



***Load sharing module.***  
***Technical documentation***

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**CRE technology**  
**Allée Charles-Victor Naudin - Zone des Templiers - Sophia Antipolis**  
**06410 BIOT - FRANCE**  
**Téléphone : + 33 (0)4.92.38.86.82 - Fax : + 33 (0)4.92.38.86.83**  
**www.cretechnology.com info@cretechnology.com**  
**RCS Antibes : 7488 625 000 15 - N°TVA FR54 488 625 583**

**NOTE :**

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage. Contact your CRE dealer for course training.

**History :**

- Version A initial document.
- Version F evolution of the commissioning.
- Version G evolution of the document
- Version H administrative update
- Version I neutral wiring (diagram §5.2)
- Version J EFC Cummins connection.

**Documentation List:**

- A51Z390004 : UNIGEN-ILS Technical documentation.
- A51Z390101 : Application note: Replacement of a 'DYN2-80109' by a Unigen ILS.
- A51Z390102 : Application note: Replacement of a 'DYN2-80100' by a Unigen ILS.
- A51Z590107 : Application note: Setting of the load sharing gain with the additional RV6 potentiometer.



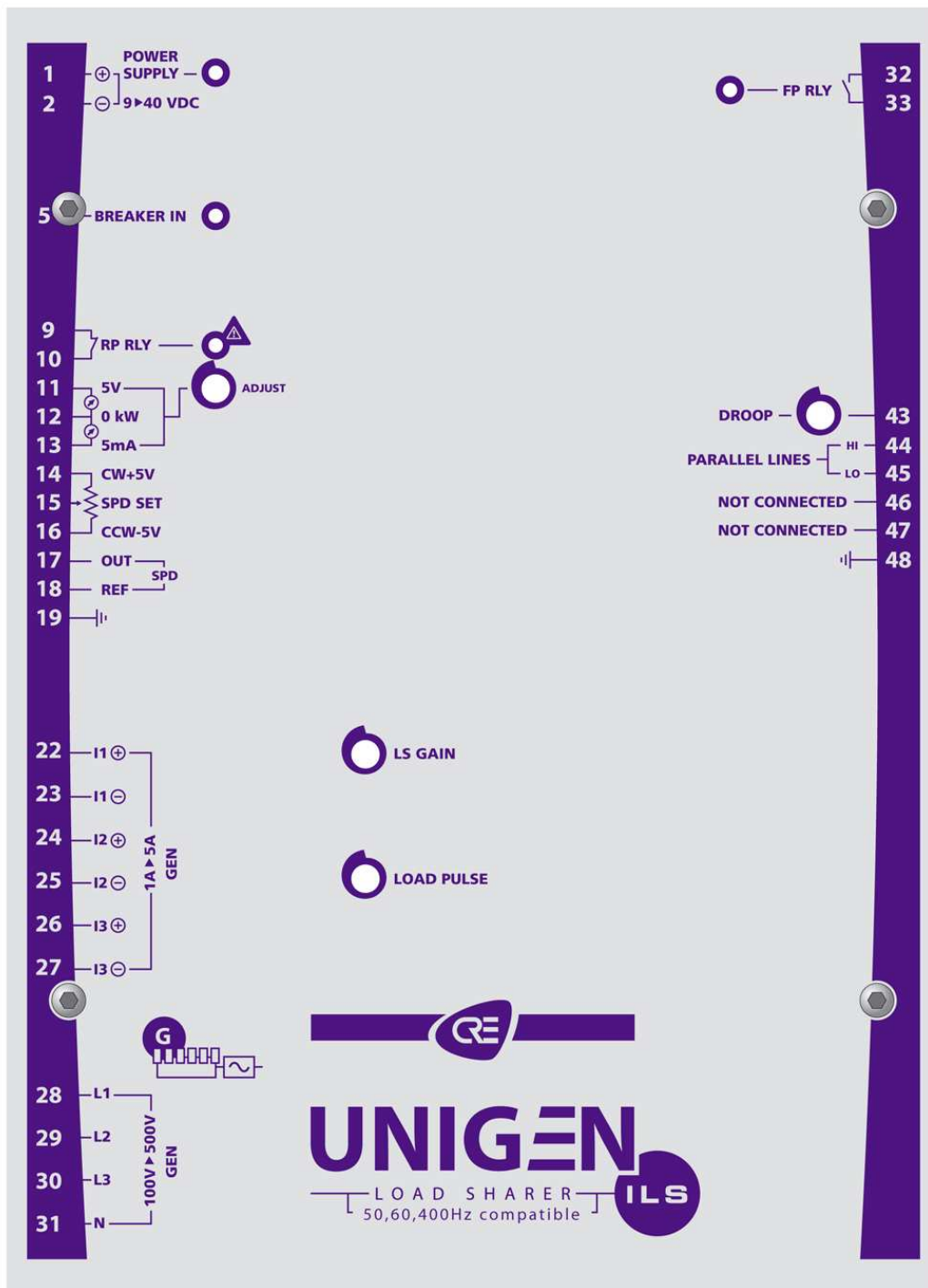
{ A51Z3 Unigen ILS 50Hz  
A51Z5 Unigen ILS 400Hz

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# 1. Overview

## 1.1. Cover



## 1.2. General overview

- Active load sharing in isochronous or DROOP mode.
- Compatibility with all speed governors on the market.
- Remote speed control by potentiometer.
- Reverse and forward power relays.
- 2 analogue outputs (0-5V or 0-5mA) for kW display.
- Load sharing with paralleling lines.
- Load pulse feature.
- Compatibility with 50Hz/60Hz and 400Hz generator.

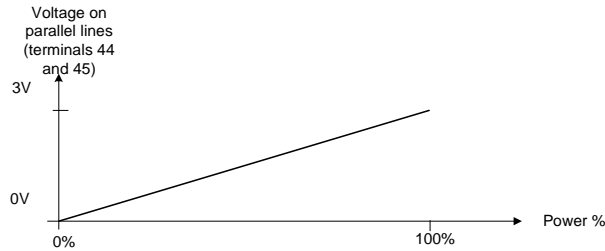
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## 2. Features

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### 2.1. Isochronous load sharing with paralleling lines.

When the UNIGEN-ILS is in **isochronous load sharing**, it compares the power with the level of paralleling lines and it generates an output signal to the speed governor to adjust its percentage power with the level of the paralleling lines.

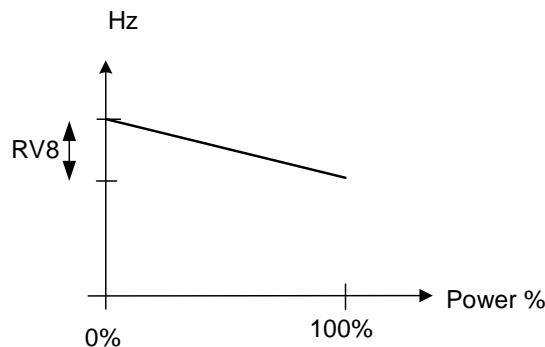


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### 2.2. DROOP load sharing

When terminals 43 and 45 are connected together, UNIGEN-ILS is in **droop mode**.

Power is managed with droop. Frequency droop is set by the droop potentiometer RV8; it is from 0 % (full CCW to 2.2 % (full CW). The recommended minimum position is 6 o'clock to have a droop about 1.2%.



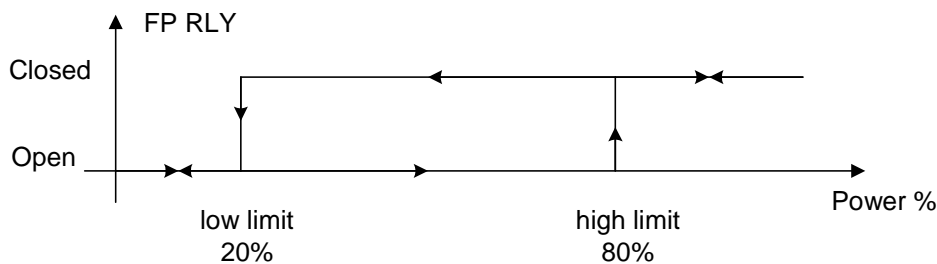
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### 2.3. Forward power relay

UNIGEN-ILS includes a forward power relay, terminals 32 and 33.

This relay output is normally open, it closes when the power is over a high limit and it opens when the power is under a low limit. Default settings are 80% for high limit and 20% for low limit.

FP RLY relay behaviour is described in the schematic below.



The green LED is ON to confirm the activation of the relay:

- LED ON = contact closed
- LED OFF = contact open

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### 2.4. Reverse power relay

UNIGEN-ILS includes a reverse power relays, terminal 9 & 10. This output is normally closed.

This relay output opens when the power of the generator is below -5% of the nominal power during more than 20 seconds.

The red LED is ON to confirm the activation of the relay, i.e. the opening of the contact.

- LED ON = contact open
- LED OFF = contact closed

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## 2.5. Power indicator

UNIGEN includes a Power monitor output on terminals 11, 12 and 13. Those outputs allow the display of the Power with a 0-5VDC or 0-5mA. Instrument scaled in kW. Multi-turn ADJUST potentiometer tune the output nominal Power to calibrate the instrument.

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## 2.6. Remote speed control input

- UNIGEN includes a remote speed control input on terminals 14, 15 and 16. Those 3 wires inputs (+5v, cursor, -5v) are design to accept 5 KOhms external potentiometers. The mid point of those potentiometers (5 turns for a 10 turns potentiometer) will generate a 0V signal to the cursor input and will not generate any speed deviation.

For 50/60Hz, the maximum speed deviation is + / - 3,00Hz:

- +5V applied on cursor input will increase the speed of + 3,00Hz
- 5V applied on cursor input will decrease the speed of -3,00Hz

This input can also be used as 0-5Vdc for a master PLC control. In this case the nominal speed have to be adjusted with 2.5 VDC applied on cursor input.

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## 2.7. Load pulse

In order to as well as possible help the genset to recover nominal frequency ASAP in case of load steps, UNIGEN-ILS includes a system of anticipation:

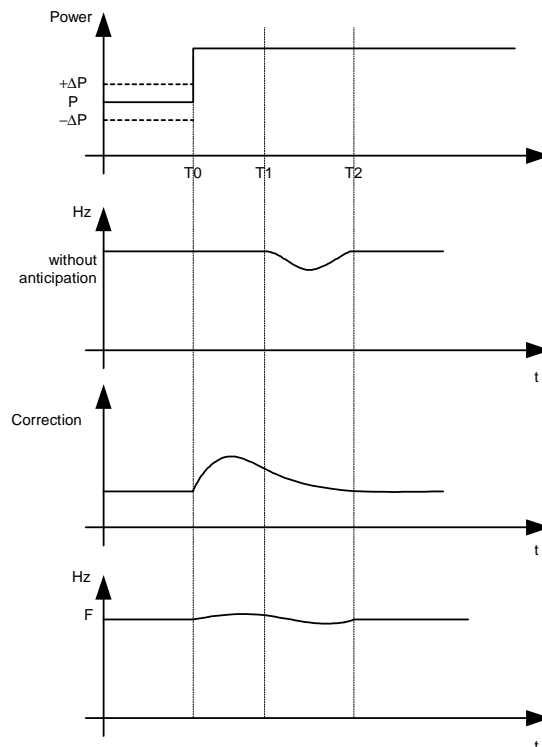
### **Active load pulse**

The load pulse functions on the effect of inertia of the engine. Indeed, at the time of an impact of load, speed or the voltage will not vary instantaneously, but with a light delay. The load pulse thus puts has profit this delay to ask an acceleration (if positive impact of power), a deceleration (if negative impact of power).

Operation is done in open loop and must thus be adapted to the entry of the installation.

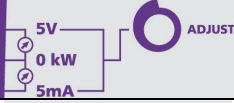



In order to guarantee the normal operation of the system, a minimum threshold of variation power makes it possible to start the system only when this is necessary.

For the active load pulse, adjust the potentiometer to optimize the response time.







### 3. Settings

UNIGEN-ILS includes the following adjustments for calibration and settings:

Setting	Picture	Default value	Description
<b>ADJUST KW monitor</b>		<b>None</b>	Multi turn potentiometer (0-100%). Output span adjustment Kw (0-5V or 0-5ma.).
<b>LS GAIN</b>		<b>CCW</b>	Have to be set during the commissioning. See chapter 6.2.
<b>Load pulse</b>		<b>CCW</b>	Have to be set during the commissioning. See chapter 6.2.
<b>Droop</b>		<b>CW</b>	Have to be set during the commissioning. See chapter 6.2.
<b>Offset speed out</b>	Under the cover RV9	<b>None</b>	Multi turn potentiometer (-10 to +10VDC). Adjustment of the offset of the speed output. Used to adjust the nominal frequency of the generator;
<b>Gain speed out</b>	Under the cover RV10	<b>CCW</b>	Single-turn potentiometer (Span from 0 to 10VDC). Span adjustment of the speed control output. Used to adjust the maximum deviation asked by UNIGEN.

### 4. Display

UNIGEN-ILS includes LED to have information feedback.

Led	Description	
<b>POWER SUPPLY</b>		Green LED. This LED is ON when DC power supply (12 or 24 VDC) is connected.
<b>FP RLY</b>		Green LED. This LED is ON when the relay FP RLY is activated (NO).
<b>BREAKER IN</b>		Green LED. This LED is ON when the breaker is closed.
<b>RP RLY</b>		Red LED. This LED is ON when the relay RP RLY is activated (NC).

## 5. Terminals

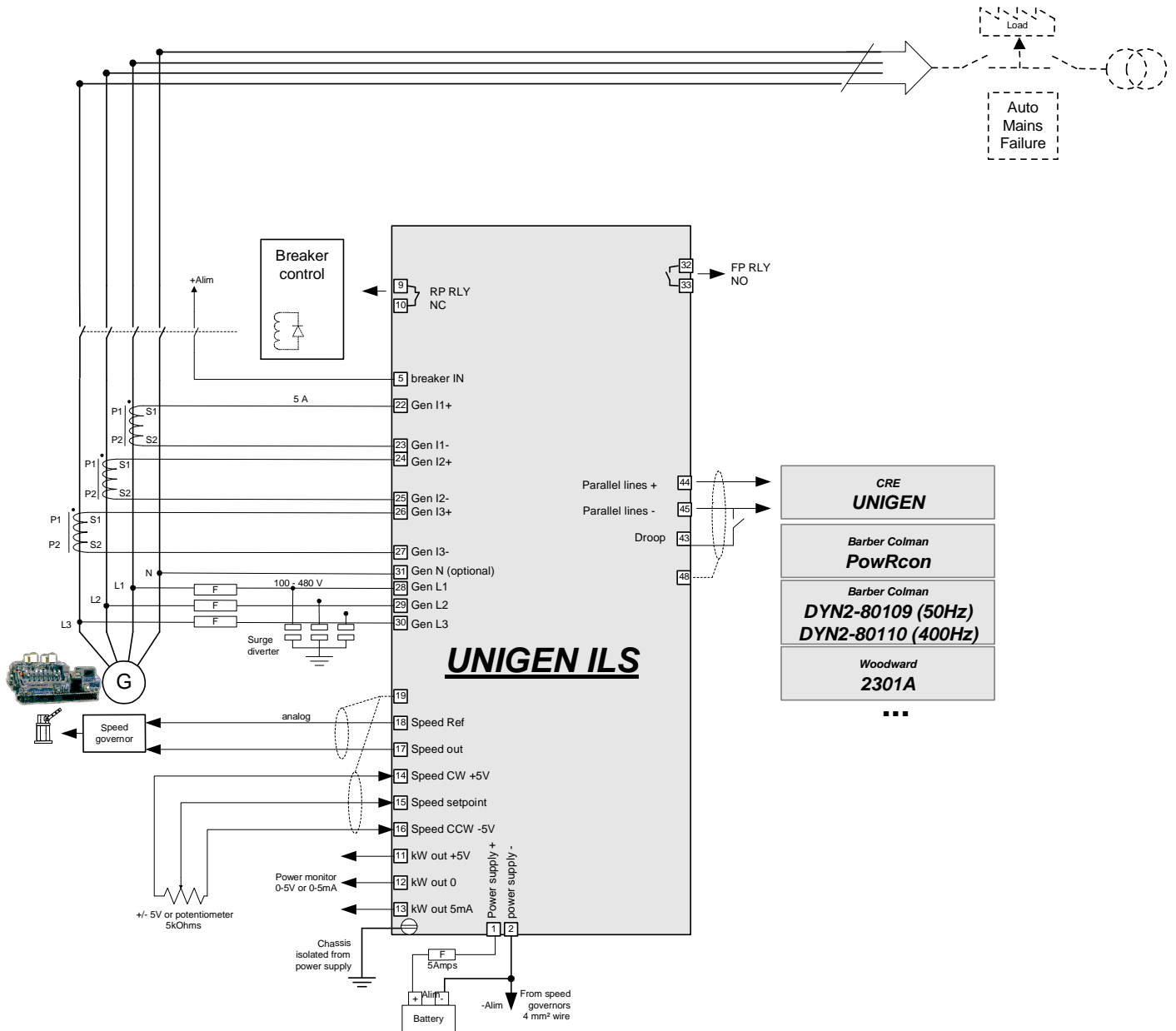
### 5.1. Terminals description

Terminal n°	Description	Wire (mm <sup>2</sup> / AWG)	Commentaries
1	POWER SUPPLY +	2.5 / 14	DC Voltage from 9 to 40 VDC, 10 Watt. Twist protection. Note: Terminal 2 MUST be connected to the 0v of the speed governors with a 4 mm <sup>2</sup> wire. Fuse: 5 Amps / 40 VDC.
2	POWER SUPPLY -	2.5 / 14	
5	BREAKER IN	1 / 18	No isolated digital input, Dry contact to +Alim (10 K/Ohms pull-up). This input gives the position of generator breaker to the UNIGEN. Use a direct Aux contact of the breaker.
6	Not connected		
9	RP RLY	1 / 18	Dry contact; normally closed. 250 VAC, 5A. The relay is opened when generator is in reverse power.
10	RP RLY	1 / 18	
11	Power monitor (0 – 5V) +	1.5 / 16	DC analogue output 0 – 5V (Terminals 11 and 12) Or 0 – 5mAmps (Terminals 12 and 13). This output (voltage and/or current) sends the actual value of the generator.
12	Power monitor (0V)	0.25 / 24	
13	Power monitor (0 – 5mA) +	0.25 / 24	
14	SPEED SET CW +5V	0.25 / 24	Analogue input 5 K/Ohms potentiometer or 0-5 VDC between 16 (-) and 15 (+). Use a shielded wire. This input allows a manual remote control of generator speed.
15	SPEED SET cursor	0.25 / 24 *	
16	SPEED SET CCW -5V	0.25 / 24 *	
17	Speed out control.	0.25 / 24 *	Analogue output +/-10 VDC. Use a shielded wire. This output controls the speed of generator. Offset and gain potentiometers, this output is compatible with all speed governors of the market.
18	Generator REF from speed governor speed control output	0.25 / 24 *	
19	Shield	0.25 / 24 *	Terminal to connect the shield of the analogue signals.
22	Generator I1+	2.5 / 14	AC current inputs from generator. Current: from 0 to 5 A. Max current: 15 A during 10s. Load: 1 VA. The nominal current of the secondary of the current transformers must be as close as possible to 5Amps.
23	Generator I1-	2.5 / 14	
24	Generator I2 +	2.5 / 14	
25	Generator I2 -	2.5 / 14	
26	Generator I3 +	2.5 / 14	
27	Generator I3 -	2.5 / 14	
28	Generator L1	1.5 / 16	AC voltage input measurement generator. Line to line voltage from 100 to 500 VAC . Frequency: 50, 60 Hz or 400Hz. Fuses: 100 mA. / 600 VAC. Note: If the neutral input is not connected, UNIGEN will generate an internal virtual neutral point.
29	Generator L2	1.5 / 16	
30	Generator L3	1.5 / 16	
31	Generator Neutral	1.5 / 16	
32	FP RLY	1 / 18	
33	FP RLY	1.5 / 16	FP RLY relay is opened when the power is below 20% of the nominal power. See chapter 2.1

<b>43</b>	DROOP	1.5 / 16	When Droop input is jumped to parallel lines low input (terminal 45), the isochronous load sharing changes to droop mode.
<b>44</b>	Parallel lines +	2.5 / 14*	0 to 3V. Load sharing and power set level. Compatibility with other UNIGEN and with analogue load sharing line. Compatibility with Wheaston bridge. Isolated.
<b>45</b>	Parallel lines -	2.5 / 14*	
<b>46</b>	Not connected		
<b>47</b>	Not connected		
<b>48</b>	Shield	0.25 / 24 *	Terminal to connect the shield of the analogue signals.
<b>COM1</b>	RS232 to PC or modem	Female DB9	CRE factory only

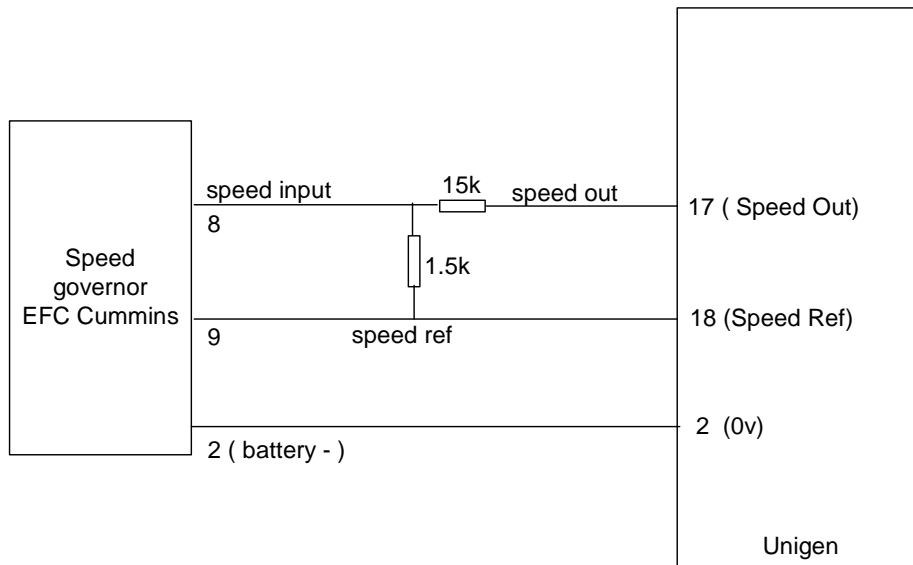
Note: \* Shielded cable is recommended for these connections. Use 2 or 3 Conductor Foil Shield with drain Wire.  
Note: Cable sizes are for guidance only. Cable size should be increased for long cable runs, to overcome possible voltage drop and to increase noise immunity.

## 5.2. Wiring diagram



### Connecting to Cummins EFC:

Due to the high sensitivity of the speed input of EFC, wiring must be done as shown below.



### 5.3. Connection specifications

- **Power supply:** 9 to 40 VDC, <1A with 12 VDC and <500mA with 24 VDC.
- **AC voltage inputs:** 100 to 500 VAC, 100mA max. The neutral wire can be connected or not.
- **AC currents inputs:** 0 to 5A, 1VA. Each input is isolated from the other ones.
- Possible over-current: 15A during 10s.
- **Frequency measurement:** 45 to 70 Hz, or 350Hz to 450Hz – 15 VAC minimum between neutral and line.
- **Digital inputs:** Normally Open, to be connected to 24v (internal pull up of 10 kOhms).
- **Relay outputs:** 5A, 230 VAC max.
- **Remote speed control input:** potentiometer (5 kOhms) or -5 +5VDC.
- Remote kW control input for 'Command mode': potentiometer (5 kOhms) or 0 +5VDC.
- **Kw monitor output (0-5 V or 0-5mA):** the maximum load impedance for the 0-5 mA is 1KOhms and the minimum load impedance for the 0-5 VDC is 1 KOhms.
- **Speed bias output:** The frequency control is made by the adjustable 0-10 VDC output. The adjustments are, Offset and Gain potentiometers.
- **Terminals:** with screws, 2.5 mm<sup>2</sup>.

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## **6. Commissioning**

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### **6.1. Caution**

#### **6.1.1. Grounding:**

The grounding of the chassis of UNIGEN must be done with the M5 screw. Use a 4mm<sup>2</sup> wire to connect to earth, this cable should be as short as possible.



#### **6.1.2. Wiring rules:**

The cables with high voltage (400 VAC) and/or high current (5A) must be separated from the DC cables. All the command and digital inputs / outputs should be in the same cable path.

If you have to cross the command/DC cables with the 400V/5A cables, it is recommended to cross with a right angle. The grounding must be done in a proper way to avoid personal injuries and for a reduction of EMC.

#### **6.1.3. Vibrations:**

In case of heavy vibrations, the UNIGEN should be mounted using AV Mounts.

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## 6.2. **Power plant start-up**

### **Caution: before starting the generating sets, please read the following part.**

This is a standard commissioning for a simple power plant. If you use only this procedure, it can't engage our responsibility.

### **Before commissioning (before going on site) : Check of schematics**

How?

- Be sure you have the latest power plant schematics.

Why?

- To be sure the wires will be present on site (shielded wires...).

What?

- 0 Volt wiring.
- Shields.
- Speed governor / UNIGEN Interface.
- Paralleled lines.

### **During commissioning : Start in safe condition**

How?

- Generator breaker output locked in open position.
- Disconnect the wires between UNIGEN (terminals 17/18) and the speed governor.
- Ask the technician who had wired the power plant to lock the generator breaker open.
- Battery negative of each UNIGEN power supply (terminal 2) must be connected to each other Unigen and to the 0V of the speed governor.
- Disconnect the wires of the relay 'SYNC OK' (terminals 34/35) of the Unigen.

Why?

- To be sure not to drive a false paralleling during the beginning of commissioning.

### **Interface UNIGEN / Speed governor**

How?

- Start the engine.
- Adjust the nominal speed, for example 50,00Hz (or 400.00Hz), on the speed regulator.
- Stop the engine.
- Remove the cover of the Unigen if necessary.
- Connect only the ref wire (terminal 18) to the speed governor "speed ref output".

- Speed setting :

- Start the engine.
- Adjust Speed gain RV10 full CCW on the UNIGEN.
- Measure the voltage between Ref and remote voltage input on speed regulator side.
- Adjust UNIGEN output voltage (terminals 17/18) adjusting the offset RV9 to have the same voltage than measurement of previous point.
- Connect the control wire (terminal 17).
- Stop the engine.
- Connect the external potentiometer of speed input and turn this one fully CCW (speed set point input, terminals 14/15/16).  
Note: Without potentiometer, connect a jumper between the cursor input (15 and 16) the CCW terminal.
- Star the generating set. The generator should run near the nominal frequency (ex:50Hz)
- Turn the Gain Speed (RV10 under the cover) potentiometer to reach 48Hz for 50Hz nominal or 376Hz for 400Hz nominal.
- Disconnect the external potentiometer (terminal 15).
- Adjust again the nominal frequency (50Hz or 400Hz) with the potentiometer of the offset speed (RV9).
- Put the cover back on the UNIGEN.

### **Check the control of the breaker on dead bus**

- Be sure there is no critical load connected on bus bar.
- Close the breaker and verify that the breaker feedback (terminal 5) is closed (the 'BREAKER IN' led should lit).
- Open the breaker and verify that the breaker feedback (terminal 5) is opened (led doesn't lit).

## Adjustment of the nominal power

- Paralleling lines are not connected on terminals 44 and 45.
- Close the circuit breaker of the generator. The 'BREAKER IN' led must light (terminal 5).
- Apply 100% of load on the generating set (with bench load for example).
- **Adjust** 'LS Gain' potentiometer RV13 to obtain 3V on parallel lines (terminal 44 & 45).
- Open the circuit breaker of the generator.

## Check wiring of current

- Put load.
- Measure the voltage between terminals 11 and 12.
- Shunt the phase 1 current directly of the secondary of the current transformer (CT).
- Measure the voltage between terminals 11 and 12. Check that this voltage decrease of 1/3 that before.
- Do the same test for phases 2 and 3 (don't forget to remove the shunt of each phase after test).

## Load sharing / kW regulation

- Regarding the application check the stability of KW and kVAR regulation.
- Stop engines.

## Droop test

- Disconnect parallel lines (terminals 44 and 45).
- Put a wire between droop and parallel lines - terminals (43 & 45).
- Close the circuit breaker of the generator. BREAKER IN LED must light on.
- Apply 100% of load to adjust the DROOP curve with the potentiometer of Droop RV8 (clockwise accentuates the droop curve).
- Open the breaker of the generator.
- Stop the generator.

## Load Pulse test

- Clockwise on 'load pulse' potentiometer (RV14) increases load pulse effect.

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## **7. Environment**

- **Operational temperature:** -20 to + 85°C.
- **Storage temperature:** -30 to +85°C.
- **Humidity:** 5 to 95%. The PCB is tropicalized to be used in humid climate areas. Protection IP20.
- **Altitude:** 2000m.
- **Size:** 275\*200\*26mm.
- **Mounting:** Can be placed in all positions.
- **Weight:** 1.5kg.
- Directive CE:
  - Generic emission standard: EN 50081-2, EN 50082-2.
  - Generic immunity standard: EN 61000-6-2.
  - Low voltage directive: 73/23EEC.

## 8. Dimensions

