INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE TT-16 AUXILIARY RELAY WITH AVALANCHE DIODE

CAUTION: Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing parts during shipment, make sure that moving parts operate freely, inspect the contacts to see that they are clean and close properly and operate the relay to check the settings and electrical connections.

APPLICATION

The type TT-16 is an auxiliary relay used in the K-DAR directional comparison tripping scheme. The TT-16 relay provides a circuit for high speed tripping, controls the transfer signal for the remote line terminals and supplies necessary coordination during sudden reversal for external fault conditions. The TT-16 relay can be used on 2 or 3 terminal lines.

CONSTRUCTION

The type TT-16 relay consists of a mercury wetted contact relay, telephone type relays, avalanche diodes, and an indicating contactor switch.

Auxiliary Unit X

Auxiliary unit X is a mercury wetted relay.

Auxiliary Unit X2, Y and LO

Auxiliary units X2, Y and LO are telephone type relays.

Tripping Diode D9 and Blocking Diodes D3 to D8

These diodes are controlled avalanche type diodes with a 1000 volt, 12 ampere rating (JEDEC NO. 1N4529).

Indicating Contactor Switch Unit (ICS)

The indicating contactor switch is a small d-c operated clapper type device.

OPERATION

The type TT-16 relay is used with microwave or pilot wire tone channel in a directional transfer trip relay scheme for power transmission line protection. High-speed tripping is obtained for two-terminal or multi-terminal line applications for faults anywhere on the protected line.

SUPERSEDES 41-958.8
*Denotes change from superseded issue. EFFECTIVE SEPTEMBER 1967

The protective relays and the relay settings used in the TT-16 scheme are the same as used in directional comparison carrier schemes with the relay set to reach beyond the remote line terminals so that end zone faults will appear well within the relay characteristic for fast relay operation.

The TT-16 scheme, however, uses a tripping signal rather than a blocking signal to provide improved security against undesired relay operation for external faults. Since the microwave or pilot wire tone channels are separate from the conductors of the protected power line, it is not necessary to use a blocking signal, as in the conventional directional comparison carrier scheme to avoid having to send the signal on the conductors through a fault. The conventional directional comparison carrier scheme is arranged to trip on absence of the blocking signal, so that the channel failure will result in false tripping for external remote faults that are within reach of the protective relays. Since the TT-16 scheme requires reception of the trip signal as well as operation of the local protection relays, channel failure cannot result in undesired tripping.

Auxiliary Unit X

The X-unit is used to provide a coordinating delay, if a sudden reversal occurs in the direction of fault power flow in the protected line. For an internal fault, the X-relay is preclosed and is kept closed by fault detecting relays.

Auxiliary Unit Y and Anti-bounce Circuit

Auxiliary unit Y, in conjunction with capacitor C and resistor R, provides for continuation of the audio tone tripping signal in case the protective relay (PR) contacts should have an initial bounce. The sequence of operation of this anti-bounce circuit is as follows:

> As soon as the PR contact first closes, the capacitor charges almost instantaneously to the approximate value of the d-c control voltage through the resistor R and the normally closed Y contact, at the same time closing of the protective relay contact applies reverse bias to transistors in the transmitter of the audio tone equipment, causing the transmitter to shift to the trip frequency. When the PR contact bounces open this reverse bias to "shift" is upheld by the capacitor voltage that is slowly discharged through a high resistance path in the transmitter circuit. When PR contact recloses the same sequence of events takes place. When finally PR closes "solid" or long enough for Y unit to operate, the anti-bounce circuit is cut off by the normally closed Y contact and the capacitor charge is dissipated through a normally open contact and resistor R.

Auxiliary Unit - LO

The LO unit is energized by the 94-G channel control contact. One contact of LO relay energizes the X unit. This makes it possible, in case of channel failure, to lockout the transfer tripping at the local terminal. The second LO contact is in series with alarm circuit, and the third LO contact is in series with the 94-T channel control contact, as a second path to energize LO unit coil, after trip signal is received. The LO unit has prolonged dropout time, thus assuring that it will stay closed long enough to transfer from guard to trip received signals without dropping out.

Auxiliary Unit - X2

The X2 unit is used to provide additional time delay in the transmitter initiate circuit, when desired. When used, it is connected in series with "b" contact of circuit breaker.

Tripping Diode D1

Tripping diode D1 provides isolation of the KD timer circuit from the ground fault detector relay.

Blocking Diodes D3 to D8

Blocking diodes D3 through D8 are utilized to prevent undesirable tripping or operation of associated equipment.

STYLE OF RELAYS

D.C. SUPPLY VOLTAGE	STYLE OF RELAY
48	*292B492A13
125	*292B492A12
250	292B492A14

SETTINGS

The only setting required is that if the X relay operating time. Operating times between 1.5 to 2.0 cycles can be obtained by utilizing slide wire resistor which is located at top front of TT-16 relay chassis. The X relay is set at the factory for a 1.5 cycle operate time.

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 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.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments should be required.

Acceptance Check

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

Auxiliary Units X, X2, Y, and LO

Energize with rated voltage each auxiliary unit and check contact action. If desired, the timing of the operation can be checked as outlined under calibration procedure.

Avalanche Diode

Reverse Characteristic:

Breakdown voltage is the value of voltage at which the reverse current just exceeds 0.5 milliamperes and should be 600 volts for each diode. The breakdown voltage is determined by slowly increasing voltage until reverse current exceeds 0.5 milliamperes and starts to increase rapidly. A safety resistor should be used to prevent shorting the D.C. source.

Rountine Maintenance

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleared. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

NOTE: When making a dielectric test on the relay, the high voltage may be applied at the relay terminal, from all circuits to ground, between coil and contact circuits, and between isolated coil circuits. However, the test voltage should not be applied across relay contacts, relay coils, or rectifier circuits.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or if the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order.

Auxiliary Units X, X1, Y, and LO

The operating time of units X and LO should be checked with an electronic timer.

Auxiliary Unit X

The X relay is located at the upper rear and is energized between terminals 5 and 13, with LO unit preclosed. Its adjusting resistor is mounted across the front and at the top of the TT-16 chassis. The operating range of the X unit is adjustable from 1.5 to 2.0 cycles and this is accomplished by adjusting its associated resistor.

The dropout time is 1.5 to 2.0 cycles at rated voltage.

NOTE: For the following telephone relay checks, the residual air gap should not be less than .002" and the contact gaps should be between .020" to .035".

Auxiliary Unit X2

The X2 unit is located at the upper right front of the TT-16 chassis and is energized between terminals 5 and 15, with the contact circuit being between terminals 15 and 18. The operating time of this unit at rated voltage is 6 to 8 cycles.

Auxiliary Unit Y

The Y unit is located at the left front of the TT-16 chassis and is energized between terminals 5 and 20. For contact circuitry, see Internal Schematic 848A729. The normally closed contact should open in 1.5 cycles at rated voltage. This adjustment is controlled by the Y unit resistor which is located at the lower left. The approximate setting of the resistor is 5000 ohms for the 125 volt relays or 13000 ohms for the 250 volt relays.

The dropout time should be 40-50 milliseconds. If necessary, the dropout time can be adjusted using the residual screw and changing the armature gap. After final adjustment, the armature gap should not be less than .002".

Auxiliary Unit LO

The LO unit is located at the lower right front of the TT-16 chassis and is energized between terminals 6 and 9. The closing time of a normally open contact should be approximately one cycle at rated voltage. This adjustment is controlled by the LO unit resistor which is located at the lower right front. The approximate setting of this resistor should 2000 ohms for 125 volt relays or 5000 ohms for 250 volt relays.

The dropout time should be 40-50 milliseconds. If necessary, the dropout time can be adjusted using residual screw and changing the armature gap. After final adjustment, the armature gap should not be less than .002".

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 not be greater than 1.0 ampere.

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.

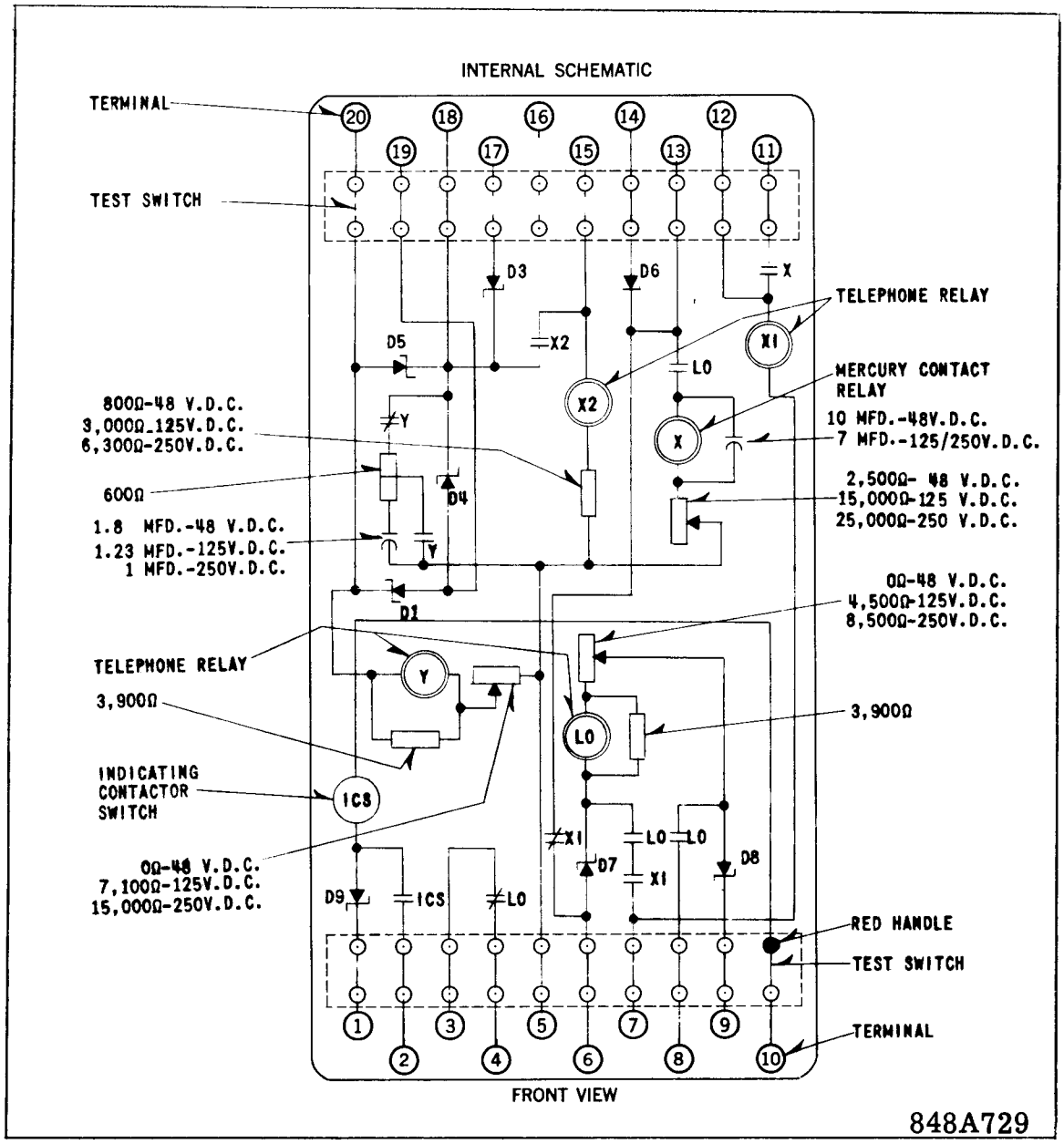


Fig. 1 Internal Schematic of the Type TT-16 Relay in the FT-32 Case.

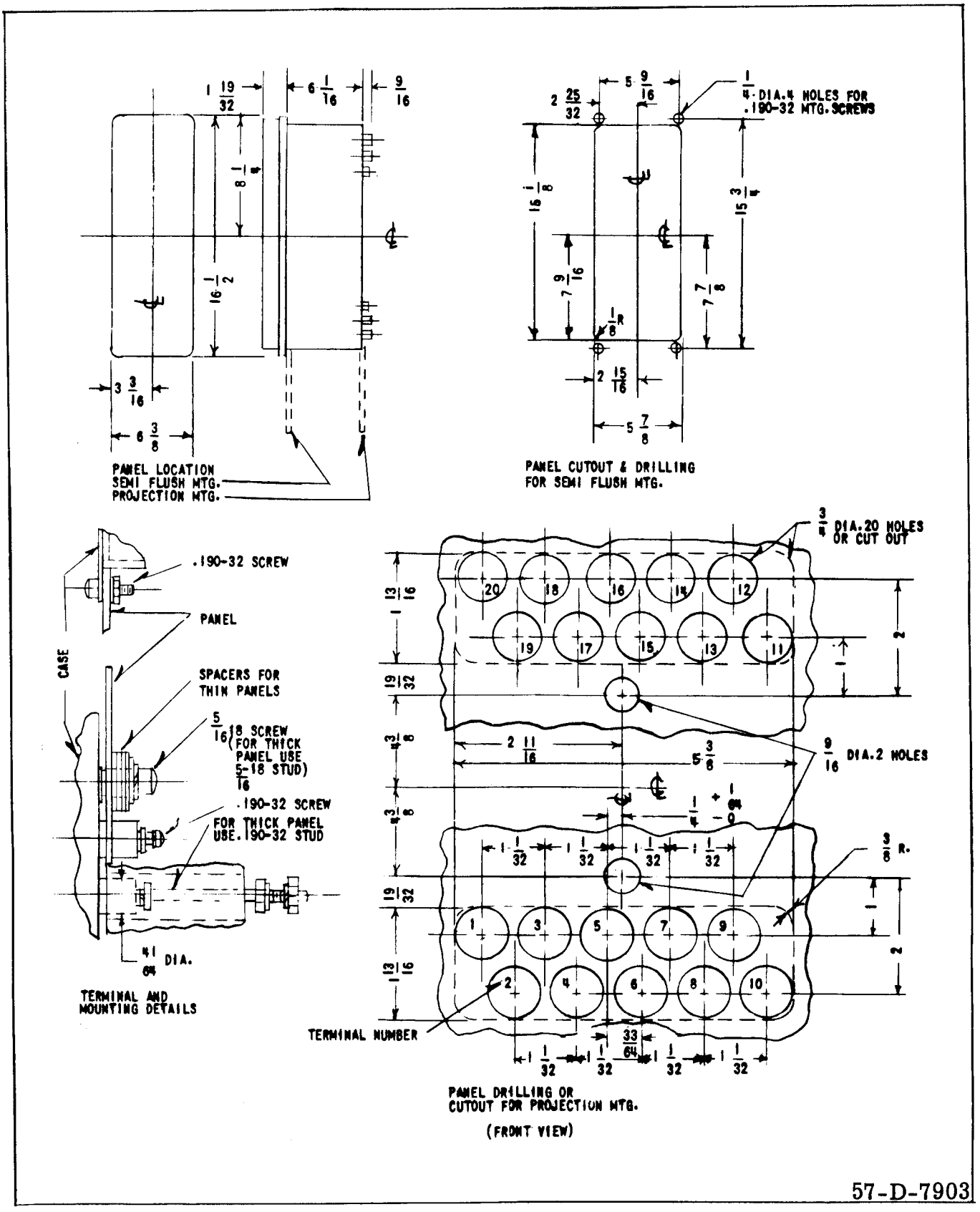
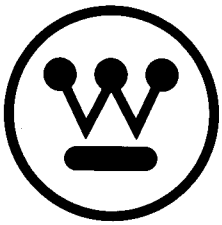


Fig. 2 Outline and Drilling Plan for the Type TT-16 Relay in the FT-32 Case.



WESTINGHOUSE ELECTRIC CORPORATION
RELAY-INSTRUMENT DIVISION
NEWARK, N. J.

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

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Tripping Diode D9 and Blocking Diodes D3 to D8

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Auxiliary Unit X

The X-unit is used to provide a coordinating delay, if a sudden reversal occurs in the direction of fault power flow in the protected line. For an internal fault, the X-relay is preclosed and is kept closed by fault detecting relays.

Auxiliary Unit Y and Anti-bounce Circuit

Auxiliary unit Y, in conjunction with capacitor C and resistor R, provides for continuation of the audio tone tripping signal in case the protective relay (PR) contacts should have an initial bounce. The sequence of operation of this anti-bounce circuit is as follows:

> As soon as the PR contact first closes, the capacitor charges almost instantaneously to the approximate value of the d-c control voltage through the resistor R and the normally closed Y contact, at the same time closing of the protective relay contact applies reverse bias to transistors in the transmitter of the audio tone equipment, causing the transmitter to shift to the trip frequency. When the PR contact bounces open this reverse bias tc "shift" is upheld by the capacitor voltage that is slowly discharged through a high resistance path in the transmitter circuit. When PR contact recloses the same sequence of events takes place. When finally PR closes "solid" or long enough for Y unit to operate, the anti-bounce circuit is cut off by the normally closed Y contact and the capacitor charge is dissipated through a normally open contact and resistor R.

Auxiliary Unit - LO

The LO unit is energized by the 94-G channel control contact. One contact of LO relay energizes the X unit. This makes it possible, in case of channel failure, to lockout the transfer tripping at the local terminal. The second LO contact is in series with alarm circuit, and the third LO contact is in series with the 94-T channel control contact, as a second path to energize LO unit coil, after trip signal is received. The LO unit has prolonged dropout time, thus assuring that it will stay closed long enough to transfer from guard to trip received signals without dropping out.

Auxiliary Unit - X2

The X2 unit is used to provide additional time delay in the transmitter initiate circuit, when desired. When used, it is connected in series with "b" contact of circuit breaker.

Tripping Diode D1

Tripping diode D1 provides isolation of the KD timer circuit from the ground fault detector relay.

Blocking Diodes D3 to D8

Blocking diodes D3 through D8 are utilized to prevent undesirable tripping or operation of associated equipment.

STYLE OF RELAYS

D.C. SUPPLY VOLTAGE	STYLE OF RELAY
48	292B492A12
125	292B492A13
250	292B492A14

SETTINGS

The only setting required is that if the X relay operating time. Operating times between 1.5 to 2.0 cycles can be obtained by utilizing slide wire resistor which is located at top front of TT-16 relay chassis. The X relay is set at the factory for a 1.5 cycle operate time.

INSTALLATION

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The dropout time is 1.5 to 2.0 cycles at rated voltage.

NOTE: For the following telephone relay checks, the residual air gap should not be less than .002" and the contact gaps should be between .020" to .035".

Auxiliary Unit X2

The X2 unit is located at the upper right front of the TT-16 chassis and is energized between terminals 5 and 15, with the contact circuit being between terminals 15 and 18. The operating time of this unit at rated voltage is 6 to 8 cycles.

Auxiliary Unit Y

The Y unit is located at the left front of the TT-16 chassis and is energized between terminals 5 and 20. For contact circuitry, see Internal Schematic 848A729. The normally closed contact should open in 1.5 cycles at rated voltage. This adjustment is controlled by the Y unit resistor which is located at the lower left. The approximate setting of the resistor is 5000 ohms for the 125 volt relays or 13000 ohms for the 250 volt relays.

The dropout time should be 40-50 milliseconds. If necessary, the dropout time can be adjusted using the residual screw and changing the armature gap. After final adjustment, the armature gap should not be less than .002".

Auxiliary Unit LO

The LO unit is located at the lower right front of the TT-16 chassis and is energized between terminals 6 and 9. The closing time of a normally open contact should be approximately one cycle at rated voltage. This adjustment is controlled by the LO unit resistor which is located at the lower right front. The approximate setting of this resistor should 2000 ohms for 125 volt relays or 5000 ohms for 250 volt relays.

The dropout time should be 40-50 milliseconds. If necessary, the dropout time can be adjusted using residual screw and changing the armature gap. After final adjustment, the armature gap should not be less than .002".

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 not be greater than 1.0 ampere.

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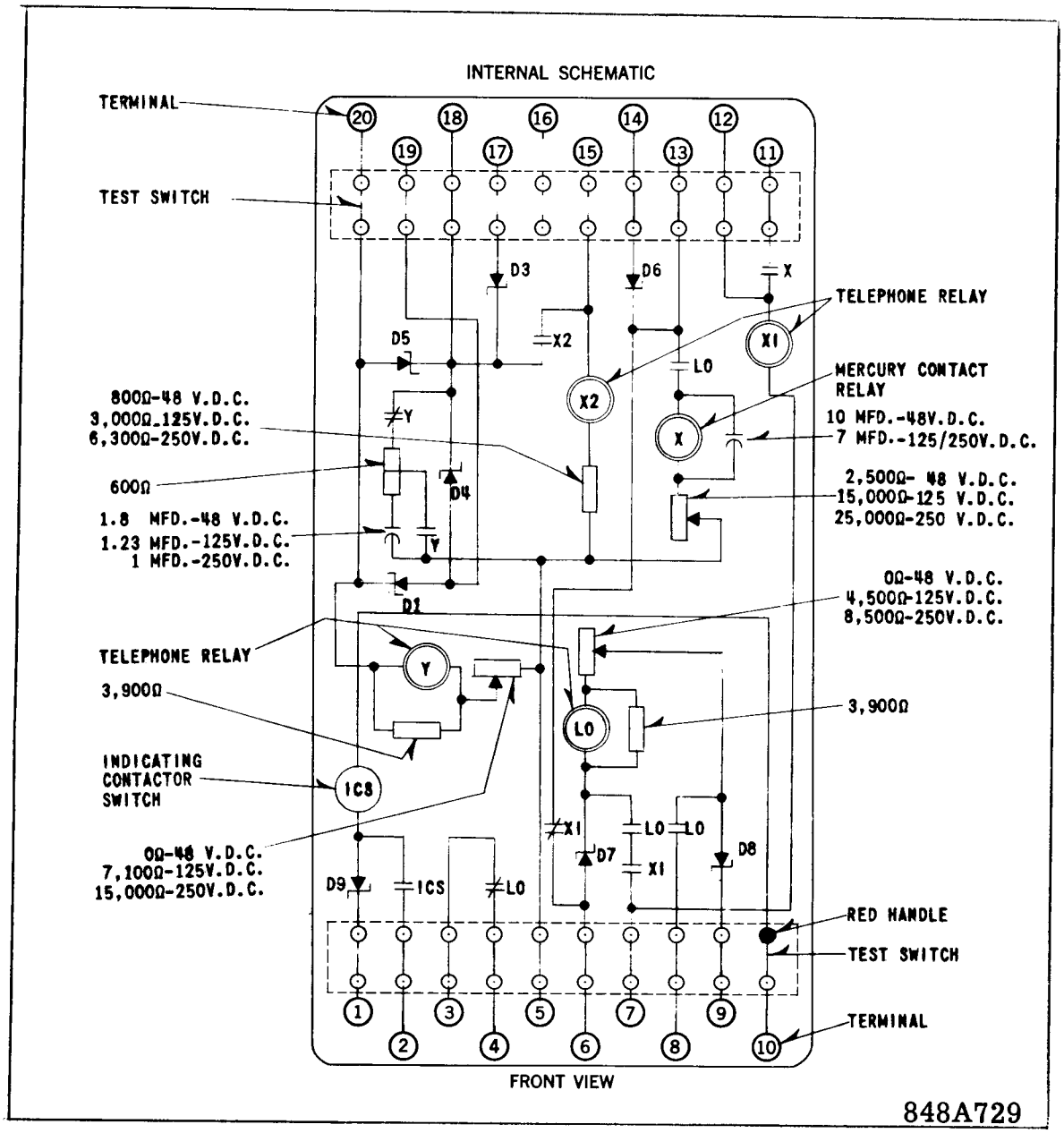

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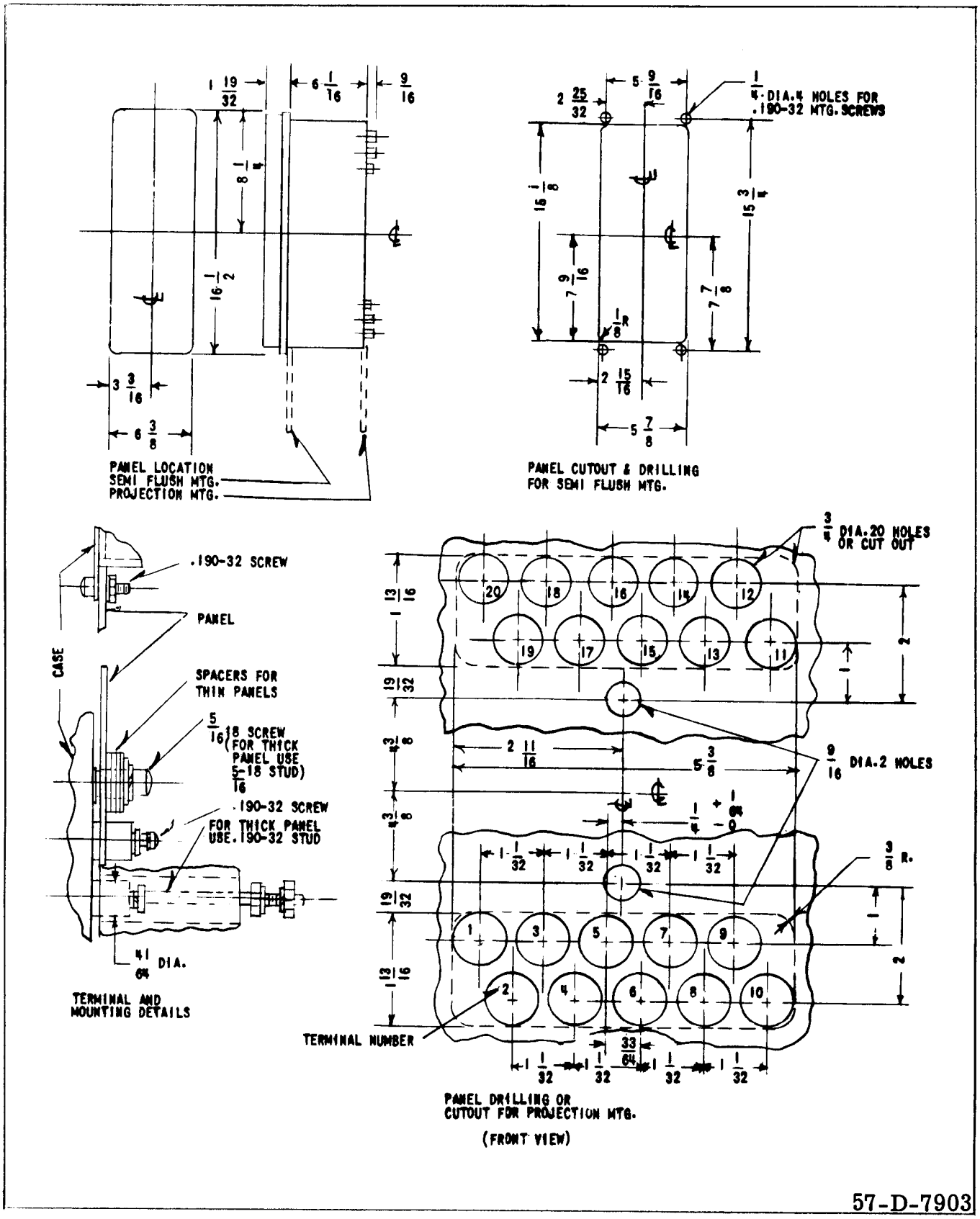
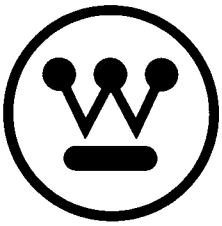


Fig. 2 Outline and Drilling Plan for the Type TT-16 Relay in the FT-32 Case.



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