

**MODEL 3500**

RESIDUAL RINGING PLANT  
WITH AUTOMATIC, MANUAL, AND DIAL-IN TRANSFER

{1} SPECIFICATIONS

ISSUE 8	DATE 01/03
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Spec. No. 3500-115

Serial No. \_\_\_\_\_

Customer Ref. \_\_\_\_\_

Size: 23" relay rack + height as follows:  
14" for basic unit.  
3.5" additional for "X" option.  
3.5" additional for "A" option.  
3.5" additional for "FP" option.

Inputs: 42-56 VDC. Current draw is 1.6 amperes at 50W load or 2.9 amperes at 100W load with all options installed.  
Dial-in transfer input terminal.

Outputs: As ordered per the following options:

- ( X ) 3500-115 Basic 50 watt Residual Ring, Cadence Plant with:
  - AC/DC AUD Continuous Ringing (20Hz + 440Hz + 480Hz)
  - CODE1 GEN Interrupted Ringing (2 sec on & 4 sec off)
  - 10, 60 & 120 IPM interrupted ground
  - Minor, Major & Fuse Alarms
  - Input & Distribution Panel
  - Automatic, Manual & Dial-in Transfer
- ( ) **H** Boosts Basic Ring Plant to 100 watts
- ( ) **X** Isolation Transformer with taps for +/-105V & AC/DC Audible
- ( ) **B** +48V Bias Supply for +AC/DC Audible (If required)
- ( ) **TL** Redundant Low Tone                      ( ) **TD** Redundant Dial Tone
- ( ) **TH** Redundant High Tone                      ( ) **TR** Redundant Ringback Tone
- ( ) **A** Aux. Alarm Panel                      ( ) **R** Aux. Mercury Relays
- ( ) **FP** Aux. Fuse Panel                      ( ) **Z** No Superimposed RBT
- ( ) **M** Load Demand Meter / Aux. Alms ( ) **U** Agency Approved Ver.
- ( ) **E** Extended Temp. Range: -40C to +65C

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- Not provided unless authorized.

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MODEL 3500-115-7

Input D.C Volts	Nominal D.C Volts	Amps. (No Load)	Amps. (Full Load) 50W / 100W
42-56	48	0.6	1.6 / 2.9
Input Filter (Noise to battery 20dBrc)			

RINGING GENERATOR OUTPUTS

Ringling A.C. Volts	Nominal A.C. Volts	Amps. (Full Load) 50W / 100W	Ringling Frequency Limits	Audible Tone Superimposed Frequency Limits
84-88	86	0.58 / 1.12	20Hz +/-0.5%	440+480 +/-0.5%

TONE OUTPUTS (OPTION \*) 115T

Volts	Full Load Watts	Regulation (4 volt tap)	Harmonics Below Fundamentals	Tone Volt Tap Interval
0.7-11	1.0	+/- 1 dB	50 dB	3-6 dB
* Precise Tone of your choice.				

ISOLATION TRANSFORMER (OPTIONAL) 115X

	Primary -AC/DC Audible	Secondary +AC/DC Audible	Secondary +/- 105 volts	Total Load
Taps	1-2	3-4	5-6	
Nominal	86	86	105	50 Volt Amps.
Limits	84-88	82-88	102-110	

NOMINAL RATINGS

Input D.C.		Ringling Output 50W / 100W		Tone (Optional)	
Volts	Amps.	Volts	Amps.	Volts	Power
48	0.6	86	0	Not Installed	
48	1.6/2.9	85	0.58/1.12	Not Installed	
48	0.03	86	0	4.0 *	0
48	1.63/2.93 **	85	0.58/1.12	3.6	1 Watt

1. Taps are provided to set tone output voltage to 0.7, 1.0, 2.0, 4.0, 8.0, 11 VAC.

\*\* These figures reflect 1 Tone Option installed. Add .03 Amp for each additional tone running under full load. Test done at 48VDC input.

MFG. BY - COMMERCIAL ELECTRIC PRODUCTS CORPORATION, CLEVELAND, OHIO.

The System 35 Ring Generator family meets requirements of UL Standard 1459 and is listed under number COM11459.

The System 35 Ring Generator family meets requirements of Title 47 of the CFR, Part 15, Subpart B for class A digital devices. Report #EM1949.

The System 35 Ring Generator family was tested and meets a Zone 4 Earthquake Seismic Vibration Test. MET Report #ESL949.

### {3} FUSE REQUIRMENTS

#### **MODEL 3500-115 (50W) & 3500-115H (100W)**

<u>Label</u>	<u>Maximum Size</u>
SYS 1	GMT 5 Amp
SYS 2	GMT 5 Amp
SUPV	GMT 1.3 Amp
TRIP	GMT 1.3 Amp

**CAUTION** - Fusing of the Ringing Generator Output should not exceed 0.5 Amp per branch circuit for 50W unit and 1.0 Amp per branch circuit for 100W unit.

#### **MODEL 3500-115T (1W)**

**CAUTION** - Fusing of the Tone Generator Output should not exceed 0.5 Amp per branch circuit (1W).

#### **MODEL 3500-115R1**

<u>Label</u>	<u>Maximum Size</u>
F101	GMT 1.3 Amp

**ATTENTION**

1. Never install telephone wiring during a lightning storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.

**CAUTION** - Plug-in circuit cards utilize C-MOS solid state components which can be degraded, damaged or destroyed by electrical static discharge. A wrist strap connected to frame ground is to be worn anytime unit requires servicing.

**EQUIPMENT ARRANGEMENT**

The unit is arranged for mounting on a 23" relay rack drilled for 1-3/4" mounting spaces. The Model 3500-115 basic unit requires 14" of vertical mounting space. It consists of a painted steel main frame 10.5" high, and a fuse panel 3.5" high. The frame contains electrical and electronic components, most of which are mounted on plug-in printed circuit cards. The fuse panel mounts directly above the main frame and contains four type GMT power input fuses and fifty type GMT output distribution fuses. The manual transfer switch is also located on this panel.

The 3500-115X isolation transformer panel requires an additional 3.5" of vertical space and mounts below the basic unit if this "X" option is specified.

The 3500-115 fuse alarm panel requires an additional 3.5" of vertical space and mounts above the basic unit if this "FP" option is specified.

The 3500-115 multiple alarm relay panel requires an additional 3.5" of vertical space and mounts above the "FP" option or the basic unit if this "A" option is specified.

The other options do not require any additional space as they mount inside the frame of the basic unit.

Refer to the drawing in section {2} of this manual for outline dimensions.

**LOCATION AND MOUNTING**

This equipment meets requirements for installation code "E", and may be used outside of restricted access locations.

This equipment is designed to operate in a location with an ambient temperature range of 0 to 50 degrees C. The free circulation of air in this temperature range must be permitted in the area surrounding the equipment.

Mount the unit to the relay rack using the thru holes provided in the mounting bars which hold the various sections of the unit together. Screws and washers for mounting are supplied with the unit.

After mounting, check the unit visually before completing the installation. Make sure that all shipping materials have been removed from the unit. Check for loose fasteners or other damage from shipping or handling. Make sure all circuit cards are fully seated in their sockets.

### **PRELIMINARY POWER CONNECTIONS AND TEST**

It is recommended that the installer first complete the ground connection to the +POS terminal block and the battery feed connections to the -NEG terminal block as described in section {5} of this manual. At this time a preliminary test of the unit can be performed. This test will assure that there was no damage to the unit in shipment, and in addition, will give the mercury wetted interrupter relays a period of no-load operation, which will distribute the mercury properly to the contacts.

To perform the preliminary electrical test, remove the four fuses marked SYS 1, SYS 2, SUPV, and TRIP from the fuse panel. Insert the feeder fuses so that the -48 VDC from the office is delivered to the unit. Now insert the fuses marked SYS 1 and SUPV, which will only power up system 1 and the supervisory circuit. After operating a short time, the unit should indicate a MINOR ALARM (yellow LED). This is because only one of the ringing generators has power and the monitors detect the lack of ringing output on system 2. Now install the fuses marked SYS 2 and TRIP. Transfer the unit from one system to the other using the manual transfer switch located on the fuse panel. Push the switch from side to side a couple of times to clear all alarms. Verify that pushing the switch to the left forces system 1 on-line (LED marked SYS1 O.L. should be lit), and pushing the switch to the right forces system 2 on-line (LED marked SYS2 O.L. should be lit). Allow the unit to run a few minutes undisturbed and verify that both SYS1 NORM and SYS2 NORM (green LED's) remain lit. The MINOR ALARM (yellow LED) and MAJOR ALARM (red LED) should not light.

If both systems remain normal, proceed with the rest of the installation. If alarms keep appearing, read through this manual and call the factory for telephone support as required.

### **ELECTRICAL CONNECTIONS**

The interconnections between the basic unit and the various optional panels have been made at the factory. The installer is to make all other electrical connections as required. Refer to the drawings in section {2} and the text in section {5} for details of connections to the basic unit's ground buss, terminal blocks, and output distribution fuse holders located on the rear of the unit. Information needed to wire certain customer-specific optional equipment will be found on the option drawings in section {4}.

**CAUTION** – The wire size to use should be adequate to carry the full rated load of each output. Refer to **Recommended Wire Sizes** in section {5} of this manual for a wiring guide.

## **INPUT FUSES**

Four type GMT fuses are provided in the battery feed circuits to the basic Model 3500-115. Fuses SYS 1 and SYS 2 carry input current to the two redundant systems in this equipment. Fuse SUPV carries input current to the supervisory system. Fuse TRIP is the trip battery fuse and supplies -48 VDC for the -AC/DC AUD and CODE 1 GEN ringing return circuit. The 3500-115A multiple alarm relay panel has a separate type GMT input fuse. Certain applications of the 3500-115 mercury relay option will also be equipped with a separate type GMT input fuse.

## **OUTPUT DISTRIBUTION FUSES**

Type GMT output distribution fuses are provided to allow the installer to divide the exchange loads into fused branch circuits as desired. The numbers of fuses provided as standard for each of the ringing and tone outputs are as follows: 8 fuses for -AC/DC AUD, 2 fuses for CODE 1 GEN, 8 fuses for +/-105, 2 fuses for +AC/DC AUD, 4 fuses for LT, 3 fuses for 60BSY, 3 fuses for 120BSY, 3 fuses for DT, 2 fuses for HT, 2 fuses for RBT, 3 fuses for 1R-RBT. The installer may rewire the rear of the fuse panel to re-allocate the fuses if necessary on a particular installation. Space is provided on the fuse panel for up to forty output distribution fuses. An additional fuse panel can be ordered if more than forty distribution fuses are required. The interrupted ground outputs are not normally fused. A terminal strip marked RTN is provided for additional positive connections and ringing returns.

The installer should mark the branch circuit I.D. on the marker strip provided above the GMT output fuses.

## **FUSE ALARM**

If any one of the input or output distribution fuses should open, a fuse alarm condition will be established. This will cause battery voltage to appear at the FAO terminal. In addition, the FUSE ALARM red LED will light. If a jumper is connected between terminals A & B on terminal block TB3 on the rear of the unit, a fuse alarm condition will also extend a major alarm. It is recommended that this feature be used.

**CAUTION** - Do not remove or replace circuit cards with power applied to the unit. First remove the input fuse and wait a few seconds for the power supply voltages to bleed off. Removing or replacing cards with power applied to the unit may damage solid state components.

**CAUTION** - Plug-in circuit cards utilize C-MOS solid state components which can be damaged by electrical static discharge. If cards are removed from the unit for any reason, be sure to observe appropriate handling precautions.

### **RINGING FREQUENCY ADJUSTMENT**

The ringing generator frequency is determined by a crystal-controlled clock circuit, which assures long-term frequency accuracy and stability. If a change of ringing frequency is required, only a jumper change is needed on the CEWT-UPR ringing generator card. Refer to Section {7} for instructions.

### **RINGING VOLTAGE ADJUSTMENT**

The output voltage of each ringing generator is set at the factory to a nominal 86 volts. This setting will also assure the proper output from the secondary windings of the optional ringing isolation transformer of 86V and 105V. If field adjustment of the ringing voltage becomes necessary as a result of replacing one or more of the plug-in cards, use the following procedure to reset the ringing voltage. Remove the front cover of the unit. Attach a voltmeter, which is accurate at 20 Hz to one of the two pairs of ringing test jacks located on the left and right sides of the lowest section of the main frame. Each pair of jacks gives access to one of the two redundant ringing generators. Facing the unit from the front, the pair of jacks on the left is system #1 and the pair of jacks on the right is system #2. Transfer the load if necessary so that the system you wish to adjust is on-line.



Adjust the ringing voltage to 86 volts using the voltage adjustment control R56 located on the front of the CEWT-UPR ringing generator card which has been selected as on-line. Clockwise rotation of the control will increase the ringing voltage. Be sure to check the voltage on both of the redundant ringing generators. After adjustment of the ringing voltage, it is suggested that the ringing monitor adjustment be checked as well.

**TONE LEVEL ADJUSTMENT (3500-115T "T" options only)**

The output level of the tone generators (if provided) are adjustable in the field to match the requirements of a particular installation. Adjustment requires moving the white wire on each tone terminal block to select the desired tone voltage tap. The tone terminal blocks are located on the CETA plug-in tone amplifier cards located in the middle section of the main frame. Tone voltages from 0.7 volts RMS to 11 volts RMS are available in 3-6 db steps and the voltages are marked next to the terminal blocks. A jumper block (J3) on all tone cards is set to positions 1/2 except CETA-HT high tone which is set to positions 2/3.



RBT, LT, DT



HT (only)

If you wish to change one of the tone output levels, remove power from one of the two redundant systems by removing the input fuse marked SYS 1 or SYS 2 (Not both at the same time!). Working on the powered-down system, remove the CETA card associated with the tone you wish to adjust. The cards to the left of the center support are part of system 1. The cards to the right of the center support are part of system 2. Within each system, the card positions are as follows going from left to right: CETA-RBT ringback tone card, CETA-BSY low tone card, CETA DT dial tone card, CETA-HT high tone card and CE4T (do not adjust). Locate the white tone-adjust wire on the card. Move this wire to the terminal providing the desired tone voltage. Replace the card, replace the input fuse, and transfer the load to the system you have adjusted. Test the tone level. Repeat this procedure on the redundant system.

**FIELD INSTALLATION OR REMOVAL OF TONE OPTIONS**

Space and wiring are provided in the 3500-115 basic unit to permit plugging in up to four (4) 3500-115T tone supplies on an optional basis. Each 3500-115T tone supply consists of two plug-in cards type CETA which provide one of the following precise tones. DIAL TONE (350 Hz + 440 Hz), LOW TONE (480 Hz + 620 Hz), HIGH TONE (480 Hz), or audible RING TONE isolated from the 20 Hz ringing signal (440 Hz + 480 Hz). The particular tone output(s) obtained from installing a 3500-115T tone option depends on the position in the basic unit into which the cards are inserted.

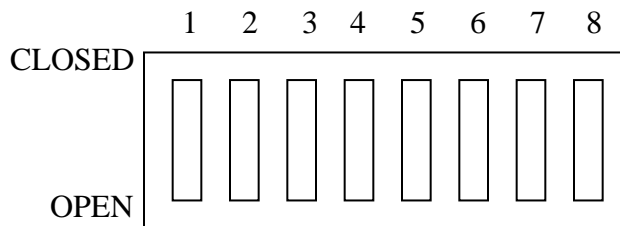


Figure 1  
CEPR Programmable  
Rocker Switch (J1)

The outputs obtained by installing the 3500-115T options are as follows:

- |                      |  |
|----------------------|--|
| (RBT, 1R RBT)        | (1) 3500-115T in the RING TONE position. |
| (BSY, 60BSY, 120BSY) | (1) 3500-115T in the LOW TONE position.  |
| (DT)                 | (1) 3500-115T in the DIAL TONE position. |
| (HT)                 | (1) 3500-115T in the HIGH TONE position. |

To install one or more of the above options in the field, follow the procedure detailed below.

To remove one or more of the above options in the field, study the procedure below and reverse the process.

### RINGBACK TONE

Ignore the alarms that will occur during this procedure. Preset the output voltage taps on the CETA cards you wish to install to your best estimate of the tone voltage required. Refer to the above paragraph, TONE LEVEL ADJUSTMENT. After installation, measurements can be made and the tone output level can be changed if necessary.

Transfer the load to system 2 using the transfer switch. Remove input fuse SYS1 to power down system 1. Insert one of the CETA cards into the RING TONE position in system 1 marked CETA-RBT. See card location description in above paragraph on TONE LEVEL ADJUSTMENT. Remove the CEME-S4 interrupter card associated with system 1. This card is the second card from the left on the bottom shelf of the main frame. Move jumper J1 on this card from position 1 to position 2 to change the monitored signal from the 10-IPM ground pulse to the 1R-RBT interrupted ringback tone signal. Replace the card in the unit. Replace fuse SYS1. Transfer the load to system 1. Remove input fuse SYS2 to power down system 2. Insert the other CETA card into the RING TONE position in system 2 marked CETA-RBT. Remove the CEME-S4 interrupter card associated with system 2. This card is the fifth card from the left on the bottom shelf of the main frame. Move jumper J1 on this card from position 1 to position 2 to change the monitored signal from the 10-IPM ground pulse to the 1R-RBT interrupted ringback tone signal. Replace the card in the unit. Replace fuse SYS2.

Remove input fuse SUPV. Remove the CEPR processor card (third card from the left on the top shelf). Find the 8-pos rocker switch (J1) on this card (See Fig. 1). The rocker switch is numbered from "1" on the end closest to the gold fingers to "8" closest to the green LED's. Toggle switch "1" to close the circuit and thus enable the firmware code that monitors the continuous ringback tone signal. Replace the card in the unit. Replace fuse SUPV.

## LOW TONE

Ignore the alarms that will occur during this procedure. Transfer the load to system 2 using the transfer switch. Remove input fuse SYS1 to power down system 1. Insert one of the CETA cards into the LOW TONE position in system 1 marked CETA-BSY. See card location description in above paragraph on TONE LEVEL ADJUSTMENT. Remove the CEME-S4 interrupter card associated with system 1. This card is the second card from the left on the bottom shelf of the main frame. Move jumper J2 on this card from position 1 to position 2 to change the monitored signal from the 120-IPM ground pulse to the 120BSY congestion tone signal. Move jumper J3 on this card from position 1 to position 2 to change the monitored signal from the 60-IPM ground pulse to the 60BSY busy tone signal. Replace the card in the unit. Replace fuse SYS1.

Transfer the load to system 1. Remove input fuse SYS2 to power down system 2. Insert the other CETA card into the LOW TONE position in system 2 marked CETA-BSY. Remove the CEME-S4 interrupter card associated with system 2. This card is the fifth card from the left on the bottom shelf of the main frame. Move jumper J2 on this card from position 1 to position 2 to change the monitored signal from the 120-IPM ground pulse to the 120BSY congestion tone signal. Move jumper J3 on this card from position 1 to position 2 to change the monitored signal from the 60-IPM ground pulse to the 60BSY busy tone signal. Replace the card in the unit. Replace fuse SYS2.

Remove input fuse SUPV. Remove the CEPR processor card (third card from the left on the top shelf). Find the 8-pos rocker switch (J1) on this card (See Fig. 1). The rocker switch is numbered from "1" on the end closest to the gold fingers to "8" closest to the green LED's. Toggle switch "3" to close the circuit and thus enable the firmware code that monitors the continuous low tone signal. Replace the card in the unit. Replace fuse SUPV.

## DIAL TONE

Ignore the alarms that will occur during this procedure. Transfer the load to system 2 using the transfer switch. Remove input fuse SYS1 to power down system 1. Insert one of the CETA cards into the DIAL TONE position in system 1 marked CETA-DT. See card location description in above paragraph on TONE LEVEL ADJUSTMENT. Replace fuse SYS1.

Transfer the load to system 1. Remove input fuse SYS2 to power down system 2. Insert the other CETA card into the DIAL TONE position in system 2 marked CETA-DT. Replace fuse SYS2.

Remove input fuse SUPV. Remove the CEPR processor card (third card from the left on the top shelf). Find the 8-pos rocker switch (J1) on this card (See Fig. 1). The rocker switch is numbered from "1" on the end closest to the gold fingers to "8" closest to the green LED's. Toggle switch "2" to close the circuit and thus enable the firmware code that monitors the continuous dial tone signal. Replace the card in the unit. Replace fuse SUPV.

## HIGH TONE

**CAUTION** – High tone card configuration is opposite of other tone cards. See TONE LEVEL ADJUSTMENT.

Ignore the alarms that will occur during this procedure.

Transfer the load to system 2 using the transfer switch. Remove input fuse SYS1 to power down system 1. Insert one of the CETA cards into the HIGH TONE position in system 1 marked CETA-HT. See card location description in above paragraph on TONE LEVEL ADJUSTMENT. Replace fuse SYS1.

Transfer the load to system 1. Remove input fuse SYS2 to power down system 2. Insert the other CETA card into the HIGH TONE position in system 2 marked CETA-HT. Replace fuse SYS2.

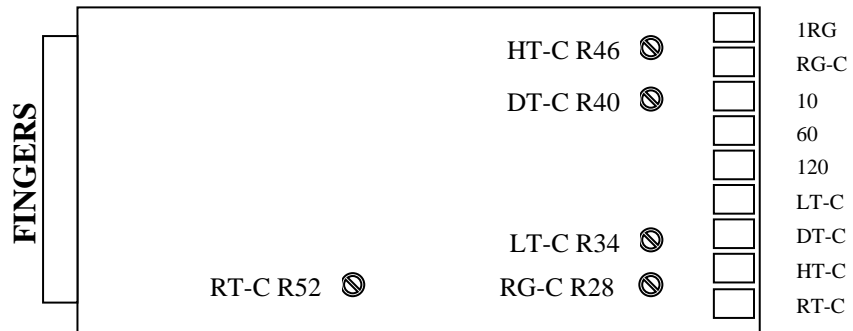
Remove input fuse SUPV. Remove the CEPR processor card (third card from the left on the top shelf). Find the 8-pos rocker switch (J1) on this card (See Fig. 1). The rocker switch is numbered from "1" on the end closest to the gold fingers to "8" closest to the green LED's. Toggle switch "5" to close the circuit and thus enable the firmware code that monitors the continuous high tone signal. Replace the card in the unit. Replace fuse SUPV.

After installing one or more of the above tone options, check the tone level in the office. If a change in tone level is necessary, adjust the tone output voltages per the above paragraph, TONE LEVEL ADJUSTMENT. It may also be necessary to adjust the tone monitors per the following paragraph, RINGING AND TONE MONITOR CALIBRATION PROCEDURE.

### RINGING AND TONE MONITOR CALIBRATION PROCEDURE

If a CEMO monitor card is replaced, or if any adjustment of the ringing or tone generator voltages is made, the monitors should be calibrated. Remove the supervisory system input fuse marked SUPV. Place one of the CEMO monitor cards on a card extender. The CEMO card for system 1 is to the left of the CEMO card for system 2. Replace the SUPV fuse and transfer the loads if necessary so that the particular CEMO card you are adjusting is monitoring the off-line system.

Adjust the monitor level controls (R28, R34, R40, R46, R52) 1/2 turn CCW past the point where the associated monitor LED (RG-C, LT, DT, HT, RT) just attains full brightness. (First, turn CW until the LED begins to flicker or dim, then turn CCW to full brightness, then turn 1/2 turn CCW further.) Not all units will have all tones installed. Ignore alarms and alarm LED's during the monitor adjustment process. Refer to the drawing below for adjustment locations on the CEMO monitor card.



Repeat the above procedure for the other CEMO card.

{5} ELECTRICAL CONNECTIONS

**ATTENTION**

The input connectons on this equipment are designed to meet requirements for power code "F". All power inputs require overcurrent protection from the equipment that provides power to this unit.

The output connections are rated for telecommunication code "X". All output connections are suitable for connection to exposed circuits requiring protection in accordance with Section 800-30 of the National Electrical Code, NFPA70.

(refer to drawings in section {2} of this manual.)

Ground connection to the ground terminal block  
(located on the rear right-hand side of the fuse panel)

Symbol \_\_\_\_\_ Description of connecting circuit \_\_\_\_\_ (+POS)

**-48 A RTN** Ground (+48V) to system 1. Note 1.

**-48 B RTN** Ground (+48V) to system 2. Note 1.

Battery feed connections to the power input terminal block.  
(located on the rear right-hand side of the fuse panel)

Symbol \_\_\_\_\_ Description of connecting circuit \_\_\_\_\_ (-NEG)

**ABS** Auxiliary Battery Supply (-48V) to supervisory system thru fuse SUPV. Note 1.

**-48 A** Battery (-48V) to system 1 thru fuse SYS 1. Note 1.

**-48 B** Battery (-48V) to system 2 thru fuse SYS 2. Note 1.

A Ground Lug, located below the ground terminal block, is provided for chassis grounding.

Connections to the I/O terminal blocks (TB3 & TB4).  
(located on the rear right-hand side of the main frame)

Symbol \_\_\_\_\_ Description of connecting circuit \_\_\_\_\_ (TB1)

**DIT** Dial-in transfer. Apply momentary ground for remote transfer. This feature allows system transfer and reset of alarms in an unattended location.

**BFA** Battery fuse alarm. This is a factory-wired connection from the fuse-alarm terminals on the battery distribution fuses to the fuse alarm supervisory circuit.

---See Connection Notes at the end of this section {5}.---

<u>Symbol</u>	<u>Description of connecting circuit</u>	(TB1)
<b>TFA</b>	Tone fuse alarm. This is a factory-wired connection from the fuse-alarm terminals on the tone distribution fuses to the fuse alarm supervisory circuit.	
<b>RFA</b>	Ringling fuse alarm. This is a factory-wired connection from the fuse-alarm terminals on the ringing distribution fuses to the fuse alarm supervisory circuit.	
<b>FAO</b>	This fuse alarm output terminal extends 500 ohm resistance battery when any input or output fuse opens. When the "A" option multiple alarm relay panel is specified, this FAO terminal is factory- wired to an alarm relay coil on the "A" option.	
<b>MNN</b>	Minor alarm relay (NORMAL) contact. Note 2.	
<b>MNC</b>	Minor alarm relay (COMMON) contact. Note 2.	
<b>MNA</b>	Minor alarm relay (ALARM) contact. Note 2.	
<b>MJN</b>	Major alarm relay (NORMAL) contact. Note 2.	
<b>MJC</b>	Major alarm relay (COMMON) contact. Note 2.	
<b>MJA</b>	Major alarm relay (ALARM) contact. Note 2.	
<b>RBT</b>	Continuous ringback tone from "T" option. Factory wired to the output distribution fuses.	
<b>10RBT</b>	Interrupted ringback tone from "T" option. Factory wired to the output distribution fuses.	
<b>BSY</b>	Continuous busy tone from "T" option. Factory wired to the output distribution fuses.	
<b>60B</b>	Busy tone interrupted at 60 IPM from "T" option. Factory wired to the output distribution fuses.	
<b>120B</b>	Busy tone interrupted at 120 IPM from "T" option. Factory wired to the output distribution fuses.	

---See Connection Notes at the end of this section {5}.---

<u>Symbol</u>	<u>Description of connecting circuit</u>	(TB1)
<b>DT</b>	Continuous dial tone from "T" option. Factory wired to the output distribution fuses.	

<b>HT</b>	Continuous high tone from "T" option. Factory wired to the output distribution fuses.	
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<u>Symbol</u>	<u>Description of connecting circuit</u>	(TB3)
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<b>-AC/DC</b>	Continuous ringing output. Factory wired to the output distribution fuses.	
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<b>CD1 GEN</b>	Interrupted ringing output. Factory wired to the output distribution fuses.	
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<b>RETGEN</b>	This is the ringing generator return lead connected to –TRIP thru a filter choke.	
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<b>+48V DC</b>	Seldom used. See Note 4.	
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<b>+AC/DC</b>	Continuous 86V ringing output from the "X" option isolation transformer. Factory wired to the output distribution fuses.	
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<b>+/-105V</b>	Continuous 105V ringing output from the "X" option isolation transformer. Factory wired to the output distribution fuses.	
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<b>10 IPM</b>	Ground pulse gate output. Ground is applied for 2 seconds on followed by 4 seconds off.	
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<b>60 IPM</b>	Ground pulse gate output. Ground is applied for 0.5 second on followed by 0.5 second off.	
---------------	---	--

<b>120 IPM</b>	Ground pulse gate output. Ground is applied for 0.25 second on followed by 0.25 second off.	
----------------	---	--

---See Connection Notes at the end of this section {5}---



<u>Symbol</u>	<u>Description of connecting circuit</u>	(TB3)
<b>+G1</b>	Ground to system 1. Factory wired to ground bar.	
<b>+G2</b>	Ground to system 2. Factory wired to ground bar.	
<b>+G3</b>	Ground to supy system. Factory wired to ground bar.	
<b>+G4</b>	Ground to "X" option. Factory wired to ground bar.	
<b>-FB1</b>	Fused Battery (-48V) to system 1. Factory wired to fuse SYS 1.	
<b>-FB2</b>	Fused Battery (-48V) to system 2. Factory wired to fuse SYS 2.	
<b>-FB3</b>	Fused Battery (-48V) to supervisory system. Factory wired to fuse SUPV.	
<b>-TRIP</b>	Fused Battery (-48V) to ringing return. Factory wired to fuse TRIP. Note 3.	
<b>SW1</b>	Manual transfer to system 1. Factory wired to transfer switch.	
<b>COM</b>	Ground to transfer switch. Factory wired to transfer switch.	
<b>SW2</b>	Manual transfer to system 2. Factory wired to transfer switch.	
<b>A</b>	Factory wired to terminal B. Note 5.	
<b>B</b>	Factory wired to terminal A. Note 5.	

#### Connections to the output distribution fuse panel.

Ringng and tone outputs to the office loads are obtained by connecting directly to the fuseholder output terminals on the rear of the output distribution fuse panel. A group of GMT fuses are provided for each specified output. The ringng or tone signal appearing on each group of fuses is marked on the front of the fuse panel. The installer should wrap the load wire to the selected branch circuit fuseholder output pin. It is suggested that these connections be soldered. Where the load circuit consists of a load wire paired with a ground wire, the ground wire may be connected to the ground buss on the rear of the panel.

---See Connection Notes at the end of this section {5}.---

### Field installation of optional equipment.

When options are ordered with the original purchase of a MODEL 3500-115, they are factory installed and wired to the basic unit. When options are ordered to be retrofitted to an existing MODEL 3500-115, they must be installed and wired in the field. Such field installation and wiring has been made quite simple, and instructions for installing and wiring each option are included with the optional equipment. Refer to section {4} of this manual for drawings to assist in wiring optional equipment.

#### Connection Notes:

Note 1. The installer should bring in two battery feed circuits each fused at 10 amperes to power this unit. This will assure ringing current to the office in the event that one of the feeds should be lost. Bring the first feed via #16 AWG wire (-NEG) to the terminal marked -48 A (T2). Bring the second feed via #16 AWG wire (-NEG) to the terminal marked -48 B (T5). If an Auxiliary Battery Supply is available, using a #22 AWG wire (-NEG), connect it to ABS (T1). This terminal is provided to keep the supervisory circuit operational in case both battery feeds fail.

A good ground is essential for the proper operation of this equipment and two #16 AWG ground wires must be provided. Bring the first ground via #16 AWG wire to the terminal marked -48 A RTN. Bring the second ground via #16 AWG wire to the terminal marked -48 B RTN. (+POS)

Note 2. The minor and major alarm relays have form C contacts to extend the alarms to the office. When the "A" option multiple alarm relay panel is specified, these alarm outputs are factory-wired to operate the major and minor alarm relays on the "A" option. This option provides three (3) sets of form C contacts for the installer to use instead of the one (1) set included in the basic unit. The installer may configure the alarm extension in any of the following ways:

- (1) To extend ground in the event of an alarm, wire the COMMON contact to the ground bar and connect the ALARM contact to the office alarm circuit.
- (2) To break ground in the event of an alarm (fail safe connection), wire the COMMON contact to the ground bar and connect the NORMAL contact to the office alarm circuit.
- (3) To close a loop in the event of an alarm, wire the COMMON and ALARM contacts in series with the loop.
- (4) To open a loop in the event of an alarm (fail safe connection), wire the COMMON and NORMAL contacts in series with the loop.

Note 3. This terminal (-TRIP) gives the installer access to the ringing generator return circuit. In all regular installations using a battery-connected ringing system, this terminal is connected to -48V fused battery via the input fuse marked TRIP. The unit is shipped from the factory with this connection in place. In the rare situation where a ground-connected ringing system is to be installed, remove the fuse marked TRIP, remove the wire in the terminal (-TRIP) which had supplied -48V from the fuse marked TRIP, insulate and tie this wire back, and install a new wire between this -TRIP terminal and the ground bar.

Note 4. This connection is only used when the "X" isolation transformer option is specified and the isolated 86 volt ringing output is to be used. If the +AC/DC output is needed for a superimposed ringing system, an external source of +48 VDC must be wired to this +48V IN terminal. This should be protected by a 1-1/3 ampere alarm type fuse. If the isolated 86 volt ringing output is to be used as a source of ringing returned to ground, connect this +48V IN to the ground bar. If the "B" Option Bias Supply is installed do not connect this terminal to an outside supply.

Note 5. This factory-installed jumper between terminals A and B causes a fuse alarm condition to extend a major alarm. It is recommended that this feature be used.

### Recommended Wire Sizes

<u>Connection</u>	<u>Maximum Size</u>	<u>Minimum Size</u>
Pos. Ground	12 AWG	16 AWG
Neg. Battery	12 AWG	16 AWG
Distribution	22 AWG	24 AWG
Alarm Outputs	22 AWG	24 AWG
Chassis Ground	08 AWG	14 AWG

## {6} GENERAL OPERATING DESCRIPTION

### GENERAL DESCRIPTION

The Model 3500-115 Residual Ringing Plant operates from -48 VDC and contains redundant systems which supply 50 watts (0.55 ampere) of continuous and cadenced 20 Hz audible ringing current, ground pulse signaling cadences, and up to four optional tone supplies with continuous and cadenced outputs. The ringing output may be increased to redundant 100 watts (1.10 ampere) by ordering the 3500-115H option. The unit is designed to furnish those signals not supplied by the central office switch, yet needed for Private Line Circuits, Metallic Facility Terminal Circuits, Dial Long Line Circuits, Foreign Exchange Circuits, Test Desk Requirements, or other general purpose applications.

In addition to the 100 watt ringing option and the optional tone supplies, other options are available to add additional isolated ringing outputs, additional mercury relays to interrupt ringing, tone, or battery, extra alarm relays, extra distribution fuses, etc.

### OUTPUTS FURNISHED BY THE BASIC MODEL 3500-115

#### (-AC/DC AUD)

The basic Model 3500-115 provides continuous 20 Hz ringing current at 86 VAC. A precise ringback tone of 440 Hz + 480 Hz is superimposed on the ringing waveform to make the signal audible. The ringing output circuit is returned to the -48 VDC battery thru a trip battery fuse. This continuous ringing output is supplied to the load thru GMT output distribution fuses.

#### (CODE 1 GEN)

The basic Model 3500-115 provides ringing current interrupted at 2 seconds on, 4 seconds off. During the 2 second ring period, the -AC/DC AUD signal is output. During the 4 second silent period, -48V trip battery is output. This interrupted ringing output is supplied to the load thru GMT output distribution fuses.

#### (GROUND CADENCES)

The basic Model 3500-115 provides three interrupted ground outputs rated at 1.0 ampere each. The first ground pulse output is a 10-IPM cadence of 2 seconds on and 4 seconds off. This cadence is also used internally to operate the mercury relays which provide the CODE 1 GEN interrupted ringing output and the 1R RBT interrupted ringback tone output when this tone option is specified. The second and third ground pulse outputs are a 60-IPM cadence and a 120-IPM cadence respectively. These cadences are also used internally to operate the mercury relays that provide the 60BSY and 120BSY interrupted busy tone signals when this tone option is specified.

### **OUTPUTS FURNISHED BY THE 3500-115X ISOLATION TRANSFORMER OPTION**

(+/-105V)

This signal is similar to the -AC/DC AUD signal except that the ringing voltage is 105 VAC and the ringing output circuit is returned to ground. This continuous ringing output is supplied to the load thru GMT output distribution fuses.

(+AC/DC AUD)

This signal is similar to the -AC/DC AUD signal except that the ringing output circuit is returned to a source of +48 VDC instead of to the -48 VDC exchange battery. The +48 VDC bias source may be supplied by the customer or a "B" option (non-redundant) may be added to the ring plant for this purpose. If the +48V bias source is obtained from the office a 1-1/3 ampere alarm type fuse should be used to protect it. In locations where such a +48V supply is not available, a Commercial Electric DC-DC converter is recommended. A redundant DC-DC converter should be specified if the loss of the +AC/DC AUD output would adversely affect any critical loads. If +AC/DC AUD is not required, this extra 86 volt ringing output may be returned to ground and used for auxiliary ground-returned ringing. This continuous ringing output is supplied to the load thru 5 GMT output distribution fuses.

### **OUTPUTS FURNISHED BY THE 3500-115T REDUNDANT TONE OPTIONS**

- |                      |  |
|----------------------|--|
| (BSY, 60BSY, 120BSY) | (1) 3500-115T in the LOW TONE position.  |
| (DT)                 | (1) 3500-115T in the DIAL TONE position. |
| (HT)                 | (1) 3500-115T in the HIGH TONE position. |
| (RBT, 1R RBT)        | (1) 3500-115T in the RING TONE position. |

Space and wiring are provided in the 3500-115 basic unit to permit plugging in up to four (4) 3500-115T tone supplies on an optional basis. Each 3500-115T tone supply consists of two plug-in cards, which provide one of the following precise tones. DIAL TONE (350 Hz + 440 Hz), LOW TONE (480 Hz + 620 Hz), HIGH TONE (480 Hz), or audible RING TONE isolated from the 20 Hz ringing signal (440 Hz + 480 Hz). The particular tone output(s) obtained from installing a 3500-115T tone option depends on the position in the basic unit into which the cards are inserted. The tone output level may be adjusted from 0.7 volts (rms) to 11.0 volts (rms) in 3-6 db steps. The full load on each tone supply is 1 watt. These tones are supplied to the load thru groups of GMT output distribution fuses. The tone interruption mercury relays, the tone monitors, and the output distribution fuses are provided in the basic 3500-115 as standard, but are not used unless the appropriate 3500-115T options are installed.

### **OUTPUTS FURNISHED BY THE 3500-115A MULTIPLE ALARM RELAY OPTION**

This separate alarm relay panel expands the number of alarm contacts available beyond those provided in the basic 3500-115 unit. Three sets of form C "dry" contacts are provided for each of the following alarms: fuse alarm, minor alarm, and major alarm. The three sets of contacts on each alarm relay may be used for audible alarm, visual alarm, scan alarm, etc. The relays are wired to the basic 3500-115 alarm circuits as slave alarm relays.

### **OUTPUTS FURNISHED BY THE 3500-115R MERCURY RELAY OPTION**

This mercury relay option mounts on the basic 3500-115 and can be use for a variety of purposes. One or more 3500-115R units can be installed on a basic 3500-115. The relay coil operates from the ground pulse cadences generated in the basic unit and the mercury-wetted form C contacts can be wired to interrupt ringing, tone, battery, etc. Examples of uses for this option would be: a 60-IPM interrupted ringing output for special attention-getting ringing purposes, a 60-IPM interrupted battery output for lamp flash, +AC/DC AUD ringing interrupted at 10-IPM, etc.

### **SYSTEM ARRANGEMENT**

The Model 3500-115 basic unit contains redundant ringing generators and redundant interrupters, which provide continuous and interrupted ringing current and interrupted ground outputs. Maximum ringing power output can be increased from the 50 watts furnished as standard to 100 watts by specifying the 3500-115H option. Space is reserved in the basic unit for up to four optional 3500-115T redundant tone supplies, which consist of additional plug-in cards. Tone interruption mercury relays are included in the basic unit, but require the optional tone supplies in order to function. A connector is provided for plugging in the optional 3500-115X isolation transformer, which comes mounted on a separate panel. A supervisory system is provided, which monitors both the on-line and off-line signal outputs, controls transfer, provides visual indication of system status, and extends minor, major, and fuse alarms.

Both redundant systems operate at all times and are constantly monitored. Either system may be selected as "on-line" and carries the exchange load. If a fault is detected on the on-line system only, the load is automatically transferred and a minor alarm is extended. If a fault is detected on the off-line system only, a minor alarm is extended. In the event a failure occurs on the on-line system, and the off-line system is also detected as being faulty, the load will not be transferred and a major alarm will be extended.

Each of the two redundant systems in the Model 3500-115 basic unit consists of a POWER SUPPLY CIRCUIT, a RINGING GENERATOR CIRCUIT, an INTERRUPTER CIRCUIT, and a TONE SYNTHESIZER CIRCUIT.

The supervisory system consists of a POWER SUPPLY CIRCUIT, a PROCESSOR CONTROL CIRCUIT, SIGNAL MONITOR CIRCUITS, a manual TRANSFER SWITCH, an alarm RESET FEATURE, a REMOTE (DIAL-IN) TRANSFER feature, and a SYSTEM STATUS CIRCUIT to display system status and extend alarms.

The optional 3500-115T redundant tone supply consists of two plug-in cards each containing a TONE OUTPUT CIRCUIT. Up to four (4) of these 3500-115T redundant tone supplies can be installed in a 3500-115 basic unit.

The optional 3500-115X ringing isolation transformer mounts on a separate panel and plugs in to a connector on the main frame. The 86V transformer primary winding is wired to the -AC/DC AUD output of the redundant ringing generators. There are two secondary windings on this transformer. The 86V secondary provides the +AC/DC AUD output, while the 105V secondary provides the +/-105V output.

Each of the sub-systems listed above in CAPITAL LETTERS is described as follows:

### **POWER SUPPLY CIRCUIT**

The 42-56 VDC input is passed thru an input fuse to protect the power wiring to the unit. It then passes thru an input LC filter to reduce noise back to the talking circuits in the telephone system. The filtered 48 VDC goes to the CEOP power supply card where a series regulator and zener diode produce system operating voltages of -6 VDC and -14 VDC. The power supply card also furnishes crystal controlled clock pulses needed by the interrupter circuits.

## **RINGING GENERATOR CIRCUIT**

Ringling power is synthesized on the CEWT-UPR ringing generator card. The frequency and waveform generated is determined by 2-pin shorting blocks and a plug-in micro-controller. The micro-controller stores in digital code two different alternations of the ringing waveform, one with the audible ringback tone superimposed and the other as an ordinary sinewave. Off card components relating to the ringing generator circuit are a ringing voltage step-up transformer, audio frequency and radio frequency filter capacitors as needed. The secondary winding of the ringing transformer is returned to the -48 VDC office battery thru a trip battery fuse. This causes the composite output of the ringing supply to be the sum of the -48 VDC battery, the 86 VAC 20 Hz output of the ringing generator, and the superimposed audible tone of 440 Hz + 480 Hz. This composite signal is the -AC/DC AUD output.

## **INTERRUPTER CIRCUIT**

The interrupter functions are located on the CEME interrupter card. Counters and logic produce the timing cadences to control three one-ampere ground pulse gate circuits. The three gates operate at 10-IPM (2 seconds on and 4 seconds off), 60 IPM (0.5 second on and 0.5 second off), and 120-IPM (0.25 second on and 0.25 second off). These three interrupted ground signals are output to the office and also used internally to operate mercury-wetted interrupter relays. The load voltage to be switched by the gates should not exceed 56 volts DC and the load current should not exceed 1 ampere DC. The gates are self-protecting against damage due to overloads and shorts. They are also designed to absorb the inductive voltage spike generated when opening an inductive load such as a relay coil.

Four (4) mercury-wetted relays are also mounted on this card and operate from the ground-pulse gates as follows: two relays at 10-IPM, one relay at 60-IPM and one relay at 120-IPM. The ringing signal is interrupted using one of the mercury relays operating at 10-IPM. The relay has form C contacts and outputs the -AC/DC AUD composite ringing signal when actuated and outputs the -48 VDC trip battery when released. This interrupted ringing signal is the CODE 1 GEN output. The other three relays are used to interrupt the tone supplies when the tone options are installed. The 10-IPM relay interrupts the audible ringback tone signal to produce the 1R RBT output. The 60-IPM and 120-IPM relays interrupt the low tone signal to produce 60BSY (line busy) and 120BSY (congestion tone) respectively.



## **TONE SYNTHESIZER CIRCUIT**

All four of the precise call-progress tones are synthesized on the CE4T four-tone generator card. A micro-controller contains digital code to define the four desired tone waveforms. The output goes thru a D/A converter to an analog switch, which demultiplexes the composite signal and outputs the four desired precise tones. The outputs of this card are low-level tone signals that need to be amplified before they are suitable for use in a telephone system.

## **TONE OUTPUT CIRCUIT**

Circuitry to amplify one of the precise call-progress tones and provide output isolation and level adjustment is contained on the CETA tone amplifier and transformer card. The tone to be amplified is brought in to the card at a level of approximately 5.0 volts peak-to-peak. A gain control potentiometer sends a portion of this signal to a push-pull audio amplifier which drives the primary winding of the tone transformer. Six taps on the secondary winding of this transformer are brought out to a tap selection terminal strip on the card. These are used to adjust the tone output level in 3-6 db steps as required for a particular installation. A non-adjustable sample of the tone output voltage is used for tone generator monitoring.

## **PROCESSOR CONTROL CIRCUIT**

A CEPR processor card uses a microprocessor to execute the instructions contained in its memory. The card functions as a programmable controller, looping thru its instruction set, monitoring the status of inputs, and controlling outputs as required. The firmware supplied causes the Model 3500-115 to operate in the following manner: Both redundant systems operate at all times and all outputs on both systems are monitored. Either system may be selected as "on-line" with the manual transfer switch and will carry the load. If a fault is detected on the on-line system only, the load is automatically transferred after a short delay, and a minor alarm is extended. If a fault is detected on the off-line system only, a minor alarm is extended. In the event a failure occurs on the on-line system, and the off-line system is also detected as being faulty, the load will not be transferred and a major alarm will be extended. Also, if a fault is detected in the supervisory system itself, or if a fuse alarm is detected, a major alarm will be extended. A dip switch (J1) on the CEPR card is used to modify the program execution to accommodate changes in the installed options, etc.

## **SIGNAL MONITOR CIRCUIT**

The on-line and off-line signal outputs are monitored for normal operation by the CEMO monitor cards. If an abnormal signal is detected, and the signal remains abnormal for a few seconds, this information is communicated to the CEPR processor card where an alarm/transfer sequence will be initiated.

The ringing generators and the tone generators (if installed) are monitored for normal output level. If the ringing voltage or one of the tone voltages should fall below a preset threshold value and remain there for a short delay, this information is communicated to the CEPR processor card where an alarm/transfer sequence will be initiated. These continuous signal monitors are adjustable and are identified as RING, LT, DT, HT, AND RT.

In addition, the interrupted signals are monitored for normal interrupter function. If one of the interrupted signals should fail to appear, or should appear continuously, this information is communicated to the CEPR processor card where an alarm/transfer sequence will be initiated. In a unit without tone options installed, the interrupted signals to be monitored are the 1-RG (interrupted ringing) and the 10-IPM, 60-IPM, and 120-IPM (interrupted ground) signals. None of these interrupted signal monitors are adjustable. If the ringback tone option is installed, the 10-IPM monitor is changed (using jumper J1 on the CEME card) to monitor the INT interrupted ringback tone output instead of the 10-IPM ground pulse output. Since the INT interrupter relay is operated from the 10-IPM ground pulse gate, the 10-IPM ground pulse output is still monitored indirectly. Similarly, if the low tone option is installed, the 60-IPM and the 120-IPM monitors are changed (using jumpers J3 and J2 respectively on the CEME card) to monitor the 60B and 120B interrupted low tone outputs instead of the 60-IPM and 120-IPM ground pulse outputs. Since the 60B and 120B interrupter relays are operated from the 60-IPM and 120-IPM ground pulse gates, the 60-IPM and 120-IPM ground pulse outputs are still monitored indirectly.

## **TRANSFER SWITCH**

A toggle switch is provided to allow for manual transfer of loads to either of the two redundant systems when desired. Upon initial application of power, system #1 will become the on-line system and will take the load, while system #2 will operate as a hot standby. Once the unit is operating, either of the two systems can be selected as the on-line system by moving the transfer switch to the FORCE 1 or FORCE 2 position which will cause the load to be taken by the selected system. When released, the switch will return by spring action back to AUTOMATIC so that automatic transfer can occur in case of a failure.

## **RESET FEATURE**

Once a fault has been detected, this fail condition will remain latched in until manually reset. The unit can be reset with the TRANSFER SWITCH by forcing the loads to the faulty system.

## **REMOTE (DIAL-IN) TRANSFER AND RESET**

Application of a momentary ground to the DIT input pin will cause the loads to be transferred to the opposite system and will reset any alarm condition that may have existed on that system. By applying a second momentary ground to the transfer input pin, the loads will be transferred back to the system originally on-line and any alarms existing on that system will be reset.

## **SYSTEM STATUS CIRCUIT**

The status of the Model 3500-115 is displayed by LED's on certain of the plug-in cards. These visual indicators are visible thru the front cover of the main frame. In addition, system status is extended to the office by a set of form C "dry" contacts to indicate minor alarm and a set of form C "dry" contacts to indicate major alarm. The alarm relays are arranged such that loss of power to the alarm circuit will bring in the alarms.

## VISUAL INDICATOR DESCRIPTION

The **CEAM** alarm card displays the following information:

**FUSE ALARM** - If one of the input or output fuses should open, this red LED will light and will extend a 500 ohm resistance battery fuse alarm signal to the office (if connected).

**SYS 1 NORM** - If system 1 is operating normally, this green LED will light. The LED will extinguish if a fault is detected on system 1 or a fuse alarm occurs.

**SYS 2 NORM** - If system 2 is operating normally, this green LED will light. The LED will extinguish if a fault is detected on system 2 or a fuse alarm occurs.

**MINOR ALARM** - If a fault is detected in either one but not both of the redundant systems, the appropriate green LED (**SYS 1 NORM** or **SYS 2 NORM**) will extinguish thus identifying the faulty system. In addition a minor alarm will be extended over form C contacts and this yellow LED will light.

**MAJOR ALARM** - If a fault is detected on both of the redundant systems, both green LEDs (**SYS 1 NORM** and **SYS 2 NORM**) will extinguish, a major alarm will be extended over form C contacts, and this red LED will light. A major alarm will also be extended if a fault is detected in the supervisory system or if a fuse alarm should occur.

The **CEPR** processor card displays the following information:

**SYS1 O.L.** - When lit, this green LED indicates that system 1 is on-line and is carrying the load.

**SYS2 O.L.** - When lit, this green LED indicates that system 2 is on-line and is carrying the load.

**POWR ON** - This green LED verifies that input power is reaching the unit, the supervisory system input fuse is O.K., and the microprocessor is scanning the memory and executing the stored program. In the event any of the above circuits develops a fault or power is removed from the unit, this LED will extinguish, and major alarm will be extended.

The **CEME-S4** interrupter card displays the following information:

120 - When this green LED is flashing at 120 IPM, it indicates that the 120 IPM interrupter relay coil is receiving the indicated cadence from the 120 IPM ground pulse gate.

60 - When this green LED is flashing at 60 IPM, it indicates that the 60 IPM interrupter relay coil is receiving the indicated cadence from the 60 IPM ground pulse gate.

10 - When this green LED is flashing at 10 IPM, it indicates that the 10 IPM interrupter relay coils are receiving the indicated cadence from the 10 IPM ground pulse gate.

The **CEMO** monitor card displays the following information:

1RG - The green LED lights when ringing voltage appears on the interrupted ringing output (CODE 1 GEN). It flashes at a 10 IPM rate (2 seconds on and 4 seconds off) when indicating normal operation of the interrupted ringing signal. The red LED is inoperative, but a fault in this signal due either to loss of ringing output or to continuous ringing output will light the red LED under "10" as described below.

RG-C - The green LED lights when normal continuous ringing voltage (-AC/DC AUD) is present. The red LED lights when the ringing voltage drops below a preset value and remains low for several seconds. The red LED remains lit even if the ringing voltage returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch.

10 - The green LED lights when voltage appears on the monitored interrupted (10 IPM) tone or ground output. This would be the interrupted ringback tone signal (1R RBT) if the ringback tone option is installed; otherwise, it would be the 10 IPM interrupted ground output. The red LED lights when any one of the monitored 10 IPM signals fails. This could be a fault in the interrupted ringing output (see 1RG above), the interrupted ringback tone output (1R RBT if installed) or the 10 IPM interrupted ground output. The fault could be due either to loss of output or to continuous output. By watching the green LEDs marked 1RG and 10, it can be determined which output is faulty and whether the signal is missing or on continuously. The red LED remains lit even if the 10 IPM signal returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch.

60 - The green LED lights when voltage appears on the monitored interrupted (60 IPM) tone or ground output. This would be the line busy tone signal (60BSY) if the low tone option is installed; otherwise, it would be the 60 IPM interrupted ground output. The red LED lights when the monitored 60 IPM signal fails. The fault could be due either to loss of output or to continuous output. The red LED remains lit even if the 60 IPM signal returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch.

120 - The green LED lights when voltage appears on the monitored interrupted (120 IPM) tone or ground output. This would be the congestion tone signal (120BSY) if the low tone option is installed; otherwise, it would be the 120 IPM interrupted ground output. The red LED lights when the monitored 120 IPM signal fails. The fault could be due either to loss of output or to continuous output. The red LED remains lit even if the 120 IPM signal returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch.

LT-C - The green LED lights when normal continuous low tone voltage (BSY) is present. The red LED lights when the low tone voltage drops below a preset value and remains low for several seconds. The red LED remains lit even if the low tone voltage returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch. If the low tone option is not installed, these LED's are inoperative.

DT-C - The green LED lights when normal continuous dial tone voltage (DT) is present. The red LED lights when the dial tone voltage drops below a preset value and remains low for several seconds. The red LED remains lit even if the dial tone voltage returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch. If the dial tone option is not installed, these LED's are inoperative.

HT-C - The green LED lights when normal continuous high tone voltage (HT) is present. The red LED lights when the high tone voltage drops below a preset value and remains low for several seconds. The red LED remains lit even if the high tone voltage returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch. If the high tone option is not installed, these LED's are inoperative.

RT-C - The green LED lights when normal continuous ringback tone voltage (RBT) is present. The red LED lights when the ringback tone voltage drops below a preset value and remains low for several seconds. The red LED remains lit even if the ringback tone voltage returns to normal so as to indicate which signal caused the alarm. The red LED must be reset with the transfer switch. If the ringback tone option is not installed, these LED's are inoperative.

**SUMMARY OF VISUAL INDICATORS**

<u>Label</u>	<u>Color</u>	<u>Description</u>	<u>Normal Status</u>
<b>LED's on the CEAM alarm card:</b>			
FUSE ALARM	RED	Lights to indicate an open fuse.	OFF
SYS1 NORM	GREEN	Lights to show system 1 is normal.	ON
SYS2 NORM	GREEN	Lights to show system 2 is normal.	ON
MINOR ALARM	YELLOW	Lights to show a minor alarm.	OFF
MAJOR ALARM	RED	Lights to show a major alarm.	OFF
<b>LED's on the CEPR processor card:</b>			
SYS1 O.L.	GREEN	Lights to show system 1 is on-line.	ON or OFF
SYS2 O.L.	GREEN	Lights to show system 2 is on-line.	OFF or ON
POWR ON	GREEN	Lights to show processor running.	ON

<u>Label</u>	<u>Color</u>	<u>Description</u>	<u>Normal Status</u>
LED's on the CEME-S4 interrupter cards (one card for each system):			
120	GREEN	120 IPM interrupter indicator.	FLASHING
60	GREEN	60 IPM interrupter indicator.	FLASHING
10	GREEN	10 IPM interrupter indicator.	FLASHING

**LED's on the CEMO monitor cards (one card for each system):**

1RG	GREEN RED	Interrupted ringing indicator. Inoperative.	FLASHING OFF
RG-C	GREEN RED	Ringing generator indicator. Ringing generator failure.	ON OFF
10	GREEN RED	10 IPM interrupter indicator. 10 IPM interrupter failure.	FLASHING OFF
60	GREEN RED	60 IPM interrupter indicator. 60 IPM interrupter failure.	FLASHING OFF
120	GREEN RED	120 IPM interrupter indicator. 120 IPM interrupter failure.	FLASHING OFF
LT-C	GREEN RED	Low tone generator indicator. Low tone generator failure.	* OFF
DT-C	GREEN RED	Dial tone generator indicator. Dial tone generator failure.	* OFF
HT-C	GREEN RED	High tone generator indicator. High tone generator failure.	* OFF
RT-C	GREEN RED	Ringback tone generator indicator. Ringback tone generator failure.	* OFF

\* These LEDs are ON if tone option is installed, otherwise OFF.

**FURTHER DETAILS**

Section {7} in this manual gives further details on the major sub-assemblies used in this unit.



## **{6} DEMAND METER (LOAD & VOLTAGE INDICATOR)**

The Ringing Level Indicator is a self-contained instrument capable of monitoring Ringing Generator voltage and current.

### **OPERATING INSTRUCTIONS**

(1) "AMPS/VOLTS" switch in the "VOLTS" position.

When the mode selector is in the "Side 1" position, the digital display shows the present ringing voltage level of generator 1 in the range of 0-199.9 VAC.

When the mode selector is in the "Side 2" position, the digital display shows the present ringing voltage level of generator 2 in the range of 0-199.9 VAC.

(2) "AMPS/VOLTS" switch in "AMPS" position.

A set of four (4) Light Emitting Diodes indicate ringing demand. These LED's when lit indicate demand exceeding 25%, 50%, 75% and 100% of generator capacity, respectively.

When the mode selector is in the "Track" position, the LED that is lit indicates the present ringing current demand.

When the mode selector is in the "Latch" position, the LED that is lit indicates the highest ringing demand level reached since the "Latch" mode has been last selected or since a dial-in reset.

The digital display indicates present ringing demand level in the range of 0-1.999 Amps.

## {6} DEMAND METER (ALARM OPERATION)

The terminal strip on the 4200A circuit board provides the following connections.

Terminal	Designation	Function
8	LWA	Load warning alarm contact.
7	LWC	Load warning common contact.
6	LWN	Load warning normal contact.
5	LAA	Load alarm alarm contact.
4	LAC	Load alarm common contact.
3	LAN	Load alarm normal contact.
2	DIR	Dial in reset.
1		No connection.

Load warning contacts are in the normal (LWN & LWC in make position) until 75% of ring generator capacity is reached. At this time LWN & LWC open and LWC & LWA will make. Load alarm contacts are in the normal (LAN & LAC make position) until 100% of ring generator capacity is reached. At this time LAN & LAC open and LAC & LAA will make. ALL contacts are form "C" dry contacts rated at 1 AMP maximum at 60 vdc.

### DIAL-IN RESET OPERATION

Dial-in reset will reset the alarm contacts to normal and also reset the demand latches on the LED display. Reset can be accomplished by applying a momentary ground to terminal 2.

## {7} CEOP-U1 OSCILLATOR/POWER SUPPLY CARD

This card furnishes regulated -14 volts DC and -6 volts DC to operate the solid state devices used in the equipment. It also furnishes a filtered -48 volt DC supply to power -48 volt components as needed. In addition this card has a crystal oscillator and digital counters and buffers to furnish clock signals as needed by other cards in the system.

connections viewing rear of edge connector

```
-----  
power GND-----|A  1|  
power GND-----|B  2|  
-6 volt DC output -----|C  3|  
-14 volt DC output -----|D  4|  
card key -----|E  5|----- card key  
-48 volt DC output -----|F  6|  
819.2 kHz clock, 6v -----|H  7|  
                        |J  8|  
                        |K  9|  
                        |L 10|  
do not use -----|M 11|  
fuse alarm resistor -----|N 12|  
fuse alarm resistor -----|P 13|  
                        |R 14|  
-48 volt DC input -----|S 15|  
-----
```

## {7} CEPR PROCESSOR CARD

This card consists of a micro-controller with memory containing the software instruction set, a RAM memory for temporary data storage, a crystal-controlled clock circuit, and various counters, input and output interface devices, etc. The card functions as a programmable controller, looping thru its instruction set, monitoring the status of inputs, and controlling outputs as required.

This card normally interfaces with from one to seven I/O cards each of which supports several inputs, outputs, monitors, or other functions.

Three visual indicators have the following functions:

- Upper LED D1 - When lit indicates that output L1 is low.
- Middle LED D2 - When lit indicates that output L2 is low.
- Bottom LED D3 - When lit indicates processor is running normally, and output L3 is low.

A pair of these cards can be used to control automatic transfer and alarm function in a fully redundant system. When so applied, inputs and outputs are typically assigned as follows: X0 is self on-line verify, X1 is LEAD/LAG input, X4 is opposite on-line verify, X5 is opposite normal verify, X6 is force OFF, X7 is force ON, L1 is not normal output, and L2 is not on-line output.

One of these cards can be used to control automatic transfer and alarm function in a fully redundant system. When so applied, inputs and outputs are typically assigned as follows: X0 is +48VDC monitor input, X4 is transfer verify, X5 is fuse alarm input, X6 is force to system 1, X7 is force to system 2, Q2 is system 2 normal output, Q3 is system 1 normal output, and L2 is transfer control output.

connections viewing rear of edge connector

	-----				
GND-----	A	1	-----	GND	
logic output Q2-----	B	2	-----	logic output Q3	
-6 volt DC input-----	C	3			
output L3 power-on reset-	D	4	-----	input X5	
write disable-----	E	5	-----	input X6	
data-----	F	6	-----	input X4	
write-----	H	7	-----	input X7	
address A3-----	J	8	-----	input X1	
address A2-----	K	9	-----	input X0	
address A1-----	L	10	-----	buffered output L2	
address A0-----	M	11	-----	buffered output L1	
card enable CE3-----	N	12	-----	card enable CE7	
card enable CE2-----	P	13	-----	card enable CE6	
card enable CE1-----	R	14	-----	card enable CE5	
inverted logic output----	S	15	-----	card enable CE4	
			-----		

## {7} CEMO MONITOR CARD

This card contains nine monitor circuits. Five of these circuits (M2,M6,M7,M8,M9) are adjustable, and can monitor continuous signals for proper voltage level. The remaining four circuits (M1,M3,M4,M5) are not adjustable, and can monitor the interruption of signals such as ground pulses or cadenced call progress signals. This card also contains two ground pulse gates (G1,G2).

Each continuous signal to be monitored should be connected to an input thru a series capacitor (and series resistor if necessary) so as to obtain a voltage at the monitor input of approximately 1.4 volts AC (peak) with all DC blocked. The monitor level adjustments (R28 for M2, R34 for M6, R40 for M7, R46 for M8, R52 for M9) set the voltage threshold of each monitor. As long as the signal level is above this threshold, the circuit will light a green LED (M1 at top of card to M9 at bottom of card), and transmit this information to the associated processor card. Red LED's next to these green LED's are under control of the associated processor card and can be used to latch in and indicate an alarm.

Each interrupted signal to be monitored should be connected to an input thru a series capacitor/resistor/diode as needed to obtain a voltage at the monitor input of at least 1.0 volts (peak). The monitor circuit detects the presence or absence of the signal and lights a green LED (M1 at top of card to M9 at bottom of card), whenever the signal is present. This is transmitted to the associated processor card where software can verify the interruption of the signal. Monitors M3, M4, and M5 can monitor entirely different cadences, but M1 can only be used to monitor a cadence, which is similar to that on M3.

- - - - Typical assignment of monitors and ground pulses - - - -

M1	M2	M3	M4	M5	M6	M7	M8	M9	G1
				G2					
1-RG	RING	10ipm	60ipm	120ipm	LT	DT	HT	RT	NORM
				XFER					

### connections viewing rear of edge connector

	-----	
	A	1 -----GND
	B	2 -----(-14) volt DC input
-6 volt DC input-----	C	3
reset-----	D	4 -----output G1
monitor input M7-----	E	5 -----write disable
data-----	F	6 -----monitor input M3
monitor input M8-----	H	7 -----write enable
input G1-----	J	8 -----address A3
monitor input M1-----	K	9 -----address A2
card enable-----	L	10 -----address A1
monitor input M4-----	M	11 -----address A0
monitor input M2-----	N	12 -----monitor input M5
	P	13
input G2-----	R	14 -----monitor input M6
monitor input M9-----	S	15 -----output G2
	-----	

## {7} CEAM-FA ALARM AND REMOTE TRANSFER RELAY CARD

This card provides visual indication of the status of two redundant systems of equipment. In addition, minor alarm, major alarm, and fuse alarm are extended to the office. A relay is provided for remote transfer of the equipment when required.

**FUSE ALARM** - The fuse alarm circuit can respond to open fuses protecting the following different types of signals: exchange battery to the BATT FA IN pin, continuous or interrupted ringing signals to the RINGING FA IN pin, or ground-level continuous or interrupted tone signals to the TONE FA IN pin. Any of these fuse alarm conditions will cause red LED D1 (fuse alarm) to light and will extend ground and 500 ohm resistance battery fuse alarm signals on the appropriate output pins. A time delay circuit assures that interrupted signals extend a continuous fuse alarm.

**BOTH SYSTEMS NORMAL** - If ground is applied to both the system 1 normal input pin and the system 2 normal input pin, then green LED D2 (system 1 normal) and green LED D3 (system 2 normal) will light. No alarms will be extended.

**MINOR ALARM** - Loss of ground on either but not both of the system normal input pins will cause the appropriate green LED (D2 or D3) to extinguish thus identifying the faulty system. In addition, a minor alarm will be extended over form C contacts and the yellow LED D4 (minor alarm) will light.

**MAJOR ALARM** - Loss of ground on both of the system normal input pins will cause both of the green LED's (D2 and D3) to extinguish and a major alarm will be extended over form C contacts. Red LED D5 (major alarm) will light.

**REMOTE TRANSFER** - Application of a momentary ground to the transfer input pin will cause relay K3 to pick up momentarily and extend logic-level ground signals to both redundant systems on the two transfer output pins.

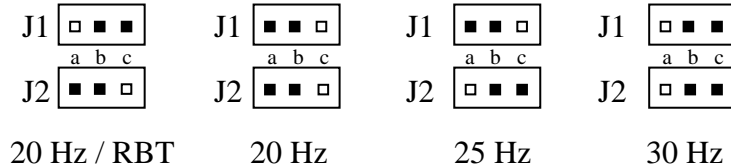
connections viewing rear of edge connector

	-----	
GND-----	A	1
auxiliary FA input-----	B	2
MJ ALM alarm contact-----	C	3 ---service alarm disable
MJ ALM common contact----	D	4 -----GND FA output
MN ALM common contact----	E	5
system 1 normal input----	F	6
system 2 normal input----	H	7
MN ALM normal contact----	J	8
MN ALM alarm contact-----	K	9
transfer input-----	L	10 -----BATT FA input
transfer output-----	M	11 -----do not use
transfer output-----	N	12 -----do not use
MJ ALM normal contact----	P	13 -----TONE FA input
500 ohm batt FA output---	R	14 -----RINGING FA input
-48 volt DC input-----	S	15
	-----	

## {7} CEWT-UPR RINGING GENERATOR CARD (MCR01-7)

This card contains circuitry to generate ringing power. The frequency and waveform generated is determined by 2-pin shorting blocks and a plug-in micro-controller. The memory stores in digital code two different alternations of the ringing waveform, one with the audible ringback tone superimposed and the other as an ordinary sinewave. A high frequency pulse train is generated with the width of the pulses proportional to the analog waveform. The pulses are fed to two pairs of push-pull operated power switching transistors. The outputs go to an L-C filter and ringing transformer. The filtering removes the high frequency components reconstructing the desired waveform.

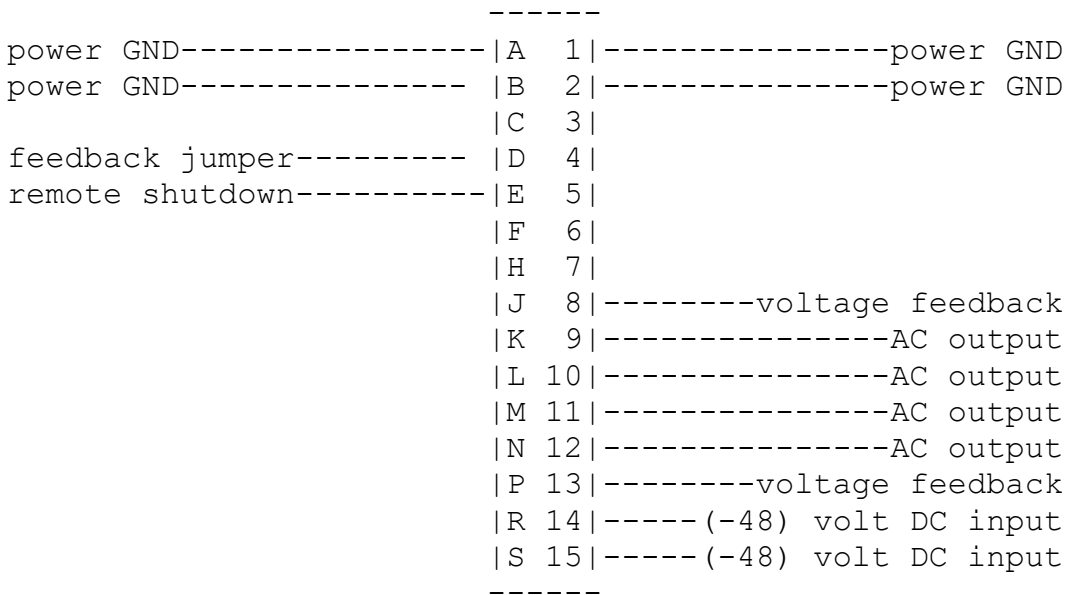
Shorting blocks determine the frequency as follows:



A gain control potentiometer is provided to adjust the amplitude of the output. This control (R1) is mounted at the front edge of the card. This control is set at the factory to provide the rated output level. If field adjustment is attempted, be sure not to exceed an output voltage to the primary of the ringing transformer of 64 volts peak-to-peak at no load. Otherwise, distortion of the output may result.

A current limit control (R2) is preset at the factory so that the full load output voltage is slightly less than the no load output voltage. I/R comp (R38) is also preset at the factory and should not require field adjustment.

connections viewing rear of edge connector



## {7} CEME-S4 INTERRUPTER CARD

This card contains three one-ampere ground pulse gate circuits (G1, G2 and G3). G1 interrupts ground at a 120-IPM rate. G2 interrupts ground at a 60-IPM rate. G3 interrupts ground to produce a one-ring pattern which is adjustable using eight DIP switches. An 819.2 KHZ clock is brought in to the card. Counters and logic produce the control signals to the three PNP transistor gates.

These ground pulse gates are intended to switch resistive or inductive DC loads. The load voltage should not exceed -56 volts DC and the load current should not exceed 1 ampere DC. The gates are self-protecting against damage due to overloads and shorts. They are also designed to absorb the inductive voltage spike generated when opening an inductive load such as a relay coil.

This card also contains four mercury-wetted relays (K1, K2, K3 and K4) with single form C contacts (break-before-make). Green LED's on the front of the card are in series with the relay coils to permit visual verification of normal operation. Relay K1 operates at 120-IPM from G1 and lights LED D8. Relay K2 operates at 60-IPM from G2 and lights LED D12. Relays K3 and K4 operate from the adjustable gate G3 and light LED D4.

The relay contacts should not switch loads in excess of 100 VA. Also the load voltage should not exceed 500 volts and the load current should not exceed 2 amperes. Adequate contact protection to be furnished by customer so that dI/dt does not exceed 25 amperes per microsecond when contacts close, and dV/dt does not exceed 5 volts per microsecond when contacts open.

Monitor connections are brought out from either the gates or the relays thru moveable jumpers J1, J2, and J3. Position (1) selects the gate and position (2) selects the relay for monitoring.

### connections viewing rear of edge connector

	-----	
	A 1 -----GND	
	B 2 -----GND	
-6 volt DC input-----	C 3	
	D 4	
	E 5 -----N.O. contact on K4	
K4 monitor-----	F 6 -----N.C. contact on K4	
clock input-----	H 7 -----N.O. contact on K1	
ARM contact on K4-----	J 8 -----N.C. contact on K1	
G1 or K1 monitor (J2)----	K 9 -----N.O. contact on K2	
G2 or K2 monitor (J3)----	L 10 -----N.C. contact on K2	
G3 or K3 monitor (J1)----	M 11 -----N.O. contact on K3	
G1 direct output-----	N 12 -----N.C. contact on K3	
G2 direct output-----	P 13 -----ARM contact on K3	
G3 direct output-----	R 14 -----ARM contact on K2	
-48 volt DC input-----	S 15 -----ARM contact on K1	
	-----	



## {7} CE4T-1 FOUR-TONE GENERATOR CARD

This card contains circuitry to synthesize all four of the precise call-progress tones. A micro-controller contains digital code to define the four desired tone waveforms. The output goes thru a D/A converter to an analog switch, which de-multiplexes the composite signal and outputs the four desired precise tones.

A gain control potentiometer is provided to adjust the amplitude of the output. This control (R2) is set at the factory to provide a voltage of 5.00 volts peak-to-peak on the 480 Hz output. This should not require adjustment in the field.

connections viewing rear of edge connector

```
-----  
GND-----|A  1|  
GND-----|B  2|  
-6 volt DC input-----|C  3|  
-14 volt DC input-----|D  4|  
                                     |E  5|  
350+440 Hz Dial tone out-|F  6|  
                                     |H  7|  
480+620 Hz Low tone out--|J  8|  
440+480 Hz Ring tone out-|K  9|  
480 Hz High tone out-----|L 10|  
                                     |M 11|  
                                     |N 12|  
                                     |P 13|  
                                     |R 14|  
                                     |S 15|  
-----
```

## {7} CETA-2 TONE AMPLIFIER AND TRANSFORMER CARD

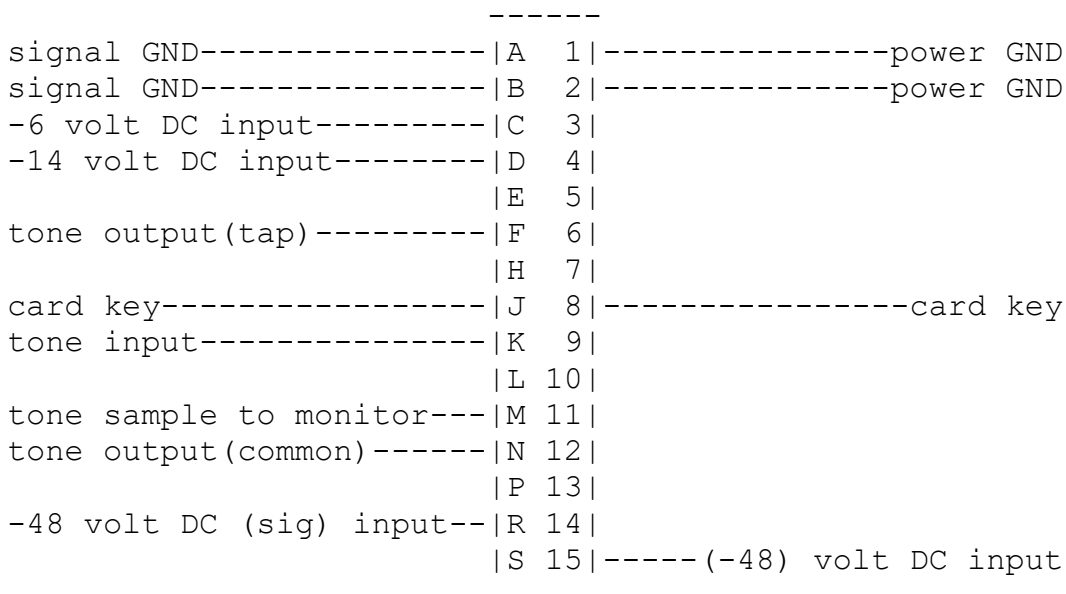
This card contains circuitry to amplify a tone signal and provide output level adjustment. The audio-frequency tone to be amplified is brought in to the card at a level of approximately 5.0 volts peak-to-peak. A gain control potentiometer sends a portion of this signal to a push-pull audio amplifier which drives the primary winding of the tone transformer.

The gain control potentiometer provides fine adjustment of the amplitude of the tone output. This control (R1) is mounted at the upper front edge of the card. This control is set at the factory to provide the rated tone output level. If field adjustment is attempted, be sure not to exceed an output voltage to the primary of the tone transformer of 62 volts peak-to-peak; otherwise distortion of the output tone may result.



The tone transformer serves to isolate the tone output circuit and transform the amplified tone signal to the voltage level required by a particular telephone system. Six output voltages are provided by transformer taps which allow adjustment of the output voltage from 0.7 volts (rms) to 11.0 volts (rms). Jumper block J1 (shown above) is used to select the primary of the transformer for a single-frequency tone (positions 2/3) or for a double-frequency tone (positions 1/2). A fixed sample of the tone output is available for monitoring.

connections viewing rear of edge connector



## {7} CEBS-10 +48V BIAS POWER SUPPLY CARD

This power supply card furnishes regulated +48 VDC @10 watts. A green LED located on the edge of the card lights when the +48V is normal.

This card is designed to operate over an input voltage range of -42 VDC to -58 VDC.

### connections viewing rear of edge connector

```
-----  
GND-----|A  1|-----GND  
GND-----|B  2|-----GND  
           |C  3|  
           |D  4|  
card key---|E  5|-----card key  
filtered +48 VDC output--|F  6|  
           |H  7|  
           |J  8|  
           |K  9|  
           |L 10|  
           |M 11|  
           |N 12|  
           |P 13|  
           |R 14|  
-48 volt DC input-----|S 15|  
-----
```

## {7} CE1X7 TRANSFER RELAY CARD

This card contains four transfer relays (K1, K2, K3, K4). These relays all energize at the same time, transferring up to seven circuits, using form "C" contacts

connections viewing rear of edge connector

```
-----  
N.O. contact K1a-----|A  1|  
N.C. contact K1a-----|B  2|-----COM contact K1a  
N.O. contact K1b-----|C  3|  
N.C. contact K1b-----|D  4|-----COM contact K1b  
N.O. contact K2a-----|E  5|  
N.C. contact K2a-----|F  6|-----COM contact K2a  
N.O. contact K2b-----|H  7|  
N.C. contact K2b-----|J  8|-----COM contact K2b  
N.O. contact K3a-----|K  9|  
N.C. contact K3a-----|L 10|-----COM contact K3a  
N.O. contact K3b-----|M 11|  
N.C. contact K3b-----|N 12|-----COM contact K3b  
N.O. contact K4a-----|P 13|  
N.C. contact K4a-----|R 14|-----COM contact K4a  
-48 volt DC input-----|S 15|-----grounding input  
-----
```

## {9} ELECTRICAL PARTS LIST

PARTS IN MODEL 3500-115 OR 3500-115H BASIC FRAME.

<u>Part Number</u>	<u>Description</u>	<u>Quantity Per Unit</u>	<u>Qty. Spares Recommended</u>
CEOP-U1	Power supply card	3	1
CEWT-UPR	Ringling card – MCR01	2	1
CEPR-3	Processor card – MCP02	1	1
CEMO	Monitor card	2	1
CEAM-FA	Alarm & annunciator card	1	1
CEME-S4	Interrupter card	2	1
CE4T-1	Tone synthesizer card	2	1
CEBS-10	+48V bias supply card (“B” Option)	1	1
CE1X7	Transfer relay card	2	1
CE115U-0	Backplane card	1	0
CECE	Card extender	1	0
1375R	Molex 03-06-1152-R socket	1	0
1506-105	Pin jack	4	0
50-30H-10	Edge connector	24	0
8281/24	Terminal block, 24-line	4	0
TS-PC-8L-45-U	Terminal block, 8-line	2	0
A-1537M	Choke	3	0
B-3849-31	PWM ringling transformer	2	0
A-4362-3	Capacitor, 1000 uf, 63 v.	3	0
230B1E105K	Capacitor, 1 uf, 400 v.	2	0
VC3D8200	Resistor, 8.2K, 3 watt	2	0
5HKS50	Capacitor, .05 uf, 500 v.	2	0
1/4W5%402K	Resistor, 402K, 1/4 watt	4	0
1/4W5%47K	Resistor, 47K, 1/4 watt	1	0
1/4W5%4700	Resistor, 4.7K, 1/4 watt	1	0
1/4W5%1500	Resistor, 1.5K, 1/4 watt	1	0
1/4W5%560	Resistor, 560 ohm, 1/4 watt	1	0
1/4W5%10K	Resistor, 10K, 1/4 watt	1	0
1/4W5%1000	Resistor, 1.0K, 1/4 watt	1	0
VC3D8200	Resistor, 8.2K, 3 watt	1	0
V250LA2	Varistor	1	0
1N4005	Diode	1	0
1N5401	Diode	3	0

## PARTS IN MODEL 3500-115T REDUNDANT TONE OPTION.

<u>Part Number</u>	<u>Description</u>	<u>Quantity Per Unit</u>	<u>Qty. Spares Recommended</u>
CETA	Tone amplifier card	2	1

## PARTS IN MODEL 3500-115 OUTPUT DISTRIBUTION FUSE PANEL.

F-7117	Fuse, GMT 5 ampere	2	3
F-7113	Fuse, GMT 1-1/3 ampere	2	3
F-7136	Fuse, GMT 1/2 ampere	50	0
F-7112	Fuseholder for 1 GMT	4	0
HAX10A	Fuseholder for 10 GMT	5	0
A-3545	Transfer switch, DPDT	1	0
B-4142-1	Ground bar	1	0
1N4005	Diode	11	0
KL16/08PA	Terminal block, 8-line	1	0
KL16/08Z	Marker strip	1	0
KL16/04PA	Terminal block, 4-line (< 2-line)	1	0
KL16/04Z	Marker strip	1	0

## PARTS IN MODEL 3500-115A AUXILIARY ALARM RELAY PANEL OPTION.

F-7113	Fuse, GMT 1-1/3 ampere	1	0
F-7112	Fuseholder type HLT	1	0
KL16/04PA	Terminal block, 4-line	1	0
KL16/04Z	Marker strip	1	0
8281/02	Terminal block, 2-line	3	0
8281/12	Terminal block, 12-line	3	0
CE112A-1	Blank card	3	0
DS4E-M-DC48V	Class H relay	3	0
1N4005	Diode	4	0

## PARTS IN MODEL 3500-115R2 AUXILIARY MERCURY RELAY OPTION.

F-7113	Fuse, GMT 1-1/3 ampere	1	0
F-7112	Fuseholder type HLT	1	0
CE112R-2	Blank card	1	0
160-351ROO	SPDT mercury relay	2	0
8281/12	Terminal block, 12-line	1	0
63258NYM	Standoff support	4	0
1N4005	Diode	4	0
1/2W5%4700	Resistor, 4.7K, 1/2 watt	1	0

## PARTS IN MODEL 3500-115X ISOLATION TRANSFORMER OPTION.

B-3849-32	Isolation transformer	1	0
1375P	Molex 03-06-2151-P Plug	1	0

## {10} TROUBLESHOOTING PROCEDURE

The MODEL 3500 does not require routine maintenance. If trouble is experienced, the following guide may be of help in locating the defective component. A set of spare cards will be of help in quickly isolating a problem. Refer to sections {3} and {6} of this manual for background information.

**CAUTION** - Do not remove or replace circuit cards with power applied to the unit. First remove the input fuse and wait a few seconds for the power supply voltages to bleed off. Removing or replacing cards with power applied to the unit may damage solid state components.

**CAUTION** - Plug-in circuit cards utilize C-MOS solid state components, which can be damaged by electrical static discharge. If cards are removed from the unit for any reason, be sure to observe appropriate handling precautions.

If trouble is experienced, observe the LED's visible thru the front cover of the unit and use the following guide to help identify and correct the problem. If you need help in diagnosing or correcting a problem, do not hesitate to contact the factory for technical support.

**SYMPTOM** - The green POWER ON LED is lit and the yellow MINOR ALARM LED is also lit. Either the SYS1 NORM or the SYS2 NORM green LED is extinguished thus identifying the system in trouble.

**POSSIBLE CAUSE AND SOLUTION** - The problem is most likely the result of a temporary overload, which has caused the unit to self-protect and indicate a fault. Try to reset the unit using the TRANSFER SWITCH marked FORCE 1 FORCE 2 as described in section {6} of this manual under TRANSFER SWITCH and RESET FEATURE. If the unit will not remain reset but continues to go into minor alarm, check the red LED's on the CEMO monitor cards for identification of the defective ringing, tone, or interrupter output.

If the faulty output is indicated to be the continuous ringing generator (RG-C), measure the ringing voltage directly using a voltmeter connected to the test jacks located behind the front cover of the unit on the left and right sides of the lowest section of the main frame. These jacks are marked SYSTEM 1 RINGING GENERATOR, and SYSTEM 2 RINGING GENERATOR. If ringing voltage has been lost, replace the CEWT ringing generator card in the defective ringing system.

If the faulty output is indicated to be one of the continuous precise tone generators (LT-C, DT-C, HT-C, or RT-C), determine if the tone has actually been lost by forcing the loads to the faulty system with the transfer switch and listening to the tone using a telephone. If the tone has been lost or sounds defective, replace the corresponding CETA tone amplifier and transformer card with a spare. Be sure to adjust the voltage tap on the spare card to match the tap used on the card you are replacing. If this does not cure the problem, replace the CE4T tone synthesizer card with a spare.

If the faulty output is indicated to be one of the interrupted ringing, tone, or ground pulse outputs, yet the continuous ringing and tone outputs are normal, replace the CEME interrupter card.

If the unit keeps alarming out even though continuous and interrupted outputs check normal, attempt to adjust the monitors per the instructions in section {3} of this manual. If this does not cure the problem, replace the CEMO monitor card with a spare.

**SYMPTOM** - The green POWER ON LED is lit and the red MAJOR ALARM LED is also lit. Both of the green SYS1 NORM and SYS2 NORM LED's are extinguished.

**POSSIBLE CAUSE AND SOLUTION** - The problem is most likely a shorted load or severe overload causing one of the output circuits to self-protect against damage and turn in a minor alarm. The unit then automatically transfers to the redundant system, which sees the same short or overload and thus turns in a major alarm. One of the red LED's on a CEMO monitor card should be lit. This identifies the defective load circuit. Attempt to reset the unit per the general operating instructions. If the unit continues to go into MAJOR ALARM, check the indicated load for overload or short circuit.



**SYMPTOM** - The green POWER ON LED is extinguished.

**POSSIBLE CAUSE AND SOLUTION** - Check for the presence of -6 volts DC on pin C of the CEPR processor card. If the -6 volts is O.K., replace the CEPR processor card. If the -6 volts is not O.K., remove the CEPR processor card and the two CEMO monitor cards and once again measure the -6 volts at the socket of the CEPR processor card, pin C. If -6 volts is still not present, replace the CEOP power supply card in the supervisory system. If the -6 volts is now O.K., replace the removed cards one at a time and observe which card causes the -6 volt supply to be overloaded. Replace that card with a spare.

**SYMPTOM** - The red FUSE ALARM LED is lit.

**POSSIBLE CAUSE AND SOLUTION** - If one of the output distribution fuses has opened, the problem is the office load in that particular office branch circuit. Repair the load and replace the fuse. If input fuse SYS1 or SYS2 has opened, the corresponding CEWT-UPR ringing generator card may be shorted. Replace the card. In the unlikely event that this is not the problem, there may be a shorted input filter capacitor. If fuse SYS1 is open, check C1. If fuse SYS2 is open, check C2. If fuse SUPV is open, check C4. C1, C2, and C4 are located on the mother board on the rear of the unit. If C1, C2 has shorted, replace it with part number A-4362-3. If the trip battery fuse TRIP has opened, the ringing output circuit has been grounded or overloaded. This should not blow fuse TRIP, which is a 1-1/3 ampere fuse if the load distribution fuses are kept to 1/2 ampere or less. Check the values of the distribution fuses on the - AC/DC AUD output and the CODE 1 GEN output.

## {11} WARRANTY

COMMERCIAL ELECTRIC PRODUCTS CORPORATION, the SELLER, warrants that this product shall be free from defects in material and workmanship during the first 90 days after the product is activated. During said period, SELLER will repair or replace any defective parts free of charge to BUYER, including any labor costs. In addition, SELLER shall repair or replace any defective parts, so discovered by BUYER to be defective within two years from the date of shipment of same, provided BUYER promptly so notifies SELLER. In no case shall SELLER'S liability under this warranty extend beyond two years from the date of shipment of said product. This warranty shall not apply if this product is misused, modified, repaired, or otherwise abused by BUYER or others. The repair or replacement of defective parts, or the refund of the invoice cost thereof, as shall be determined by SELLER in its sole discretion, shall be the limit of SELLER'S liability hereunder and shall be BUYER'S sole and exclusive remedy.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES. SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS EXCEPT AS HEREIN EXPRESSLY PROVIDED.

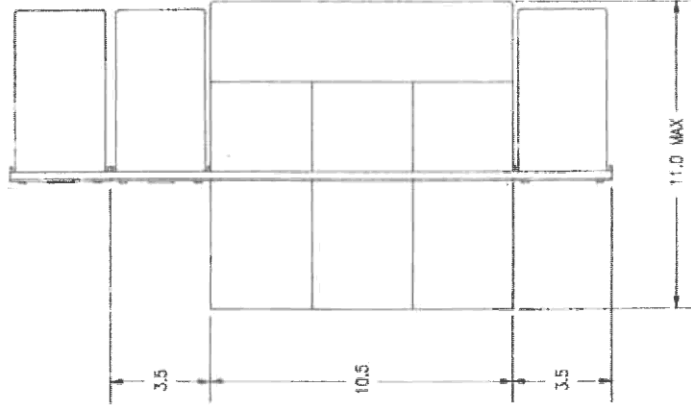
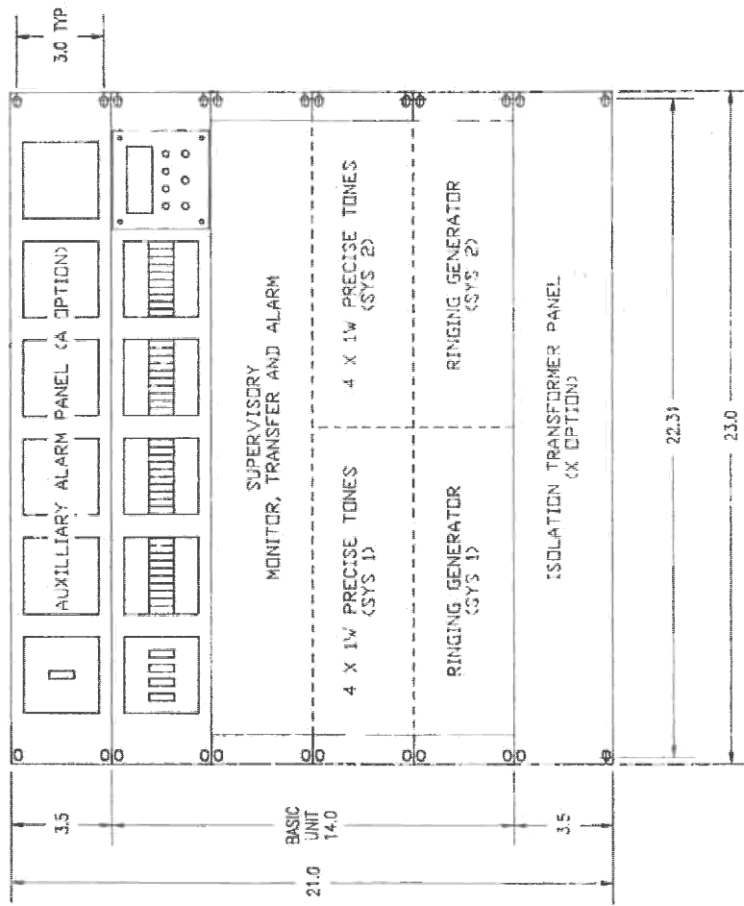
### SYSTEMS AND EQUIPMENT NOT ECONOMICALLY RETURNABLE TO THE FACTORY

In the event that the product involved is a system or equipment which, in the judgment of SELLER, is not economically returnable to the factory or if SELLER has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and SELLER'S repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, SELLER will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is SELLER'S fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from date of shipment, BUYER will be billed at the prevailing CUSTOMER SERVICE RATES but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit component and repair labor are billable. If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, BUYER will be billed for circuit components and labor.

### GENERAL PROVISIONS

COMMERCIAL ELECTRIC PRODUCTS CORPORATION shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will COMMERCIAL ELECTRIC PRODUCTS CORPORATION be liable for consequential damages. No waiver, alteration, or modification of any of the provisions herein shall be binding on COMMERCIAL ELECTRIC PRODUCTS CORPORATION unless in writing and signed by an authorized official of COMMERCIAL ELECTRIC PRODUCTS CORPORATION. If, during any warranty period, the subject equipment has, in the opinion of COMMERCIAL ELECTRIC PRODUCTS CORPORATION, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with COMMERCIAL ELECTRIC PRODUCTS CORPORATION and upon the recommendation of COMMERCIAL ELECTRIC PRODUCTS CORPORATION.

COMMERCIAL ELECTRIC PRODUCTS CORPORATION recommends that all shipments of equipment be inspected by the customer for hidden damage upon receipt from the carrier to insure that a timely claim be filed, if necessary, by the customer. COMMERCIAL ELECTRIC PRODUCTS CORPORATION will not pay claims for shipping damages.



COMMERCIAL ELECTRIC PRODUCTS  
CLEVELAND-OHIO-U.S.A.

SCALE: 25=1  
DATE: 05-25-99  
APPROVED BY: [Signature]  
DRAWN BY: D.J.K.

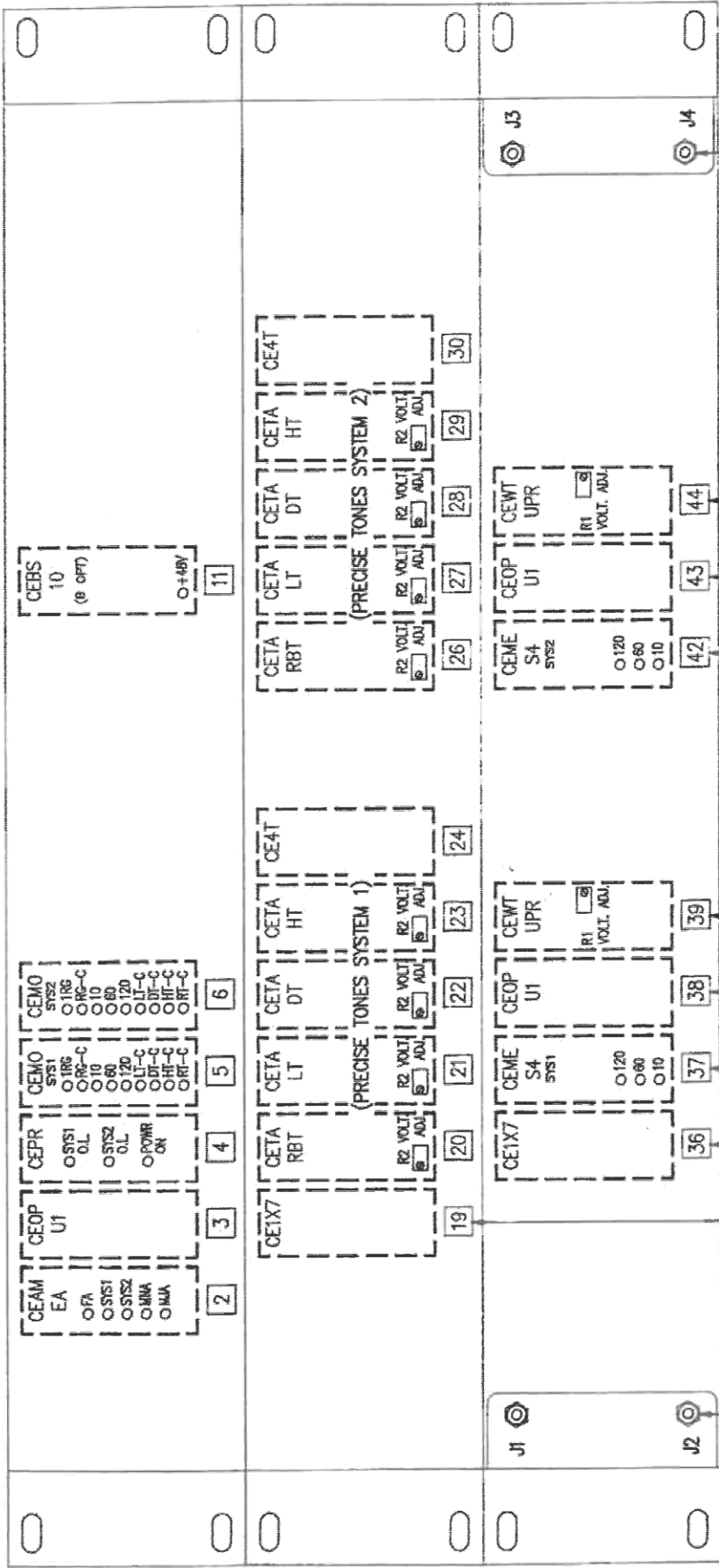
REV: 3  
REVISED: 03-19-02

RESIDUAL RINGING PLANT OUTLINE

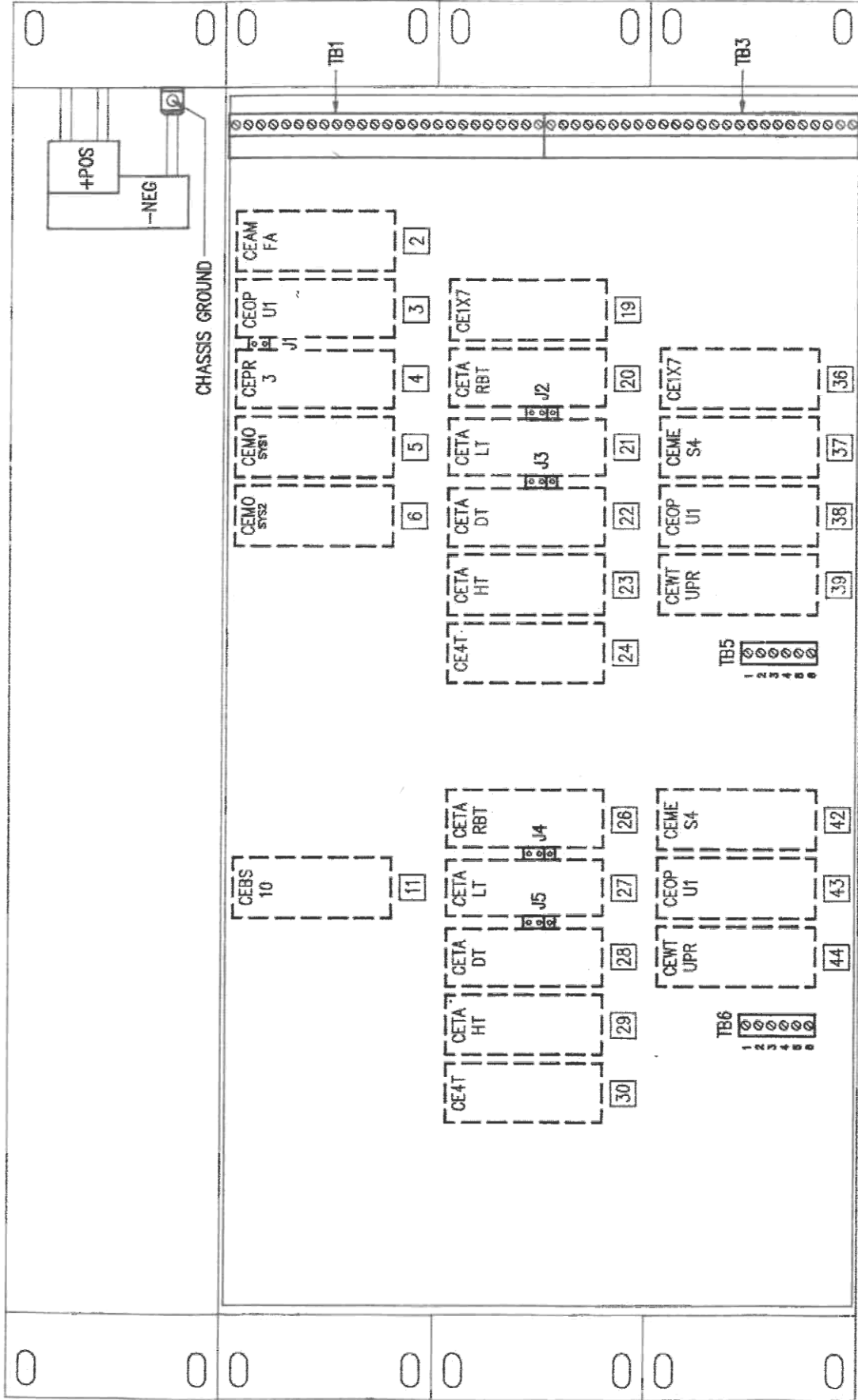
FOR MODEL 3500-115  
DRAWING NUMBER: B-4207

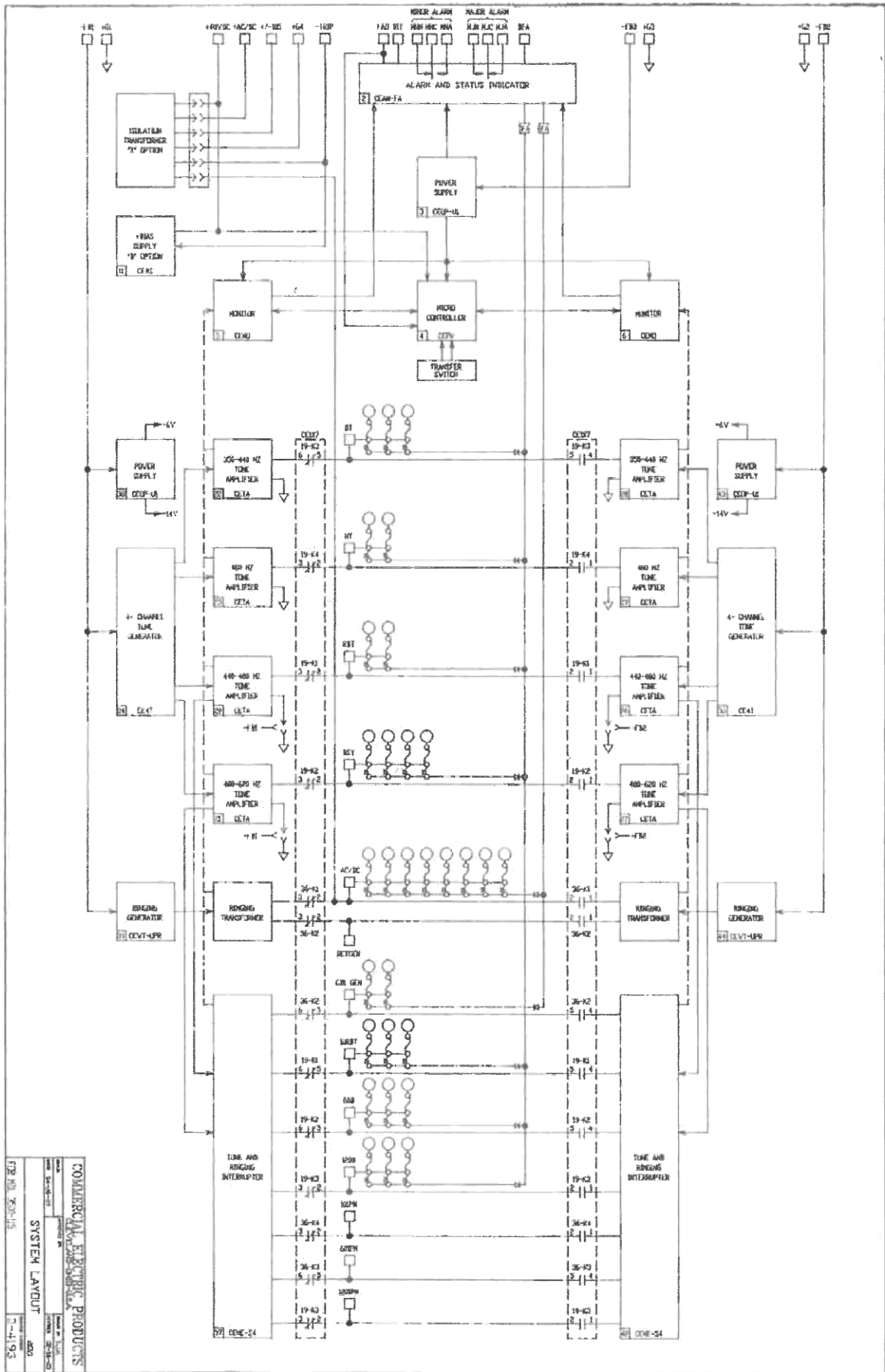
# MODEL 3500-115 CARD LAYOUT

## SUPERVISORY

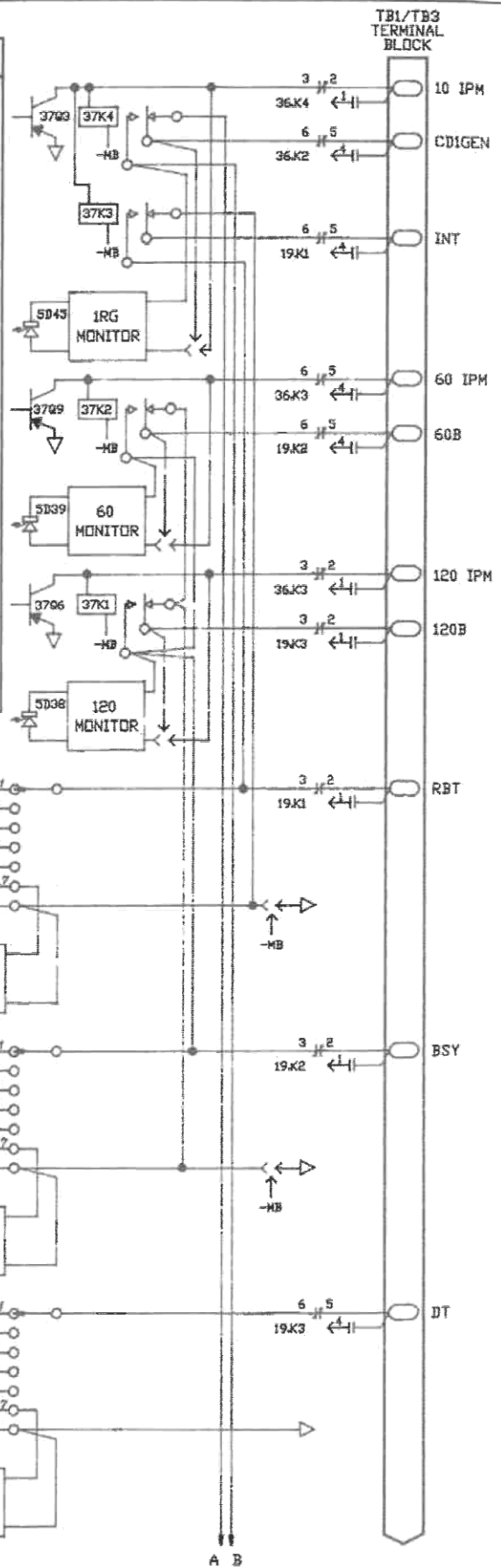
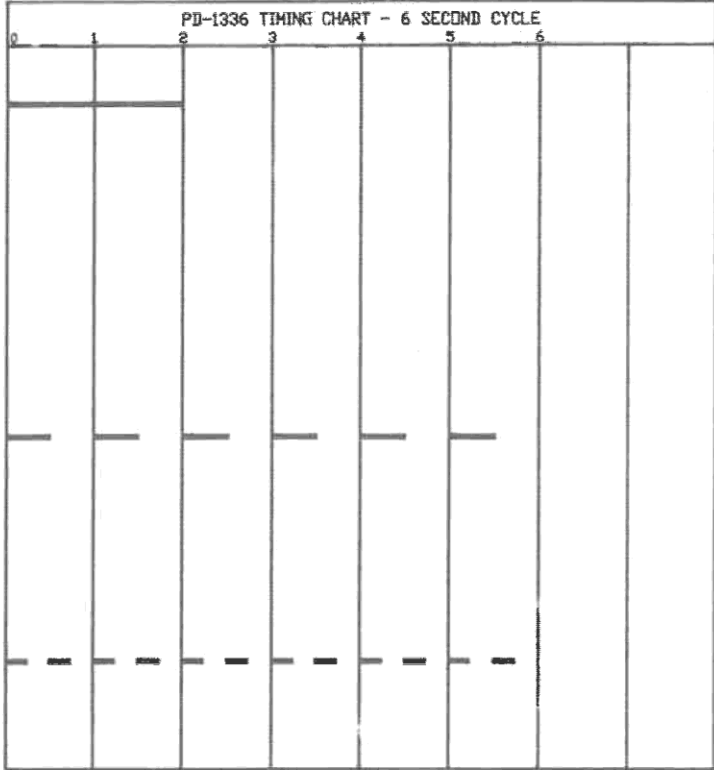


# MODEL 3500-115 TERMINAL BLOCK & CARD LOCATION (REAR VIEW)

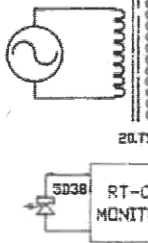




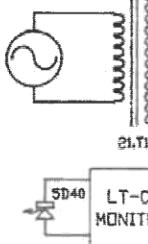
**COMMERCIAL ELECTRIC PRODUCTS**  
 SYSTEM LAYOUT  
 1-4-93



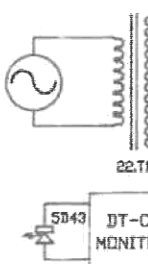
RBT GENERATOR



BUSY TONE GENERATOR

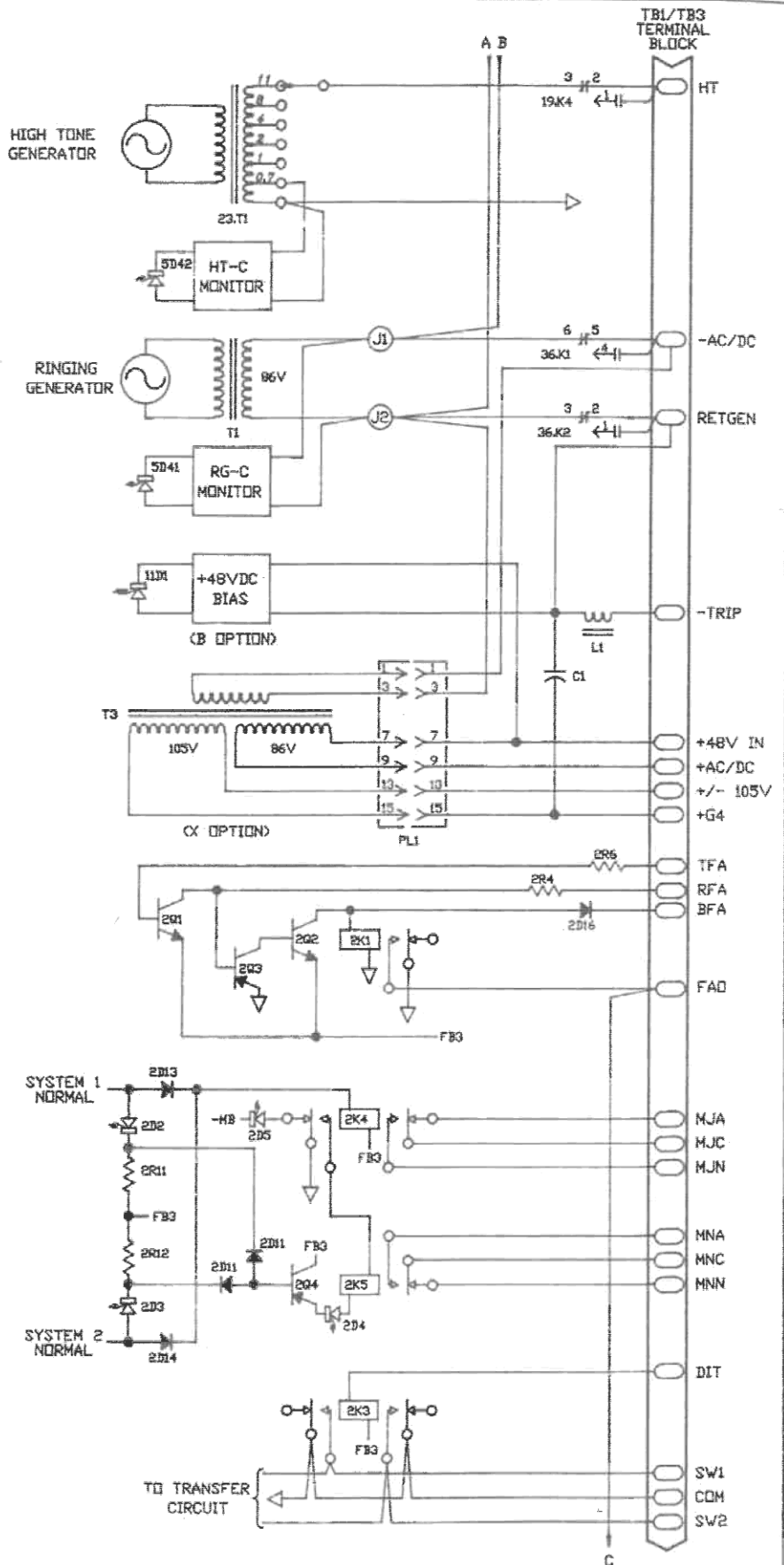


DIAL TONE GENERATOR



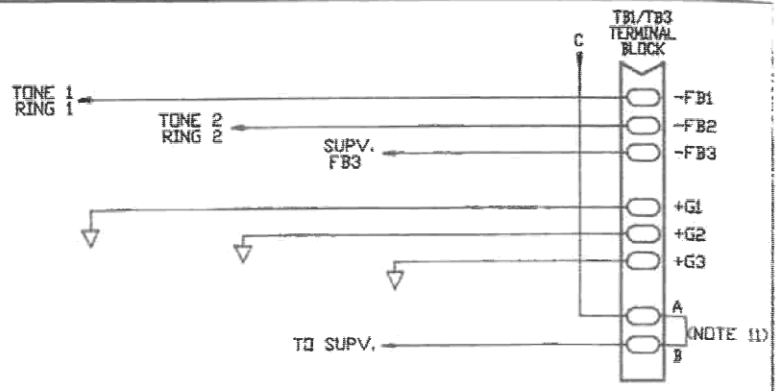
A B

3500-115-B



3500-115-B





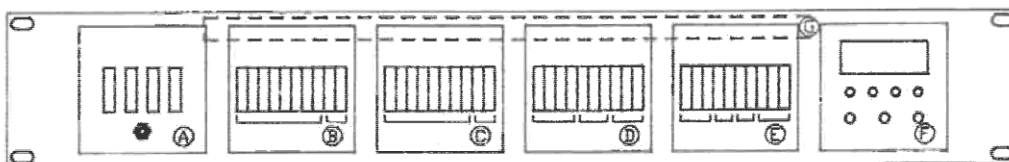
TB1	⊗	DIT
	⊗	BFA
	⊗	TFA
	⊗	RFA
	⊗	FAO
	⊗	MNN
	⊗	MNC
	⊗	MNA
	⊗	MJN
	⊗	MJC
	⊗	MJA
	⊗	RBT
	⊗	10RBT
	⊗	BSY
	⊗	60B
	⊗	120B
	⊗	DT
	⊗	HT
TB3	⊗	-AC/DC
	⊗	CD1GEN
	⊗	RETGEN
	⊗	+48V/DC
	⊗	+AC/DC
	⊗	+/-105V
	⊗	10IPM
	⊗	60IPM
	⊗	120IPM
	⊗	+G1
	⊗	+G2
	⊗	+G3
	⊗	+G4
	⊗	-FB1
	⊗	-FB2
	⊗	-FB3
	⊗	-TRIP
	⊗	SW1
	⊗	COM
	⊗	SW2
	⊗	A
	⊗	B

NOTES

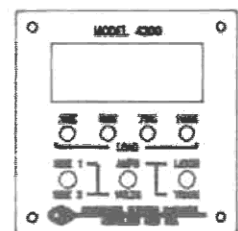
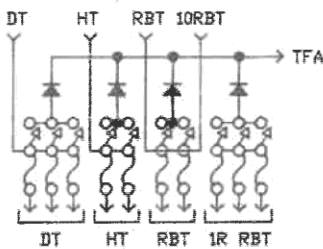
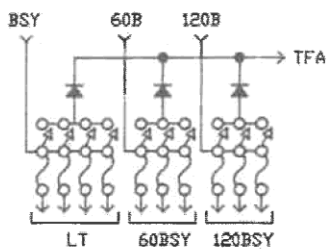
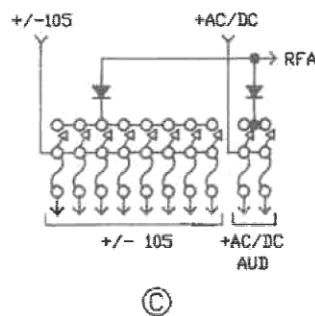
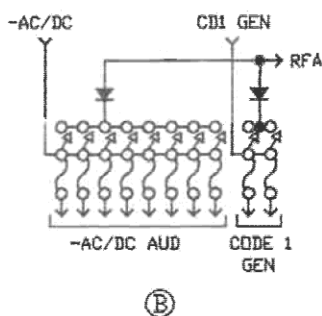
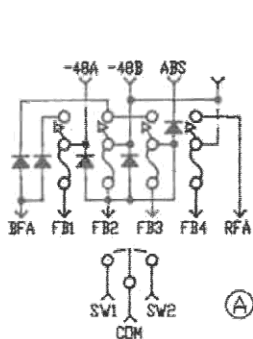
1. ALL GROUND PULSE GATES ARE RATED AT 10 AMP.
2. ALL MERCURY RELAY CONTACTS ARE RATED AT 100VA.
3. ← DESIGNATES THIS POINT GOES TO SAME POINT ON REDUNDANT UNIT.
4. PL1 IS A 15-PIN INTERCONNECT PLUG AND RECEPTACLE.
5. 20.T1 THRU 23.T1 ARE (C.E. NO. A-4436) TONE TRANSFORMERS.
6. T1 IS A (C.E. NO. B-3849-31) RINGING TRANSFORMER.
7. T3 IS A (C.E. NO. B-3849-32) ISOLATION TRANSFORMER (OPTIONAL).
8. L1 IS A (C.E. NO. A-1537H) FILTER CHOKE.
9. C1 IS A (C.E. NO. A-4362-3) FILTER CAPACITOR.
10. ALARM RELAY (2K4) DE-ENERGIZES AND ALARM RELAY (2K5) ENERGIZES TO BRING IN AN ALARM.
11. THESE TWO PINS (PINS A & B ON TB3) IF JUMPED WILL PROGRAM UNIT TO SEND OUT AND INDICATE A MAJOR ALARM IF ANY PART OF THE SYSTEM AS A WHOLE FAILS. THIS INCLUDES ANY FUSE ALARMS.

INPUT-OUTPUT  
TERMINAL BLOCK

# FUSE PANEL OUTLINE



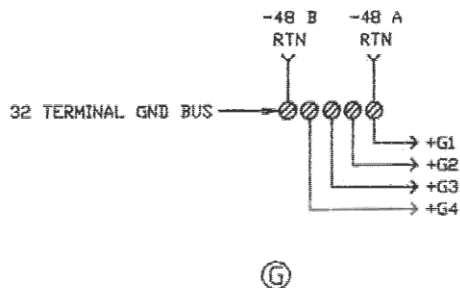
# FUSE PANEL HOOK-UP



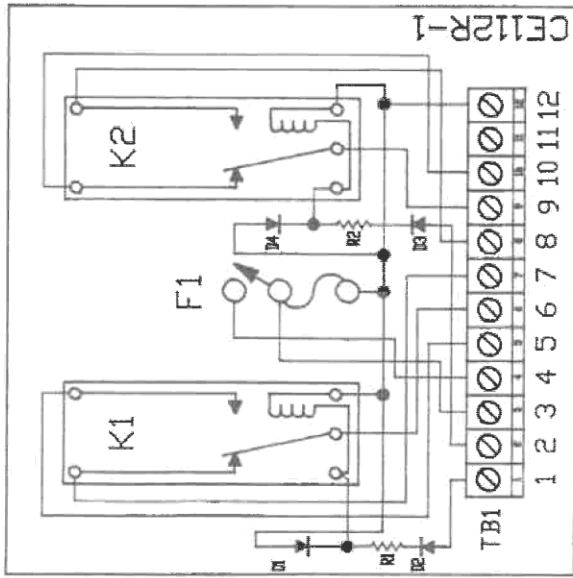
MODEL 4200 DEMAND METER (M OPTION)

**LEGEND**

- BFA - BATTERY FUSE ALARM
- TFA - TONE FUSE ALARM
- RFA - RINGING FUSE ALARM
- RBT - CONTINUOUS RINGBACK TONE
- 10RBT - INTERRUPTED RINGBACK TONE
- BSY - CONTINUOUS BUSY TONE
- 60B - 60 IPM INTERRUPTED BUSY TONE
- 120B - 120 IPM INTERRUPTED BUSY TONE
- DT - CONTINUOUS DIAL TONE
- HT - CONTINUOUS HIGH TONE
- AC/DC - CONTINUOUS RINGING GENERATOR (RTN TO BATT.)
- CODE 1 GEN - INTERRUPTED RINGING GENERATOR
- +AC/DC - CONTINUOUS RINGING GENERATOR (RTN TO + SUPPLY)
- +/-105 - CONTINUOUS RINGING GENERATOR
- SW1 - TRANSFER TO SYS1
- COM - GROUND TO TRANSFER SWITCH
- SW2 - TRANSFER TO SYS2



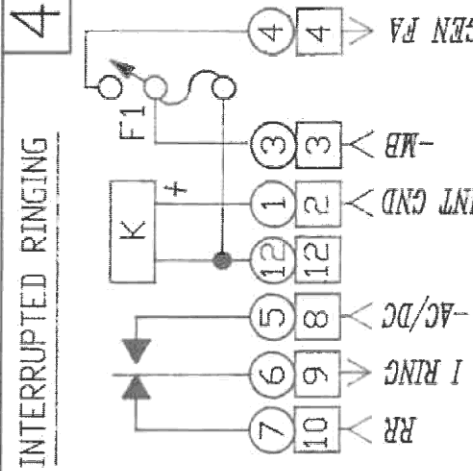
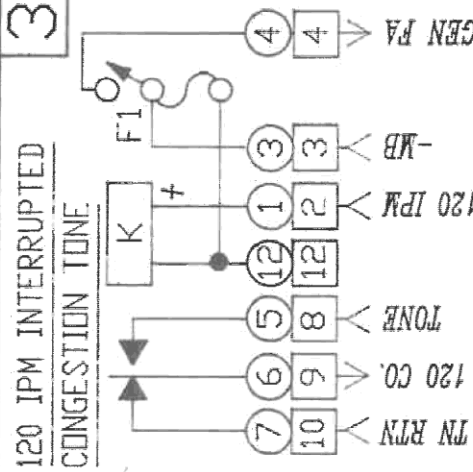
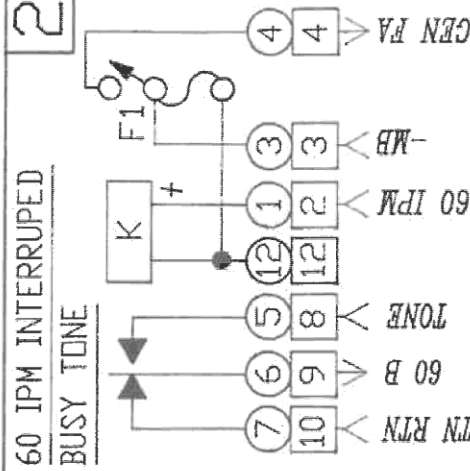
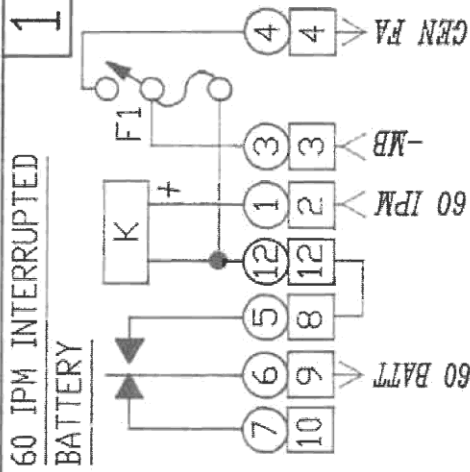
3500-115-B



PICTORIAL DIAGRAM

NOTES

1. K1 AND K2 ARE SPDT MERCURY-WETTED RELAYS RATED AT 2A.
2. IN FIG. 1 THRU 4 O REPRESENTS TB1 CONNECTIONS FOR RELAY K1 AND □ REPRESENTS CONNECTIONS FOR RELAY K2.
3. TB1 COLOR CODE:  
 (1) #22 RED = GP INPUT #1  
 (2) #22 GREEN = GP INPUT #2  
 (3) #18 BLUE = -MB3  
 (4) #22 WHITE = GEN FA  
 (5) #22 BLACK JUMPER TO (8)  
 (8) #22 BLACK JUMPER TO (12)  
 (12) #22 BLACK JUMPER = -FB3
4. CE112/115R1= (K1) RELAY; CE112/115R2= (K1,K2) RELAYS.



COMMERCIAL ELECTRIC PRODUCTS  
CLEVELAND-OHIO-U.S.A.

SCALE: NONE

DATE: 05-07-91

APPROVED BY:

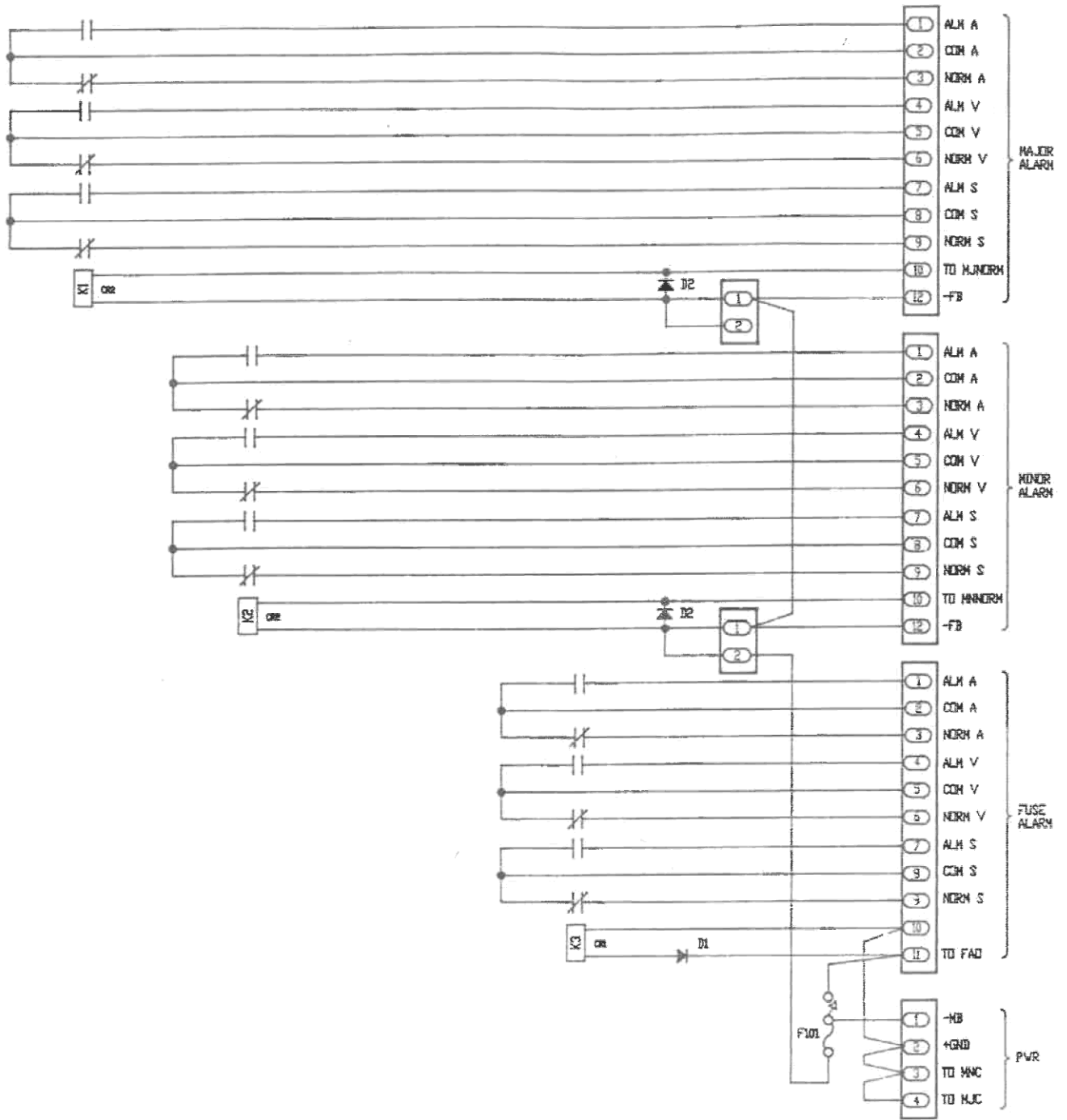
DRAWN BY DJK

REVISED 01-22-01

TYPICAL RELAY HOOK-UP REV 2

DRAWING NUMBER

AUX. 2A, M. RELAY REF: 3500-112/115R W--4136



NOTES

1. A - AUDIBLE  
V - VISUAL  
S - SCAN
2. ALL RELAY CONTACTS ARE SHOWN WITH RELAY COIL ENERGIZED EXCEPT RELAY K4 WHICH IS ENERGIZED TO BRING IN FUSE ALARM

02-10-03	C-4124-3	REMOVED K4 TO K3
02-21-02	C-4124-2	REMOVED 600PH ALM
01-12-90	C-4124-1	DESIGN EXT. BOARD
REVISED	REVISED NO.	CHANGES

AUXILIARY ALARM PANEL

3500-112/115A OPTION

COMMERCIAL ELECTRIC PRODUCTS  
CLEVELAND-OHIO-U.S.A.

C-4124