

28A RINGER ISOLATOR

1. GENERAL

1.01 This section contains identification, installation, connection, and testing information of the 28A ringer isolator.

1.02 This section is reissued to:

- Add Fig. 2 and 3
- Add Table B, O, and P
- Revise all set connection tables

1.03 The 28A ringer isolator is a solid state device used to extend and provide ringer isolation on all lines using grounded ringers. It is a replacement for the 10A, 11A, and 11B extenders which are rated MD. The 28A is a high performance, centrally mounted device for use in ringer coupling for all multiparty lines. It can also be used for nonregistered single party service where capacitor coupled bridged ringer range is inadequate.

1.04 The 28A (Fig. 1) is a small weatherproof unit with a four conductor pigtail and should be mounted near the station protector on the premises of the subscriber. One isolator is required for each main station.

1.05 The 28A is compatible with both ac-dc and superimposed ringing for single party, two-party (including ANI), four-party semiselective, four-party full selective, eight-party semiselective, or divided code service. It may be used with 97-volt ringing provided by most dial long line circuits.

2. IDENTIFICATION

2.01 The 28A is a solid state, polarity sensitive, voltage controlled switch which connects the ringer(s) in the subscriber's station set(s) into the circuit when the proper polarity and level of ringing voltage is applied. The circuit triggers on the voltage differential between tip and ring and, once

triggered, connects the ringer between the ringing lead and ground (see Fig. 2).



The 28A isolator will not work with some revertive call selectors or trunk circuits without modification. Revertive call selectors, SD-31831-01 (4-party, semiselective) and SD-31762-01 (10-party, divided code) in some 355A step-by-step offices apply the same ringing voltage to the tip and ring simultaneously and therefore do not provide a voltage difference between tip and ring to trigger the isolator. Reverting call trunk circuits SD-26068-01 in No. 5 crossbar offices and SD-26068-05 in No. 5A crossbar offices require option S to ground the called party side of the line while the calling party phone is ringing.

2.02 The 28A provides isolation for all grounded ringers without causing radio or TV interference, or reduction of ringing current. It can be used effectively on lines having high inductive noise. Since the ringer capacitance is normally isolated from the loop, dial pulsing ranges are not significantly affected by the number of ringers.

2.03 There is no significant reduction in ringing range when the isolator is added to the ringing circuit since only 2 volts of ringing voltage is absorbed by the circuit.

2.04 The polarity sensitivity feature of the 28A trigger circuit allows ringers to be set in the weak notch for all two-party, four-party semiselective and divided code ringing without cross ring when a party answers. With superimposed ringing, cross-ringing on answer may sometimes occur with ringers in the weak notch. Use of the stiff notch may be necessary, see Table A.

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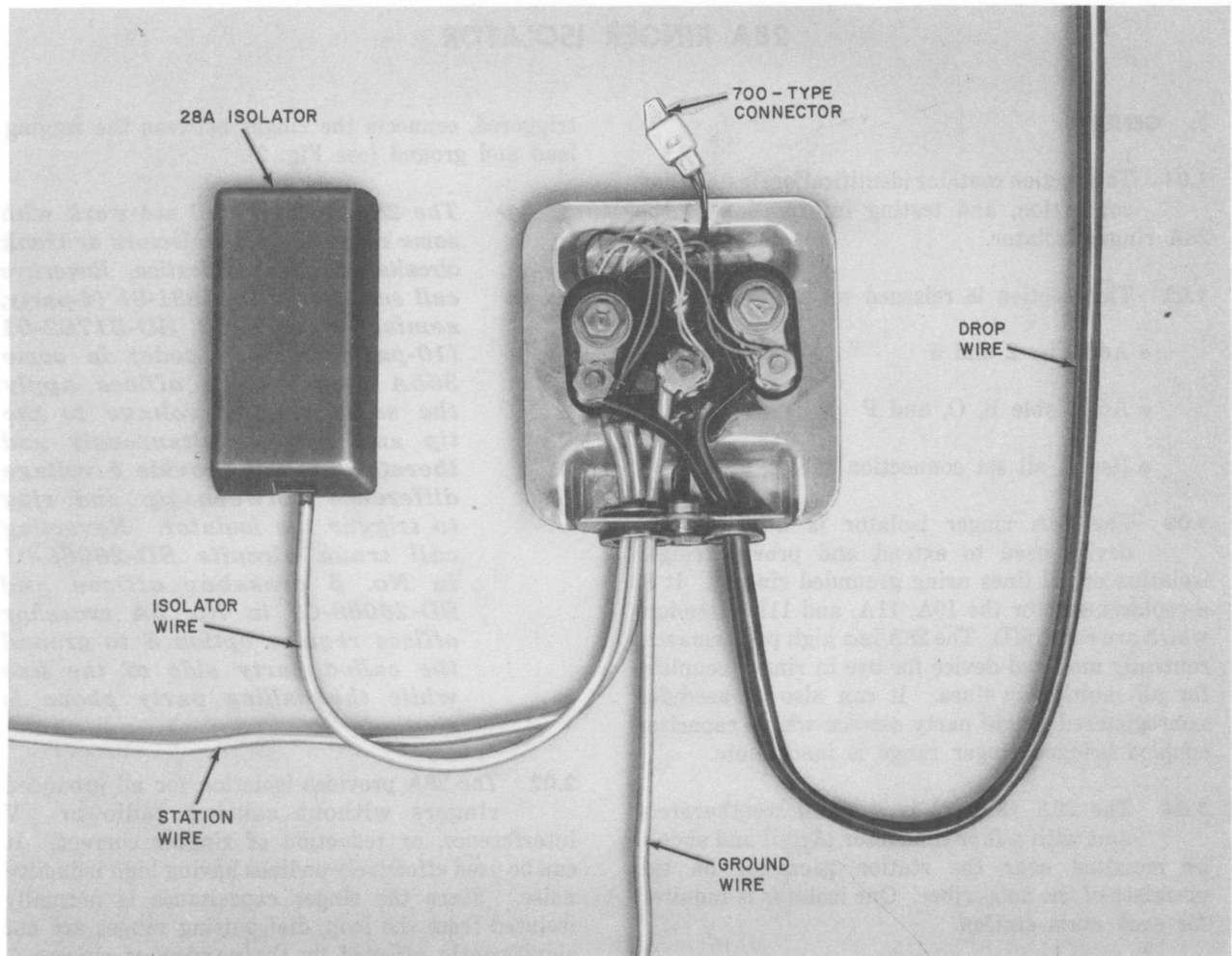


Fig. 1—28A Ringer Isolator, Typical Installation

2.05 When the 28A is used to improve line balance for noise abatement purposes, all grounded ringers at all parties must have isolation devices. Different types of ringer isolators can be used on the same subscriber pair if they operate independently, that is, if they are on opposite sides of the line or wired for different polarities. Simultaneous operation of the 28A and 11A/B, 425A, or 426A is not recommended because it can significantly reduce the number of ringers that can be operated. The 28A and the D-180036 ringer isolator kit, however, can operate simultaneously. If a 28A is to be installed, therefore, it is not

necessary to remove the D-180036 Kit from other parties that may be on the same side of the line and of the same polarity.

2.06 The 28A is compatible with all standard Bell System ringing where 86 or 97 volts, 20 Hz is applied with a 38-, 48-, or 72-volt trip battery, and where the loop idle voltage is 48 volts. These conditions exist for all nonrange extended loops, for loops with REGs, and with 48-volt dial long line circuits in single-party, two-party (including ANI), four-party semiselective and fullselective, eight-party semiselective, and divided code service.

◆ TABLE A ◆

MAXIMUM NUMBER OF RINGERS THAT CAN
BE RUNG SIMULTANEOUSLY USING 28A ISOLATOR
(SEE NOTE)

LONG ROUTE DESIGNED TRANSMISSION ZONES	RINGER BIAS SPRING	
	WEAK NOTCH	STIFF NOTCH
13	8	4
16	7	3
18	6	3
28	5	2
36	4	2
UNIGUAGE	5	2

Note: These ringer loads are based on a minimum of 40 volts across the ringers in the weak notch and 55 volt in the stiff notch.

2.07 Brief crossing can occur during superimposed ringing when the 28A is used with dial long line circuits SD-95435 or SD-96591 that have been modified for 72 or 96 volts.

2.08 Brief crossing sometimes occurs with revertive superimposed ringing in step-by-step and crossbar offices because there is insufficient spacing between ringing codes. The maximum crossing duration is only about 0.1 second so it should not be confused with a normal ring. Some existing No. 1 and No. 2 ESS offices also exhibit this crossing, however, corrective program changes are available. The No. 3 ESS has sufficient spacing between ringing codes to prevent crossing.

3. INSTALLATION AND CONNECTIONS

3.01 Install the 28A near the station protector using the stainless steel mounting screws furnished with the isolator. The four conductor pigtail lead should come out of the bottom of the isolator and is used to connect to the protector and inside wire as shown by Fig. 1.

3.02 The wiring arrangements for connecting an isolator for various ringing applications are shown by Table B with some examples shown by Fig. 3 and 4.

3.03 Tables C through P show telephone set connections when using a 28A isolator.

3.04 Table Q shows connections for the D-180489 ANI Kit of Parts which may be used, to maintain a better balance, when ANI ground is required. Some sets use both the 1728-type inductor and the 840398168 printed wiring board (PWB). Other sets use only the PWB portion of the kit.

3.05 Make isolator connections as follows.

- (1) Check service order or work order to verify polarity and polarity of station.



The isolator is turned on by the application of negative (-) or positive (+) ringing voltage. It is imperative that the installer know what the polarity of the line is, even with nonregistered one- or two-party service. Proper polarity must be observed at the isolator as well as at the telephone set by using the proper figure and appropriate column of the connection tables. (Since polarity is not shown on service order for one- or two-party service, the installer must be familiar with ringing polarity or obtain information locally.)

- (2) Choose column in Table B that fits the application for station involved.
- (3) Make connections to protector and inside wire as shown by Table B or Fig. 3 and 4.
- (4) Refer to proper table(s) (C through P) for telephone set(s) being used and connect according to appropriate column.

Note: Any previously installed isolator devices mounted either inside the phone or at the protector must be removed when installing the 28A isolator.

- (5) If ANI ground is required, and a D-180489 Kit of Parts is needed for noise balance, refer to Table Q for connection information.

3.06 To prevent crossing on answer on four-party fullselective and eight-party semiselective service, place ringers in the stiff notch if a proper

ring can be obtained (see Table A). Also use the stiff notch with C4A ringers in two-party, four-party semiselective and divided code service with SD-95590 and SD-96591 96-volt dial long line circuits to prevent bell tap. Use the weak notch in all other two-party, four-party, and divided code service. Disconnect unused ringers for best ringing performance.

4. TESTING

Testing From Station

4.01 Operation can be checked by reverting calls, automatic call back, or test desk call back. Ringing should occur on the proper number. There should not be any crossring or bell tap when other parties on the line receive calls.

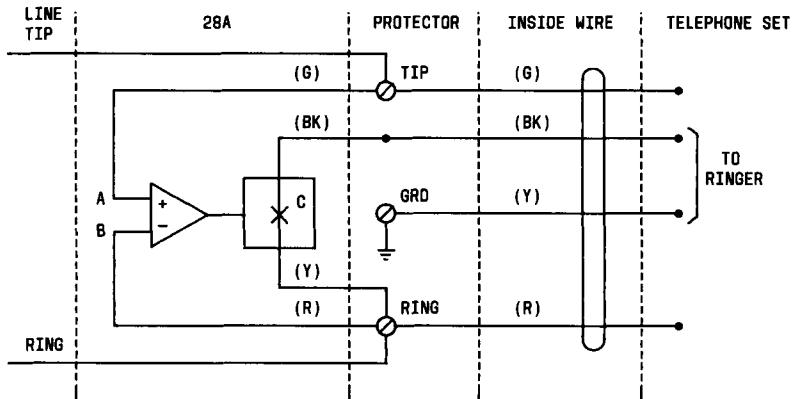
4.02 If the telephone set does not ring, short the (BK) and (Y) isolator leads. If the set rings with the leads shorted, the trouble is in the isolator. If the set still does not ring (use hand test set to verify that ringing voltage actually reaches the protector) the problem is with the inside wire or telephone set.

4.03 If the telephone set rings on the wrong number, insure that the line is correct at the protector, i.e., battery on the ring and ground on the tip. If line is correct, but polarity is reversed, reverse (R) and (G) isolator leads. Repeat ringing test.

Testing From Test Desk

4.04 A simple dc test may be made to verify loop continuity of the line and the isolator without any test desk modification. When tested with 48-volt test battery the isolator will appear open and only cable leakage will be indicated. When 100-volt test battery is applied, this will trigger the 28A isolator and cause a deflection (on the MA scale) of the meter at the test desk.

4.05 Loop continuity normally cannot be verified by the local test desk by testing for ringer capacitance because the 28A isolates this capacitance. There is a wiring option available for No. 14 and No. 16 test desks which will enable them to test through 28A..



ISOLATOR TRIGGERS ON VOLTAGE DIFFERENTIAL BETWEEN A AND B AND SWITCHES RINGING CURRENT THROUGH AT C TO TELEPHONE SET, THROUGH RINGER, AND BACK TO GROUND

Fig. 2—Typical Ringing Circuit for Negative Ring Party

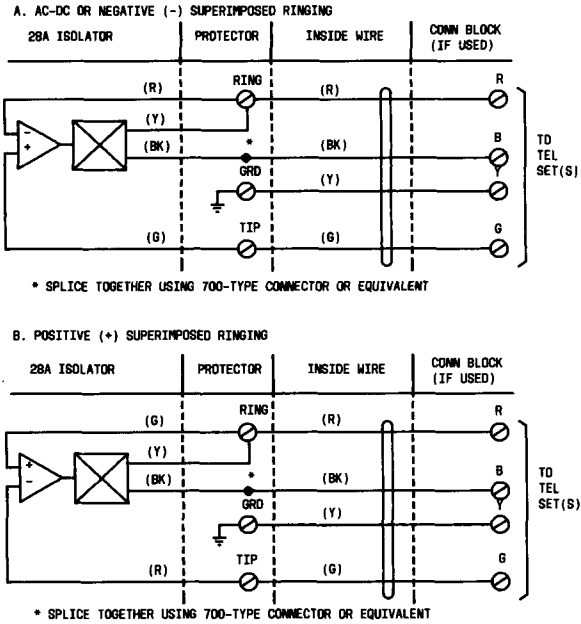


Fig. 3—28A Isolator Connections for Ring Parties (4-Conductor Wiring)

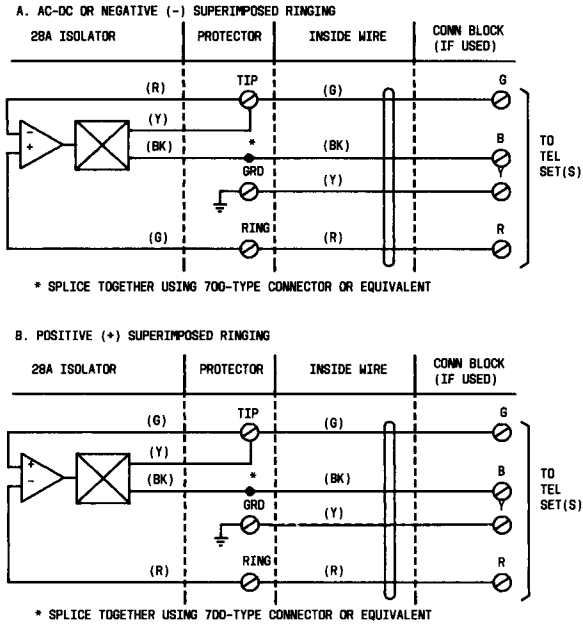


Fig. 4—28A Isolator Connections for Tip Party (4-Conductor Wiring)

◆ TABLE B ◆

28A ISOLATOR AND INSIDE WIRE CONNECTIONS (NOTE 1)

WIRE OR LEAD	COLOR	(-) RING PARTY 1 OR 5 (NOTE 2)		(-) TIP PARTY 2 OR 6		(+) RING PARTY 3 OR 7		(+) TIP PARTY 4 OR 8	
		4-COND	3-COND	4-COND	3-COND	4-COND	3-COND	4-COND	3-COND
Isolator Leads at Protector	R G Y BK	Ring Tip Ring *	Ring Tip GRD *	Tip Ring Tip *	Tip Ring GRD *	Tip Ring Ring *	Tip Ring GRD *	Ring Tip Tip *	Ring Tip GRD *
Inside Wire at Protector	R G Y BK	Ring Tip GRD *	Ring Tip * —	Ring Tip GRD *	Ring Tip * —	Ring Tip GRD *	Ring Tip * —	Ring Tip GRD *	Ring Tip * —
Inside Wire at Conn. Blk (If Used)	R G Y BK	R (2) G (1) Y (3) B (4)	R (2) G (1) Y (3) —	R (2) G (1) Y (3) B (4)	R (2) G (1) Y (3) —	R (2) R (1) Y (3) B (4)	R (2) R (1) Y (3) —	R (2) G (1) Y (3) B (4)	R (2) G (1) Y (3) —

* Splice isolator lead and inside wire using 700-type connector or equivalent.

() Indicates terminal of 630A4, 71B, or 74D connecting blocks.

- Notes:
1. The 4-conductor connections are recommended for general use and must be used for tip party with identification ground. The 3-conductor connections should be used when only 3-conductor inside wire is available.
 2. These connections are also used for ac-dc ringing of single parties with grounded ringers.

◆ TABLE C ◆

500- AND 2500-TYPE TELEPHONE SETS
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

WIRE OR LEADS (SEE NOTE)	COLOR	RING RTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER †		THRU ANI KIT †
						1000Ω	2650Ω	
Mtg Cord or Jack Leads at Conn. Blk	R G Y BK	R G Y B	R G Y —	R G Y B	R G Y —	R G Y B		R G Y B
Mtg Cord or Jack Leads in Set	R G Y BK	L2 L1 G *	L2 L1 G —	L2 L1 G *	L1 L2 G —	L1 L2 G A		L1 L2 G *
Line Switch Leads	W S BR	F L2 C	F L2 C	F L2 C	F (C) L2 (F) C	F L2 C	(C) (F)	F (C) L2 (F) C (F)
Ringer Leads	R BK S S-R	* G K A	L2 G K A	* G K A	L2 G K A	K G B B	B B K G	* G K A

* Connect (BK) wire or jack lead to (R) ringer lead using D-161488 connector.

† If bell taps when connected to long line equipment, reverse (R) – (S-R) and (BK) – (S) ringer leads.

‡ See Table Q for connection of D-180489 Kit of Parts

○ Indicates connections for TOUCH-TONE equipped sets or when G36 handset is provided.

Note: For 4-conductor connections, it is necessary to have 623D4 jack in set.

◆ TABLE D ◆

**554-TYPE TELEPHONE SET
28A RINGER ISOLATOR-LINE AND RINGER CONNECTIONS**

WIRE OR LEADS (SEE NOTE)	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER †		THRU ANI KIT ‡
						1000Ω	2650Ω	
Inside Wire or 523 Plug Leads in Set	R	L2	L2	L2	L1	L1		L1
	G	L1	L1	L1	L2	L2		L2
	Y BK	G *	G —	G *	G —	G A	G *	
Line SW Lead	S	L2	L2	L2	L2	L2		L2
C4A Ringer Leads	R	*	L2	*	L2	K	B	*
	BK	G	G	G	G	G	B	G
	S	K	K	K	K	B	K	K
	S-R	A	A	A	A	B	G	A

* Connect (BK) wire or plug lead to (R) ringer lead using D-161488 connector.

† If bell taps when connected to long line equipment, reverse (R) — (S-R) and (BK) — (S) ringer leads.

‡ See Table Q for connection of D-180489 Kit of Parts.

Note: For 4-conductor connections, it is necessary to have 523A4 plug in set.

◆ TABLE E ◆

**2554-TYPE TELEPHONE SET USING 4010D NETWORK
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS**

WIRE OR LEADS IN SET (SEE NOTE)	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER		THRU ANI KIT ‡
						1000Ω	2650Ω	
Inside Wire or 523 Plug Leads in Set	R	2	2	2	1	2		2
	G	1	1	1	2	1		1
	Y	3	3	3	3	3		3
	BK	A	—	A	—	A		A
Line Switch Leads	W	F	F	F	C	F		F
	S	L2	A	L2	A	L2		L2
	BR	C	C	C	F	C		C
Strap	BK	*	2-A	*	2-A	*		*
PIA Ringer Leads †	R	K	K	K	K	K	K	K
	BK	3	3	3	3	3	3	3
	S	*	*	*	*	B	*	*
	S-R	*	*	*	*	*	B	*

* Insulate and store.

† Early production models had a (BL) ringer lead which should be insulated and stored for all applications.

‡ See Table Q for connection of D-180489 Kit of Parts.

Note: For 4-conductor connections, it is necessary to have 523A4 plug in set.

◆ TABLE F ◆

**2554-TYPE TELEPHONE SET USING 4228K NETWORK
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS**

WIRE OR LEADS IN SET (SEE NOTE)	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER		THRU ANI KIT †
						1000Ω	2650Ω	
Inside Wire or 523 Plug Leads in Set	R	L2	L2	L2	L1	L2		L2
	G	L1	L1	L1	L2	L1		L1
	Y	G	G	G	G	G		G
	BK	A	—	A	—	A		A
Line Switch Leads	W	F	F	F	C	F		F
	S	L2	A	L2	A	L2		L2
	BR	C	C	C	F	C		C
Strap	BK	*	L2-A	*	L2-A	*		*
P1A Ringer Leads	R	K	K	K	K	K	K	K
	BK	G	G	G	G	G	G	G
	S	*	*	*	*	B	*	*
	S-R	*	*	*	*	*	B	*

* Insulate and store.

† See Table Q for connection of D-180489 Kit of Parts.

Note: For 4-conductor connections it is necessary to have 523A4 plug in set.

◆ TABLE G ◆

750- AND 2750-TYPE TELEPHONE SETS (CURRENT MODELS)
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

WIRE OR LEADS	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER ‡		THRU ANI KIT §
						1000Ω	2650Ω	
Cord and Plug Assy or 652A4 Jack at 71B Conn. Blk	R	2	2	2	1	1		1
	G	1	1	1	2	2		2
	Y	3	3	3	3	3		3
	BK	4	4	4	4	4		4
623P4 Jack Leads at TB1 † (750- or 2750-AM/ BM	R	R	R	R	R	R		R
	G	G	G	G	G	G		G
	Y	Y	Y	Y	Y	Y		Y
	BK	BK	BK	BK	BK	BK		BK
Line Switch Leads	W	F	F	F	F (C)	F	(C)	F (C)
	S	*	L1	*	L1	*		*
	BR	C	C	C	C (F)	C	(F)	C (F)
Straps	Y	L2	L2	L2	L2	L2		L2
	BK	L1	*	L1	*	A		L1
DIE Ringer Leads	R	L1	R	L1	R	K	B	L1
	BK	L2	L2	L2	L2	Y	B	L2
	S	K	K	K	K	B	K	K
	S-R	A	A	A	A	B	Y	A

* Insulate and store.

† Terminals R, G, Y, and BK are on 841390735 terminal board (modular sets) or 814313946 (nonmodular sets).

‡ If bell taps when connected to long line equipment, reverse (R) – (S-R) and (BK) – (S) ringer leads.

§ To mount inductor of ANI Kit, loosen two right most screws from switchhook bracket, slide inductor bracket under switchhook bracket and retighten screws. For connection of D-180489 Kit of Parts, see Table Q.

○ Indicates connections for TOUCH-TONE equipped sets.

◆ TABLE H ◆

702BM AND 2702BM TELEPHONE SETS (SEE NOTE)
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

WIRE OR LEADS IN SET ‡	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD		
		4-COND	3-COND	4-COND	3-COND	THRU RINGER		THRU ANI KIT
						1000Ω	2650Ω	
623P6 Jack Leads in Set	R	L2	L2	L2	L1	L1		L1
	G	L1	L1	L1	L2	L2		L2
	Y	3	3	3	3	3		3
	BK	4	4	4	4	4		4
	W	A	G	A	G	A		A
	BL	G	*	G	*	G		G
Line Switch Leads	W	F	F	F	F (C)	F	(C)	F (C)
	SL	*	A	*	A	*	*	*
	BR	C	C	C	C (F)	C	(F)	C (F)
Strap	BK	*	A-H	*	A-H	*		*
Ringer Leads	R	K	K	K	K	K	K	K
	BK	3	G	3	G	3	3	3
	S	*	*	*	*	B	*	†
	S-R	*	*	*	*	*	B	*

* Insulate and store.

† See Table Q for connection of D-180489 Kit of Parts.

‡ Terminals 3 and 4 in telephone set are on lamp terminal block.

○ Indicates connections for TOUCH-TONE equipped sets.

Note: When a 28A is used with modular PRINCESS® telephone sets, the 623P4 jack must be replaced with a 623P6 jack in the set and a 281A adapter provided. Two D4BU mounting cords are required for connecting the 281A adapter to a 248A adapter for dial light power and to a 625-type connecting block.

TABLE 14

**AD1, AD2, OR AD3 BASES WITH 220A HAND TELEPHONE SET
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS**

WIRE OR LEADS	COLOR	RING PTY - (+) OR (-)				TIP PTY - (+) OR (-)				TIP PTY WITH IDENT GRD APP 2000Ω	
		4-COND		3-COND		4-COND		3-COND		(1)	(2)
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Trnsf Leads at Conn. Blk	Y	3	Y	4	†	3	Y	4	†	3	Y
	BK	5	†	5	B	5	†	5	B	5	†
Mtg. Cord at Conn. Blk. or 652A6 Jack in 74D Conn. Blk.	R	2	R	2	R	2	R	2	R	2	R
	G	1	G	1	G	1	G	1	G	1	G
	Y	3	Y	4	†	3	Y	4	†	3	Y
	BK	5	†	5	B	5	†	5	B	5	†
	W	4	B	3	Y	4	B	3	Y	4	B
BL	6	—	6	—	6	—	6	—	6	—	
Mtg. Cord or 623T6 Jack Leads in Set ‡	R	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1
	G	L1	L1	L1	L1	L1	L1	L2	L2	L2	L2
	Y	3	3	3	3	3	3	3	3	3	3
	BK	1	1	1	1	1	1	1	1	1	1
	W	G	G	G	G	G	G	G	G	G	G
	BL	*	—	*	—	*	—	*	—	*	—
Handset Cord Jack	R	C		C		C		C		C	(F)
	G	F		F		F		F		F	(C)
Line SW	S	*		A		*		A		*	
Strap From A	BK	G		L2		G		L2		G	
P1A Ringer Leads	R	K		K		K		K		K	
	BK	3		G		3		G		3	
	S	B §		B §		B §		B §		B	
	S-R	*		*		*		*		*	

(1) Connections for AD2 and AD3 requiring 74D connecting block, D6AM or D6AP mounting cord, and a 623T6 jack in base.

(2) Connections for AD1 require 5-conductor mounting cord (D5AL or D5AN).

* Insulate and store.

† Connect transformer lead to cord or jack lead using D-161488 connector.

‡ All bases manufactured prior to 10-1-72 or any base which has been opened should be wired per Section 502-322-400, Table A, before installing.

§ If H5AA handset cord is used, insulate and store (S) lead.

○ Indicates connections for 2220B hand telephone set.

♦TABLE J♦

AD2 OR AD3 BASE WITH 220B, 220C, 220AL, 226A, 2220C, OR 2226A HAND TELEPHONE SET—28A RINGER ISOLATOR—LINE AND RINGER CONNECTIONS

WIRE OR LEADS	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD APP 2000Ω (SEE NOTE)
		4-COND	3-COND	4-COND	3-COND	
Jack Leads at Conn. Blk.	R	R	R	R	R	R
	G	G	G	G	G	G
	Y	Y	Y	Y	Y	Y
	BK	B	B	B	B	B
623T4 Jack Leads in set §	R	L2	L2	L2	L1	L1
	G	L1	L1	L1	L2	L2
	Y	3	G	3	G	3
	BK	G	1	G	1	G
Line Switch	S	*	A	*	A	*
	BR	C	C	C	C	Cor (1) †
Strap From A	BK	G	L2	G	L2	G
PIA Ringer Leads	R	K	K	K	K	K
	BK	3	G	3	G	3
	S	B	B	B	B	3†
	S-R	*	*	*	*	*
Handset Jack Leads in Base	R	C	C	C	C	Cor (2) †
	G	F	F	F	F	F
	Y	3	3	3	3	5†
	BK	4	4	4	4	4†
Jack Leads in Handset	R	—	—	—	—	—
	G	—	—	—	—	—
	Y	*	*	*	*	A‡
	BK	*	*	*	*	4‡

* Insulate and store.

† Terminals on 840362776 terminal board.

‡ Handset Terminals.

§ All bases manufactured prior to 10-1-72 or any base which has been opened should be wired per Section 502-322-400, Table A, before installing.

(1) Indicates connections for 2220C and 2226A hand telephone set.

Note: Handset must be opened to wire for tip party with identification ground. 220AL handsets use the D-180824 Kit of Parts (ordered separately) and the 220C, 226A, 2226A, and later versions of the 2220C use the D-180825 Kit of Parts (ordered separately). The 220B(MD) and early version 2220C handsets use only the 840362776 terminal board of the D-180825 Kit of Parts.

♦TABLE K♦

AC1 BASE WITH 220A, 220AM, 2220B, OR 2220BM HAND TELEPHONE SET
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

WIRE OR LEADS	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD APP 2000Ω
		4-COND	3-COND	4-COND	3-COND	
Inside Wire in Set ‡	R	L2	L2	L2	L1	L1
	G	L1	L1	L1	L2	L2
	Y	3	G	3	G	3
	BK	G	—	G	—	G
Dial LGT TRNSF	Y	3	3	3	3	3
	BK	1	1	1	1	1
Line SW	S	*	A	*	A	*
Strap From A	BK	G	L2	G	L2	G
Handset Cord Jack	R	C	C	C	C (F)	C (F)
	G	F	F	F	F (C)	F (C)
P1A Ringer Leads	R	K	K	K	K	K
	BK	3	G	3	G	3
	S	B†	B†	B†	B†	B
	S-R	*	*	*	*	*

* Insulate and store.

† If H5AA handset cord is used, insulate and store (S) lead.

‡ All bases manufactured prior to 10-1-72 or any base which has been opened should be wired per Section 502-322-400, Table A, before installing.

○ Indicates connections for 2220B hand telephone set.

TABLE L4

AC1P OR AC2P BASE WITH 220B, 220C, 220AL, 226A, 2220C, OR 2226A HAND TELEPHONE SET — 28A RINGER ISOLATOR—LINE AND RINGER CONNECTIONS

WIRE OR LEADS	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD APP 2000Ω (SEE NOTE)
		4-COND	3-COND	4-COND	3-COND	
523A4 Plug Leads in Set §	R	L2	L2	L2	L1	L1
	G	L1	L1	L1	L2	L2
	Y	3	G	3	G	3
	BK	G	1	G	1	G
Line Switch	S	*	A	*	A	*
	BR	C	C	C	C	C or (1) †
Strap From A	BK	G	L2	G	L2	G
P1A Ringer Leads	R	K	K	K	K	K
	BK	3	G	3	G	3
	S	B	B	B	B	3 ‡
	S-R	*	*	*	*	*
Handset Jack Leads in Base	R	C	C	C	C	C or (2) †
	G	F	F	F	F	F
	Y	3	3	3	3	5 ‡
	BK	4	4	4	4	4 ‡
Jack Leads in Handset	R	—	—	—	—	—
	G	—	—	—	—	—
	Y	*	*	*	*	A ‡
	BK	*	*	*	*	4 ‡

* Insulate and store.

† Terminals on terminal board.

‡ Handset terminals.

§ All bases manufactured prior to 10-1-72 or any base which has been opened should be wired per Section 502-322-400, Table A, before installing.

○ Indicates connections for 2220C and 2226A hand telephone set.

Note: Handset must be opened to wire for tip party with identification ground. The 220AL handsets use the D-180824 Kit of Parts (ordered separately), and the 220C, 226A, 2226A, and later versions of the 2220C use the D-180825 Kit of Parts (ordered separately). The 220B(MD) and early version 2220C handsets use only the 840362776 terminal board of the D-180825 Kit of Parts.

◆ TABLE M ◆

960A01M OR 2960A01M TELEPHONE SETS
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

LEADS IN TEL SET	COLOR	RING PTY (+) OR (-)		TIP PTY (+) OR (-)		TIP PTY WITH IDENT GRD APP 2600Ω †
		4-COND †	3-COND †	4-COND †	3-COND †	
Mtg. Cord Jack Leads (Phone)	R	5	5	5	7	6
	G	7	7	7	5	7
	Y	1	1	1	1	1
	BK	19	*	19	*	19
Pigtail Strap Leads ‡	BL	19	10	19	10	19
	BK	9	9	9	9	11
	G	*	*	*	*	9
P1A Ringer Leads	R	4	4	4	4	4
	BK	1	1	1	1	1
	S	*	*	*	*	5
	S-R	*	*	*	*	*

* Insulate and store.

† Terminals are on power supply board (PSB).

‡ Pigtail strap leads have a spade tip on one end and are connected to the printed wiring board by a Berg terminal on the other end.

◆ TABLE N (SEE NOTE) ◆

DESIGN LINE* SERIES TELEPHONE SETS
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

USED WITH THESE SETS	LEADS IN TEL SET	COLOR	RING PARTY (+) OR (-)		TIP PARTY (+) OR (-)		TIP PARTY WITH IDENT GRD			
			4 COND	3 COND	4 COND	3 COND	THRU RINGER		THRU ANI KIT	
							1000Ω	2650Ω		
900A, 2900A 910A, 2910A 920A, 2920A 921A, 2921A § 921B, 2921B 930A, 2930A 930B, 2930B 931A, 2931B 940-Type	Mtg. Cord or Jack Leads	R	L2‡	A	L2‡	L1	F	(C)	F (C)	
		G	L1	L1	L1	A	L2‡		L2‡	
		Y	G	G	G	G	G		G	
		BK	A	L2‡	A	L2‡	A		A	
Line Switch Leads	Y W BR S		L2‡	A	L2‡	A	L2‡		L2‡	
			F	F	F	C	B		¶	
			C	C	C	F	(F)		(F)	
			L2‡	A	L2‡	A	C	L2‡	C	
881A100, 2881A100 881B100, 2881B100 881A101, 2881A101 881B101, 2881B101 881B110, 2881B110 881A102, 881B102 881A104, 881B104 881A105, 881B105 881A108, 881B108 881B109, 2881B109 882A200	PIA Ringer Leads	R	K	K	K	K	K	K	K	
		BK	G	G	G	G	G	G	G	
		S	†	†	†	†	L1	†	L1	
		S-R	†	†	†	†	†	L1	†	

* Trademark of AT&T Co.

† Insulate and store.

‡ Terminal S in 2930A telephone set.

§ In 921A and 2921A telephone sets, terminals A, L1, G, and L2 are replaced by 1, 2, 3, and 4, respectively.

¶ See Table Q for connection of 840398168 printed wiring board.

○ Indicates connections for TOUCH-TONE equipped sets.

Note: For other DESIGN LINE sets, see Tables O and P.

◆ TABLE O (SEE NOTE) ◆

DESIGN LINE* SERIES TELEPHONE SETS
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

USED WITH THESE SETS	LEADS IN TEL SET	COLOR	RING PARTY (+) OR (-)		TIP PARTY (+) OR (-)		TIP PARTY WITH IDENT GRD		
			4-COND	3-COND	4-COND	3-COND	THRU RINGER		THRU ANI KIT
							1000Ω	2650Ω	
900B, 2900B 902A, 2902A 911A, 2911A 881C100, 2881C100 881C101, 2881C101 881C110, 2881C110	Mtg. Cord or Jack Leads	R	L2	A	L2	L1	F	(C)	F (C)
		G	L1	L1	L1	A	L2	(C)	L2
881C102 881C103 881C104 881C105 881C107 881C108	Line Switch Leads	Y	†	†	†	†	†		†
		BK	†	†	†	†	†		†
		S	†	†	†	†	†		†
		W	F	F	F	C	B		†
		BL-W	L2	A	L2	A	L2		†
		BL	C	C	C	F	C	(F)	C (F)
881C109, 2881C109 881C111, 2881C111 882B200	P1A Ringer Leads	R	K	K	K	K	K	K	K
		BK	G	G	G	G	G	G	G
		S	†	†	†	†	†	†	L1
		S-R	†	†	†	†	†	†	†

* Trademark of AT&T Co.

† Insulate and store.

‡ See Table Q for connection of 840398168 printed wiring board.

○ Indicates connections for TOUCH-TONE equipped sets.

Note: For other DESIGN LINE sets, see Tables N and P.

◆ TABLE P ◆

950A AND 2950A TELEPHONE SETS
28A RINGER ISOLATOR – LINE AND RINGER CONNECTIONS

LEADS IN TEL SET	COLOR	RING PARTY (+) OR (-)		TIP PARTY (+) OR (-)		TIP PARTY WITH IDENT GRD		
		4- COND	3- COND	4- COND	3- COND	BASE TERM. BOARD	D-180825 TERM. BOARD	HANDSET TERM. (NOTE 1)
Mtg Cord Jack Leads	R	L2	A	L2	L1	F	—	—
	G	L1	L1	L1	A	L2	—	—
	Y	G	G	G	G	G	—	—
	BK	A	L2	A	L2	A	—	—
Line Switch Leads	Y	*	*	*	*	*	—	—
	BR	*	*	*	*	*	—	—
	S	*	*	*	*	*	—	—
	W	F	F	F	C	—	3	—
	O	L2	A	L2	A	L2	—	—
BL	C	C	C	F	C†	1‡	—	
P1A Ringer	S	B	B	B	B	L1	—	—
Handset Jack Leads in Base	G	F	F	F	F	F	—	—
	R	C	C	C	C	C†	2‡	—
	W	1	1	1	1	—	4	—
	BK	4	4	4	4	—	5	—
Handset Jack Leads in Handset (Note 2)	G	—	—	—	—	—	—	—
	R	—	—	—	—	—	—	—
	Y	—	—	—	—	—	—	A
	BK	—	—	—	—	—	—	4

* Insulate and store.

† Rotary dial equipped sets.

‡ TOUCH-TONE dial equipped sets.

Notes:

1. Handsets must be opened to wire for tip party with identifying ground.
2. Leads for these connections are provided by the 282A adapter furnished as part of the D-180825 Kit of Parts.

Caution: Do not store spade-tipped leads under terminal board mounting screws.

TABLE Q
CONNECTIONS FOR D-180489 KIT OF PARTS (ANI)
(SEE NOTE)

SETS USING BOTH 1728-TYPE INDUCTOR AND 840398168 PWB						
TYPE TEL SET	(R) HANDSET JACK OR HANDSET LEAD		INDUCTOR		PWB	
	REMOVE FROM	CONNECT TO	COLOR	CONNECT TO	COLOR	CONNECT TO NET. TERM.
500- and 554-	R of Net.	R on PWB	S BK	S of PWB G of Net.	Y G	R B
2500- and 2554- E/W 4228K Network	T of Net.	R on PWB	S BK	S of PWB G of Net.	Y G	T B
2554- E/W 4010D Network	11 of Term. Strip	R on PWB	S BK	S of PWB 3 of Term. Strip	Y G	11 of Term. Strip B
750- and 2750-	R of Net.	R of PWB	S BK	S of PWB Y †	Y G	R (Rotary) G (TOUCH-TONE) B
SETS WHICH USE 840398168 PWB ONLY						
TYPE TEL SET	(R) HANDSET JACK OR HANDSET LEAD		RINGER LEAD		PWB	
	REMOVE FROM	CONNECT TO	COLOR	CONNECT TO	COLOR	CONNECT TO NET. TERM.
702-	R of Net.	R of PWB	S	S of PWB	Y G	R B
2702-	6 of Term. Strip	R of PWB	S	S of PWB	Y G	6 of Term. Strip B
DESIGN LINE* Series	R of Net. (Rotary) T of Net. (TOUCH-TONE)	R of PWB	W ‡	S of PWB	Y G	R (Rotary) T (TOUCH-TONE) B

* Trademark AT&TCo.

† This terminal is found on the 814313946 (P-43A394) mounting block inside set.

‡ Line switch lead on DESIGN LINE sets.

Note: See Section 501-376-100 for mounting instructions.