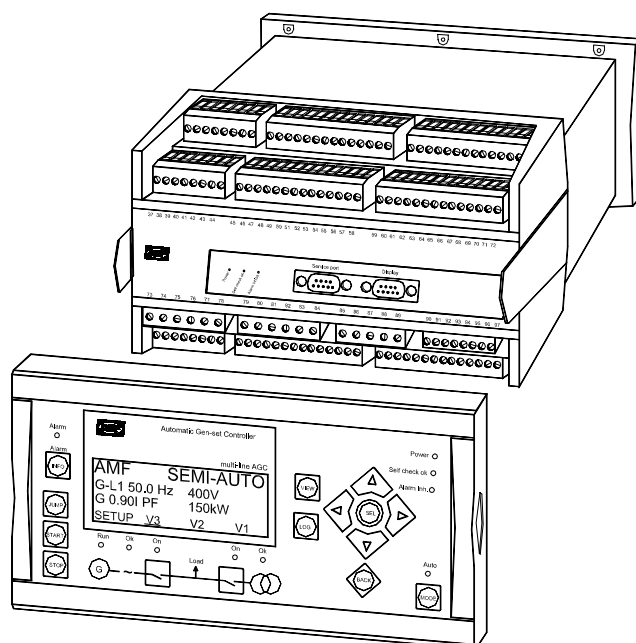


## Description of options

### Option EF3 and EF4, Combination outputs Automatic Gen-set Controller

4189340387A

SW version 2.1X.X



- Description of option
- Terminal description
- Functional description
- Parameter list



Table of contents

**1. WARNINGS AND LEGAL INFORMATION ..... 3**

LEGAL INFORMATION AND RESPONSIBILITY ..... 3

ELECTROSTATIC DISCHARGE AWARENESS ..... 3

SAFETY ISSUES ..... 3

DEFINITIONS ..... 3

**2. DESCRIPTION OF OPTION ..... 4**

EF3 OPTION..... 4

EF4 OPTION..... 4

**3. TERMINAL DESCRIPTION ..... 5**

TERMINALS, OPTION EF3 OUTPUT ..... 5

TERMINALS, OPTION EF4 OUTPUT ..... 7

**4. FUNCTIONAL DESCRIPTION ..... 8**

**5. PARAMETER LIST ..... 10**

ANALOGUE CONTROLLER OFFSET ..... 11

## 1. Warnings and legal information

### 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 set controlled by the unit, the company responsible for the installation or the operation of the set must be contacted.

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



**Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.**

### Definitions

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

#### Notes



**The notes provide general information which will be helpful for the reader to bear in mind.**

#### Warning



**The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.**

## 2. Description of option

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This document describes the functionality of the mixed governor and AVR outputs contained in options EF3 and EF4.

### EF3 option

| Option EF3                                                   | ANSI no. |
|--------------------------------------------------------------|----------|
| PWM speed control output for CAT <sup>®</sup> engines        | 77       |
| Selectable +/-20mA or relay output for voltage control (AVR) | 77       |

### EF4 option

| Option EF4                                                      | ANSI no. |
|-----------------------------------------------------------------|----------|
| Selectable +/-20mA or relay output for speed control (governor) | 77       |
| Selectable +/-20mA or relay output for voltage control (AVR)    | 77       |



**Option EF4:** If analogue output is chosen for the governor, then only relay outputs will be available for AVR, and vice versa.



**AVR control is option D1.**

### 3. Terminal description

Slot #4 is used for governor and AVR outputs.

Slot #6 is used for different options as well as the PWM droop output. Therefore, choosing option EF3, care must be taken not to choose two options that use the same slot.

The analogue governor output is intended to control a governor requiring an analogue speed setting signal. This can be DC current or, by mounting a resistor across the output, DC voltage. The maximum DC voltage available is 10V DC (500  $\Omega$  across the terminals).



The choice of resistor depends on the specific governor. Please refer to the DEIF document 'Interfacing DEIF Equipment with Governors and AVR's' for detailed information.

#### Terminals, option EF3 output

##### PWM for GOV without AVR control

The PWM output is designed for use with Caterpillar generator sets.

| Term.<br>Slot #4 | Function | Description               |   | Term.<br>Slot #6 | Function | Description      |
|------------------|----------|---------------------------|---|------------------|----------|------------------|
| 65               |          |                           |   | 90               |          |                  |
| 66               |          |                           |   | 91               |          |                  |
| 67               | PWM +    | PWM speed governor signal | x | 92               | PWM +    | PWM droop signal |
| 68               | PWM -    |                           |   | 93               | PWM -    |                  |
| 69               |          |                           |   | 94               |          |                  |
| 70               |          |                           |   | 95               |          |                  |
| 71               |          |                           |   | 96               |          |                  |
| 72               |          |                           |   | 97               |          |                  |



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (speed) input (called RATED SPEED on the ADEM controller and PRIMARY THROTTLE on the PEEC controller).



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (droop) input (called DROOP SPEED on the ADEM controller and DROOP on the PEEC controller).

**PWM for GOV, analogue control for AVR (Option D1)**

The PWM output is designed for use with Caterpillar generator sets.

| Term.<br>Slot #4 | Function | Description               | x | Term.<br>Slot #6 | Function | Description      |
|------------------|----------|---------------------------|---|------------------|----------|------------------|
| 65               | +/- 20mA | AVR set point output      |   | 90               |          |                  |
| 66               | 0        |                           |   | 91               |          |                  |
| 67               | PWM +    | PWM speed governor signal |   | 92               | PWM +    | PWM droop signal |
| 68               | PWM -    |                           |   | 93               | PWM -    |                  |
| 69               |          |                           |   | 94               |          |                  |
| 70               |          |                           |   | 95               |          |                  |
| 71               |          |                           |   | 96               |          |                  |
| 72               |          |                           |   | 97               |          |                  |



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (speed) input (called **RATED SPEED** on the ADEM controller and **PRIMARY THROTTLE** on the PEEC controller).



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (droop) input (called **DROOP SPEED** on the ADEM controller and **DROOP** on the PEEC controller).

**PWM for GOV, relay control for AVR (option D1)**

The PWM output is designed for use with Caterpillar generator sets.

| Term.<br>Slot #4 | Function | Description                         | x | Term.<br>Slot #6 | Function | Description      |
|------------------|----------|-------------------------------------|---|------------------|----------|------------------|
| 65               |          |                                     |   | 90               |          |                  |
| 66               |          |                                     |   | 91               |          |                  |
| 67               | PWM +    | PWM speed governor signal           |   | 92               | PWM +    | PWM droop signal |
| 68               | PWM -    |                                     |   | 93               | PWM -    |                  |
| 69               | NO       | Relay output for AVR. Raise voltage |   | 94               |          |                  |
| 70               | Com.     |                                     |   | 95               |          |                  |
| 71               | NO       | Relay output for AVR. Lower voltage |   | 96               |          |                  |
| 72               | Com.     |                                     |   | 97               |          |                  |



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (speed) input (called **RATED SPEED** on the ADEM controller and **PRIMARY THROTTLE** on the PEEC controller).



Connect PWM- to the engine battery negative and PWM+ to the engine control system S-SPD (droop) input (called **DROOP SPEED** on the ADEM controller and **DROOP** on the PEEC controller).

### Terminals, option EF4 output

Slot #4 is used for governor/AVR outputs.

#### Analogue output for speed, relay output for voltage

| Term.<br>Slot #4 | Function | Description                         |
|------------------|----------|-------------------------------------|
| 65               | +/- 20mA | Analogue +/-20mA for GOV            |
| 66               | 0        |                                     |
| 67               | Not used | Not used                            |
| 68               | Not used |                                     |
| 69               | Relay 13 | Relay output for AVR. Raise voltage |
| 70               | Relay 13 |                                     |
| 71               | Relay 14 | Relay output for AVR. Lower voltage |
| 72               | Relay 14 |                                     |

#### Analogue output for voltage, relay output for speed

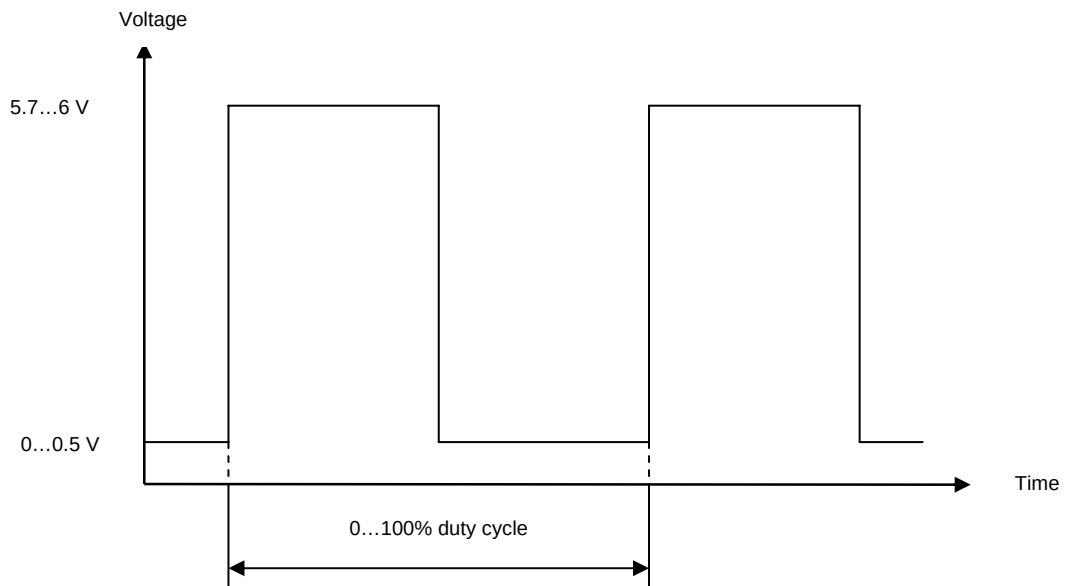
| Term.<br>Slot #4 | Function | Description                           |
|------------------|----------|---------------------------------------|
| 65               | +/- 20mA | Analogue +/-20mA for AVR              |
| 66               | 0        |                                       |
| 67               | Not used | Not used                              |
| 68               | Not used |                                       |
| 69               | Relay 13 | Relay output for GOV. Raise frequency |
| 70               | Relay 13 |                                       |
| 71               | Relay 14 | Relay output for GOV. Lower frequency |
| 72               | Relay 14 |                                       |

The two configuration combinations shown above in option EF4 are selected in menu 2650.

## 4. Functional description

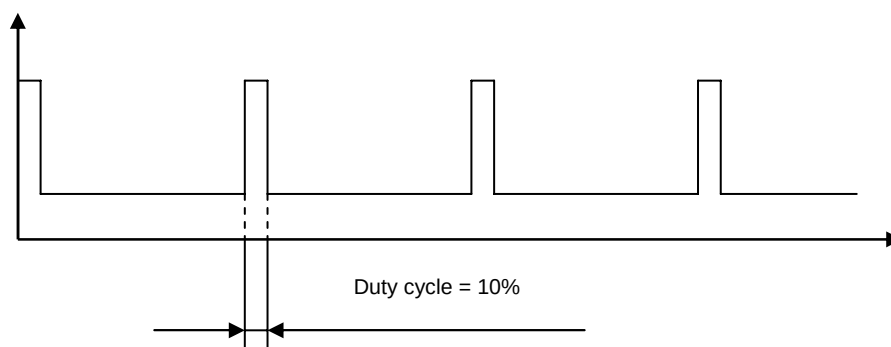
The PWM signal has a frequency of 500Hz +/- 50Hz. The resolution of the duty cycle is 12 bits, which gives output 4095 different levels. The output is an open collector output with a 1k-ohm pull-up resistor.

The low level of the signal is between 0 and 0.05 volt, whereas the high level is between 5.7 and 6 volt.



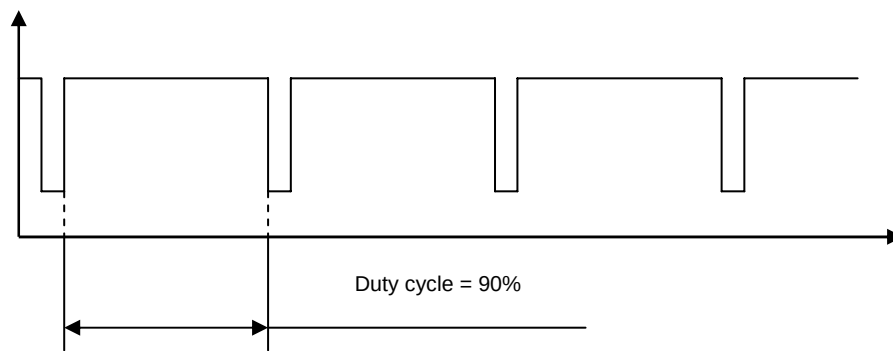
### Principle of duty cycles

The drawing below shows an example of a 10% duty cycle:





The drawing below shows an example of a 90% duty cycle:



## 5. Parameter list

The setup of parameters is done via the display or the PC utility software (USW).



For further information about the structure of the parameter descriptions, please see the Designer's Reference Handbook.

### 2650 Governor/AVR setup

| No.  | Setting |      | Min. setting           | Max. setting           | Factory setting        |
|------|---------|------|------------------------|------------------------|------------------------|
| 2651 | Type    | Type | GOV = Ana<br>AVR = Bin | GOV = Bin<br>AVR = Ana | GOV = Ana<br>AVR = Bin |



If PWM control is enabled in menu 2664, then only AVR selection can be made.



AVR control is option D1.

### 2660 Pulse with modulation

| No.  | Setting     |                  | Min. setting | Max. setting | Factory setting |
|------|-------------|------------------|--------------|--------------|-----------------|
| 2661 | PWM control | Minimum value    | 0.0%         | 50.0%        | 10.0%           |
| 2662 | PWM control | Init. value      | 0.0%         | 100.0%       | 35.0%           |
| 2663 | PWM control | Maximum value    | 50.0%        | 100.0%       | 90.0%           |
| 2664 | PWM control | Enable           | OFF          | ON           | OFF             |
| 2665 | PWM control | Droop duty cycle | 0.0%         | 100.0%       | 50.0%           |

These are the settings for the PWM output:

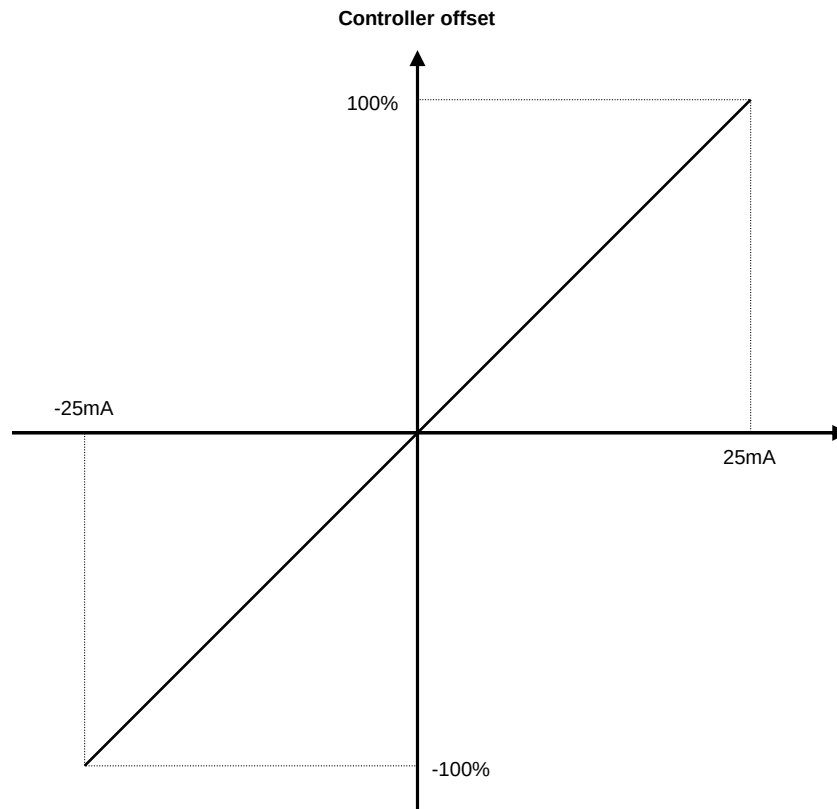
| No.  | Setting       | Comment                                                                                                                                             |
|------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 2661 | Minimum value | This is the minimum output level of the PWM signal                                                                                                  |
| 2662 | Init. value   | This is the initial output level, which is the level where the PWM signal will start the regulation                                                 |
| 2663 | Maximum value | This is the maximum output level of the PWM signal                                                                                                  |
| 2664 | Enable        | Enables or disables the PWM control. If the PWM control is disabled, the menu group 2260 is displayed, and governor and AVR output must be selected |
| 2665 | Droop         | This is selection of the engine droop. The range is 2-95% equal to 0-10% droop                                                                      |

### Analogue controller offset

In addition to the controller parameters described above, the analogue offset setting can be used. The purpose is to give the analogue output an offset value, when powering up the unit. Furthermore, a binary input can be used to reset the output to the offset value. The offset value must be adjusted, so the gen-set will start up at the correct speed and voltage.



Typically the speed/voltage adjustment is made on the speed governor/AVR itself.



**2550 Analogue governor offset**

| No.  | Setting        |        | Min. setting | Max. setting | Factory setting |
|------|----------------|--------|--------------|--------------|-----------------|
| 2551 | Ana GOV offset | Offset | -100%        | 100%         | 0%              |



Menu 2550 analogue GOV offset only appears, if option PWM control is deactivated and the analogue GOV control is selected.

**2600 Analogue AVR offset**

| No.  | Setting        |        | Min. setting | Max. setting | Factory setting |
|------|----------------|--------|--------------|--------------|-----------------|
| 2601 | Ana AVR offset | Offset | -100%        | 100%         | 0%              |



Menu 2600 analogue AVR offset only appears, if option D1 is chosen and analogue AVR control is selected.



After adjusting the analogue offset values, the controller unit must be reset (power off) in order to use the new adjustment.

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