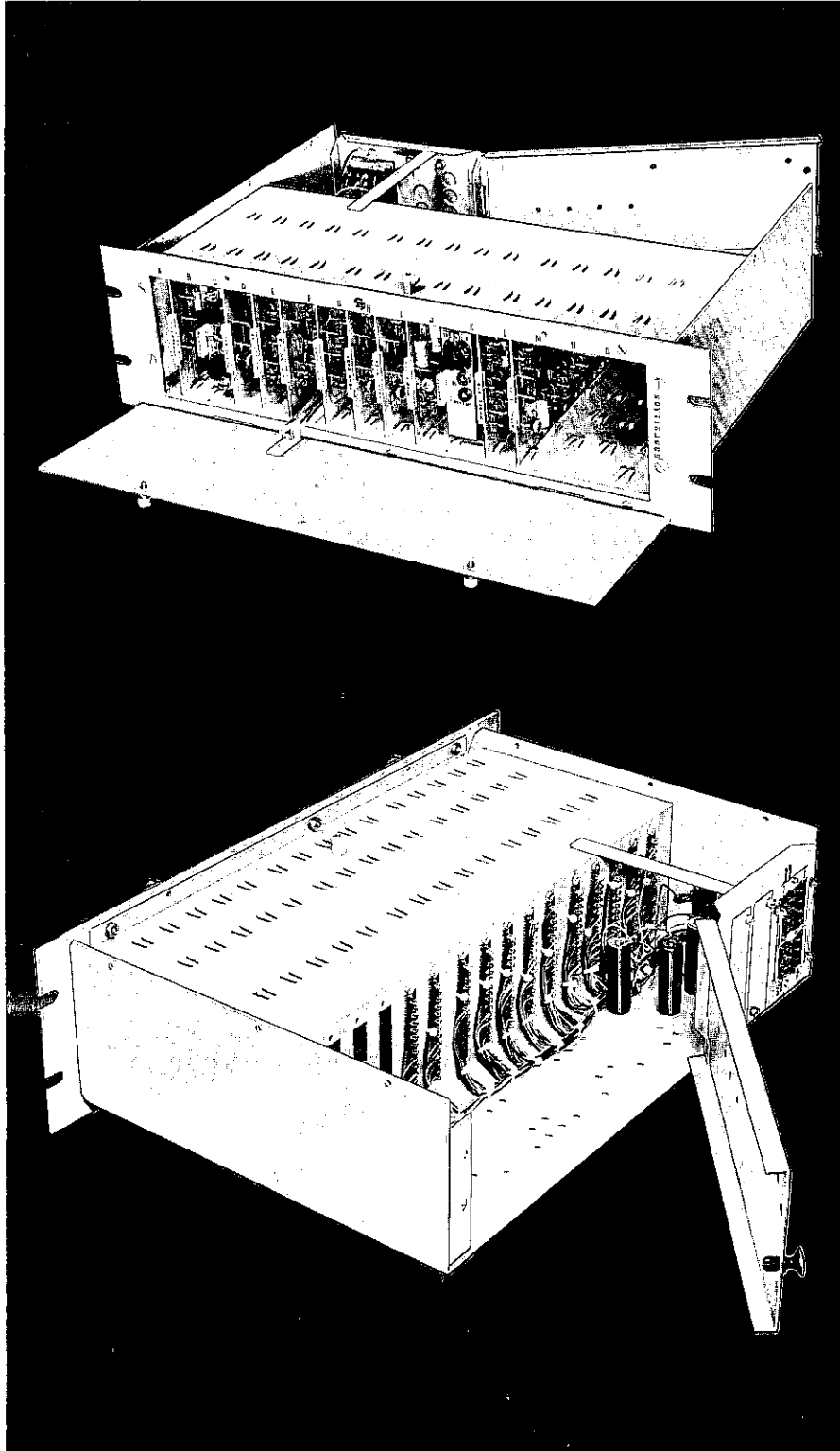


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## SKAU-3 Channel Auxiliary Blocking Relay



### Function

The type SKAU-3 relay is a solid-state auxiliary relay utilized in directional comparison blocking systems. This relay will prevent tripping for faults external to the protected line section to which it is applied, and allow high-speed simultaneous tripping for internal faults. It responds to inputs indicative of fault direction, distance and power thereby controlling the transmission of a blocking signal for an external fault or high speed tripping for an internal fault.

### Features

1. The SKAU-3 relay may be applied to two or multi-terminal lines. If all terminals do not have strong feed and high speed tripping is required at all terminals, the SKAU-3 weak feed option must be applied.
2. A weak feed option permits the relay to be used at terminals that do not deliver a meaningful amount of fault current.
3. A manual checkback option is available within the relay (not a separate device). The checkback permits a check of all the remote SKAU-3 terminals and channels from one location.
4. The solid state directional comparison blocking system terminal which utilize the SKAU-3 relay can be compatible with an electromechanical relay terminal at the remote end.

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**Construction**

The type SKAU-3 relay is mounted on a 19 inch wide panel 5 1/4 inches high (3 rack units) with edge slots for mounting on a standard relay rack or panel. A hinged, removable door on the front of the relay chassis covers the printed circuit boards.

The printed circuit boards slide into position in slotted guides and engage a terminal block at the rear of the compartment. Each board and terminal block is keyed to avoid accidentally inserting the board into the wrong slot location. The circuit boards may be removed for use with a printed circuit board extender (Style number 849A534G01) which permits access to the board's test points and terminals for making measurements while the relay is energized.

The relay contains eight (8) printed circuit boards for the basic system, two (2) additional if the checkback option is used, and two (2) more with the weak feed option.

The rear panel includes a hinged door which may be opened to expose the relay harness wiring and the four (4) power supply resistors.

**Printed Circuit Boards****A Power Supply Board****B Protective Relay Interface Board**

Contains the buffered interface logic for the phase and ground tripping relays and the overcurrent supervising relays.

**C Loss of ac Potential Board**

Contains a 500/500 ms. time delay and a buffered input and output. If an input to this timer is obtained, as for an ac potential fuse failure, then 500 ms. later a voltage output will be present.

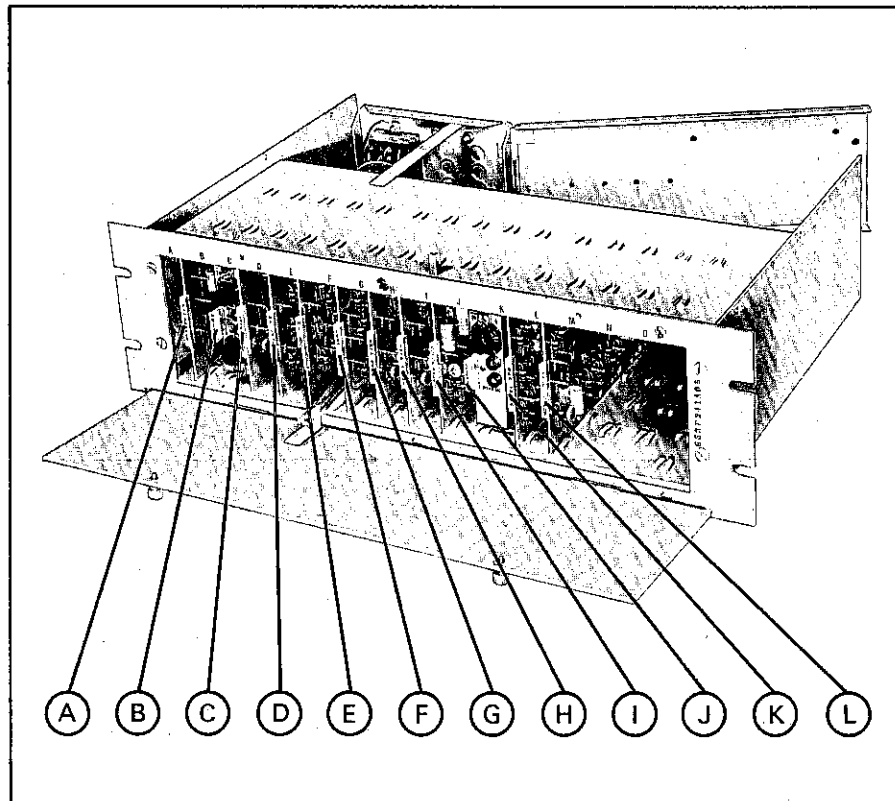
A link on this board may be removed to prevent block of trip due to an output from this timer.

**D Weak Feed Logic 1 Board**

Contains logic and timing for only those SKAU-3 relays with the weak feed option. Primarily, the purpose of this logic is to determine if a weak feed trip is required, or it is to be blocked.

**E Weak Feed Logic 2 Board**

Also only used in those SKAU-3 relays with the weak feed option. The primary purpose of this board is to block a trip output at the weak feed terminal when bus potentials are used and the supply breaker



is open and the under-voltage relay is operated, and to block tripping at remote terminals when energizing a faulted bus.

**F Receiver Interface Board**

Contains the buffered channel interface inputs, buffered channel output, and appropriate AND and OR logic for initiation of transient blocking.

**G Transmitter Stop Control Board**

Buffered inputs for a high set overcurrent unit, a spare input and a ground relay, and a buffered output for transmitter stop are included on this board.

**H Transmitter Start Control Board**

Buffered inputs for an overcurrent unit 50 ( $I_{os}$ ), carrier start unit 21S and a test switch for checkback, and a buffered output for transmitter start are included on this board.

**I Checkback Board**

Contains logic and timing only for those

relays equipped with the checkback option. One buffered input for a test switch, a flip flop for locking out a station after it checkedback, and various control logic.

**J Checkback 2 Board**

A front adjustable 5 to 10 second timer which is the check-in time of the checkback scheme is contained on this board. The output of this timer starts transmitter keying. The transmitter will remain keyed for approximately 2.5 seconds after an input to the timer is lost.

**K Block/Unblock Control Board**

This board contains logic and timers for the control of the transient blocking and unblocking 18/18 timer on the TRIP OUTPUT board.

**L Trip Output Board**

Contains the final logic and timing of the relay. This board utilizes the intelligence supplied to it by the P.R. INTR. board for tripping or the BLK/UNBLK board for either transient blocking or unblocking.

## SKAU-3 Channel Auxiliary Blocking Relay

### Operation

#### Internal Fault

For an internal fault either the ground protective relay (21NP or 67N) or the phase protective relay (21P) and the 50 ( $I_a/I_c$ ) overcurrent unit will operate and the start timing either one or both of the 2-20/0 ms timers on the Protective Relay Interface Board.

With a pilot trip signal, the 18/18 ms transient blocking timer is stopped, and an input is applied to the XMTR STOP CONTROL board to insure that there is no keying.

#### External Fault – Reverse

For a reverse external fault, the reverse reaching relays 21S or the overcurrent relay 50 ( $I_{os}$ ) will operate to start keying the local transmitter. This keyed signal will be received at the remote end causing it to block.

Transient blocking is established to insure against any misoperation due to fault power flow reversals caused by unequal breaker reclosing times on parallel lines. The 1000 ms reset time of the 0/1000 ms timer holds transient blocking intact to prevent misoperation during adjacent line high speed sequential closing.

#### External Fault – Forward

For a forward external fault, the overreaching tripping relays which saw the internal fault may see the external fault. If they do see the fault then the remote reverse reaching relays 21S or 50 ( $I_{os}$ ) will see the fault since they reach farther than the tripping relays. This will cause the remote transmitter to key, which will block both AND's on the PR. Relay Interface Board, thus no pilot trip output will appear.

If the forward reach tripping relay sees the external fault, then a transmitter stop signal together with the CH. BLOCK signal will satisfy the upper AND on the RECEIVER INTERFACE board to initiate transient blocking as for the reverse external fault.

#### Sequential Fault

Occasionally an external fault will be followed by an internal fault before the former is cleared. In order to prevent a long delay in clearing a sequential fault, 18 millisecond transient unblocking time is provided. Although transient blocking has been initiated by the external fault, the presence of an internal fault will stop signal transmission at the remote end to remove the CH. BLOCK input at the local terminals.

### Channel Transmitter Control

Two separate transmitter control buffered outputs are provided: one for transmitter start, the other for transmitter stop. Within the transmitter, stop must have priority over start.

Transmitter start is controlled by the reverse reaching relays 21S or 50 ( $I_{os}$ ), in order to send a signal to the remote terminal indicating an external fault. The 0/10 ms timer and the XMTR START CONTROL board is used to continue blocking for relay reset coordination to take care of any condition where transient blocking has not had a chance to set up. Transmitter start will initiate transient block timing provided there is no transmitter stop signal. There is also provision on the XMTR START CONTROL board for starting the transmitter with either a test switch test (CBI) or with the output of the checkback circuit. The transmitter is stopped for an internal fault condition. Operation of a phase (21P), ground (21NP or 67N ( $Z \times I_{os}$ )) or high set overcurrent 50 ( $I_H$ ) unit will stop keying. The 21NP/67N unit is supervised externally by  $I_{os}$  to stop keying and prevent  $I_{os}$  block of trip for a low current internal fault. When a pilot trip occurs, its output will hold keying stopped, and after both the pilot trip and 50 ( $I_H$ ) signals are removed, keying will remain squelched for another 150 ms.

### Loss of ac Potential

Since tripping of circuit breakers is undesirable for loss of ac potential as for fuse failure, the SKAU-3 relay provides a voltage output and optional block of tripping for this situation. This is accomplished by the 500/500 ms. timer on the LOSS OF AC POTENTIAL board. When loss of potential condition has cleared, the 500/500 ms. timer will reset in 500 ms. to remove the block of trip.

### Channel Checkback

The SKAU-3 contains provision for optional checkback. This feature allows an operator to check his local carrier transmitter, one or more remote receivers operating on the same frequency, the remote transmitters (one at a time) and the local receiver.

The sequence is begun by moving the TK switch on the Functional Test Unit (FTAU) to CHECKBACK INITIATE (CBI). This causes the local CHECKBACK to be locked out, and begins transmission of carrier. At the remote terminal (s), carrier reception for 2 seconds or more commits the system to retransmission.

After more than 2 seconds CBI is restored to NORMAL. Loss of transmission for the preset interval of 5 to 10 seconds causes the SKAU-3 with the lowest time setting to retransmit for 2.5 seconds and lockout. If there is more than one remote station, each will report in turn. By observing the carrier level indicator deflections the behavior of the entire carrier system can be observed.

### Characteristics

#### Control Voltage:

48 Vdc (42 to 58 volts) or 125 Vdc (105 to 140 volts)

#### Current Drain:

nominal=70 MA  
maximum=130 MA

Either the weak feed or checkback option adds 20 MA drain

#### Temperature Range:

20°C to +55°C around chassis

#### Inputs:

48/125 Vdc control voltage buffered  
49 V. – 1.5 MA max. current  
125 V. – 2.5 MA max. current  
All other inputs – 15 to 25 Vdc buffered  
2 MA max. current

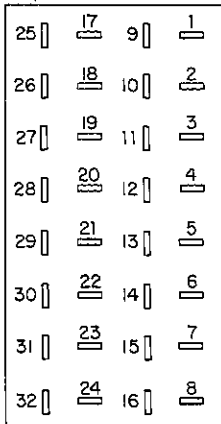
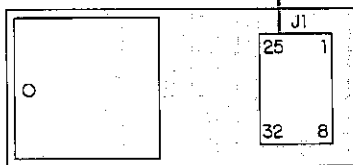
#### Outputs:

15 to 20 Vdc buffered  
10 MA max. current

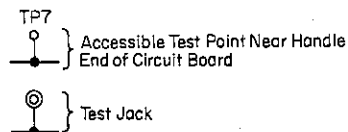
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## Type SKAU-3 Directional Comparison Blocking Relay

Connector J1  
(as Viewed from Rear of Relay)

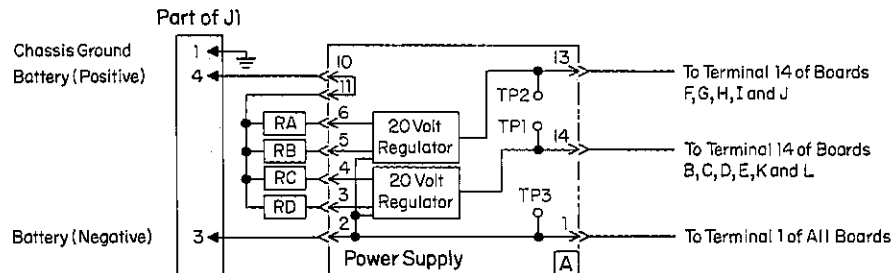
Rear View of Relay



## Notes:

- (A) Symbols "O" and "I" Represent The Logic Voltage States for The Energized, Reset Conditions.
- (B) Relay Styles Available Without Check back Option (Board Slots I and J).
- (C) Remove Link on Loss of Potential Board (Slot C) to Prevent Block of Trip Due to Loss of Potential.

Power Supply Resistors Volt	RA and RC	RB and RD
48 Vdc	150 Ohms D-1267272	1800 Ohms S-1201004
125 Vdc	900 Ohms S-1267287	5000 Ohms S-1205214

50(I<sub>A</sub>/I<sub>C</sub>)

21P

2INP(ZX I<sub>O</sub>) or  
67N(DX I<sub>O</sub>)

Loss of Potential

Channel Receiver  
Outputs { Noise Block  
Channel Block

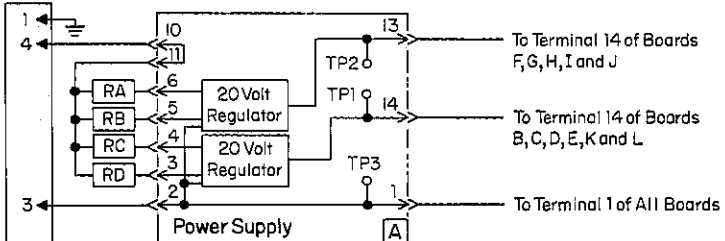
Test (FOR)

2INP(ZX I<sub>OS</sub>) or  
67N(DX I<sub>OS</sub>)Spare  
50(I<sub>M</sub>)

Test (CBT)

50(I<sub>OS</sub>)  
2IS

Part of J1



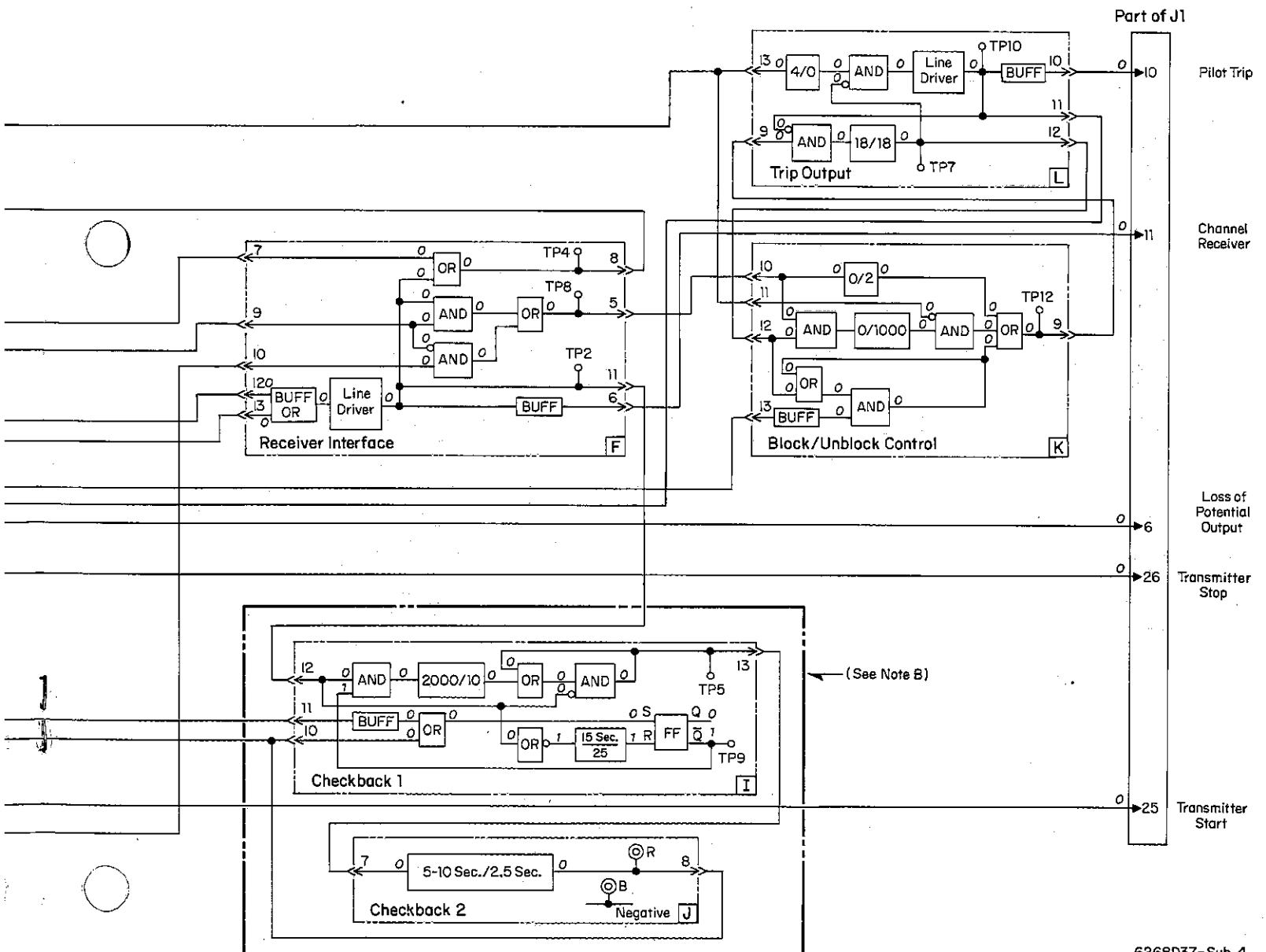
Protective Relay Interface

Loss of Ac Potential

Transmitter Stop Control

Transmitter Start Control

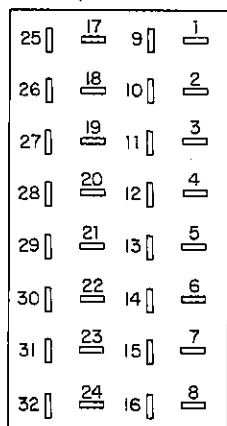
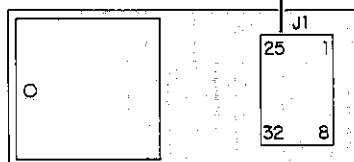
# SKAU-3 Channel Auxiliary Blocking Relay



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## Type SKAU-3 Directional Comparison Blocking Relay for a Weak Feed Terminal

Connector J1  
(as Viewed from Rear of Relay)

Rear View of Relay

TP7 } Accessible Test Point Near Handle  
End of Circuit Board

Test Jack

## Notes:

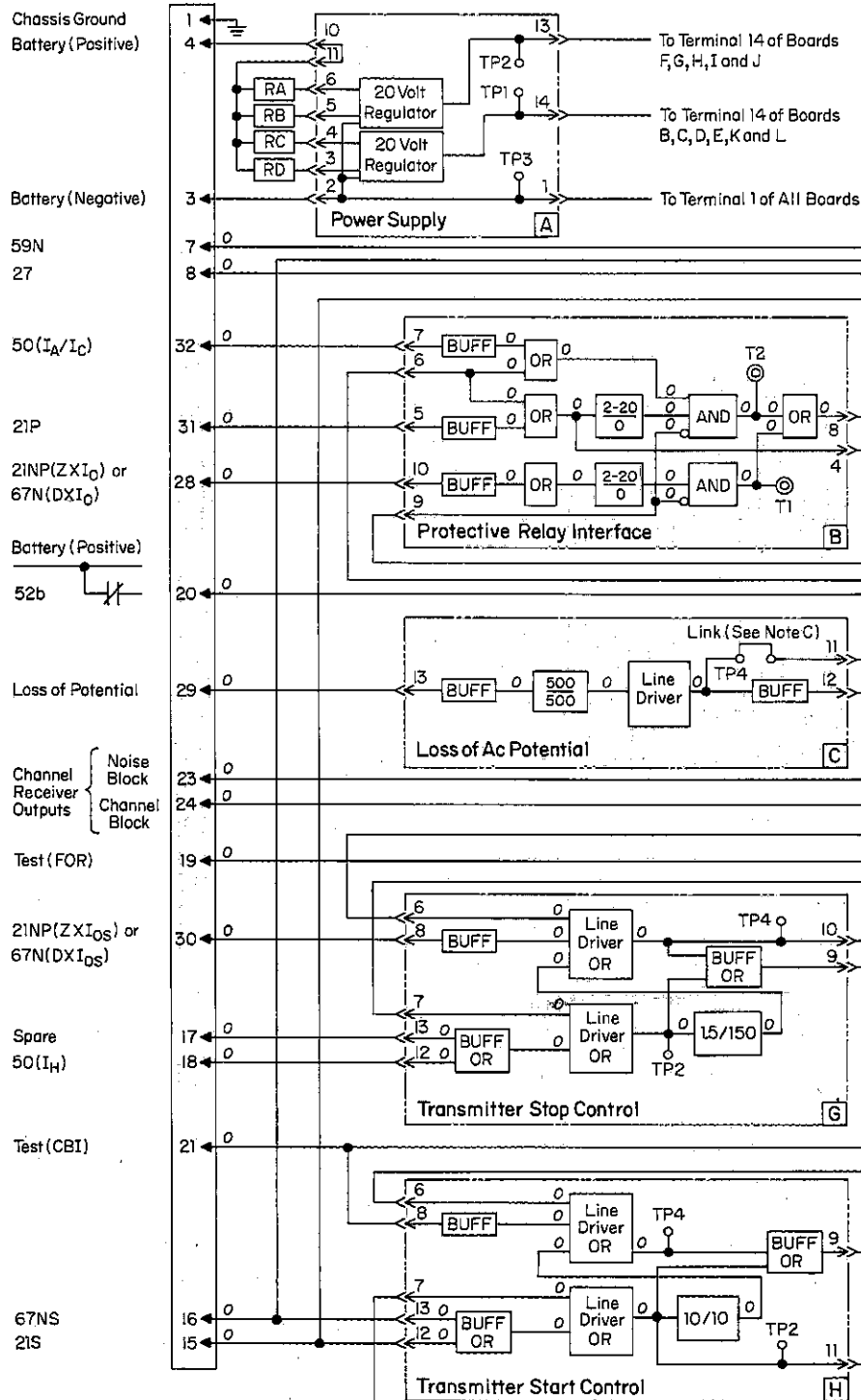
(A) Symbols "0" and "1" Represent The Logic Voltage States for The Energized, Reset Conditions.

(B) Relay Styles Available Without Check back Option (Board Slots I and J).

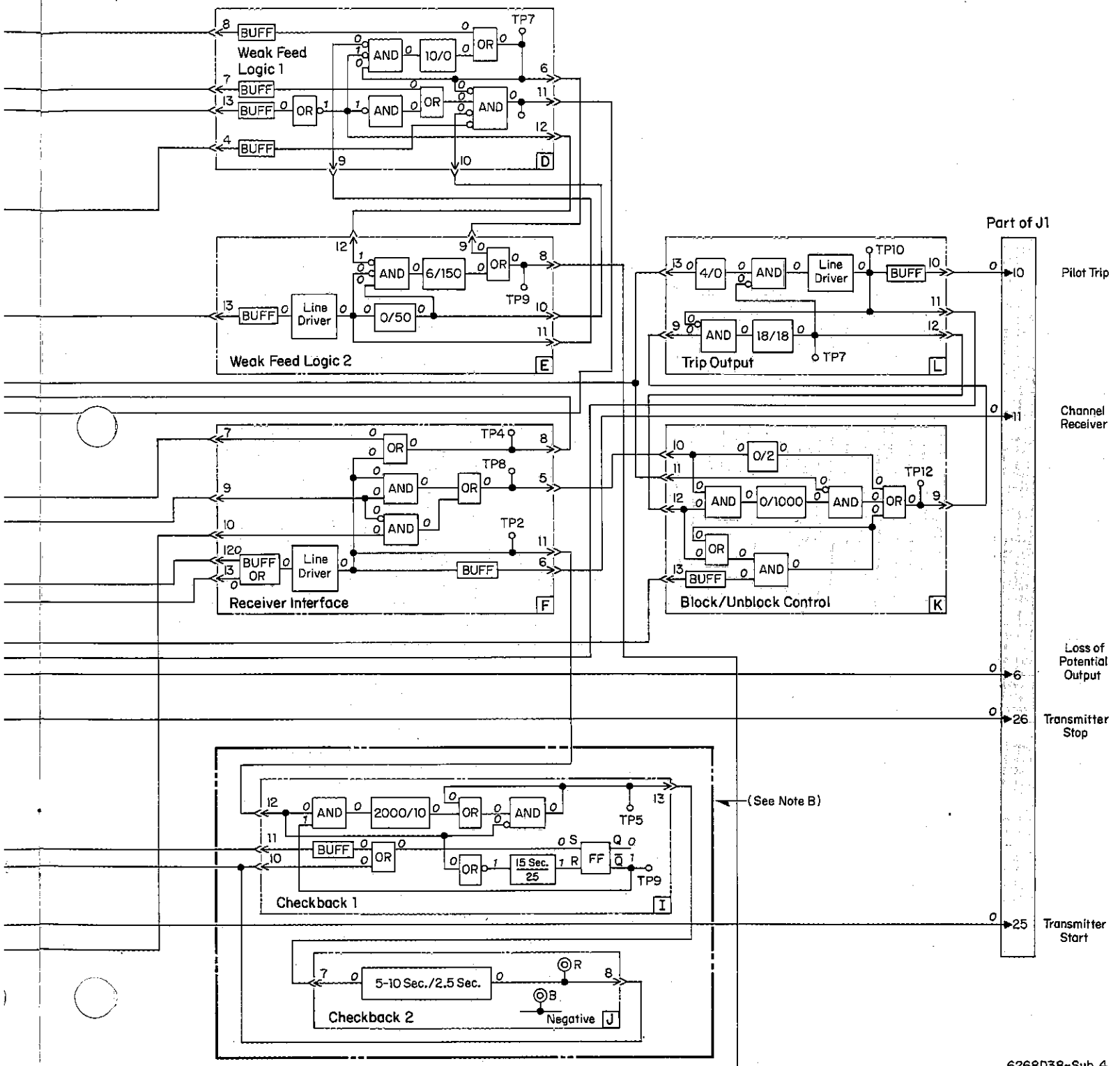
(C) Remove Link on Loss of Potential Board (Slot C) to Prevent Block of Trip Due to Loss of Potential.

Power Supply Resistor Volt	RA and RC	RB and RD
48 Vdc	150 Ohms S-1267272	1800 Ohms S-1201004
125 Vdc	900 Ohms S-1267287	5000 Ohms S-1205214

## Part of J1

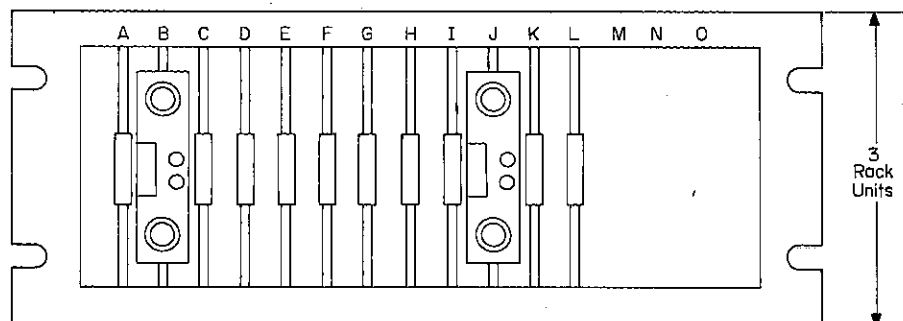


# SKAU-3 Channel Auxiliary Blocking Relay



## SKAU-3 Channel Auxiliary Blocking Relay

Relay Type SKAU-3 Component Location



Component Location

Position	Description
A	Power Supply
B	Protective Relay Interface
C	Loss of ac Potential
D	Weak Feed Logic - 1
E	Weak Feed Logic - 2
F	Receiver Interface
G	Transmitter Stop Control
H	Transmitter Start Control
I	Checkback - 1
J	Checkback - 2
K	Block/Unblock Control
L	Trip Output

878A568

### Further Information

Prices and Ordering Information:

Price List 41-021

Instructions, Maintenance, etc.:

Instruction Leaflet 41-923.9

Solid State Directional Comparison Blocking System:

Instruction Leaflet 40-203.2