UNIGEN *ILS*

"Load sharing module"

A51 Z3 9 0004 EN

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NOTE:

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Apply all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.
Motors, turbines and any other type of generator must be equipped with protections (overspeed, high temperature, low pressure… depending on the power plant).
Any changes of the normal use of the equipment can cause human and material damage.

For further information, please contact your CRE technology distributor or the After-Sales Service Team.

All CRE Technology products are delivered with one year warranty, and if necessary we will be happy to come on site for product commissioning or troubleshooting. The company also provide specific trainings on our products and softwares.

Technical support: +33 (0)4 92 38 86 86 (office hours: 8.30AM-12AM / 2PM-6PM GMT+1).
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INFORMATION

You can download the most up-to-date version of this documentation and different other documentations relating to CRE technology products on our Web site http://www.cretechnology.com

TECHNICAL DOCUMENTATION HISTORY

VERSION	DATE	MODIFICATION
H	November 2007	Administrative update
I	December 2008	Neutral wiring diagram update
J	May 2010	Connection to Cummins EFC speed governor
K	June 2012	Connection to Woodward EPG speed governor. Connection to Barber Colman Silverline synchronizer. Firmware v2.00: • Compatibility with CRE Config software.

TABLE 1 TECHNICAL DOCUMENTATION HISTORY

Documentations available on CRE technology Web site:

A51 Z3 9 0004: UNIGEN ILS Technical documentation.
A51 Z1 9 0015: TCP-IP connection under Windows XP.
A51 Z0 9 0246: TCP-IP connection under Windows 7.
A51 Z3 9 0101: Replacement of a Barber Colman DYN2-80109 by a UNIGEN ILS.
A51 Z3 9 0102: Replacement of a Barber Colman DYN2-80100 by a UNIGEN ILS.

NOTE:

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Apply all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

Contact your CRE technology distributor for course training.

CE
    A51Z3 UNIGEN *ILS* 50Hz
    A51Z5 UNIGEN *ILS* 400Hz

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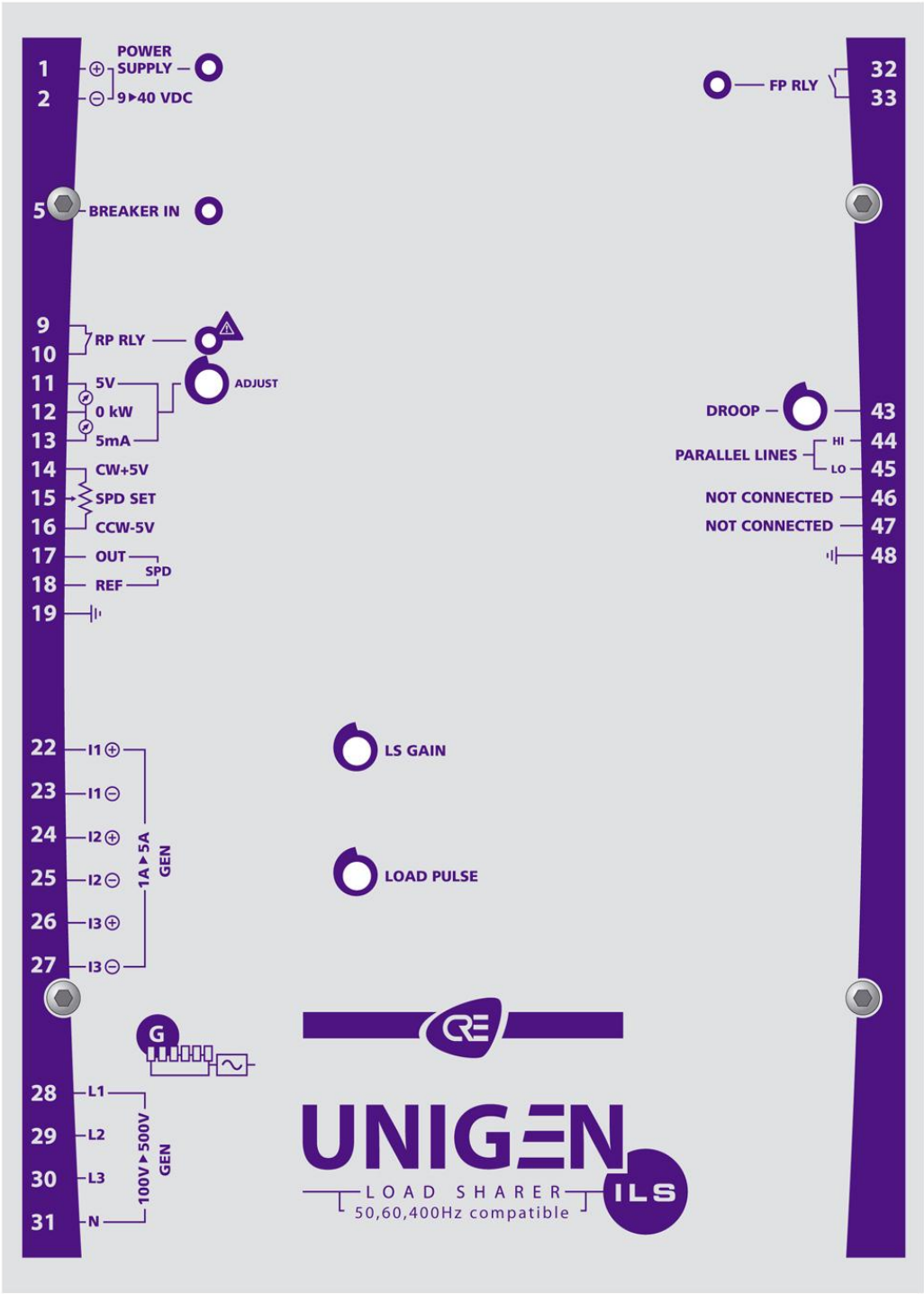Chapter : Overview

1 OVERVIEW

1.1 COVER

FIGURE 1: FRONT PANEL

1.2   GENERAL OVERVIEW

UNIGEN *ILS* main features are:
- 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.
- Analogue outputs (0-5V_{DC} or 0-5mA) for kW display.
- Load sharing with paralleling lines.
- Load pulse feature.
- Compatibility with 50Hz/60Hz and 400Hz generator.

1.3   CRE CONFIG SOFTWARE

Starting from firmware v2.00, UNIGEN *ILS* is compatible with PC software *CRE Config*. This software gives you the ability to communicate with your module using RS232 serial communication. Serial COM port is placed under the front cover of UNIGEN *ILS*.

UNIGEN *ILS* can be used without any computer, but you may want to use *CRE Config* software to set advanced parameters or display internal measurements such as generating set voltages, currents, power and so on.

For more information, please refer to the following documentation available on CRE technology Web site:
- A70 Z1 90003: *CRE Config* user manual.
- A51 Z1 9 0015: TCP-IP connection under Windows XP.
- A51 Z0 9 0246: TCP-IP connection under Windows 7.

2 FEATURES

2.1 ISOCHRONOUS LOAD SHARING WITH PARALLELING LINES.

When the UNIGEN *ILS* is in **isochronous load sharing**, kW set point is read from the parallel lines. Speed output is then adjusted so that the generator active load matches the set point. Voltage on the parallel lines represents the average kW of all connected generators working in isochronous load sharing mode.
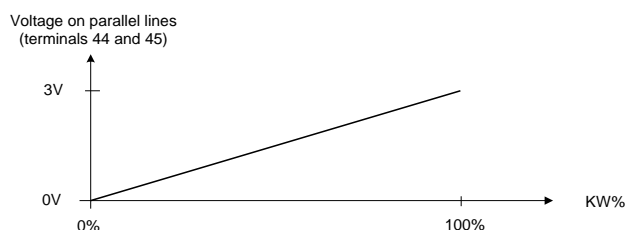

FIGURE 2: ISOCHRONOUS LOAD SHARING WITH PARALLELING LINES

2.2 DROOP LOAD SHARING

When terminals 43 and 45 are connected together, UNIGEN *ILS* switches into **DROOP** mode to share the load between generating sets.

Frequency droop is set using potentiometer RV8; it can be set from 0% (RV8 fully turned CCW) to 2.2 % (fully CW). Recommended minimum position is 6 o'clock to set approximately 1.2% of droop.

FIGURE 3: LOAD SHARING WITH DROOP

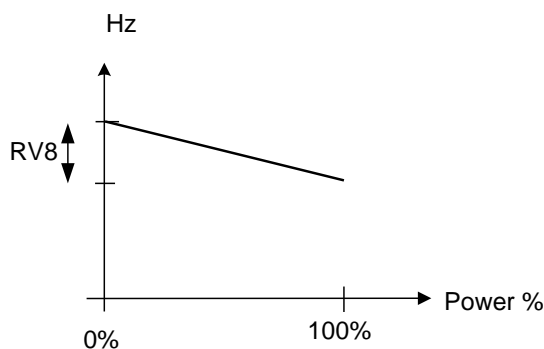## 2.3 FORWARD POWER RELAY

UNIGEN *ILS* includes a forward power relay between terminals 32 and 33. This relay output is normally open. It closes when the power is kept over a predefined high limit and opens again when the power decreases below a predefined low limit. Default settings are:

- 80% for high limit.
- 20% for low limit.

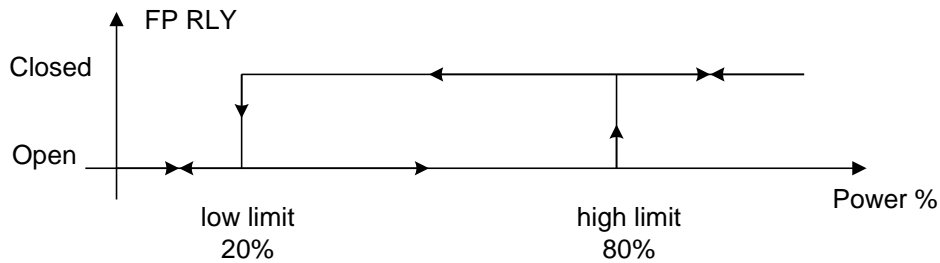**FP_RLY** relay behaviour is described in the schematic below.

FIGURE 4: FP RLY BEHAVIOUR

The green LED is switched ON to confirm the activation of the relay (closed contact).

Note:

Power levels mentioned above are factory settings. They can be adjusted via parameters E01220 and E01221 that can be accessed through page "Modification by variable number" on UNIGEN ILS embedded Web site or on CRE Config software.

2.4 REVERSE POWER RELAY

UNIGEN *ILS* includes a reverse power relay between terminals 9 and 10. This output is normally closed and switches to open position when the power of the generator is kept 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 is open.
- LED OFF = contact is closed.

2.5 POWER INDICATOR

UNIGEN *ILS* features power monitor outputs on terminals 11, 12 and 13. Those outputs allow the reading of the active power using either a 0…5V$_{DC}$ or 0…5mA display.

A multi-turn ADJUST potentiometer tunes up the output to calibrate it the connected instrument.

2.6 REMOTE SPEED CONTROL INPUT

UNIGEN *ILS* includes a remote speed control input on terminals 14, 15 and 16. These 3 wires (+5V, cursor, -5V) are designed to accept 5kΩ external potentiometers. The mid-point of those potentiometers (*i.e.* 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 depends on the speed output settings. If the recommended range of +/- 3,00Hz is applied, then:

- +5V on cursor input will increase the speed by + 3.00Hz.
- -5V on cursor input will decrease the speed by -3.00Hz.

This input can also be used as a 0…5V$_{DC}$ signal controlled by a master PLC. In this case the nominal speed of the engine must be adjusted with 2.5V$_{DC}$ applied on the cursor input.

2.6.1 CONNECTION WITH BARBER COLMAN SILVERLINE SYNCHRONIZER

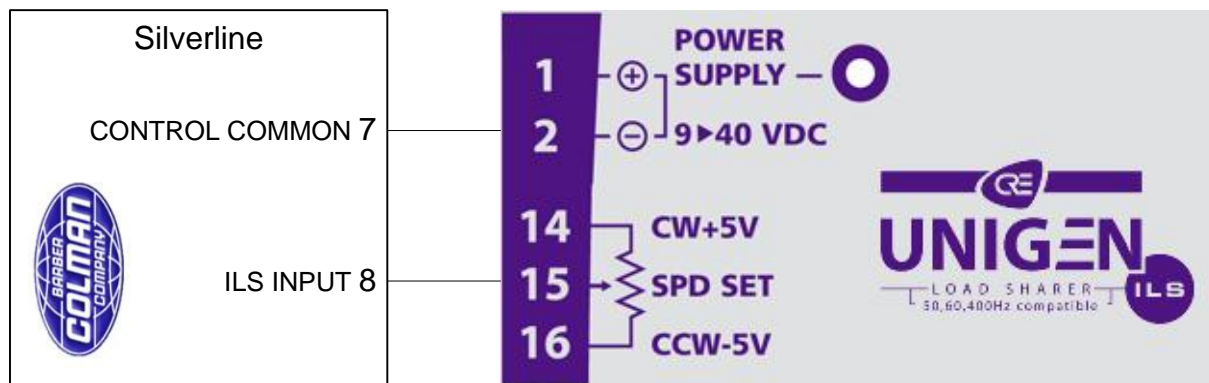Figure below shows the connection between a Silverline synchronizer and a UNIGEN ILS.

FIGURE 5: CONNECTING TO A BARBER COLMAN SILVERLINE SYNCHRONIZER

Note: Silverline module will automatically limit its speed control to +/-0.25Hz compared to the engine speed measured at the beginning of the synchronization process. This limit is imposed by the Silverline even if you have set up your UNIGEN ILS speed output with higher speed amplitude. This must be taken into consideration for example if you intend to use a high droop value in your installation.

2.7 LOAD PULSE

UNIGEN *ILS* includes a load anticipation system to prevent frequency drops when a load impact is applied to the generating set.

A load impact that is higher than the pre-set threshold will trigger a reaction from the load pulse system. The level of response can be adjusted using the **LOAD PULSE** potentiometer.
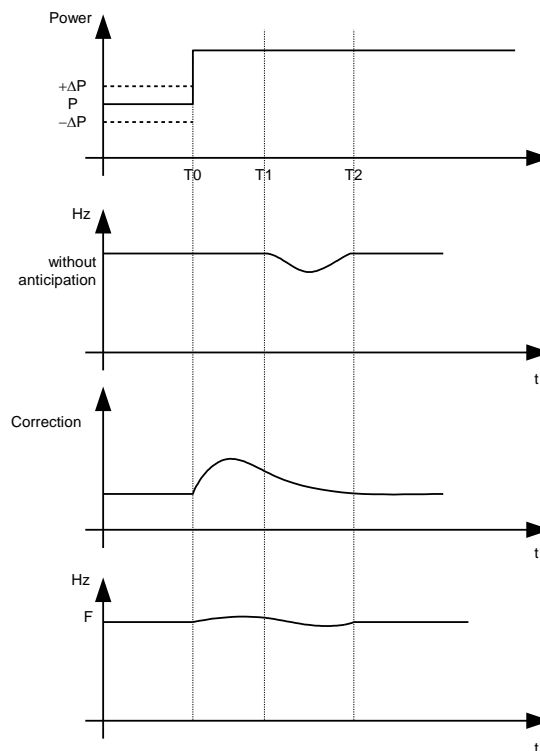

FIGURE 6: ACTIVE LOAD PULSE

3 SETTINGS

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

Setting	Potentiometer	Default value	Description
ADJUST kW monitor		**None**	Multi turn potentiometer (0-100%). Active power (kW) output span adjustment for both 0…5V and 0…5mA signals.
LS GAIN	LS GAIN	**CCW**	Refer to commissioning chapter.
Load pulse	LOAD PULSE	**CCW**	Refer to commissioning chapter.
Droop	DROOP —	**CW**	Refer to commissioning chapter.
Offset speed out	RV9 (Under the cover)	**None**	Offset of the speed control output (-10…+10V_{DC}). Refer to commissioning chapter.
Gain speed out	RV10 (Under the cover)	**CCW**	Span adjustment of the speed control output (From 0 to 10V_{DC}). Used to adjust the maximum speed deviation UNIGEN *ILS* can generate.

TABLE 2: POTENTIOMETER SETTINGS

4 DISPLAY

UNIGEN *ILS* features some LED to give feedback about its status.
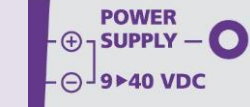
LED	Description
POWER SUPPLY ⊕ ⊖ 9▸40 VDC	Green LED lit when DC power supply (12 or 24V_{DC}) is connected.
FP RLY	Green LED lit when relay *FP_RLY* is activated (NO).
BREAKER IN	Green LED lit when the breaker is closed.
RP RLY ⚠	Red LED lit when relay RP RLY is activated (NC).

TABLE 3: STATUS LED

5 TERMINALS

Terminal	Name	Wire (mm² / AWG)	Description
1 2	POWER SUPPLY + POWER SUPPLY -	2.5 / 14	9 to 40 V_{DC} power supply, 10 W. Protected against reverse connection. Use with a 5A / 40V_{DC}.fuse. Note: terminal 2 must be tightly connected to the 0V of the speed governor.
5	BREAKER IN	1 / 18	Digital input. Connect to POWER SUPPLY+ when the generator breaker is closed. Use an auxiliary contact of the generator breaker.
6	Not connected		
9 10	RP RLY	1 / 18	Dry contact; normally closed. 250V_{AC}, 5A. Relay is open when generator is in reverse power conditions.
11 12 13	+Power monitor (0…5V) -Power monitor (Common 0V) +Power monitor (0…5mA)	1.5 / 16 0.25 / 24	0…5V_{DC} or 0…5mA analogue output proportional to the actual power of the generator.
14 15 16	SPEED SET CW +5V SPEED SET cursor SPEED SET CCW -5V	0.25 / 24	5kΩ potentiometer input or +/-5V_{DC} between terminal 2 (-) and 15 (+). Use a shielded wire. Remote control of the generator speed.
17 18	Generator OUT Generator REF (from speed governor)	0.25 / 24 *	+/-10 V_{DC} analogue output. Use a shielded wire. Engine speed control output compatible with most speed governors on the market. See dedicated commissioning chapter.
19	Shield	0.25 / 24 *	Terminal used to connect the shield of the analogue signals.

Terminal	Name	Wire (mm² / AWG)	Description
22	Generator I1+	2.5 / 14	AC current inputs from generator.
23	Generator I1-		0 to 5A inputs (1VA). Withstands up to 15A during 10s.
24	Generator I2 +		
25	Generator I2 -		Nominal current input must be as close as possible to 5A to ensure maximum measurement accuracy.
26	Generator I3 +		
27	Generator I3 -		
28	Generator L1	1.5 / 16	AC voltage measurement inputs from generator.
29	Generator L2		100 to 500 V_{AC} (Line to line), 50, 60 Hz or 400Hz.
30	Generator L3		Use 100 mA / 600 V_{AC} fuses.
31	Generator Neutral		Note: neutral connection is optional.
32 33	FP RLY	1.5 / 16	Dry contact: Normally open, 250 V_{AC}, 5A. FP RLY relay is closed when kW measure exceeds 80% of the nominal power. FP RLY is released when the power is below 20% of the nominal power.
43	DROOP	1.5 / 16	Switches load sharing into DROOP mode when this input is connected to PARALLEL LINES LO input (terminal 45).
44 45	Parallel lines + Parallel lines -	2.5 / 14*	0...3V_{DC} load sharing signal between UNIGEN modules, or active power set point when used with GCR module. Compatible with Wheatstone bridge load sharing signals.
46	Not connected		
47	Not connected		
48	Shield	0.25 / 24 *	Terminal used to connect the shield of the analogue signals.
COM1	RS232 to PC or modem	Female DB9	Communication with *CRE Config* software or internal Web site. Use a 9 wires straight cable.

TABLE 4: TERMINAL DESCRIPTION

Note:

* Use shielded cable for these connections. Use 2 or 3 Conductor Foil Shield with drain Wire.

* Cable sizes are for guidance only. Cable size should be increased for long cable runs, to overcome possible voltage drop and increase noise immunity.

6 WIRING DIAGRAM
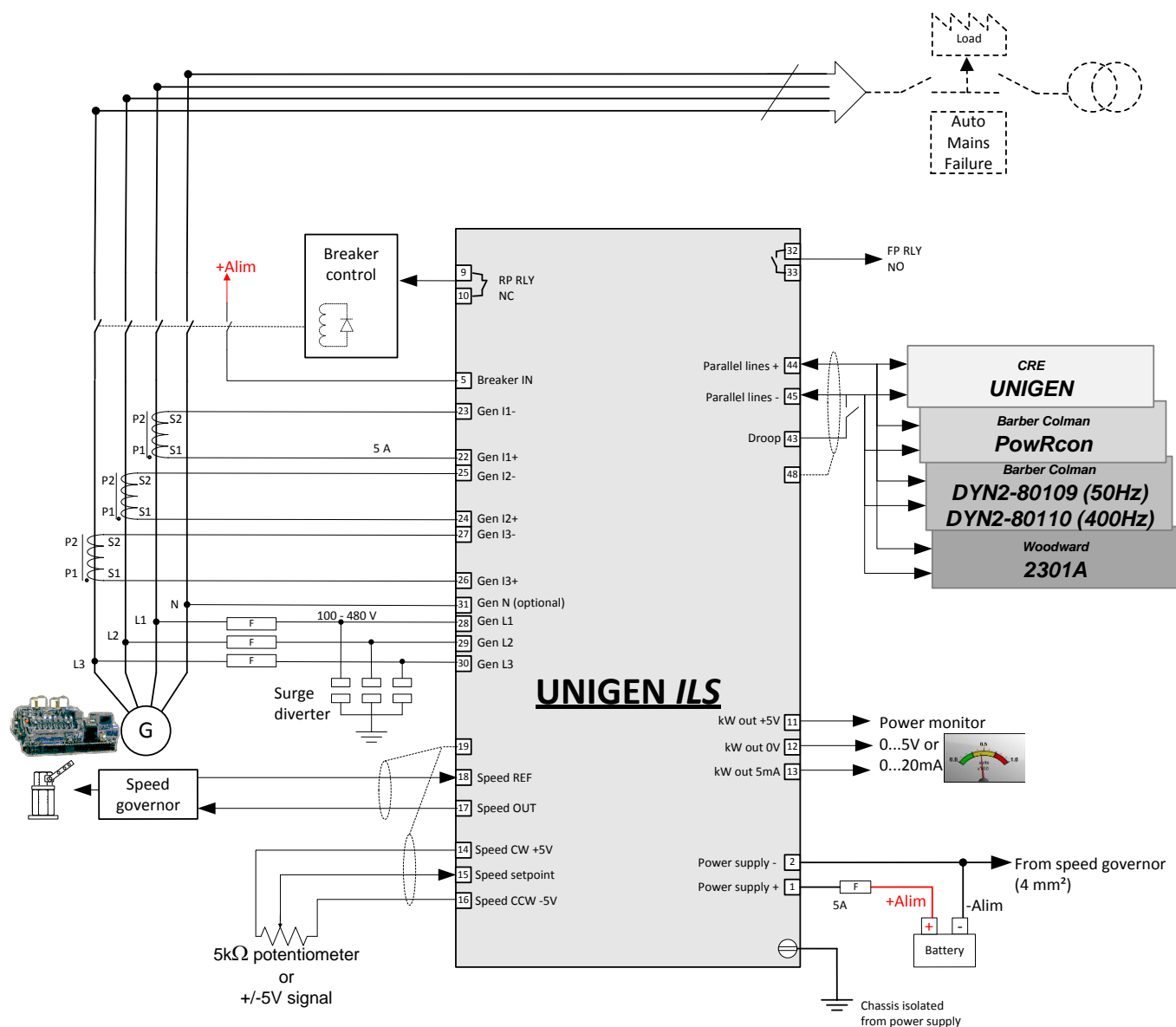
FIGURE 7: WIRING DIAGRAM

6.1 Connecting to a Cummins EFC speed governor:

Due to the high sensitivity of the speed input of EFC, wiring must be done as shown below. This allows a higher voltage span on UNIGEN ILS speed output.
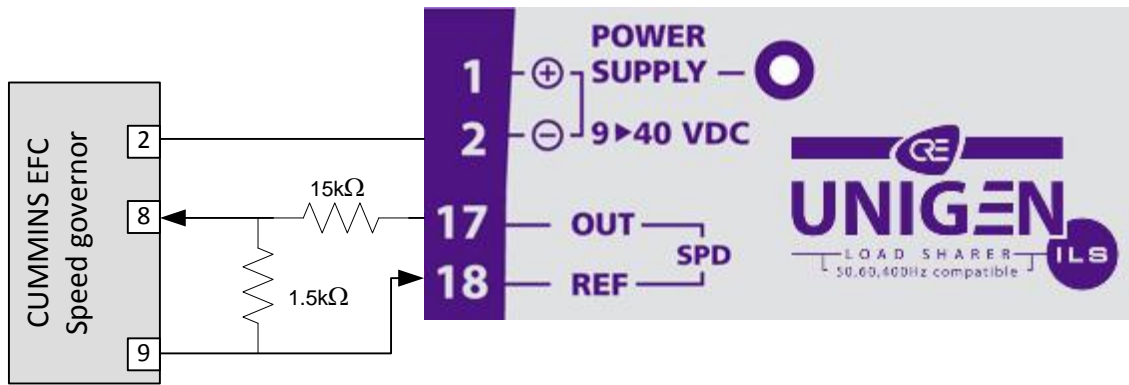
FIGURE 8: CONNECTION TO CUMMINS EFC SPEED GOVERNOR

6.1 CONNECTION TO A WOODWARD EPG SPEED REGULATOR

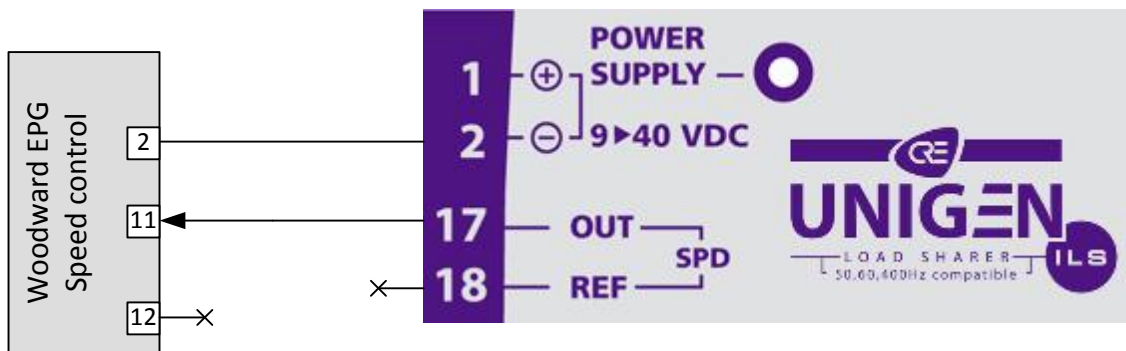Refer to dedicated commissioning chapter for potentiometers adjustment.

FIGURE 9: WOODWARD EPG CONNECTION

7 CONNECTION SPECIFICATIONS

Power supply: 9 to 40 V_{DC}, <10W.

AC voltage inputs: 100 to 500 V_{AC}, 100mA max. Neutral wire connection is optional.

AC currents inputs: 0 to 5A, 1VA. Inputs are isolated from each other. Withstands up to 15A during 10s.

Frequency measurement: 45 to 70 Hz, or 350Hz to 450Hz – 15 V_{AC} minimum between neutral and line.

Digital inputs: Normally Open, to be connected to POWER SUPPLY+.

Relay outputs: 5A, 230V_{AC} max.

Remote speed control input: 5kΩ potentiometer or +/-5V_{DC} signal.

kW monitor output (0…5V or 0…5mA): maximum load of 1 kΩ for the 0…5 mA signal and minimum load of 1 kΩ for the 0…5 V_{DC} signal.

Speed bias output: frequency control is made using this 0…10 V_{DC} adjustable output. Adjustments are made using OFFSET and GAIN potentiometers.

Terminal blocks: with screws, 2.5 mm^2.

8 COMMISSIONING

8.1 GROUNDING:

Grounding of the chassis of UNIGEN must be done using the M5 screw. Use a 4mm² wire to connect to earth, this cable should be kept as short as possible.
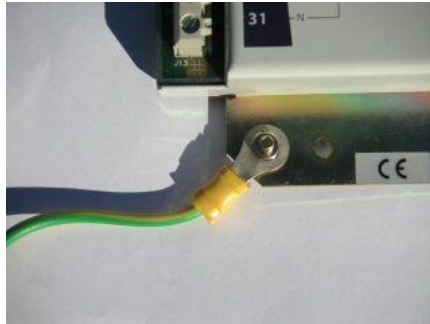
FIGURE 10: EARTH CONNECTION

8.2 WIRING RULES:

The cables with high voltage (400 V_{AC}) 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_{AC}/5A cables, it is recommended to cross with a right angle.

Grounding must be done in a proper way to avoid personal injuries and reduce EMI.

8.3 VIBRATIONS:

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

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 *ILS* (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 *ILS* power supply (terminal 2) must be connected to each other UNIGEN *ILS* and to the 0V of the speed governor.
- Disconnect the wires of the relay 'SYNC OK' (terminals 34/35) of the UNIGEN *ILS*.

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 *ILS* 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 *ILS*.
    - Measure the voltage between Ref and remote voltage input on speed regulator side.
    - Adjust UNIGEN *ILS* 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).

- 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 *ILS*.

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.

9 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:
- o Generic emission standard: EN 50081-2, EN 50082-2.
- o Generic immunity standard: EN 61000-6-2.
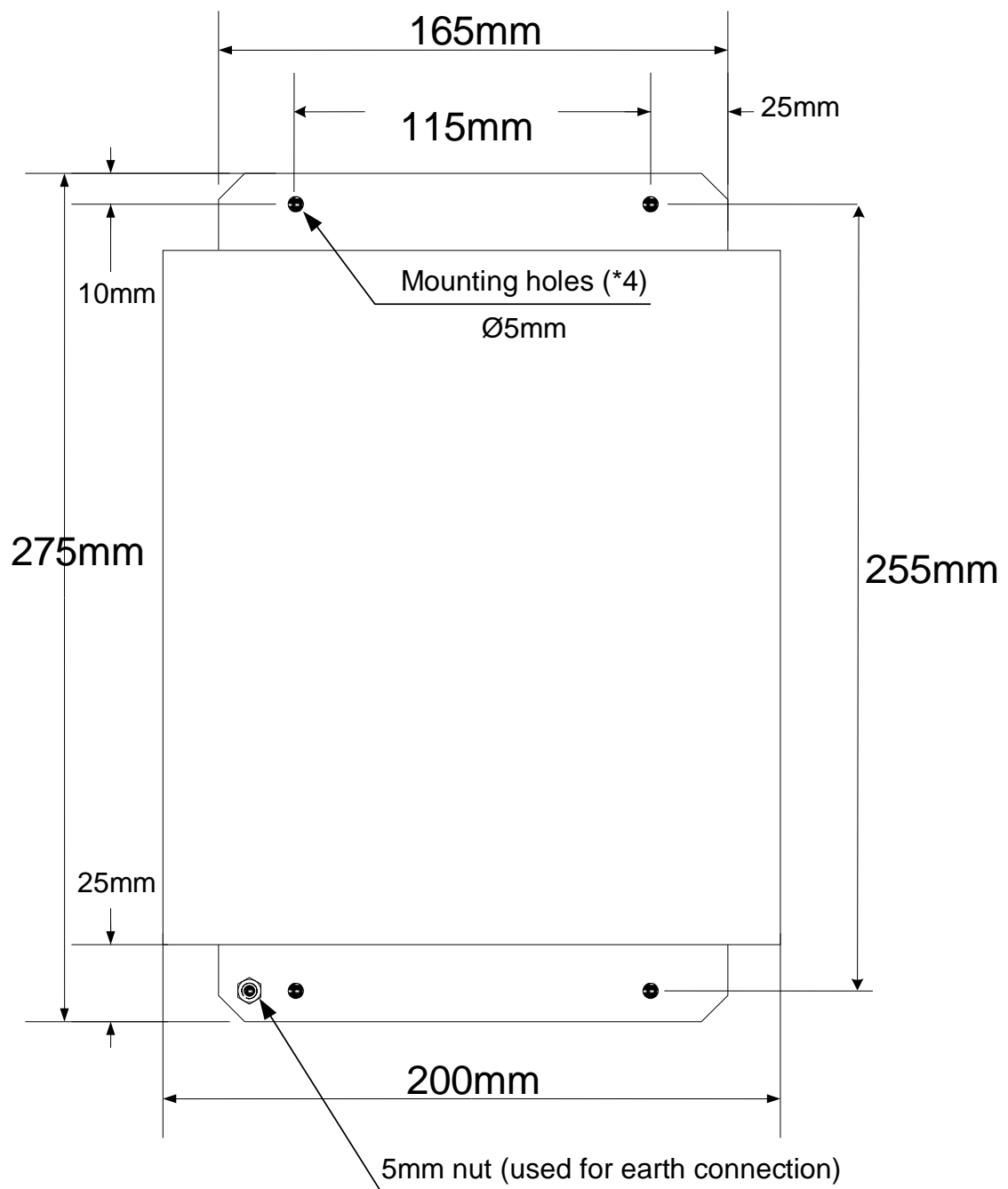- o Low voltage directive: 73/23EEC.

10 DIMENSIONS

FIGURE 11: DIMENSIONS

11 CRE TECHNOLOGY

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Email: support@cretechnology.com
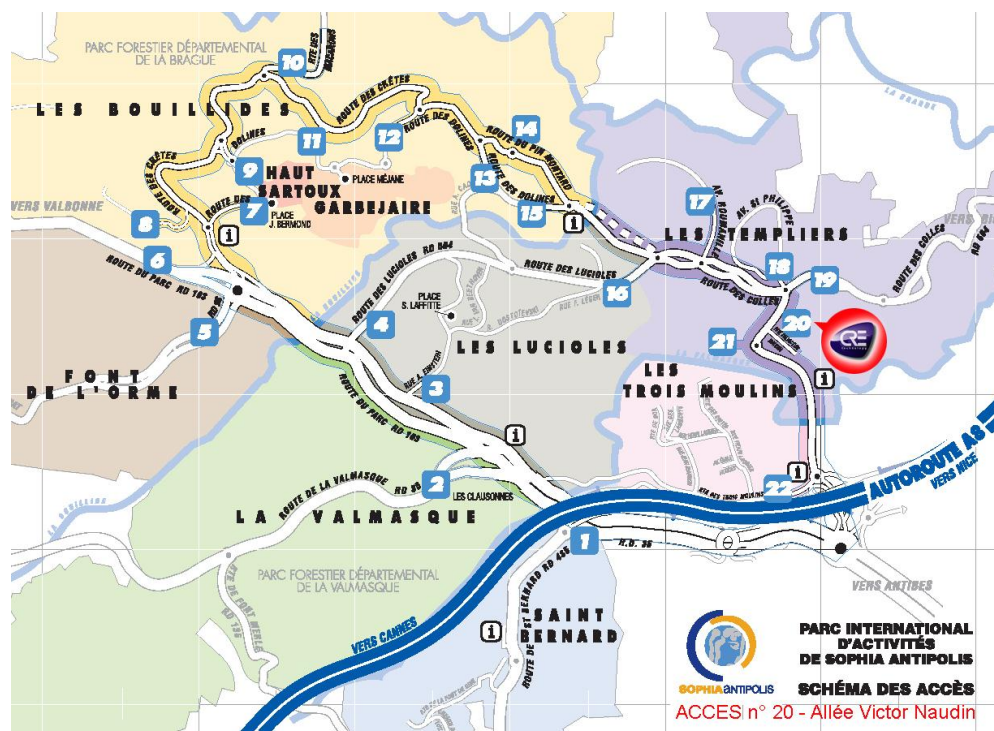
SKYPE: support-cretechnology.com

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Chapter : CRE TECHNOLOGY