INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE ARS RELAY

CAUTION: Before putting protection relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment. Make sure that all moving parts operate freely and can close properly. Operate the relay to check the settings and electrical connections.

ARS APPLICATION

The ARS relay is a high speed auxiliary that has a 20 volt low energy level input and a multiple contact output. It may be used as a tripping auxiliary for relays such as the SP and SDG-1 or as an oscillograph interface.

The driving device must be capable of providing an input to the ARS of 6 milliamperes at a level of 15 to 20 volts.

CONSTRUCTION & OPERATION

The type ARS relay is composed of 1 or 2 AR units with series resistors, a printed circuit module, and indicating contactor switches (ICS) when required, mounted in a FT-11 or FT-22 case, depending upon style.

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

Printed Circuit Module

The printed circuit module contains the proper number of transistors, protective zener diodes, capacitors, resistors, and diodes for the buffered amplifier circuitry controlling each AR unit. With the rated supply voltage to the relay, the proper signal voltage applied to an input terminal will cause the related AR unit to pick up. The AR unit will then energize the ICS (if used), which will seal around the AR unit contacts.

The removal of the input voltage will cause the AR unit to drop out.

Indicating Contactor Switch Unit (ICS)

The dc indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator to drop.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

All ARS relays are capable of being energized continuously. The energy requirements are listed in Table I.

AR Unit

All AR units are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables II and IV.

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

Indicating Contactor Switch (ICS)

The AR contacts will safely close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

ICS Circuit Constants

0.2 ampere tap — 6.5 ohms dc resistance

2.0 ampere tap — 0.15 ohms dc resistance

ARS Operate and Reset Time

The operate and reset times for the ARS relay are shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

SETTINGS

Indicating Contactor Switch (ICS)

The only setting required on the ICS unit is the selection of the 0.2 or 2.0 ampere tap setting. This is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed information on the FT-11 or FT-22 case, refer to I.L. 41-076.

✪ TABLE I

INPUT ENERGY REQUIREMENTS

PER INPUT

INPUT (dc Volts)	INPUT VOLTAGE RANGE (dc volts)	MAXIMUM INPUT CURRENT REQUIREMENT
20	15 to 20	6 milliamperes

DRAIN PER AR UNIT

dc volts	Non-Operate	Operate
48	0	83 milliamperes
125	0	210 milliamperes

TABLE II

AR UNIT OPERATE AND RESET TIMES

Rated Operating Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO Contact Closes	NC Contact Opens	NC Contact Closes
10	2.0	1.5	4.0

TABLE III

MAXIMUM CIRCUIT DELAY TIME

INPUT (dc Volts)	VOLTAGE APPLIED	DELAY TIME IN MICROSECONDS
20	15 volts	90

TABLE IV

AR UNIT CONTACT BOUNCE

CONTACT LOADING	Effective Bounce Time In Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	—
Breaker Trip Coil	0.2	—

TABLE V

CONTACT INTERRUPTING CAPABILITY (AMPERES)

DC VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD
	WILL INTERRUPT	WILL INTERRUPT
250	0.2	0.1
125	0.5	0.25
48	1.5	1.0

ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

ACCEPTANCE CHECK

AR Unit

The following check is recommended to insure that the AR unit is in proper working order.

1. Contact gaps
   - a. Normally open contacts should have a gap 0.018 to 0.023 inch.
   - b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   - a. On four normally open contact relays, the normally open contacts should have approximinately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   - b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 15 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.
3. Armature gap

   The armature gap should be 0.0009 inches measured at the narrowest part of the armature gap.
4. Contact operate time

   Per Table II

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient dc current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting used. The operation indicator target should drop freely.

Printed Circuit Module

The following check is recommended to insure that the circuitry on the printed circuit module is functioning properly.

1. Apply rated voltage to the proper supply terminals, marked positive and negative on internal schematics.
2. Apply rated voltage to each input, one at a time, and its respective AR unit should operate (pick up). Remove the input and the AR unit should drop out. The ARS relay should operate within the times shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. ((See "Acceptance Check")

Tripping Relay (AR Unit)

If the type AR tripping relay unit adjustments are disturbed or are in error, or it becomes necessary to replace some part, use the following adjustment procedure.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each normally open contact spring for 8 grams to just move the contact away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move contact spring away from the card. Then adjust the stationary contact screw to just away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table II and IV.

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

Printed Circuit Module

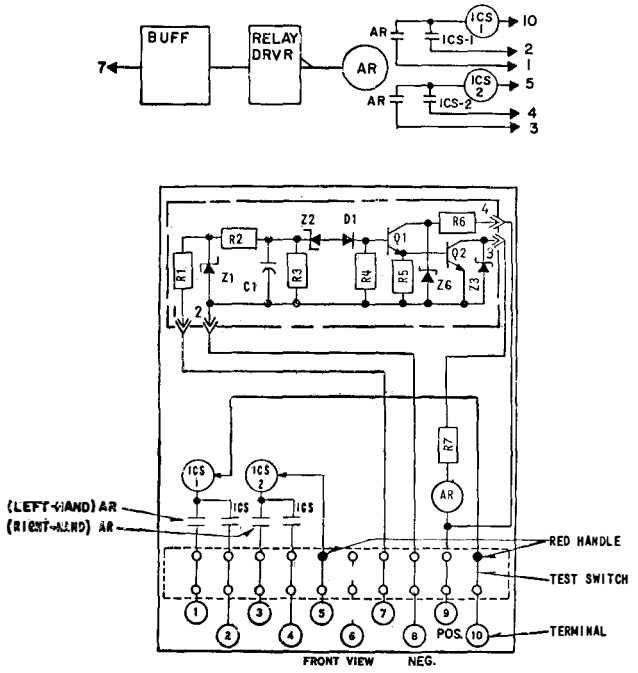
No calibration required other than check listed under acceptance check.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

RELAY STYLE NUMBER	DESCRIPTION	NUMBER OF UNITS ICS	NUMBER OF UNITS AR	INTERNAL SCHEMATIC	CIRCUIT BOARD STYLE NUMBER	CIRCUIT BOARD COMPONENT LOCATION
FT-11 CASE (Fig. 27)						
718B820A09	48 Vdc; 2M contacts;	2	1	719B963 (Fig. 1)	204C674G01	880A436(Fig. 5)
718B820A10	125 Vdc; 2M contacts	2	1	719B963 (Fig. 1)	204C674G02	880A435 (Fig.6)
718B820A11	250 Vdc; 2M contacts	2	1	719B944 (Fig. 2)	204C818G01	880A433 (Fig. 7)
718B820A12	48 Vdc; 2M contacts	1	1	719B945 (Fig. 3)	204C674G01	880A436 (Fig. 5)
718B820A13	125 Vdc; 2M contacts	1	1	719B945 (Fig. 3)	204C674G02	880A435 (Fig. 6)
718B820A14	250 Vdc; 2M contacts	1	1	719B946 (Fig. 5)	204C818G01	880A433 (Fig. 7)
FT-22 CASE (Fig. 28)						
717B770A10	48 Vdc; 2M-2B contacts	0	1	719B951 (Fig. 8)	204C761G02	880A962 (Fig. 13)
717B770A11	125 Vdc; 2M-2B contacts;	0	1	719B951 (Fig. 8)	204C761G01	880A434 (Fig. 14)
717B770A12	48 Vdc; 4M contacts;	0	1	719B952 (Fig. 9)	204C761G02	880A962 (Fig. 13)
717B770A13	125 Vdc; 4M contacts;	0	1	719B952 (Fig. 9)	204C761G01	880A434 (Fig. 14)
717B770A14	48 Vdc; 2M-2B contacts;	2	1	719B947 (Fig. 10)	204C761G02	880A962 (Fig.13)
717B770A15	125 Vdc; 2M-2B contacts;	2	1	719B947 (Fig. 10)	204C761G01	880A434 (Fig. 14)
717B770A16	250 Vdc; 2M-2B contacts;	2	1	719B948 (Fig. 11)	204C762G01	880A431 (Fig. 15)
717B770A17	48 Vdc; 4M contacts;	2	1	719B956 (Fig. 12)	204C761G02	880A962 (Fig. 13)
717B770A18	125 Vdc; 4M contacts;	2	1	719B956 (Fig. 12)	204C761G01	880A434 (Fig. 14)
717B770A19	48 Vdc; 4M- 4M-4M contacts;	0	2	719B953 (Fig. 16)	204C675G02	880A965 (Fig. 23)
717B770A20	125 Vdc; 4M-4M contacts	0	2	719B953 (Fig. 16)	204C675G01	880A964 (Fig. 24)
717B770A21	48 Vdc; 4M-2M/2B contacts;	0	2	719B950 (Fig. 17)	204C675G02	880A965 (Fig. 23)
717B770A22	125 Vdc; 4M-2M/2B contacts;	0	2	719B950 (Fig. 17)	204C675G01	880A964 (Fig.24)
717B770A23	48 Vdc; 2M/2B-2M/2B contacts;	0	2	719B949 (Fig. 18)	204C675G02	880A965 (Fig. 23)
717B770A24	125 Vdc; 2M/2B-2M/2B contacts;	0	2	719B949 (Fig. 18)	204C675G01	880A964 (Fig. 24)
717B770A25	48 Vdc; 4M-4M contacts;	2	2	719B954 (Fig. 19)	204C675G02	880A965 (Fig. 23)
717B770A26	125 Vdc; 4M-4M contacts;	2	2	719B954 (Fig. 19)	204C675G01	880A964 (Fig. 24)
717B770A27	250 Vdc; 4M-4M contacts;	2	2	719B955 (Fig. 20)	204C763G01	880A963 (Fig. 25)
717B770A28	125 Vdc; 2M-2B/2M-2B contacts;	2	2	719B957 (Fig. 21)	204C675G01	880A964 (Fig. 24)
717B770A29	250Vdc; 4M contacts;	2	1	719B958 (Fig. 22)	204C762G01	880A431 (Fig. 15)

2M = 2 make (normally open)
2M-2B = 2 make, 2 break (2 normally open, 2 normally closed)
4M = 4 make (normally open)

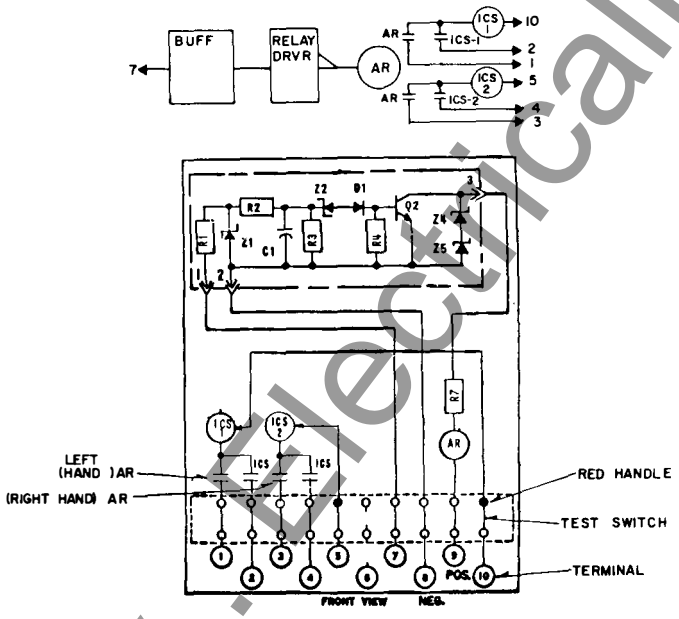


COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1 - R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	783A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202588	1	200 Ω-25W
R7 (125VDC)	1267293	1	1500 Ω-25W

REF.
WIRING DWG. – 204C814
ASSY. BD. REF. – 204C674

SUB. 1
719B963

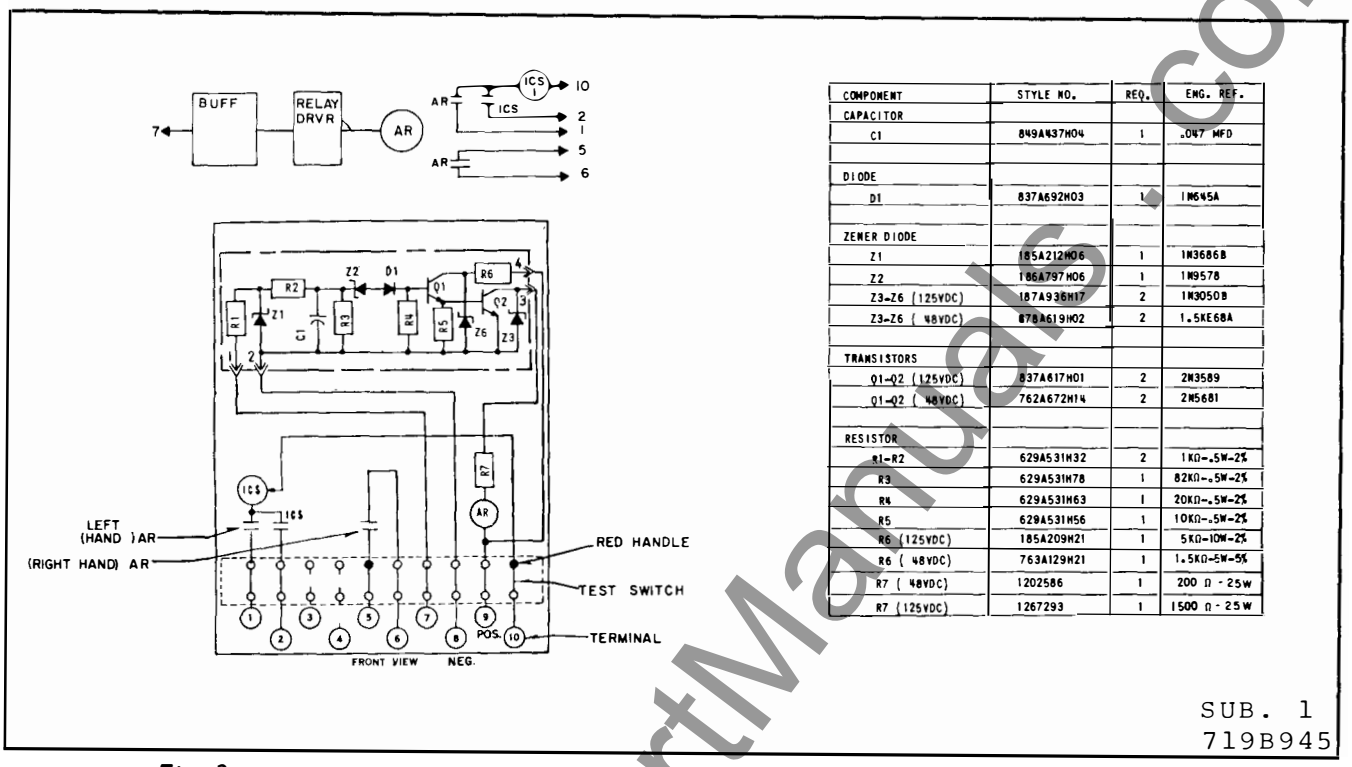
Fig. 1. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts - 2 ICS Units in FT-11 Case 48 & 125 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z4 - Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1 - R2	629A531H32	2	1KΩ-.5W -2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250V)	1205222	1	6000 Ω- 25W

SUB. 1
719B944

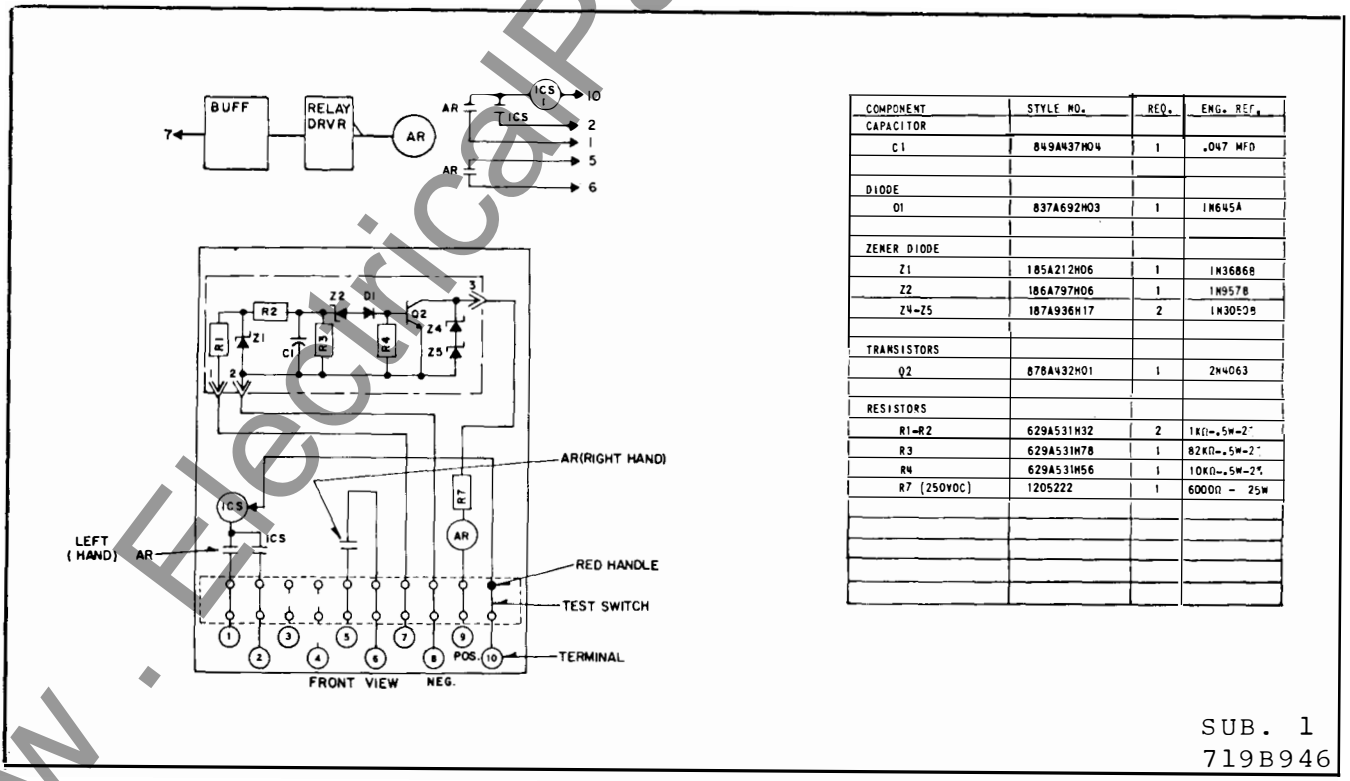
Fig. 2. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts 2 ICS Units in FT-11 Case 250 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202586	1	200 Ω - 25W
R7 (125VDC)	1267293	1	1500 Ω - 25W

SUB. 1
719B945

Fig. 3. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 48 & 125 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z4-Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250VDC)	1205222	1	6000Ω - 25W

SUB. 1
719B946

Fig. 4. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 250 V.D.C.

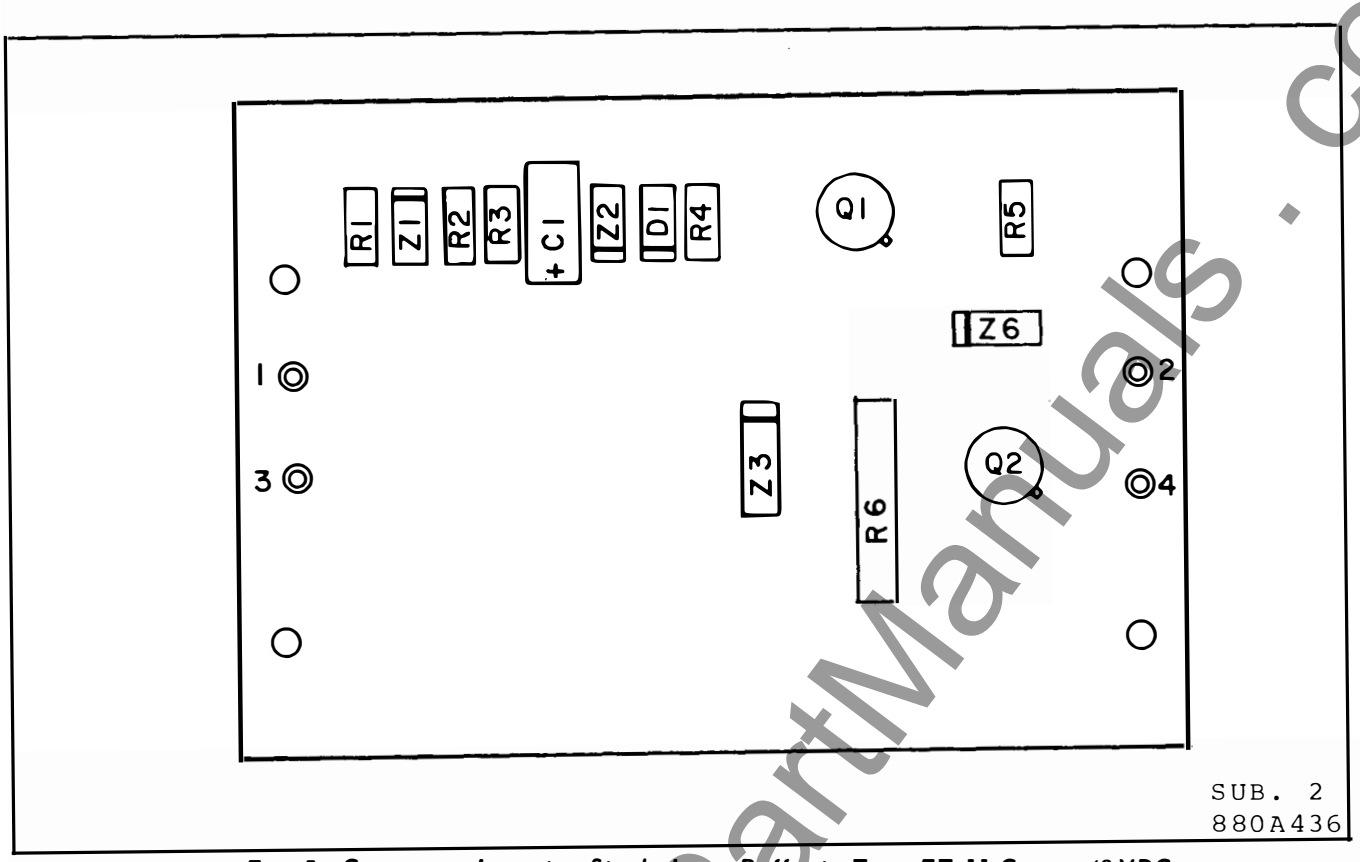


Fig. 5. Component Location Single Input Buffer in Type FT-11 Case - 48 VDC.

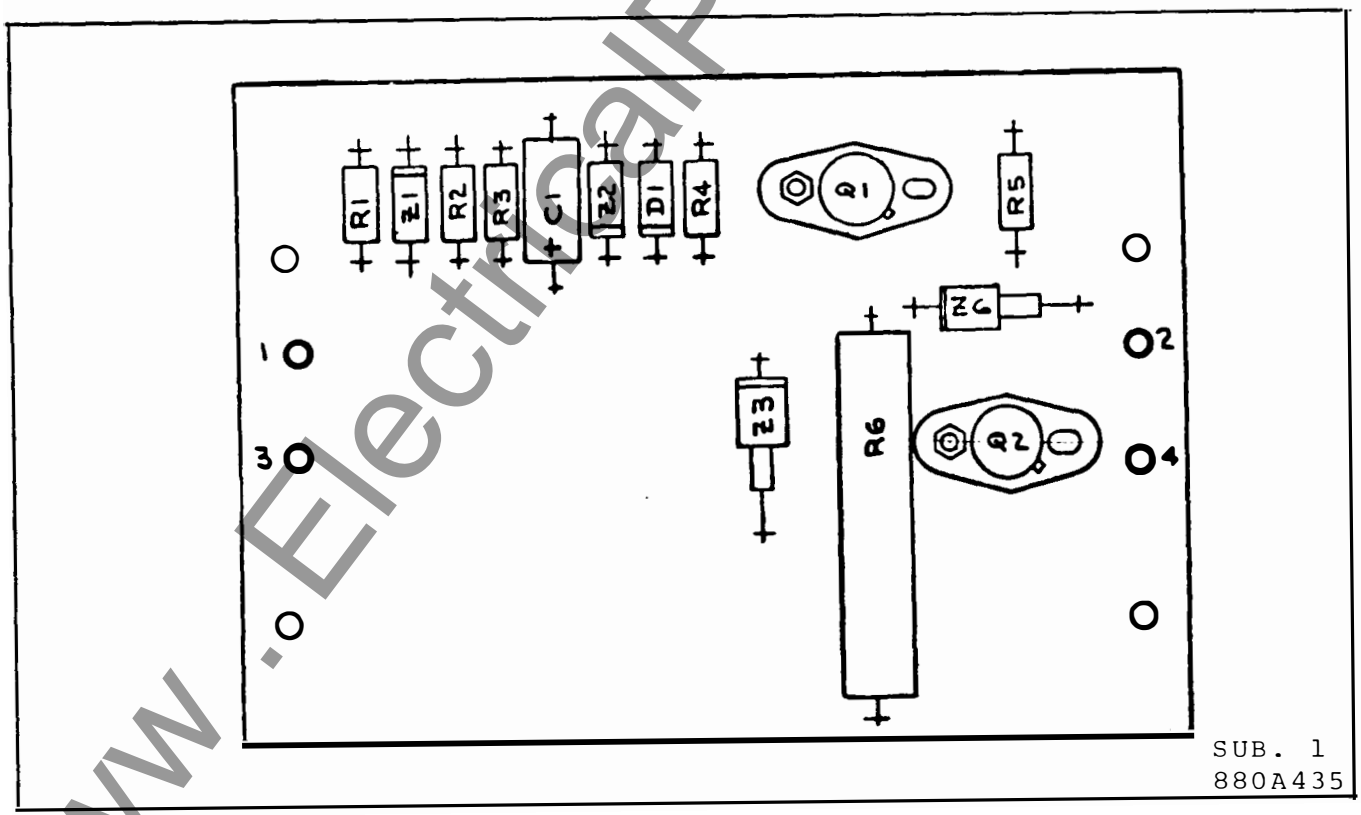


Fig. 6. Component Location Single Input Buffer in FT-11 Case 125 VDC.

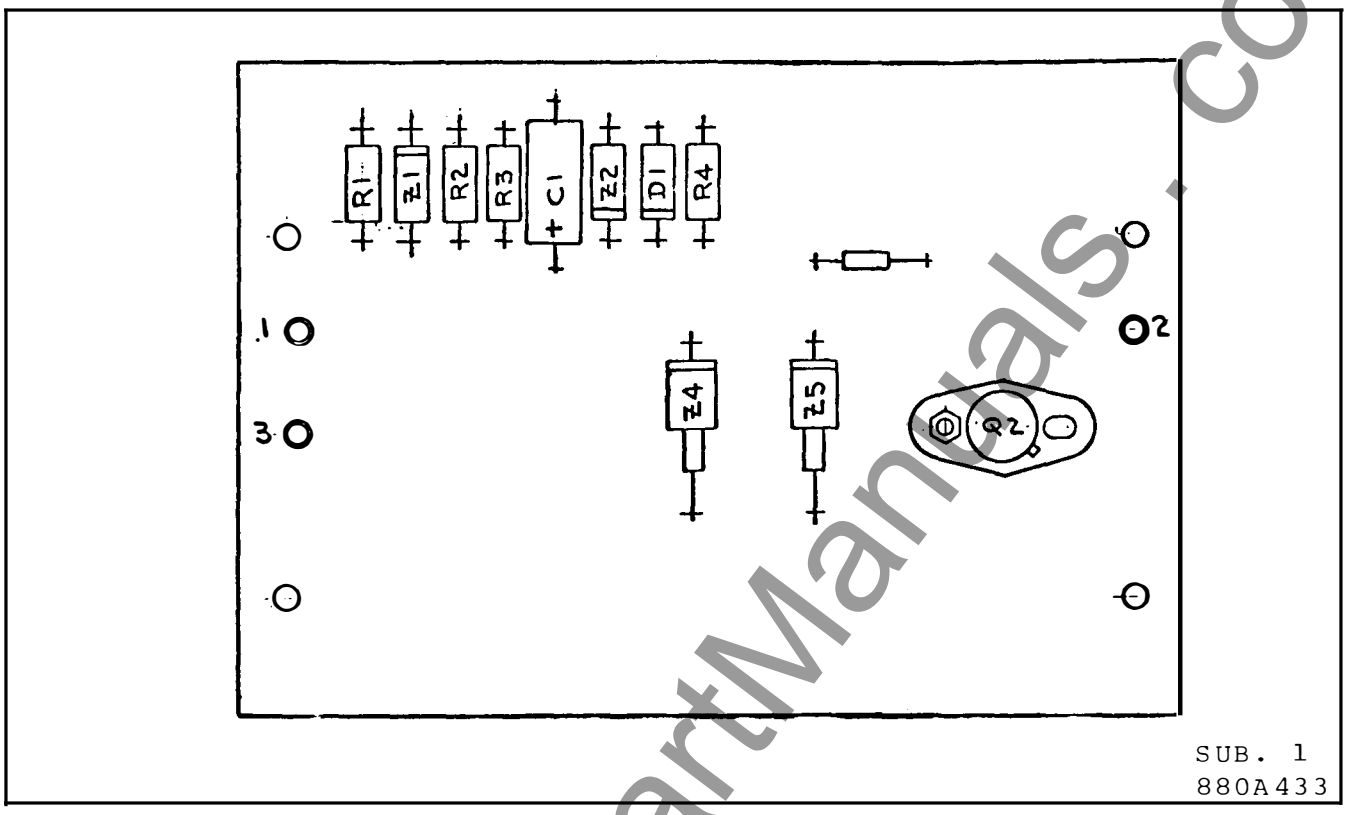
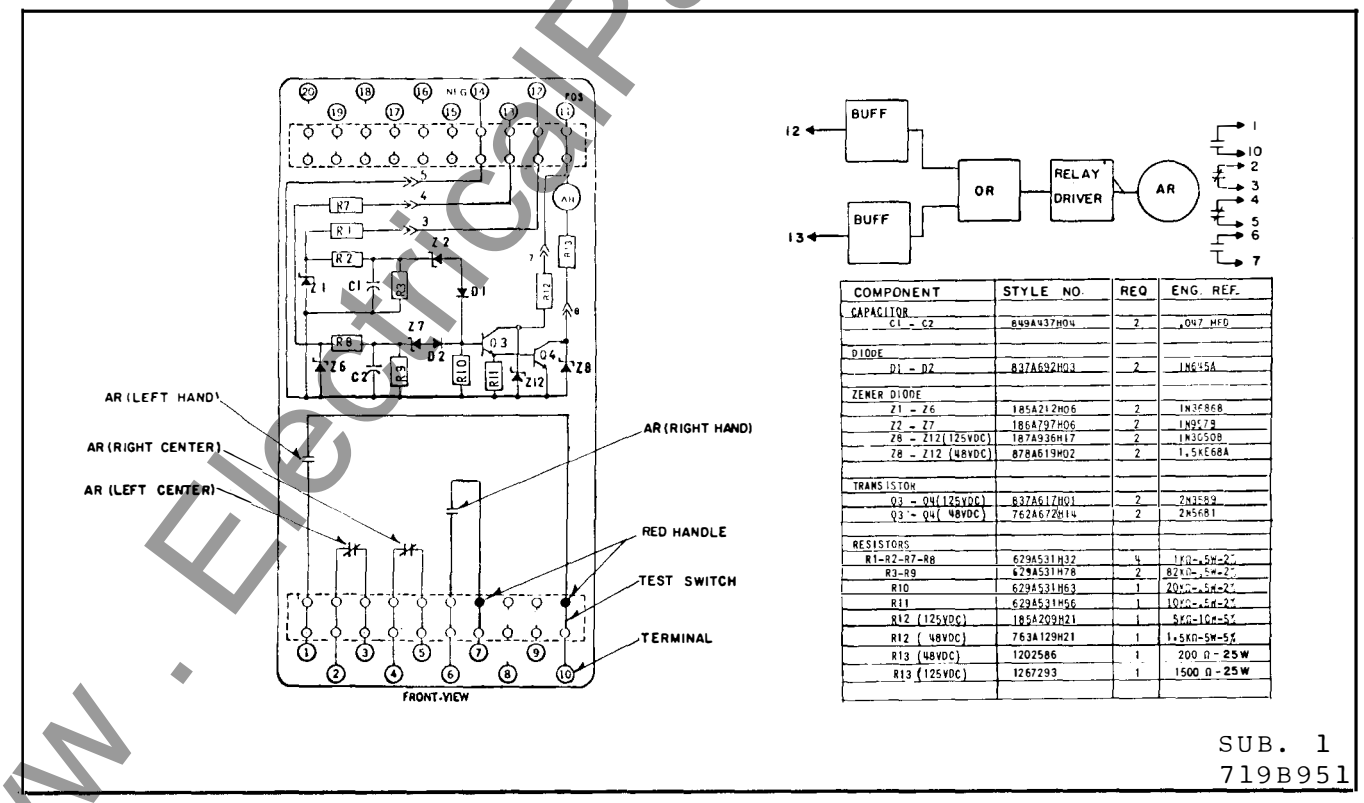
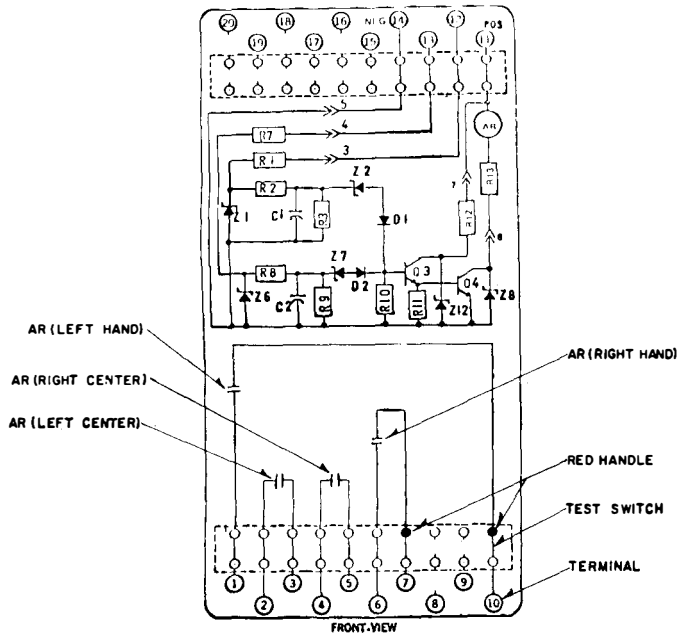


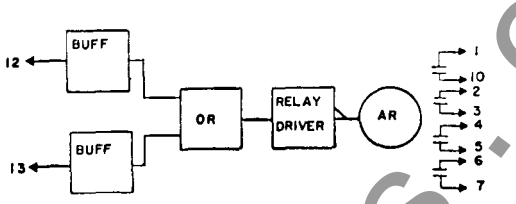
Fig. 7. Component Location Single Input Buffer in FT-11 Case 250 VDC.



COMPONENT	STYLE NO.	REQ	ENG. REF.
CAPACITOR			
C1 - C2	649A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12(125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4(125VDC)	837A617H01	2	2N3589
Q3 - Q4(48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125VDC)	1267293	1	1500 Ω - 25W

Fig. 8. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts in FT-22 Case 48 & 125 VDC.

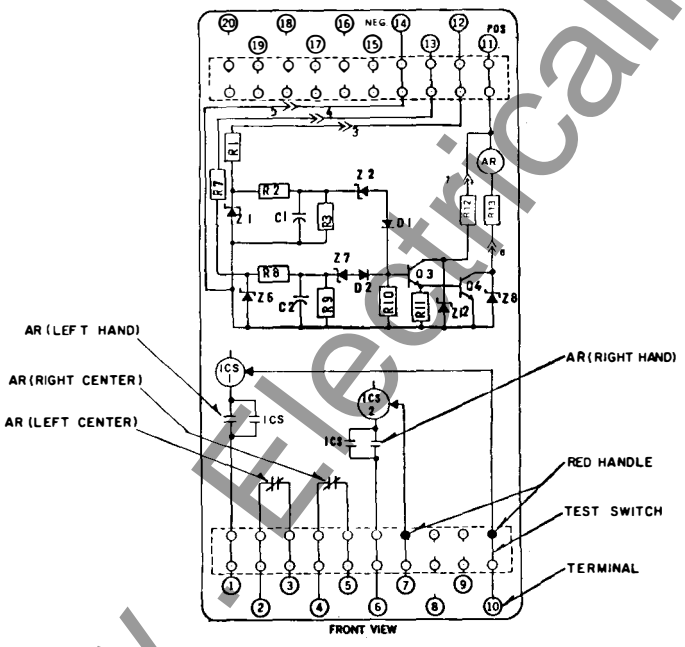


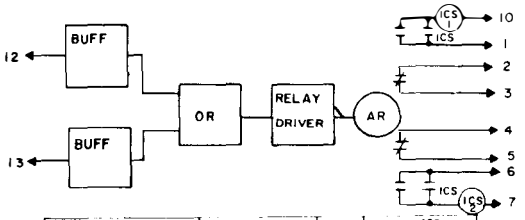


COMPONENT	STYLE NO.	REQ	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3-Q4 (125VDC)	837A617H01	2	2N3589
Q3-Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	1854209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125 VDC)	1267293	1	1500 Ω - 25W

SUB. 1
719B952

Fig. 9. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts in FT-22 Case 48 & 125 VDC.

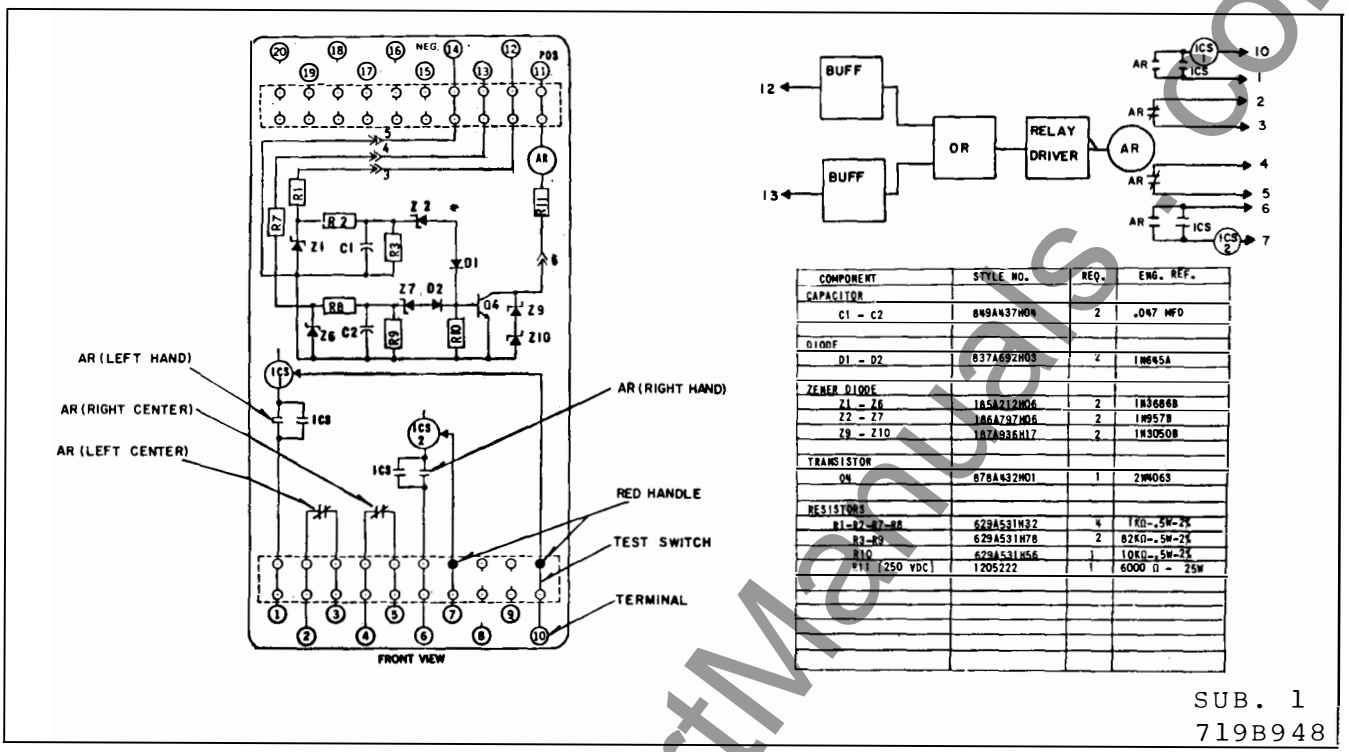




COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	1854209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125VDC)	1267293	1	1500 Ω - 25W

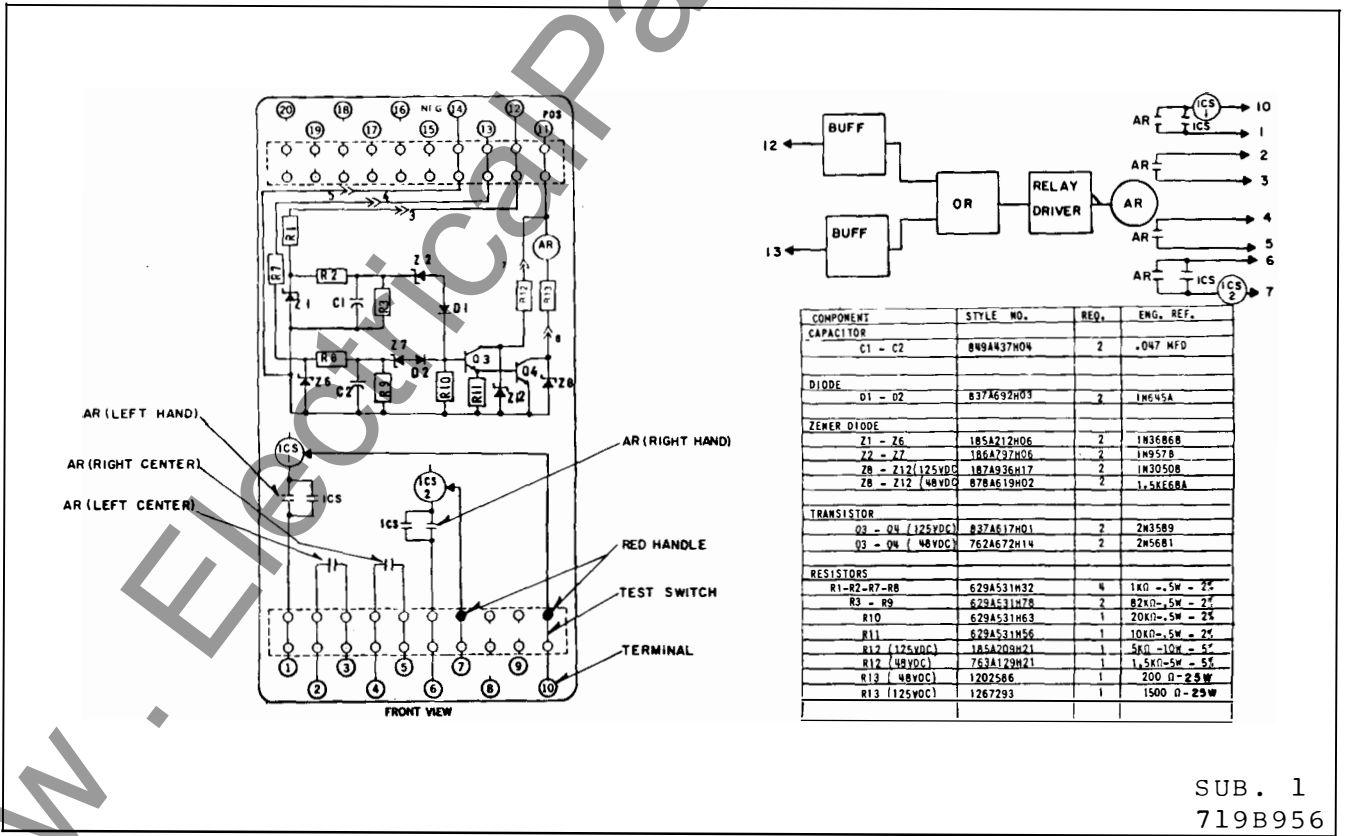
SUB. 1
719B947

Fig. 10. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT- 22 Case.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
R11 (250 VDC)	1205222	1	6000 Ω - 25W

Fig. 11. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT-22 Case 250 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12(125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ -.5W - 2%
R3 - R9	629A531H78	2	82KΩ-.5W - 2%
R10	629A531H63	1	20KΩ-.5W - 2%
R11	629A531H56	1	10KΩ-.5W - 2%
R12 (125VDC)	185A209H21	1	5KΩ -10W - 5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W - 5%
R13 (48VDC)	1202586	1	200 Ω-25W
R13 (125VDC)	1267293	1	1500 Ω-25W

Fig. 12. Type ARS Relay - 2 Buffered Input "OR" 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 48 & 125 VDC.

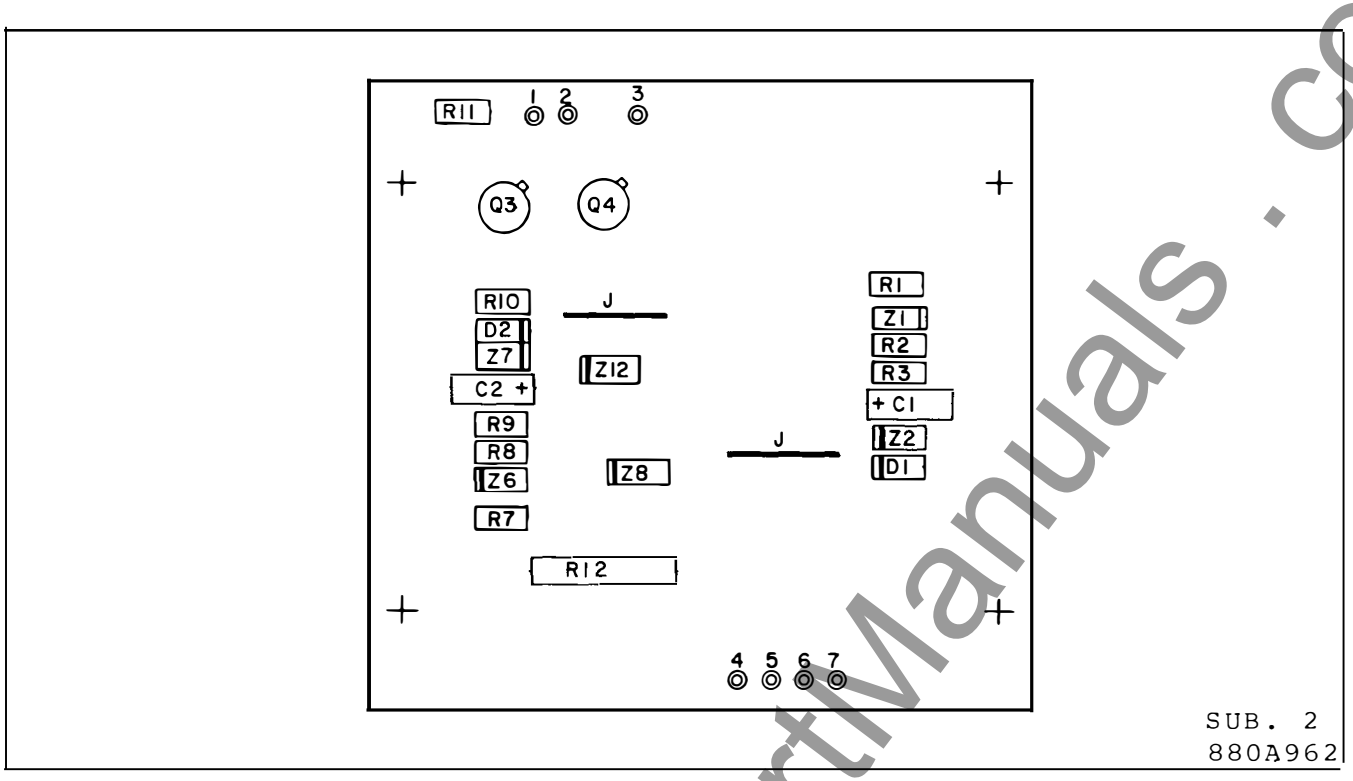


Fig. 13. Component Location Two Buffered Input "OR" in FT-22 Case - 48 VDC.

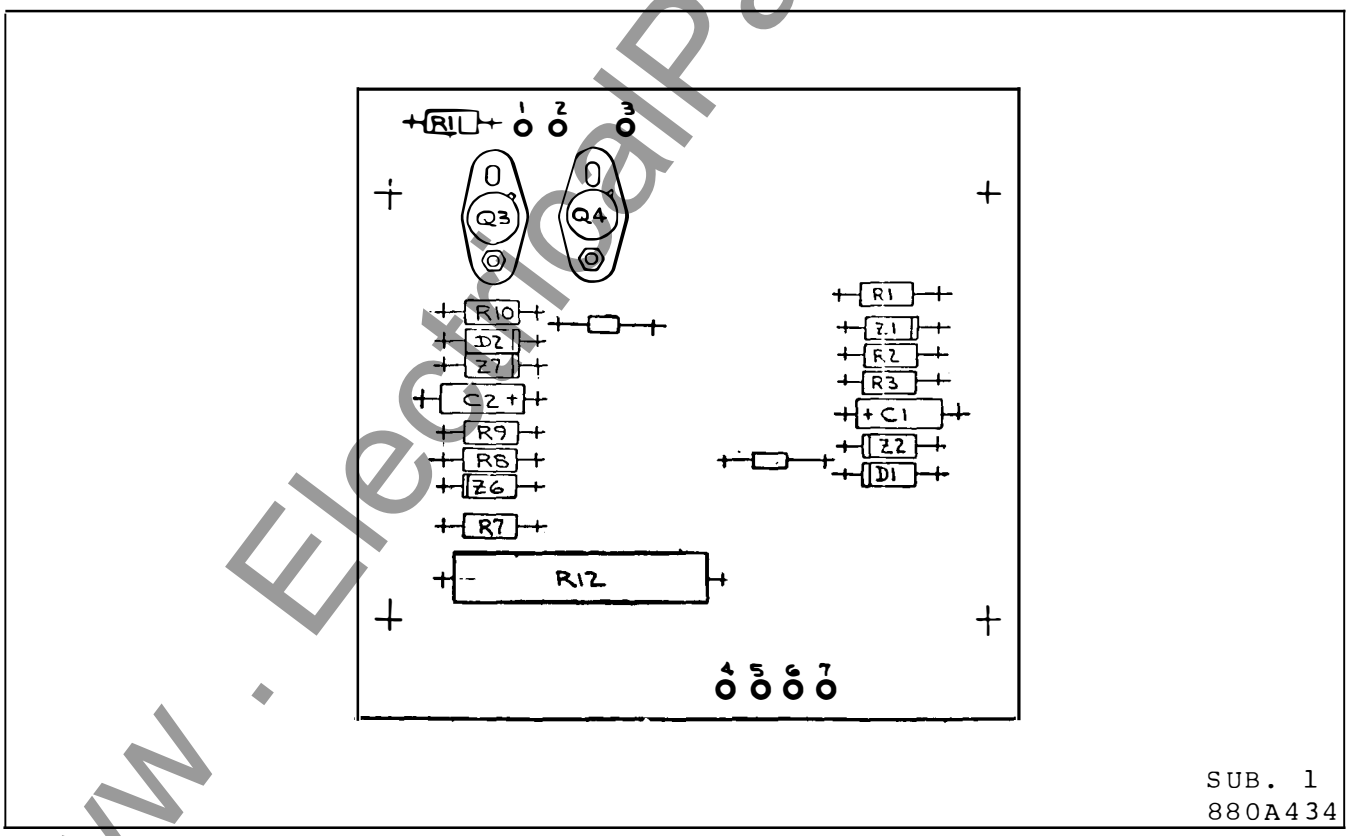


Fig. 14. Component Location Two Buffered Input "OR" in FT-22 Case 125 VDC.

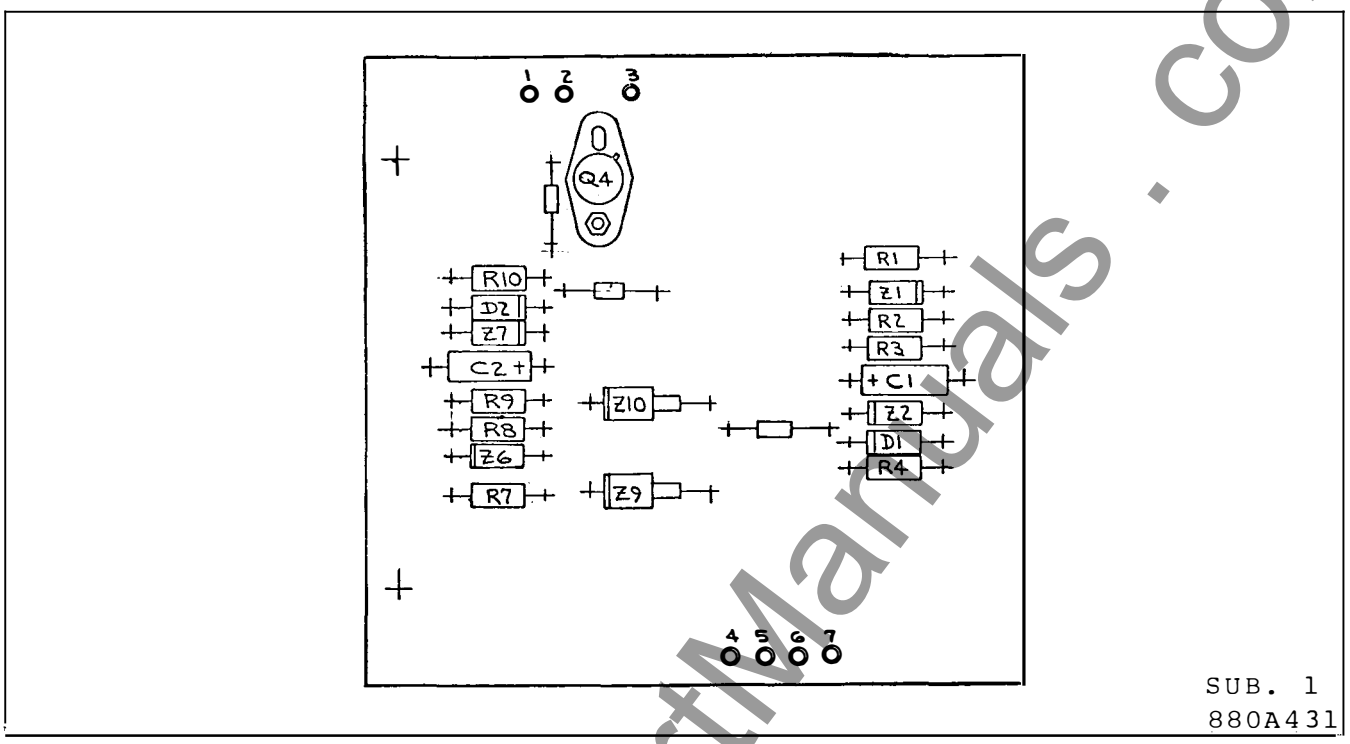
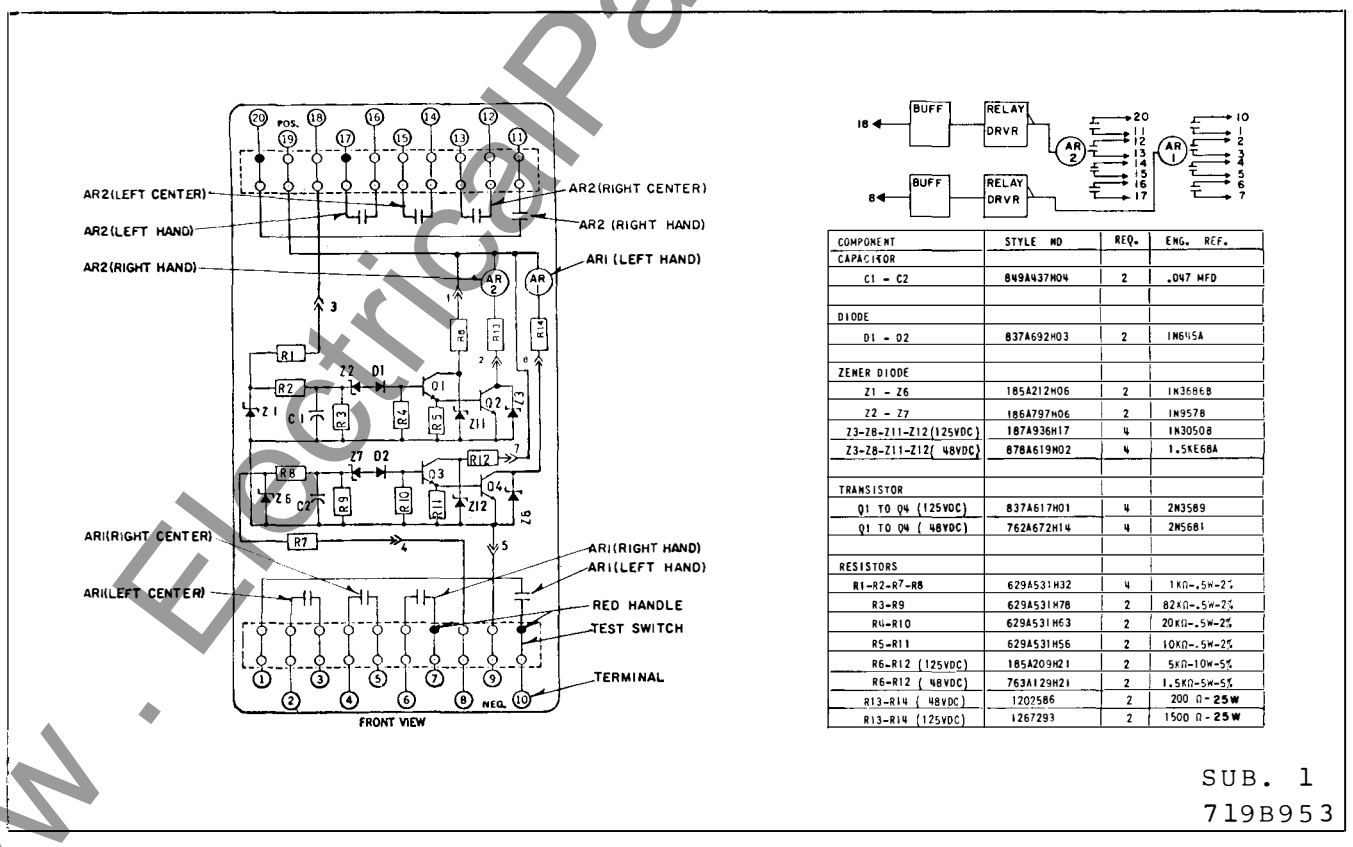
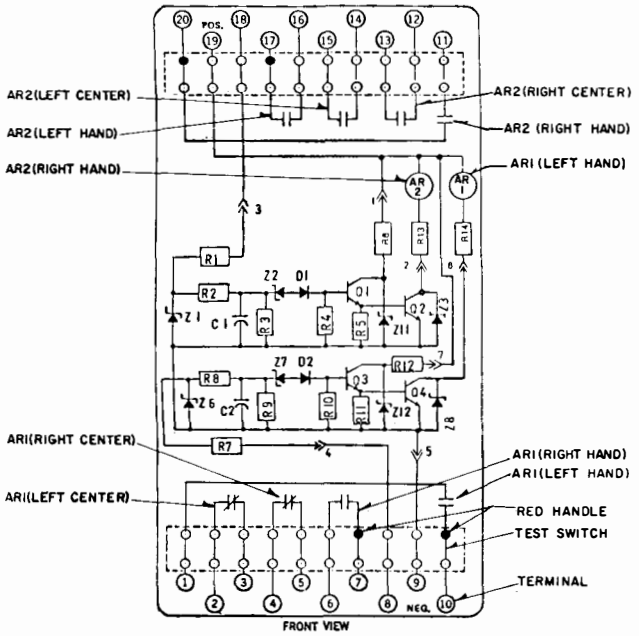


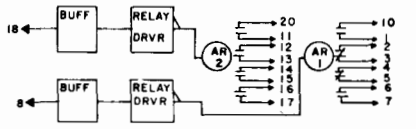
Fig. 15. Component Location Two Buffered Input "OR" in FT-22 Case - 250 VDC.



COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N6681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

Fig. 16. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (All Make) Contacts in FT-22 Case - 48 & 125 VDC.

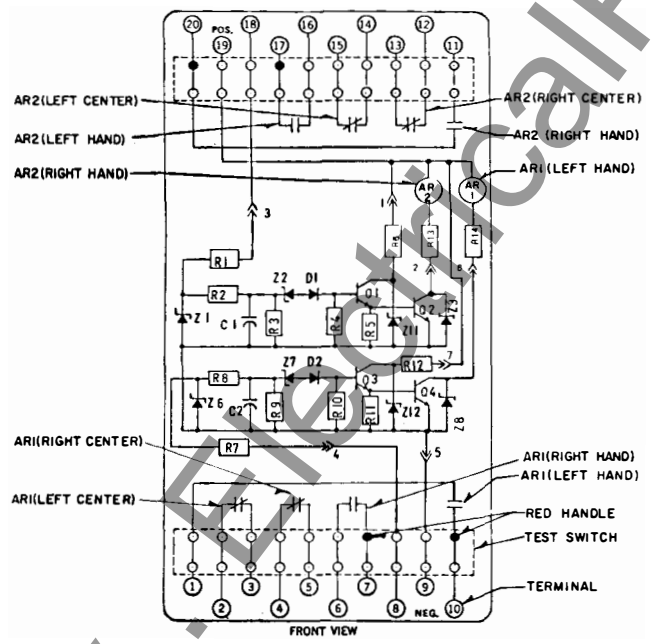


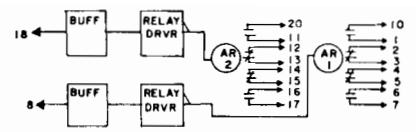


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125 VDC)	1267293	2	1500 Ω-25W

SUB. 1
719B950

Fig. 17. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-2M 2B) Contacts in FT-22 Case. 48 and 125 Vdc

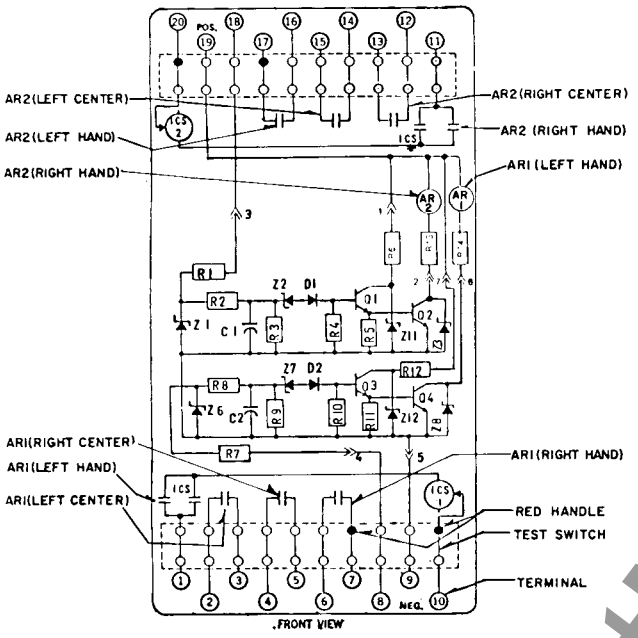


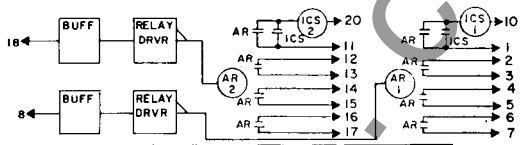


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125VDC)	1267293	2	1500 Ω-25W

SUB. 1
719B949

Fig. 18. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (2M2B-2M2B) Contacts in FT-22 Case. 48 and 125 Vdc

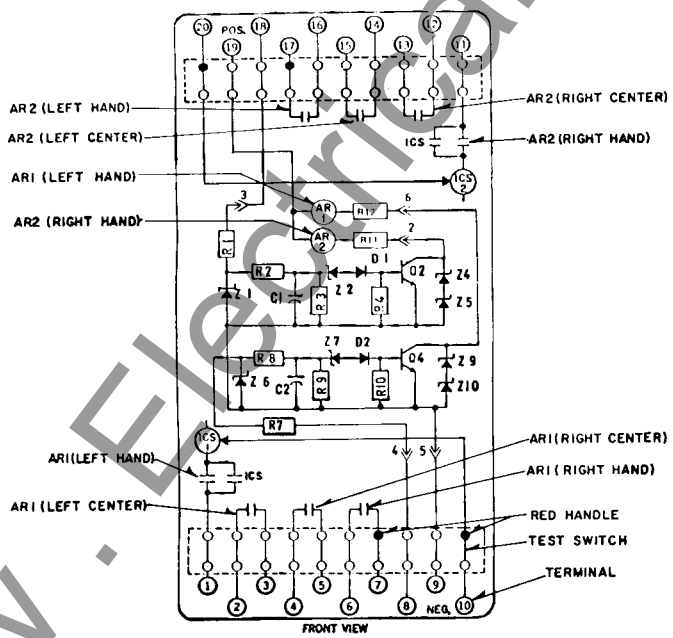


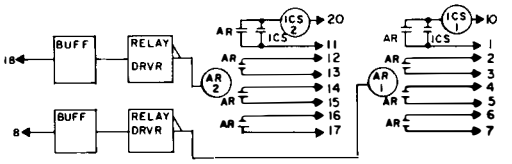


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B954

Fig. 19. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units All Make Contacts - 2 ICS Units in FT-22 Case – 48 and 125 Vdc

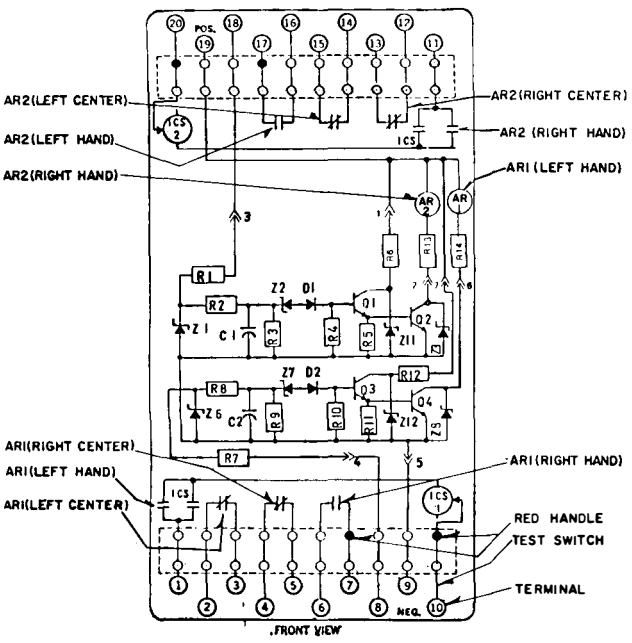


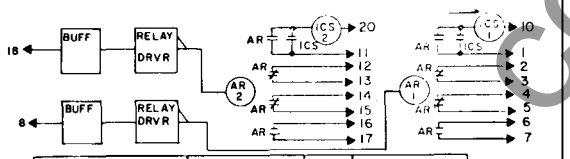


COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1-C2	849A437H04	2	.047 MFD
DIODE			
D1-D2	837A692H03	2	1N645A
ZENER DIODE			
Z1-Z6	185A212H06	2	1N3686B
Z2-Z7	186A797H06	2	1N957B
Z4-Z5-Z9-Z10	187A936H17	4	1N3050B
TRANSISTOR			
Q2 - Q4	878A432H01	2	2N4063
RESISTOR			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H56	2	10KΩ-.5W-2%
R11-R12 (250VDC)	1205222	2	6000Ω - 25W

SUB. 1
719B955

Fig. 20. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-4M) Contacts - 2 ICS Units in FT-22 Case- 250 VDC.

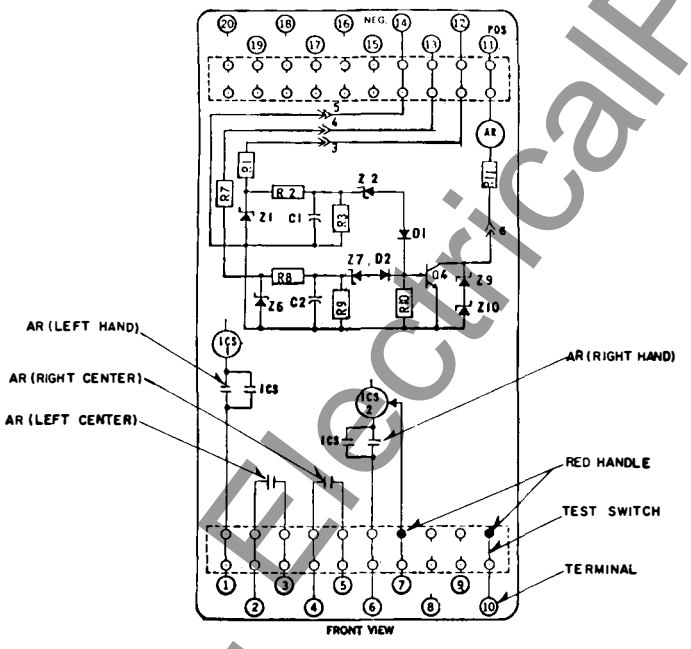


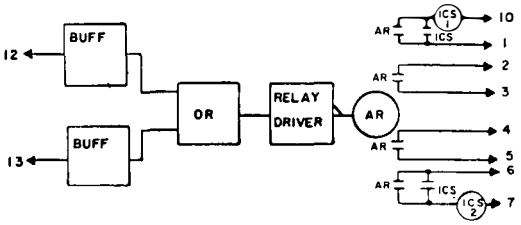


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B957

Fig. 21. Relay Type ARS - 2 Single Buffered Inputs - 2AR Units (2M2B-2M2B) Contacts - 2 ICS Units in FT-22 Case – 125 Vdc





COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1- D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
R11 (250VDC)	1205222	2	6000Ω - 25W

SUB. 1
719B958

Fig. 22. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 250 VDC.

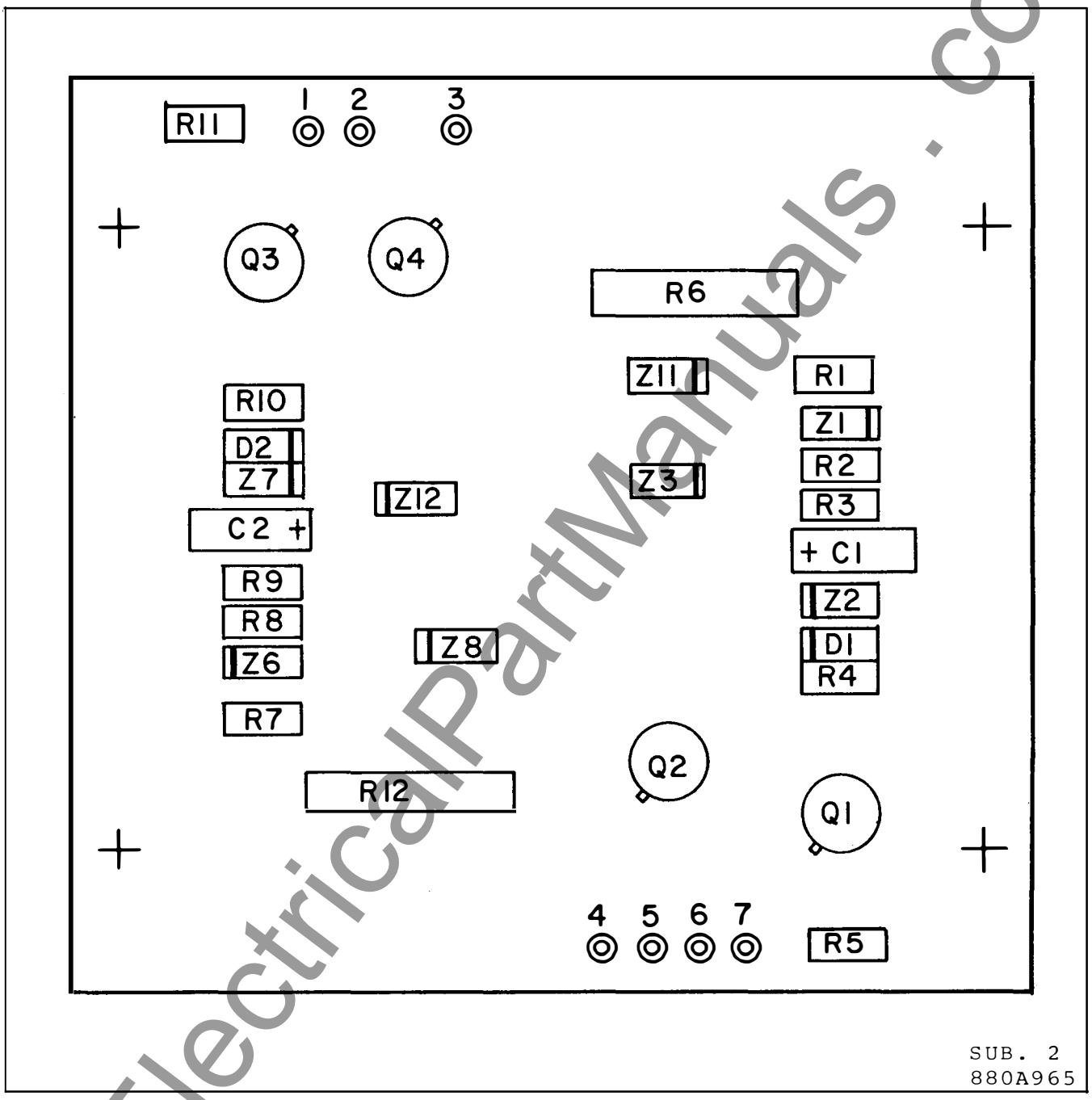


Fig. 23. Component Location Two Single Buffered Inputs in Type FT-22 Case - 48 VDC.

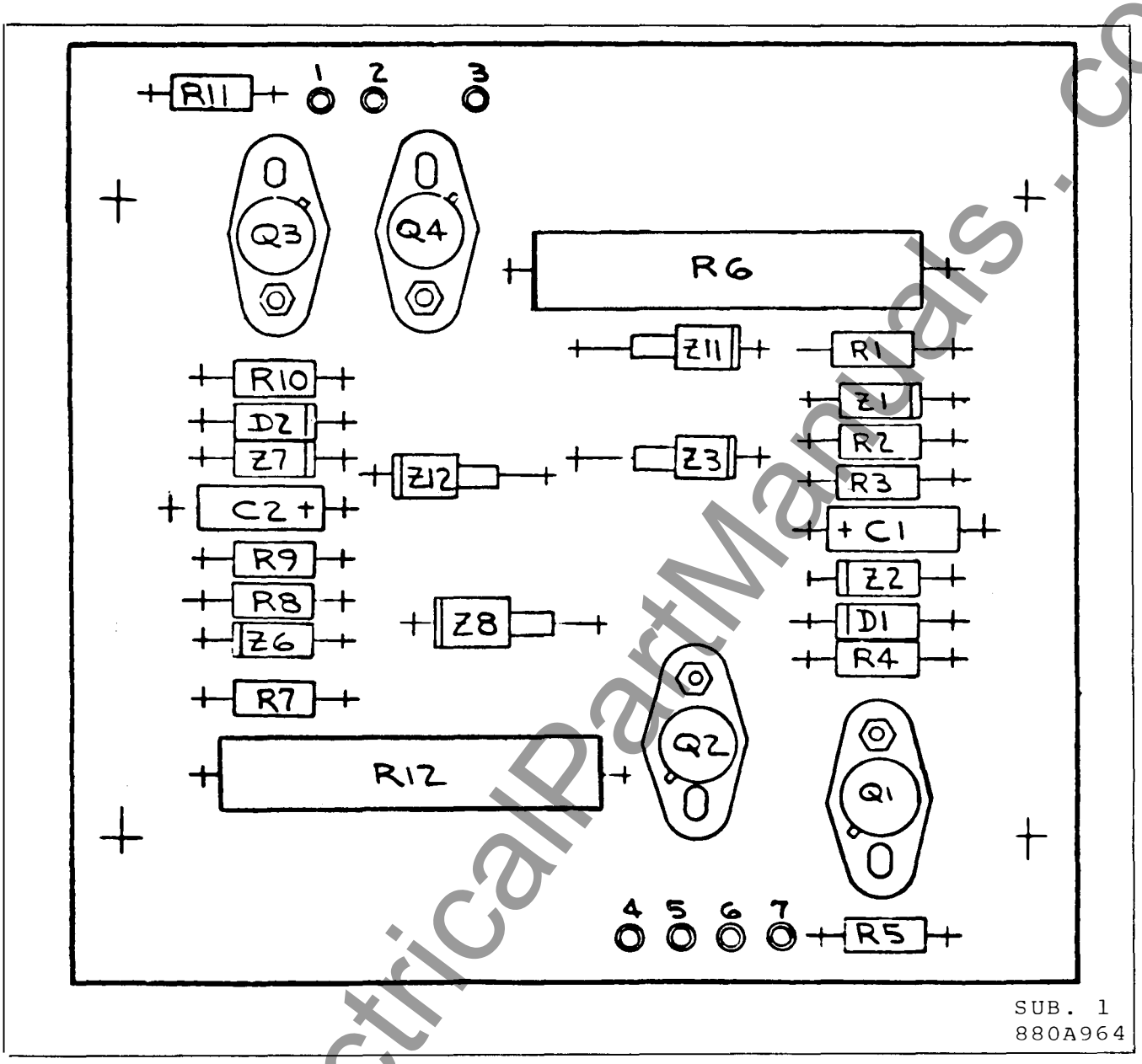


Fig. 24. Component Location Two Single Buffered Inputs in Type FT-22 Case - 125 VDC.

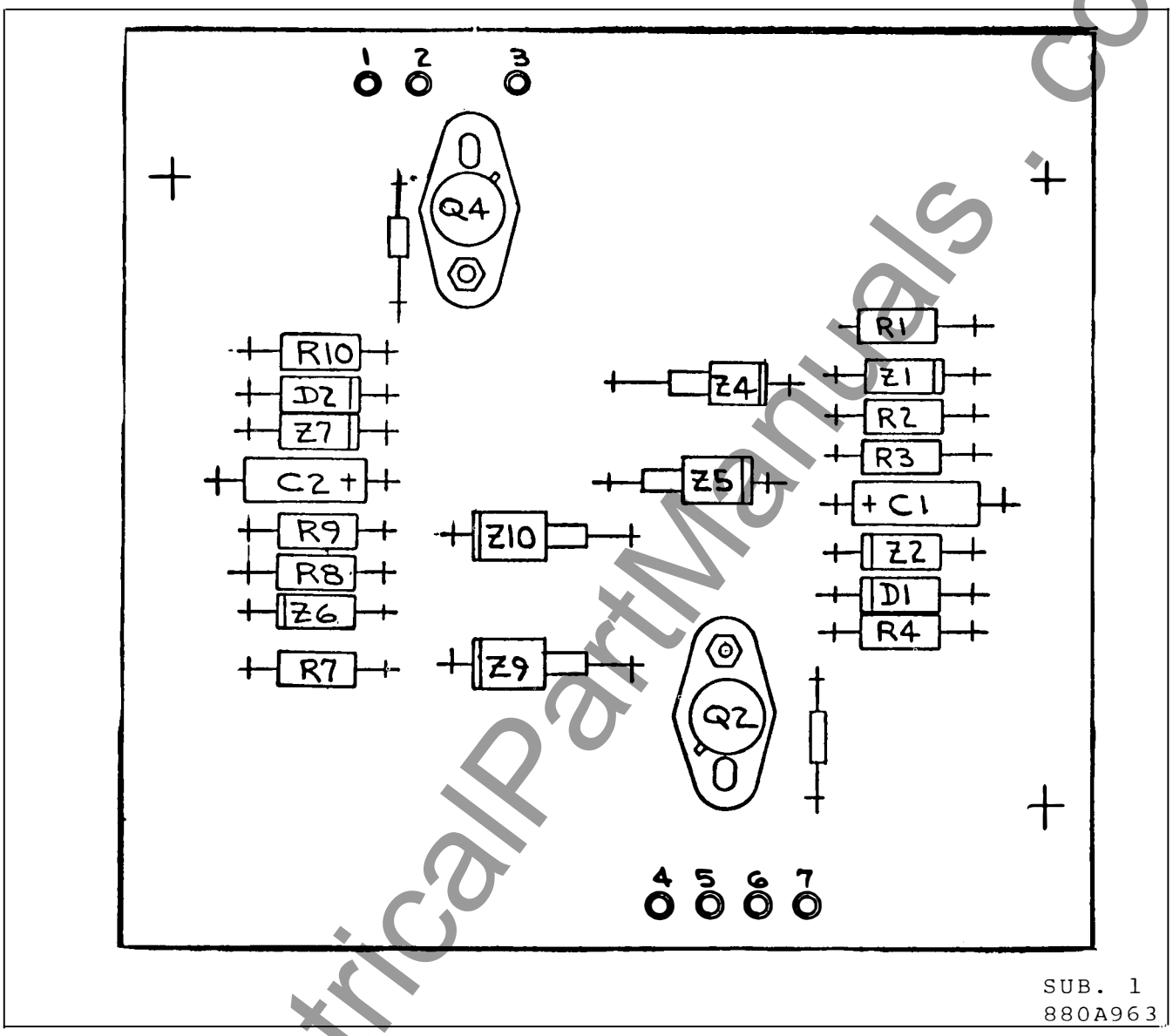


Fig. 25. Component Location Two Single Buffered Inputs in FT-22 Case 250 VDC.

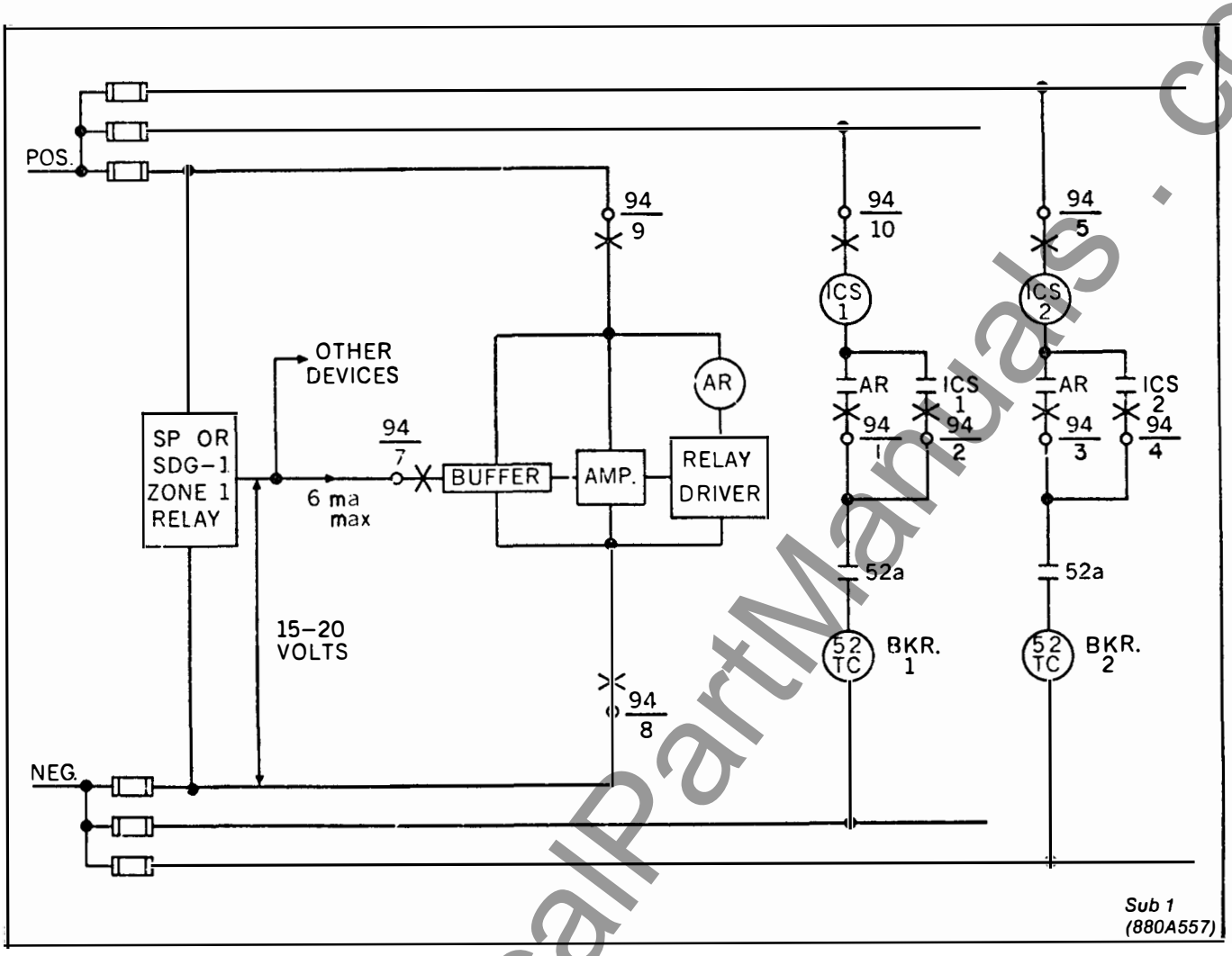


Fig. 26. Typical External Schematic of Type ARS Relay.

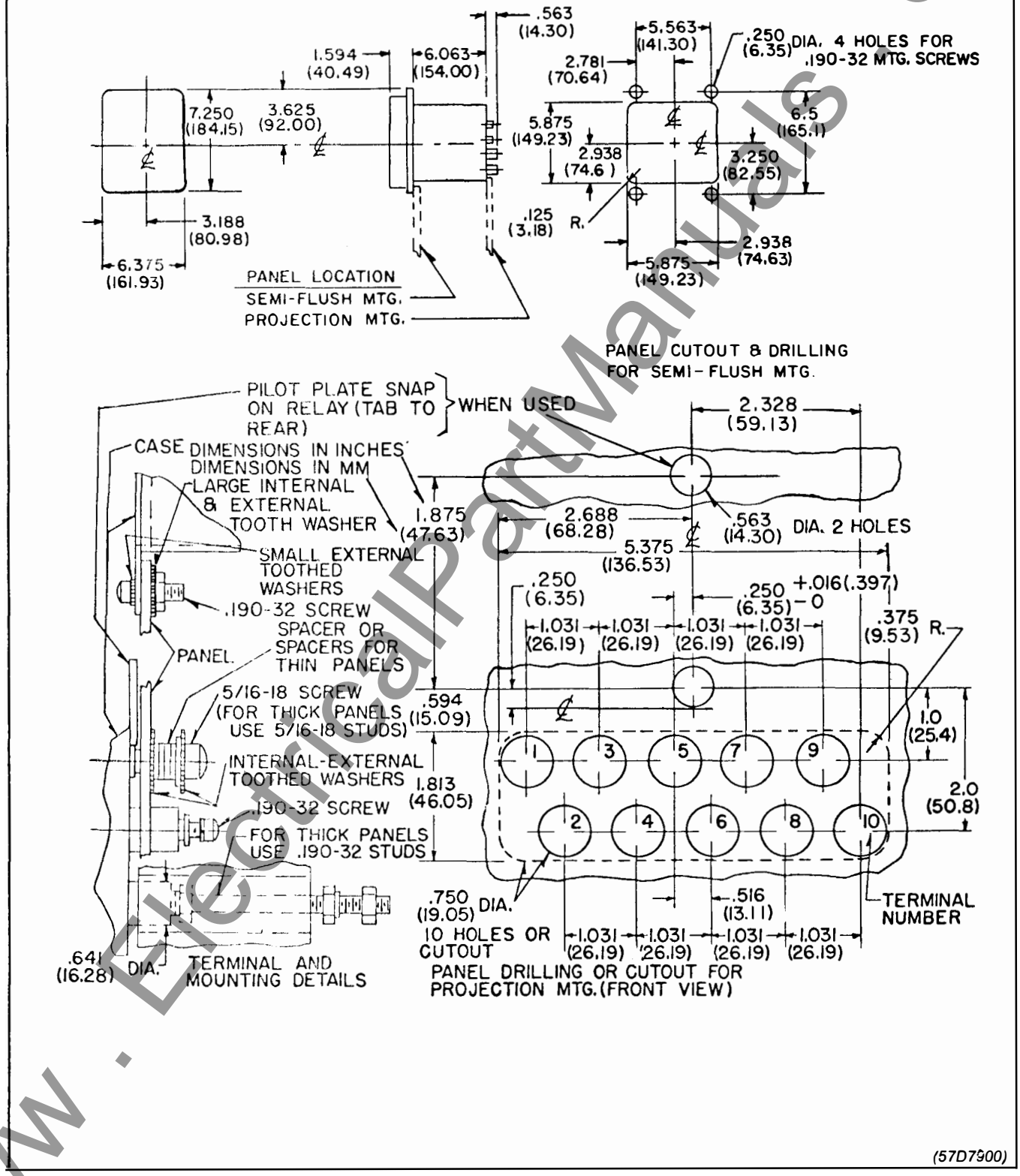


Fig. 27. Outline and Drilling Plan for ARS Relay in FT-11 Case.

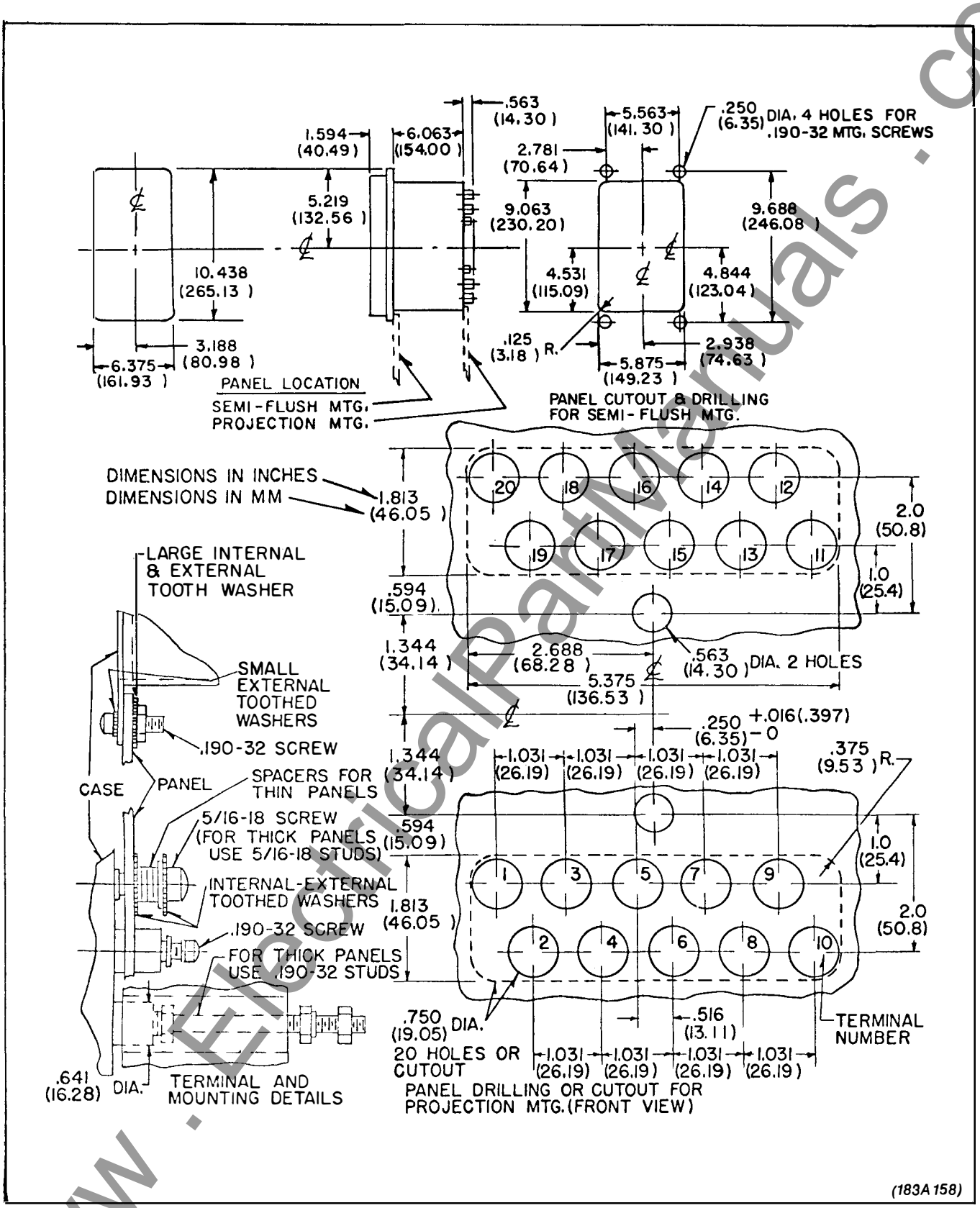


Fig. 28. Outline and Drilling Plan for ARS Relay in FT+22 Case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE ARS RELAY

CAUTION: Before putting protection relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment. Make sure that all moving parts operate freely and can close properly. Operate the relay to check the settings and electrical connections.

ARS APPLICATION

The ARS relay is a high speed contact converter for a 20 volt low energy level signal. It may be used as a tripping auxiliary for relays such as the SP and SDG-1 or as an oscillograph interface.

The driving device must be capable of providing an input to the ARS of 6 milliamperes at a level of 15 to 20 volts.

CONSTRUCTION AND OPERATION

The type ARS relay is composed of 1 or 2 AR units with series resistors, a printed circuit module, and indicating contactor switches(ICS) when required, mounted in a FT-11 or FT-22 case, depending upon style.

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

Printed Circuit Module

The printed circuit module contains the proper number of transistors, protective zener diodes, capacitors, resistors, and diodes for the buffered amplifier circuitry controlling each AR unit. With the rated supply voltage applied to the relay, the proper signal voltage applied to an input terminal will cause the related AR unit to pick up. The AR unit will then energize the ICS (if used), which will seal around the AR unit contacts.

The removal of the input voltage will cause the AR unit to drop out.

Indicating Contactor Switch Unit(ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

All ARS relays are capable of being energized continuously. The input energy requirements are listed in Table I.

AR Unit

All AR units are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables II and IV.

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

Indicating Contactor Switch(ICS)

The AR contacts will safely close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

ICS Circuit Constants

0.2 ampere tap - 6.5 ohms dc resistance

2.0 ampere tap - 0.15 ohms dc resistance

ARS Operate and Reset Time

The operate and reset times for the ARS relay are shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time(Table III)plus the AR Unit time(Table II)according to the particular contact arrangement used.

SETTINGS

Indicating Contactor Switch(ICS)

The only setting required on the ICS unit is the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration,and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or

inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed information on the FT-11 or FT-22 case, refer to I.L. 41-076.

TABLE I

INPUT ENERGY REQUIREMENTS		
INPUT (dc VOLTS)	INPUT VOLTAGE RANGE (dc VOLTS)	MAXIMUM INPUT CURRENT REQUIREMENT
20	15 to 20	6 Milliamperes
48/125	42 to 140	3 Milliamperes

TABLE II

AR UNIT OPERATE AND RESET TIMES			
Rated Operating Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO Contact Closes	NC Contact Opens	NC Contact Closes
10	2.0	1.5	4.0

TABLE III

MAXIMUM CIRCUIT DELAY TIME		
INPUT (dc Volts)	VOLTAGE APPLIED	DELAY TIME IN MICROSECONDS
20	15 Volts	90
48/125	42 Volts	700
	105 Volts	300

TABLE IV

AR UNIT CONTACT BOUNCE		
CONTACT LOADING	Effective Bounce Time in Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	---
Breaker Trip Coil	.2	---

TABLE V

CONTACT INTERRUPTING CAPABILITY (AMPERES)		
D.C. VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD
	WILL INTERRUPT	WILL INTERRUPT
250	0.2	0.1
125	0.5	0.25
48	1.5	1.0

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

Acceptance Check

AR Unit

The following check is recommended to insure that the AR unit is in proper working order.

1. Contact gaps
   a. Normally open contacts should have a gap of .018 to .023 inch.
   b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   a. On four normally open contact relays, the normally open contacts should have approximately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 15 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.
3. Armature gap

   The armature gap should be approximately .009 inches measured at the narrowest part of the armature gap.
4. Contact operate time

   Per Table II

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

Printed Circuit Module

The following check is recommended to insure that the circuitry on the printed circuit module is functioning properly.

1. Apply rated voltage to the proper supply terminals, marked positive and negative on internal schematics.
2. Apply rated voltage to each input, one at a time, and its respective AR unit should operate(pick up). Remove the input and the AR unit should drop out. The ARS relay should operate within the times shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time(Table III) plus the AR unit time(Table II) according to the particular contact arrangement used.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. (See "Acceptance Check")

Tripping Relay (AR Unit)

If the type AR tripping relay unit adjustments are disturbed in error, or it becomes necessary to replace some part, use the following adjustment procedure.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each normally open contact spring for 8 grams to just move the contact away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move contact spring away from the card. Then adjust the stationary contact to just move the contact spring away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table II and IV.

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

Printed Circuit Module

No calibration required other than check listed under acceptance check.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ELECTRICAL PARTS LIST

Note: All parts are not applicable to each relay style.

ARS FT-11 CASE

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
	RESISTORS	
R1, R2	1 K Ohm 2% ½W.	629A531H32
R3	82 K Ohm 2% ½W.	629A531H78
R4(48/125V)	20 K Ohm 2% ½W.	629A531H63
R4(250V)	10 K Ohm 2% ½W.	629A531H56
R5	10 K Ohm 2% ½W.	629A531H56
R6(48V)	1.5 K Ohm 5% 5W.	763A129H21
R6(125V)	5 K Ohm 5% 10W.	185A209H21
R7(48V)	200 Ohm 5% 25W.	1202586
R7(125V)	1.5 K Ohm 5% 25W.	1267293
R7(250V)	6 K Ohm 5% 25W.	1205222
	CAPACITORS	
C1	.047 MFD.	849A437H04
	DIODES	
D1	1N645A	837A692H03
	ZENER DIODES	
Z1	1N3686B	185A212H06
Z2	1N957B	186A797H06
Z3, Z6(48V)	1.5KE68A	878A619H02
Z3, Z6(125V)	1N3050B	187A936H17
Z4, Z5	1N3050B	187A936H17
	TRANSISTORS	
Q1, Q2(48V)	2N5681	762A672H14
Q1, Q2(125V)	2N3589	837A617H01
Q2(250V)	2N4063	878A432H01

ARS FT-22 CASE

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
	RESISTORS	
R1, R2, R7, R8	1 K Ohm 2% ½W.	629A531H32
R3, R9	82 K Ohm 2% ½W.	629A531H78
R4, R10(48/125V)	20 K Ohm 2% ½W.	629A531H63
R4, R10(250V)	10 K Ohm 2% ½W.	629A531H56
R5, R11(48,125V)	10 K Ohm 2% ½W.	629A531H56
R6, R12(48V)	1.5 K Ohm 5% 5W.	763A129H21
R6, R12(125V)	5 K Ohm 5% 10W	185A209H21
R13, R14(48V)	200 Ohm 5% 25W.	1202586
R13, R14(125V)	1.5 K Ohm 5% 25W.	1267293
R11, R12(250V)	6 K Ohm 5% 25W.	1205222
	CAPACITORS	
C1, C2	.047 MFD.	849A437H04
	DIODES	
D1, D2	1N645A	837A692H03
	ZENER DIODES	
Z1, Z6	1N3686B	185A212H06
Z2, Z7	1N957B	186A797H06
Z3, Z8, Z11, Z12 (48V)	1.5KE68A	878A619H02
Z3, Z8, Z11, Z12 (125V)	1N3050B	187A936H17
Z4, Z5, Z9, Z10 (250V)	1N3050B	187A936H17
	TRANSISTORS	
Q1, Q2, Q3, Q4(48V)	2N5681	762A672H14
Q1, Q2, Q3, Q4(125V)	2N3589	837A617H01
Q2, Q4(250V)	2N4063	878A432H01

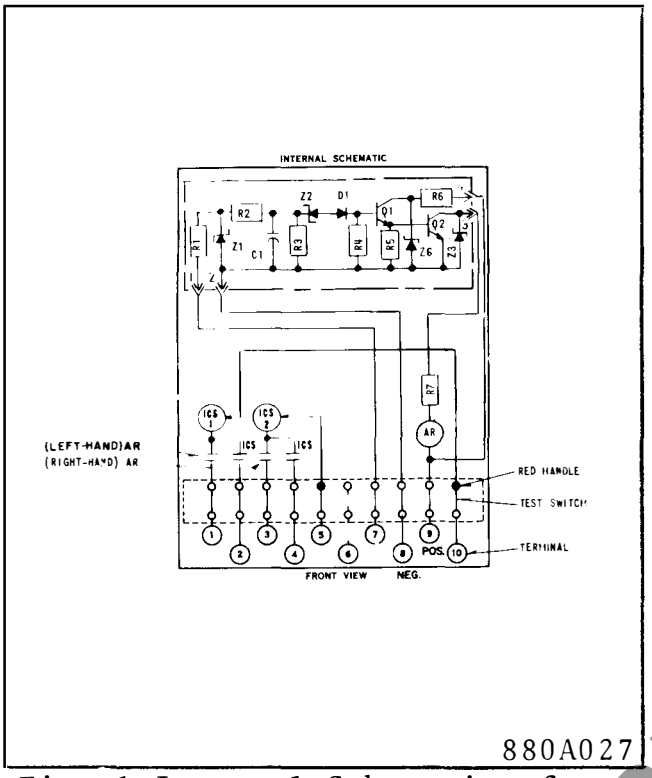


Fig. 1 Internal Schematic of type ARS Relay in the FT-11 case single input buffer, 1 AR unit (2M Contacts) with double ICS units.

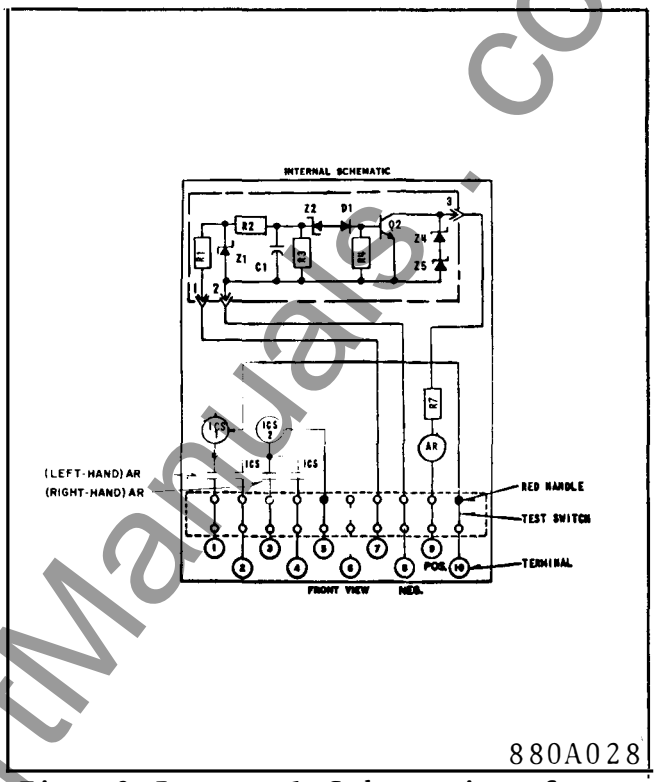


Fig. 2 Internal Schematic of type ARS relay in the FT-11 case single input buffer, 1AR unit (2M Contacts) with double ICS units. (250 VDC)

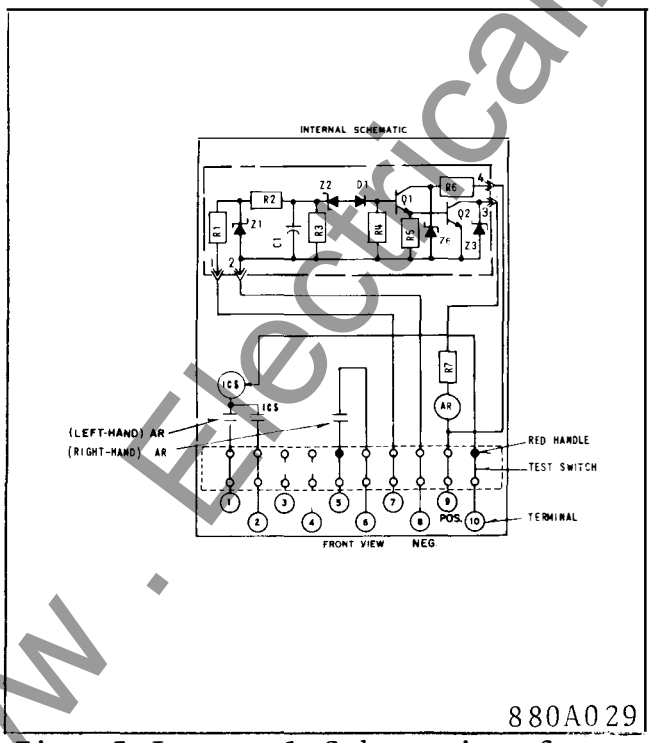


Fig. 3 Internal Schematic of type ARS Relay in the FT-11 case single input buffer, 1 AR unit (2M contacts) with single ICS UNIT.

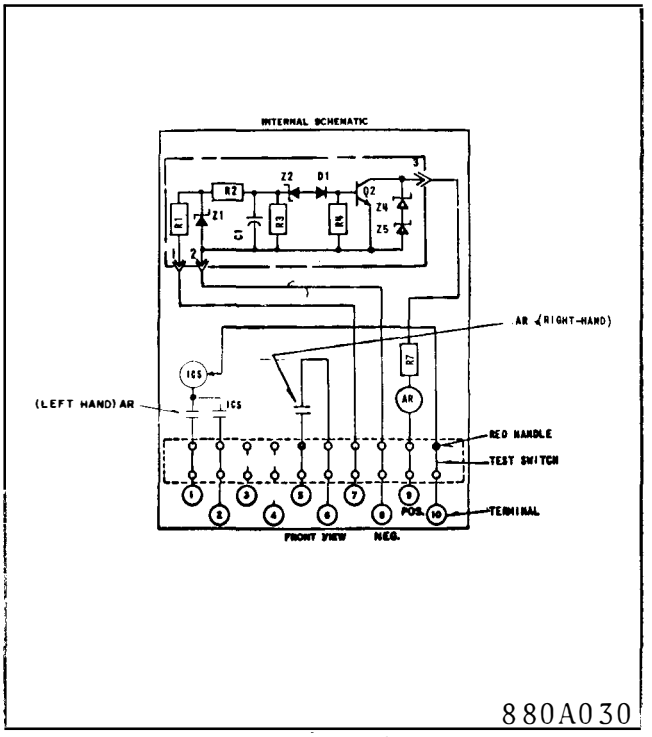


Fig. 4 Internal Schematic of type ARS relay in the FT-11 case, single input buffer, 1 AR unit (2M contacts) with single ICS unit (250 VDC)

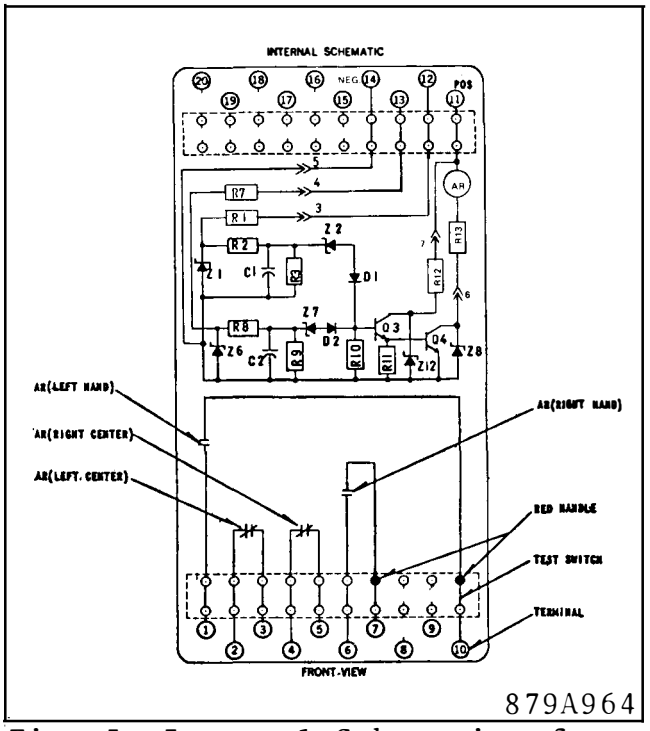


Fig. 5 Internal Schematic of type ARS relay in the FT-22 case, two buffered input "or" 1 AR unit (2M2B contacts).

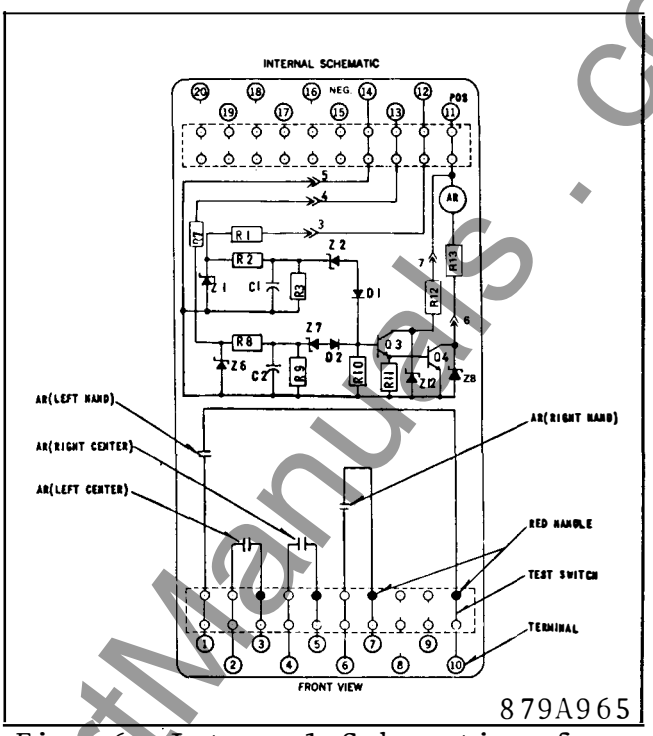


Fig. 6 Internal Schematic of type ARS relay in the FT-22 case, two buffered input "or" 1 AR unit (4M contacts).

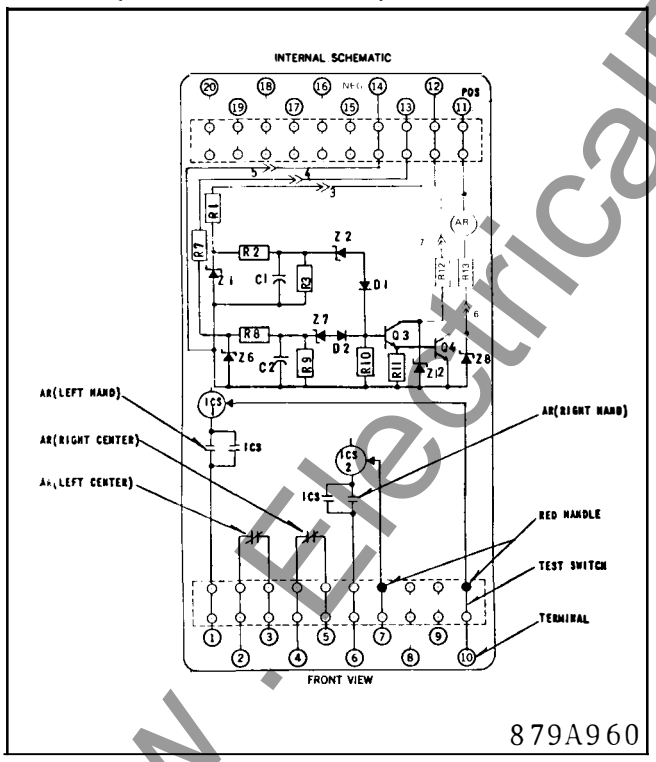


Fig. 7 Internal Schematic of type ARS relay in the FT-22 case, two buffered input "or" 1 AR unit (2M2B) contacts with double ICS units

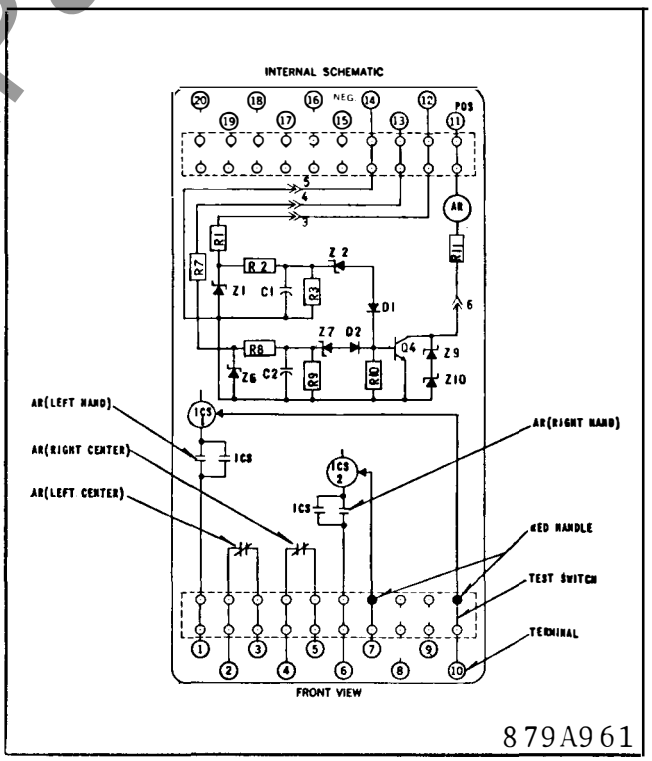


Fig. 8 Internal Schematic of type ARS relay in the FT-22 case, two buffered input "or", 1 AR unit (2M2B contacts) with double ICS Units (250 VDC).

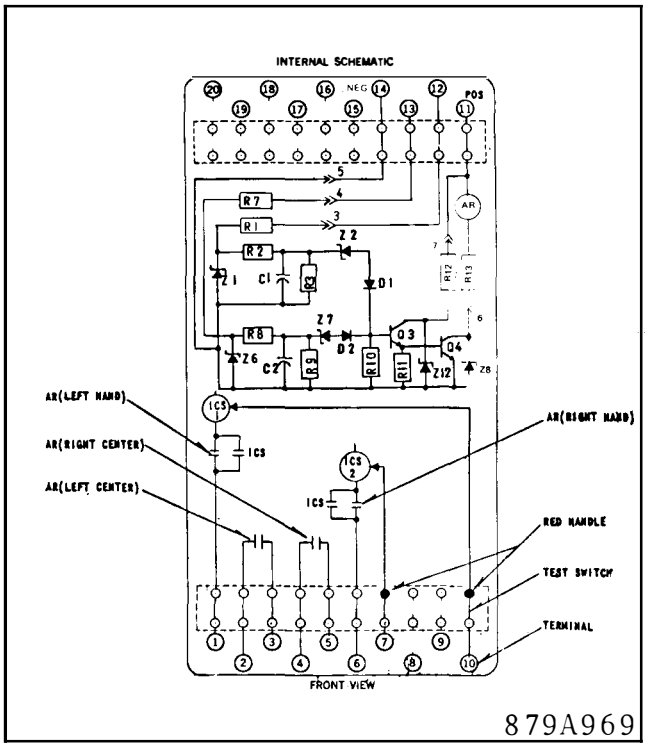


Fig. 9 Internal Schematic of type ARS relay in the FT-22 case, two buffered input "or", 1 AR unit (4M contacts) with double ICS units.

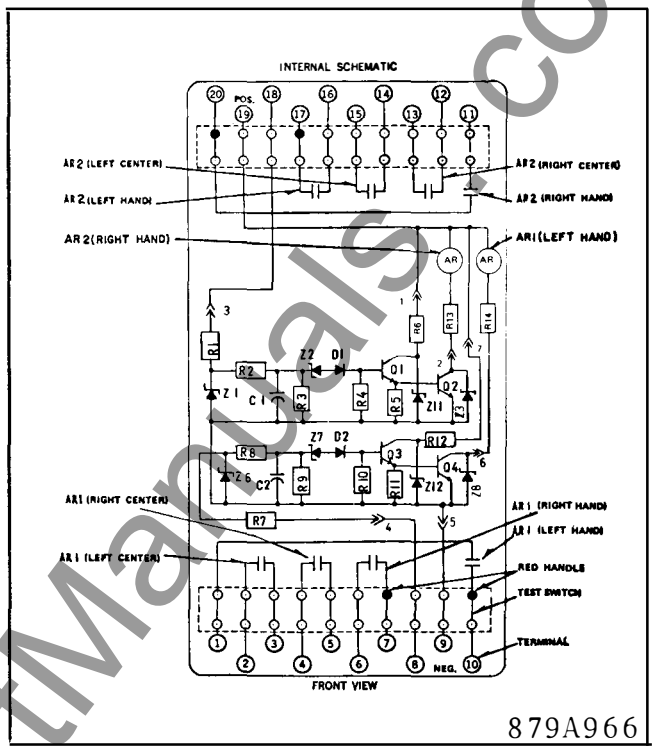


Fig. 10 Internal Schematic of type ARS relay in the FT-22 case, two single buffer inputs, 2 AR units (4M-4M contacts).

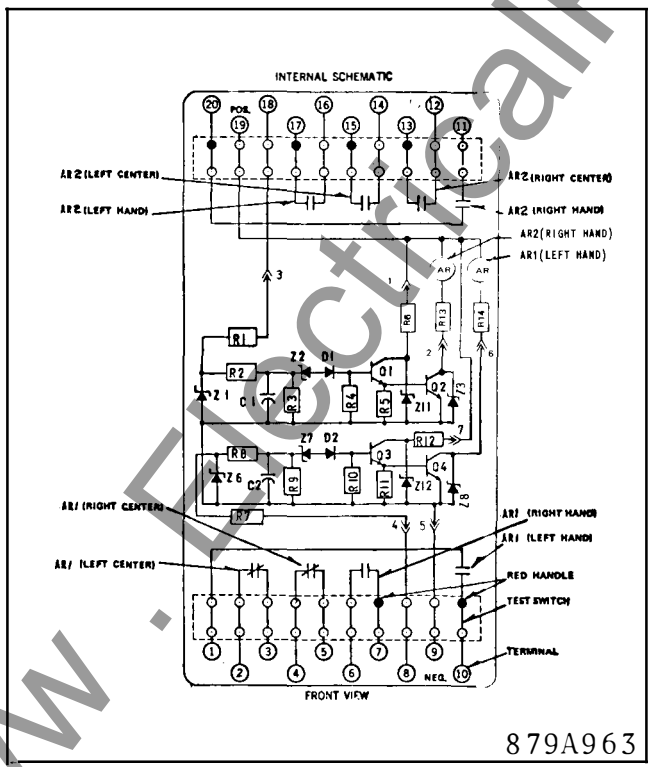


Fig. 11 Internal Schematic of type ARS relay in the FT-22 case, two single buffer inputs 2 AR units (4M-2M2B contacts).

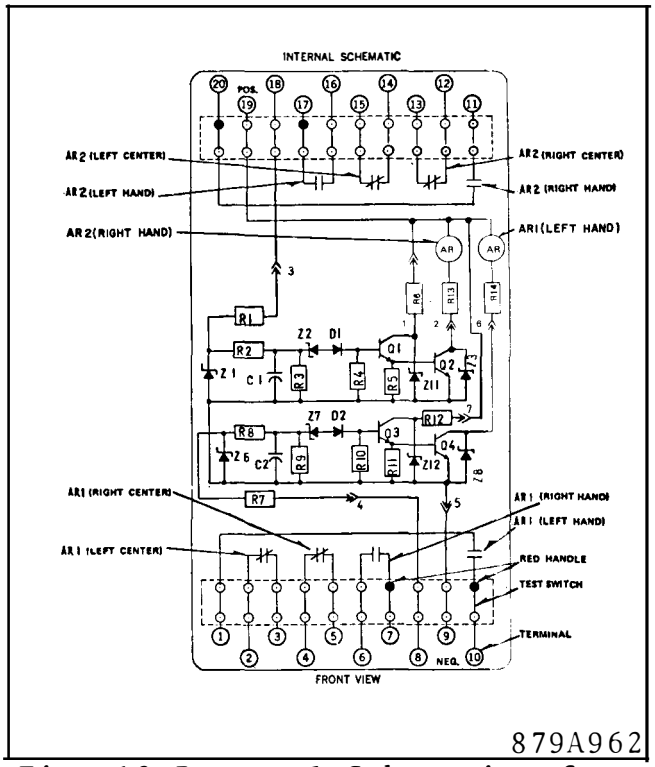


Fig. 12 Internal Schematic of type ARS relay in the FT-22 case, two single buffer inputs, 2 AR units (2M2B-2M2B contacts).

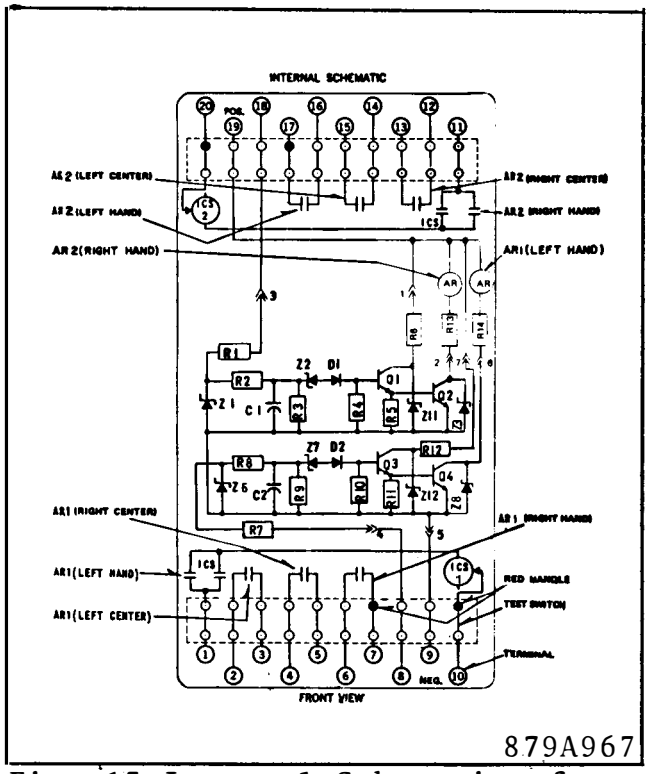


Fig. 13 Internal Schematic of type ARS relay in the FT-22 case, two single buffer inputs, 2 AR units (4M-4M contacts) with double ICS Units.

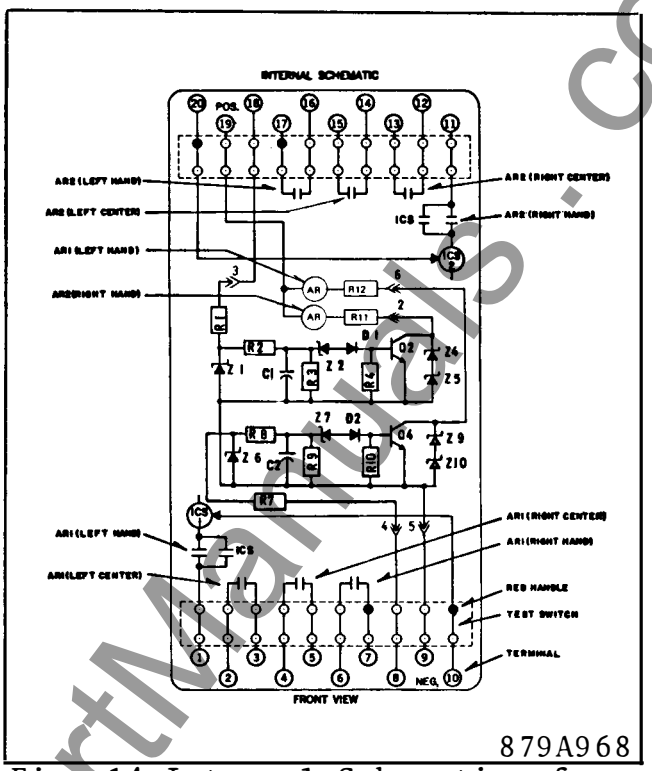


Fig. 14 Internal Schematic of type ARS relay in the FT-22 case, two single buffer inputs 2 AR units (2M2B-2M2B contacts) with double ICS units (250 VDC).

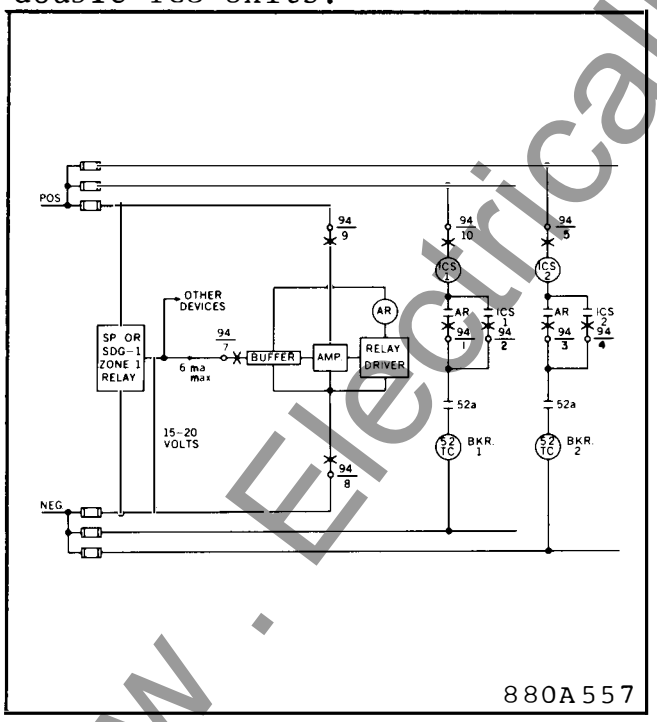


Fig. 15 External Schematic for the type ARS Relay

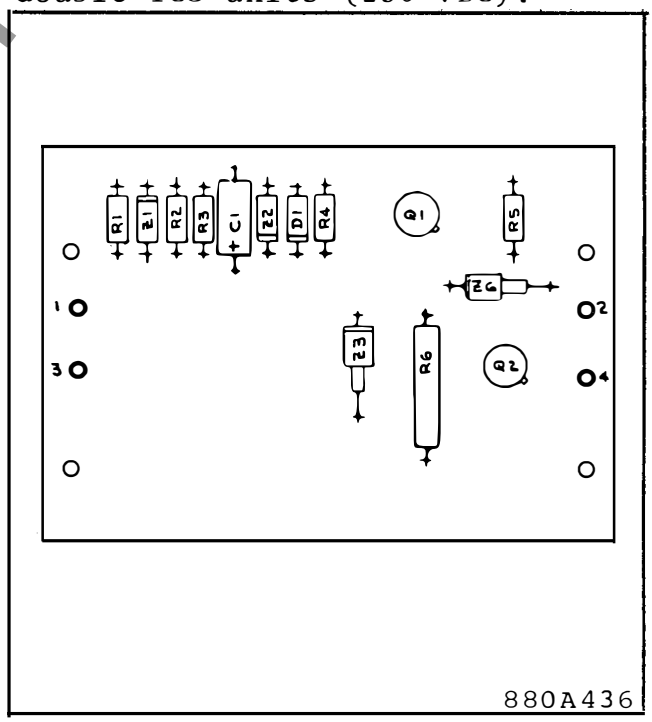


Fig. 16 Printed Circuit Module Component location type ARS relay FR-11 case 48 VDC

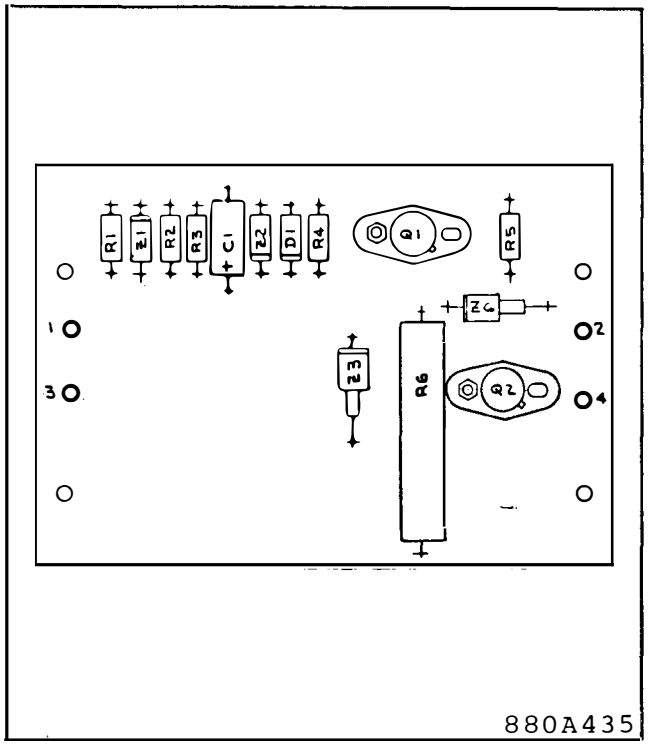


Fig. 17 Printed Circuit Module Component location type ARS relay FT-11 case 125 VDC

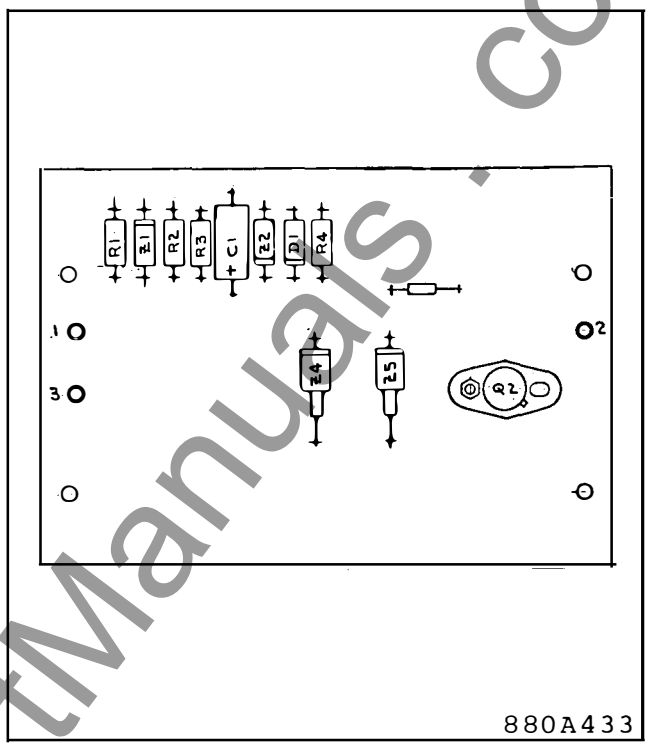


Fig. 18 Printed Circuit Module Component location type ARS relay FT-11 case 250 VDC

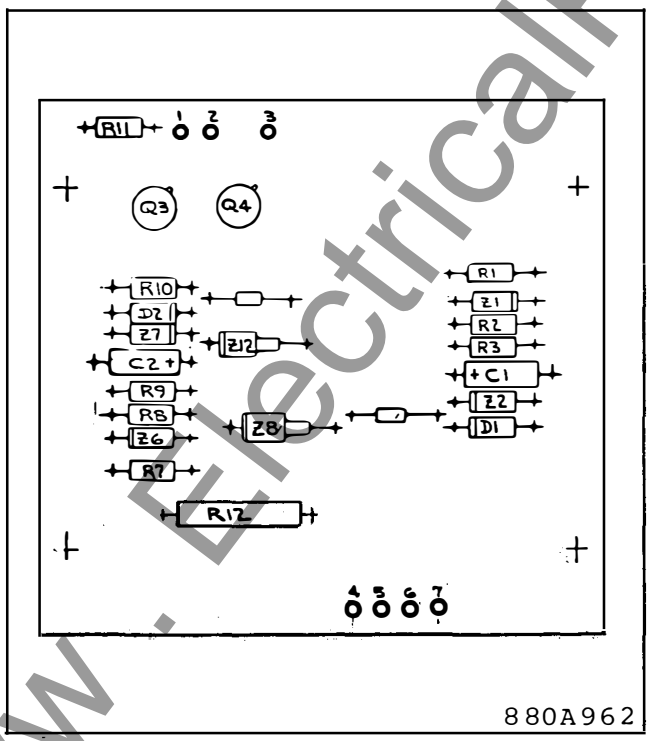


Fig. 19 Printed Circuit Module Component location type ARS relay FT-22 case 48 VDC Two buffered input "or"

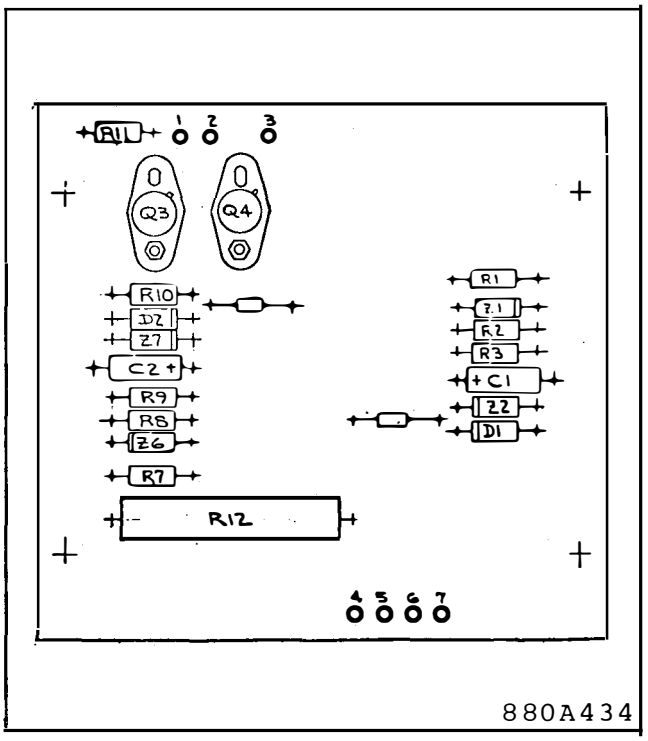


Fig. 20 Printed Circuit Module Component location type ARS relay FT-22 case 125 VDC Two buffered input "or"

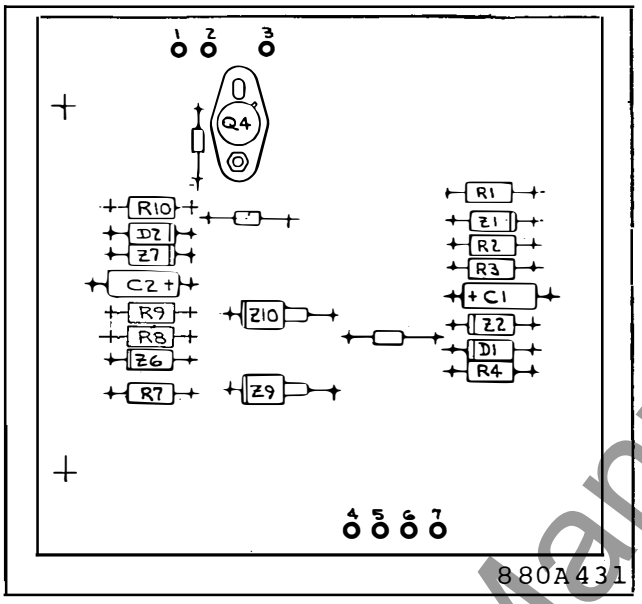


Fig. 21 Printed Circuit Module Component location Type ARS relay FT-22 case 250 VDC Two buffered input "or"

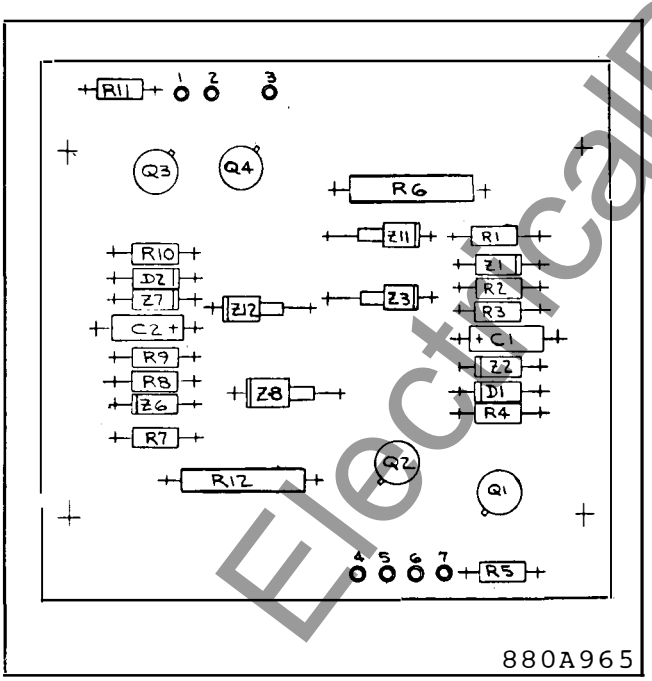


Fig. 22 Printed Circuit Module Component location type ARS relay FT-22 case 48 VDC Two single buffer inputs

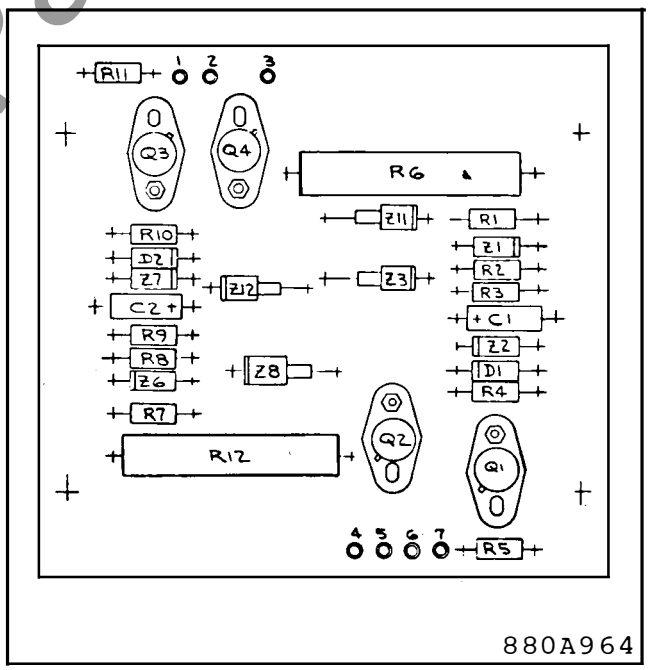


Fig. 23 Printed Circuit Module Component location type ARS relay FT-22 case 125 VDC Two single buffer inputs

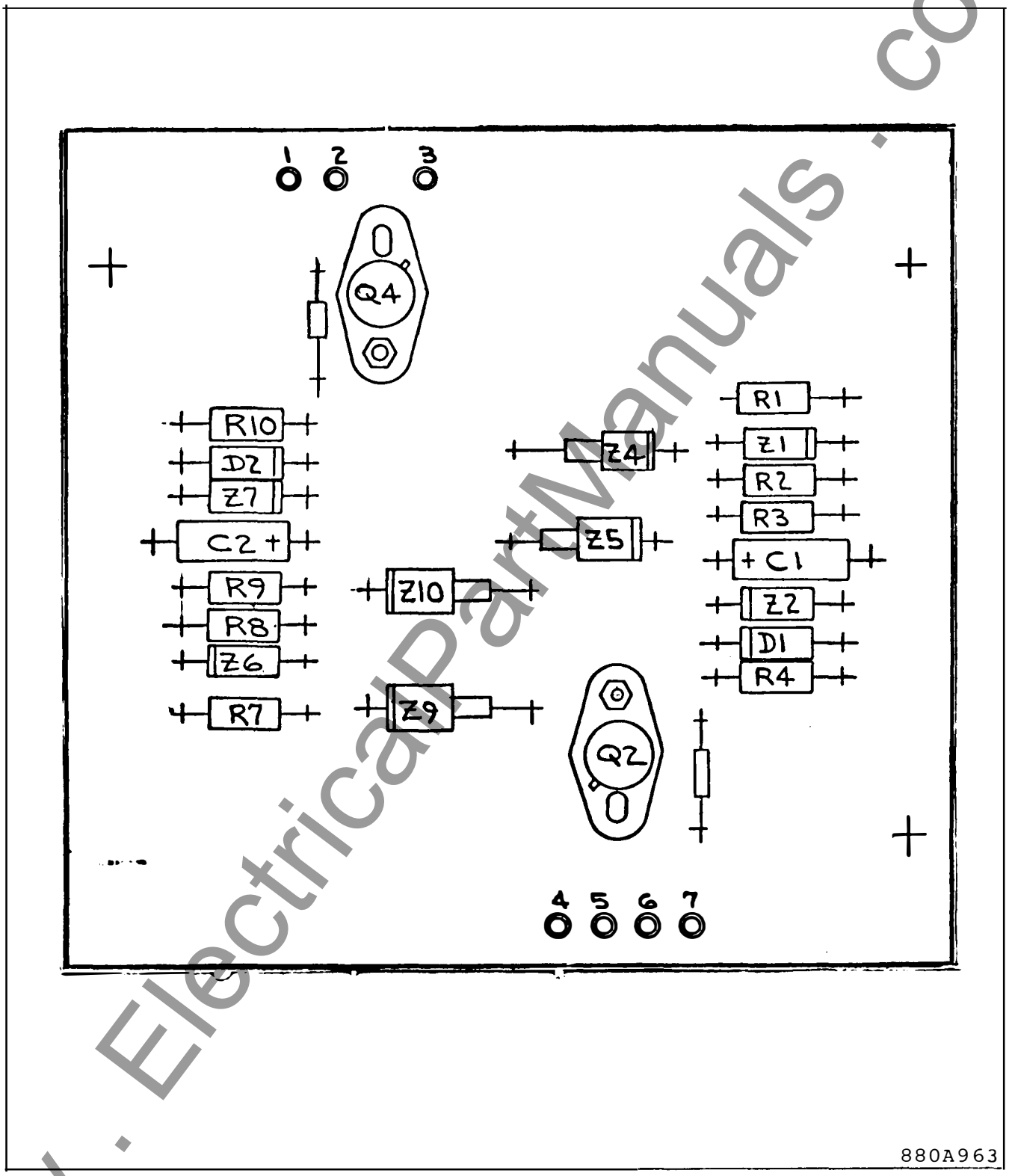


Fig. 24 Printed Circuit Module Component location type ARS relay FT-22 case 250 VDC two single buffer inputs.

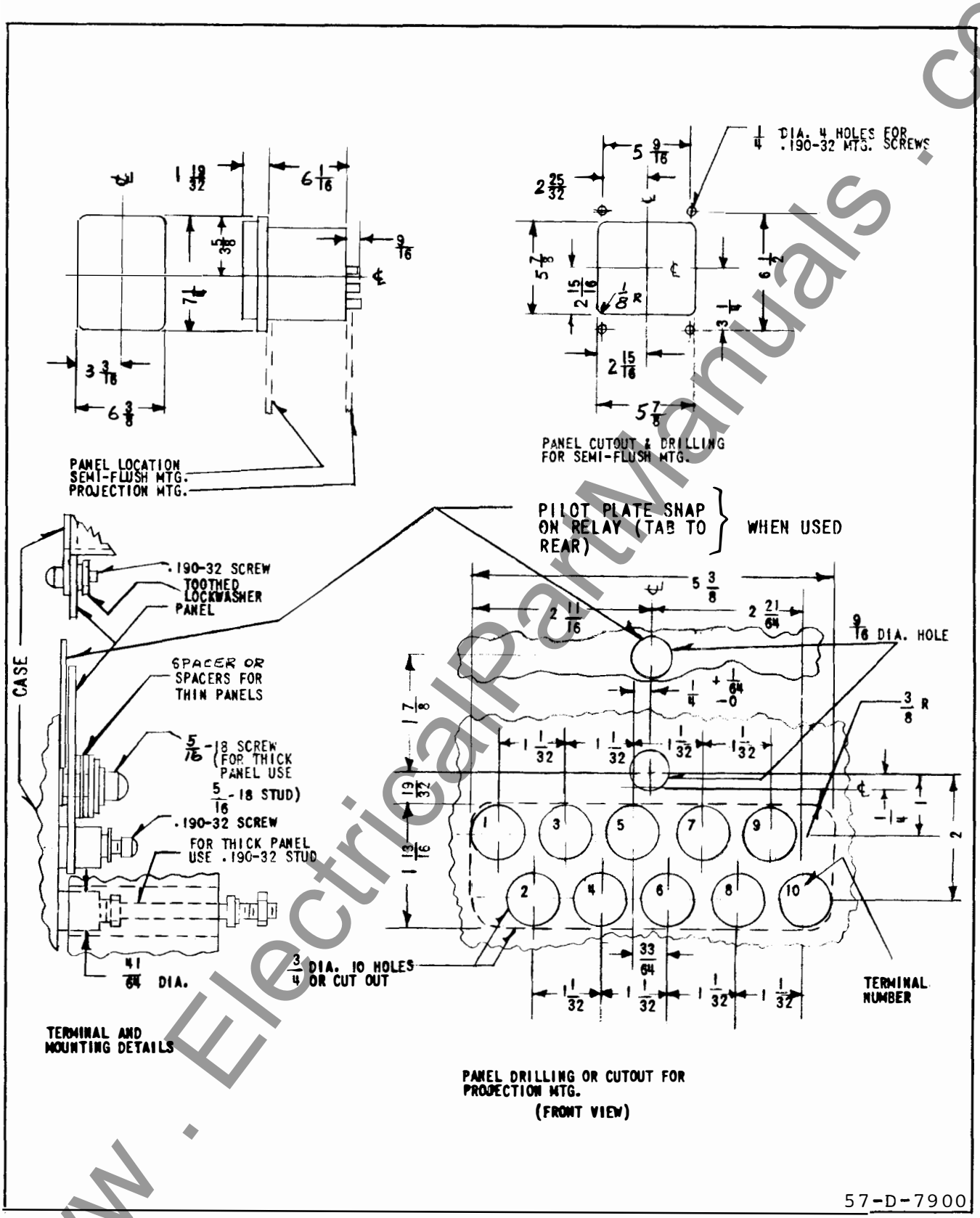


Fig. 25 Outline and drilling plan for the type ARS relay in the FT-11 case.

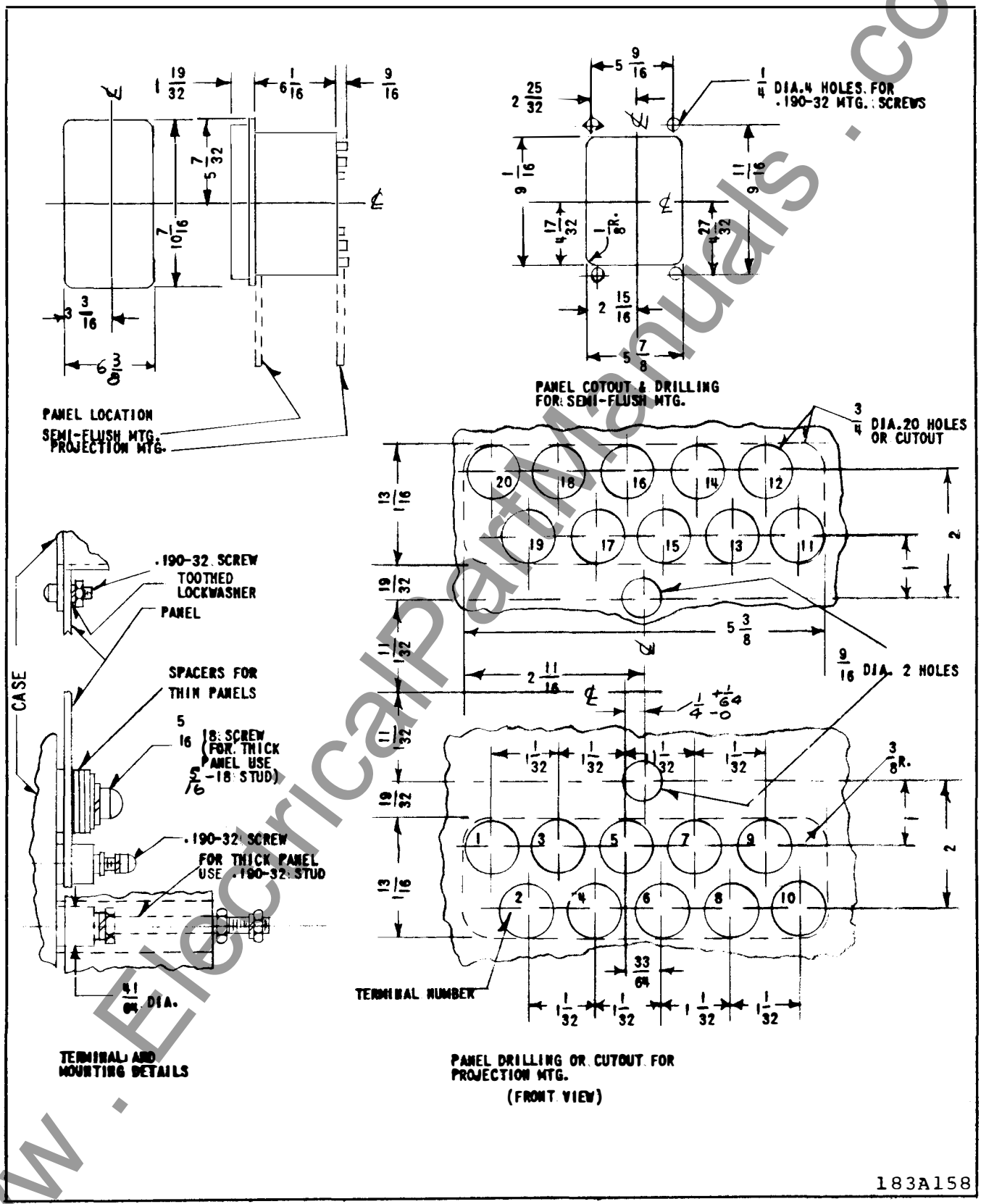


Fig. 26 Outline and drilling plan for the type ARS relay in the FT-22 case

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE ARS RELAY

CAUTION: Before putting protection relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment. Make sure that all moving parts operate freely and can close properly. Operate the relay to check the settings and electrical connections.

ARS APPLICATION

The ARS relay is a high speed contact converter for a 20 volt low energy level signal. It may be used as a tripping auxiliary for relays such as the SP and SDG-1 or as an oscillograph interface.

The driving device must be capable of providing an input to the ARS of 6 milliamperes at a level of 15 to 20 volts.

CONSTRUCTION & OPERATION

The type ARS relay is composed of 1 or 2 AR units with series resistors, a printed circuit module, and indicating contactor switches (ICS) when required, mounted in a FT-11 or FT-22 case, depending upon style.

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

Printed Circuit Module

The printed circuit module contains the proper number of transistors, protective zener diodes, capacitors, resistors, and diodes for the buffered amplifier circuitry controlling each AR unit. With the rated supply voltage to the relay, the proper signal voltage applied to an input terminal will cause the related AR unit to pick up. The AR unit will then energize the ICS (if used), which will seal around the AR unit contacts.

The removal of the input voltage will cause the AR unit to drop out.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

All ARS relays are capable of being energized continuously. The input energy requirements are listed in Table I.

SUPERSEDES I.L. 41-759.2
Complete Revision

EFFECTIVE FEBRUARY 1973

AR Unit

All AR units are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables II and IV.

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

Indicating Contactor Switch (ICS)

The AR contacts will safely close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

ICS Circuit Constants

0.2 ampere tap – 6.5 ohms dc resistance

2.0 ampere tap – 0.15 ohms dc resistance

ARS Operate and Reset Time

The operate and reset times for the ARS relay are shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

SETTINGS

Indicating Contactor Switch (ICS)

The only setting required on the ICS unit is the selection of the 0.2 or 2.0 ampere tap setting. This is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed information on the FT-11 or FT-22 case, refer to I.L. 41-076.

TABLE I

INPUT ENERGY REQUIREMENTS

INPUT (dc Volts)	INPUT VOLTAGE RANGE (dc Volts)	MAXIMUM INPUT CURRENT REQUIREMENT
20	15 to 20	6 Milliamperes

TABLE II

AR UNIT OPERATE AND RESET TIMES

Rated Operating Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO Contact Closes	NC Contact Opens	NC Contact Closes
10	2.0	1.5	4.0

TABLE III

MAXIMUM CIRCUIT DELAY TIME

INPUT (dc Volts)	VOLTAGE APPLIED	DELAY TIME IN MICROSECONDS
20	15 Volts	90

TABLE IV

AR UNIT CONTACT BOUNCE

CONTACT LOADING	Effective Bounce Time In Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	—
Breaker Trip Coil	.2	—

TABLE V

CONTACT INTERRUPTING CAPABILITY (AMPERES)

D.C. VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD
	WILL INTERRUPT	WILL INTERRUPT
250	0.2	0.1
125	0.5	0.25
48	1.5	1.0

ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

ACCEPTANCE CHECK

AR Unit

The following check is recommended to insure that the AR unit is in proper working order.

1. Contact gaps
   a. Normally open contacts should have a gap of .018 to .023 inch.
   b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   a. On four normally open contact relays, the normally open contacts should have approximinately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 15 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.
3. Armature gap

   The armature gap should be .009 inches measured at the narrowest part of the armature gap.
4. Contact operate time

   Per Table II

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting used. The operation indicator target should drop freely.

Printed Circuit Module

The following check is recommended to insure that the circuitry on the printed circuit module is functioning properly.

1. Apply rated voltage to the proper supply terminals, marked positive and negative on internal schematics.
2. Apply rated voltage to each input, one at a time, and its respective AR unit should operate (pick up). Remove the input and the AR unit should drop out. The ARS relay should operate within the times shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. ((See "Acceptance Check")

Tripping Relay (AR Unit)

If the type AR tripping relay unit adjustments are disturbed or are in error, or it becomes necessary to replace some part, use the following adjustment procedure.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each normally open contact spring for 8 grams to just move the contact away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move contact spring away from the card. Then adjust the stationary contact screw to just away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table II and IV.

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

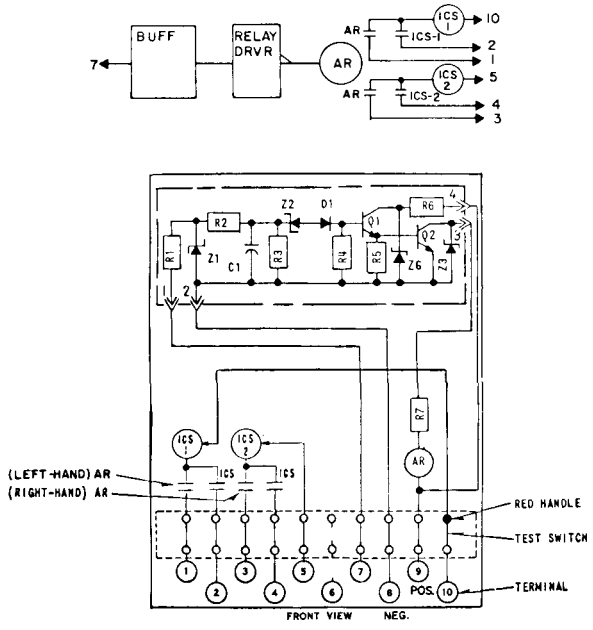
Printed Circuit Module

No calibration required other than check listed under acceptance check.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

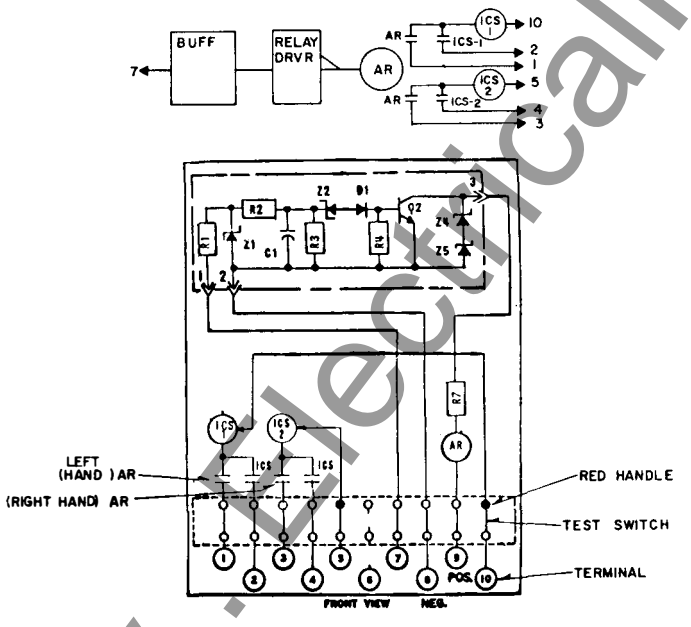
RELAY STYLE NUMBER	DESCRIPTION	INTERNAL SCHEMATIC	CIRCUIT BOARD STYLE NUMBER	CIRCUIT BOARD COMPONENT LOCATION
FT-11 CASE				
718B820A09	48 Vdc; 2M contacts; 2 ICS units	719B963 (Fig. 1)	204C674G01	880A436 (Fig. 5)
718B820A10	125 Vdc; 2M contacts; 2 ICS units	719B963 (Fig. 1)	204C674G02	880A435 (Fig. 6)
718B820A11	250 Vdc; 2M contacts; 2 ICS units	719B944 (Fig. 2)	204C818G01	880A433 (Fig. 7)
718B820A12	48 Vdc; 2M contacts; 1 ICS unit	719B945 (Fig. 3)	204C674G01	880A436 (Fig. 5)
718B820A13	125 Vdc; 2M contacts; 1 ICS unit	719B945 (Fig. 3)	204C674G02	880A435 (Fig. 6)
718B820A14	250 Vdc; 2M contacts; 1 ICS unit	719B946 (Fig. 4)	204C818G01	880A433 (Fig. 7)
FT-22 CASE				
717B770A10	48 Vdc; 2M-2B contacts;	719B951 (Fig. 8)	204C761G02	880A962 (Fig. 13)
717B770A11	125 Vdc; 2M-2B contacts;	719B951 (Fig. 8)	204C761G01	880A434 (Fig. 14)
717B770A12	48 Vdc; 4M contacts	719B952 (Fig. 9)	204C761G02	880A962 (Fig. 13)
717B770A13	125 Vdc; 4M contacts;	719B952 (Fig. 9)	204C761G01	880A434 (Fig. 14)
717B770A14	48 Vdc; 2M-2B contacts; 2 ICS units	719B947 (Fig. 10)	204C761G02	880A962 (Fig. 13)
717B770A15	125 Vdc; 2M-2B contacts; 2 ICS units	719B947 (Fig. 10)	204C761G01	880A434 (Fig. 14)
717B770A16	250 Vdc; 2M-2B contacts; 2 ICS units	719B948 (Fig. 11)	204C762G01	880A431 (Fig. 15)
717B770A17	48 Vdc; 4M contacts; 2 ICS units	719B956 (Fig. 12)	204C761G02	880A962 (Fig. 13)
717B770A18	125 Vdc; 4M contacts; 2 ICS units	719B956 (Fig. 12)	204C761G01	880A434 (Fig. 14)
717B770A19	48 Vdc; 4M-4M contacts;	719B953 (Fig. 16)	204C675G02	880A965 (Fig. 23)
717B770A20	125 Vdc; 4M-4M contacts;	719B953 (Fig. 16)	204C675G01	880A964 (Fig. 24)
717B770A21	48 Vdc; 4M-2M/2B contacts;	719B950 (Fig. 17)	204C675G02	880A965 (Fig. 23)
717B770A22	125 Vdc; 4M-2M/2B contacts;	719B950 (Fig. 17)	204C675G01	880A964 (Fig. 24)
717B770A23	48 Vdc; 2M/2B-2M/2B contacts;	719B949 (Fig. 18)	204C675G02	880A965 (Fig. 23)
717B770A24	125 Vdc; 2M/2B-2M/2B contacts;	719B949 (Fig. 18)	204C675G01	880A964 (Fig. 24)
717B770A25	48 Vdc; 4M-4M contacts; 2 ICS units	719B954 (Fig. 19)	204C675G02	880A965 (Fig. 23)
717B770A26	125 Vdc; 4M-4M contacts; 2 ICS units	719B954 (Fig. 19)	204C675G01	880A964 (Fig. 24)
717B770A27	250 Vdc; 2M-2B/2M-2B contacts; 2 ICS units	719B955 (Fig. 20)	204C763G01	880A963 (Fig. 25)
717B770A28	125 Vdc; 2M-2B/2M-2B contacts; 2 ICS units	719B957 (Fig. 21)	204C675G01	880A964 (Fig. 24)
717B770A29	250 Vdc; 4M contacts; 2 ICS units	719B958 (Fig. 22)	204C762G01	880A431 (Fig. 15)



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N9578
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1 - R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202586	1	200 Ω-25W
R7 (125VDC)	1267293	1	1500 Ω-25W

SUB. 1
719B963

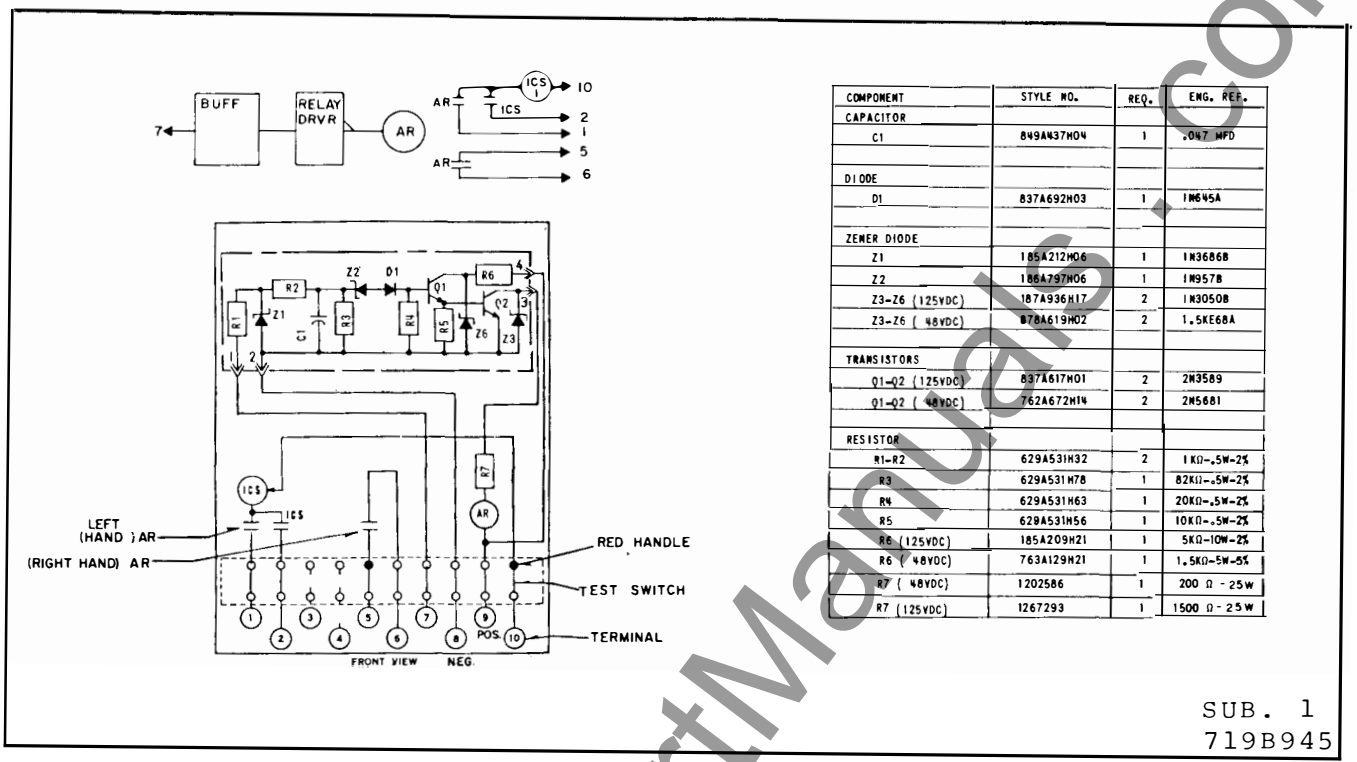
Fig. 1. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts - 2 ICS Units in FT-11 Case 48 & 125 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N9578
Z4 - Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1 - R2	629A531H32	2	1KΩ-.5W -2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250V)	1205222	1	6000 Ω- 25W

SUB. 1
719B944

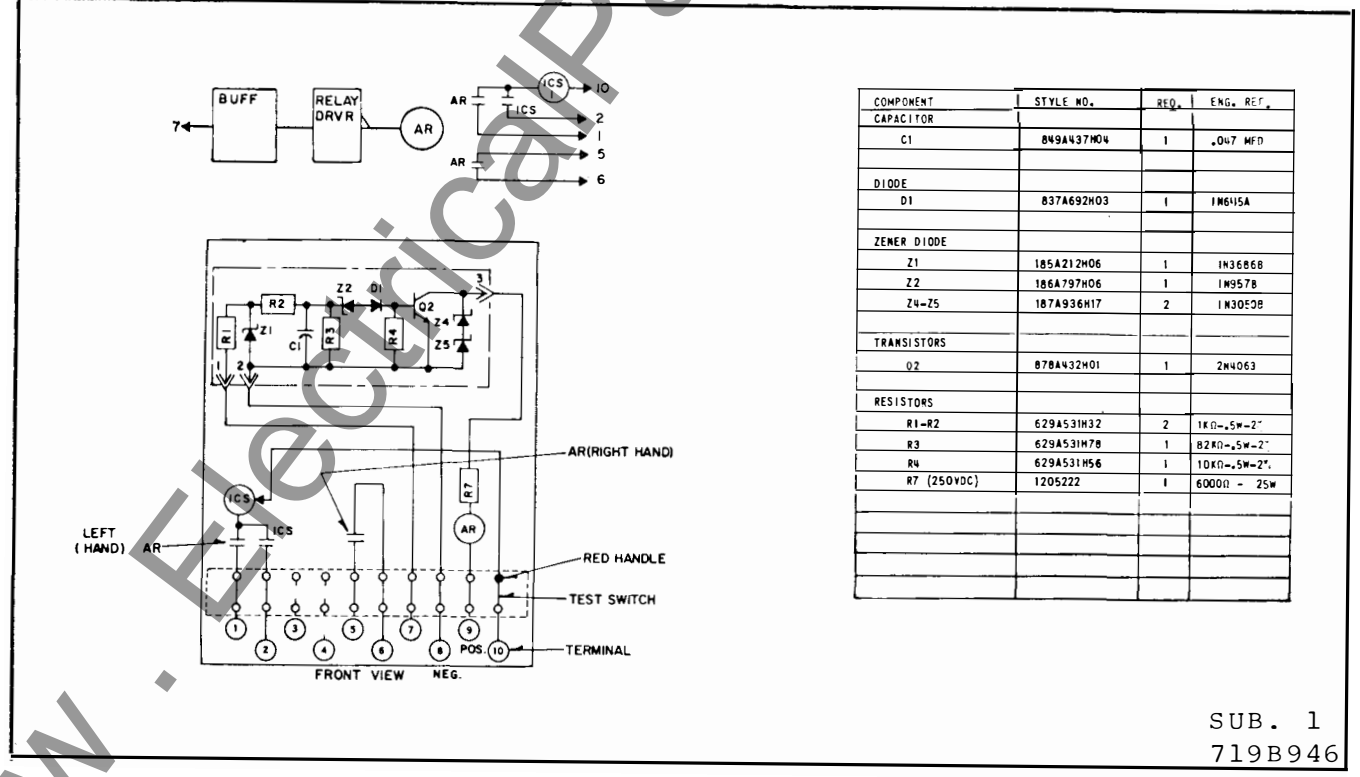
Fig. 2. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts 2 ICS Units in FT-11 Case 250 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202586	1	200 Ω - 25W
R7 (125VDC)	1267293	1	1500 Ω - 25W

SUB. 1
719B945

Fig. 3. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 48 & 125 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z4-Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250VDC)	1205222	1	6000Ω - 25W

SUB. 1
719B946

Fig. 4. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 250 V.D.C.

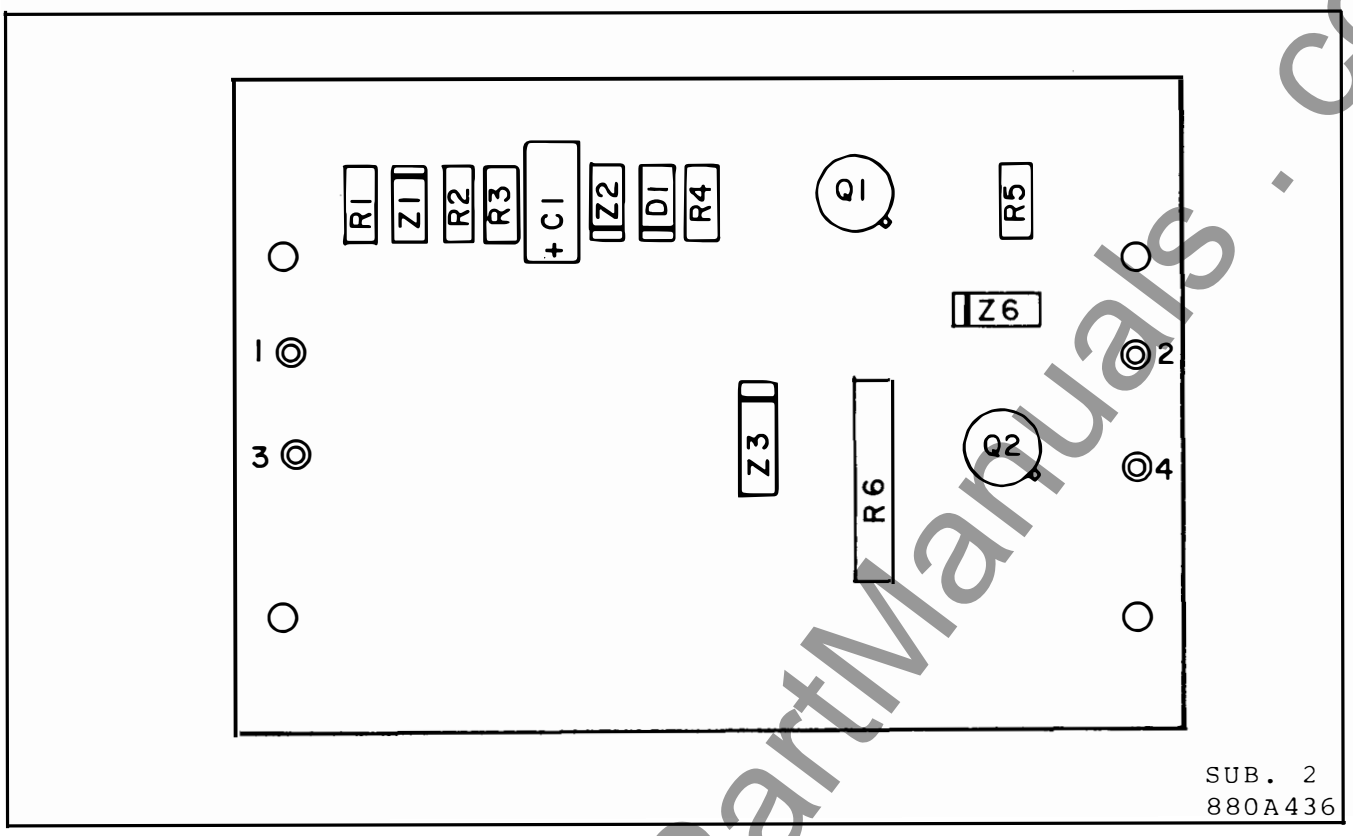


Fig. 5. Component Location Single Input Buffer in Type FT-11 Case - 48 VDC.

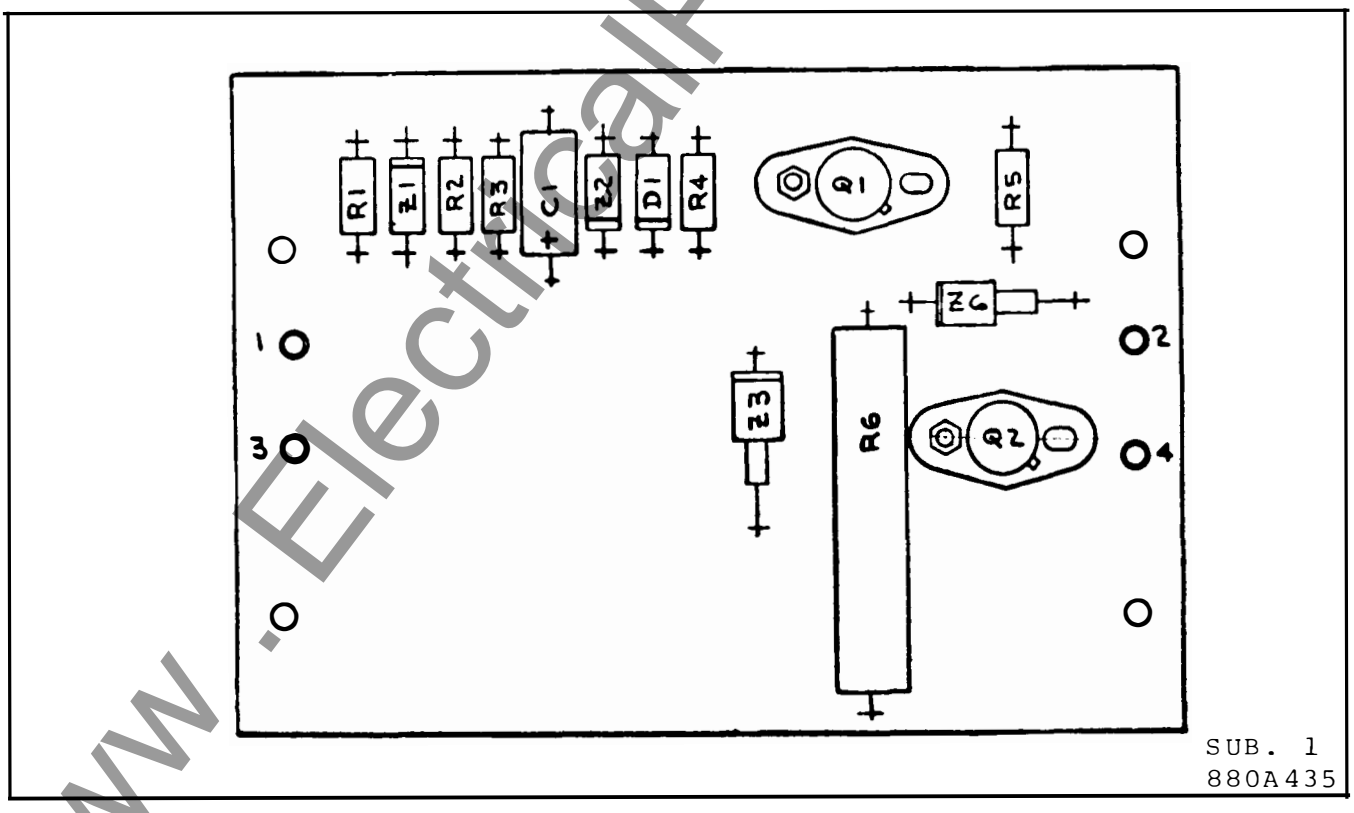


Fig. 6. Component Location Single Input Buffer in FT-11 Case 125 VDC.

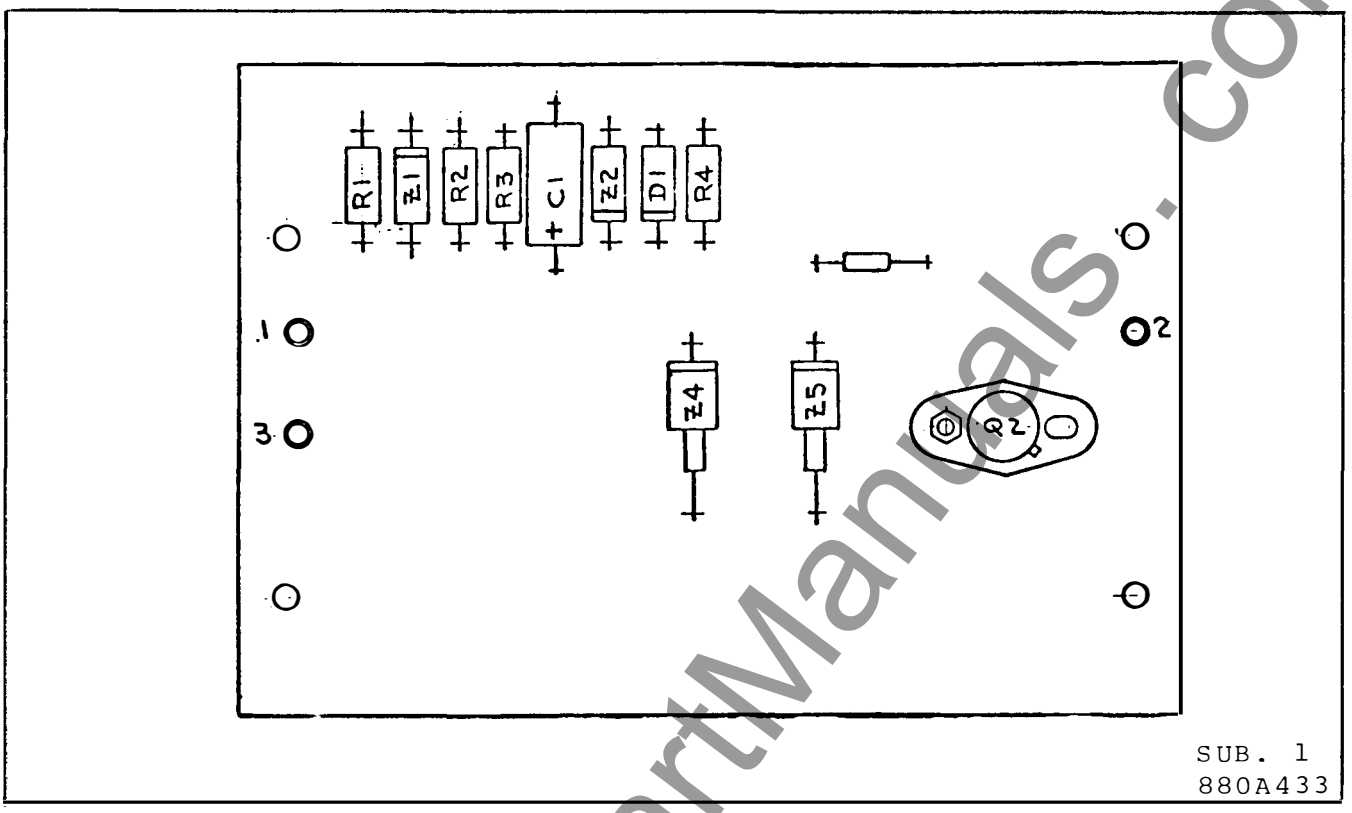
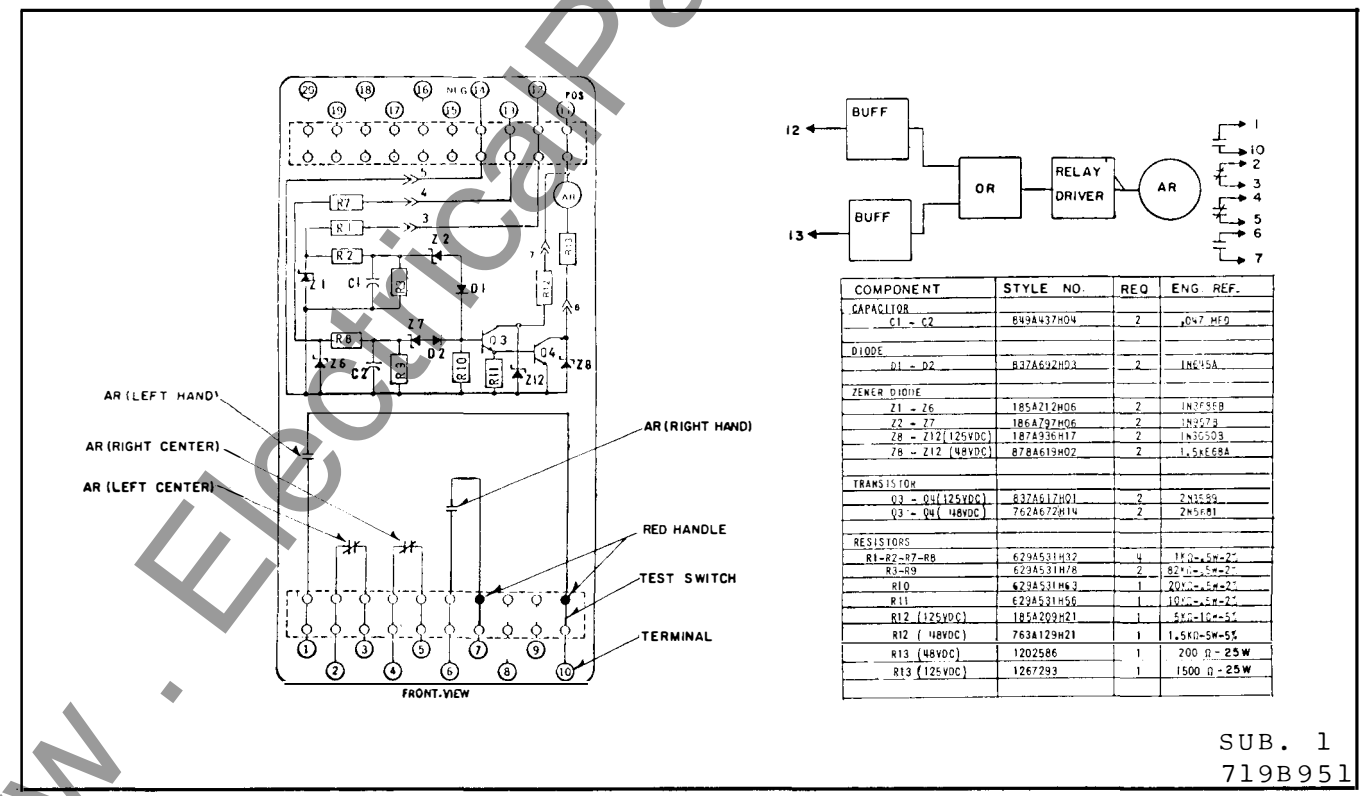
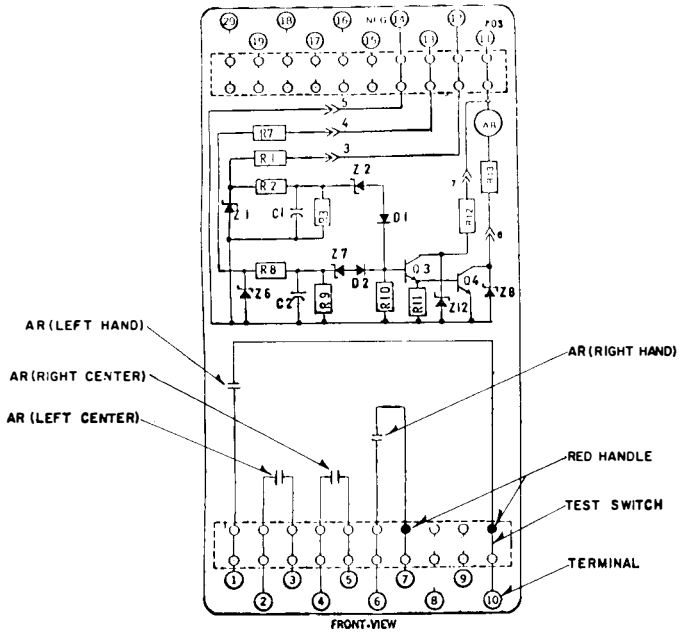


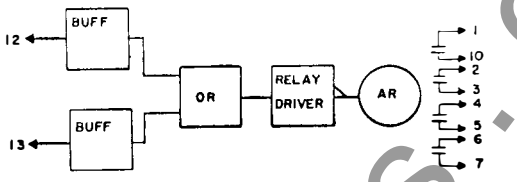
Fig. 7. Component Location Single Input Buffer in FT-11 Case 250 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	IN645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	IN2998B
Z7 - Z7	186A797H06	2	IN2973
Z8 - Z12 (125VDC)	187A936H17	2	IN3600B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3599
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125VDC)	1267293	1	1500 Ω - 25W

Fig. 8. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts in FT-22 Case 48 & 125 VDC.

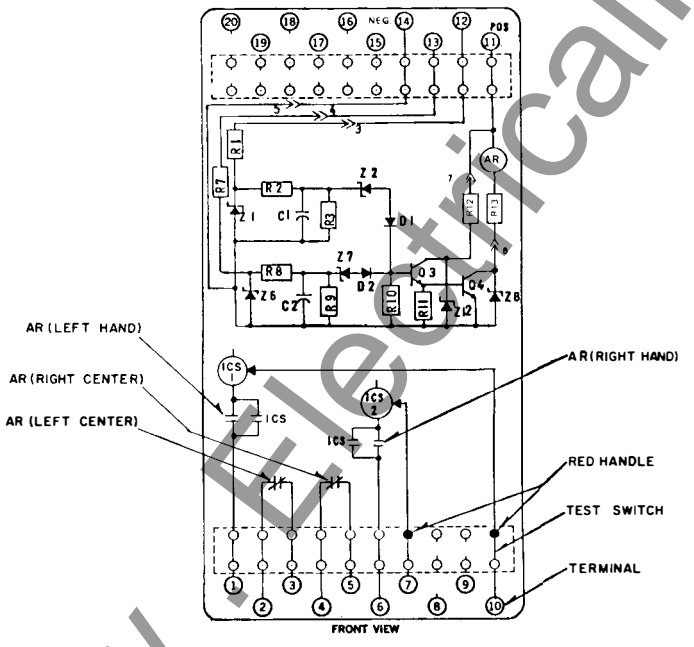


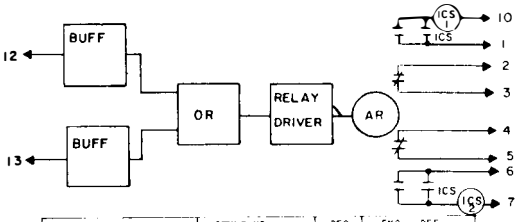


COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3668B
Z2 - Z7	186A797H06	2	1N9578
Z8 - Z12 (125VDC	187A936H17	2	1N3050B
Z8 - Z12 (48VDC	879A619H02	2	1.5KE68A
TRANSISTOR			
Q3-Q4 (125VDC)	837A617H01	2	2N3589
Q3-Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1 02586	1	200 Ω- 25W
R13 (125 VDC)	1267293	1	1500 Ω- 25W

SUB. 1
719B952

Fig. 9. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts in FT-22 Case 48 & 125 VDC.

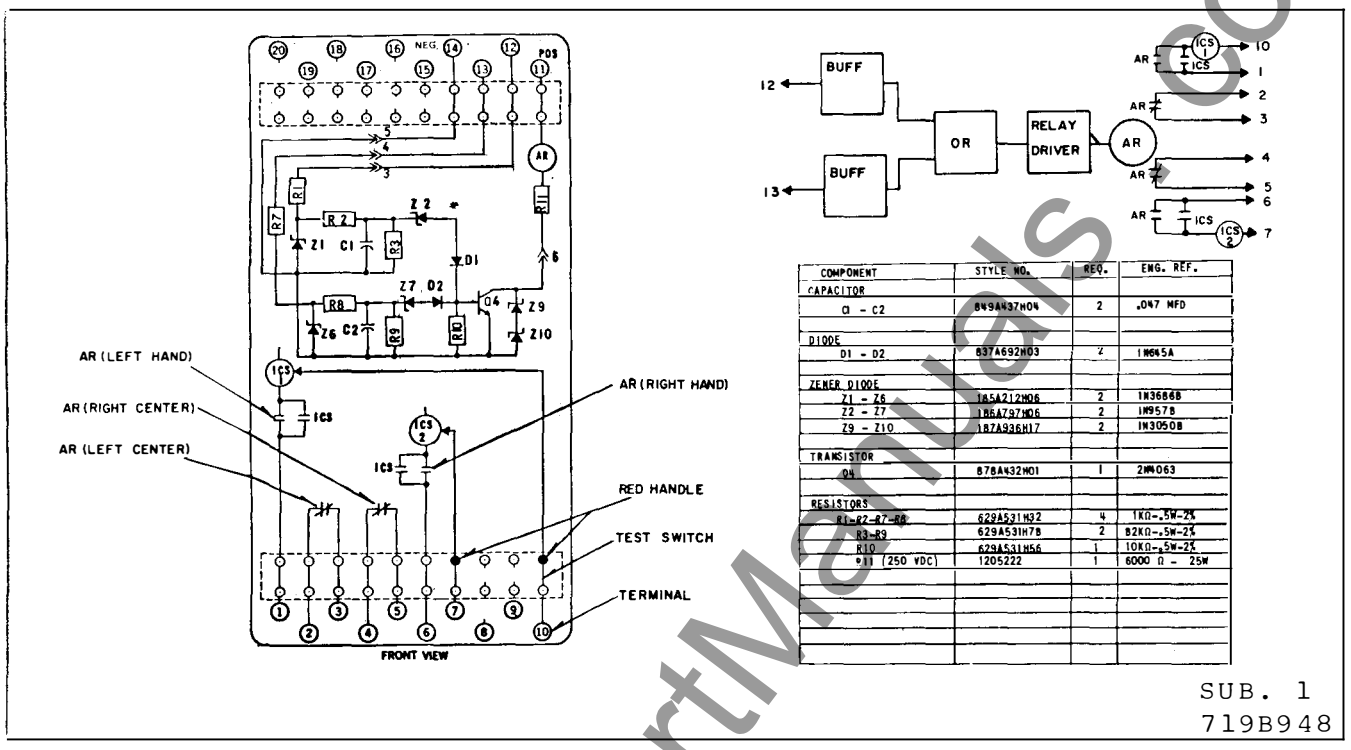




COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A.
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3668B
Z2 - Z7	186A797H06	2	1N9578
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	879A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ- 5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω- 25W
R13 (125VDC)	1267293	1	1500 Ω- 25W

SUB. 1
719B947

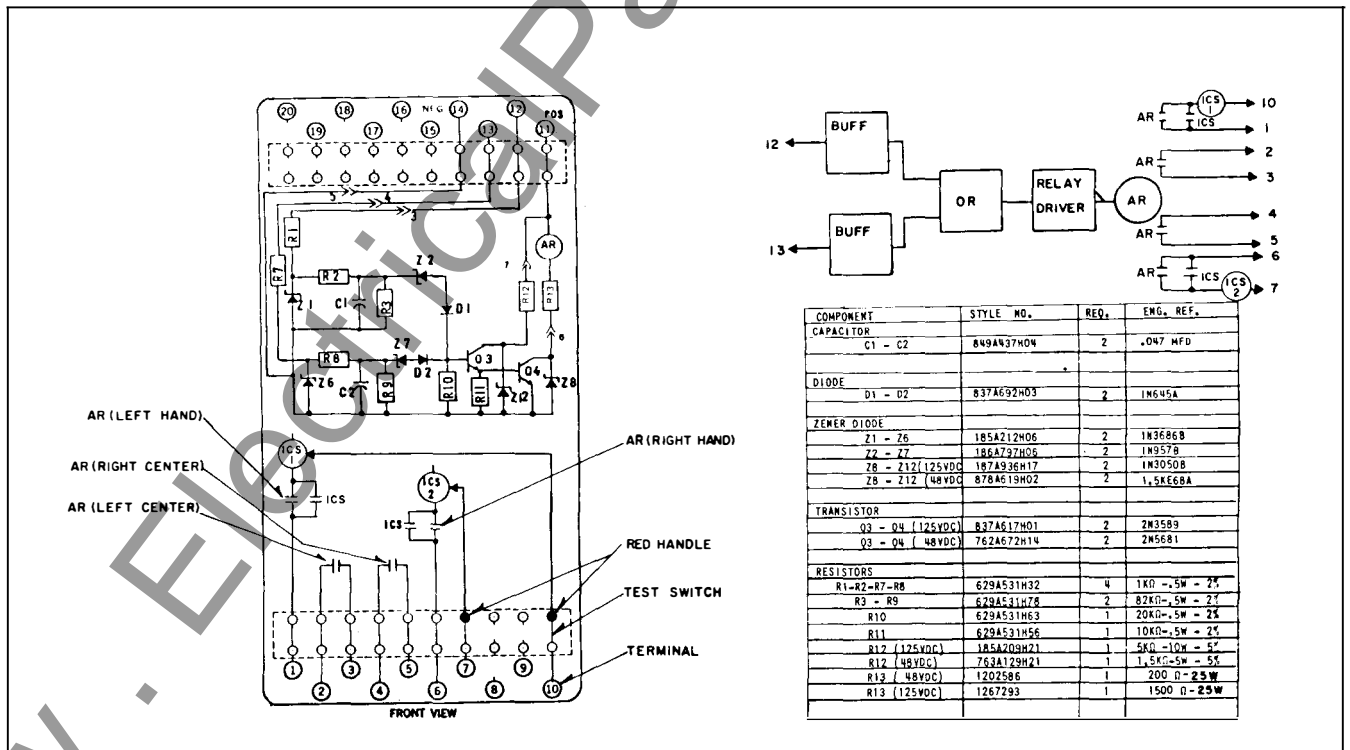
Fig. 10. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT- 22 Case.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
*11 (250 VDC)	1205222	1	6000 Ω - 25W

SUB. 1
719B948

Fig. 11. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT-22 Case 250 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC	187A936H17	2	1N3050B
Z8 - Z12 (48VDC	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ -.5W - 2%
R3 - R9	629A531H78	2	82KΩ-.5W - 2%
R10	629A531H63	1	20KΩ-.5W - 2%
R11	629A531H56	1	10KΩ-.5W - 2%
R12 (125VDC)	185A209H21	1	5KΩ -10W - 5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W - 5%
R13 (48VDC)	1202586	1	200 Ω-25W
R13 (125VDC)	1267293	1	1500 Ω-25W

SUB. 1
719B956

Fig. 12. Type ARS Relay - 2 Buffered Input "OR" 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 48 & 125 VDC.

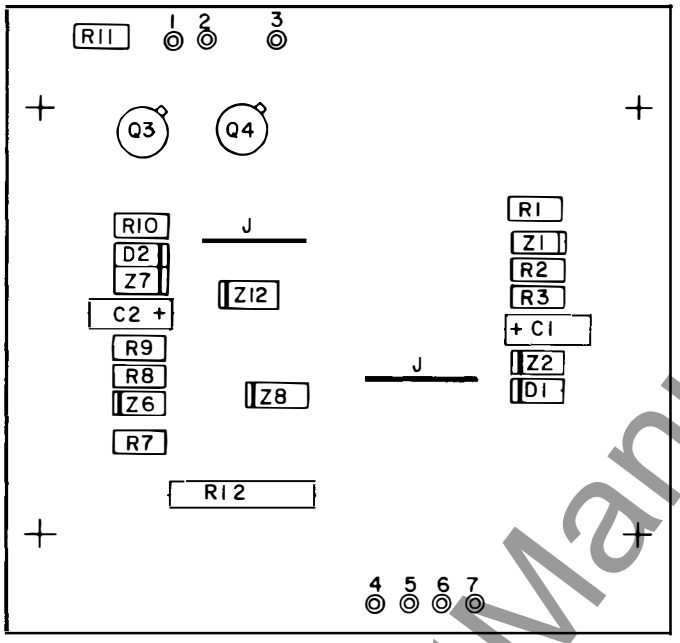


Fig. 13. Component Location Two Buffered Input "OR" in FT-22 Case - 48 VDC.

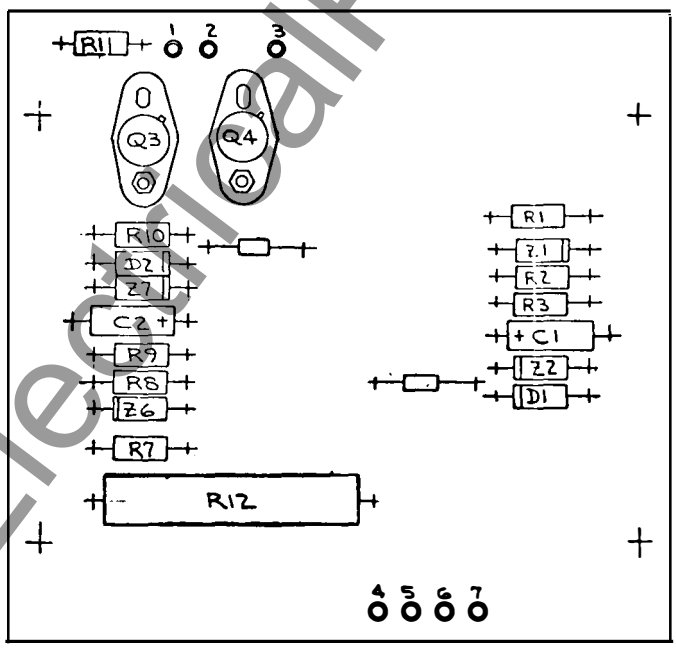
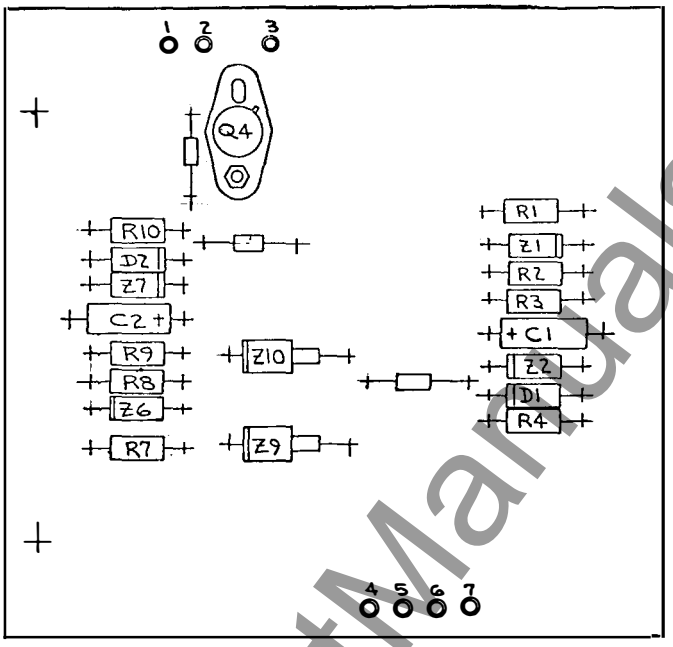
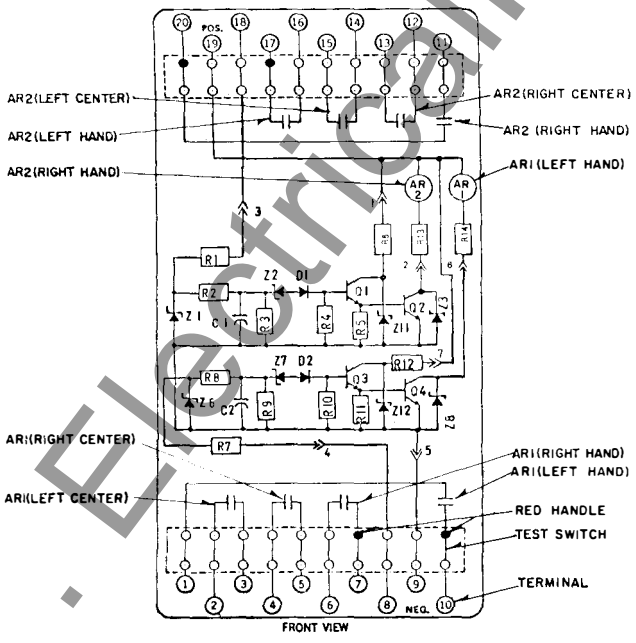


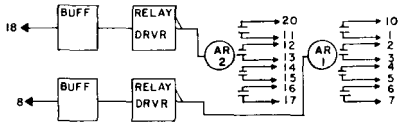
Fig. 14. Component Location Two Buffered Input "OR" in FT-22 Case 125 VDC.



SUB. 1
880A431

Fig. 15. Component Location Two Buffered Input "OR" in FT-22 Case - 250 VDC.

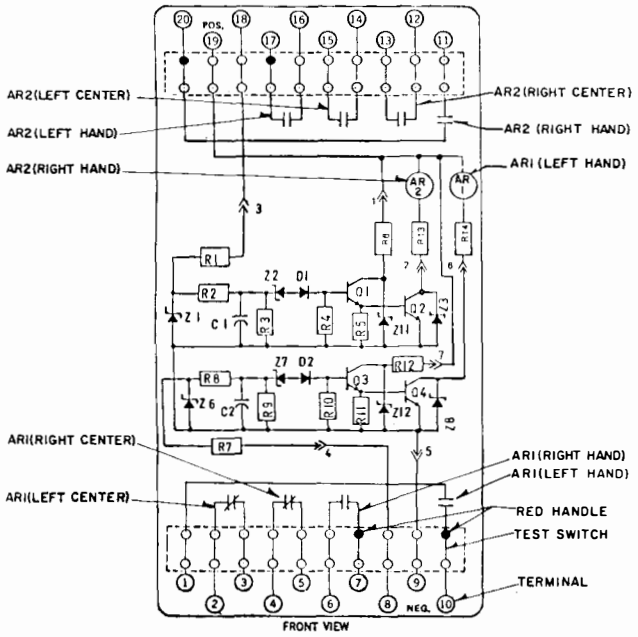


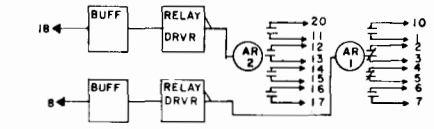


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B953

Fig. 16. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (All Make) Contacts in FT-22 Case - 48 & 125 VDC.

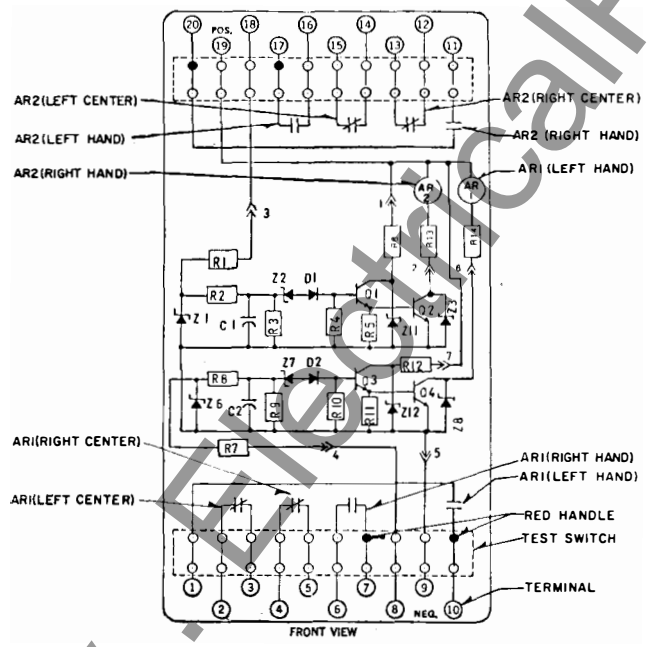


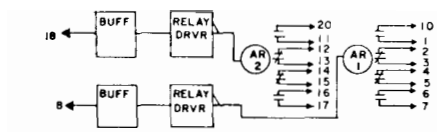


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N6686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125 VDC)	1267293	2	1500 Ω-25W

SUB. 1
719B950

Fig. 17. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-2M 2B) Contacts in FT-22 Case. 48 and 125 Vdc

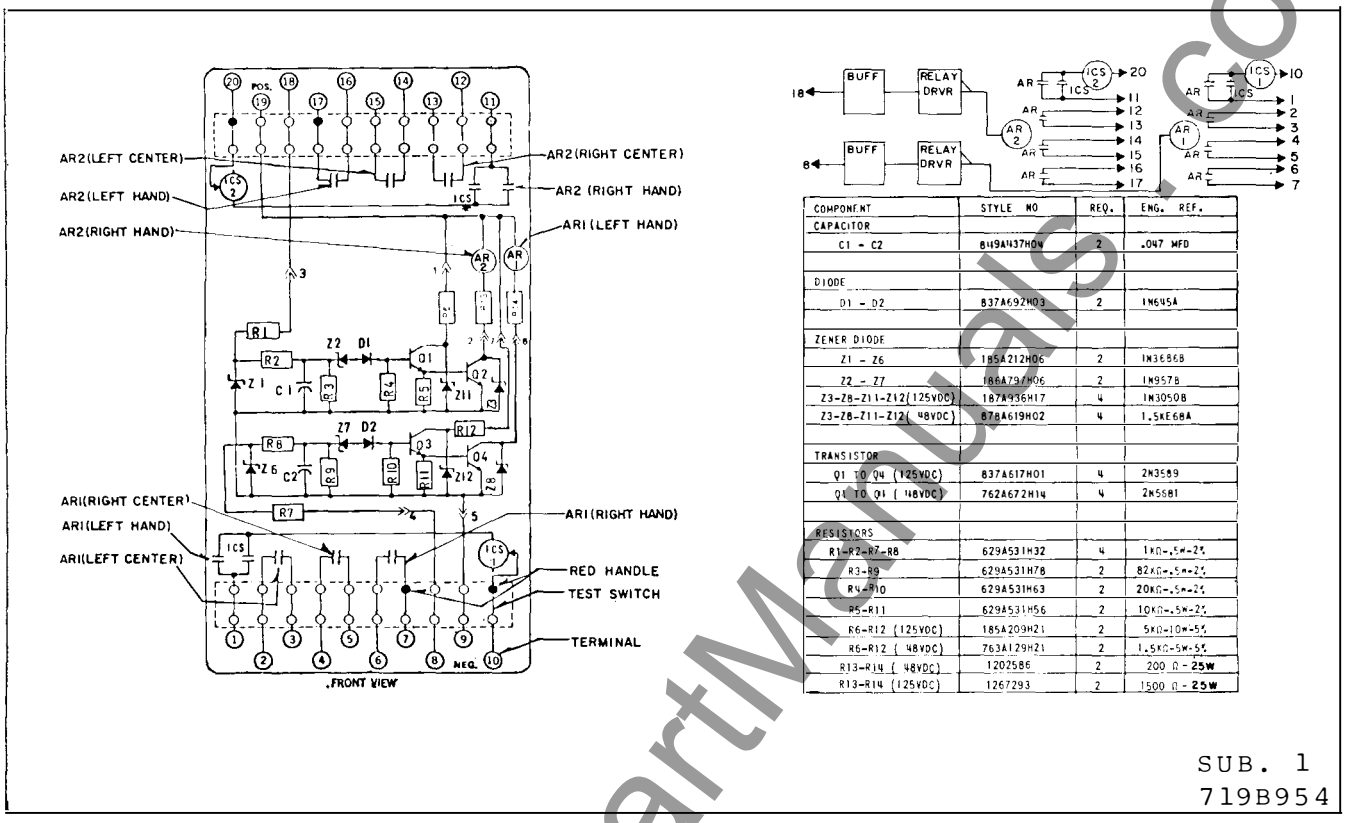




COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N6686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125VDC)	1267293	2	1500 Ω-25W

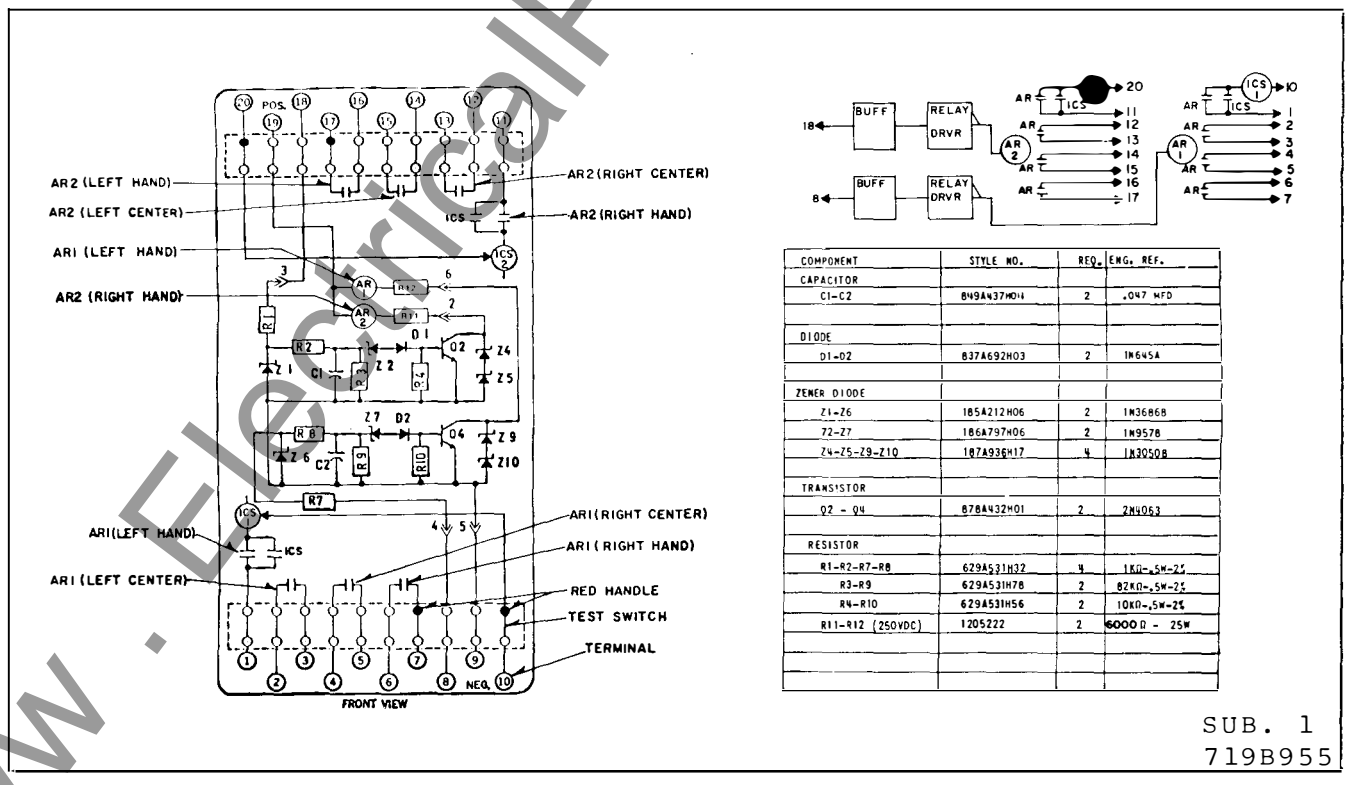
SUB. 1
719B949

Fig. 18. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (2M2B-2M2B) Contacts in FT-22 Case. 48 and 125 Vdc



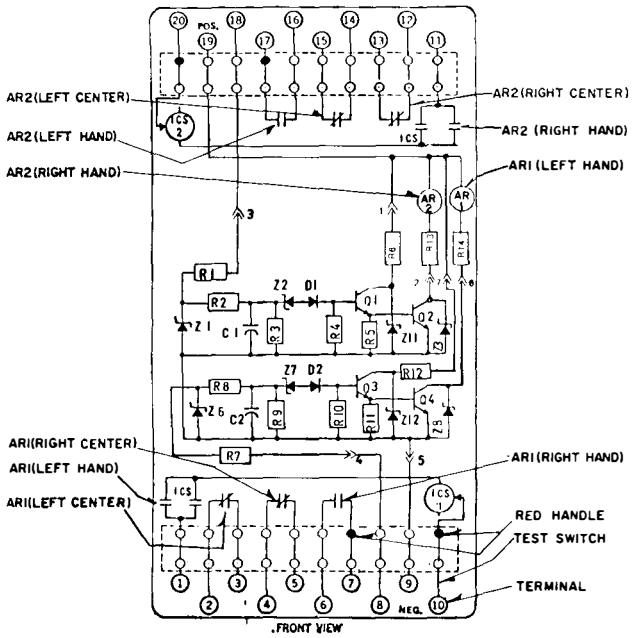
COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N9578
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	678A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5581
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

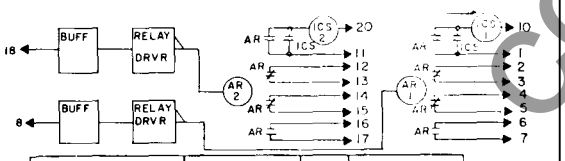
Fig. 19. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units All Make Contacts - 2 ICS Units in FT-22 Case – 48 and 125 Vdc



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1-C2	849A437H04	2	.047 MFD
DIODE			
D1-D2	837A692H03	2	1N645A
ZENER DIODE			
Z1-Z6	185A212H06	2	1N3686B
Z2-Z7	186A797H06	2	1N9578
Z4-Z5-Z9-Z10	187A936H17	4	1N3050B
TRANSISTOR			
Q2 - Q4	878A432H01	2	2N4063
RESISTOR			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H56	2	10KΩ-.5W-2%
R11-R12 (250VDC)	1205222	2	6000 Ω - 25W

Fig. 20. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-4M) Contacts - 2 ICS Units in FT-22 Case- 250 VDC.

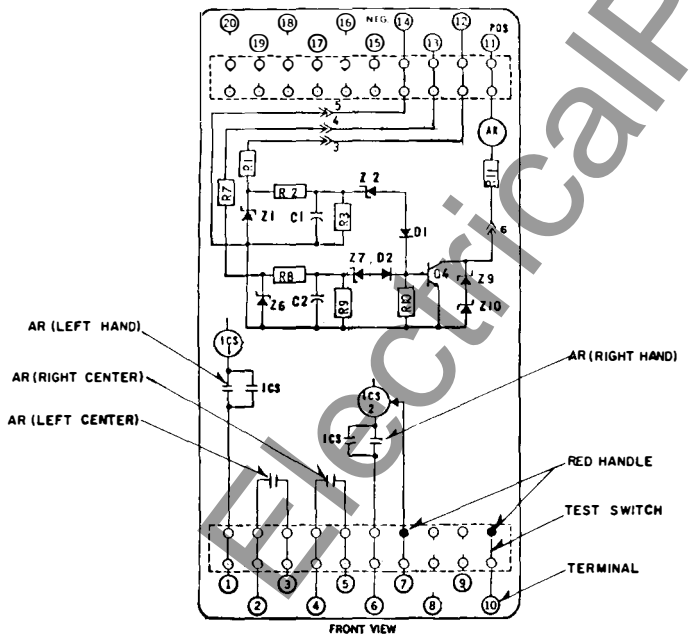


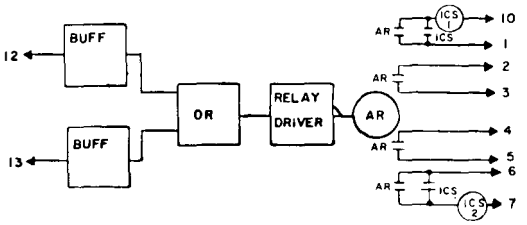


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B957

Fig. 21. Relay Type ARS - 2 Single Buffered Inputs - 2AR Units (2M2B-2M2B) Contacts - 2 ICS Units in FT-22 Case – 125 Vdc





COMPONENT	STYLE NO.	REQ.	ENG.REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1- D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
R11 (250VDC)	1205222	2	6000Ω - 25W

SUB. 1
719B958

Fig. 22. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 250 VDC.

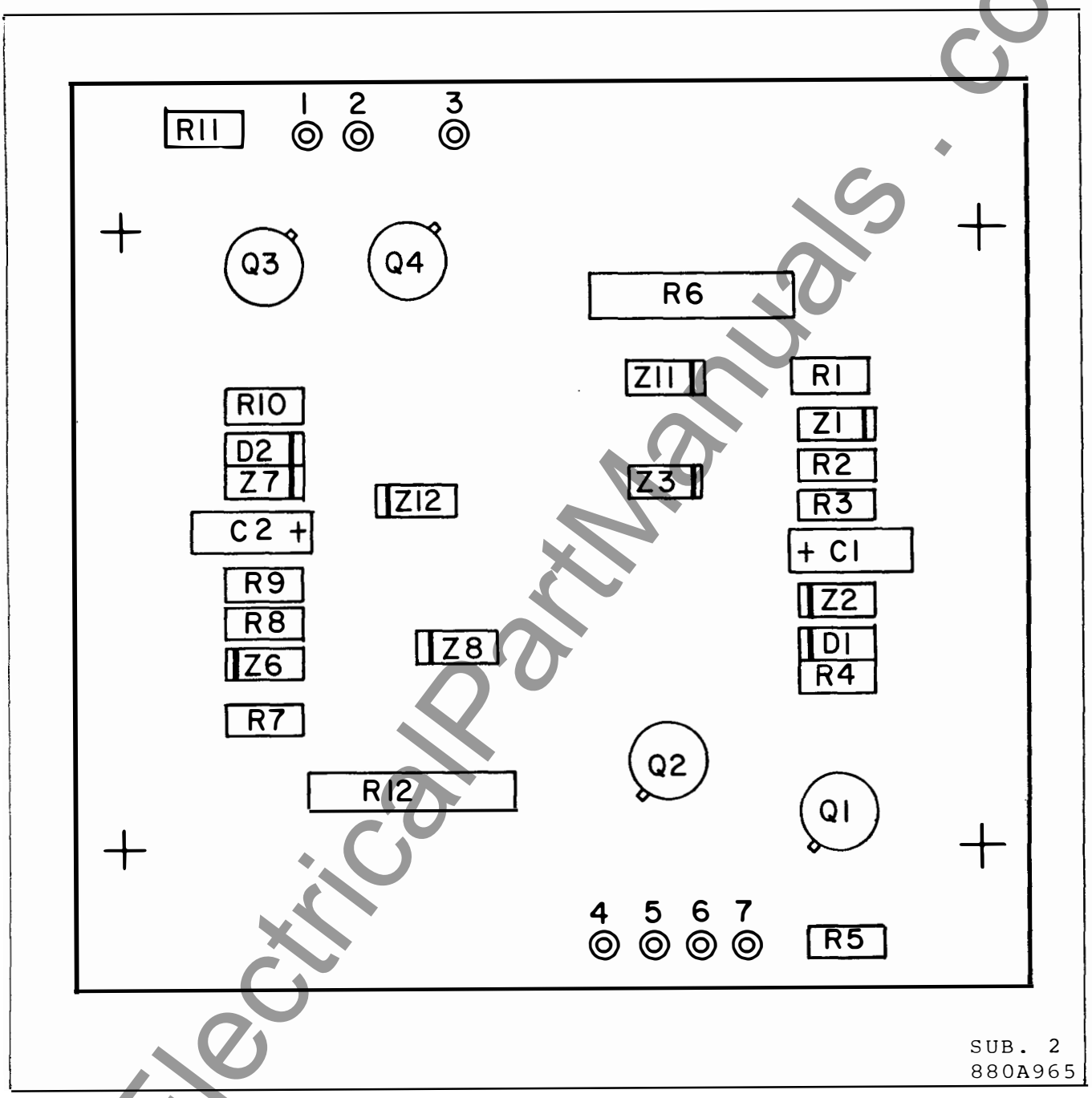


Fig. 23. Component Location Two Single Buffered Inputs in Type FT-22 Case - 48 VDC.

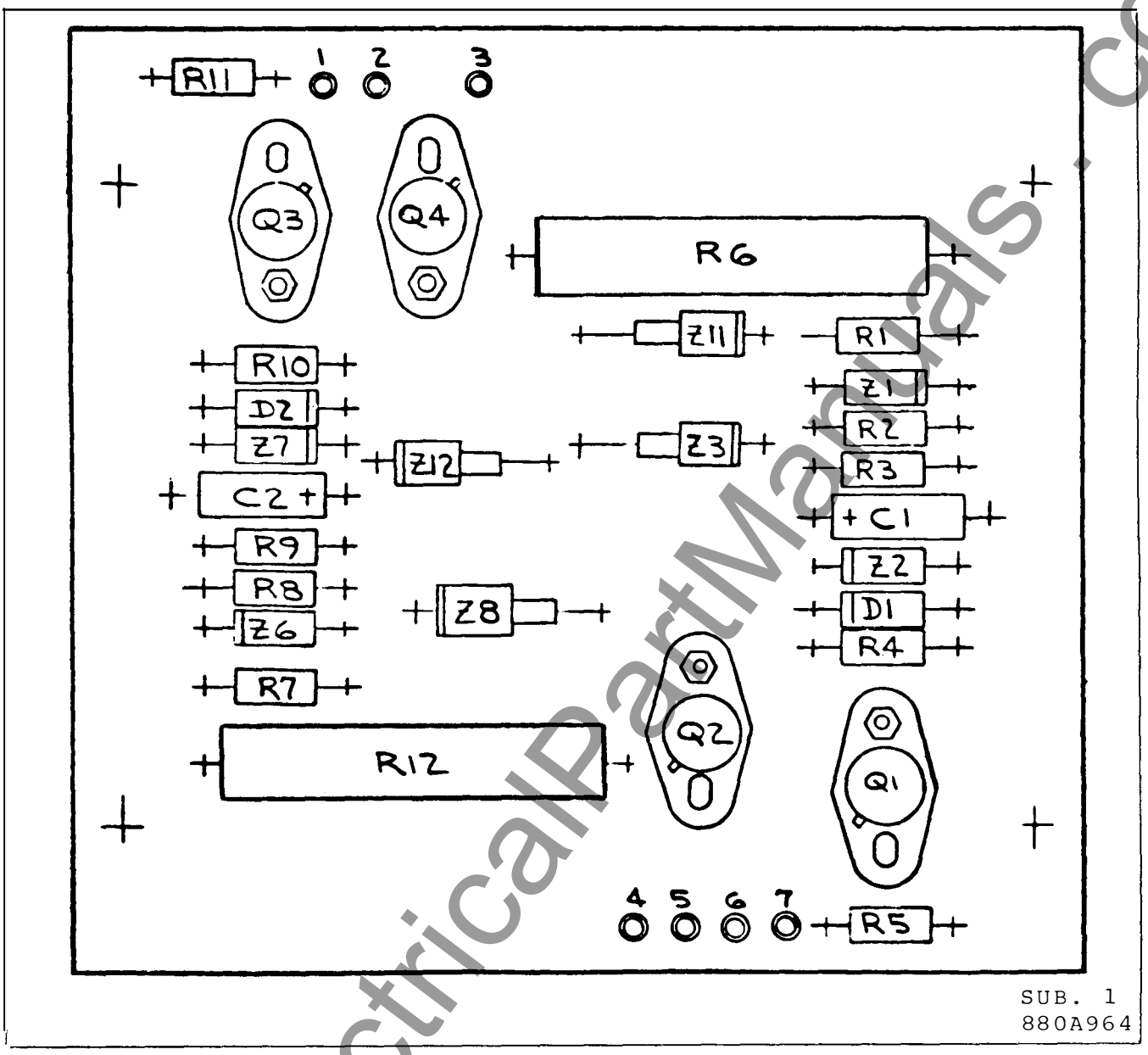


Fig. 24. Component Location Two Single Buffered Inputs in Type FT-22 Case - 125 VDC.

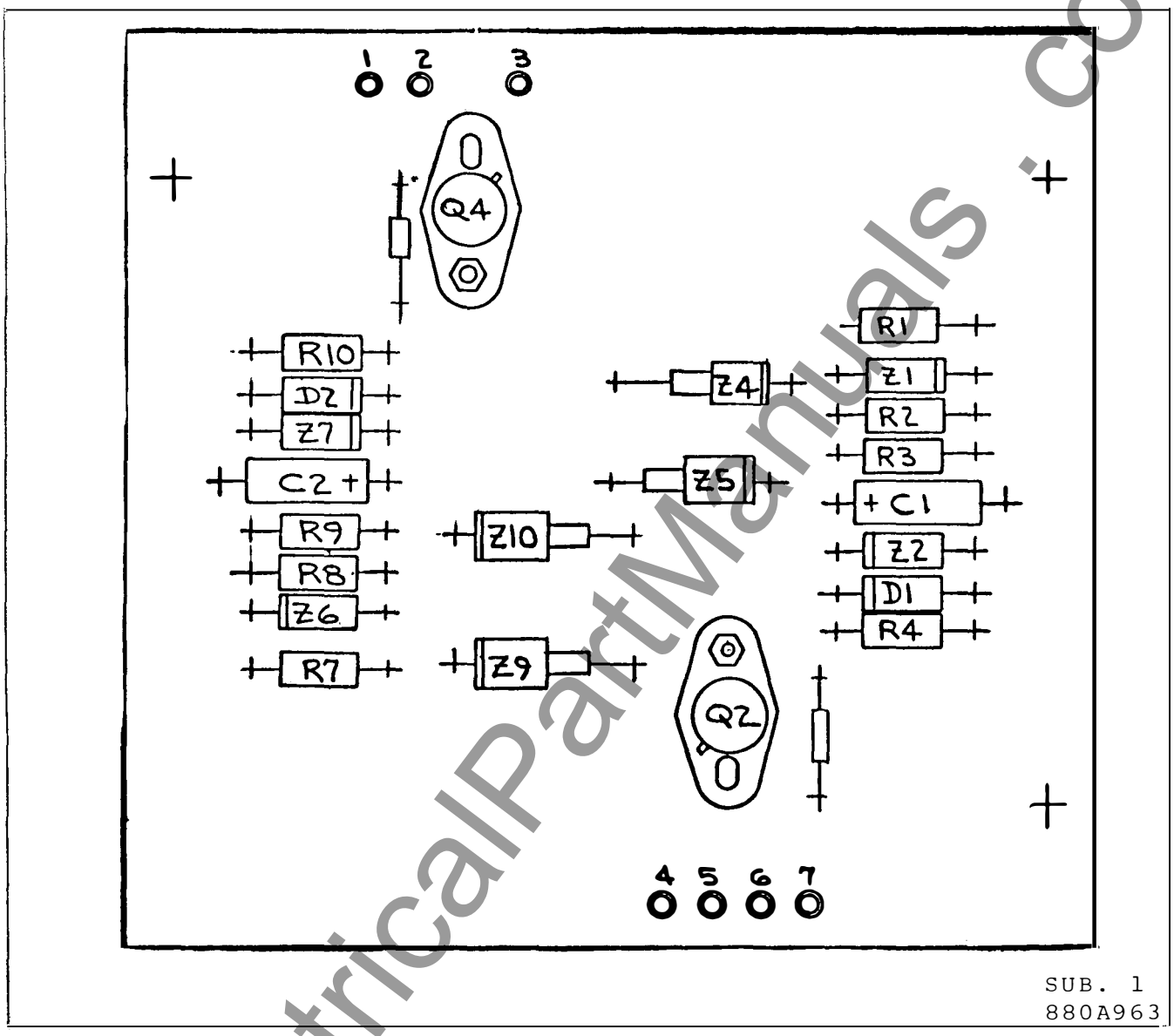


Fig. 25. Component Location Two Single Buffered Inputs in FT-22 Case 250 VDC.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE ARS RELAY

CAUTION: Before putting protection relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment. Make sure that all moving parts operate freely and can close properly. Operate the relay to check the settings and electrical connections.

ARS APPLICATION

The ARS relay is a high speed contact converter for a 20 volt low energy level signal. It may be used as a tripping auxiliary for relays such as the SP and SDG-1 or as an oscillograph interface.

The driving device must be capable of providing an input to the ARS of 6 milliamperes at a level of 15 to 20 volts.

CONSTRUCTION & OPERATION

The type ARS relay is composed of 1 or 2 AR units with series resistors, a printed circuit module, and indicating contactor switches (ICS) when required, mounted in a FT-11 or FT-22 case, depending upon style.

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

Printed Circuit Module

The printed circuit module contains the proper number of transistors, protective zener diodes, capacitors, resistors, and diodes for the buffered amplifier circuitry controlling each AR unit. With the rated supply voltage to the relay, the proper signal voltage applied to an input terminal will cause the related AR unit to pick up. The AR unit will then energize the ICS (if used), which will seal around the AR unit contacts.

The removal of the input voltage will cause the AR unit to drop out.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

All ARS relays are capable of being energized continuously. The input energy requirements are listed in Table I.

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AR Unit

All AR units are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables II and IV.

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

Indicating Contactor Switch (ICS)

The AR contacts will safely close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

ICS Circuit Constants

0.2 ampere tap – 6.5 ohms dc resistance

2.0 ampere tap – 0.15 ohms dc resistance

ARS Operate and Reset Time

The operate and reset times for the ARS relay are shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

SETTINGS

Indicating Contactor Switch (ICS)

The only setting required on the ICS unit is the selection of the 0.2 or 2.0 ampere tap setting. This is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed information on the FT-11 or FT-22 case, refer to I.L. 41-076.

TABLE I

INPUT ENERGY REQUIREMENTS

INPUT (dc Volts)	INPUT VOLTAGE RANGE (dc Volts)	MAXIMUM INPUT CURRENT REQUIREMENT
20	15 to 20	6 Milliamperes

TABLE II

AR UNIT OPERATE AND RESET TIMES

Rated Operating Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO Contact Closes	NC Contact Opens	NC Contact Closes
10	2.0	1.5	4.0

TABLE III

MAXIMUM CIRCUIT DELAY TIME

INPUT (dc Volts)	VOLTAGE APPLIED	DELAY TIME IN MICROSECONDS
20	15 Volts	90

TABLE IV

AR UNIT CONTACT BOUNCE

CONTACT LOADING	Effective Bounce Time In Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	—
Breaker Trip Coil	.2	—

TABLE V

CONTACT INTERRUPTING CAPABILITY (AMPERES)

D.C. VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD
	WILL INTERRUPT	WILL INTERRUPT
250	0.2	0.1
125	0.5	0.25
48	1.5	1.0

ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

ACCEPTANCE CHECK

AR Unit

The following check is recommended to insure that the AR unit is in proper working order.

1. Contact gaps
   a. Normally open contacts should have a gap of .018 to .023 inch.
   b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   a. On four normally open contact relays, the normally open contacts should have approximinately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 15 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.
3. Armature gap

   The armature gap should be .009 inches measured at the narrowest part of the armature gap.
4. Contact operate time

   Per Table II

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting used. The operation indicator target should drop freely.

Printed Circuit Module

The following check is recommended to insure that the circuitry on the printed circuit module is functioning properly.

1. Apply rated voltage to the proper supply terminals, marked positive and negative on internal schematics.
2. Apply rated voltage to each input, one at a time, and its respective AR unit should operate (pick up). Remove the input and the AR unit should drop out. The ARS relay should operate within the times shown in Tables II and III. The ARS operating time is the combined time of the circuit delay time (Table III) plus the AR unit time (Table II) according to the particular contact arrangement used.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. ((See ''Acceptance Check'')

Tripping Relay (AR Unit)

If the type AR tripping relay unit adjustments are disturbed or are in error, or it becomes necessary to replace some part, use the following adjustment procedure.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each normally open contact spring for 8 grams to just move the contact away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move contact spring away from the card. Then adjust the stationary contact screw to just away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table II and IV.

Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The operation indicator target should drop freely.

The contact gap should be approximately .047'' between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

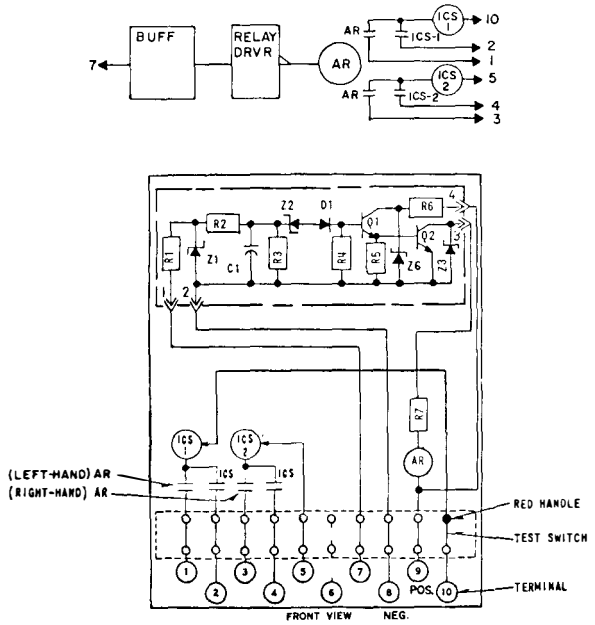
Printed Circuit Module

No calibration required other than check listed under acceptance check.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

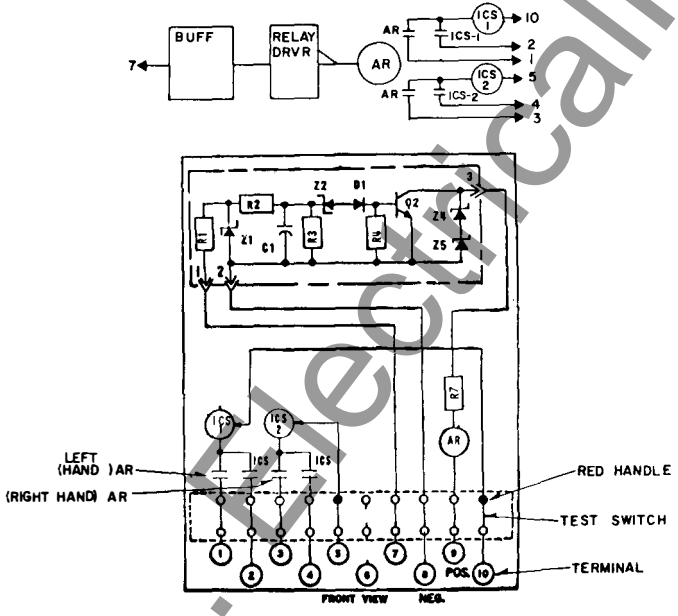
RELAY STYLE NUMBER	DESCRIPTION	INTERNAL SCHEMATIC	CIRCUIT BOARD STYLE NUMBER	CIRCUIT BOARD COMPONENT LOCATION
FT-11 CASE				
718B820A09	48 Vdc; 2M contacts; 2 ICS units	719B963 (Fig. 1)	204C674G01	880A436 (Fig. 5)
718B820A10	125 Vdc; 2M contacts; 2 ICS units	719B963 (Fig. 1)	204C674G02	880A435 (Fig. 6)
718B820A11	250 Vdc; 2M contacts; 2 ICS units	719B944 (Fig. 2)	204C818G01	880A433 (Fig. 7)
718B820A12	48 Vdc; 2M contacts; 1 ICS unit	719B945 (Fig. 3)	204C674G01	880A436 (Fig. 5)
718B820A13	125 Vdc; 2M contacts; 1 ICS unit	719B945 (Fig. 3)	204C674G02	880A435 (Fig. 6)
718B820A14	250 Vdc; 2M contacts; 1 ICS unit	719B946 (Fig. 4)	204C818G01	880A433 (Fig. 7)
FT-22 CASE				
717B770A10	48 Vdc; 2M-2B contacts;	719B951 (Fig. 8)	204C761G02	880A962 (Fig. 13)
717B770A11	125 Vdc; 2M-2B contacts;	719B951 (Fig. 8)	204C761G01	880A434 (Fig. 14)
717B770A12	48 Vdc; 4M contacts	719B952 (Fig. 9)	204C761G02	880A962 (Fig. 13)
717B770A13	125 Vdc; 4M contacts;	719B952 (Fig. 9)	204C761G01	880A434 (Fig. 14)
717B770A14	48 Vdc; 2M-2B contacts; 2 ICS units	719B947 (Fig. 10)	204C761G02	880A962 (Fig. 13)
717B770A15	125 Vdc; 2M-2B contacts; 2 ICS units	719B947 (Fig. 10)	204C761G01	880A434 (Fig. 14)
717B770A16	250 Vdc; 2M-2B contacts; 2 ICS units	719B948 (Fig. 11)	204C762G01	880A431 (Fig. 15)
717B770A17	48 Vdc; 4M contacts; 2 ICS units	719B956 (Fig. 12)	204C761G02	880A962 (Fig. 13)
717B770A18	125 Vdc; 4M contacts; 2 ICS units	719B956 (Fig. 12)	204C761G01	880A434 (Fig. 14)
717B770A19	48 Vdc; 4M-4M contacts;	719B953 (Fig. 16)	204C675G02	880A965 (Fig. 23)
717B770A20	125 Vdc; 4M-4M contacts;	719B953 (Fig. 16)	204C675G01	880A964 (Fig. 24)
717B770A21	48 Vdc; 4M-2M/2B contacts;	719B950 (Fig. 17)	204C675G02	880A965 (Fig. 23)
717B770A22	125 Vdc; 4M-2M/2B contacts;	719B950 (Fig. 17)	204C675G01	880A964 (Fig. 24)
717B770A23	48 Vdc; 2M/2B-2M/2B contacts;	719B949 (Fig. 18)	204C675G02	880A965 (Fig. 23)
717B770A24	125 Vdc; 2M/2B-2M/2B contacts;	719B949 (Fig. 18)	204C675G01	880A964 (Fig. 24)
717B770A25	48 Vdc; 4M-4M contacts; 2 ICS units	719B954 (Fig. 19)	204C675G02	880A965 (Fig. 23)
717B770A26	125 Vdc; 4M-4M contacts; 2 ICS units	719B954 (Fig. 19)	204C675G01	880A964 (Fig. 24)
717B770A27	250 Vdc; 2M-2B/2M-2B contacts; 2 ICS units	719B955 (Fig. 20)	204C763G01	880A963 (Fig. 25)
717B770A28	125 Vdc; 2M-2B/2M-2B contacts; 2 ICS units	719B957 (Fig. 21)	204C675G01	880A964 (Fig. 24)
717B770A29	250 Vdc; 4M contacts; 2 ICS units	719B958 (Fig. 22)	204C762G01	880A431 (Fig. 15)



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1 - R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202586	1	200 Ω-25W
R7 (125VDC)	1267293	1	1500 Ω-25W

SUB. 1
719B963

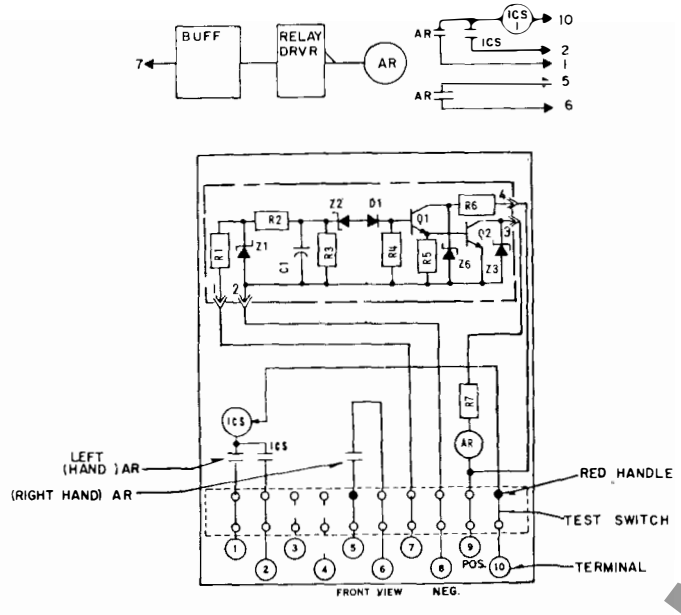
Fig. 1. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts - 2 ICS Units in FT-11 Case 48 & 125 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N3686B
Z2	186A797H06	1	1N957B
Z4 - Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1 - R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250V)	1205222	1	6000 Ω- 25W

SUB. 1
719B944

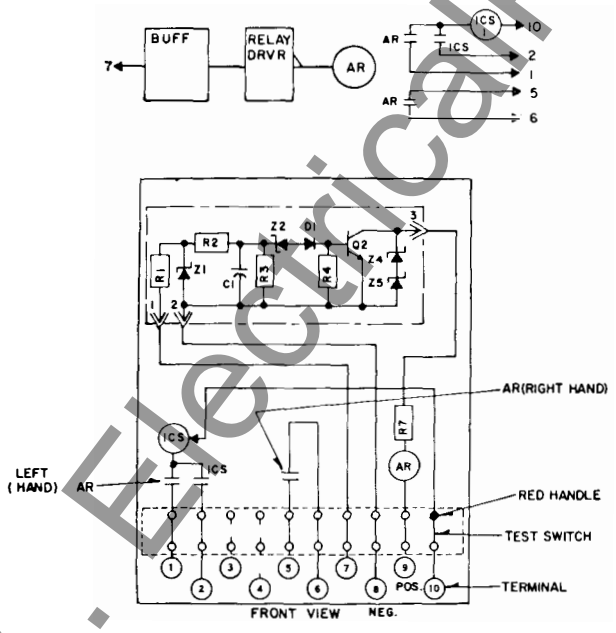
Fig. 2. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2M Contacts 2 ICS Units in FT-11 Case 250 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N36868
Z2	186A797H06	1	1N9578
Z3-Z6 (125VDC)	187A936H17	2	1N3050B
Z3-Z6 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTORS			
Q1-Q2 (125VDC)	837A617H01	2	2N3589
Q1-Q2 (48VDC)	762A672H14	2	2N5681
RESISTOR			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H63	1	20KΩ-.5W-2%
R5	629A531H56	1	10KΩ-.5W-2%
R6 (125VDC)	185A209H21	1	5KΩ-10W-2%
R6 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R7 (48VDC)	1202586	1	200 Ω - 25W
R7 (125VDC)	1267293	1	1500 Ω - 25W

SUB. 1
719B945

Fig. 3. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 48 & 125 V.D.C.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1	849A437H04	1	.047 MFD
DIODE			
D1	837A692H03	1	1N645A
ZENER DIODE			
Z1	185A212H06	1	1N36868
Z2	186A797H06	1	1N9578
Z4-Z5	187A936H17	2	1N3050B
TRANSISTORS			
Q2	878A432H01	1	2N4063
RESISTORS			
R1-R2	629A531H32	2	1KΩ-.5W-2%
R3	629A531H78	1	82KΩ-.5W-2%
R4	629A531H56	1	10KΩ-.5W-2%
R7 (250VDC)	1205222	1	6000Ω - 25W

SUB. 1
719B946

Fig. 4. Type ARS Relay - Single Input Buffer - 1 AR Unit with 2 M Contacts 1 ICS Units in FT-11 Case 250 V.D.C.

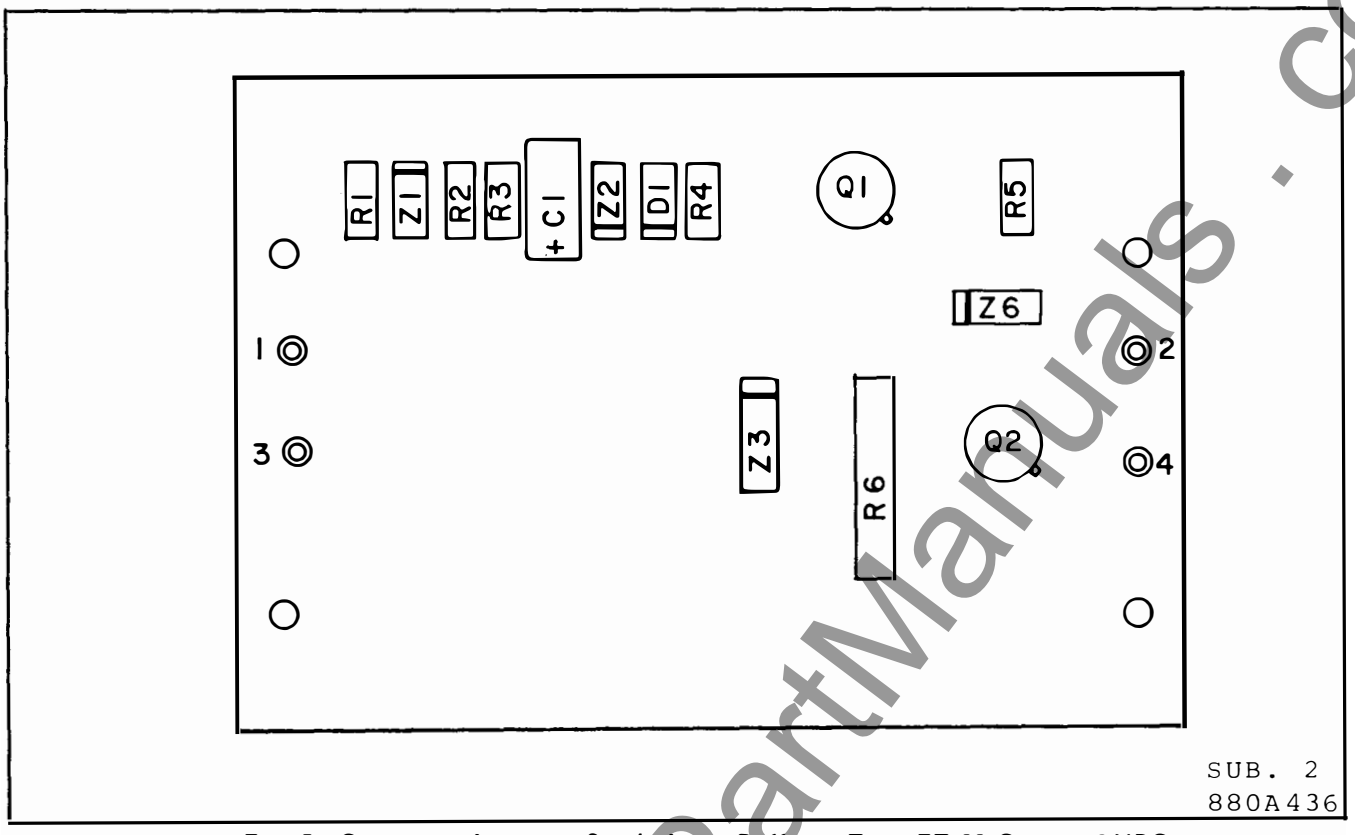


Fig. 5. Component Location Single Input Buffer in Type FT-11 Case - 48 VDC.

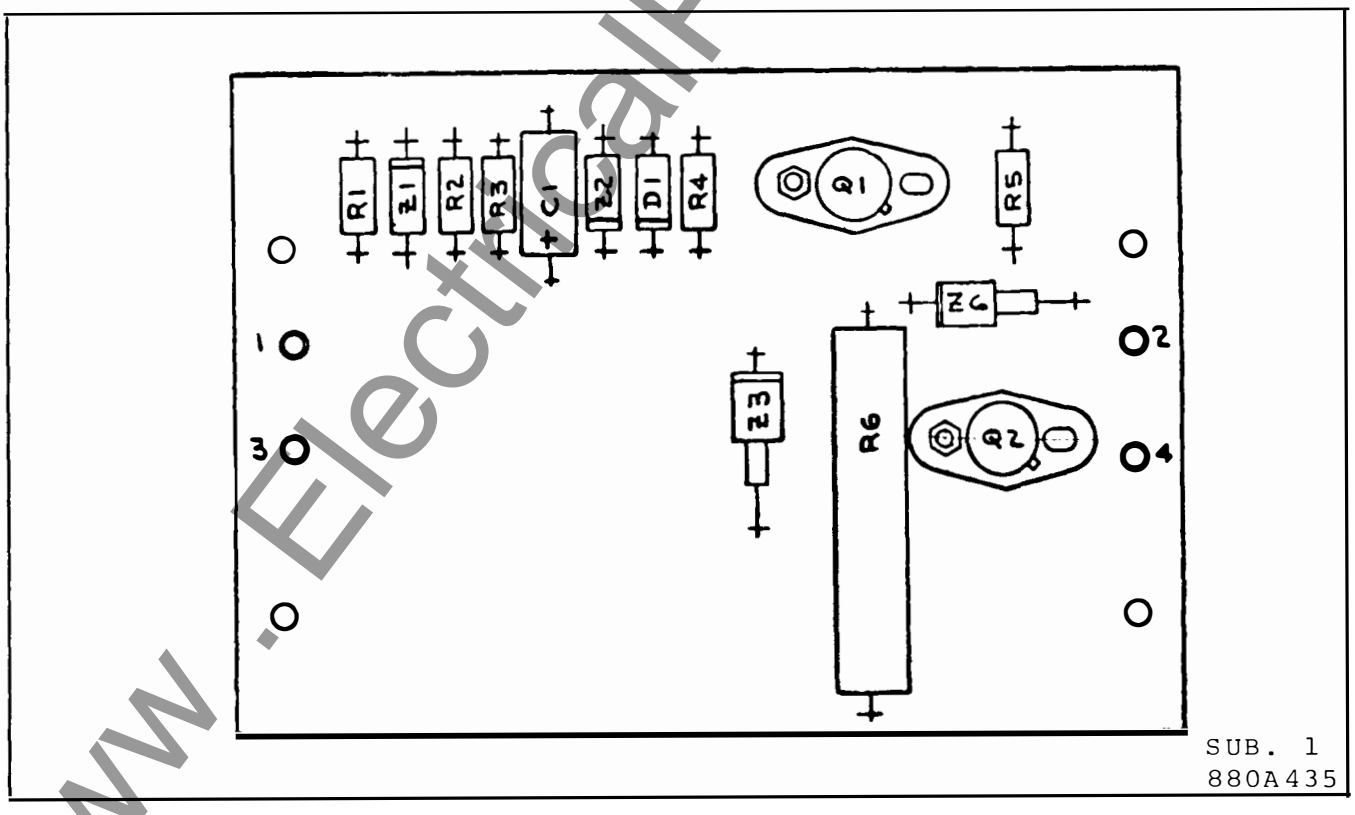


Fig. 6. Component Location Single Input Buffer in FT-11 Case 125 VDC.

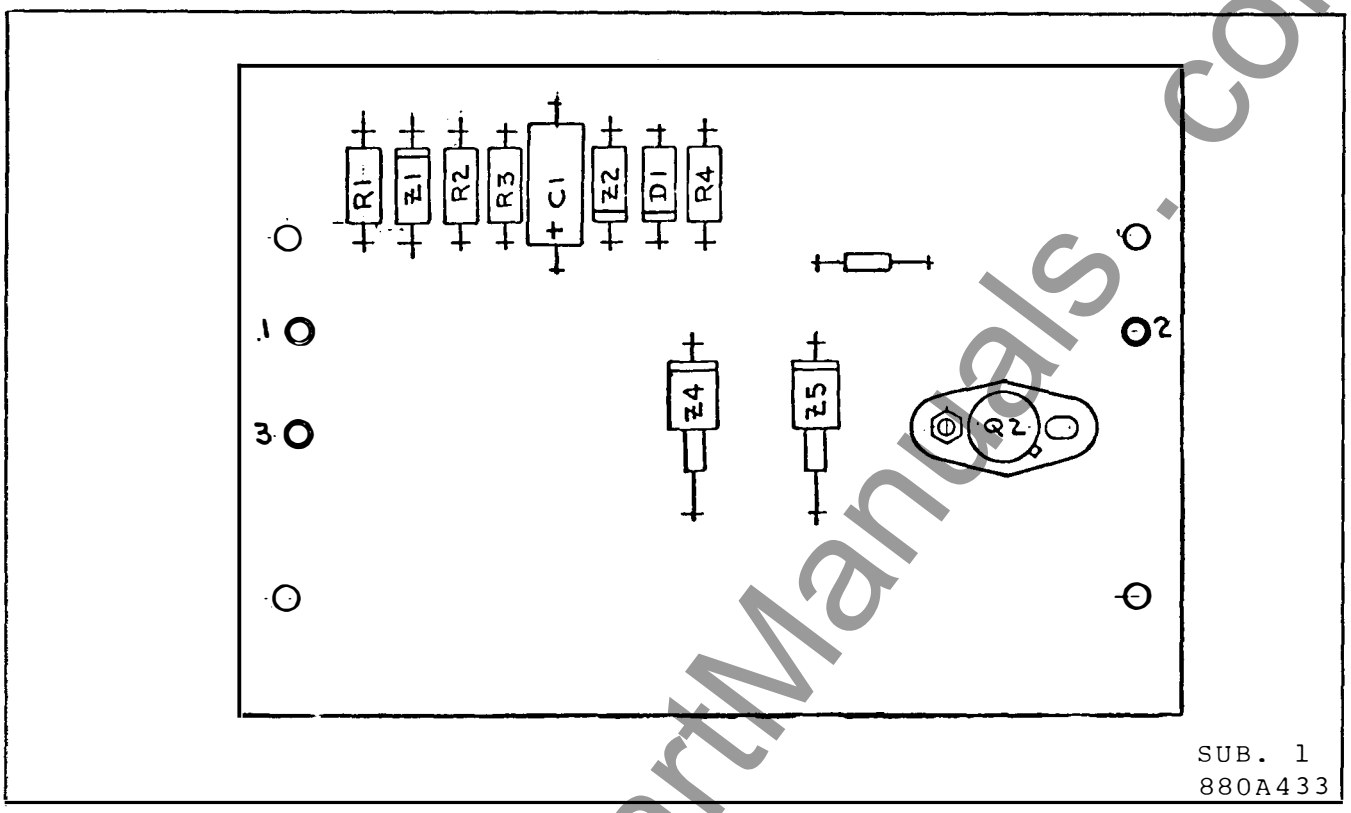
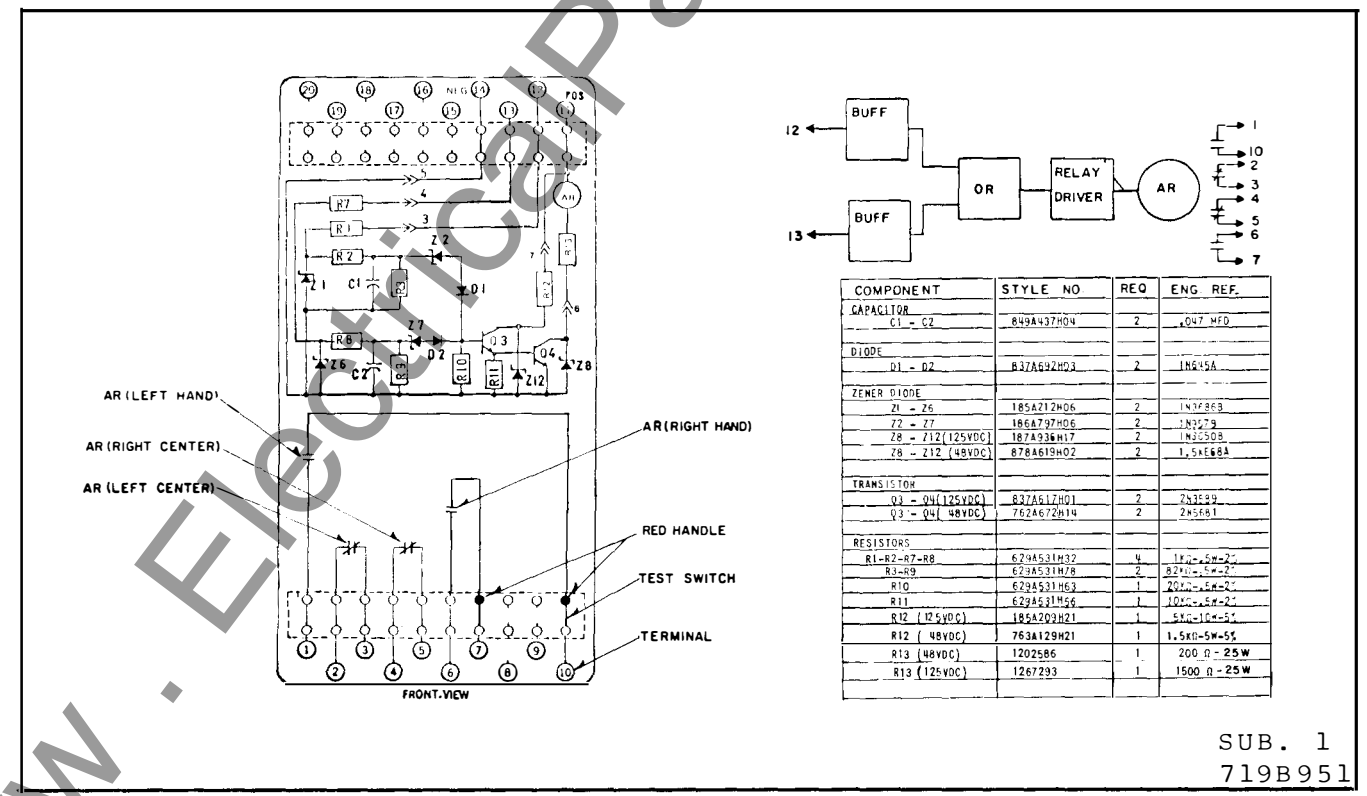
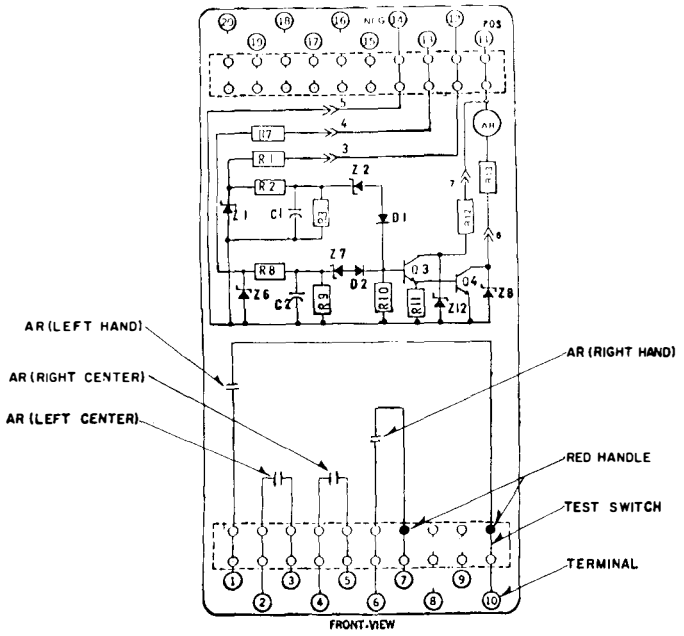


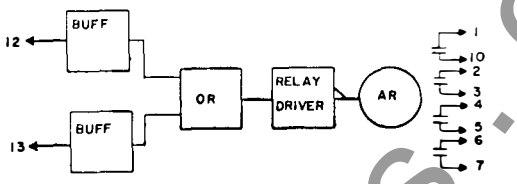
Fig. 7. Component Location Single Input Buffer in FT-11 Case 250 VDC.



COMPONENT	STYLE NO	REQ	ENG REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3863
Z7 - Z7	186A797H06	2	1N3579
Z8 - Z12 (125VDC)	187A936H17	2	1N3550B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H63	1	20KΩ-.5W-2%
R11	629A531H56	1	10KΩ-.5W-2%
R12 (125VDC)	185A203H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125VDC)	1267293	1	1500 Ω - 25W

Fig. 8. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts in FT-22 Case 48 & 125 VDC.

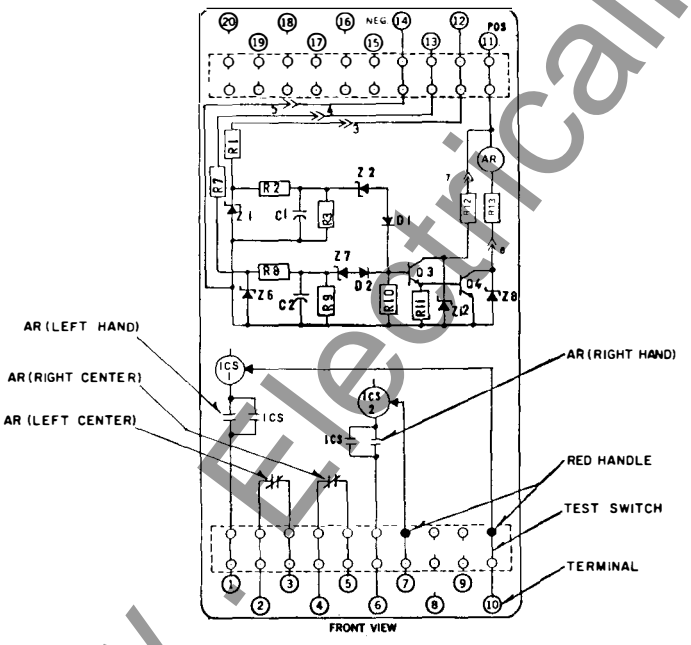


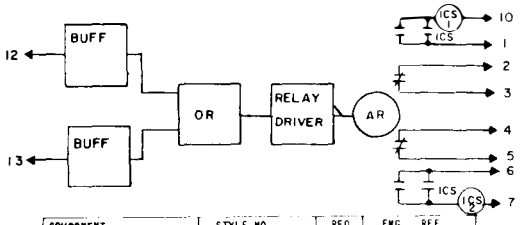


COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3-Q4 (125VDC)	837A617H01	2	2N3589
Q3-Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-5W-2%
R3-R9	629A531H78	2	82KΩ-5W-2%
R10	629A531H63	1	20KΩ-5W-2%
R11	629A531H56	1	10KΩ-5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω - 25W
R13 (125 VDC)	1267293	1	1500 Ω - 25W

SUB. 1
719B952

Fig. 9. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts in FT-22 Case 48 & 125 VDC.

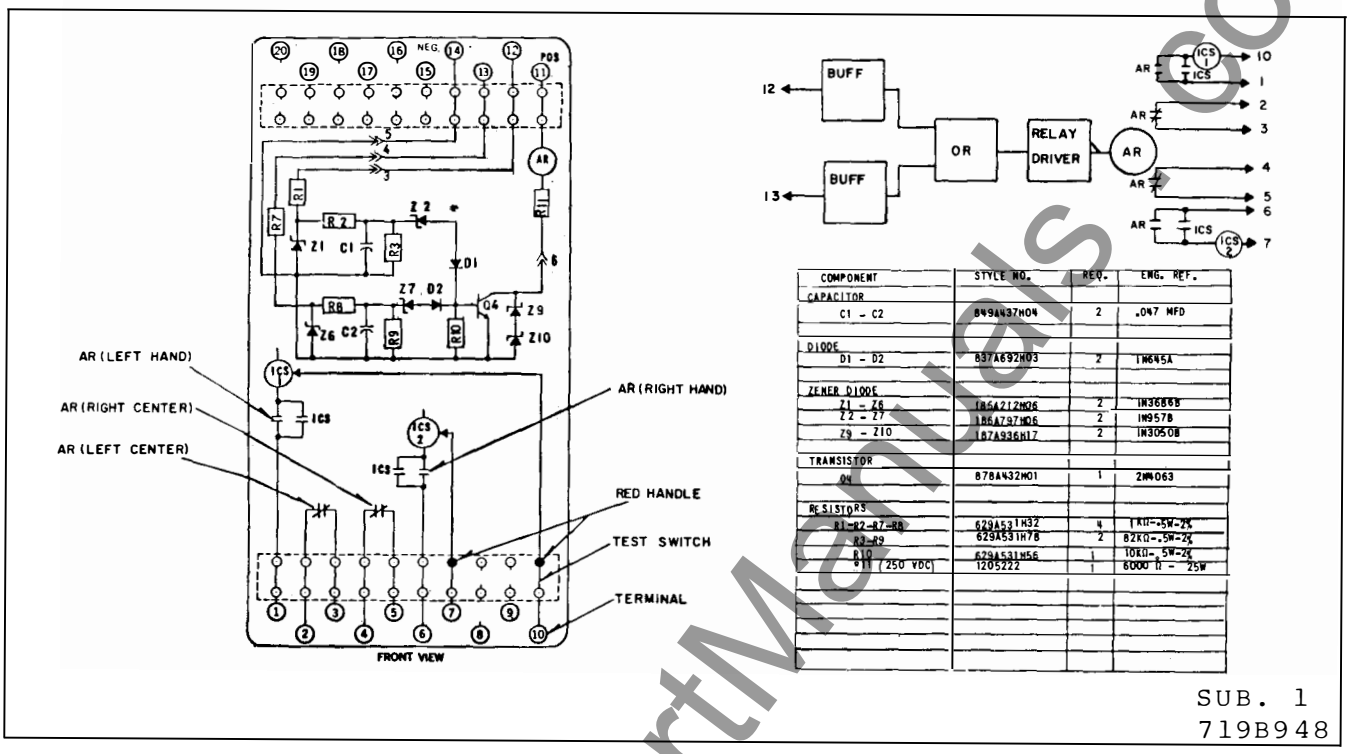




COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ- 5W-2%
R3-R9	629A531H78	2	82KΩ- 5W-2%
R10	629A531H63	1	20KΩ- 5W-2%
R11	629A531H56	1	10KΩ-5W-2%
R12 (125VDC)	185A209H21	1	5KΩ-10W-5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W-5%
R13 (48VDC)	1202586	1	200 Ω- 25W
R13 (125VDC)	1267293	1	1500 Ω- 25W

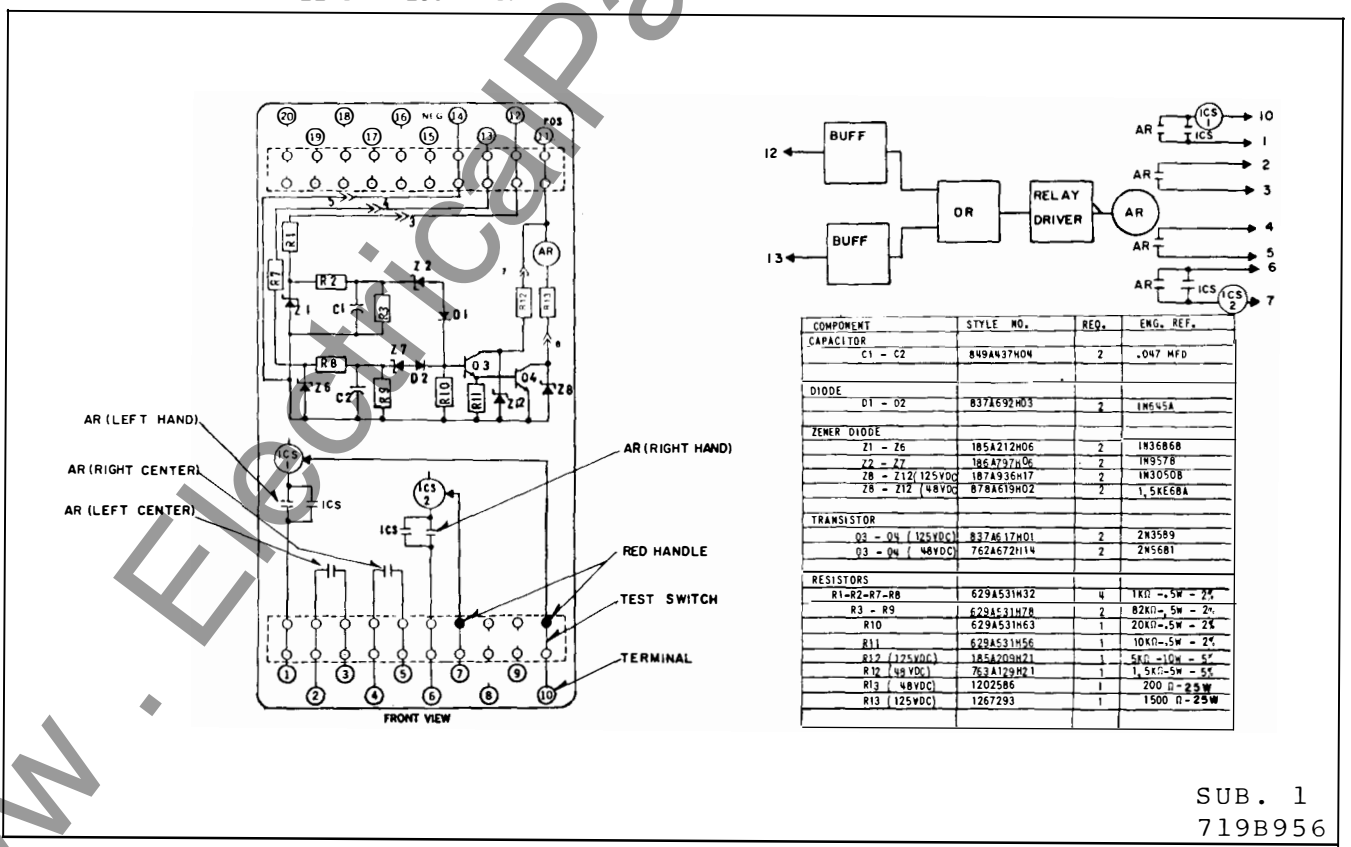
SUB. 1
719B947

Fig. 10. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT- 22 Case.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
R11 (250 VDC)	1205222	1	6000 Ω - 25W

Fig. 11. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 2M2B Contacts 2 ICS Units in FT-22 Case 250 VDC.



COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z8 - Z12 (125VDC)	187A936H17	2	1N3050B
Z8 - Z12 (48VDC)	878A619H02	2	1.5KE68A
TRANSISTOR			
Q3 - Q4 (125VDC)	837A617H01	2	2N3589
Q3 - Q4 (48VDC)	762A672H14	2	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ -.5W - 2%
R3 - R9	629A531H78	2	82KΩ-.5W - 2%
R10	629A531H63	1	20KΩ-.5W - 2%
R11	629A531H56	1	10KΩ-.5W - 2%
R12 (125VDC)	185A209H21	1	5KΩ -10W - 5%
R12 (48VDC)	763A129H21	1	1.5KΩ-5W - 5%
R13 (48VDC)	1202586	1	200 Ω-25W
R13 (125VDC)	1267293	1	1500 Ω-25W

Fig. 12. Type ARS Relay - 2 Buffered Input "OR" 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 48 & 125 VDC.

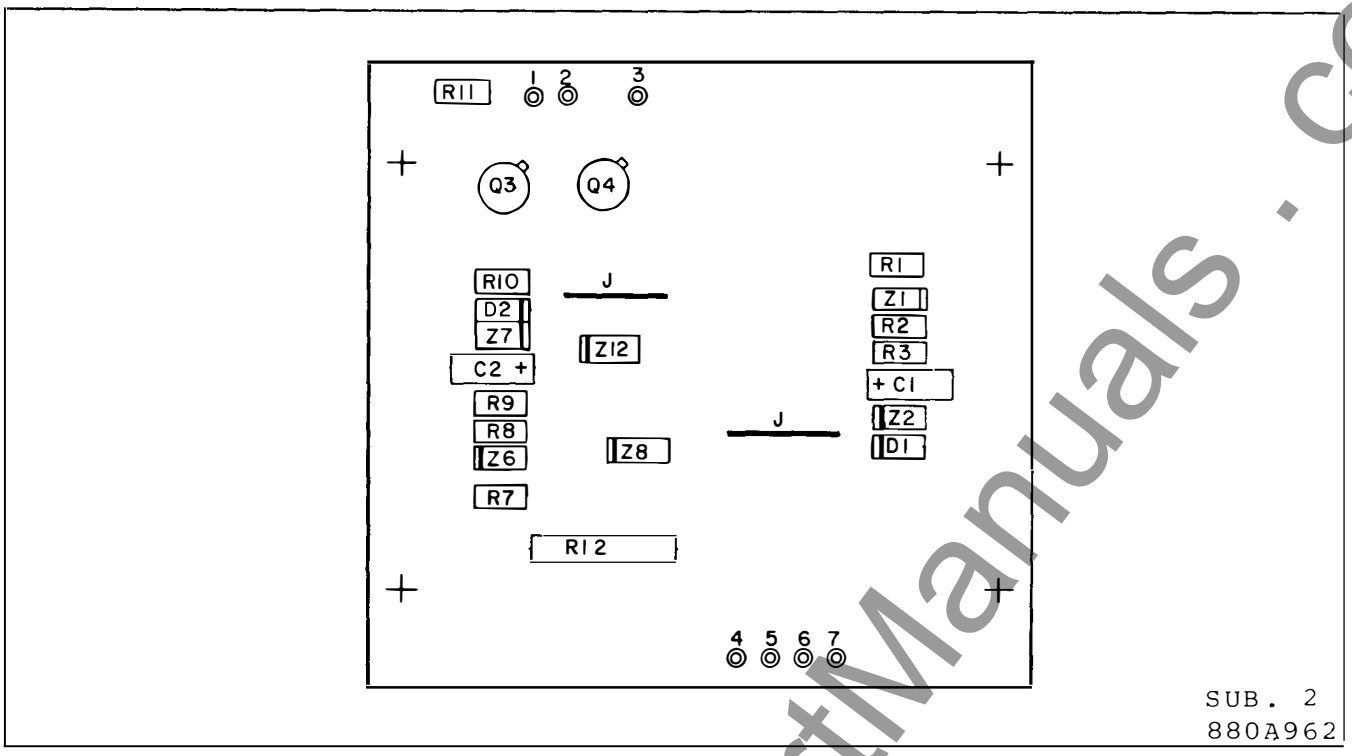


Fig. 13. Component Location Two Buffered Input "OR" in FT-22 Case - 48 VDC.

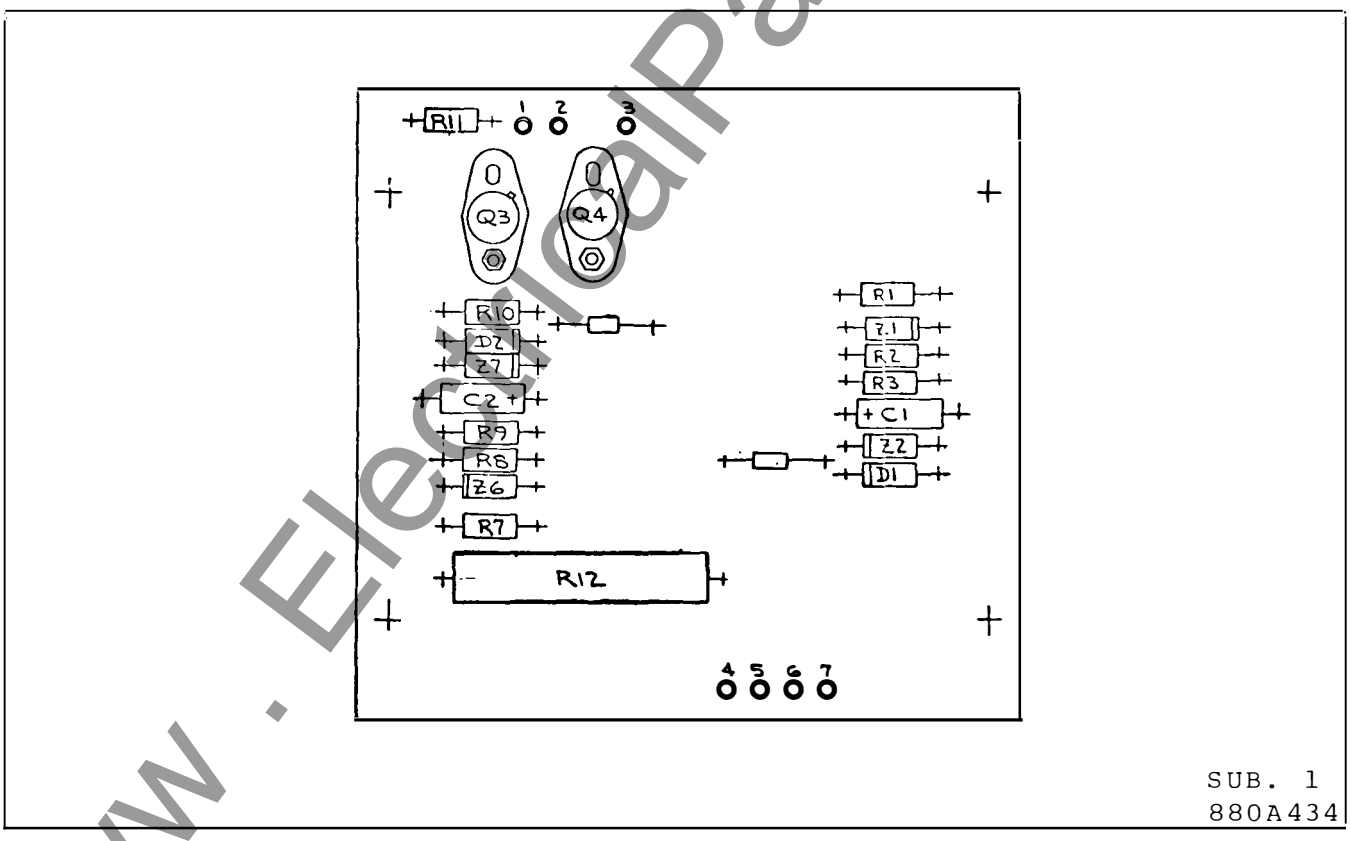


Fig. 14. Component Location Two Buffered Input "OR" in FT-22 Case 125 VDC.

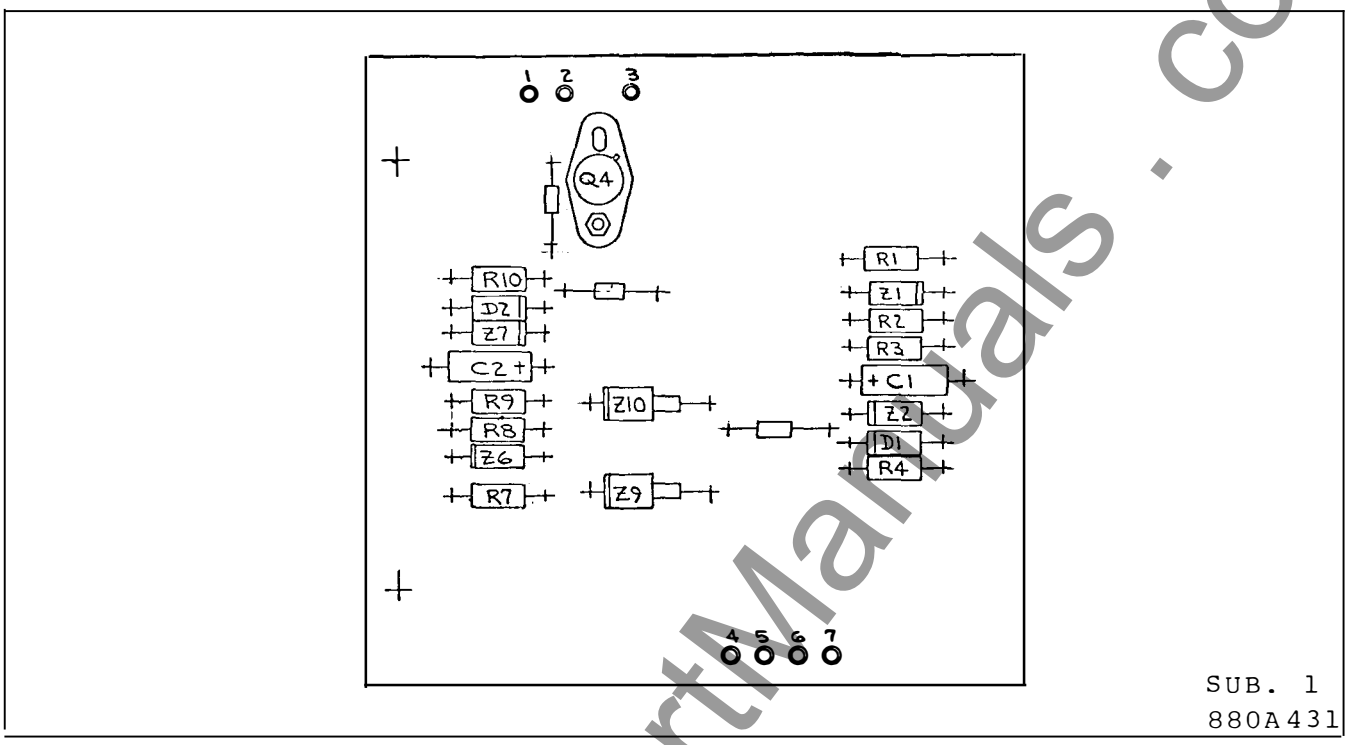
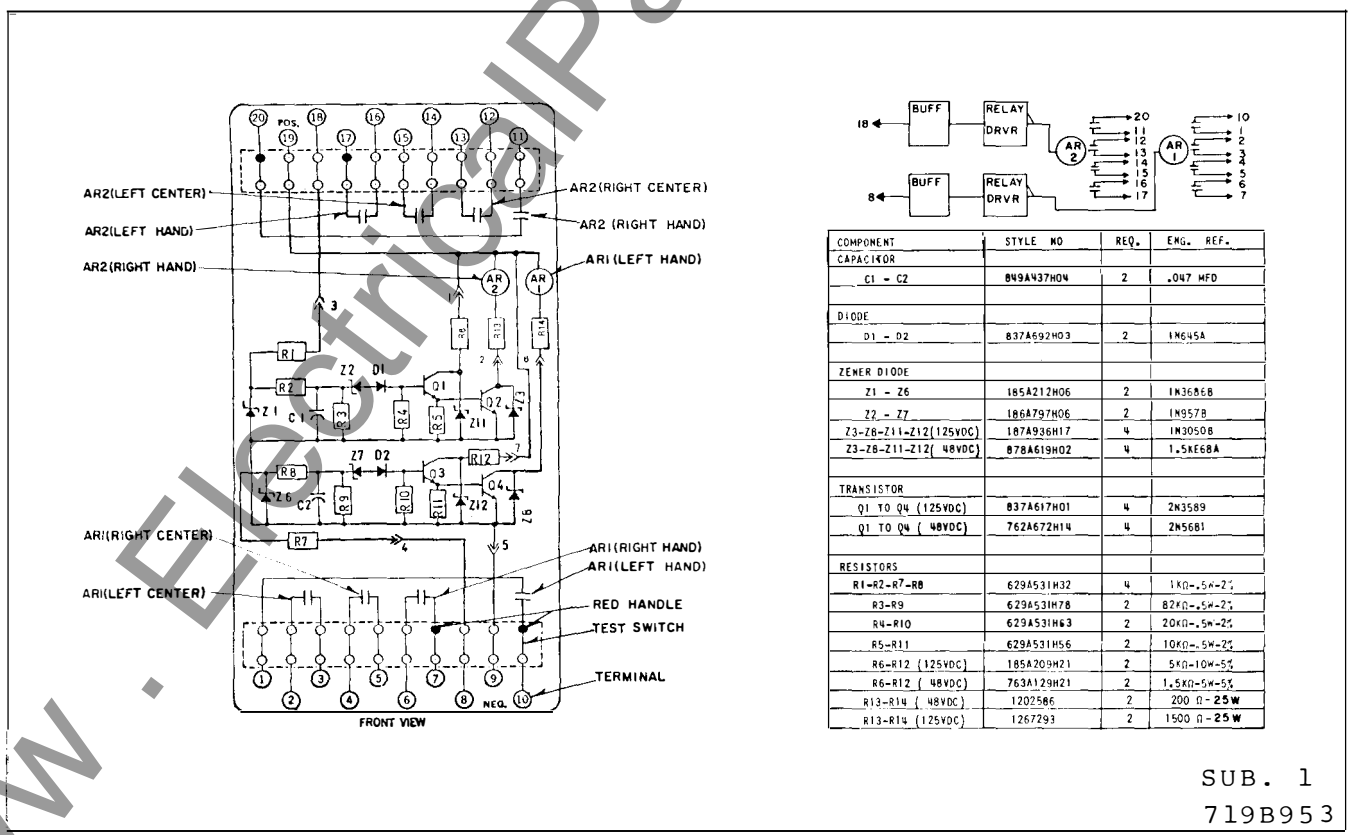
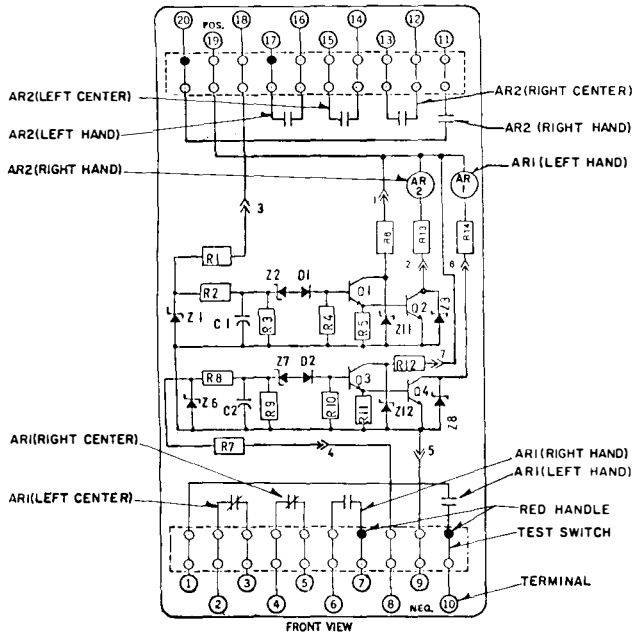


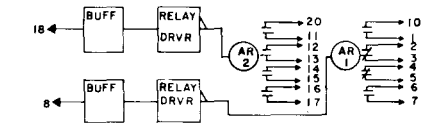
Fig. 15. Component Location Two Buffered Input "OR" in FT-22 Case - 250 VDC.



COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

Fig. 16. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (All Make) Contacts in FT-22 Case - 48 & 125 VDC.

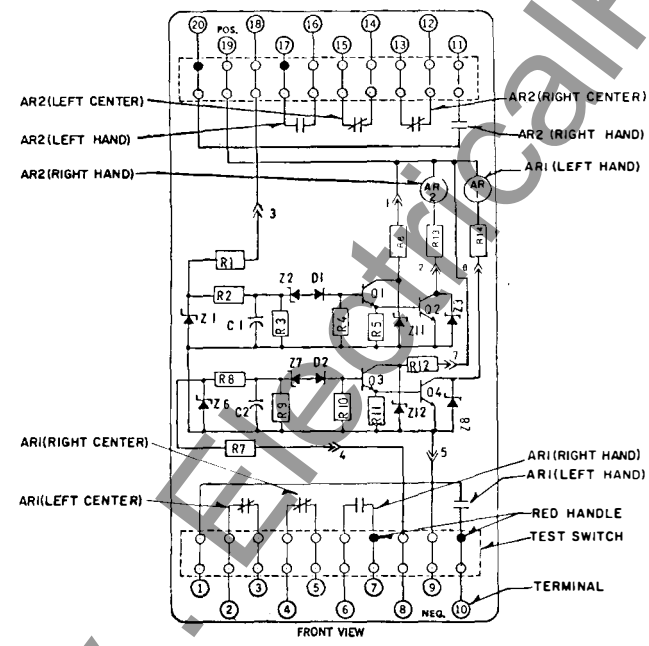


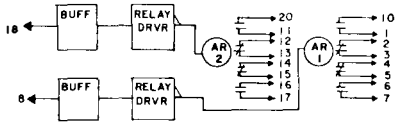


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N6686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125 VDC)	1267293	2	1500 Ω-25W

SUB. 1
719B950

Fig. 17. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-2M 2B) Contacts in FT-22 Case. 48 and 125 Vdc

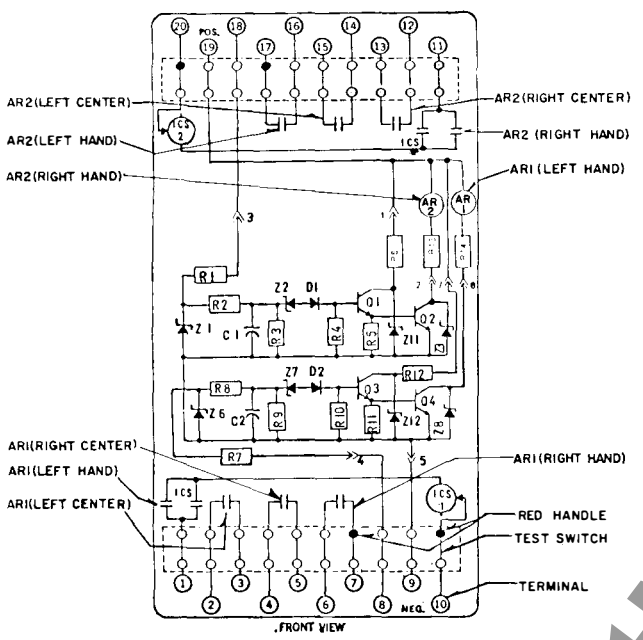


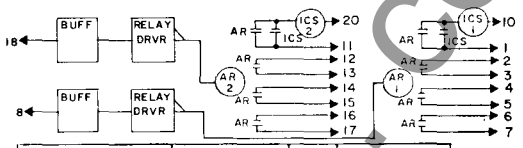


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N6686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω-25W
R13-R14 (125VDC)	1267293	2	1500 Ω-25W

SUB. 1
719B949

Fig. 18. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (2M2B - 2M2B) Contacts in FT-22 Case. 48 and 125 Vdc

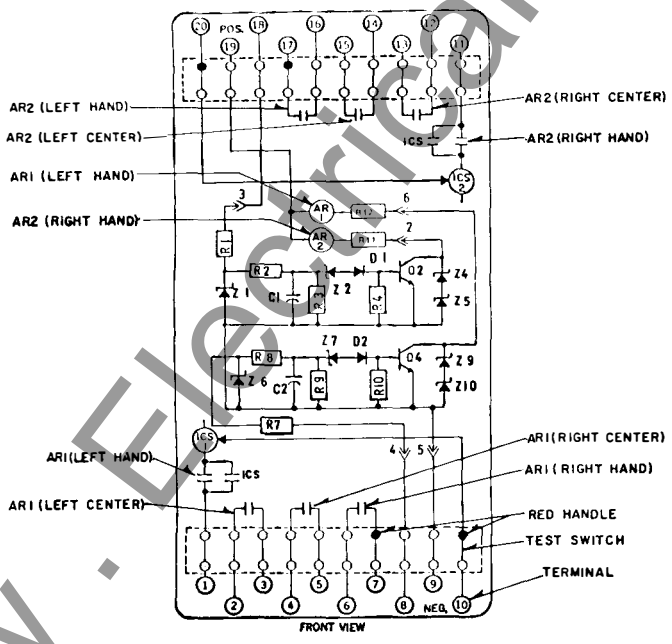


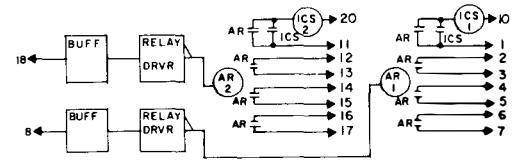


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5581
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B954

Fig. 19. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units All Make Contacts - 2 ICS Units in FT-22 Case – 48 and 125 Vdc

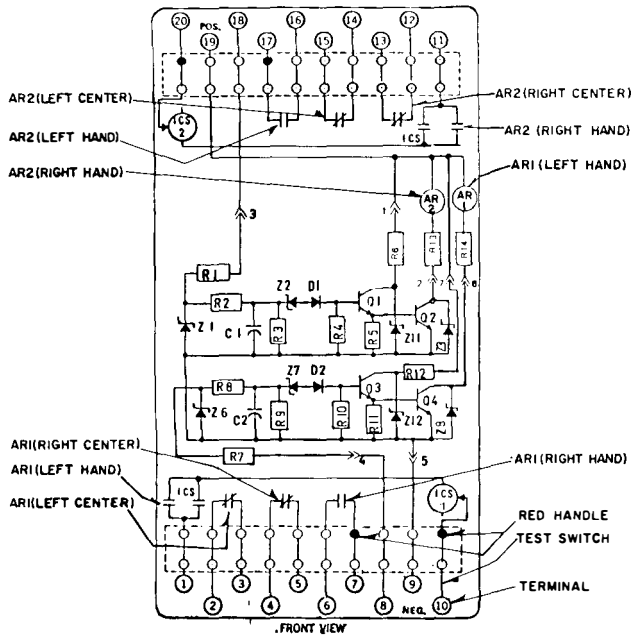


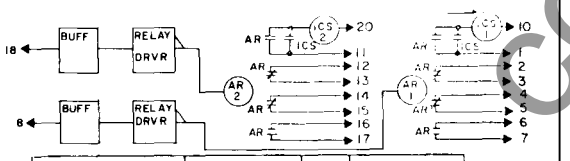


COMPONENT	STYLE NO.	REQ.	ENG. REF.
CAPACITOR			
C1-C2	849A437H04	2	.047 MFD
DIODE			
D1-D2	837A692H03	2	1N645A
ZENER DIODE			
Z1-Z6	185A212H06	2	1N3686B
Z2-Z7	186A797H06	2	1N957B
Z4-Z5-Z9-Z10	187A936H17	4	1N3050B
TRANSISTOR			
Q2 - Q4	878A432H01	2	2N4063
RESISTOR			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H56	2	10KΩ-.5W-2%
R11-R12 (250VDC)	1205222	2	6000 Ω - 25W

SUB. 1
719B955

Fig. 20. Relay Type ARS - 2 Single Buffered Inputs - 2 AR Units (4M-4M) Contacts - 2 ICS Units in FT-22 Case- 250 VDC.

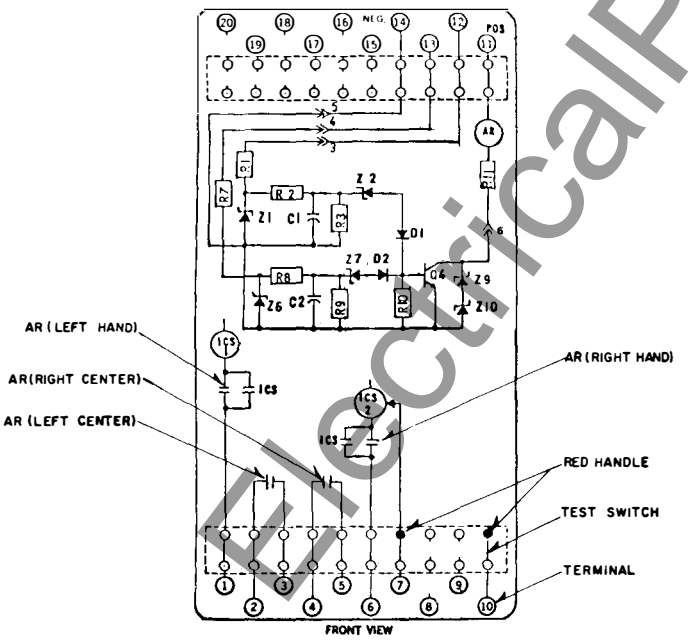


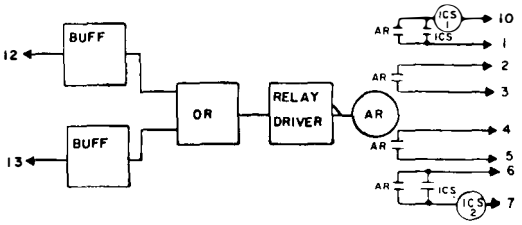


COMPONENT	STYLE NO	REQ.	ENG. REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1 - D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z3-Z8-Z11-Z12(125VDC)	187A936H17	4	1N3050B
Z3-Z8-Z11-Z12(48VDC)	878A619H02	4	1.5KE68A
TRANSISTOR			
Q1 TO Q4 (125VDC)	837A617H01	4	2N3589
Q1 TO Q4 (48VDC)	762A672H14	4	2N5681
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R4-R10	629A531H63	2	20KΩ-.5W-2%
R5-R11	629A531H56	2	10KΩ-.5W-2%
R6-R12 (125VDC)	185A209H21	2	5KΩ-10W-5%
R6-R12 (48VDC)	763A129H21	2	1.5KΩ-5W-5%
R13-R14 (48VDC)	1202586	2	200 Ω - 25W
R13-R14 (125VDC)	1267293	2	1500 Ω - 25W

SUB. 1
719B957

Fig. 21. Relay Type ARS - 2 Single Buffered Inputs - 2AR Units (2M2B-2M2B) Contacts - 2 ICS Units in FT-22 Case – 125 Vdc





COMPONENT	STYLE NO.	REQ.	ENG.REF.
CAPACITOR			
C1 - C2	849A437H04	2	.047 MFD
DIODE			
D1- D2	837A692H03	2	1N645A
ZENER DIODE			
Z1 - Z6	185A212H06	2	1N3686B
Z2 - Z7	186A797H06	2	1N957B
Z9 - Z10	187A936H17	2	1N3050B
TRANSISTOR			
Q4	878A432H01	1	2N4063
RESISTORS			
R1-R2-R7-R8	629A531H32	4	1KΩ-.5W-2%
R3-R9	629A531H78	2	82KΩ-.5W-2%
R10	629A531H56	1	10KΩ-.5W-2%
R11 (250VDC)	1205222	2	6000Ω - 25W

SUB. 1
719B958

Fig. 22. Type ARS Relay - 2 Buffered Input "OR" - 1 AR Unit 4M Contacts 2 ICS Units in FT-22 Case 250 VDC.

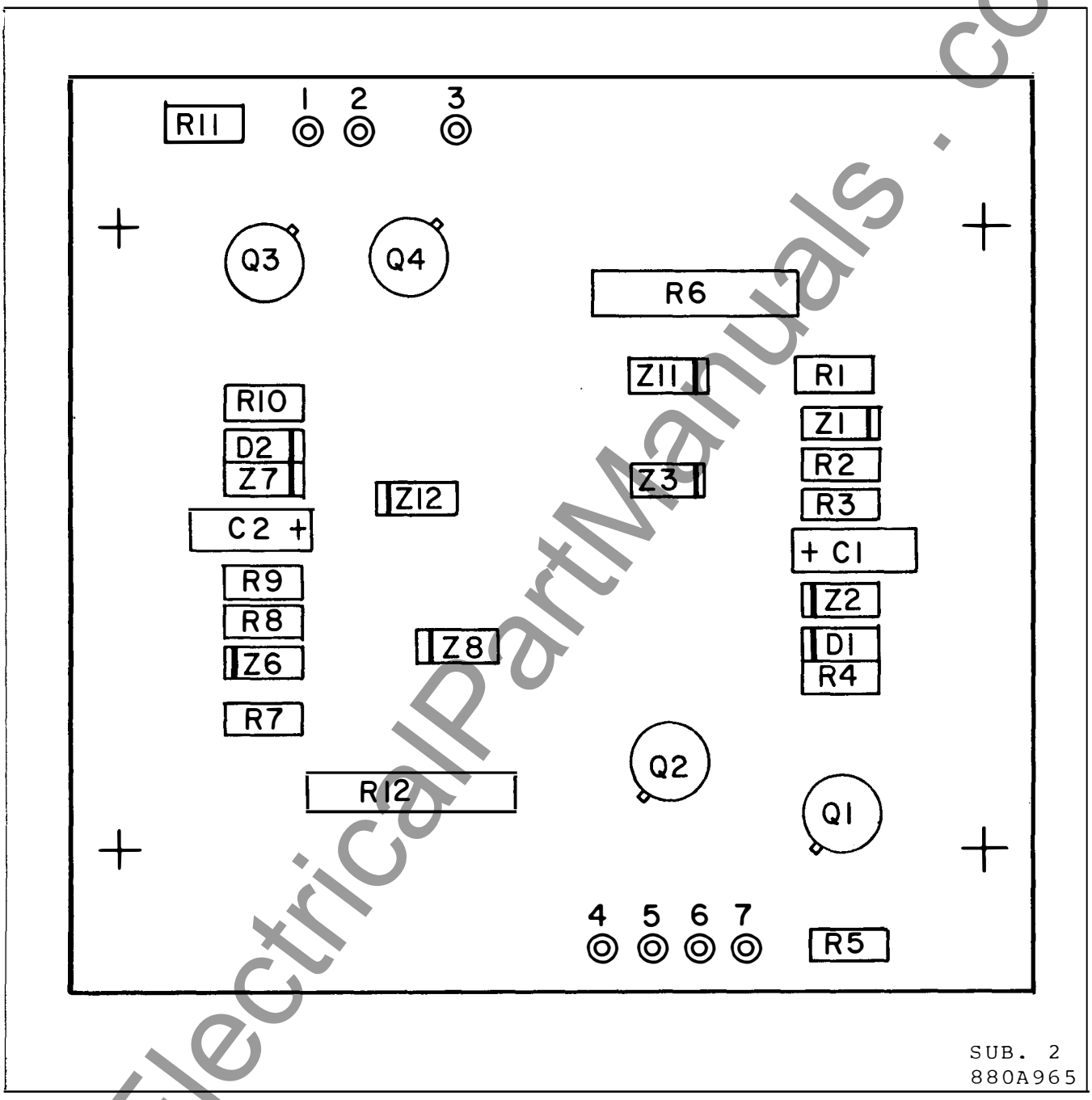


Fig. 23. Component Location Two Single Buffered Inputs in Type FT-22 Case - 48 VDC.

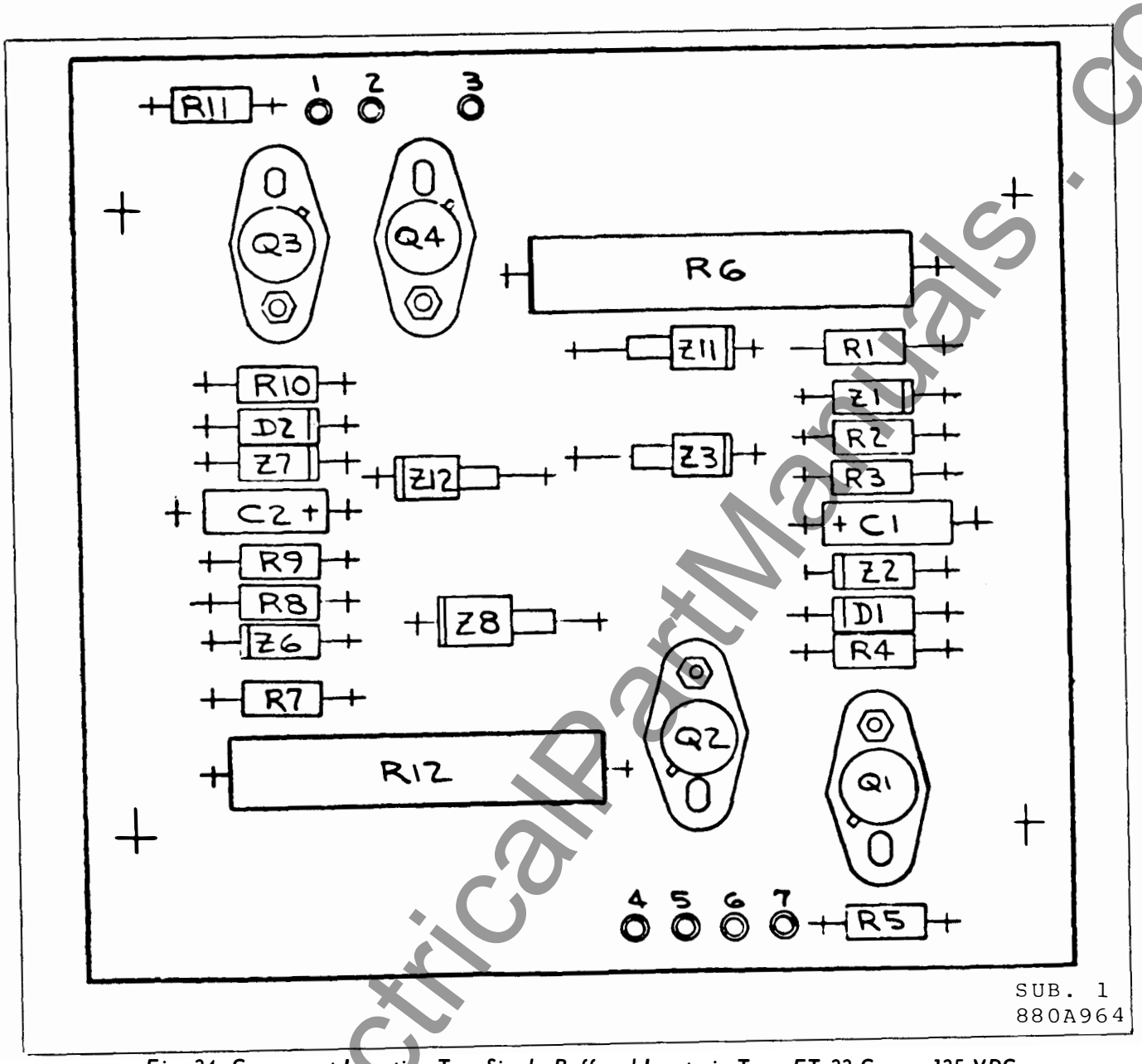


Fig. 24. Component Location Two Single Buffered Inputs in Type FT-22 Case - 125 VDC.

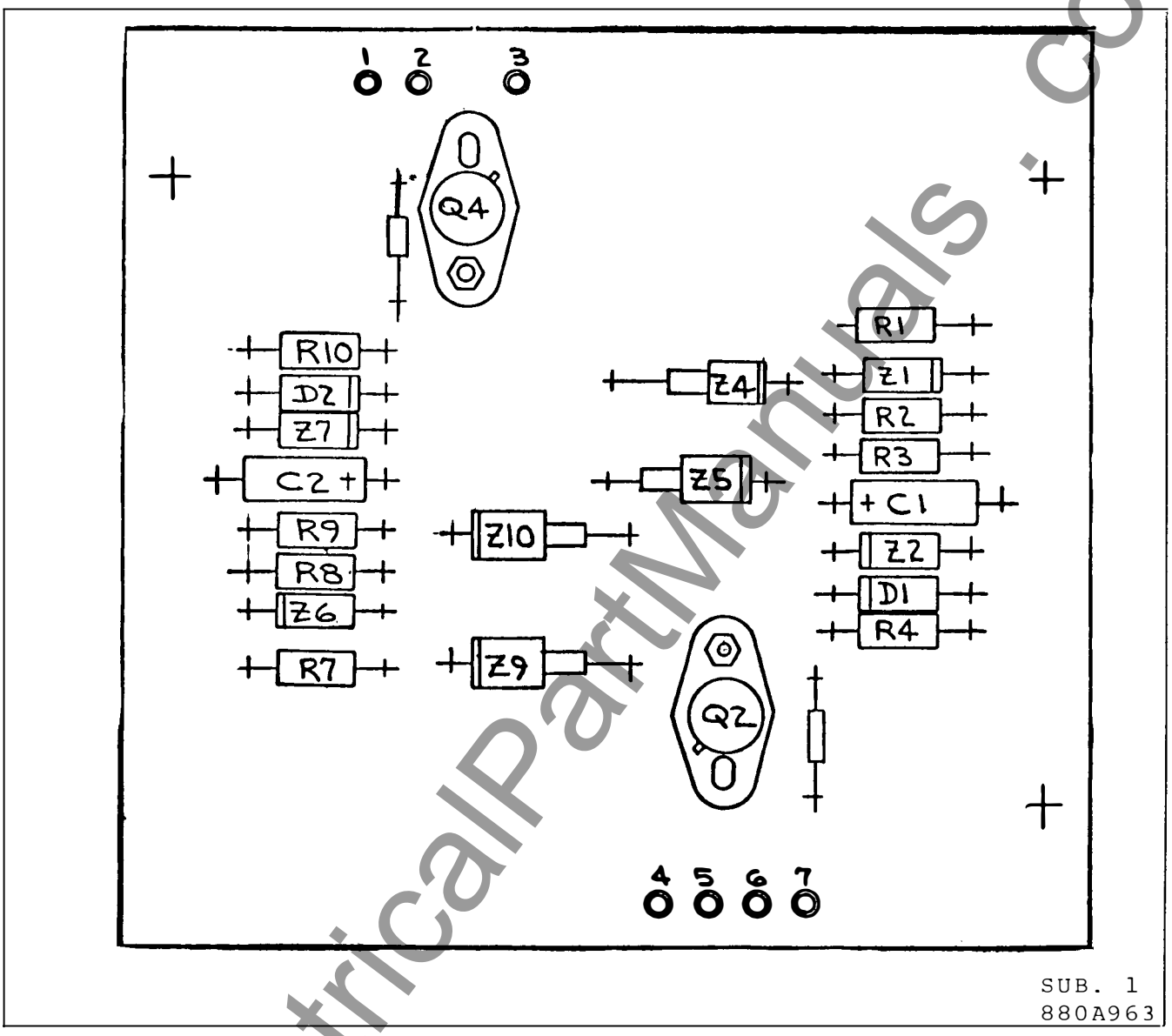


Fig. 25. Component Location Two Single Buffered Inputs in FT-22 Case 250 VDC.

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