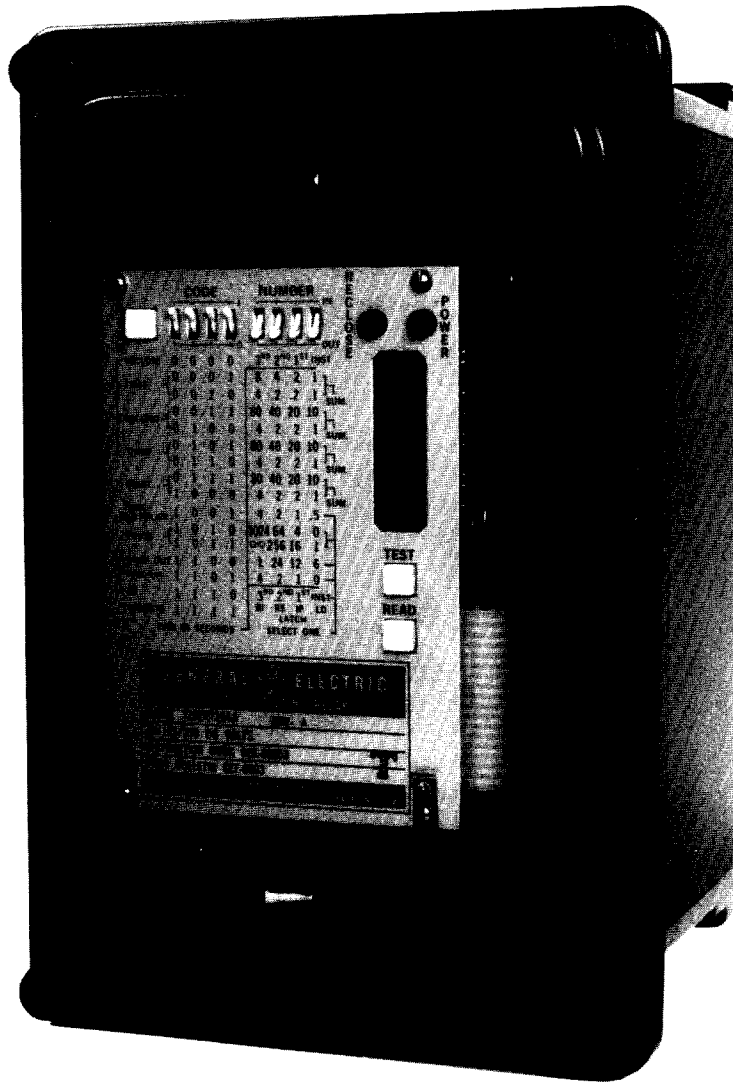




# INSTRUCTIONS

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## RECLOSER RELAYS TYPE SLR12A and SLR12B



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**GENERAL ELECTRIC**

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Cover photograph: (8043813) SLR12 Relay (In Case)

*These instructions do not purport to cover all details or variations in equipment nor provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.*

*To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.*

## INTRODUCTION

The SLR12A and SLR12B relays can be used to reclose a breaker up to four times following tripping by protective relays. These relays can be set to provide one instantaneous (no intentional delay) and three time-delayed reclosures. Any, or all, of the reclosures can be disabled.

The SLR12A relay is designed for use with DC voltages (48,110,125,220,250), whereas the SLR12B relay is designed for use with AC voltages (120/240).

Typical external connections to the SLR12A and SLR12B relays are shown in Figures 1 and 2 respectively.

## DESCRIPTION

The SLR12 relays are microprocessor-controlled and designed for use in the reclosing of a circuit breaker following tripping by protective relays. Up to four reclosures can be selected, with one being instantaneous and the other three being settable over various time ranges. Additional features, to be discussed subsequently, are also included.

A Liquid Crystal Display (LCD) is included in the relay to display all settings that are directly programmable from the front of the relay. Programming is done via a set of four CODE switches, a set of 4 NUMBER switches and an ENTER button (see the nameplate, Figure 13, for details). The CODE switches (set to 1 or 0) are used to select which setting is to be made, whereas the NUMBER switches (set to IN or OUT) are used to make the actual setting. After the CODE and NUMBER switches have been set, the ENTER button is pushed to store the setting in the relay. Further details can be found under the **Settings** section.

Settings can be checked by pushing the READ button, which will cause the settings to be sequentially displayed on the LCD (see **Read** section). The READ button can be pushed at any time to check the settings. The recloser is also programmed to perform a self-test by pushing the TEST button, which will cause the recloser to go through its operating sequence without energizing the output relays (see **TESTING** section). The READ and TEST buttons can be pushed at any time without the need for removing the recloser from service: however, the relay must be enabled for the TEST button to work. If a reclosing operation is called for during either the test or read sequence, they will be overridden and the recloser will then run through its normal operating sequence.

## APPLICATION

The SLR12 relays can be used to close a circuit breaker up to four times following tripping by protective relays. Any, or all, of the reclosures can be selected. If all four reclosures are selected, the first reclosure will always be instantaneous,

followed by three time-delayed reclosures. If three, or less, reclosures are selected, all three may be time delayed, or one instantaneous reclosure followed by one or two delayed reclosures may be used. The instantaneous reclosure has no intentional time delay. The reclosure and reset times are as follows:

	<u>TIME RANGE</u> <u>SECONDS</u>	<u>RESOLUTION</u>	<u>MULTIPLIER</u>
Instantaneous Reclosure	No delay	-	
First Timed Reclosure	0.1 to 15.9	0.1	} 0.5, 1.0, 2.0, 4.0
Second Timed Reclosure	1.0 to 159	1.0	
Third Timed Reclosure	1.0 to 159	1.0	
Reset Time	1.0 to 159	1.0	

The time multiplier works on all time ranges concurrently: i.e., it is not possible to change only one time range. The multiplier has no effect on the instantaneous reclosure.

Typical external connections to the SLR12A and SLR12B relays are shown in Figures 1 and 2 respectively. These diagrams illustrate the connections to be used in simple, straightforward applications without any special requirements such as synchronism check, delayed reset, etc. These special requirements will be discussed separately. A breaker control switch (52CS) and breaker auxiliary "a" and "b" switches are required as shown in the connections. A control switch contact (5-5C) that is closed only in the "close" and "normal after close" positions is employed to prevent automatic reclosing of the breaker following a manual trip. With this switch arrangement, the relay will sense that reclosing is being prevented, and it will go to lockout when it tries to close the breaker following a manual trip.

The SLR12 relays have many unique features and a great deal of flexibility in how they may be employed. Following is a description of how these features can be used in some special applications. Please refer to the **OPERATION** section for specific details on each of the functions used in these applications. The figures used in the following descriptions apply only to the pertinent input connections. Refer to the overall elementaries, Figures 1 and 2, for the remainder of the connections.

### Block Instantaneous Tripping

It is sometimes desirable on distribution circuits to block the instantaneous trip circuits after the first trip but before the first reclosure is completed, thus providing for coordination with branch circuit fuses. This can be implemented with the normally-closed BI contact as shown in the simplified connection diagram of Figure 3. The diagram represents an application with time overcurrent (TOC) and instantaneous overcurrent (IOC) functions. Note that the BI contact opens at the first selected reclosure and stays open during the remainder of the reclosing cycle, and in the lockout position if reclosing proves to be unsuccessful. A contact of the breaker control switch is shown, connected across the BI contact. This control switch contact, which is closed in the "close" position of the switch, is used to re-establish the instantaneous trip circuit when the breaker is manually reclosed with the SLR relay in the lockout position.

It is also possible to use the normally-closed RS contact to block instantaneous tripping. In this case, RS can be set to pick up after the first, or even the second, delayed reclosure and thus allow instantaneous tripping to occur two, or even three, times rather than just once, as can be done with the BI contact. Note that the RS function can be set to drop out at the lockout position; thus, instantaneous tripping is re-instated at that time and it is not necessary to use the control switch contact described in the preceding paragraph.

### **Block Automatic Tap Changer**

The normally-closed RS contact can be used to block the automatic tap changer circuit during the reclosing cycle. The RS contact would typically be set to open at the start of the reclosing cycle and to close when lockout is reached.

### **Selective Reclosing**

In some applications it may be desirable to initiate instantaneous plus delayed reclosures following a high-speed trip, but to allow delayed reclosures only, following a time-delayed trip. This can be accomplished by applying a signal from the time delay trip bus to the DR input of the SLR relays as shown in Figure 4. With this connection, the recloser will skip the instantaneous reclosure (or the first selected reclosure) and go immediately to the next selected reclosure. It is possible to use the high-speed reclose initiate (RI) output from the protective relaying scheme to initiate the reclose cycle, but it must be paralleled by a breaker "b" switch contact as shown in Figure 4 to ensure completion of the reclose cycle.

It is also possible to set the SLR relays to provide two separate single-shot reclosures, with each reclosure having a different time delay. For example, it might be desirable to provide a single-shot of reclosing with a long time delay for ground faults, but to provide a single-shot of faster reclosing for phase faults. This can be accomplished via the connections shown in Figure 5. Assume, as an example, that a single-shot instantaneous reclosure is required following phase faults, but that a single-shot time-delayed reclosure is required following ground faults. To do this, make the connections shown in Figure 5 with a contact from the ground fault detection circuit connected to the DR input (select single-shot No. 2) of the SLR relay. Make the following settings:

1. Select instantaneous (INST) and first (1st) reclosure.
2. Set the first reclosure time delay to that required for ground faults.
3. Set pause control jumper P9 to the IN position
4. Set pause select jumper P10 in the 1 to A position
5. Set pause time setting to zero (0)
6. Set appropriate reset time.

With these connections and settings the following will occur.

1. For phase faults - when a phase fault occurs, there will be no DR input to the SLR relay. Consequently, when the breaker trips and the "b" switch closes, the SLR relay will initiate an instantaneous reclose output to close the breaker. At the same time, the BI contacts will open to remove the pause input. If the reclosure is successful, the SLR will reset following the reset time (BI contacts will close at that time). If the reclosure is not successful and the breaker retrips, the SLR will count down the first reclose time and then try to close the breaker. Reclosing will not be permitted, however, because of the open pause input, and the SLR will then immediately go to lockout. Thus, only one reclosure is permitted.
2. For ground faults - when a ground fault occurs, there will be an input applied to the DR input of the relay (must be applied before "b" closes). At that time, the instantaneous reclosure will be skipped and the SLR will start to count down to the first reclosure when the "b" switch closes. The breaker will thus be closed following a delay equal to the first reclose time. If the reclosure is successful, the SLR will go to reset. If the breaker retrips, the SLR will go immediately to lockout. Here too, only one reclosure is allowed.

### Synchronism Check

Synchronism check may be used with the SLR reclosers via the pause input, as shown in Figure 6. In this connection, the synchronism check contact must be closed when the system is in synchronism and open when the system is out of synchronism. Thus, when a reclose is called for it will be permitted if the system is in synchronism, or blocked if the system is out of synchronism. The pause time setting is the time that is permitted for a synchronism check input to be produced and is started when a reclose output is called for. If a synchronism check input is not present when the pause time elapses, the SLR will go immediately to lockout. Note that a synchronism check input is required at all selected reclosures when the pause function is implemented. If it is desired not to synchronism check a reclosure, some means must be used to bypass the synchronism check input at the reclosure where synchronism check is not wanted. For example, the RS normally-closed contact may be used to eliminate the synchronism check requirement for an instantaneous reclosure by connecting it as shown dotted in Figure 6. For this connection to be effective for the described condition, RS should be set to pick up with 0 time and to drop out at lockout. In this way, synchronism check will be required on all delayed reclosures but not on the instantaneous reclosure.

### Delayed Reset

Some applications may require a delay in (extension of) the reset time to allow certain events to occur before the SLR is allowed to go to reset. For example, it may take a time overcurrent function a very long time to operate for low-level ground faults, whereas the phase time overcurrent functions may operate very quickly. Thus, long reset times may be required to accommodate the low-level ground faults, whereas shorter reset times may be required for phase faults. The pause input to the SLR relays can be used to accomplish this requirement. A simplified connection diagram to meet this requirement is shown in Figure 7. Note that a sensitively-set instantaneous overcurrent (IOC) function and an auxiliary function 79X are required. With this connection, the pause input will be open whenever IOC operates. The pause time will last as long as IOC is picked up or until the pause time elapses, and the reset time will be extended accordingly. In this way, time will be allowed for the TOC to operate before the SLR resets.

### Pause Function - Dual Use

Two separate and distinct applications have been described using the pause function. It is possible to use the pause function during both reclose and reset, but special connections are required, as shown in Figure 8. Note that although the synchronism check and reset delay functions are totally isolated in this example, they both operate for a common pause time; i.e., it is not possible to use separate pause time settings when the pause function is used for a dual purpose.

### Special Input Capabilities

There are 4 special input capabilities designed into the SLR12 recloser to increase the flexibility in its application.

1. A signal on the DR input will cause the recloser to skip the first selected reclose. (The SLR11 was designed to skip Instantaneous with a DR signal.)

The recloser can now be set up as a 1 shot recloser with a short-time or long-time delay using the DR input.

2. The reclose cycle can be operated using the 52b input only. (The 52a input stud #9 must be connected to relay stud #2 on the SLR12A or to stud #4 on the SLR12B.)

This connection was included in the design for applications where only one signal was available for reclosing; it requires that the signal have a bounce time less than 16 milliseconds. **This connection is not recommended for reclosing where a 52a and a 52b signal are available!**

3. During the reset time (52a closed and 52b open) the recloser can be returned to the reset condition by opening 52a for .3 seconds or more. When 52a closes, the recloser will go to reset.
4. During the reclose time (52a open and 52b closed), the recloser can be put directly into the lockout condition by opening 52b for .3 seconds or more. When 52b closes, the recloser will go to lockout.

### Setting Up the SLR12 to Operate as an SLR11

The SLR12 is designed to operate as a direct replacement for the SLR11. The following is the procedure for setting the SLR12 to operate in an SLR11 case without changing any wiring to the SLR11 case.

1. Set P9 to the out position.
2. Set P11 to the B to 2 position.
3. Set P6 to the N.O. position.
4. Set P7 to the N.C. position.
5. If the SLR12B (AC recloser) is being used, set P1 to the correct voltage.
6. Program the recloser.



It should be noted that the SLR12 does not need a manual close signal (Stud 8 on the SLR11). With P9 set to the OUT position, any signal at Stud 8 of the relay case will be ignored. With the signal at stud 8 ignored, the position of P10 is irrelevant.

Because Stud 11 is not used on the SLR11 case, the position of P8 is irrelevant.

## OPERATION

### SLR12 Inputs and Outputs

The SLR12 family of relays consists of 2 models. The SLR12A is designed for a DC input with an input voltage of 48,125,250 volts DC (see Figure 9). The SLR12B is designed for an AC input with an input voltage of 120/240 volts AC (see Figure 10).

Each model has 4 inputs and 5 outputs as listed below.

#### Inputs:

DR	"Delayed Reclose" is used to skip the first selected reclose signal.
P	"Pause" is used to delay the start of the reclose signal, or to extend the reset time, or both.
52a, 52b	Auxiliary contacts of the circuit breaker used to indicate the state of the breaker.

#### Outputs:

IP	"In Progress" is used to indicate that the recloser is in progress for a reclose or reset.
RS	"Relay Spare" is an auxiliary relay which can be operated at any selected reclose with adjustable pickup and dropout times.
LO	"Lockout" is used to indicate the relay is in lockout. (Note that stud 15 is shared by IP and LO.)
BI	"Block Instantaneous" operates at the first reclose signal and remains on until the recloser is reset.
REC	"Reclose" is the reclose signal. The reclose relay is a telephone type that is mounted with its contacts visible through the front of the SLR relay case.

It should be noted that shorting bars are used across the normally-closed contacts of RS and BI to complete the circuits if the connection plug is withdrawn from the case.

Surge capacitors are installed from all input and output circuits to surge ground.

## Basic Operation

The recloser is not enabled until all of the CODE switches are placed in the "1" position and the ENTER button pushed. Note that the NUMBER switches in this case control the state of the BI, RS, IP and LO relays on loss of and return of power (see step 7 in the **Programming** section). The CODE switches must all be left in the "1" position for the recloser to remain enabled. If any of the switches are set to "0", the recloser will be disabled and will not respond to any external input commands. If any of the switches are set to "0", the LCD display will be blank, indicating that the recloser is disabled. When the recloser is enabled, it will display RES. if it is in reset or L.O. and B.I. if it is in lockout.

Once the recloser is enabled, operation is controlled by the breaker auxiliary "a" and "b" switches and the breaker control switch 52CS. Please refer to Figures 1 and 2, which show typical external connections to the SLR relays.

If the breaker is closed when the recloser is enabled, it will recognize that the "a" switch is closed, and that the "b" switch is open, and will "awaken" in the reset (RES) position. RES. will be displayed on the LCD. If the breaker is open when the recloser is enabled, the auxiliary switches will be in the opposite state; the recloser will recognize this and it will "awaken" in the LO "Lockout" position. L.O. and B.I. will be displayed on the LCD. When the breaker is closed manually, the auxiliary switches will transfer state ("a" closes, "b" opens) and the recloser will start to count down from a time equal to the reset setting (this can be observed on the LCD). At the end of the reset period, the recloser will assume the reset position and RES. will be displayed on the LCD. If the breaker were to trip as the recloser was counting down, the auxiliary switches would again change state and the recloser would immediately go to the lockout position, thus preventing any further reclosures. At that time, L.O. and B.I. would be displayed on the LCD.

If the breaker is tripped manually, the recloser will count down to the first reclosure selected (no countdown if instantaneous was selected) and at that time will produce an output to reclose the breaker. No reclosure will take place, however, because the 5-5C contacts of the control switch (52CS) will be open at that time. At the instant that the reclose output is produced, the recloser will check to see if the breaker auxiliary switches transfer, i.e. if "b" opens and "a" closes. A time limit is built into the recloser for this transfer to occur, and is equal to 0.9 times the time multiplier in seconds (see Set Time Multiplier in the **Programming** section). Thus, if a time multiplier of 1.0 is selected, the transfer of the auxiliary switches must occur within 0.9 seconds after a reclose output is produced. If the transfer does not occur within this time period, the recloser will immediately go to lockout. Since reclosing is prevented by the control switch following a manual trip, the recloser will go to lockout following any manual trip. THE ABOVE-DESCRIBED TIME LIMIT APPLIES ANY TIME THAT THE RECLOSER PRODUCES A RECLOSE OUTPUT.

If the breaker is tripped by the protective relays, the 5-5C contacts of the control switch will be closed, and the recloser will go through its programmed sequence following closure of the "b" switch. When the first reclosure point is reached, a reclose output will be produced to close the breaker. If the breaker closes successfully as indicated by a transfer of the auxiliary switches within the specified time limit, the recloser will start to count down to reset. If no tripping occurs during this period, the recloser will reset and be ready to initiate another complete reclose cycle when called for. If a trip does occur during the reset period, the recloser will then go on to the next reclosure, if one has

been selected. If the breaker retrips following each reclosure, the recloser will go through its complete cycle. Following the last reclosure, the recloser will immediately go to lockout when the breaker retrips. The programmed time for each reclosure is independent of previous reclosures; i.e. the reclose times are not cumulative and do not start from the time that the breaker is first tripped.

## **Additional Features**

### Delayed Reclose

A DR "Delayed Reclose" input is included to allow the first selected reclosure to be skipped and to go directly to the next reclosure. For example, if the instantaneous, first and third reclosures are selected, an input (contact closure) at the DR input will cause the instantaneous reclosure to be skipped and the recloser will go directly to the first reclosure.

### Pause

A "pause" feature is provided that can be used to control a reclose output and/or the reset time of the SLR relay, as follows:

1. When used in the reclose mode, a reclose output will be delayed for up to the pause setting or until a contact is closed at the pause input to the relay. If a pause input occurs during the pause period, the reclose output will be produced immediately; otherwise the relay will go directly to lockout when the pause time has expired. The relay cannot produce a reclose output unless the pause input is present at the time a reclose is called for or is applied during the pause period. The pause period begins at the time that a reclose output would normally occur. For example, if a 16 second pause setting were selected, the recloser would count down to each reclosure, and at that time would reclose the breaker if a pause input is present (contact closed) or would wait 16 seconds from that time for a pause input to be applied. If a pause input is applied during that time, reclosing will occur immediately; otherwise lockout will occur when the pause time elapses (provided the pause time is not set to infinity, in which case it will wait forever for a pause input).
2. When used in the reset mode, the reset time can be delayed for up to the pause setting. Here too, the pause time will be initiated if there is no pause input and the pause time will be prevented, or terminated, by a contact closure at the pause input to the relay. In other words, a continuous pause input will produce the reset times stored in memory. The reset time can be extended by up to the pause time, or for a lesser time, by controlling the time that the pause input is open during the reset period. For example, with a pause setting of 16 seconds, the reset time can be extended for 16 seconds, or less, by opening a contact at the pause input. If the contact is open for 16 seconds or longer, the reset time will be extended by 16 seconds. If the contact is open for a lesser time, then the reset time extension will be equal to the time that the contact is open. The pause input (contact opening) can be applied at any time during the reset period.

Option plugs are provided wherein the pause feature can be ignored altogether, used for reclose only, used during reset only, or used during both reclose and reset. Only one pause setting can be made, and it applies to both the reclose and/or reset periods.

Output Contacts

RS "Relay Spare" Contacts are provided for use in external control circuits. The RS contacts can be set to be activated at any one, but only one, of the selected reclosures. The RS contacts can be set to operate with a pickup delay and dropout delay if desired. These delays are measured starting at the reclosure selected to activate RS. For example, if RS is set to operate at the second reclosure and with a pickup time of 2 seconds and a dropout time of 6 seconds, the following will occur:

When the reclose signal is applied to the breaker at the end of the second reclose period, the RS function will pick up 2 seconds later, remain picked up for 4 seconds, and then drop out. Thus, the time that the RS function remains picked up is equal to the set dropout time minus the set pickup time, because both timing periods are started at the same time.

BI "Block Instantaneous" Contacts are provided for use in external control circuits. These contacts pick up with the first reclosure signal and remain picked up until the recloser resets. For example, if the second and third reclosures are selected, the BI function will operate when the second reclosure times out and produces a reclose signal to the breaker. The BI function will stay up until the recloser is reset. If the reclosure attempts are unsuccessful, the recloser will go to lockout and the BI function will stay up. In fact, the BI function will be picked up any time the recloser is in lockout, and it will stay picked up until the recloser is reset.

IP "In Progress" Contacts are provided for use as an indication that a reclosing operation is in progress. The IP function will be picked up except when the recloser is completely reset or in lockout.

LO "Lockout" Contacts are provided for use when the recloser is locked out. The LO function will be picked up only when the recloser is in the locked-out position.

Memory

## CAUTION

When SLR12 relays are powered up, a reclose signal could be produced. See **WARNING** on page 33.

The SLR relays are provided with a memory feature that is useful in those cases where the input power can be lost during a reclose cycle. The memory feature can be plugged in or out at the user's discretion. When it is used, it will remember where in the reclose cycle the recloser was when the power was lost, and will return at the beginning of that reclose cycle when the power is returned. For example, assume that the first reclosure was set to operate in 15 seconds and that the power was lost when the recloser was half way through the countdown. When the power is restored, the recloser will pick up in the first reclose period, but will start counting down at 15 seconds rather than at the halfway point where power was lost. When the countdown is complete, the first reclose output will be produced to close the breaker and the recloser will then go through the remainder of its set sequence. If the memory feature is not used, the recloser will "awaken" in reset if the breaker is closed when the power is restored, or it will "wake up" in lockout if the breaker is open.

The memory feature can also be used to remember the state of the BI, RS, IP and LO functions when power is lost and then restored. This feature is implemented via the NUMBER switches when CODE (1 1 1 1) is set to enable the recloser. The NUMBER switches, reading from left to right, control the BI, RS, IP and LO functions respectively. If a NUMBER switch is "IN", and the respective function is picked up when power is lost, it will stay in that state and be there when power is returned. The state of the function will be ignored if the respective NUMBER switch is "OUT" when power is lost.

### Time Multiplier

A Time Multiplier is included in the SLR relays, wherein the range of all of the time settings can be changed. The nameplate (Figure 13) of the relay lists the times for a time multiplier setting of 1.0. Note that the time multiplier setting applies to all times, including the reclose limit time described earlier on page 10; i.e., it is not possible to change just one time range via the time multiplier.

### **DC Power Supply**

The DC power supply is designed to operate over an input voltage range of 38 to 300 VDC. The supply is a non-isolated stepdown chopper type that produces a 14 VDC regulated output and does not require any input taps for the entire input voltage range. (See Figure 11.)

An output signal  $\overline{PV}$  (power valid when pulled negative) is produced to indicate the power supply is at a safe value for the electronics to operate.

### **AC Power Supply**

The AC power supply is designed to operate at 120 or 240 VAC, 50/60 Hz. The input voltage is selected with jumper plug (P1) by setting 120 or 240. Each input voltage will work over the range of 80% to 110% of nominal. The supply is an isolated type that produces a 14 VDC regulated output and a 150 VDC unregulated output. (The 150 VDC assumes that the output is loaded and the input is nominal.) (See Figure 12).

An output signal  $\overline{PV}$  (power valid when pulled negative) is produced to indicate the power supply is at a safe value for the electronics to operate.

### **Printed Circuit Board Assembly**

The printed circuit board assembly includes the relay and power supply board (see Figure 14) and the logic and control board (see Figure 15), which are connected together with an 18-conductor jumper cable.

The relay and power supply board consists of the following circuits:

1. Input circuits for the 4 input signals and the input voltage. The input voltage is used as a reference and is compared to the input signals to determine their state.

Note that the pause input circuit has a jumper plug (P9) at its output to put the pause functions IN or OUT. If the pause function is not used, it must have the plug in the OUT position.

2. A 5 VDC power supply for the system logic.
3. The output relay driver circuits and the output relays except for the reclose relay.

The output relays L0 and IP have output jumper plugs, (P6) and (P8) respectively, so that the NO (normally-open contacts) can be changed to NC (normally closed). If the normally-closed contacts are used for L0 or IP, it must be remembered that there are no shorting bars supplied to complete the circuits if the connection plug is withdrawn from the case.

The output relay BI has an output jumper plug (P7) to change the NC (normally-closed contact) to a NO (Normally-open contact). It must be remembered that there is a shorting bar supplied for BI to complete the circuit if the connection plug is withdrawn from the case, and that it would short out a normally-open contact of the SLR relay. If a normally-open contact is used for BI, the shorting bar in the case can be removed if necessary.

The logic and control board consists of the following circuits:

1. Input switches to program the reclose functions.
2. Input push buttons to read and test the reclose functions that are programmed in.
3. Jumper plugs (P10 and P11) to select the pause and memory functions.
4. Logic and memory to produce the reclose functions and readout signals for the LCD (liquid crystal display).

All settings required for the logic and control board will be covered in the **Settings** section.

### **Settings**

Select the input voltage of the SLR relay using jumper plug (P1) by setting 120 or 240. This is on the AC relay only (SLR12B), and does not apply to the DC relay (SLR12A).

On the relay and power supply board, select the positions of jumper plugs (P6, P7, P8 and P9).

Set P6 to select whether the L0 relay has a normally-closed or a normally-open contact.

Set P7 to select whether the BI relay has a normally-closed or a normally-open contact. (Remember that there is a shorting bar in the SLR relay case that is shorting the BI contact when the connection plug is withdrawn from the case)

Set P8 to select whether the IP relay has a normally-closed or a normally-open contact.

Set P9 to the IN position if the pause input is to be used. If the pause input is not going to be used, P9 must be set to OUT, because the pause input is designed to operate on a contact opening.

On the logic and control board, select the positions of jumper plugs (P10 and P11).

Set P10 to select where in the reclose cycle the pause function operates.

1. If P10 is set 1 to A, the pause will occur just prior to the reclose signal when P9 is in the IN position and the pause input to the SLR relay is open.
2. If P10 is set A to 2, the pause will occur during the reset time when P9 is in the IN position and the pause input to the relay is open.
3. If P10 is set 2 to 1, a pause can be called for at reclose and during reset.

If P9 is in the OUT position, jumper plug P10 will have no effect on the reclose cycle. The pause function is set up so that only one pause can occur per reclose or reset.

Set P11 to select what action the recloser will take on power up after a power interruption to the relay.

1. If P11 is set 1 to B, it will power up at the beginning of the time period that was in progress when power to the relay was interrupted.
2. If P11 is set B to 2, it will power up at reset if the breaker is closed and at lockout if the breaker is open. Where in the cycle the power was interrupted has nothing to do with the power up of the relay.

The operation of the NUMBER, CODE, ENTER, READ and TEST switches will be covered in the **Programming**, **Read** and **TESTING** sections.

### Programming

In order to program settings, the SLR relay must be powered up and in reset or lockout. A change in CODE from 1 1 1 1 (see nameplate, Figure 13) when the relay is in progress will be ignored until the relay reaches the reset or lockout condition. Programming is accomplished by selecting the code of the function, setting the number, and pushing ENTER. Push READ to verify a setting. (The operation of the READ switch is covered in the **Read** section.)

When the code is anything but 1 1 1 1, the relay will not respond to input changes and the outputs are inhibited from changing state.

#### 1. Select Reclosures

RECLOSE	CODE	NUMBER
	0 0 0 0	3rd 2nd 1st INST.

There are 16 combinations of RECLOSE settings, all of which are valid. INST. is the instantaneous reclose signal (no intentional time delay on reclose). The 1st, 2nd and 3rd reclosures occur after an adjustable time delay. All reclosures not

selected are skipped. If none of the reclosures are selected, (all numbers of the CODE entered in the OUT position), the recloser will go to lockout when the 52b contact closes.

2. Set First Reclose Time

	CODE	NUMBER	
FIRST-[	0 0 0 1	8 4 2 1	]—SUM
	0 0 1 0	.4 .2 .2 .1	

The FIRST (1st) reclose time can be set from .1 to 15.9 seconds. If no time is selected (all numbers of each CODE entered in the OUT position), the delay will be .1 second. The time is selected in 2 bytes. If 8 and 2 are entered for CODE 0 0 0 1 and .4 and .2 are entered for CODE 0 0 1 0, the time setting will be 10.6 seconds.

3. Set Second and Third Reclose Times and Reset Time

	CODE	NUMBER	
SECOND-[	0 0 1 1	80 40 20 10	]—SUM
	0 1 0 0	4 2 2 1	
THIRD -[	0 1 0 1	80 40 20 10	]—SUM
	0 1 1 0	4 2 2 1	
RESET -[	0 1 1 1	80 40 20 10	]—SUM
	1 0 0 0	4 2 2 1	

The SECOND (2nd) and THIRD (3rd) reclose times along with the RESET time can be set from 1 to 159 seconds. If no time is selected for the SECOND reclose, THIRD reclose or RESET time (all numbers of each CODE entered in the OUT position), the delay will be 1 second.

4. Set Time Multiplier

	CODE	NUMBER	
TIME MULTIPLIER	1 0 0 1	4 2 1 .5	]—SELECT ONE

The TIME MULTIPLIER multiplies the following time settings by the NUMBER selected.

- A. First reclose time
- B. Second reclose time
- C. Third reclose time
- D. Reset time
- E. Pause time
- F. RS dropout time
- G. RS pickup time
- H. \*Reclose signal time limit

\* The reclose signal time limit is the time allowed for the breaker to close following a reclose signal. If the breaker does not close in that time, as indicated by the transfer of the breaker "a" and "b" switches, the relay will go directly to lockout. The reclose time limit with a 1.0 multiplier is 0.9 seconds.



Only one MULTIPLIER should be selected. If more than one MULTIPLIER is selected, the highest of the selected MULTIPLIERS will be used. If no MULTIPLIER is selected (all numbers of the CODE entered in the OUT position), the MULTIPLIER will be 4.

5. Set Pause Time

	CODE	NUMBER
PAUSE- [	1 0 1 0	1024 64 4 0
	1 0 1 1	∞ 256 16 1
		SELECT ONE ]

Pause can be used to delay the start of a reclose signal output or to insert a time delay in the reset time. The time set is a limit on the PAUSE signal. Only one PAUSE limit of the eight should be selected. In order to be sure only one PAUSE limit is set, the CODE position not used should be entered with all values OUT. If more than one PAUSE limit is selected, the highest of the selected values will be used (∞ is considered the highest value). If no PAUSE limit is selected (all numbers of the codes entered in the OUT position), the pause limit will be 1024 seconds.

6. Set RS Pickup, Dropout and Operate Point

	CODE	NUMBER
[ DROPOUT	1 1 0 0	L 24 12 6
[ PICKUP	1 1 0 1	4 2 1 0
[ RS	1 1 1 0	3rd 2nd 1st INST.
		SELECT ONE ]

The RS "Relay Spare" is an output signal that is selected to operate at, or with a time delay from one of the four reclose signals. The PICK UP and DROP OUT time delays both start at the selected reclose. (If DROP OUT is set at 6 and PICK UP is set at 4 and RS is set at 2nd, the RS output will operate 4 seconds after the 2nd reclose and stay picked up for 2 seconds).

If L is selected for lockout, the RS output signal will stay up until lockout.

If more than one RS position is selected, the earliest will be used. (If the 2nd and INST. were selected, INST. would be used.) If RS is selected in an unused reclose position, the nearest reclose that is earlier in the reclose cycle would be selected.

If RS is set at INST. and instantaneous is skipped because of a DR "Delayed reclose" input, the RS timing will start with the 52b input signal.

If more than one PICK UP time is selected, the highest selected time will be used. If a PICK UP time is not selected, 0 will be used.

If more than one DROP OUT time is selected, the highest selected time will be used. (L will be considered the highest DROP OUT time). If a DROP OUT time is not selected, L will be used.

When the recloser goes to lockout, the RS output signal will drop out. (RS drops out immediately with LO and is not contingent on any PICK UP or DROP OUT timing.)

If RS is selected for an earlier time in the reclose cycle than the earliest reclose, the RS output will be picked up, except when the recloser goes to lockout. For this condition, L is substituted for whatever was programmed in the RS dropout CODE position.

7. Enable Recloser and Select Memory for BI, RS, IP and LO

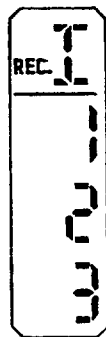
	CODE	NUMBER
OPERATE	1 1 1 1	BI RS IP LO
		LATCH

After the 15 lines of CODE are entered, the CODE must be set at 1 1 1 1 and ENTER pushed for the recloser to operate. In this position, the NUMBER is used to select which outputs (BI, RS, IP, LO) are to stay latched if the input power is removed from the recloser. If the switch is IN, the output relay will stay latched without changing state if the input power is removed from the recloser. If the switch is OUT, the output relay will be reset if the input power is removed from the recloser. Being able to select whether the outputs (BI, RS, IP, LO) are to be latched or reset on power down is not contingent on the position of P11 being in the 1 to B or B to 2 position.

**Read**

The data programmed into the recloser is read out on the LCD display when the READ pushbutton is operated. The data is displayed in 8 readings of 4 seconds each. Any function not used is skipped, which shortens the read cycle. The following is a description of each 4 second read.

1. Reclosure selected  
All reclosures selected will be on solid and REC. will blink for the 4 seconds.

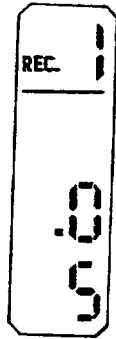


Readout for a 4 shot recloser (instantaneous and 3 timed)

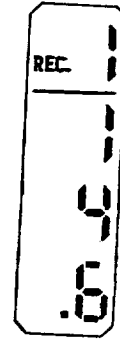


Readout for a 2 shot recloser (instantaneous and 1 timed)

2. Time of reclose (1st)  
 The number of the timed reclosure (1) along with the time will be on solid, and REC. will blink for 4 seconds.

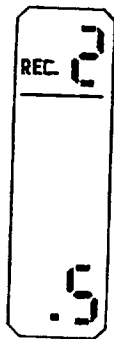


1st timed reclosure set at .05 seconds



1st timed reclosure set at 14.6 seconds

3. Time of reclose (2nd)  
 The number of the timed reclosure (2) along with the time will be on solid, and REC. will blink for 4 seconds.



2nd timed reclosure set at .5 seconds

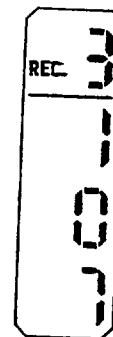


2nd timed reclosure set at 34 seconds

4. Time of reclose (3rd)  
 The number of timed reclosure (3), along with the time, will be on solid and REC. will blink for 4 seconds.



3rd timed reclosure set at 60 seconds

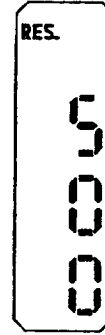


3rd timed reclosure set at 107 seconds

5. Time of reset  
 The time for reset will be on solid, and RES. will blink for 4 seconds.

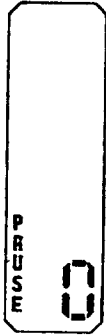


Reset time set at 89 seconds

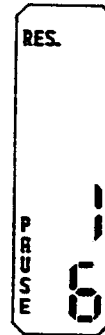


Reset time set at 500 seconds

6. Time of pause limit  
 The time for pause will be on solid and pause will blink for 4 seconds. \*If RES. is on solid, pause is for reset only, and if RES. is blinking, pause is for reclose and reset. If RES. is not on, pause is for reclose only.



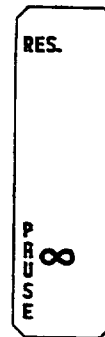
Pause limit set at 0 seconds  
 (reclose only)



Pause limit set at 16 seconds (\*)



Pause limit set at 2048 seconds  
 (reclose only)

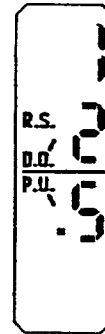


Pause limit set at  $\infty$  (\*)

7. Pickup and dropout time of RS  
 The pickup and dropout times will be on solid, and R.S. and  $\frac{D.O.}{P.U.}$  will blink for 4 seconds.

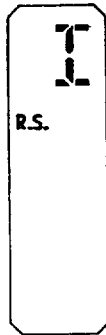


Pickup set at 0 and dropout set for lockout of the recloser



Pickup set at 0.5 seconds and dropout set at 12 seconds

8. Reclose position of RS  
 The RS start position will be on solid, and R.S. will blink for 4 seconds.



Timing of RS set to start with the INST. reclose signal



Timing of RS set to start with the 2nd reclose signal

Power Up and Power Down

CAUTION

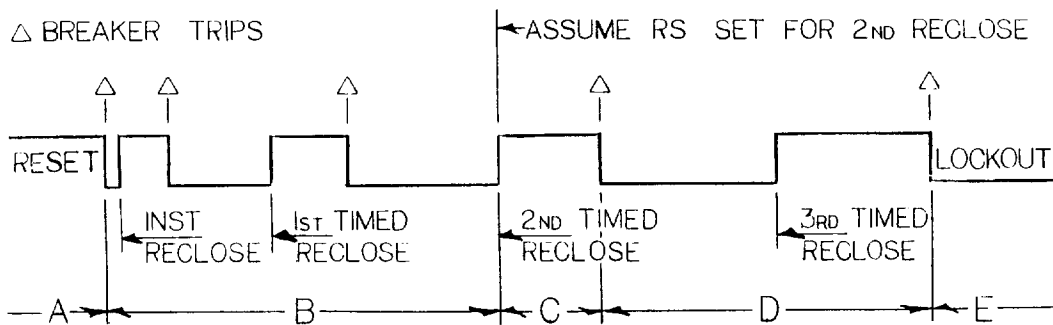
When SLR12 relays are powered up, a reclose signal could be produced. See **WARNING** on page 33.

Power up and power down operate in 2 different memory modes, depending on the position of jumper plug P11.

When P11 is set 1 to B, the recloser powers up in the same part of the reclose cycle it was in at power down. When the recloser powers up, the full time is counted down even though part of the time might have been counted prior to power down (example: the recloser powers down on the 2nd reclose set at 15 seconds after 10 seconds. On power up, the recloser will count the full 15 seconds of the 2nd reclose before the reclose signal is produced). Relays (BI, IP, LO) will stay latched if the appropriate NUMBER switches are in the IN position during power down. If the NUMBER switches for (BI, IP, LO) are in the OUT position, the relays will be reset on power down, and return to the state they were in on power up.

The operation of relay RS during power down and power up is controlled by its NUMBER switch, the pickup and dropout setting of RS, the reclose position selected for RS, the place in the reclose cycle the power down occurs, and the selected reclosures. The following is a summary of the operation of relay RS during power down and power up.

1. Assume RS is selected to operate at a reclosure that is earlier in the cycle than the first selected reclosure; i.e., RS is set to operate at the Instantaneous reclosure but only the 1st and 2nd reclosures have been selected. For this condition, RS will be picked up except for lockout. RS will stay picked up if power is lost and then restored, provided the NUMBER switch is in the IN position and the relay is not in lockout. If the NUMBER switch is in the OUT position and the recloser is not in lockout, RS will drop out on power down and pick up on power up.
2. The timing diagram in the figure below is for a 4 shot reclose cycle which goes from the reset condition to the lockout condition after 5 breaker trips. RS is set to operate for the 2nd timed reclose. This example will be used to explain the operation of RS during power down and power up of the recloser.



- A. During the "A", "B" and "E" portions of the reclose cycle there is no effect on RS due to power down and power up because RS cannot be picked up before "C", and RS is never picked up during lockout.

- B. If the dropout of RS is set for lockout and there is a power down during "C", the following will occur:
- i. If RS was not picked up when the recloser was powered down, it will operate on power up after the pickup time.
  - ii. If RS was picked up when the recloser was powered down and the NUMBER switch for RS was in the IN position, it will remain picked up during power down and after power up.
  - iii. If RS was picked up when the recloser was powered down and the NUMBER switch for RS was in the OUT position, it will drop out on power down. RS will then operate on power up after the pickup time.
- C. If the dropout of RS is set for lockout and there is a power down during "D", the following will occur:
- i. If RS was not picked up when the recloser was powered down, it will operate on power up immediately, and not wait for the pickup time.
  - ii. If RS was picked up when the recloser was powered down and the NUMBER switch for RS was in the IN position, it will remain picked up during power down and after power up.
  - iii. If RS was picked up when the recloser was powered down and the NUMBER switch for RS was in the OUT position, it will drop out on power down. RS will then operate on power up immediately and not wait for the pickup time.
- D. If the dropout of RS is set for a time delay and there is a power down during "C" or "D", the following will occur:
- i. If RS was not picked up when the recloser was powered down, it will not pick up after power up.
  - II. If RS was picked up when the recloser was powered down, and the NUMBER switch for RS was in the IN position, it will remain picked up during power down and drop out on power up.
  - iii. If RS was picked up when the recloser was powered down and the NUMBER switch for RS was in the OUT position, it will drop out on power down and will not pick up after power up.

When P11 is set B to 2, the recloser powers up in reset if the breaker is closed, and in lockout if the breaker is open. Relays (BI, RS, IP, LO) will stay latched if the appropriate NUMBER switches are in the IN position during power down. If the NUMBER switches are in the OUT position, the relays will be reset on power down. Relays (BI, RS, IP, LO) go to their normal reset or lockout conditions on power up.

**Ratings**

The SLR12A is a DC-operated relay with ratings of 48, 125 and 250 volts DC. The SLR12B is an AC-operated relay with ratings of 120 and 240 volts AC, 50/60 hertz. The interrupting ratings of the telephone-type relay contacts are shown in Table I, and the interrupting ratings of the auxiliary relay contacts are shown in Table II. If the interrupting rating is exceeded on any of the SLR12 output relay contacts, a suitable breaker contact or interposing relay must be used.

TABLE I  
INTERRUPTING RATINGS OF TELEPHONE-TYPE RELAY CONTACTS  
 CONNECTION STUDS 19 AND 20

AC VOLTS	AMPERES	
	INDUCTIVE**	NON-INDUCTIVE
120	0.75	2.0
240	0.50	1.5
<u>DC VOLTS</u>		
48	1.0	3.0
125	0.5	1.5
250	0.25	1.0

\*\* The inductive rating is based on a L/R ratio of .04 second

TABLE II  
INTERRUPTING RATINGS OF AUXILIARY RELAY CONTACTS  
 CONNECTION STUDS 11, 12, 13, 14, 15, 16, 17 and 18

ARRANGEMENT	1 FORM A - 1 FORM B
CONTACT MATERIAL	GOLD FLASH OVER SILVER ALLOY
INITIAL CONTACT RESISTANCE, MAX.	30 milli-ohms
RATINGS (RESISTIVE) Max. Switching Power Max. Switching Voltage Max. Switching Current	AC--2000 VA, DC--50 W 250 VAC 8 A
HP Rating	1/4 HP 125, 250 VAC

The output relays have make-and-carry ratings of 3 amperes continuously and 30 amperes for 0.2 second.



## Burdens

The burdens shown in Table III assume the SLR relay is either in reset or lockout with a nominal input voltage.

TABLE III - INPUT VA AND POWER RATINGS

VOLTS	FREQUENCY	VA	WATTS
250	DC	--	10.8
125	DC	--	6.4
48	DC	--	4.9
240	60	7.4	--
240	50	9.1	--
120	60	7.9	--
120	50	10.2	--

The burdens of Table III will be slightly higher during reclose.

## TESTING

### Recloser Self Test

The self test circuit of the recloser is designed to test the electronics of the system while running the program information entered into memory. The test system operates all circuits except the input networks and output relays. During the test, the SLR relay assumes that the circuit breaker is working into a fault so that each time the circuit breaker closes it will open immediately. During the test, the output relays do not change state. Reclose signals are indicated by the reclose LED (green light emitting diode).

If the circuit breaker is closed during test, (52a closed and 52b open), the relay will time down all the reclose operations programmed in, wait 4 seconds in lockout, do a manual close, and count down the reset time.

If the circuit breaker is open during test (52a open and 52b closed), the relay will do a manual close, count down the reset time, wait 4 seconds in reset, and time down all the reclose operations programmed in.

A DR "Delayed Reclose" signal can be added to the test cycle by holding the TEST button down for more than 1 second. The normal test is started by holding the TEST button down for less than 1 second.

During test, all function messages on the LCD blink (RES., REC., R.S., B.I., L.O.).

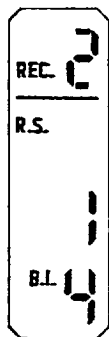
The following are some typical LCD displays as test proceeds from reset to lockout and back to reset.



Normal reset condition. R.S. could be ON if it was set earlier than the first reclose. RES. not blinking.



1st timed reclose counting down in .5 second intervals. REC. is blinking. B.I. not being energized indicates that instantaneous reclose was not called for, or the test button was held for more than 1 second, causing a DR input signal.



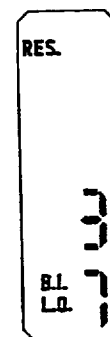
2nd timed reclose counting down in 1 second intervals. REC., R.S. and B.I. are blinking. R.S. being on could be from being set at INST. with a time delay, or being set at 1st.



3rd timed reclose counting down in 1 second intervals. REC. and B.I. are blinking. R.S. being off indicates the dropout time has timed out.



Relay is now at lockout for 4 seconds, B.I. and L.O. are blinking.



A manual close has occurred and the reset time is counting down in 1 second intervals. RES., B.I. and L.O. are blinking.

After the reset time is counted down, the test is complete and the LCD will show RES.

**Dielectric Tests**

The surge capacitors of Figures 9 and 10 used in the type SLR relay do not have voltage ratings to withstand AC hipot voltage; therefore, caution must be exercised when hipotting to avoid damaging these capacitors. (Unplug the .05  $\mu$ f capacitor between the cradle and the negative of the power supply during hipot testing.)

If hipot tests are to be performed, these tests should be accomplished on a bench with the relay in its case. If the relay is to be tested together with other apparatus in an equipment, all external connections to terminal 1 (surge ground) must be removed.

The hipot test voltage should be 1,500 volts RMS, 50 or 60 hertz for new relays, or 1,125 volts RMS, 50 or 60 hertz for other relays. New relays are defined as those which have not been in service, which are not more than one year old from the date of shipment, and which have been suitably stored to prevent deterioration. The duration of application of the test voltage for both old and new relays should be 60 seconds or less.

Common Mode Hipot Tests (all terminals to case)

Temporary connections should be made to tie all relay terminals, including terminal 1, together. Hipot voltage can then be applied between the common connection and the relay case.

Transverse Mode Hipot Tests (between circuits)

For hipot tests between circuits of the relay, the surge capacitors must be temporarily disconnected from the surge capacitor bus inside the relay. The relay terminals should be jumpered to provide the groups of circuits shown in Table IV. Hipot voltage can then be applied between each pair of groups of circuits.

TABLE IV - HIPOT CIRCUIT GROUPS

CIRCUIT GROUP	JUMPER BETWEEN TERMINAL NUMBERS	
	SLR12A	SLR12B
AC Potential		5, 6
Output Contacts	11, 12, 13, 14, 15, 16, 17, 18, 19, 20	11, 12, 13, 14, 15, 16, 17, 18, 19, 20
Input Signals	2, 3, 7, 8, 9, 10	4, 7, 8, 9, 10

An alternate test using a 500 volt megger can be performed between the circuit groups of Table IV with the surge capacitors and the .05  $\mu$ f capacitor between the cradle and the negative of the power supply connected in their normal manner. While this method does not test the relay to its full dielectric rating, it will detect some cases of degraded insulation.

After the hipot or megger testing is complete, the surge capacitor should be reconnected to the surge capacitor bus and external wiring to terminal 1 should be reconnected.

**Functional Test**

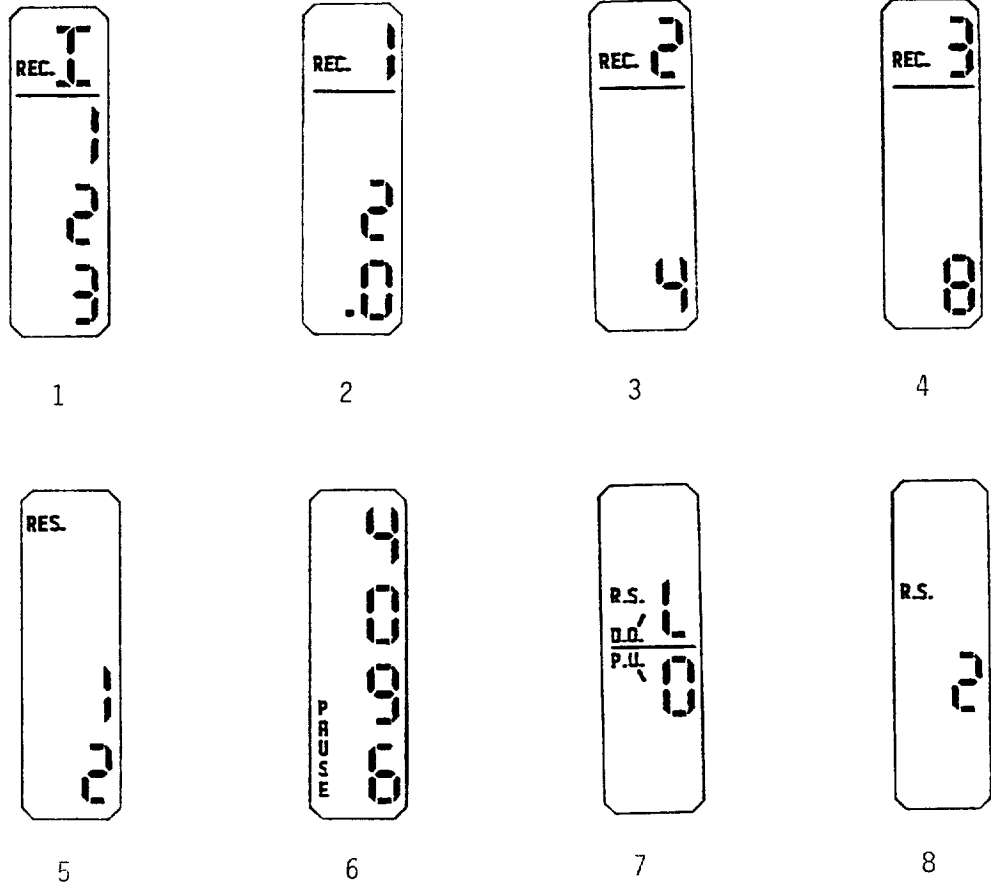
In order to run the functional test per Figure 16, set up and program the recloser as follows:

1. If the recloser is an SLR12B, make sure that P1 on the AC power supply board (see Figure 12) is set for the correct AC input voltage.
2. Make sure P6 is set for N.O., P7 is set N.C., P8 is set for N.O. and P9 is set for OUT on the relay and power supply board (see Figure 14).
3. Set P10 for 1 to A and P11 for B to 2 on the logic and control board (see Figure 15). (The position of P10 has no effect on the test.)
4. Put the recloser in the case and energize the test circuit and recloser.
5. The recloser should be in lockout with B.I. and L.O. appearing on the LCD. Relays BI "block instantaneous" and LO "lockout" will be picked up.
6. Program the relay as follows:

CODE	NUMBER	
A. 0 0 0 0	IN IN IN IN	push ENTER - All reclosures in (4)
B. 0 0 0 1	OUT OUT OUT OUT	push ENTER
C. 0 0 1 0	IN OUT OUT IN	push ENTER
D. 0 0 1 1	OUT OUT OUT OUT	push ENTER
E. 0 1 0 0	OUT OUT OUT IN	push ENTER
F. 0 1 0 1	OUT OUT OUT OUT	push ENTER
G. 0 1 1 0	OUT OUT IN OUT	push ENTER
H. 0 1 1 1	OUT OUT OUT OUT	push ENTER
I. 1 0 0 0	OUT OUT IN IN	push ENTER
H. 1 0 0 1	IN OUT OUT OUT	push ENTER - Multiply all times by 4
K. 1 0 1 0	IN OUT OUT OUT	push ENTER
L. 1 0 1 1	OUT OUT OUT OUT	push ENTER
M. 1 1 0 0	IN OUT OUT OUT	push ENTER - RS Dropout at lockout
N. 1 1 0 1	OUT OUT OUT IN	push ENTER - RS pickup = 0
O. 1 1 1 0	OUT IN OUT OUT	push ENTER - RS operate with 2nd reclose
P. 1 1 1 1	OUT OUT OUT OUT	push ENTER - Recloser in lockout ready to operate

The 4 multiplier was used to increase the reclose signal time limit in order to avoid going to lockout while operating the Instantaneous reclose.

The recloser is now ready for test. To check the program, push READ and observe the LCD as follows. It should be noted that, even though a pause limit is programmed in, the pause input will not operate because P9 (see Figure 14) is in the OUT position. Remember that the time multiplier is set at 4!



Before starting the functional testing, monitor the output contacts of interest.

Push the CLOSE button for 1 second and then release. The 52 relay of the test circuit will pick up, along with the IP "In Progress" relay of the recloser. RES. "Reset" of the LCD will come on and the LCD will count down the 12 second reset time. After the reset time, BI, LO, and IP relays will drop out and only RES. will appear on the LCD. The SLR relay is now in the reset condition.

Push the OPEN button for 1 second and then release. During the 1 second period, the following occurs:

1. The 52 relay of the test circuit drops out.
2. The BI, IP, and REC "Reclose" relays will pick up.
3. RES. of the LCD will go out and the reclose LED will come on.
4. B.I. of the LCD will come on and the LCD will start counting down the 3.6 second reclose signal time limit. (During the 1 second time period, 3 will appear for .6 second and 2 for .4 second.)

As soon as the OPEN button is released, the following occurs:

1. The 52 relay of the test circuit picks up.
2. The REC relay will drop out.
3. RES. of the LCD will come on and the reclose LED will go out.
4. The LCD will start counting down the 12 second reset time.

Before the 12 second reset time is complete, push the OPEN button for 1 second and then release. As soon as the OPEN button is pushed, the RES. of the LCD will go out, REC.1 (1st reclose) of the LCD will come on, and the LCD will start counting down the 2 second 1st reclose in .5 second intervals. When the OPEN button is released, the LCD continues to count down the 2 second 1st reclose. After the 2 second 1st reclose time, the REC relay will pick up and the reclose LED will come on. The REC relay and the reclose LED will only be on until the 52 relay of the test circuit picks up and the recloser responds to the change of state of the 52 relay. Because the pickup time for 52 is short, the reclose LED will appear to have a single blink during reclose. Now that the 52 relay is picked up, REC.1 of the LCD has gone out and RES. of the LCD has come on. At this time the recloser is counting down the 12 second reset time.

Before the 12 second reset time is complete, push the OPEN button for 1 second and then release. The recloser will now do REC.2 (2nd reclose). The 2nd reclose is similar to the 1st, except the second reclose has a time delay of 4 seconds counted down in 1 second intervals and initiates the RS "Relay Spare" relay when the 2nd reclose of 52 takes place. R.S. of the LCD will come on to indicate that the RS relay has picked up. It should be noted that the 2nd reclose is the second timed reclose and the 3rd reclose of the reclose cycle due to Instantaneous reclose being called for. With 52 picked up, the recloser is in reset and is counting down the 12 second reset time.

Before the 12 second reset time is complete, push the OPEN button for 1 second and then release. The SLR relay will now do REC.3 (3rd reclose). The 3rd reclose is similar to the first, except the third reclose has a time delay of 8 seconds, counted down in 1 second intervals. At the end of the 8 seconds, the 52 test relay will pick up and the recloser will start counting down the 12 second reset time.

Before the 12 second reset time is complete, push the OPEN button for 1 second and then release. When the recloser responds to the 52 relay of the test circuit, it will proceed to lockout with the following results:

1. The IP and RS relays will drop out and the LO relay will pick up.
2. RES. and R.S. of the LCD will go out and L.O. of the LCD will come on.

The recloser is now back in lockout condition, where the test started.

This functional test exercises most, but not all, of the electronics in the SLR relay system. In most cases it will indicate that the relay is completely functional. The 2 inputs not used in this test (DR and P), along with other settings, in most instances can be run with the same basic test setup.

## INSTALLATION

### Receiving, Handling and Storage

These relays, when not included as part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured or the adjustments disturbed.

If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed, and cause trouble in the operation of the relay.

### Case

The case is suitable for either surface or semi-flush panel mounting and an assortment of hardware is provided for either. The cover attaches to the case and has screws with provision for a sealing wire.

The case has studs or screw connections at both ends for the external connections. The electrical connections between the relay and case studs are made through spring-backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connection plug, which completes the circuit. The outer blocks, attached to the case, have the studs for the external connections, and the inner blocks have the terminals for the internal connections.

The relay electronics are mounted in a steel framework called the cradle, which is a complete unit, with all leads being terminated at the inner blocks. This cradle is held firmly in the case with a latch at the top and bottom, and by a guide pin at the back of the case. The case and cradle are so constructed that the relay cannot be inserted in the case upside down. The connection plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews, holds the connection plug in place.

To draw out the relay unit, the cover is first removed, and the plugs drawn out. The latches are then released, and the relay can be easily drawn out. To replace the relay unit, the reverse order is followed.

A separate testing plug can be inserted in place of the connecting plug to test the relay in place on the panel, either from its normal source of power or from other sources. The relay can also be withdrawn for testing, and replaced by a spare relay unit.

A photograph of the relay in its case with cover in place is shown on the cover of the instruction book. The series of photographs in Figures 17, 18 and 19 show the principal parts of the relays and their relative positions in the assembly.

### Mounting

The relay should be mounted on a vertical surface in a location reasonably free from excessive heat, moisture, dust and vibration. The relay case may be grounded, if desired, using at least #12 B&S gauge copper wire. The panel drilling for the SLR relays is shown in Figure 21.

### Connections

The internal connections for the SLR12A are shown in Figure 9, and the internal connections for the SLR12B are shown in Figure 10. All contacts are shown as they are with the relay completely de-energized (reset condition).

Shorting bars are furnished between terminals 13 and 14 and between terminals 17 and 18 to complete the circuits if the connection plug is withdrawn from the case.

On SLR12B relays, the 125 volt DC line is brought out to be used as power for the input relays through external contacts.

### Relay Removal and Insertion

#### CAUTION

The condition of the memory in an SLR12 relay depends upon where it was in the reclose cycle when its power was removed. Because of this, a reclose signal could be produced when the recloser is inserted in its case and its power restored. See **WARNING** on page 33.

When the SLR relay is removed, the normally-closed circuits are shorted in the relay case. This shorting takes place when the upper connection plug is removed.

After the SLR relay is inserted into the case, the connection plugs can be inserted in either order. The output relays will remain in their latched condition (except the reclose relay, which will remain in its de-energized condition) until the SLR relay goes through a power up sequence.

### RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken or damaged.

Should a printed circuit card become inoperative, it is recommended that this card be replaced with a spare. In most instances, the user will be anxious to return the equipment to service as soon as possible and the insertion of a spare card represents the most expeditious means of accomplishing this. It is recommended that a faulty printed circuit card be returned to the factory for repair.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of the part wanted, and give complete nameplate data, including the serial number. If possible give the General Electric Company requisition number on which the relay was furnished.



**CAUTIONS**

The SLR12A relay may misoperate if the breaker control switch contact (5-5c) shown in Figure 1 is connected across studs # 10 and #19 to avoid using another 52b contact.

Do not remove the soldered flexible connection between the printed circuit boards. Some of the protection for the CMOS is mounted on the other side of the flexible connection.

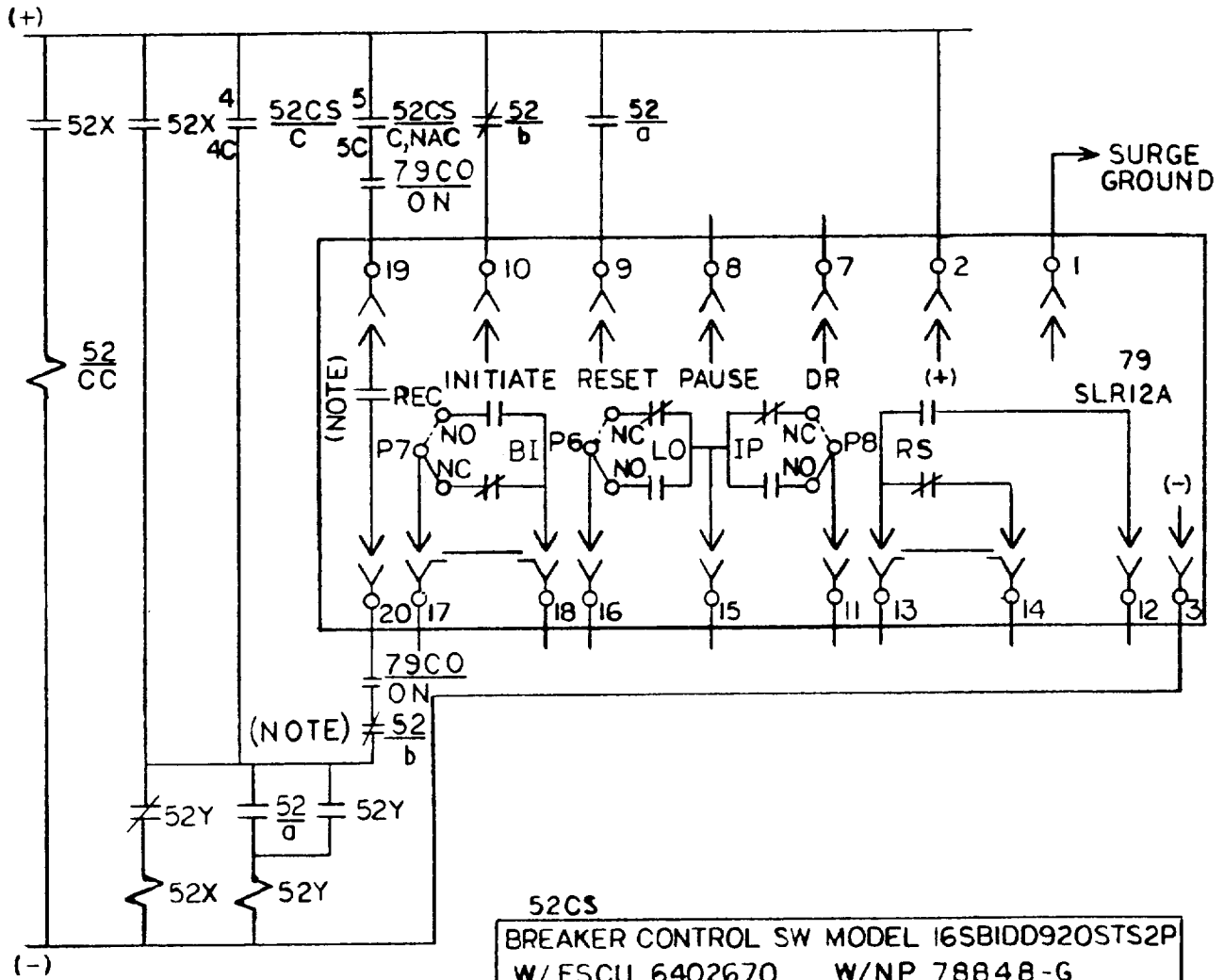
Before assembling the nameplate, place all switches in the UP position. Tighten the nameplate screws so that the switch handles clear the nameplate, then check to make sure all switches move freely.

**WARNING**

UNLIKE THE SLR11 RELAYS, THE SLR12 RELAYS CAN BE POWERED UP IN THE RECLOSE CYCLE. IF THE CIRCUIT BREAKER IT CONTROLS IS OPEN WHEN THE POWER IS RESTORED TO THE SLR12, A RECLOSE SIGNAL MAY BE PRODUCED. THEREFORE ANY TIME IT IS UNDESIRABLE FOR THE CIRCUIT BREAKER TO CLOSE, OR IF THE CIRCUIT BREAKER IS BEING WORKED ON, THE RECLOSE SIGNAL TO THE BREAKER SHOULD BE INTERRUPTED WITH A SWITCH SUCH AS THE 79C0 SHOWN IN FIGURES 1 AND 2 ON PAGES 34 AND 35. OTHERWISE, ELECTRICAL SHOCK OR SEVERE PERSONAL INJURY MAY OCCUR.

**CAUTION**

Remove ALL power from the relay before removing or inserting any of the printed-circuit boards. Failure to observe this caution may result in damage to and/or misoperation of the relay.



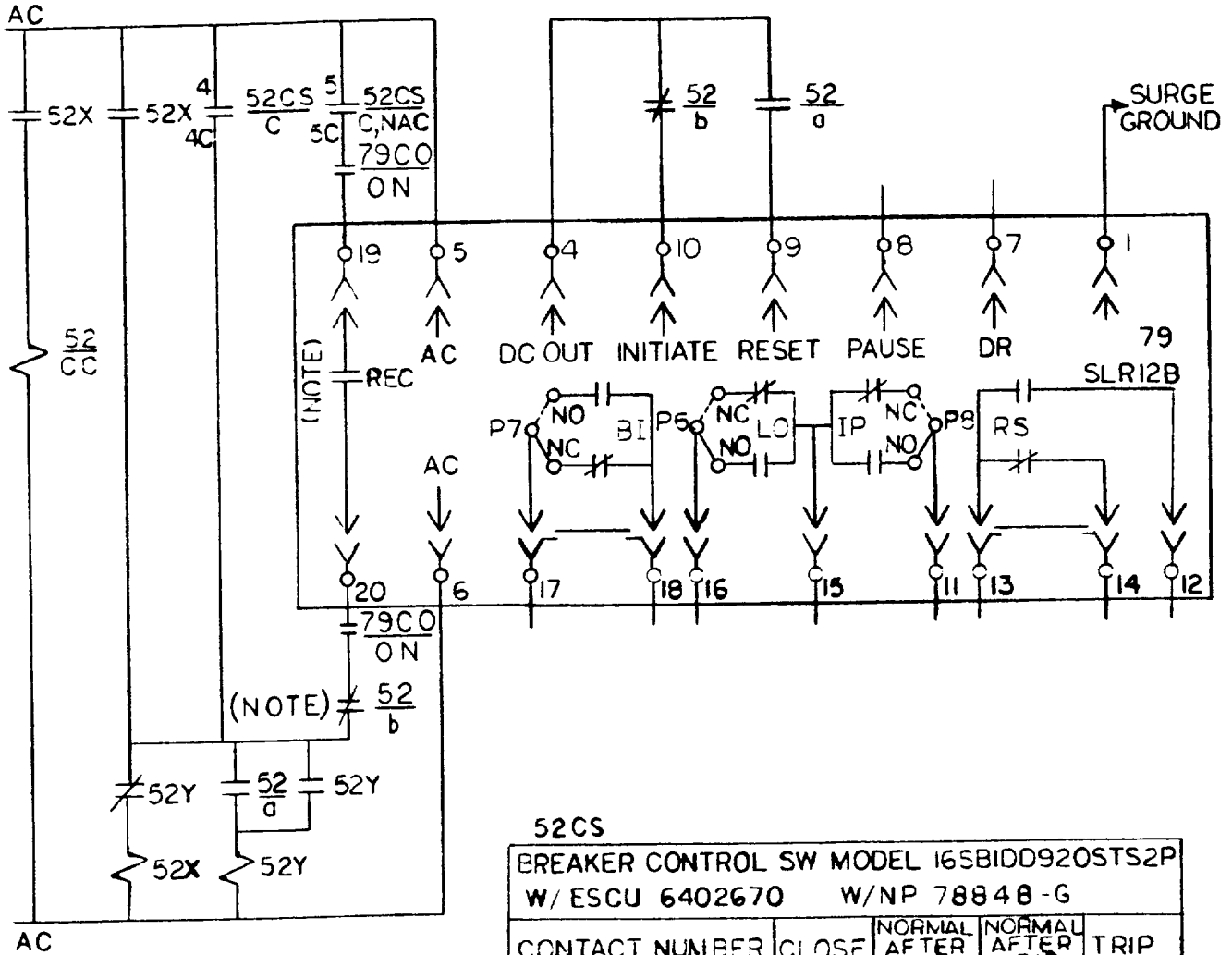
NOTE: 52/b CONTACT REQUIRED ONLY IF REC CONTACT RATING IS EXCEEDED

52CS

BREAKER CONTROL SW MODEL 16SBIDD920STS2P  
W/ ESCU 6402670 W/NP 78848-G

CONTACT NUMBER	CLOSE	NORMAL AFTER CLOSE	NORMAL AFTER TRIP	TRIP
1	2			X
3	4			X
5	6	X		
7	8	X	X	

Figure 1 - (0285A9533-1) Elementary Diagram Showing Typical External Connections to the SLR12A



NOTE: 52/b CONTACT REQUIRED ONLY IF REC CONTACT RATING IS EXCEEDED.

52CS  
BREAKER CONTROL SW MODEL 16SBIDD920STS2P  
W/ ESCU 6402670 W/NP 78848-G

CONTACT NUMBER	CLOSE	NORMAL AFTER CLOSE	NORMAL AFTER TRIP	TRIP
1 — 2				X
3 — 4		X	X	X
5 — 6	X	X		
7 — 8	X	X	X	

Figure 2 - (0285A9534-1) Elementary Diagram Showing Typical External Connections to the SLR12B

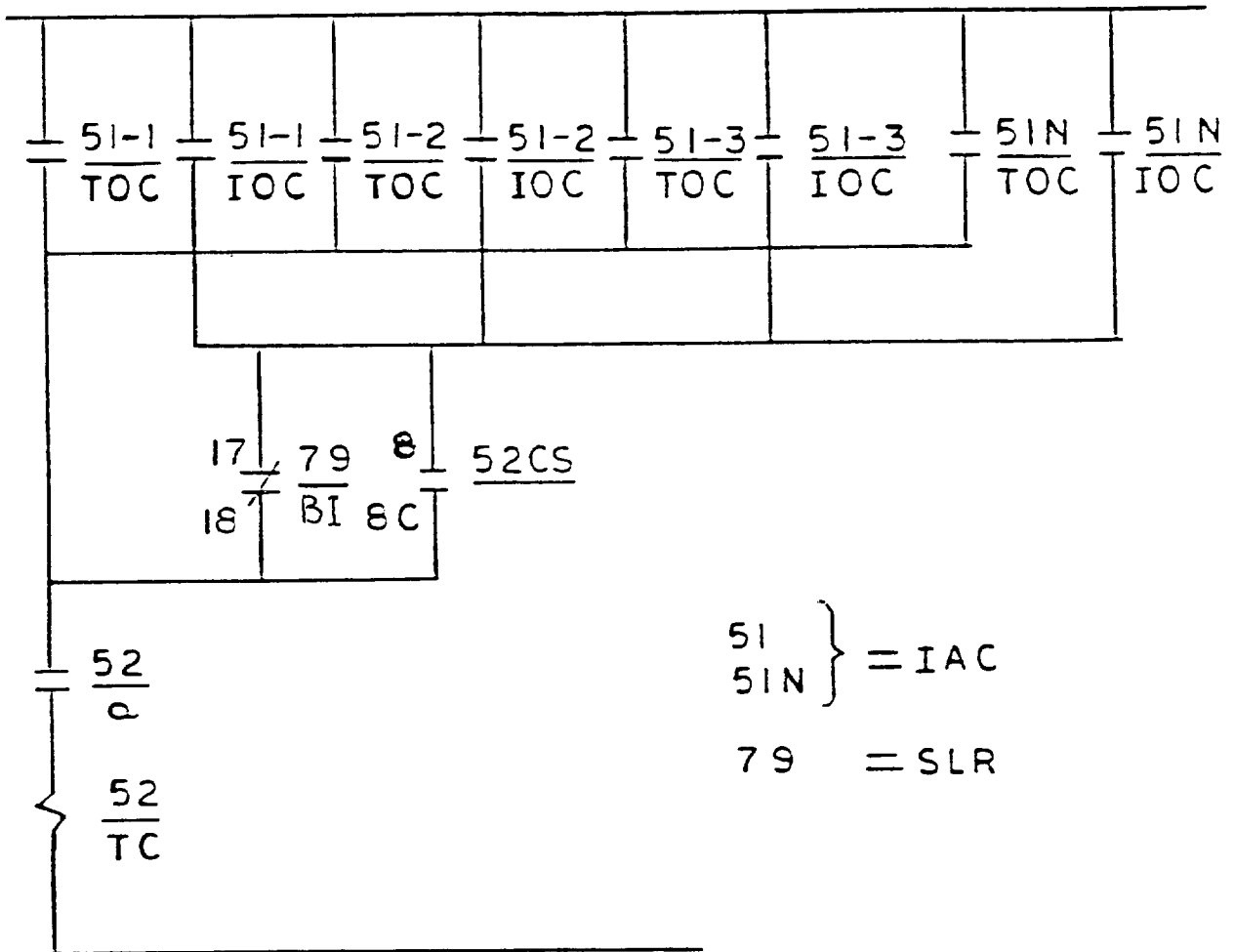


Figure 3 - (0285A6294) Use of Contact to Block Instantaneous Trip Circuit Prior to First Reclosure

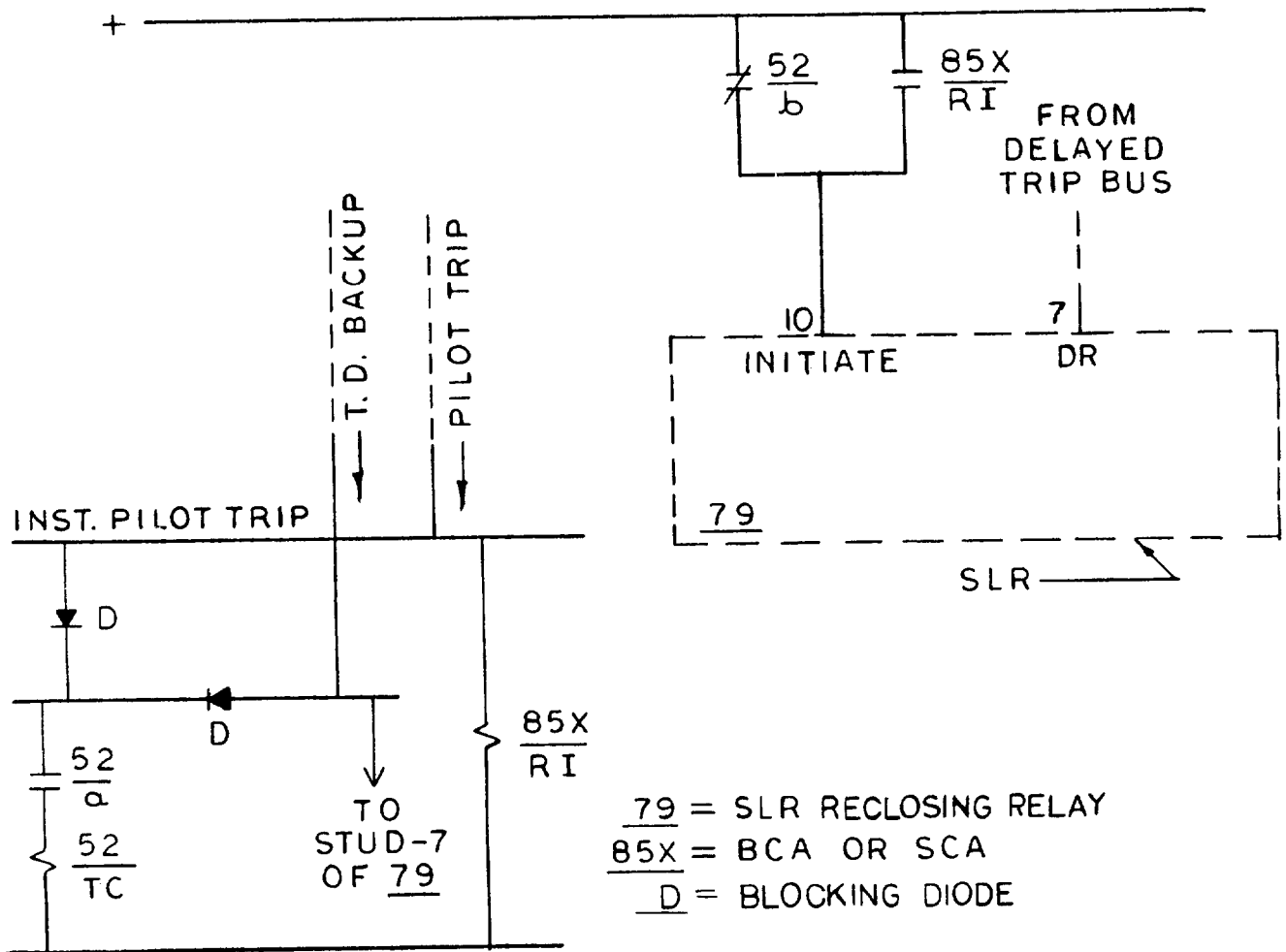


Figure 4 - (0285A6293-2) RI and Delayed Trip Diagrams

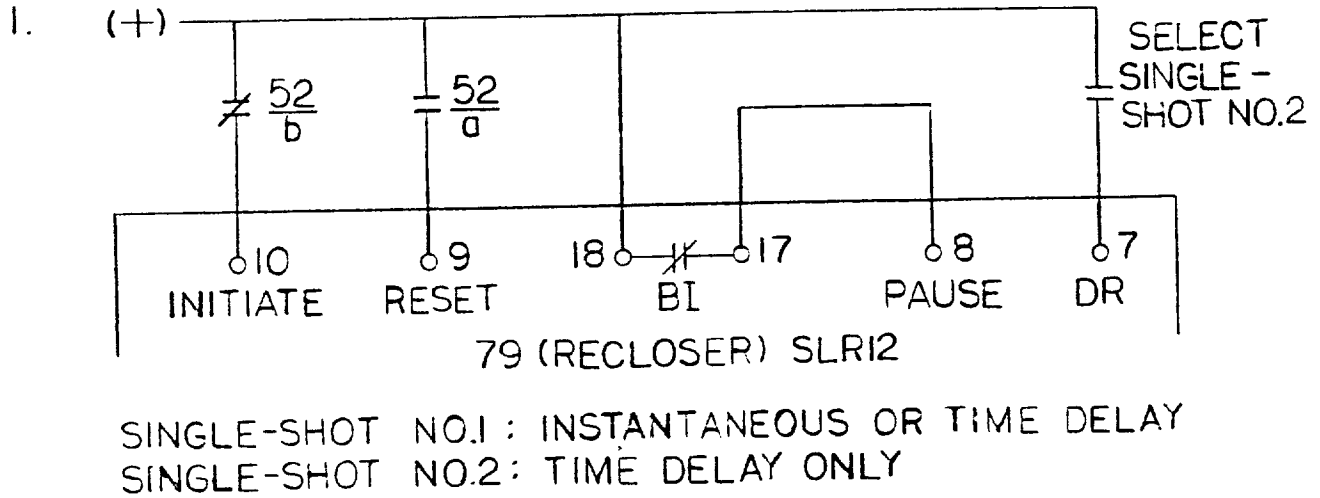


Figure 5 - (0285A9531, 1.) Connections for Two Separate Single-Shot Reclosures, Each with a Different Time Delay

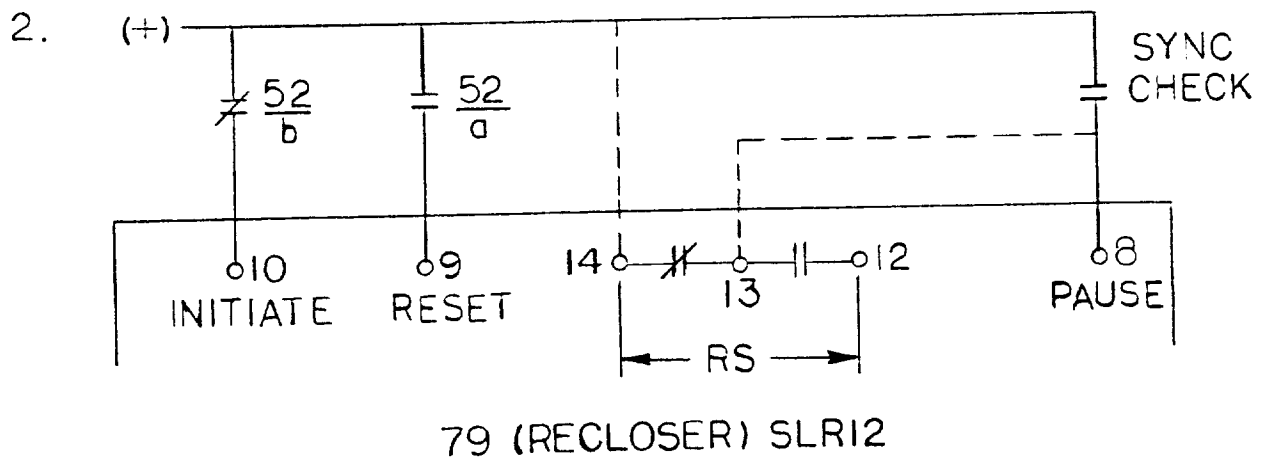
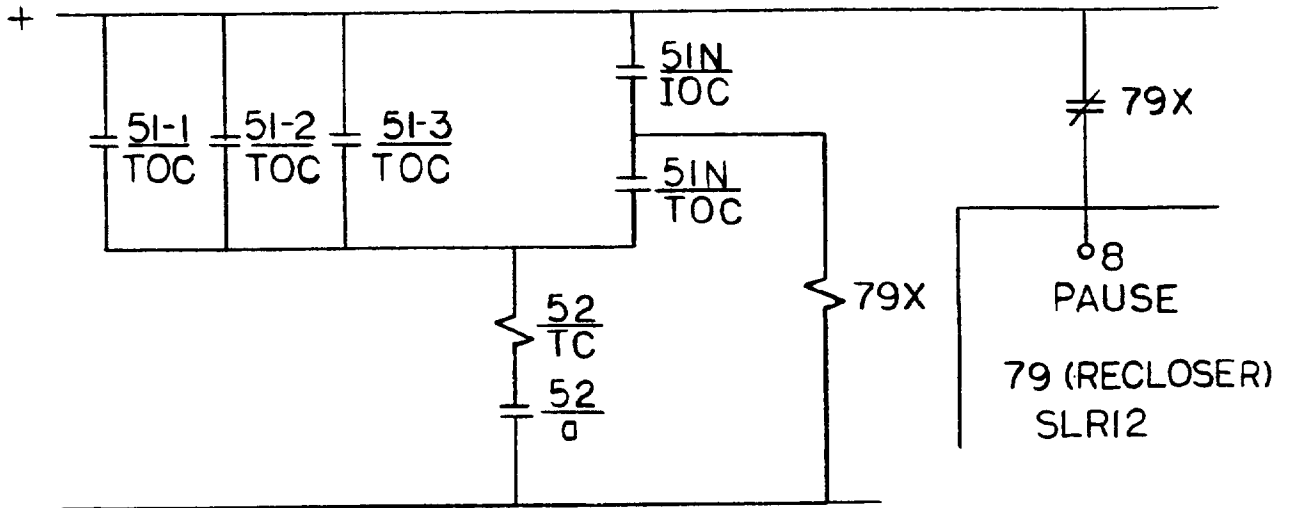


Figure 6 - (0285A9531, 2.) Connections for Synchronism Check Function

1.



TOC - TIME OVERCURRENT  
 IOC - INSTANTANEOUS OVERCURRENT

Figure 7 - (0285A9532, 1.) Delay Reset for Ground Faults

2.

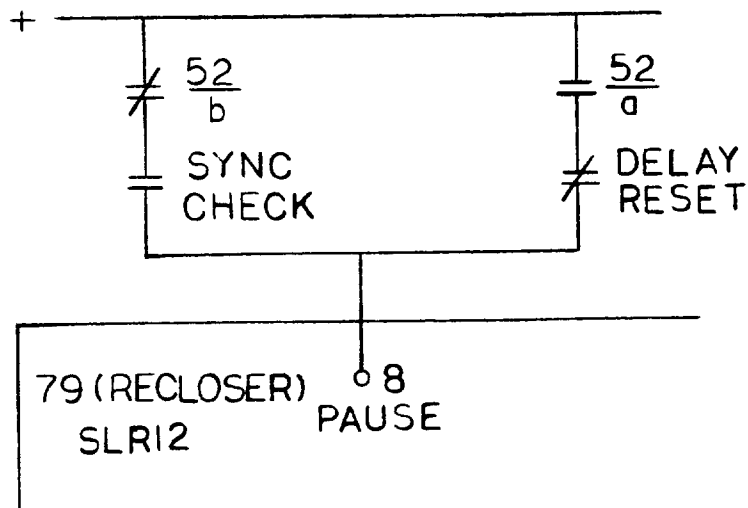
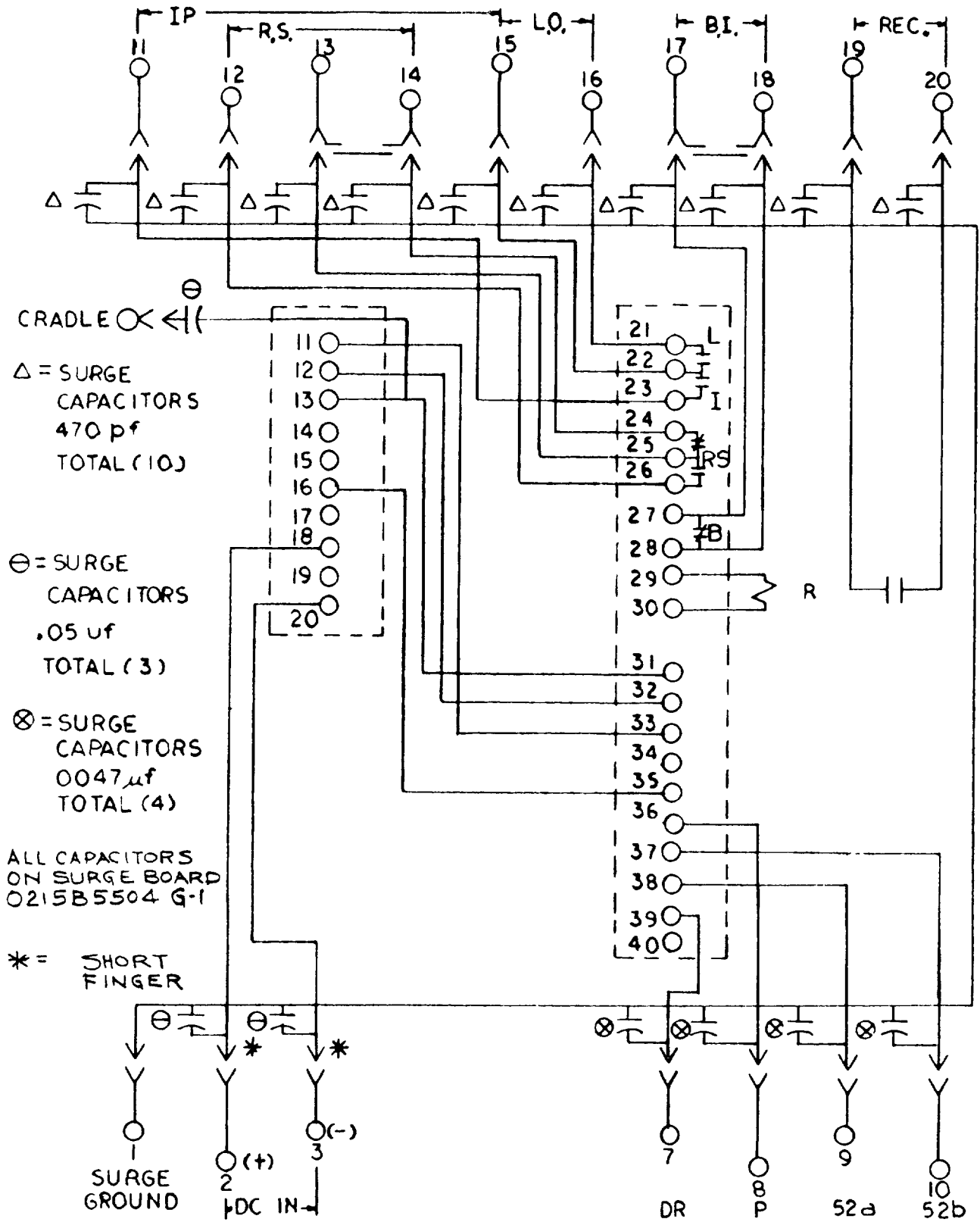


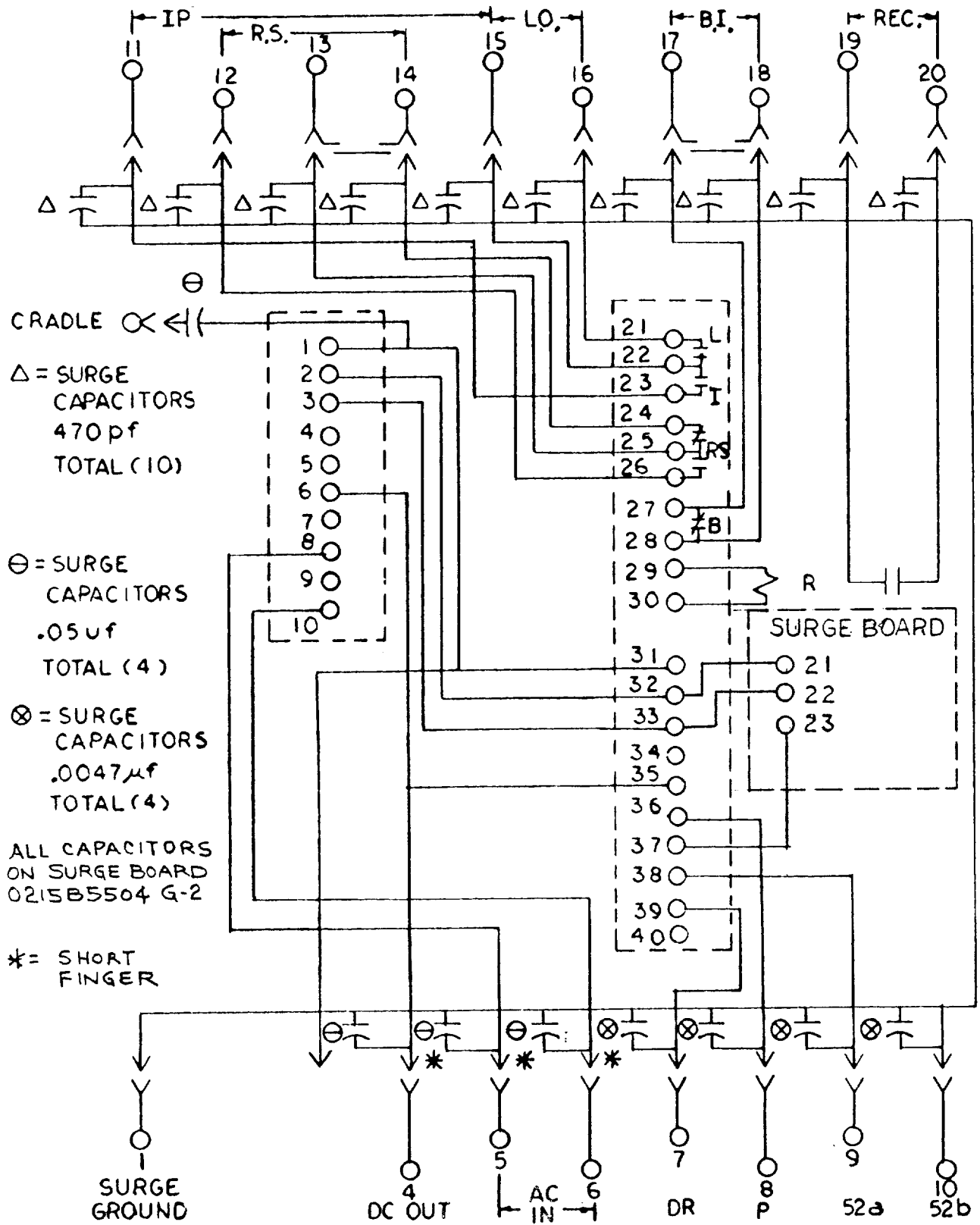
Figure 8 - (0285A9532, 2.) Pause Function - Dual Use



\*Figure 9 - (0286A1828 [1]) Internal Connections for SLR12A

\* Revised since last issue





\*Figure 10 - (0286A1829 [1]) Internal Connections for SLR12B

\* Revised since last issue

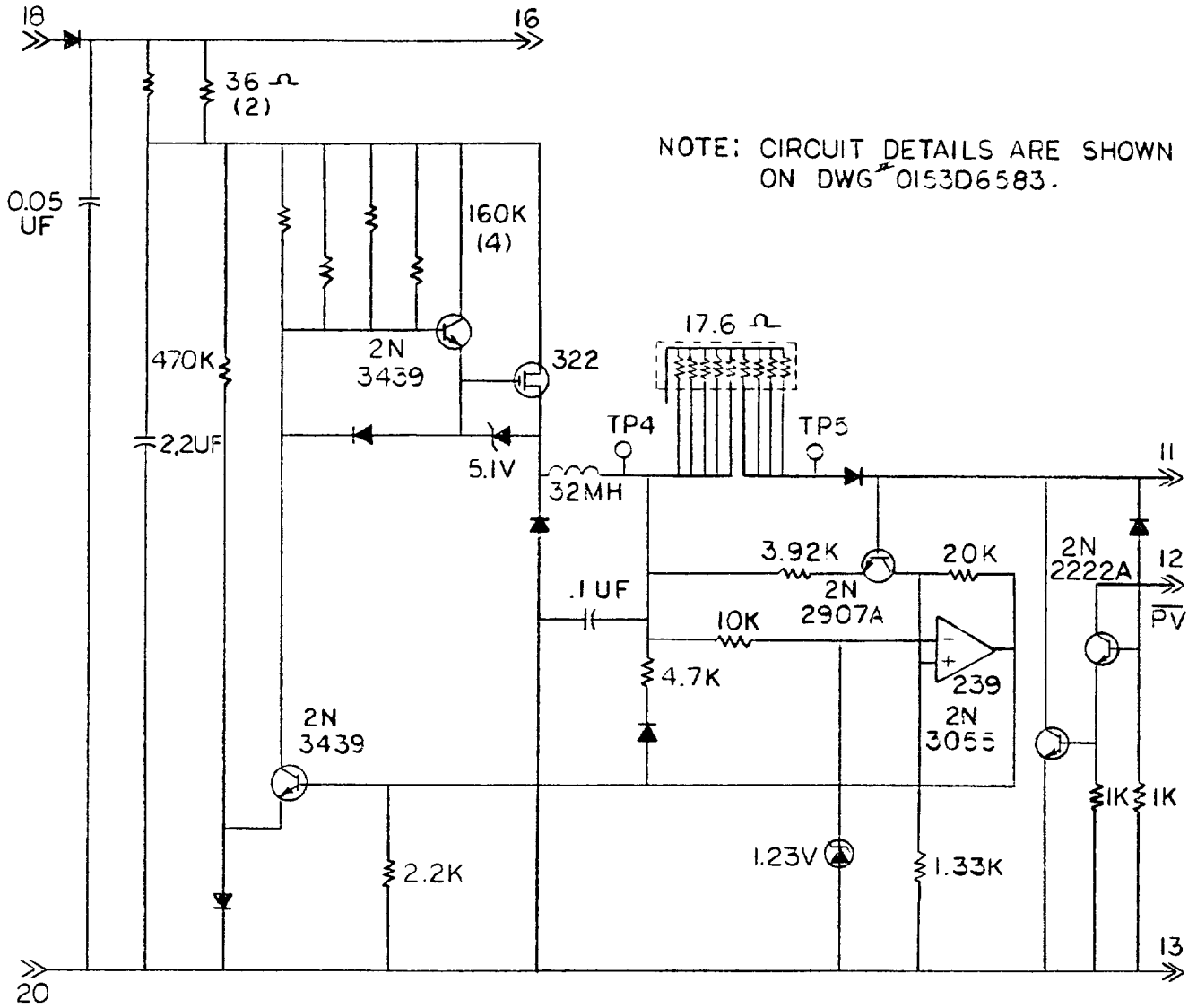


Figure 11 - (0285A9527) DC Power Supply

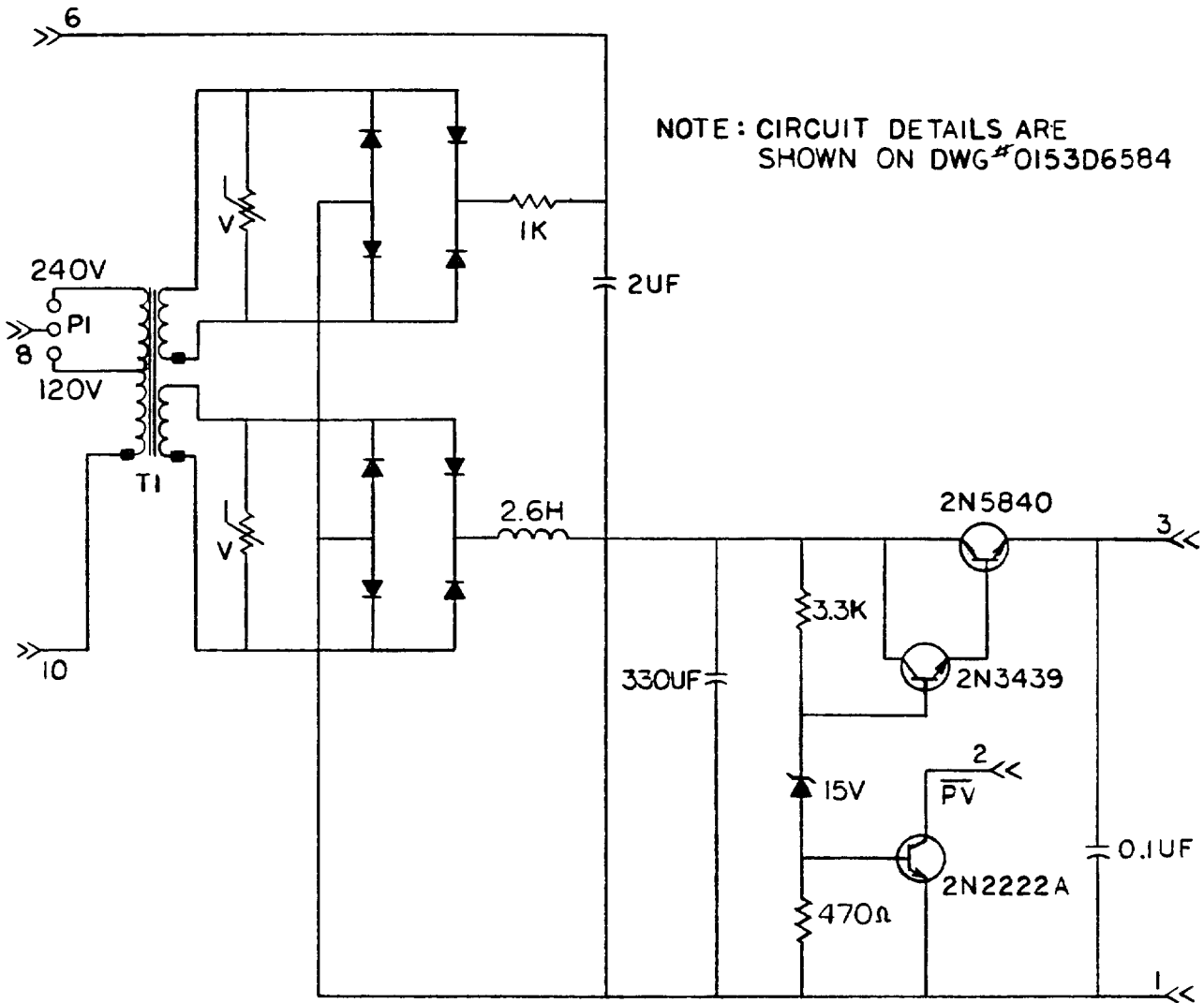


Figure 12 - (0285A9529) AC Power Supply

ENTER

**CODE**

0 0 0 0

**NUMBER**

IN

OUT

RECLOSE

POWER

	0	1	3 <sup>RD</sup>	2 <sup>ND</sup>	1 <sup>ST</sup>	INST			
RECLOSE	0	0	0	0	0	0			
FIRST	0	0	0	1	8	4	2	1	SUM.
	0	0	1	0	.4	.2	.2	.1	
SECOND	0	0	1	1	80	40	20	10	SUM.
	0	1	0	0	4	2	2	1	
THIRD	0	1	0	1	80	40	20	10	SUM.
	0	1	1	0	4	2	2	1	
RESET	0	1	1	1	80	40	20	10	SUM.
	1	0	0	0	4	2	2	1	
TIME MULTIPLIER	1	0	0	1	4	2	1	.5	
PAUSE	1	0	1	0	1024	64	4	0	SUM.
	1	0	1	1	∞	256	16	1	
DROP OUT	1	1	0	0	1	24	12	6	
PICK UP	1	1	0	1	4	2	1	0	
RS	1	1	1	0					
OPERATE	1	1	1	1					

TIME IN SECONDS

3<sup>RD</sup> 2<sup>ND</sup> 1<sup>ST</sup> INST

BI RS IP LO

LATCH

SELECT ONE

**TEST**

**READ**

**GENERAL ELECTRIC**

**STATIC RECLOSING RELAY**

MODEL 12SLR12B1A

120/240 AC VOLTS      50/60 HZ

INSTRUCTION BOOK GEK-86653

PART BULLETIN GEF-6003

NP 0285A8836
MALVERN, PA.
MADE IN U.S.A.

1 A 2 1

1 B 2

Figure 13 - (0285A8836) Nameplate

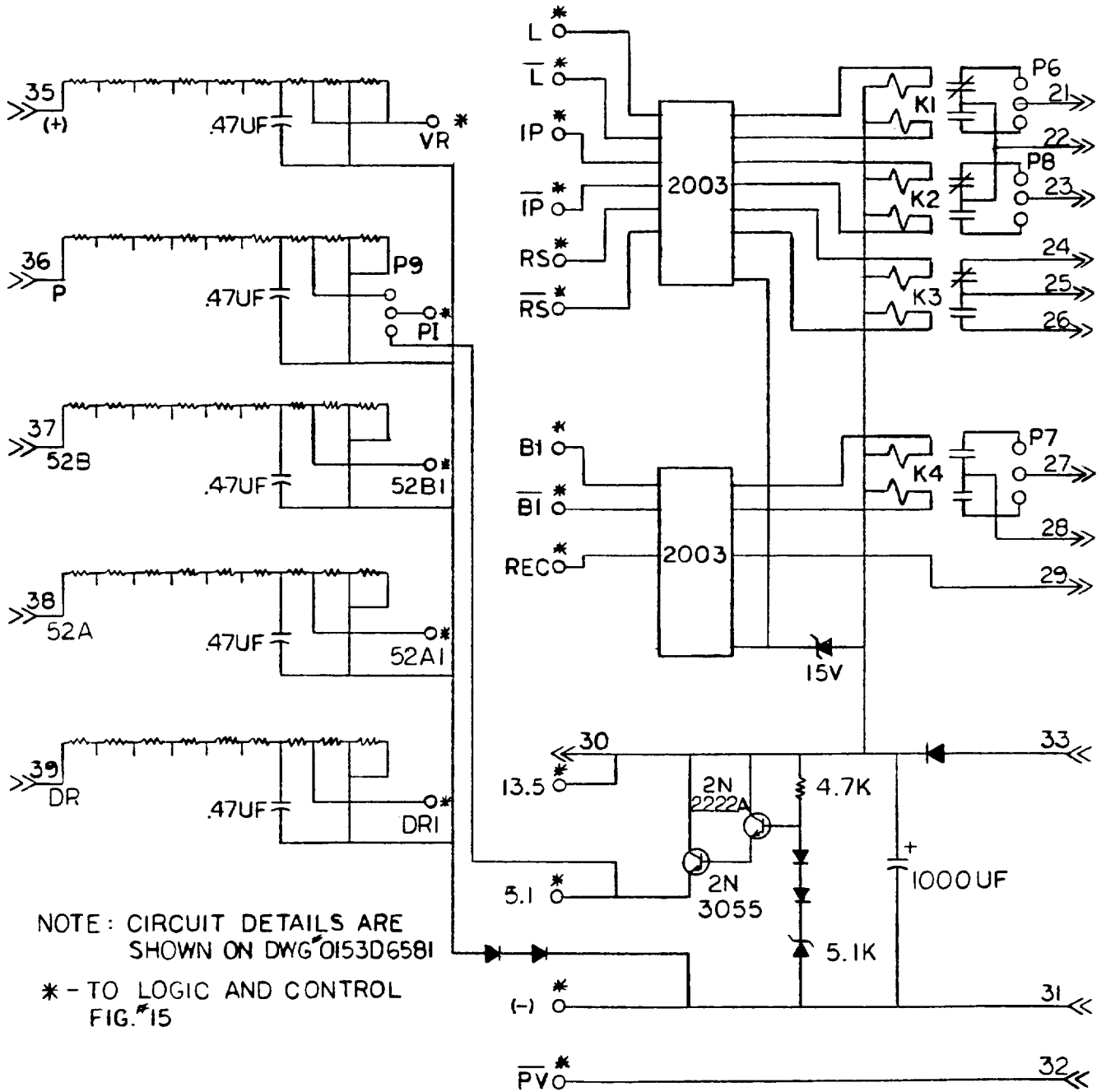
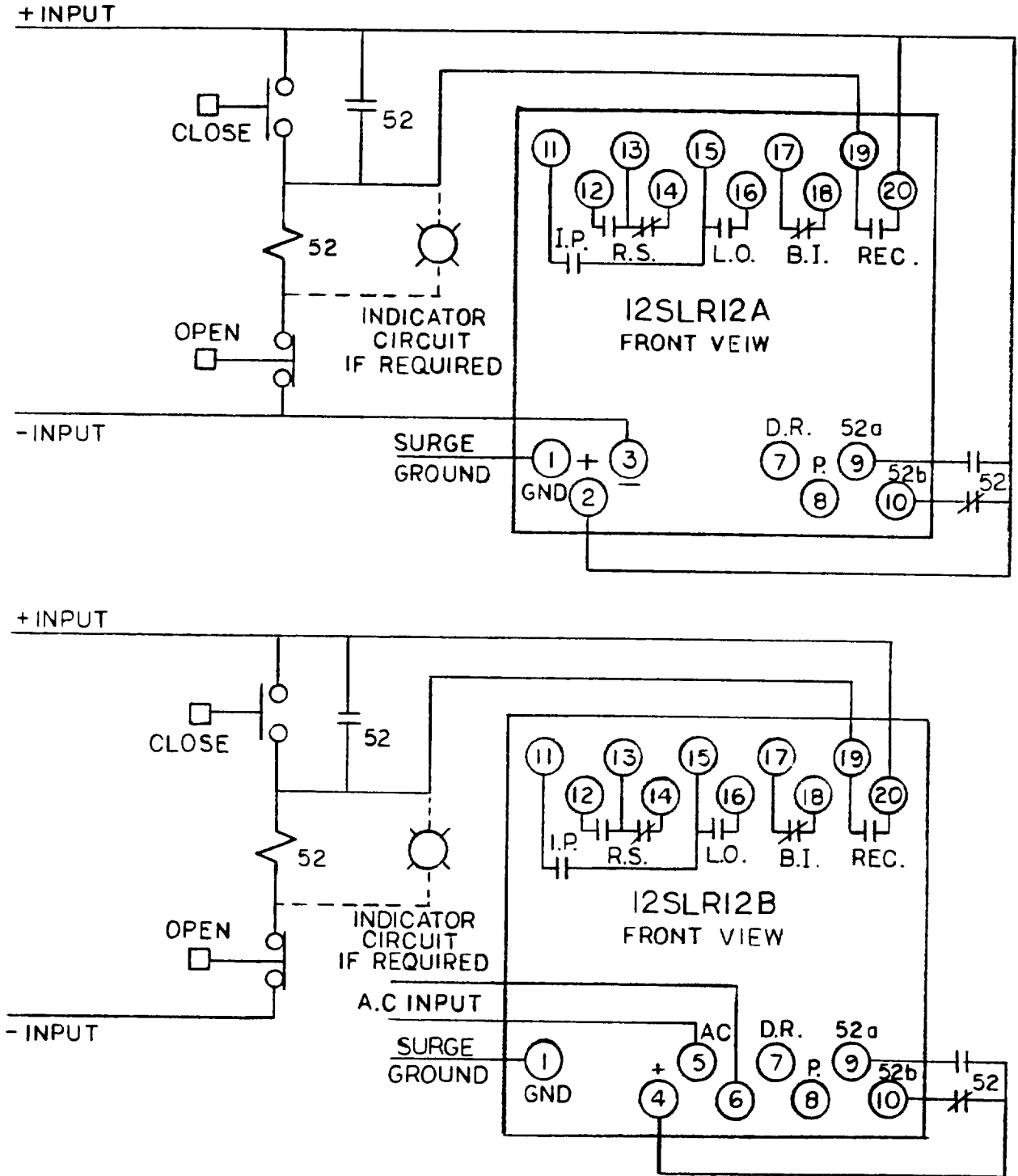


Figure 14 - (0285A9528) Relay and Power Supply





NOTE: THE SWITCHES ON THE ABOVE CIRCUITS ARE MOMENTARY.  
 THE 52 RELAY COIL SHOULD BE RATED FOR THE INPUT VOLTAGE.

Figure 16 - (0285A9530) Functional Test Diagrams

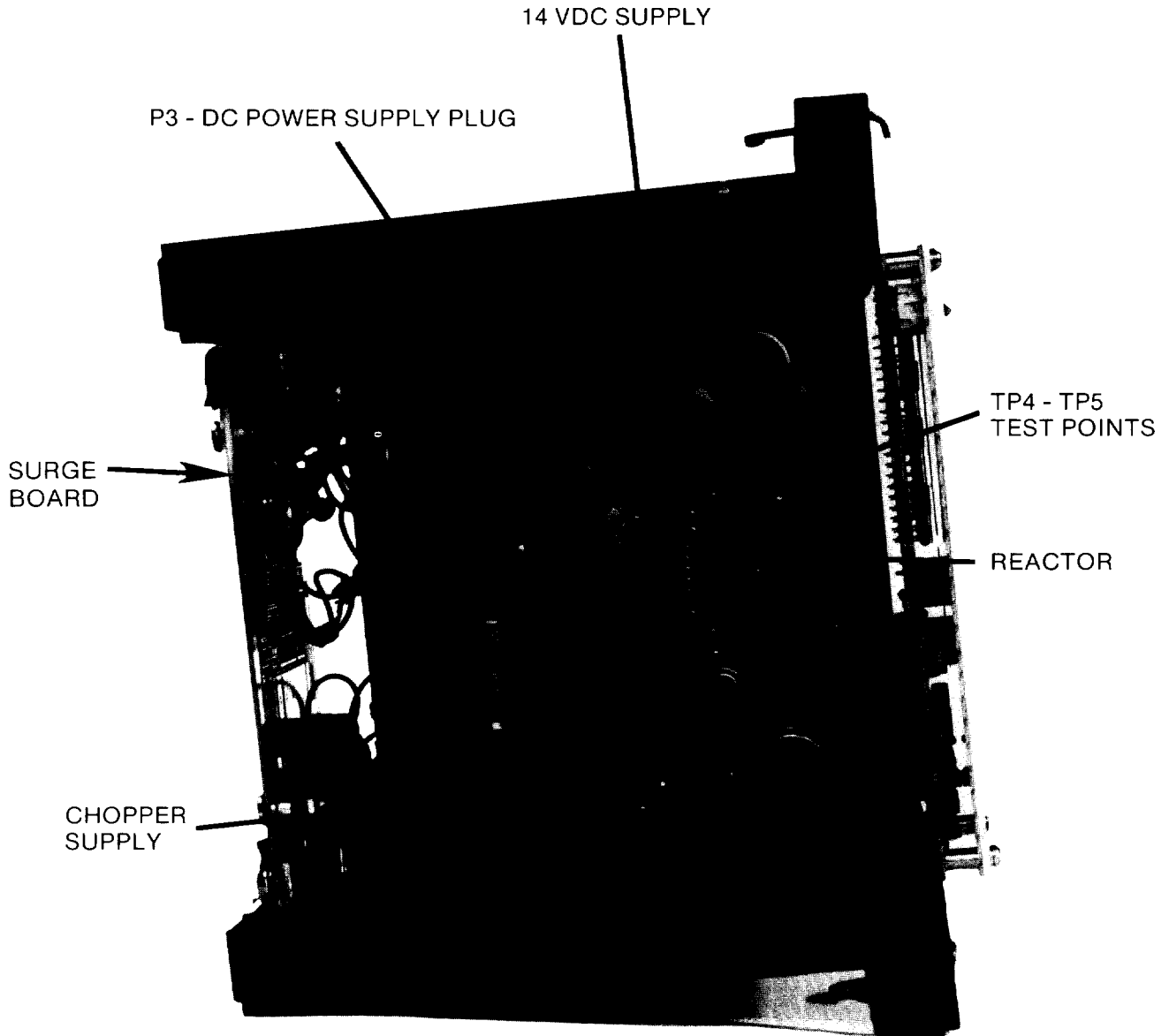


Figure 17 - (8043814) SLR12A Relay, Side View (Power Supply)



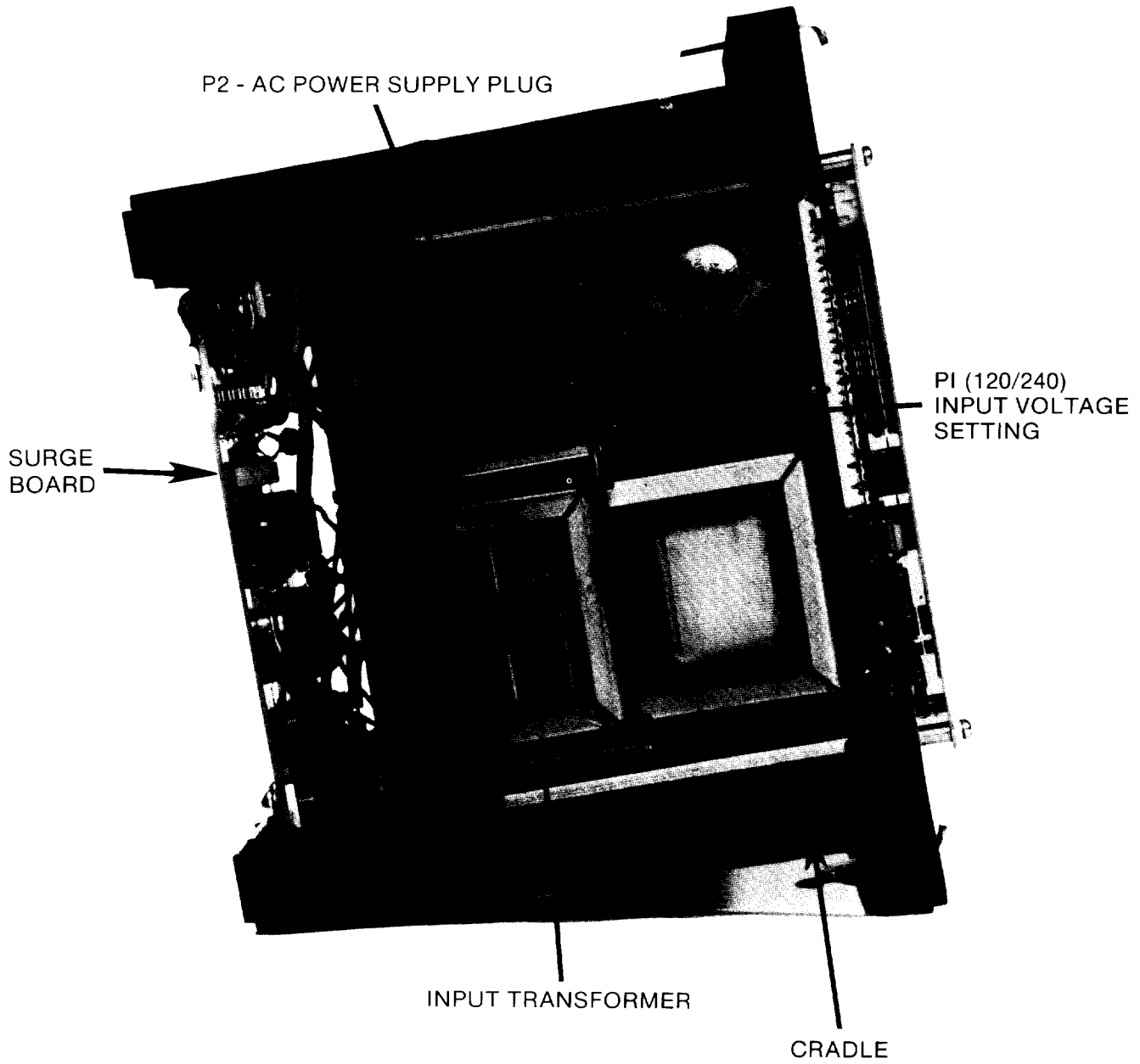


Figure 18 - (8043815) SLR12B Relay, Side View (Power Supply)

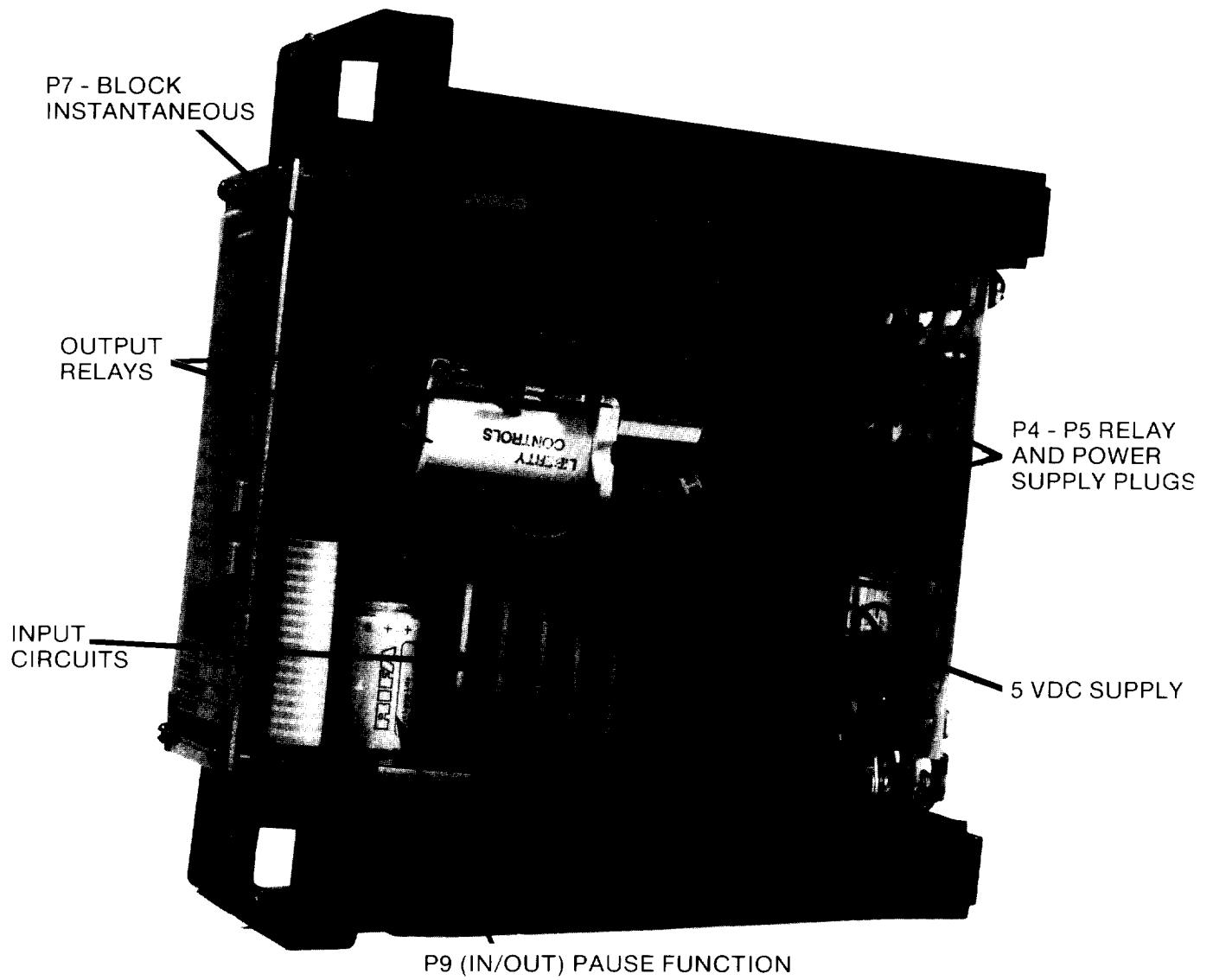


Figure 19 - (8043816) SLR12 Relay, Side View (Relay and Power Supply)

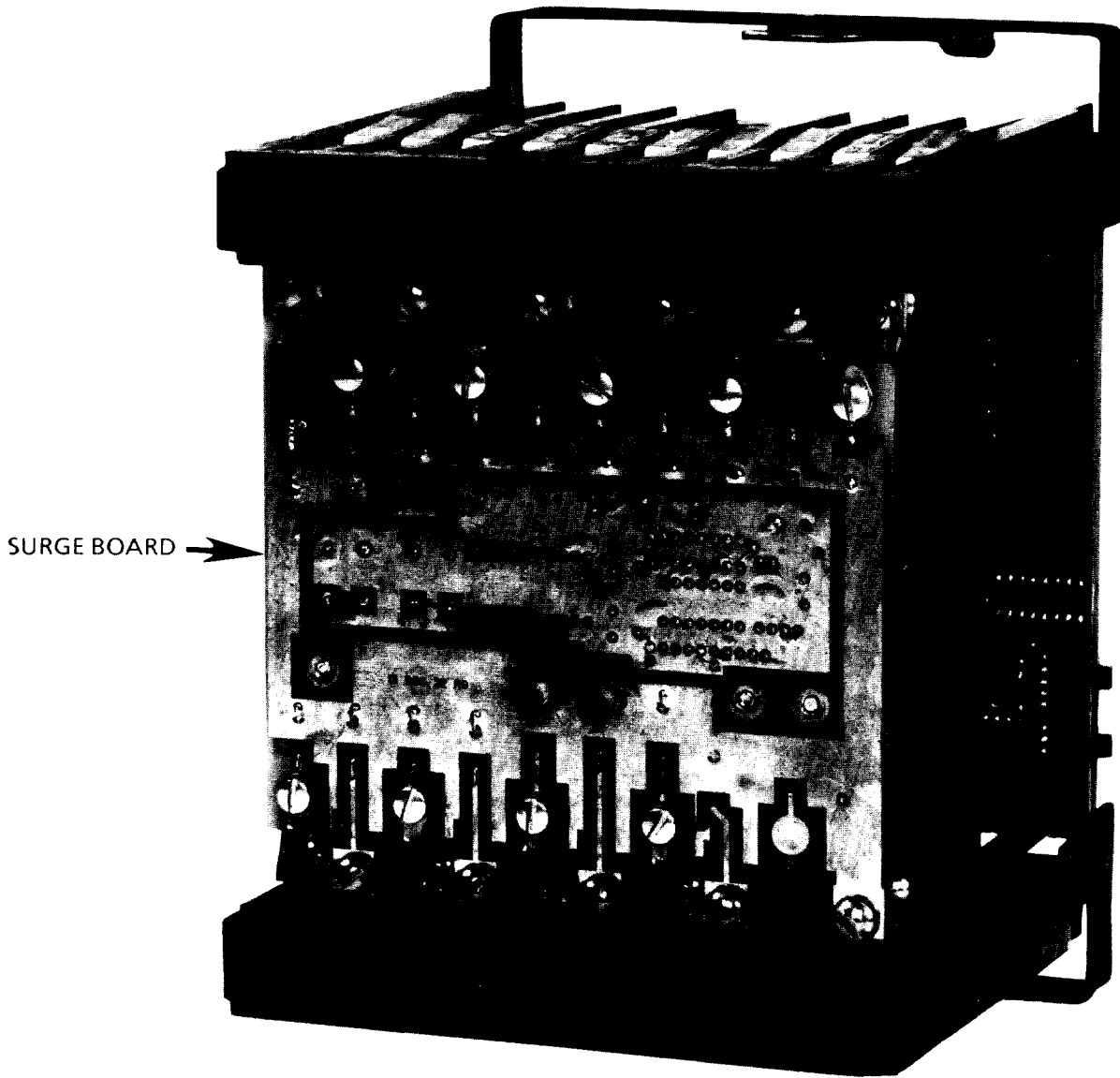
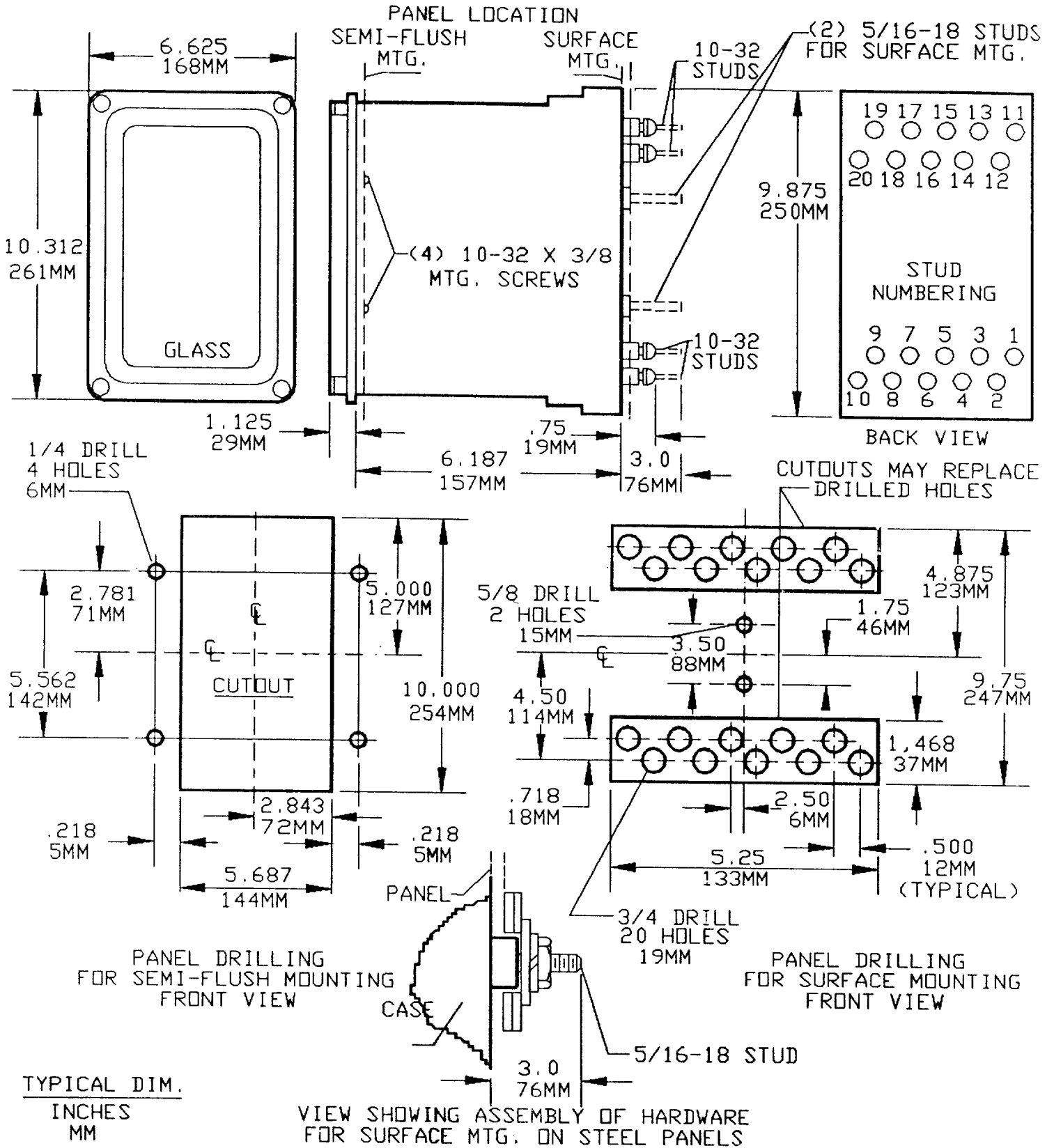


Figure 20 - (8043817) SLR12 Rear View (Surge Board)



\*Figure 21 - (006209272 [7]) Outline and Panel Drilling Dimensions for SLR Relay

\* Revised since last issue

(2/92) (1000) GENERAL ELECTRIC METER AND CONTROL BUSINESS DEPT., MALVERN, PA 19355