



**ENGINE
GOVERNING
SYSTEMS**

PRODUCT
INFORMATION
BULLETIN

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PRC100A POWER RAMP CONTROL

DESCRIPTION

The function of the Governors America Corp. PRC100A Power Ramp Control is to regulate the power output of from one to ten generators operating in parallel with a main utility bus. The load control smoothly ramps to Load, Unload or Load Limit the output of the generators. It can also regulate the Import or Export of power to the main bus when it is supplied with an external power signal from the main bus.

The PRC100A controls the paralleled generators by signaling the common parallel cable connection of their load sharing modules. This allows the number of generator sets to be varied without altering the function of the power control.

INSTALLATION for LOADING and UNLOADING of GENERATORS

A typical load transfer application diagram, with a group of generators paralleled with the utility, is shown in Figure 1. When connected to the parallel cable (K1A closed), the PRC100A can command the generators to smoothly transfer their share of the building load back to the utility (Unload generator), or Load the generators up to the level set by the Power Control Bias Adjustment (PCBA) or the HIGH LOAD LIMIT Adjustment. The ramp time to accomplish this is adjustable from 1-5 seconds (based on 5 Amps in the CT equaling 100% Load and a maximum sensitivity setting in the Load Sharing module). The PRC100A is intended to be used with the utility during short periods of load transfer such as when:

1. The generators have been supplying the power to the building load, and the load is to be transferred back to the mains and the generators removed from service.

or,

2. The generators were not in service and they were started and paralleled to the utility. The load is then smoothly transferred (bumplessly) from the mains to the generator(s).

Condition 1a exists when the generators are supplying power, and removal from service to the mains or "Unloading" is requested. The output of the PRC100A Terminals D and E are directly connected to the parallel cable (+ to +) and (- to -), and a permanent connection between Terminals J and K is made. Switch from "Load" to "Unload" and the generators will ramp down in power to an unloaded condition. 24 V DC power to Terminals A and B is also required.

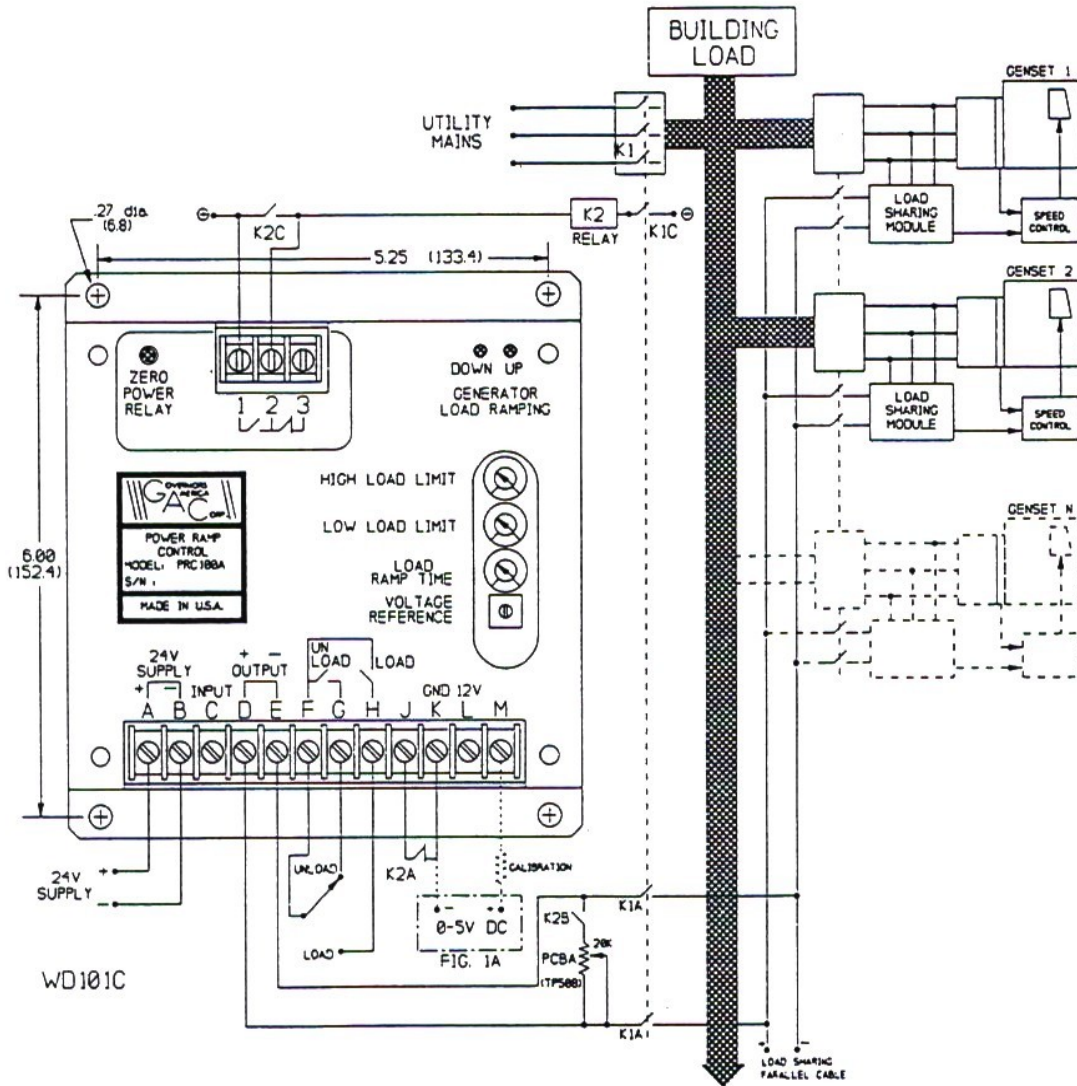
Condition 1b If the generators are to be "Unloaded" and then "Loaded" back up to a manually set power level, refer to Figure 1. The external relay K2 senses that the PRC100A is still in the "Loading" condition (zero power relay open, K1 closed). When switching to the "Unload" condition, the PRC100A takes control of the parallel cable and smoothly unloads the generators without disruption.

Once the generators have reached zero load, the zero power relay in the PRC100A closes (seals itself), adds the PCBA control (closes K2B) and opens the Terminal J to K connection (opens K2A). While the generators are connected to the mains, the PRC 100A and the PCBA will be in control of all the engine generators.

The functions the PRC100A will perform are: Unload the generators to zero power; Limit the generators maximum power; Allow manual control of the generators power output (with the PCBA) from maximum to minimum; and provide a ramping function between the extremes.

For condition 2 (generators stopped) the PRC100A should be placed in the "Unload" condition for at least 5 seconds before the K1 mains contactor is closed. Once the generator(s) is paralleled with the mains, the generator "Loading" can be initiated by the PRC100A. The functions that the PRC100A will perform are: Maximum Load Limiting; Unloading of the generators; or manual control of the generators power output, through the PCBA, at any point between the maximum load limit and zero power.

Figure 1



INSTALLATION for MAINS POWER CONTROL

When the amount of power Imported or Exported to the mains is to be controlled, the PRC100A can act as part of a mains power control loop. By adding an LSM672 load measuring unit at the mains, their contribution can be measured. The LSM672 will signal the PRC100A accordingly, which in turn will adjust the generator's power output.

Importing Power

Import limiting / control is achieved by connecting the equipment as shown in Figure 2 to form a power control loop with the mains. The LSM672, through its Terminal 15, will signal the PRC100A to unload the mains by causing the generators to increase their power contribution until the desired reference imported power setting of the PCBA is reached. Note, two possible PCBA configurations are shown to set the reference, a unipolar type, Figure 2A, and a bipolar dual ganged potentiometer type, Figure 2B.

If at any time the buildings load exceeds the HIGH LOAD LIMIT setting or the generators maximum output, the mains power contribution will increase accordingly to support the added load. The system will then be importing the additional power beyond the setting of the PCBA.

Exporting Power

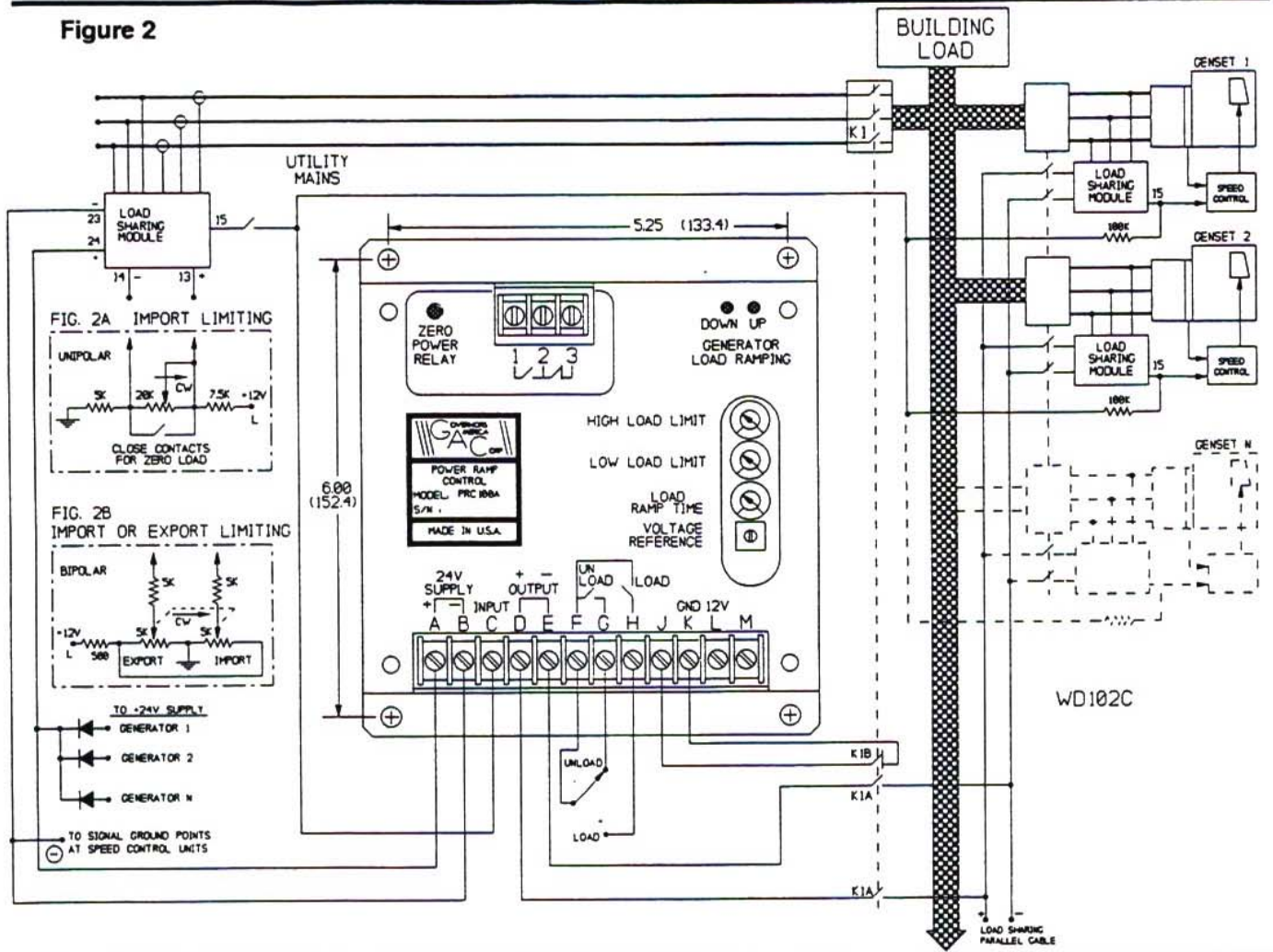
Export limiting is achieved by changing the connections of the LSM672 monitoring the mains. Reversing the CT phasing and using an LSM672-1 (see PIB4000), or using a dual ganged potentiometer as a bipolar import / export control (see Figure 2) allows export limiting.

Load Control Stability

To insure stable load control, external resistors should be added from Terminal C of the PRC100A to Terminal 15 of each LSM672 connected to the generators as shown in Figure 2.

Also of importance is the proper configuration of signal grounds. Since the power source to the PRC100A and the LSM672 sensing the mains is not associated with a specific generator, a diode power isolation circuit with a good common grounding circuit as shown is suggested.

Figure 2



PRC100A FEATURES

Indicators

Load Ramping direction is indicated by the two LEDs in the upper right hand corner of the unit. The red LED indicates that a ramping condition exists and that the generator is being "Unloaded". The green LED indicates that a ramping condition exists where the generator is being "Loaded". The red LED in the upper left hand corner of the unit and an internal relay contact indicate when the power output of the generators has reached zero (Zero Power Relay).

J-K Connection

It is helpful to understand the function of the Terminal J to K connection. When this connection is removed, two bias resistors are electronically added between the parallel cable and an internal power source. This allows the PRC100A to send a signal out to the parallel cable, and hence the generators, to develop more power. When there is a connection between Terminals J and K, the resistors are removed and the PRC100A cannot send a signal out to the parallel cable but can still reduce generator load and LOAD LIMIT.

Terminal L

Terminal L is a regulated 12 Volt DC supply capable of delivering approximately 25 ma of current to be used by external accessories. Its ground reference is Terminal K.

Programmable Power Control

The PRC100A has the ability to control the power output to the mains of a single engine or a group of engines in proportion to a linear analog voltage signal. If a 0-5 Volt signal is applied between Terminals M (+) and K (-) (see Figure 1A) it will control the engines power from 0-100%. For example, 1 Volt would represent 20%, and 2.5 Volts would represent 50%, etc.

Note: The sensitivity adjustment in the Load Sharing unit must be adjusted or a resistor must be added in series with Terminal M to obtain this exact calibration. A 10K ohm resistor will adjust the range to approximately 0-10V.

To use this feature, a simple jumper connection must be made on the circuit board.

1. Remove the four bottom screws and the two top cover screws holding the circuit board in its case. Remove the circuit board and expose the components.

2. Locate the two posts, E3 and E4, next to Terminals A and B. Solder a jumper connection between these two posts.

3. Reinstall the circuit board back into its case with the four bottom screws and the two top screws in the cover.

Note: The function of Terminal C for mains control cannot be used simultaneously with this programmed operation.

REFERENCE ADJUSTMENT

The PRC100A has its own internal VOLTAGE REFERENCE adjustment to allow the unit to closely match the references in the LSM672s. The procedure to equalize the references is to first check and / or adjust the references of each LSM672 and then to set the references in the PRC100A units. If this is not set properly, the "Unload" function may not go exactly to zero load on the generators.

LSM672 Reference Adjustment

1. Remove any AC voltage or current from the LSM672.
2. Apply 24V DC battery power to Terminals 23 (-) and 24 (+).
3. Measure the DC voltage between Terminals 13 (+) and 23 (-).
4. Adjust the internal reference adjustment of the LSM672 until the measured voltage is 5.10V DC.

PRC100A Reference Adjustment

Each unit is factory set for 5.0 volts.

1. With the PRC100A connected to a 24 Volt supply, temporarily connect a jumper between Terminals F and G and between Terminals J and K.
2. Measure the voltage between Terminals E and K.
3. Compare this with the average voltage between Terminals 13 and 23 on the LSM672 measured above.
4. Adjust the PRC100A VOLTAGE REFERENCE to match this voltage. The Zero Power Relay must be "ON".
5. Remove the temporary connections between Terminals F and G and between J and K and install the PRC100A following the wiring diagrams provided.

LOW LOAD LIMIT ADJUSTMENT

A LOW LOAD LIMIT adjustment is provided to control the minimum power output of the generators. It may be desired to limit the generators to a minimum power output so they do not run with very small levels of load. This method of control is normally used for applications where a mains control loop is used and the engines are not to operate at very low loads for sustained periods of time. A CW adjustment increases the minimum load setting.

HIGH LOAD LIMIT ADJUSTMENT

The HIGH LOAD LIMIT adjustment limits the parallel cables maximum voltage. Limiting this level holds the generators at a fixed maximum power level. CCW adjustment lowers the power of the generators.

SPECIFICATIONS

Ramp Time	1 to 40 ± 5 sec.
Supply Voltage.....	24V DC ± 20%
Temperature Range	-40° to 80°C
Humidity	0 to 95%
Vibration	1g, 10 - 100 Hz
Shock	10g

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