



**PELSUE®**

**ISO 9001**

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# **ELECTRIC GOVERNOR INSTALLATION MANUAL**

Model SA Actuator      or      Model SF Actuator

Used with a  
Model E-211 Controller

## **GENERAL**

The following information is intended as an aid to properly applying a Precision Governor Electric Governor. Since these governors are used on a wide range of engines in many different applications, much of the information is somewhat general in nature. If you need assistance concerning a specific detail on your application, please consult Precision Governors Application Engineering at 815/229-5300.

These instructions presume no electrical test equipment other than a multimeter for making the electrical measurements called for on the following pages. If no suitable meter is available, an inexpensive but adequate meter, part number 22-188 is available from any local Radio Shack store.

Many "governor problems" turn out to be installation problems, particularly in first-time applications. Careful attention to the directions provided will go far toward a successful installation made in the least amount of time.

## **QUICK-START INSTRUCTIONS**

If you are experienced in installing and adjusting Electric Governors, follow these steps. Otherwise, refer to the more detailed instructions which begin on Page 2, starting with "MOUNTING-ACTUATOR".

- 1) Mount Actuator rigidly to engine in a location which will permit a short, straight linkage to the carburetor or fuel valve. Avoid very hot areas.
- 2) Mount Controller in a dry, fairly cool location. Accessibility for adjusting is required.
- 3) Wire per appropriate included schematic, using #18 wire.
- 4) Set up fuel linkage. This is critical, so review the section titled "LINKAGE", Page 2.
- 5) Check wiring, turn on power. Actuator should kick once toward "fuel on", and then return immediately to "fuel off".
- 6) Hold linkage for safety, and start engine.
- 7) If E-211 was ordered with Engine Overspeed Protection option, set the overspeed trip speed using  $\alpha/s$  set pot. (See Figure on Page 9.) Turn CW to increase, CCW to decrease.
- 8) Adjust engine speed to desired value using Speed-set pot. (See figure on page 9.) Turn CW to increase, CCW to decrease speed.
- 9) Set Gain as required, using Gain pot. (See page 9.) CW increases sensitivity. Load and unload engine to check for proper gain. Also, pull back Governor arm slightly and release.

## MOUNTING-ACTUATOR

The Actuator may be mounted in any attitude— there is no preferred orientation. Construct a simple, rigid bracket to mount the unit to the engine. 1/4" steel plate is recommended for bracket material. Use braces as required to insure rigidity. There can be no relative motion between the Actuator and engine, even during extremes of vibration and engine loading.

Avoid mounting the Actuator adjacent to exhaust system parts and other hot components. Extremely high temperatures will reduce the muscle available from the Actuator, in addition to shortening its life cycle.

With no power applied, the Actuator is spring-loaded to the minimum fuel position. The Actuator output shaft rotates toward the maximum fuel position against this spring through electrical power from the Controller. This rotation is CW (clockwise) on one side of the Actuator, and CCW (counterclockwise) on the other. If necessary, reverse the Actuator on its mounting plate so that the desired direction of rotation is on the desired side to match the fuel system direction of travel.

Before selecting the mounting location, consider the linkage that will be required to connect the Actuator output arm to the butterfly or fuel valve. Read the following section on linkages before deciding on a mounting location!

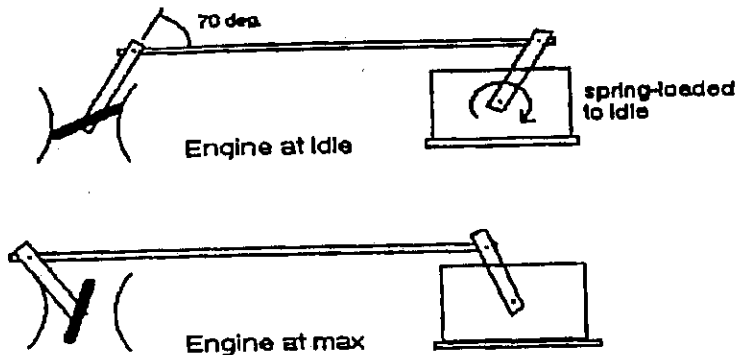
## LINKAGE

1/4" -28 threaded rod and low friction rod-end bearings are recommended for linkage materials.

Keep the linkage as short and as straight as possible. "Dog leg" linkages seldom work as desired, and generally are to be avoided.

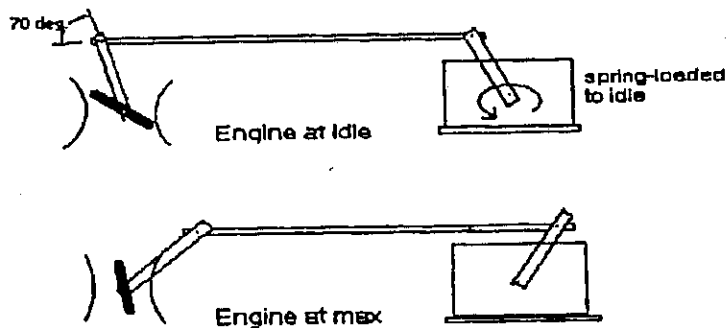
The linkage **must not** rub against the engine, brackets, hoses, etc. The linkage **must** be free of friction and lost motion or "slop". The following sketch indicates the proper linkage geometry for most installations.

1)

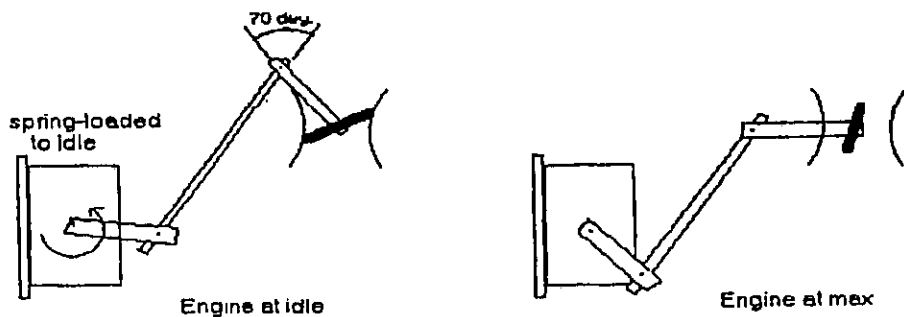


Note that the angle between the carburetor arm and the rod is **70 degrees** with the engine at idle. This is **highly desirable!** Note also that the Actuator arm travels equally on either side of a 90 deg. angle with the rod. This angular arrangement will give the proper mechanical gain for good stability and performance. It may be necessary to rotate the carburetor arm relative to the butterfly to achieve this. This can usually be done, and is usually worth the effort! Below are some workable installations, with good linkages. Remember, the Actuator can be turned 180 deg. on its mounting to "reverse" the spring-loaded direction. Also, the Actuator can be mounted in any attitude.

1)



2)



4

The needed travel of the carburetor determines how far out on the Actuator arm the rod is to be attached. In most cases, the carb should be moved from closed to about 10 degrees from full open as the actuator is moved from min to max. THEN ALTER THE LENGTH OF THE ROD SLIGHTLY (PERHAPS .030"), SO THAT THE ACTUATOR IS JUST OFF ITS INTERNAL STOP, AND IS PULLING THE BUTTERFLY AGAINST ITS STOP. This insures that the carb can fully close to idle on load dumps, minimizing overspeeds.

Examine the system for springs, such as carb return springs. These should be removed. Some automotive carbs (as opposed to industrial carbs) contain internal springs for accelerator pumps, etc. These may make good governing difficult, or even impossible. For this, and other reasons, industrial carbs are much to be preferred.

Move the linkage slowly through its travel, and look for any binding or unexplained forces. Correct any before going further.

Many "governing" problems are really caused by binding of the butterfly and its shaft in the carb. This is caused by loading due to vacuum under the butterfly and atmospheric pressure above when the engine is running. These forces cannot be felt when the engine is not running. Therefore, start the engine while carefully controlling the speed by hand, and feel for binding or airload forces. Needle bearings on the butterfly shaft are available on many industrial carbs to deal with this problem. Any tendency of the butterfly to stick must be corrected.

## MOUNTING-CONTROLLER

The Controller is water and weather resistant when filleted with RTV by the user. However, attention to the following points will enhance its performance and reliability;

Select a reasonably cool, dry, and vibration free location.

The rear cover will probably need to be removed during set-up in order to make adjustments for speed-setting and gain. You may wish to defer final installation until this is done.

After completing these adjustments, replace cover, and seal with a finger-fillet of RTV. Mount so that water cannot pool on this cover. Mounting with this cover out of sight discourages "fiddling".

## WIRING

See wiring diagrams for details of hook-up.

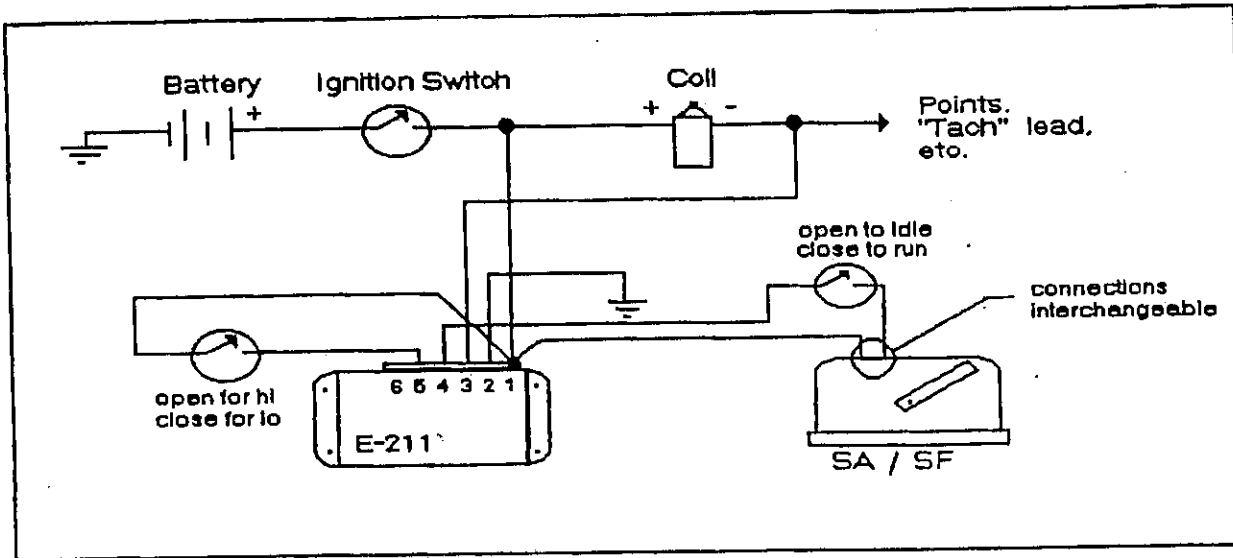
Use #18 wire minimum, #16 is preferred.

If Governor is to be switched through the ignition switch, run power to the Governor directly via a dedicated #16 wire. Check that the wiring from the switch to the battery is at least #14 gage.

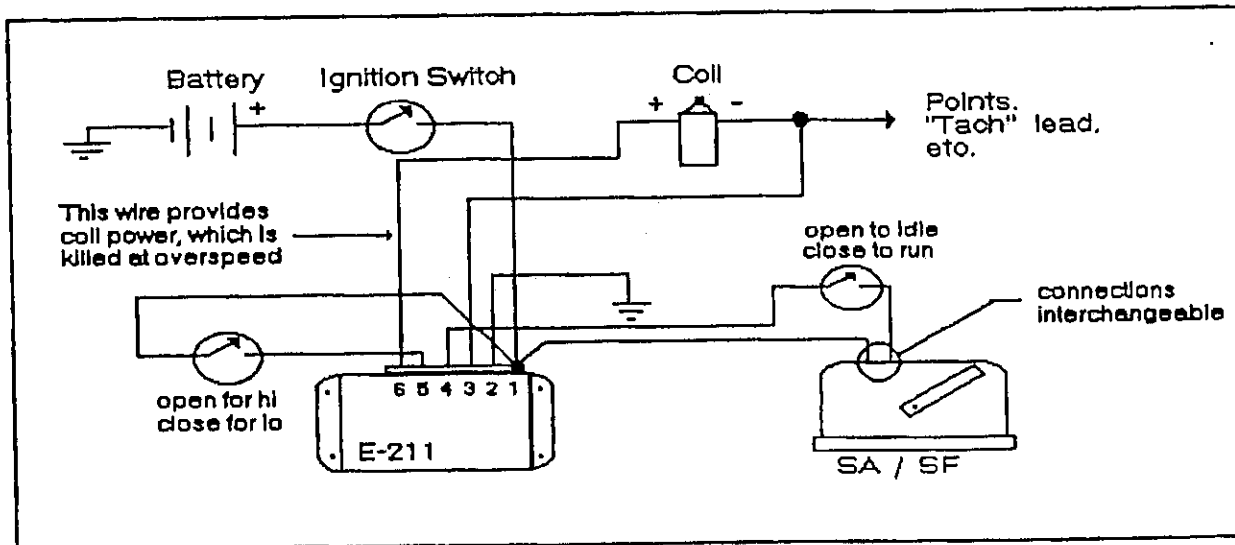
Keep all wiring to the Governor as short as is practical.

Go directly from the Controller ground terminal (# 2) by dedicated wire, to the battery "minus" terminal. If this cannot be done, for some reason, go by dedicated wire to a very good engine ground.

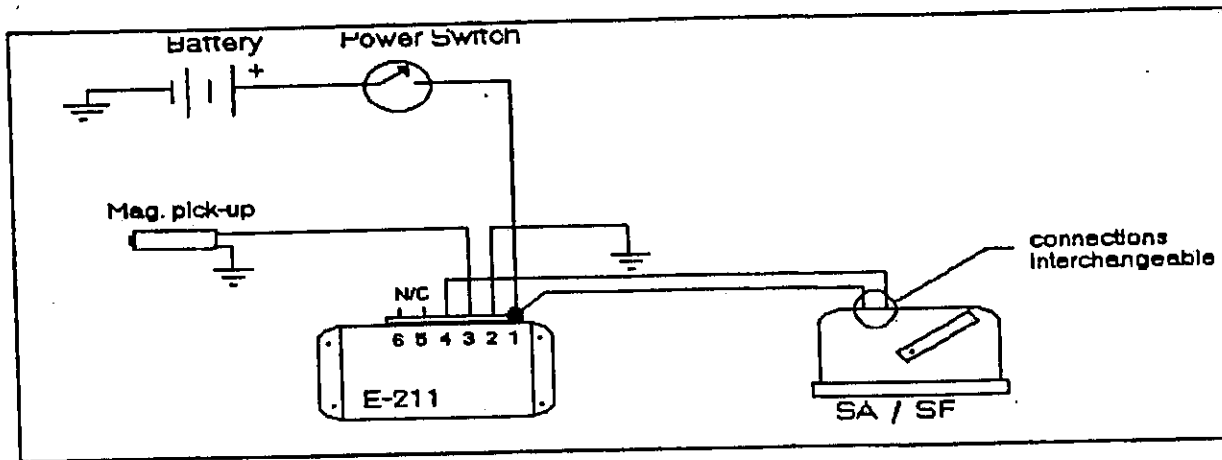
### WIRING DIAGRAM—SPARK-IGNITED ENGINES (WITH RUN / IDLE SWITCH AND REMOTE TWO SPEED SET OPTION)



### WIRING DIAGRAM—SPARK-IGNITED ENGINES (WITH RUN / IDLE SWITCH AND REMOTE TWO SPEED SET OPTION, AND OVERSPEED PROTECTION)



## WIRING DIAGRAM—DIESEL ENGINES (BASIC SYSTEM SHOWN AS TYPICAL)



Add options as desired

## CHECK-OUT & INITIAL START-UP PROCEDURES

Assuming that the Actuator and Controller are mounted, the wiring is run and checked, and that the linkage is properly installed, proceed as follows:

1) Turn ignition switch **on**. Do not start engine. Actuator should kick toward max fuel once, and then immediately return to min fuel. If not, see Troubleshooting, page 9.

2) Use Multimeter to check battery voltage at battery terminals, and record. Now check voltage between terminals 1 & 2 on the E-211 (#1 is +, #2 is -). Voltage reading should be the same as at battery. If not, shut down, and correct wiring. If polarity has been reversed, the E-211 has probably been **seriously damaged**.

3) Before proceeding, familiarize yourself with the location of the **Speed Set** pot and the **Gain** pot. (See page 9.) Read the section on **Adjustments**, page 8.

4) Set Overspeed, if incorporated. Start engine, holding linkage. Slowly advance throttle by hand until either the desired O/S speed is reached, or the O/S function kills the engine. If the O/S kills the engine below the desired trip speed, turn O/S speed set pot CW to raise trip point, and try again. Otherwisw, adjust CCW to reduce trip speed.

5) Hold the linkage back by hand, so as to control engine speed manually. Start engine, gradually release the linkage, and adjust the speed-set as needed to set the speed as desired. If engine speed surges, reduce Gain a little, as required.

6) Re-check voltage between terminals 1 & 2 on the E-211. Voltage reading should be between 13.5–14.6 VDC. If less, look for undersized wiring somewhere in the system, or for other components wired in parallel with the Governor.

7) Carefully adjust Gain. You are looking for the best compromise between quick response and good stability. Make very small adjustments, then load and unload engine, or pull linkage back slightly and release. Usually, a good set-up is one that makes 1 to 3 small bounces and then steadies down after a large load change. Too much Gain shows up as a rapid (once per second) instability, most commonly at light loads. Too little Gain shows up in large over-shoots on start-up or large load changes, and generally sluggish operation.

8) Make final adjustment to the Speed-set.

9) Re-install back cover on the E-211. Add a finger fillet of RTV around the edge of this cover to seal against dirt and moisture. Final-mount the E-211 Controller.

## **GOVERNOR ADJUSTMENTS (E-211).**

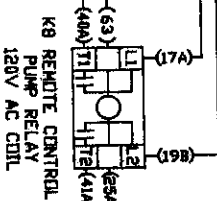
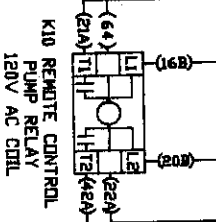
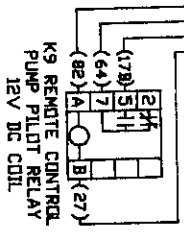
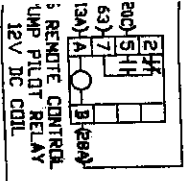
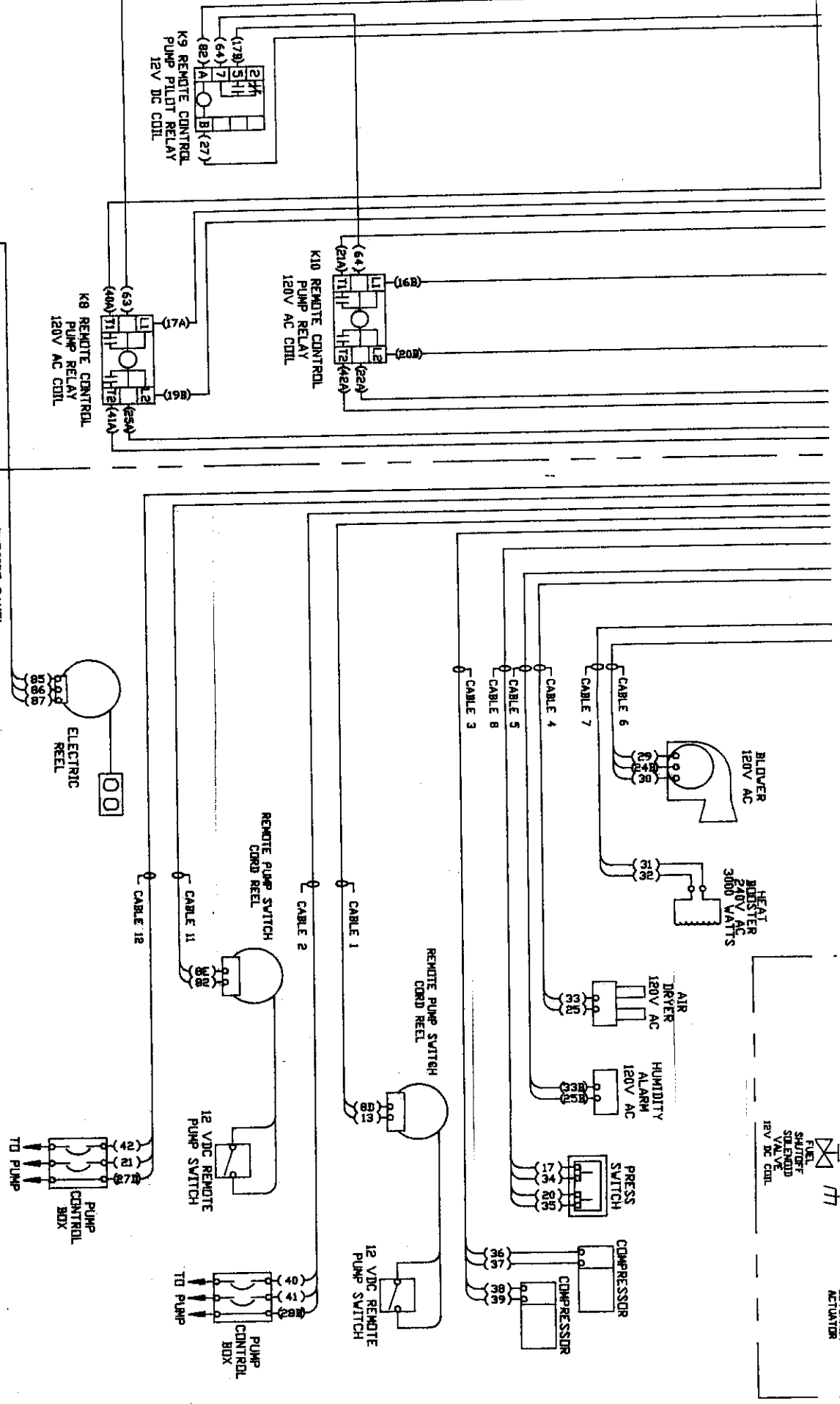
### **MULTI-TURN ADJUSTMENT (SPEED-SET, OVERSPEED SET)**

This adjustment is made by turning the 1/8" brass screw clockwise (CW) to increase speed, and counterclockwise (CCW) to decrease speed. The adjustment range of the pot is 25 full turns, and one full turn will change speed about 100-200 rpm. This pot is protected by a slip clutch at each end, and will not be harmed by moderate over-adjustment. However, the Governor will not function while the pot is past full travel.

If you suspect you may have over-adjusted the Speed-set pot, or have lost track of where you are, turn the pot 25-30 turns CCW, then back 10-12 turns CW to get back into the range of normal adjustment.

### **SINGLE-TURN ADJUSTMENT (GAIN, LOW SPEED SET, FACTORY ADJUST)**

This pot is 3/8" square and has a 1/8" plastic screw in its center. **Be gentle!** This pot turns 270°, and over-turning will break the internal stops, making adjustment impossible. Turning the Gain pot CW increases Governor sensitivity, while turning CCW decreases sensitivity. On most applications, best operation is achieved with the Gain pot set at 1/3 turn CW  $\pm$  60°.



REV. NO.	DATE	BY	DESCRIPTION
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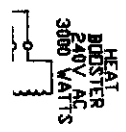
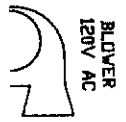
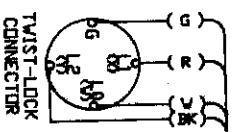
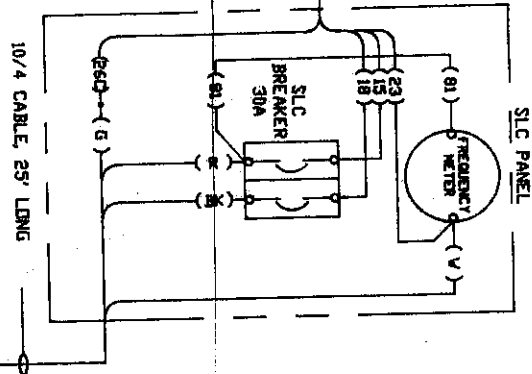
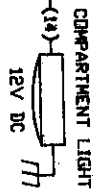
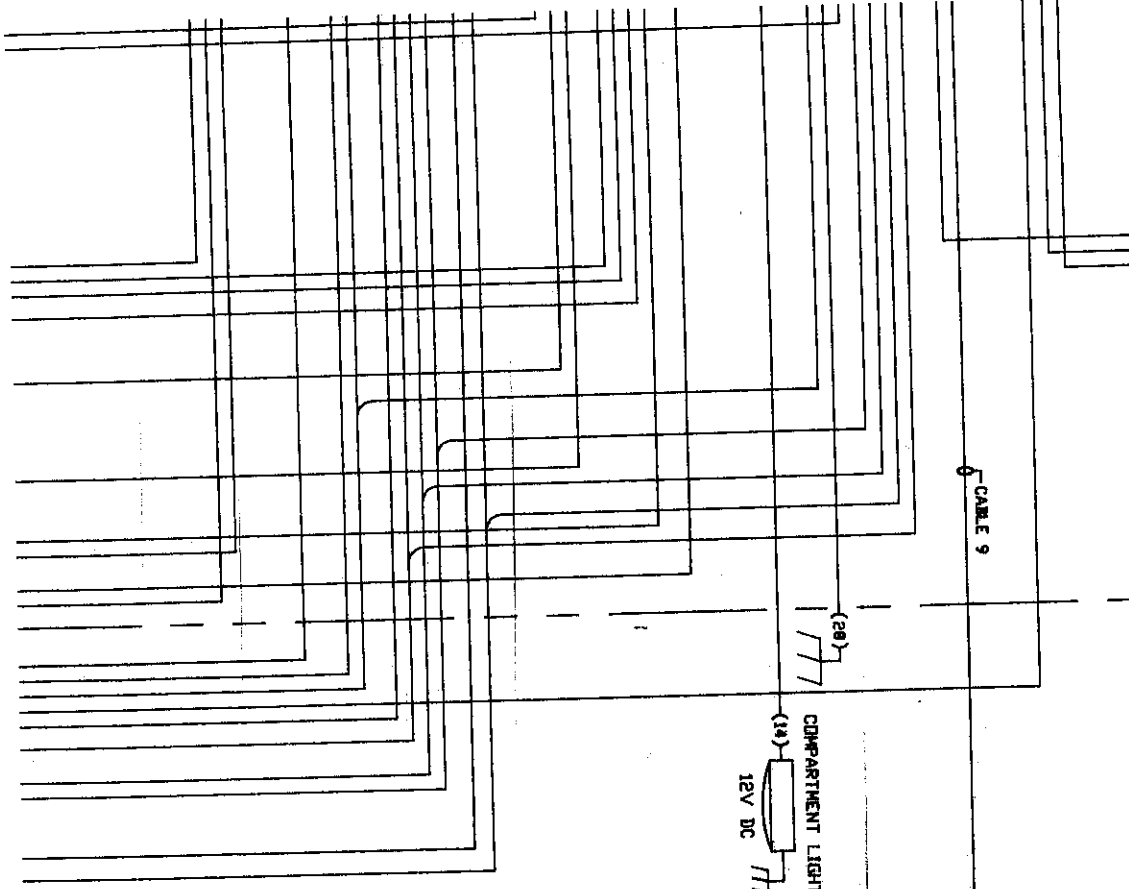
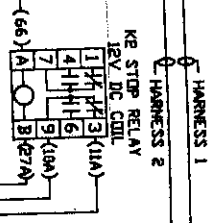
DRAWN BY:	KAL
CHECKED BY:	
APPROVED BY:	
DATE:	9-12-90
SCALE:	NONE
REF:	T-12-21
	SOUTH WESTERN BELL

TITLE  
 WIRING DIAGRAM  
 METRO VI, 10 KW  
 ELECTRONIC GOVERNOR  
 BATTERY SAVER CIRCUIT

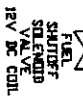
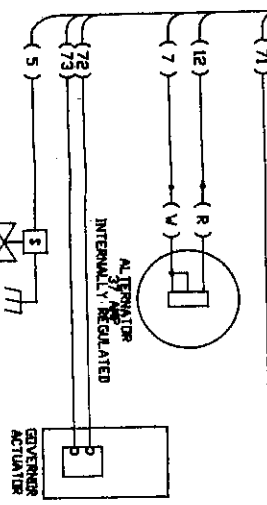
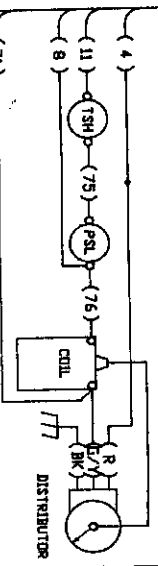
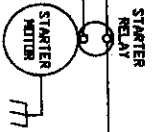
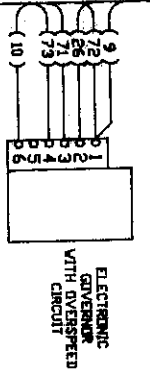
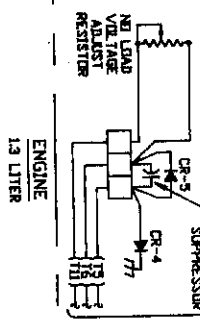
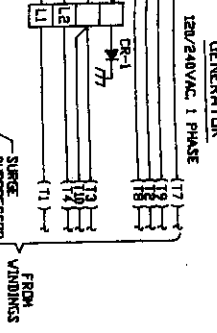
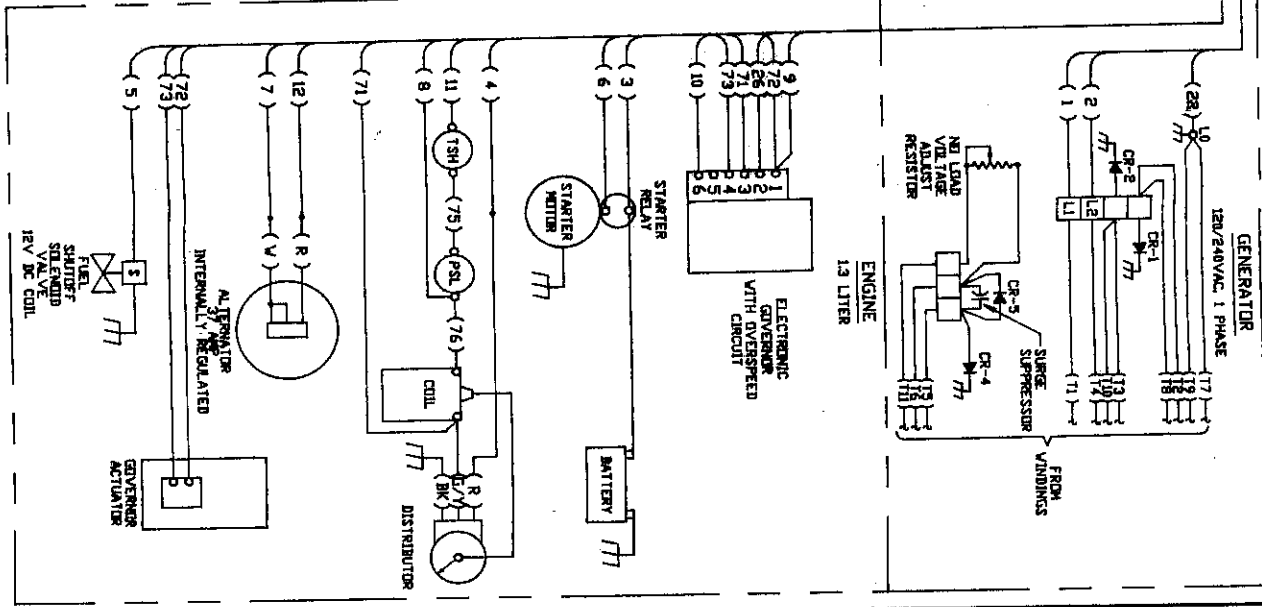


DWG. NO.	E-1212
SHEET 1 OF 1	REV. 1

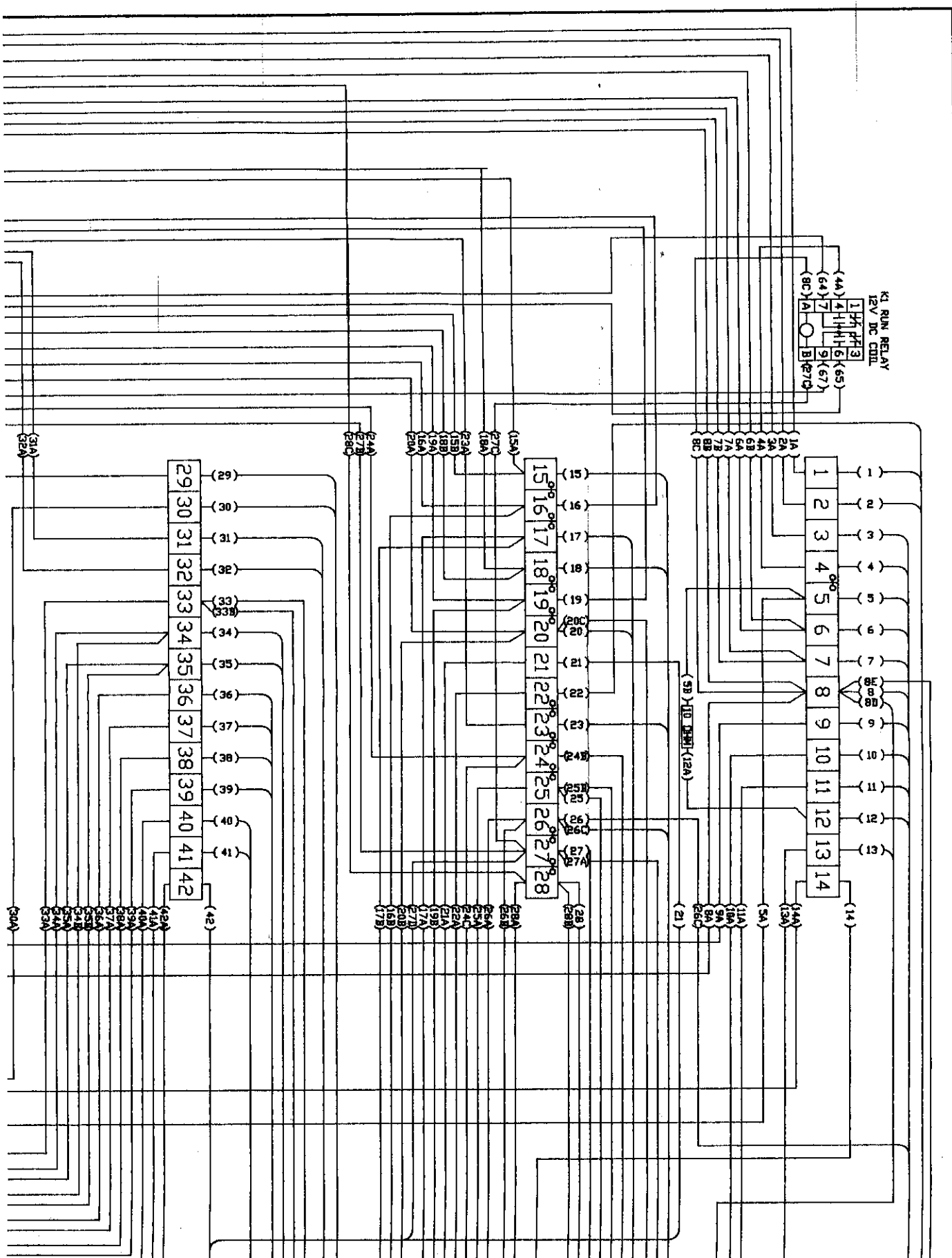
INSIDE PANEL ——— OUTSIDE PANEL AREA



10.0kW GENSET







K1 RUN RELAY  
12V DC COIL

