B/m # 82/B

GFELLER LINE CONCENTRATOR 49-9-2, 49-11 + 1-2, 49-12-2 APPARATUS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the apparatus requirements and adjusting procedures for the Gfeller line concentrator.

1.02 This section is reissued to include apparatus for the models 49-11 + 1-2 and 49-12-2 of the Gfeller line concentrator, and the title has been changed accordingly. Additions and corrections have been made to bring this section up-to-date. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Gfeller relays are miniature flat-spring type. The contact springs are mounted to the right of the coil and consist of an upper and lower spring pile-up when two or more sets of contacts are required. See Fig. 1A.

1.04 The contacts are numbered by sets or position, similar to the system used for wirespring type relays. Odd number positions are located on the bottom and even number positions are located on the top. Facing the front, they number from left to right. See Fig. 1B, Sketch A.

1.05 Relay winding terminals are numbered by position from 1 to 4 inclusive, counting from the bottom up. The windings are designated by the terminals to which they are connected. See Fig. 1B, Sketches B, C, and D.

1.06 Precautions when making adjustments:

 (a) Tests and adjustments are service affecting and should be confined to low traffic periods unless required to correct out-of-service conditions. (b) Contact springs are made of fine gauge material and may be easily distorted by applying excessive pressure when tensioning them.

- (c) Fiber contact separators between relay springs are held in place by spring tension and may easily become dislodged.
- (d) Use only Gfeller spring benders when adjusting spring tension.

2. **REQUIREMENTS**

Relays

2.001 Electrical and mechanical requirements are given in the circuit requirement tables which are part of this section. Preparation of the 35-type test set for dc requirements shall be in accordance with Section 100-101-101.

2.002 Preparation of the 35-type test set for ac requirements used with the marking relays RA through RF as shown in the circuit requirement table, shall be in accordance with Fig. 2 and the steps given as follows:

- (a) Open all of the short-circuiting switches of the telegraph keys and operate all sliders to their extreme right position.
- (b) Operate the BAT & GRD CO key and VM key.
- (c) Open the G switch.
- (d) Connect a 2W17A cord to the T&R jack.
- (e) Remove short circuit plug from the MC test jack associated with the relay under test and insert the Gfeller test leads.





Fig. 1A – Gfeller Relay



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- (f) Connect, by means of a KS-6278 connecting clip, the No. 360C tool of the 2W17A cord to one side of the 25 ohm, 10 watt resistor, and the No. 360B tool to one of the Gfeller test leads using a No. 141 cord tip.
- (g) Connect the remaining Gfeller test lead, using a KS-6278 connecting clip to the other side of the 25 ohm 10 watt resistor.
- (h) The specified current values may be set up using the 35-type test set rheostats, telegraph keys and noting the voltage reading on the KS-14510 meter.
- (i) The current flowing in the circuit may be found by setting the KS-14510 meter selector to 3 volts ac and observing the meter reading on the 12 volt scale. The voltage reading, multiplied by 10 is the current value ± 2 ma. For example: reading is 6.5 volts on the 12 volt scale — $6.5 \times 10 = 65$ ma.

- (j) The use of the KS-14510 meter is limited to concentrators having 200 ohm coils for the RA through RF relays due to its inaccuracy at lower voltages. For units equipped with 1000 ohm coils, consideration should be given to using an ac milliammeter.
- 2.003 Numbers encircled in the relay column of the circuit requirement tables indicate the models applicable as follows:

Relays without an encircled number are either applicable to one model alone or are common to all models.

2.01 *Cleaning:* The contacts and other parts of the relays shall be cleaned when necessary in accordance with Section 069-306-801. After cleaning, make sure both contacts of the bifurcated springs meet requirements.



Fig. 2

2.02 Armature Travel: The requirements specified in the circuit requirement tables are the minimum values for armature travel without the fixed residual disk. Since the disk will normally be in place, the armature travel being measured will be the difference between the thickness of the disk and the minimum armature travel as shown in the circuit requirement table. Insert proper KS-6909 gauge between the nonoperated armature and the pole face or residual disk.

Caution: Exercise care, so as to avoid dislodging the residual disk.

2.03 Contact Follow: There shall be a minimum of .005 inches.

Gauge by eye.

2.04 Contact Separation: There shall be a minimum of .005 inches between make contacts with the relay unoperated and between break contacts with the relay operated.

Gauge by eye.

2.05 Contact Make: Both contacts on the bifurcated springs shall make or break at approximately the same time.

Gauge by eye.

2.06 Contact Pressure: Each contact pair shall be as follows (see circuit requirement tables):

Contacts designated "A": 12 to 24 grams

Contacts designated "B": 14 to 28 grams

Measure with 70J gram gauge applied at point "P" of associated contact sketch of Fig. 5.

2.07 Contact Sequence: For the spring combinations shown in Sketches 3 and 6 of Fig. 5, break contacts shall open before make contacts close, unless otherwise specified in the circuit requirement tables.

2.08 Residual Gap: To meet the proper release requirement, a Residual Gap is provided by a residual disk fastened to the yoke and except for the RA, RB, RC, RD, RE and RF relays no other adjustment is provided. The thickness of the residual disk is specified in the circuit requirement table. The following additional requirements apply to the RA through RF relays when equipped with a residual set screw.

RA, RB, RC, RD, RE and RF relays equipped with 1000-ohm windings:

Central office unit - .003 to .004 inches

Remote unit — .002 to .004 inches

RA, RB, RC, RD, RE and RF relays equipped with 200-ohm windings:

Central office unit - .002 to .004 inches

Remote unit — No adjustment

Insert proper KS-6909 gauge between armature and pole face or residual disk so residual screw is free to touch pole face or residual disk through hole in gauge; then manually operate relay.

Caution: Exercise care, so as to avoid dislodging the residual disk.

Vertical Bar Requirements

2.09 Bar Pressure: The requirement to lift vertical bar from its normal position is as follows:

Control office unit: 70 grams minimum

Remote unit: 50 grams minimum

Place 70J gauge under bottom of vertical bar; apply pressure upward until bar just leaves its normal position.

2.10 *Air Gap:* Between the lift magnet pole face and armature hinge in its operated position:

.004 to .012 inches

Insert 74D gauge from the side between pole face and armature of lift magnets as follows:

 49-9-2
 — vertical bars 1 and 9

 49-11 + 1-2
 — vertical bars BES and 11

 49-12-2
 — vertical bars 1 and 12

Operate the armature manually. To use the gauge on the remaining lift magnets, it will be necessary to remove the vertical bars (see Section 067-201-801). Then insert the gauge between the armature and pole face and

operate armature manually. To avoid removing the vertical bars, the requirement may be gauged by eye by comparison with the measured gap for lift magnets as given above, if these meet the requirements.

2.11 Contact Pressure: For contacts on vertical bar:

Make contacts - 17 to 35 grams

Break contacts - 20 to 35 grams

To measure the pressure of make contacts: operate the vertical bar manually and apply the 70J gauge to the lower surface of the free end of the stationary spring. Observe the pressure required to just break the contacts.

To measure the pressure of break contacts: with the vertical bar nonoperated apply the 70J gauge to the lower surface of the free end of the movable spring. Observe the pressure required to just break the contacts. When measuring pressure on a movable spring which actuates a second spring by means of a stud, lift the second spring clear of the stud with a KS-6320 orange stick while making the measurement.

Horizontal Bar Requirements

- 2.12 Bar Pressure: The requirement to move horizontal bar from normal:
 - 25 to 40 grams

Apply 70J gauge to the front right-hand end and apply pressure until horizontal bar just leaves its normal position.

2.13 Air Gap: Between pole face and armature of the horizontal bar in the operated posi-

tion:

.002 inches maximum

Note: Pole face may touch armature in the operated position.

Insert 74D gauge between pole face and armature and manually operate horizontal bar.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus:

Note: The following tools are furnished in a kit sent with the concentrator — Fig. 3 depicts these tools.

DESCRIPTION
Open End Wrench
Socket Wrench
Socket Wrench
Spring Adjuster
Spring Adjuster
Spring Adjuster
Blocking Tool
Duck bill Pliers
Tweezers

Note: The following are Bell System Standard.

KS-6320	Orange Stick
P-220366	Dental Mirror
474A	Wrench
206 and 207	Offset Screwdriver

Note: Modify the 206 and 207 offset screwdrivers, by filing the blades until they fit the lower hinge spring adjusting screw slot (see 3.09). If modifying a 206 and 207 offset screwdriver is not feasible, a suitable screwdriver may be obtained locally.

GAUGES	
74D	Gauge Nest
70J	0-150 Gram Gauge
KS-6909	Gauge Nest
0.10mm	Gfeller feeler gauge
TEST APPARATUS	
35-Type	Test Set
J94723A	Pulse checking test set (SD-96362-01)

3.01 Cleaning (Reqt 2.01)

Clean the contacts and other parts of the relay in accordance with Section 069-306-801.

3.02 Armature Travel (Reqt 2.02)

Armature travel may be adjusted by placing or removing relay washers at the rear of the relay between the coil and yoke at the point designated X in Fig. 4. When the armature travel has been adjusted it should correspond when operated, with view A or B but not view C.



Fig. 3 – Gfeller Tool Kit



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- 3.03 Contact Follow (Reqt 2.03)
- **3.04** Contact Separation (Reqt 2.04)
- **3.05** Contact Make (Reqt 2.05)

Caution: When adjusting springs be careful not to dislodge separators.

3.06 Contact Pressure (Reqt 2.06)

3.07 Contact Sequence (Reqt 2.07)

To correct contact pressure, adjust the contact spring with the LD5 tool. Insert the slot of the tool over the bifurcated portion of the spring, slide the tool to the rear, lifting the spring from the spring support. Add or remove tension at the rear of the spring.

To correct the contact follow, separation, make, or sequence, adjust the spring or spring support with the LD5, LD6, or LD7 tool depending on the thickness of the spring. Insert the tool so that the forked section of the spring is entirely within the slot of the tool. Slide tool to within 3/16 inch of the pile-up and apply pressure.

3.08 Residual Gap (Reqt 2.08)

Where a residual adjusting screw is provided, insert the proper KS-6909 gauge between the armature and the pole face or the residual disk so that adjusting screw passes through the hole in the gauge. Loosen locknut with the Gfeller open end wrench, and with armature manually operated, adjust set screw to obtain required gap. After making this adjustment, check contact follow.

3.09 Vertical Bar Pressure (Reqt 2.09)

If the requirement is not met, increase the tension on the lowest hinge spring as follows: at the rear of the hinge spring, loosen the locknut on the adjusting screw with the 474A wrench. Turn the screw clockwise with the modified 206 or 207 offset screwdriver. Keep the tension at or near the minimum so that the lift magnet will meet its operate requirement.

3.10 Air Gap: Between the lift magnet pole face and armature hinge in its operated position (Reqt 2.10).

If the minimum requirement is not met, sufficient air gap may be obtained by loosening the 4 mounting screws holding the lift magnets and contact assembly mounting bar and adding shims to meet the requirement. After tightening the mounting screws, recheck requirement 2.07. If the maximum requirement is exceeded, consideration should be given to replacing the hinge spring armature assembly.

3.11 Contact Pressure (Reqt 2.11)

Make Contacts: If the tension is less than minimum, adjust the contact follow to maximum. If the requirement is still not met, the stationary spring is not resting against its support with sufficient tension. Since this spring is pretensioned during manufacture, it must be removed from the assembly and retensioned or the spring assembly may be replaced. If the tension is greater than maximum, decrease tension of the movable spring against its support by gently moving the spring away from the support using an orange stick.

3.12 Horizontal Bar Pressure (Reqt 2.12)

If the requirement is not met remove the horizontal bar as covered in Section 067-201-801. Increase or decrease the tension on the horizontal bar retaining springs using an orange stick.

3.13 Air Gap between Armature and Pole Face (Reqt 2.13)

If the requirement is not met first check for binding or obstructing foreign material. If nothing is found, consideration should be given to the replacement of the horizontal bar.



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Fig. 5 - Contact Spring Sketches ---- Gfeller Relays

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A2	3	2	2	1	1	1	<u>3(I)</u>	_1	GRD	164	0	9	.004	.024	Slow release
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B A B 4(K) 0 50 After contact PD2 K *3 8 4 8 5(A1) 1&44 C/BAT 1.444 0 4 .004 .024 To make 1(K) I.3 B B B 1 1 1 6 10 To fully operate * Make before break 2(U1) 6 10 4 .004 .024 To make 1(K) (2) B B B S 5 (A1) 1 1 6 10 To fully operate * Make before break 2(U1) 0 10 0 10	<u>G8</u>	1	2	1				1(K)	4	BAT	184	0	33	004	020	To open contact PD2
K *3 8 4 8 5(A1) 14 ⁴ G/BAT 14 ⁴ 0 4 .004 .024 To make 1(K) 3 B B B B 1(AB1) 6 10 To fully operate * Make before break 2(U1) 6 10 To fully operate K *3 8 4 8 5 5(A1) 184 G/BAT 184 0 4 .004 .024 To make 1(K) C B B B B I(AB1) 0 4 .004 .024 To make 1(K) C B B B I(AB1) 0 14 0 14 0 14 .004 .024 To make 1(K) C 2 2 2 6(A2) 1 TED 144 0 15 .004 .029 3 B B B 3(PIRS) 1 GRD 184 0 15 .004 .020 3 B B B B <td></td> <td>В</td> <td></td> <td>B</td> <td></td> <td></td> <td>┟──┟</td> <td><u>4(K)</u></td> <td></td> <td></td> <td></td> <td>0</td> <td>50</td> <td></td> <td></td> <td>After contact PD2 op</td>		В		B			┟──┟	<u>4(K)</u>				0	50			After contact PD2 op
K *3 8 4 8 5(A4) 144 G/BAT 144 0 4 .004 .024 To make 1(K) 3) B B B B B 1(AB1) 0 10 To fully operate * Make before break 2(U1) 0 10 To fully operate K *3 8 4 8 9 5(A1) 184 G/BAT 184 0 4 .004 .024 To make 1(K) K *3 8 4 8 9 5(A1) 184 G/BAT 184 0 4 .004 .024 To make 1(K) C) B B B B I IABI 0 10 4 0 10 70 100 70 100 70 100 70 100 70 100 70 100 70 100 70 70 70 70 70 70 70 70 70 70 70 70 70 70 <th70< th=""></th70<>							┟──┥									
3) B C <thc< th=""> <thc< th=""> <thc< th=""></thc<></thc<></thc<>	K	<u>"2</u> .	<u>s</u>	4.			┟╍╍┢	<u>5(AL)</u>		<u>G/BAT</u>	104	0	4	004	024	To make 1(K)
Nake before break 2(01) 1&44 G/BAT 1&44 0 4 .004 .024 To make 1(K) 2) B B B B 1(ABI) 0 10 10 To fully operate * Make before break 2(U1) 0 10 10 To fully operate 0 2 2 2 6(A2) 1. TED 1&44 0 15 .004 .020 3) B B 3(PIRS) 0 15 .004 .020 .0 2 2 1 6(A2) 1 GED 1&44 0 15 .004 .020 .0 2 2 1 6(A2) 1 GED 1&44 0 15 .004 .020 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 .0 <	12	<u> </u>	B	<u> </u>	B	1			+			0				To fully operate
2) B B B B B B COL COL COL COL To fully operate * Make before break 2(U1) COL COL To fully operate 0 2 2 COL COL COL To fully operate 0 2 2 COL COL COL COL COL 0 2 2 COL COL COL COL COL COL 0 2 2 COL COL<	x - 1	<u>*</u> 2_1	PIEK 8 i		<u>stor</u> e		ear		TAIL	678AT	7.81				021	To make 1(K)
* Make before break 2(01)	2	B	B	B	B	B		L(ARI)			-	ŏ	10		• <u>V</u> <u>C</u> y	To fully operate
D 2 2 2 6(A2) 1 IEED 1&44 0 15 .004 .020		*	Mak	e be	fore	br	eak	2(01)	F							
.3) B B B 3(PIRS) .0 2 2 2 1 6(A2) 1 GRD 184 0 15 .004 .020 .0 B B B 3(PIRS)	o l	2	2	2				6(A2)		GRD	184	0	15	.004	.020	[
0 2 2 2 1 6(A2) 1 GRD 1&4 0 15 .004 .020 2) B B B 3(PIRS) -<	.3)	B	B	B				3(PIRS)				Ι				
0 2 2 2 1 6(A2) 1 GRD 184 0 15 .004 .020 2) B B B 3(PIRS) -<																
P B B B 3(PIRS) CO1 3 2 2 2 6(A2) 1 GED 1644 0 15 .004 .020 B B B B B 1(PIRT) 0 15 .004 .020	0	2	2	2	1			6(A2)	1	GRD	184	0	15	.004	,020	
CO1 3 2 2 2 2 6(A2) 1 GED 1A44 0 15 .004 .020 B B B B B 1(PIRT) 1 144 0 15 .004 .020	2	₿↓	B	B	B			3(PIRS)								· · · · · · · · · · · · · · · · · · ·
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	~~ +	╾┯┼					 +-			OT D						
	₩urt	- ¦∔	-耛	-음-	- 2	- 욹		D(A2)		GED	Tout	8-†	-1 5	004	020	
──╊─╊─╊─╊─╊──╀──╀──────╊───╊───╊───╊───		╶╩┼	- P	-₽-	- ₽	P	_₽									
	+	+			+	+		·								

	CIRCUIT REQUIREMENTS - CENTRAL OFFICE UNIT														
Rolay	G	Press	Shatah Iro Roi	No. (P	ig. 5) (ant far	ené n	Diock or insulate	Consoct Test Set	Teat Set	Test WDG	Test For	MA	Reeld. Diek	Min. Arm. Travel	Remarks
	CTI	CT	CT3	СТ4	CTS	CT6		Te Terne.	Prop.			<u> </u>	laches	Inches	
M	3 B	3 B	1 B	•		1	1(N) 1(X)	1	GRD	1&4	¥.	*	.004	.020	Slow release (4 times slower)
			<u> </u>				4 (PD)				🛎 Re	fer to	A804.90	1.04.0	85.010.04
N	2						3(M)	1	GRD	184	8		.004	.020	Slow release (4 times
	B		L		-		5(X)								slower)
							4(PC)				🛎 Re	efer to	A804,90)1.04.	C85.010.04
PA	2						4(VB3) 4(VB4)		GRD	184	Q	15	.008	.016	
	B						4(VB7) 4(VB8)			1					
PA	2						4(VB3) 4(VB4)	1	GRD	184	0	15	008	.016	
(2)	В						4(VB7) 4(VB8)			_					
							5(VB10)			+					
PA	2						<u>4(VB3) 4(VB4</u>	1	GRD	104	0	15	.008	•016	
(3)	В						4(VB7) 4(VB8)			+					
							5 (VB10)5 (VB1)			+					
PB	_2						<u>4(VB5) 4(VB6</u>		GRD	1.00				016	
<u> </u>	В						5(VB7) 5(VB8								
										-					
<u>- PB</u>	2						4(VB5) 4(VB6)		GRD	1 194	0		,008	•010	
(2)	B_						5(VB7) $5(VB8)$			<u> </u>					
							5(VB11)								
<u></u>	_21	. 1					4(VB5) 4(VB6)	1	GRD	104	0	15	.008	•010	
(3)	B						<u>5(VB7) 5(VB8</u>			┟╌╌╴┟					
							5(VB11)6(VB12))							
PC	2	<u> </u>	1	1			2(PC) 4(VB4)		GRD	104	0	15	,008	.016	
W +	₿	<u></u>	<u>B_</u> _	<u></u>			$(\underline{VB6})$ $\underline{4}$ $(\underline{VB8})$			├ ───┤					
<u> </u>					·		2/0801 41/0891								
- DO	-+	╤┼			+			<u> </u>	-OPD	2 811-1			0001	012	
-6+	<u> </u>	╧┼		──┿	++	<u> </u>	CIPUT CAVEL		GNU	1 1004			.000	-010	
-64	<u> </u>	<u>_</u>	-B+		₽+		HVD4/4/VDOA								
·····										┝────┼					
	<u> </u>									┝					
- 27-	5+	╼┲┼╴	╌┱┿	╾┱┼╴				·	CRD	1.811	 +		008		
- 6 +	६ +-	+	- +++	井	-+			* {-	UIU	Tact	<u> </u>		.000	.010	
<u>-</u> w+	┹┼╸			P	+	+1	TURA SUPA						+		
	-+	-+			+-		IVEIDIS VEIDI	+-							
	+	<u>†</u> -					(VBII)L(VBI3)				{			+	

- - -

	CIRCUIT REQUIREMENTS - CENTRAL OFFICE UNIT														
Rolay	C	entect Press	Skatab ero Roc	No. (I puirom	Hg. 5) ont for	and n	Block or Insulate	Consect Test Set	Test Set	Test WDG	Test For	MA	Rooid. Disk	Min. Arm. Travel	Romarks
. 		CT2	CT3	CT4	CTS	CT6	<u> </u>			<u> </u>	Į	<u> </u>		Inches	ļ
PD	12	1	÷	 1	÷	+		· · · ·	CED	1.81	+	10		076	
0	B	B	B.	B		+	4(VB3) 4(VB5	ţ±	្រូកហ្	Tœd	U	15	•000	•010	
	+=-	1	+	1	+	†	4(VB7) 5(VB7	j	†		t	<u>†</u>			• • • • • • • • • • • • • • • • • • •
	1]	4(VB9)								1
PD	12	1	1	11	11	 	2(PD) 1(V2)	1	GRD	184	0	15	.008	.016	
(2)	B	B	B	B	B	<u> </u>	4(VB3)4(VB5)		·	<u> </u>	ļ	·	+		
	+	 	ļ	<u> </u>			4(VB))4(VB))		1 1 1	<u>+</u>	ļ		ł		
	+	<u>† – –</u>	<u>†</u>		<u>†</u>		4(VB11)5(VB11)		1					· · · · · · · · · · · · · · · · · · ·
PD	2	1	1	1			2(PD) 2(BSU)	1	GRD	144	0	15	.008	.016	
Ø	B	B	B	B			4(VB3)4(VB5)								
	 	 			 		4(VB7)5(VB7)								
[+						L(VB11)5(VB1)	Y							
					÷		4(VB12)								
PIRS	2	1	1				7 (SCH) 3 (PC)	184	G/BAT	164	0	12	.002	.016	Slow release (2 times
	A	A	A				3(PD) 2(A1)				H	6			slover)
							3(D)								
PIRT	3	2				+	21SCH) 3(D)	164	G/BAT	184	0	- 20	.008	.020	Slow release (2 times
						+		+							slower)
PR	1	1					1(13)		GRD	184	0	6	800	.020	
												,			
RA	3	3	3	3	1			MC1	MET	144	0	680	.006	.024	Jee 2.002
	В	<u></u>	<u>_B</u>	<u>B</u>	<u></u>			+			<u>R</u>	500			(See Note 1)
RB	3	3	1					MC2	MET	1.41	0	680	800	1024	Sec. 2.002
	В	B	В				1	1			R	500			(See Note 1)
RC	3	-31	1					MC3	MET	1.44	0	68	008	024	See 2,002
	В		B			-+-					<u></u>	500			(See Note 1)
RD	3	- 3	3	2	1			MC1	MET	184	0	684	-006	.020	See 2.002
	B	B	B	B	B						Ř	500	,000	• ~ -]	(See Note 1)
		_	<u>_</u> +	<u> </u>											
RE	3	3		·+				MU2	MET	T 64	0	660	800.	.024	See 2,002
	P.L	<u> </u>	P.I								<u>_ n _</u>	240		i	(Dec Note 1)

SECTION 067-201-701

Note 1: \$ Current values given are measured at the central office unit.

Central office units equipped with 1000-ohm RA thru RF relays have operate and release requirements as follows: RA and RD, operate 28 ma, release 15 ma. RB, RC, RE, RF operate 26 mm. release 15 mm.

Con Crn 3 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1	G72 1 B 1 B 1 B 1 B 1 B 1 B 1 B 1 B 1 B 1	1 B 1 B	1 B B	s 5) and at for: CTS (CT6	Block or Inculate 2(RC) 1(A2 3(PC) 3(PD) 2(RC) 1(A2	Comment Text Set To Term. MC3	Teet Set Prop. MET G/BAT	Test WDG 184	Test Far O R	MA 68Ø 50Ø	Restd. Disk Juckes .008	Min. Arm. Trevol Inches	Remarks See 2,002 (See Note 1)
3 B 1 B 1 B 1 B 1 B 1 B 1 B 1 B 1 B 1 B	1 B 1 B 1 B 1 B	1 B 1 B				2(RC) 1(A2 3(PC) 3(PD) 2(RC) 1(A2	MC3	MET G/BAT	184 182	O R	68ø 50ø	.008	.024	See 2.002 (See Note 1)
2 B B B C C C C C C C C C C C C C C C C	1 B 1 B 1 B 1 B	1 B 1 B	1 B 1 B			2(RC) 1(A2 3(PC) 3(PD) 2(RC) 1(A2	My3) 1&2	G/BAT	1&2	R	500	•000	•044	(See Note 1)
1 B 1 3 1 B	1 B 1 B 1 B	1 B 1 B	1 B 1 B			2(RC) 1(A2 3(PC) 3(PD) 2(RC) 1(A2	1#2	G/BAT	1&2	0		and the second se		
B L 3 L 3	B 1 B 1 B	B 1 B	B 1 B			3(PC) 3(PD) 2(RC) 1 (A2				<u> </u>	20	800	.020	
1 3 1 3	1 B 1 B	1 B 1	1 B			2(RC) 1 (A2	1			NO	12			· · · ·
L 3 1	1 B 1 B	B	B				A TAO	C/PAT	142	0	15	008	020	
р 1 В	1 B	1				3(PC) 3(PD)	142	U/DAI	TWC	NO	9		•020	
1 B	1 B	1												
B	Ві	<u> </u>	1			2(RC) 1(A2)	184	G/BAT	184	0	10	.008	.020	RS2 alone-break conn.
	+	B	В		-+-	3(PC) 3(PD)				NO	6			term II
	-+				-+-		7.84	G/BAT	184	0	20	╉╍╍╍╍╌╉		RS2 &RS3 in parallel
T	+			-+-	-+			Q/ 14-1		ŇO	12	1		
1						2(RC) 1(A2) 184	G/BAT	184	0	8	.008	.020	RS2 & RS3 in parallel
В						3(PC) 3(PD)								conn to RS2
							184	G/BAT	184	0				RS2 & RS3 in parallel
1	1	-1	⊒∔	<u> </u>	-+-	$\frac{2(RC)}{1(A2)}$) 184	<u> </u>	184	_0_	10	.008	_020	HS2 & HS3 in parallel
₿╷	_B	<u></u>	<u>B</u>		-	3(PC) 3(PD)				NO		++		
-+-	+						العد	C/RAT	7.81	- 10	20	╞╴┈╾╍╼		RS2 & RS3 in parallel
1	it	1	1		-	2(RC) 1 (A2) 7.61	G/BAT	7.84	0	8	.008	-020	RS2 & RS3 in parallel
B	B	B	B	-		3(PC) 3(PD)	1	·····			······································			conn to RS2
1		Ī					184	G/BAT	1&4	0	16			RS2&RS3 in parallel
	1	1	1			1(A2) 2(A1)	162	G/BAT	142	- 8-		.008	020	
≝	-8	<u></u>	в		+	-1 2 3 (RD)				NUT	14	┨─────┤		
i †	1	1	11		+	1 (A21 2(A1)	182	G/BAT	1#2	0	15	.008	.020	
B	B	B	B			3(D)		-		NO	9			
						1.2.3 (RD)								
1	1	1	1		12	2(A1) 1(A2)	184	G/BAT	184	0	10	.008	.020	Any RT-relay individue
B	B	B	_ <u>B</u>		3	$3(D)$ $\frac{1}{2}(A1)$				<u>NO</u>	6	┝────┼		Any RT-relay pair in
-+-					+	<u>+9 < 9 (KD)</u>			+	- NOT	12			connection between RIC
-	-+-				+-						<u></u>			RT3 RT4 etc.
3	3		Ĺ		T	2 (RC)	1&2	G/BAT	1&2	0	3	.002	.020	
A	A				T					H	1.5			
			1 1 B B 1 1 B B 1 1 B B 1 1 B B 1 1 B B 1 1 B B 3 A	1 1 1 B B B 1 1 1 B B B 3 A A	1 1 1 B B B 1 1 1 B B B 1 1 1 B B B 1 1 1 B B B B B	1 1 1 B B B 1 1 1 B B B 1 1 1 B B B 1 1 1 B B B B B	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $				

Note 1: \emptyset Current values given are measured at the central office unit.

Central office units equipped with 1000-ohm RA thru RF relays have operate and release requirements as follows: RA and RD, operate 28 ma., release 15 ma. RB, RC, RE, RF operate 26 ma., release 15 ma.

CIRCUIT REQUIREMENTS - CENTRAL OFFICE UNIT															
Relay	CTI	Press	Skotch ure Rei	No. (F quirom	ig. 5) (ant for CTS	nnd n CT6	Block or Insulate	Connect Test Set To Term.	Test Set Prep.	Test WDG	Test For	MA	Resid. Disk Inches	Min. Arm. Travel Inches	Remarks
SCH	13	3	1	ا میں میں اور	1	- -	2 (RC)	182	C/BAT	1#2	1 0	3	-002	-020	
Ö		A	Ā		-+	+				+ -	H	1.5			· · · · · · · · · · · · · · · · · · ·
U	13		1	<u>+</u>	<u>+</u>		2(K) 5(A2)	1&2	G/BAT	1&2	0	6	.008	.020	
j	<u>↓ B</u>	<u> </u>	+		+	+	<u> 2(AB1) 1 (U1)</u>	384	GRD	384	H	6		}_	
<u> </u>	6	1	5	+			2(U1) 3(U1)	1&2	G/BAT	142	0	8.5	.004	.024	CT1 makes before 2&3
	B	B	B				1(U) 1(AB1)				0	4.5			To close 2 contact
	<u> </u>	<u> </u>		-	'	·لم	<u></u>	364	GRD	384		8.5	<u> </u>		Same as WDG 1&2
UB	<u>2</u> <u>B</u>	<u>2</u> <u>B</u>	<u> </u>		+'	 '	6(A1) 1(PIRS)	1&2	G/BAT	1&2		3.5	008	_016	*Nos.2 to 4 only, 49-9
			<u>t</u>		<u>+</u> '		+44 (X)	<u> </u>							
Y	3	3	2		\Box		3(X) 1(V)	1&2	GRD	1&2	0	11	.002	.016	Connect WDG term.2 to
(1,3)				_	F	\square	1(A1)	<u> </u>	—		H	4.5			WDG term. 4
V	3	3	2				3(X) 1(V)	142	GRD	142	0	11	.002	.016	Connect WDG term.2 to
2	A	A	A		\square	\square	3(SCH)4(V1)			=	H	4.5			WDG term. 4
71		h.		+	├ ── ┤		2(V)	<u> </u>	GRD	142		3	-002	.016	
1.3		A	A	A											
			Ę	ليسك											
-3	į 41	[4]	1		[]	1.1	2 (V) 5(PC)	1	GRD	1&2	0		.002	.016	
	.A	<u> </u> -≜-			++	/ †	[עיז) כ			+	+		<u> </u>		
V2	3	3	3]	3		I	1(V1)	1	GRD	184	0	9	.004	.020	
	≞	B	B	B	B	B	3(V3)	+							
₩3	2	2	1				3(12)-6(12)	1.1	GRD 1	1.04	0	7	.002	.016	
	A	A	A	\square							R	*			# Minimum 50 ms.
		┉┽		┍╼╦╾┥		+	- /10				+			000	
	- 2	-	+	+	·+	+'	T(M) T(APT)	+		104	+	<u> </u>	-000	020	
	<u> </u>		<u> </u>												
VB1	3	1	1	1			2(W) 1(VB1)	1	GRD	184	0	12	.008	.020	
	- <u>B</u> +	_ <u></u>	<u>_B</u>	B									·+	+	
VB1	3	-2	1	1			1(W) 1.(VB1)	1	GRD	184	0	12	.008	.020	
(3)	B	. B	. 8]	R	. 1		S(ARTS)	1	1	1	1	1	1	1	

CIRCUIT REQUIREMENTS - CENTRAL OFFICE UNIT																
Rolay	C	Pressu	Skotch ro Ro	No. (F quirom	ig, 5) o ont for	end n	Biec	ik or ilato	Consect Test Set	Teet Set	Test	Teat For	MA	Rooid. Disk	Min. Arm. Travel	Remarks
L	(CTI	CT2	СТЗ	CT4	CT5	СТб	<u> </u>		10 10rm.			<u> </u>		100000	Inches	
VB2 (1,2)	3 B	1 B	l B	B	1	+	2 (VB1)	1 (VB2)) 1	GRD	1&4	0	12	.008	.020	
VB2	3	1	1	1	1	1	4(VB1)	1.(VB2)	1	GRD	184	0	12	800.1		and the second secon
3	B	B	B	B	İ					†				+		
VB3	1	1	1	1	1	1	2(VB2)	1 (VB3)	1	GRD	184	0	12	.008	.020	
VB4				+	ļ		2(VB3)	1 (VB4)	ļ	GRD	184	0	12	008	.020	
	}	įi		+			2(VB4)	1 (VB5	<u> </u>	GRD	184	$\frac{1}{2}$	12	.008	.020	
VB7	3		1	1	1		2(VB6)	1 (VB7		GRD	184		$\frac{12}{12}$	- 008	-020	
-	B	B	B	B	B			<u> </u>								
100				<u> </u>			-	1750								
AR8	3		<u> </u>				2(VB7)	<u> </u>		GRD	184	0	12		020	
	- 5		<u> </u>	D	<u> </u>						 	+	+		+	
VB9	3	3	1	1			2(VB8)	1.(VB9	1	GRD	184	0	12	.008	.020	
)	B	B	B	В												
VB9	3	1	1	1			2(VB8)	1 (VB9)) 1	GRD	1&4	0	12	.008	.020	
(2,3)	В		B	B								 		[• • • • • • • • • • • • • • • • • • • •	
VB10	3	1	1	1	7		2(VBQ)	1 (VB10)		GRD	J &)L	0	12	008	020	
	B	B	B	В	B		* 1 1. <u>~</u> // .								AV-V	
10011		╺╼┱╍┽╸			╺╼┱╾┿	,	5/10101	1 1 10 10		000	7 011			00.0	000	
VDII		+	B	B	B		2(VBIU)	TYAR	╘┛┈┻┈╻╁	GRU	04	0	<u> </u>	.008	•020	
VB12	3	1	1	1	1	1	2(VB11)	2(VB1)		GRD	184	0	12	.008	.020	
	B	B	_ <u>B</u>	<u>B</u>	B	_ B _										
W	1					-+	<u>ן</u> (ע	B1)		GRD	181	0	6	.004	.020	
4.3	B			····+·												
W	2	1		 			2(VB11)	1 (VB1)	1	GRD	1&4	0	6	.004	020	
0	В	В										-				
				- +			· ·····								· · · ·	1
i			-					L								

	CIRCUIT REQUIREMENTS - CENTRAL OFFICE UNIT														
Relay	СП СП	Pressu	Sketch are Ret	No. (Fi juiromi CT4	ig. 5) ant fo	and r: 5 CT6	Block or Insulate	Consect Test Set To Torm.	Test Set Prop.	Test WDG	Test For	MA	Resid. Disk inches	Min. Arm. Travel Inches	Romarks
X	3 B	3 B	3 B	*1 *B	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	- - -	1,2(X) 1(UB)		GRD	184	0	9	.004	.020	*Nos.2 to 4 only, 49-9-2
TN- (1.3)		+			 		1(TR-)		GRD	1&2	0	8	006	020	If provided block operated relay V1
TN- (2)	1 A			↓ ↓		+	1(TR_)		GRD	1&2	0	8	.006	.020	
						↓ ↓ ↓							++		
						+ 									
				+ '	i	<u>↓</u> ↓ ↓				 			↓		
								<u>+</u> +						······	
			 		 			<u>}</u> + }+							
				+ +											
	. I	T.		T			,	1I				J			

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							CIRCUIT	REQUIRE	MENTS -	- REMO	TE UN	IT			
Roley	C	Prese	Skotch tro Ros	No. (Fi puiroma	ig. 5) a int for	and I	Block or Insulate	Consect Test Set	Teet Set	Test WDG	Test Fer	MA	Resid. Disk	Min. Arm. Travel	Romerks
	CTI	CT2	CT3	CT4	CT5	CT6	L	10 10710.			ļ			Inches	
A	3 A	3 A	2 A	1 A	+ ···	- 	· · · · · · · · · · · · · · · · · · ·	184	NGB	1&4	0	42	•004	•016	Slow release (4 times slower)
ABS	2	12	1	1	1			184	NGB	184	0	6	.004	,016	
	B	B	1		1										
				1											
D	2	2	1				1 (PIRT)	1&2	NGB	1&2	0	72	_004	.024	Slow release (2 times
	B	В	B				<u>2 (A)</u>			L	NO	68			slower)
			·	1		· · · ·				7.01				0.20	2811 has als hadrens 1
<u>F1</u>	3	1	ļ	1	 	L	<u>1(F-)</u>	184	NGB	104		8	.008	.020	204 Dreak Delore 1
thru	B	B	į	B	 		Remove		NGB	104	NU	4.4	·	••• •·	After 1 makes
<u>F6</u>					ļ		MC4 Plug		NGB	1 1 22		20	008	020	2 3 ll break before]
<u></u>	1							1811	NGB	184	NO	<u> </u>		.020	makes
	D	–	- D				MCli Plug	182	NGB	182	0	58	<u> </u>		After 1 makes
61	7	2	7				Remote MCI	141	NGB	181	Ő	33	.004	.020	33ma will open PD2
+hm.	R	Δ	B				Plug				0	50			contacts
GG															
G7	7	2	7	Ш			Remove MC4	184	NGB	1&4	0	33	.004	.020	
H I	B	A	B	B			Plug								
															,
G8	7	2	7				Remove MC4	1&4	NGB	1&4	0	33	.004	.020	
	В	A	B				Plug								
]									
PIRS	1							1&2	NGB	1&2	- 0	<u>19</u>	.008	.016	
	<u>B</u>														
DTDD		-			+	+		TLOT	NCP	142	-	17	00)1	016	
PIRT						+				- LVic	NO	10			
	- 8			+			· · · · · · · · · · · · · · · · · · ·	381	NGB	381	H	8			
RA	2	- 2	3	- 1				MC1	MET	184	Ö	650	.006	.024	See 2,002
	B	B	B	- F	+						R	400			(See Note 1)
RB	3	31	1					MC2	MET	1&4	0	650	.008	.024	See 2,002
	B	B									R	40Ø			(See Note 1)
												7.22	000	COL	A
RC	3.1	31	_ <u>∔</u> ∔	+				_MC3	MET				<u>\$00</u>		
	R	R	R	1							π	400			(Tee Nove T)

Note 1: Ø Current values given are measured at the central office unit. Central office units equipped with 1000-ohm RA thru RF relays have operate and release requirements as follows: RA and RD, operate 28 ma., release 15 ma. RB,RC,RE,RF operate 26 ma., release 15 ma.

CIRCUIT REQUIREMENTS -									- REMOTE UNIT						
Rakay	CTI	Pres	Skote uro R t CT:	h No. Inquiron	(Fig. 5 nont () and or: 5 CT	Block or insulate	Connect Test Set To Torm.	Test Set Prep.	Test WDG	Ted Fer	MA	Reaid. Diek Inches	Min. Arm. Trevel Inches	Remarks
RD	3	3	3		3 !			MC1	MET	1&4	10	650	.006	.024	See 2.002
	B	B	B	I	3						R	400			(See Note 1)
FF	1-	2	+	+				MC2	MET	1 1.81	+	650	008	0.21	Sec. 0.000
<u> </u>	1A		+	+				THOE		1 1004	R	Ling	1.000	1.024	(See Note 1)
	+	<u> </u>	+	+	+-			+	+	+		TOP		****	
RF	3	(3)				1	MC3	MET	184	0	650	800	.024	See 2,002
	B	(B	2								R	400			(See Note 1)
503	+			+			C (DTIM)	1.1.0	NOD	1200					
ISI (1 3)	++	++	++	+		-	2(P1RF)	105	NGB	102	$\frac{0}{1}$	15	1.004	•010	
وب ا	/ <u>*</u>	<u> </u>	 ^	+-	-+-		+	+		+	н	0	·	<u>↓</u>	
RS1	1	$\frac{1}{1}$	11	1			2(PIRT)	142	NGB	142	0	15	004	016	
2	B	B	В	I	3						H	8			
RS2	11	ļļ	11	11	+		2(PIRT)	184	NGB	184	0	1	.004	.016	
(1,3)	A	A	A	A		+				<u> </u>	H	3			
PCO	<u> </u>	<u> </u>	+	1	+	+	O(DIDM)	7.010	NOD	7 01		7		016	
- B2	B	B	B		+	+	2(PIRT)	1 TON	NGB	1 1 00	- 0 -	- 1	1.004	•010	
	-		1-	1-	+	+	<u>† </u>			<u> </u>			†		
RS3	3	3	1		1		2(PIRT)	1&2	NGB	1&2	0	15	.004	.016	
D	A	A	A	I							H	8			
			 	 	<u> </u>					<u> </u>					
<u>RS3</u>	3	-3	1	┝╶╊	+	+	<u>2(PIRT)</u>	184	NGB	144	<u>_<u>Q</u>_ </u>	<u> </u>	_004	016	· · · · · · · · · · · · · · · · · · ·
	-			<u>↓</u>	1-							· · · · · · · · · ·	1		
RS3	3	3	1	1	11	1	2(FIRT)	1 AL	MGB	- 184	0	15	.004	.016	
3	A	A	A	A	A	A -				·	H	8 .			
-														a da ser an an	
KII	-3	1			 		1(SCH)	142	NGB	1&2	- 0	5	.002	.016	
الامل	-	A	A	<u>A</u>	 	 				┝───┟	<u>H</u>	<u> </u>	└ ∤		
RTI	3	1	1	1	<u> </u>		l(SCH)	184	NGB	184	0	15	.002	-016	
(2)	B	B	B	B							H	8			
			_												
					 	 									
		i				L									

Note 1: Ø Current values given are measured at the central office unit.

Central office units equipped with 1000-ohm RA thru RF relays have operate and release requirements as follows: RA and RD, operate 28 ma, release 15 ma. RB,RC,RE,RF operate 26 ma., release 15 ma.

							CIRCUIT	REQUIR	EMENTS -	. REM	DTE U	NIT			
Rolary	4	Press	Skotch ire Rei	No. (Fi	ig. 5) - int for	and n	Block or Insulate	Connect Test Sat To Term	Test Set Pres.	Test WD0	Test For	MA	Roold. Disk Inches	Min. Arm. Travel	Remarks
1000	<u> តា</u>			CT4		CT6	1/0011	7.84	NCP	1 1 21			002	016	Any BT- neir in
RT2	11	<u> </u>	1	+ +	÷	÷	I (SUH)	1004	NGD	1004			1.002	.010	nerellel
		<u>A</u>	A		i	+		÷	ł	+	+		ł	+	parazitz
80U			†	+	+	+	1 (PC)	142	NCB	142		26	02	016	
SUL			+	+	 	+		1.4.6		┉┉┉┉	H H	1 2	1		
			 	+	+	<u>†</u>			<u>†</u>		+	+	<u> </u>	†	
TN-	1	<u> </u>	İ.	+	1	<u>† </u>	$1(TN_{-}) + (A)$	1&2	NGB	1&2	0	13	.006	.020	
•••	Ā		1		1	1	1.2(TR-)			1	1		1	1	
	t			1							L				
				1		Ι					I				
			i.									L			
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			ļ	ļ	ļ	ļ				ļ	ļ	 		į	
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			+		+	+									
		-+		+											
