- No. Of starts
- Mains voltage	- Battery voltage
- Running hours counter	- Mains power transport
- Mains current	- Analog setpoint (power setpoint)
- Analog input values	- Energy counter (kWh)

### 5.2 "V"

Scrolling through generator voltage display (L1-L2, L2-L3, L3-L4, L1-0, L2-0, L3-0). Also, if mains voltage is shown on the lower display line (select with the "LOG" pushbutton), a scroll through the mains voltages will take place.

### 5.3 "SET"

Selects function of the " $\blacktriangle$ " and " $\blacktriangledown$ " buttons on the left hand side. Pushing the button once shifts the lower display line from values/alarms into setpoints. Pushing the button again swaps between the different possible settings. During "AUTO" running, the value chosen will be stored in memory and used as new setpoints. During "MAN" running, the settings chosen will only be effective as long as "MAN" running is active. Selecting an other running mode resets to the values present before the "MAN" mode was chosen.



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## 5.4 "ACK"

Acknowledge of alarms, in 2 ways:

- 1) 1-second push: Reset of "common failure" alarm output.
- 2) 5-second push: Acknowledge of all alarms. Acknowledge of alarms one by one is not possible.

**Warning:** Unwanted start can occur, if alarms are acknowledged, and an "auto 1" or "auto 2" input is active.

## 6. Selection of running modes

### 6.1 "STOP" pushbutton

- Generator set is stopped or will be stopped
- Emergency power function is inactive
- Generator set is blocked
- Mains breaker (MBC) will not be operated (Option A)

### 6.2 "TEST" pushbutton

- Generator set is started
- Engine supervision is activated
- Outputs for governor / AVR are de-activated
- None of the breakers will be activated, unless a failure causes a trip

If a mains failure takes place during test-run, the MGC-1 will carry out the emergency power function and the generator breaker will be closed. After restoration of the mains, the MGC-1 will synchronise the MCB mains breaker (if option A is implemented), and remain in parallel with mains running mode.

### 6.3 "MAN" pushbutton

- engine start/stop via push-buttons "start" and "stop"
- GCB generator breaker close/open via push-buttons "on" and "off"
- MCB mains breaker close/open via push-buttons "on" and "off" (option A only)

The closing of the breakers are NOT controlled by the synchroniser function during "MAN" run. Therefore, manual closing of the breaker(s) can only take place if the busbar voltage is 0 V.

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## 6.4 "AUT" pushbutton

### 6.4.1 Automatic start with closing of breaker

The genset will start automatically and the GCB will be closed if:

- emergency power is requested, caused by a mains failure
- fixed load running is requested via digital input "auto 1" or "auto 2"
- analog power setpoint is active and input "auto 2" is "ON"

### 6.4.2 Shutdown inhibit running

**WARNING: SHUTDOWN INHIBIT RUNNING MODE DISABLES ENGINE PROTECTIVE FUNCTIONS. THIS CAN LEAD TO DISASTROUS EVENTS!!!**

If the input at terminal 6 (shutdown inhibit running) is shortly activated, the mode will be chosen.

The shutdown inhibit mode is a special running mode intended for emergency situations other than the emergency power mode. There will be 6 start attempts. This running mode will de-activate all shutdown functions of the unit, i.e. even if a fatal failure occurs (e.g. low lubricating oil pressure), the genset will keep on running until breakdown. The only shutdown function still active is the terminal 61, "emergency stop".

There will be no synchronisation to a live busbar. If the busbar is "dead" the generator breaker will be closed.

Even if the input is de-activated, the shutdown inhibit mode will still be active, but the display will show "shutdown inhibit end". The mode is de-activated by pressing pushbutton "stop". This will also reset shutdown functions to normal. "Shutdown inhibit end" message is removed by pushing "ack".

Errors and changes excepted