INSTRUCTION MANUAL

MAGNIPHASE

Line Protection System

Type 19876-B

Continental Electronics

MANUFACTURING COMPANY

4212 S. Buckner Blvd. Dallas 27, Texas

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CONTENTS

INTRODUCTION

The Continental Electronics Type 19876-B MAGNIPHASE Line Protection Unit is an all-electronic device used to protect the radio frequency transmission lines, antennas, and antenna tuning equipment from damage due to line faults, or to arcs and overloads at any of these points. An arcover is usually caused by a lightning discharge, which in itself may do little damage. The major damage occurs if the transmitter is allowed to remain on and to supply sustaining energy to this arc. This energy may be a small percent of the transmitter's total output, and damage may therefore be done before it is detected by overload devices in the transmitter.

The MAGNIPHASE system will detect an arc at any point in the antenna system, will convey this information to the transmitter, and will squelch the transmitter output in a matter of microseconds. It may be adjusted over a wide range of sensitivity to suit operating conditions, and may be used over a wide range of frequency, transmission line impedance, and transmitter power output.

The system consists of two units:

(1) a line coupler, which is inserted in the transmission line at the transmitter output, and

(2) a bridge unit, which may be located on the transmitter front panel or at any other location near the transmitter.

The units are interconnected by two coaxial cables of the required length.

The MAGNIPHASE system is designed for use with any transmitter operating in the standard broadcast band, with output power of from five to fifty kilowatts, and into impedances from 50 to 250 ohms. Two coupler types are available which are basically the same, except for power handling capacity. One is for use with power levels of up to ten kilowatts, and the other for fifty kilowatts.

In cases where power cutback operation or directional antenna systems are employed, combinations of several couplers may be desirable in order to obtain increased protection and sensitivity.

FIGURE 1 — MAGNIPHASE BRIDGE UNIT

FIGURE 2 — 50 KW LINE COUPLER UNIT

FIGURE 3 — 5/10 KW LINE COUPLER UNIT

GENERAL DESCRIPTION

The MAGNIPHASE Line Protection System is expressly designed to detect an impedance change in the load seen by the transmitter. The most usual disturbance in an antenna system is an arcover caused by a nearby lightning discharge. Such an arcover will cause an impedance change which is sensed by the MAGNIPHASE unit as an unbalanced condition at the bridge input, thereby cutting off the transmitter for a period of about sixty milliseconds. The transmitter will then be re-energized, but if the arc still exists, it will drop off again. The arc should burn itself out very rapidly without sustaining RF energy.

The line coupler unit is both capacitive and inductive in nature and may therefore sample both voltage and current. The two RF samples from the coupler are fed to a balanced bridge circuit which, with the remaining MAGNIPHASE circuitry, is mounted in a self-contained chassis on the transmitter front panel. The two RF samples may be balanced from the unit front panel so that no DC will flow in the bridge output circuit unless there is a change in one, or both, of the samples. In this manner, the bridge is sensitive to either a change in voltage and current magnitude, or to a change in phase. An arc or other disturbance at any point in the system will cause either or both of the above changes to occur.

The bridge output network is connected to a thyratron which may be set to operate at any desired sensitivity. The thyratron plate circuit is usually connected directly to the transmitter RF buffer amplifier grid, so that as the thyratron fires, a high negative bias is applied to the transmitter buffer grid and is held on the grid by a relay for about sixty milliseconds. When the relay releases, the bias is removed and the thyratron is ready to fire again if a fault is still present on the line. The bias is applied independent of the relay, which is necessary for the fast action required in this application.

Due to the fast action of the thyratron, cut-off bias is applied to the buffer amplifier in a matter of microseconds. (If biasing off a low level stage is found to be impractical in some transmitters, auxiliary relay contacts are provided which may be used to remove excitation by other means. This involves an additional delay of only a few milliseconds, which is not objectionable in the majority of cases.)

In addition to the sensitivity control, there are two balancing controls and a "disable" switch on the front panel. The balancing controls are used for nulling an external meter during initial bridge balance. The disable switch prevents the transmitter from being cut off while the bridge balance or the sensitivity is adjusted.

Two BNC jacks are mounted on the bridge chassis for connection to the coupler. A terminal strip on the side is provided for connecting the meter, 115 V AC power, bias cable, and other auxiliary connections. A normally lighted neon lamp is mounted on the unit front panel. In case of a fault, the lamp will flash at a rapid rate until the fault clears, or until the transmitter is manually cut off.

MAGNIPHASE SPECIFICATIONS

1. **Frequency Range:**

   0.54 to 1.6 MC.

2. **Transmission Line Impedance:**

   50 to 250 ohms, unbalanced.

3. **Transmission Line Coupler:**

   Available in 5/10 KW and 50 KW models.

4. **Outputs:**

   a. Instantaneous bias cut-off output for transmitter squelching.

   b. Relay contact cut-off circuit for externally operated transmitter cut-off.

   c. Relay contact output for operation of external alarm.

5. **Meter:**

   Externally mounted, to indicate null at bridge balance.

6. **Tube Complement:**

   6AL5, 2D21.

7. **Power Input:**

   115 volts ±10%, 60 cycles, 25 watts.

8. **Size:**

   Bridge Unit: Front panel size, 3-1/2" x 9-1/2".
   Projection behind panel, 5-1/2".

   Line Coupler: 5/10 KW, 2" diameter x 11-1/2" long.
   50 KW, 5" diameter x 6-1/2" high

9. **Shipping Weight Per System:**

   10 pounds, approximate.

CIRCUIT DESCRIPTION

The MAGNIPHASE line coupler unit consists of a capacitor and a toroid inductor which sample transmission line voltage and current, respectively. These two RF samples are fed via coaxial cables to the bridge unit. At the bridge input circuit, the voltage sample is connected to a capacitive divider, and the current sample connects through a phase shift network. A 6AL5 tube, V1, is used as a bridge rectifier, connected so that no current will flow when the bridge is balanced. A change in phase, or voltage and current magnitude, will then cause a bridge unbalance. When properly connected and balanced, the voltages measured on either side of V1, from pin 1 or pin 2 to ground, should be approximately equal, as measured with a vacuum tube voltmeter. The external null meter should produce minimum indication under these conditions.

A bridge unbalance causes a voltage difference across grid resistor, R4 of the 2D21 thyratron, V2. The voltage necessary to fire the thyratron depends on the tube bias, which is adjusted by sensitivity control, R2. The point at which this control should be set is dictated by the conditions of operation.

Upon bridge unbalance, the thyratron will fire, and will produce a voltage of approximately 100 volts negative at the MAGNIPHASE output. This voltage appears at terminal TB1-6 and may be connected via a shielded wire to the grid circuit of a low-level stage in the radio transmitter. This stage is usually the buffer amplifier following the crystal oscillator, and the grid bias developed is sufficient to immediately remove transmitter excitation.

In order to provide for instantaneous transmitter cut-off action, the negative bias is applied independent of the action of relay K1. The relay is then energized, shorting the thyratron and holding the bias present for about sixty milliseconds. Upon relay release the transmitter excitation is restored, thereby resetting the sequence of operation. Should an unbalance still exist, the transmitter excitation will again be interrupted until the trouble is cleared.

During normal operation, the coil of relay K1 serves as a grid resistor for the transmitter buffer amplifier stage. For test and balance procedures, OPERATE-DISABLE switch S1 is placed in the DISABLE position, thereby connecting grid load resistor R8 in place of the relay coil. MAGNIPHASE testing may then proceed without disturbing transmitter operation.

The connections and mode of operation described in the preceeding paragraphs are applicable to Continental Electronics transmitters employing low level "Regulinear" screen modulation, and to other transmitters utilizing linear final amplifiers. In some transmitters, notably those using high level plate modulation, it may be found that transmitter cutoff by instantaneous excitation interruption is unsatisfactory. This is so, because of the possibility of continuing modulation after the modulation transformer load has been removed. To prevent this occurance, and to prevent possible damage to the modulation components, an external relay circuit should be installed to interrupt the transmitter audio input before excitation is removed. Additional contacts are provided on relay K1 and are available at the MAGNIPHASE unit terminal strip for this purpose. A typical circuit for this connection is shown in the Drawings section.

INSTALLATION - MECHANICAL

Line Coupler Unit - 5/10 KW

The line coupler unit is intended for mounting in series with the transmitter output transmission line near the transmitter output connection. If possible, the coupler should be mounted within the transmitter cubicle, near the output connection.

Lug terminals are provided at each end of the coupler unit, for convenient insertion in the output line. Additionally, a single hole mounting bracket is provided for securing and grounding the coupler to the transmitter cabinet. Drawing No. 19931-A shows the overall dimensions of the line coupler.

For installing the 5/10 KW line coupler in Continental Electronics Type 315B/316B transmitter, the following procedure applies:

1. The coupler is to mount within the Exciter-Amplifier cubicle, in series with the bus to the output connection stud. For access to this area, temporarily remove the P.A. output tubes and the tube chimneys.

2. Remove the bus from the output bowl insulator stud, but allow the bus to remain in place.

3. Hold line coupler in position, with one end lug connected to bowl insulator stud, mounting bracket contacting cabinet top panel, and BNC connectors facing forward.

4. Mark position for cabinet mounting hole and remove coupler. Hole may be drilled from top of cabinet for convenience. Be sure to allow for reversal of mounting foot if measuring from atop cabinet. Do not allow metal chips to fall within transmitter circuitry.

5. Install line coupler unit with hardware provided. Be sure to provide a good ground connection to the transmitter cabinet.

6. Mark output bus for connection to coupler. Remove bus, saw to length, flatten end, and drill for connection to coupler. Re-install bus.

7. Re-install tube chimneys and tubes. Line coupler installation is now complete.

Line Coupler Unit - 50 KW

The MAGNIPHASE line protection system is an integral part of the Continental Electronics Type 317B 50 KW transmitter. As such, installation of the entire assembly is made at the factory before the transmitter is shipped.

When used with other transmitters, it is recommended that the 50 KW coupler unit mount within the transmitter output cubicle, with the output transmission line conductor passing through the exact center of the line coupler. Generally, in the case of 50 KW installations, the factory will issue specific instructions regarding the best installation arrangement for the particular case.

Bridge Unit

The MAGNIPHASE bridge unit is intended for mounting behind the transmitter front panel, in close proximity to the transmission line coupler unit. Alternately, the bridge unit may be mounted on a standard rack panel of 1/8" maximum thickness. In this case, the rack should be located as close as possible to the line coupler unit, to maintain the lengths of the interconnecting coaxial cables within the recommended 20 ft. maximum.

A special mounting arrangement is provided to permit a neat transmitter installation, with all mounting screws completely hidden behind the MAGNIPHASE nameplate. The following steps should be followed in mounting the bridge unit:

1. Choose an appropriate location on the transmitter front panel, making sure that adequate clearance exists behind the panel, and that the unit is spaced away from all high voltage RF and DC sources.

NOTE: For installation in Continental Electronics Type 315B/316B 5/10 KW, and Type 317B 50 KW transmitters, the unit is mounted on the righthand control panel of the Exciter-Amplifier cubicle. Center the MAGNIPHASE nameplate vertically and horizontally midway between the TEST METER selector switch nameplate, and the output LOADING control nameplate.

2. Using the MAGNIPHASE nameplate as a template, mark and punch holes in the transmitter panel for the five front panel controls. The holes should be equal in size to the holes in the nameplate.

3. Temporarily install the two aluminum mounting blocks on the bridge unit chassis, using the mounting screws provided. The lower, and larger, block should be held in the single hole, using the long retainer bolt provided, after first securing the small retainer clip against the bolt shoulder, at the threaded end. Be sure to mount both blocks squarely, with screws centered in their clearance holes. Both blocks mount with the unused hole areas extending away from the chassis.

4. Hold bridge unit chassis against the outside of the transmitter front panel, with the two capacitor shafts exactly centered in the center two front panel holes, and with the chassis vertical. (The large mounting block will be at the lower end.) Mark positions of the two mounting holes for each block on the transmitter front panel. Remove chassis and drill and countersink the four holes for #6-32 flat-head machine screws.

5. Remove the mounting blocks from the chassis, and install in their final position inside the transmitter front panel, using the flat-head screws provided.

6. At this point, before the bridge unit is permanently installed, it will be necessary to make preliminary adjustments under power. This is accomplished with the chassis connected, but located outside the transmitter where internal measurements may easily be made. See Preliminary Adjustments section for this procedure.

7. Holding the unit chassis behind the panel, near the mounting area, install the pilot lamp, potentiometer, and switch through the transmitter front panel, and the MAGNIPHASE nameplate. Long leads are provided on these components for this purpose. The toggle switch should be mounted with its unused terminal at bottom.

8. Fasten the unit chassis in place against mounting blocks, using two #6-32 screws at top, and the long retainer bolt at bottom. Allow excess wire length to front panel components to coil neatly within the chassis.

9. Drill front panel for the six #2-56 self-tapping nameplate mounting screws provided. Use #48 drill.

Bridge unit installation is now complete.

INSTALLATION - ELECTRICAL

As stated in the Mechanical Installation section, certain electrical measurements and adjustments must be made within the bridge unit before final installation can be completed. These adjustments will require that power be applied to the unit, and the transmitter be operated while the bridge unit is outside the transmitter for convenient access.

For these reasons, the connections to the unit terminal board, and the two coaxial cables, should be made long enough to extend to an outside area for this test. Alternately, where the particular installation space permits, and where there is no danger of personal hazard to the operator, the unit may be permanently installed, with access for the adjustments made by removing the unit righthand side panel.

The following electrical connections should be made. Twenty gauge stranded wire may be used for all connections, except as noted.

1. Connect two lengths of RG-62/U coaxial cable between line coupler unit and bridge unit. The coaxial jacks at each unit are color-coded to facilitate identification. Forty feet of cable is provided for the maximum recommended cable lengths of twenty feet, each. However, this length should be kept to a minimum to reduce the effects of cable shunt capacity.

   NOTE: For the Continental Electronics Type 315B/316B 5/10 KW transmitter, these cables should be routed to the right from the line coupler, along the cabinet right side, and down to the bridge unit.

2. Connect TB1-1 to the "hot" side of the 115 V AC power line. For the Type 315B/316B transmitter, connect to transmitter terminal TB101-4.

3. Connect TB1-5 to the "ground" side of the 115 V AC power line, and to the transmitter cabinet ground. For the Type 315B/316B transmitter, connect to transmitter terminal TB101-24.

4. Connect TB1-7 and -8 to the externally mounted meter provided. In lieu of this item, any 200 microamp. DC meter may be used, of 500 or 750 ohms internal resistance.

NOTE: For the Type 315B/316B transmitter, the existing test meter is used in lieu of the external meter normally supplied. Remove the test meter switch S201 from panel and remove adjustable stop bar, allowing switch to move one additional position counter-clockwise. Re-install, and position knob to indicate one step to the left of existing markings when switch is in maximum counter-clockwise position. Connect wires from TB1-7 and -8 to the unused switch terminals, observing currect polarity.

In the Type 317B 50 KW transmitter, wires connect directly to the PROTECTION NULL meter.

5. For Continental Electronic's transmitters, and for other transmitters utilizing linear final amplifiers, or low level modulation, the thyratron output circuit may be connected to bias off the buffer amplifier in the normal fashion. A shielded wire should connect from TB1-6 to the grid circuit, with the shield grounded at TB1-5. A series resistor, and shunt capacitor, are provided for termination of this wire at the grid circuit. The grid resistor normally in use should now be removed. See Drawing No. 19937-A for connections within the Continental transmitter.

CAUTION

Before connecting the above circuit, which removes transmitter excitation, be sure that all successive transmitter stages are arranged with fixed bias supplies in the normal manner, so that removal of excitation will not cause high current flow in any tube.

In some transmitters, the loss of overall rectified feedback upon excitation removal may cause large increases in modulator output. The user should verify that such increases will not produce damaging voltages at the modulator amplifier components.

Neither of the foregoing precautions apply to Continental Electronics transmitters.

6. As explained in the Circuit Description section, in the case of high level and plate modulated transmitters, the use of the bias cut-off output circuit may not be satisfactory. In these cases, the normally-closed relay contact output, appearing at TB1-3 and -4, may be used to operate an external relay circuit. As shown in Drawing No. 19938-A, the external circuit is arranged to interrupt the transmitter audio input circuit before removing excitation, thus preventing possible damage to the modulation components. The external relay connections may be arranged to apply grid cut-off bias at a low level stage, to interrupt excitation directly through the external relay contacts, or to open some other transmitter circuit which will result in high-speed RF removal.

7. One additional relay contact is available at TB1-2 for operation of an external alarm, if desired. This application is discussed further in the section on Special Purpose Arrangements.

INSTALLATION PARTS LIST

Quantity	Description
	BRIDGE UNIT
1	19876-B MAGNIPHASE Bridge Unit
1	25031-A-1 Upper Mounting Block
1	25031-A-2 Lower Mounting Block
1	25071-A Retainer Bolt
1	Key Retainer Clip
1	19031-42 MAGNIPHASE Nameplate
2	#1450 Knobs
4	#6-32 x 1/4" F.H.M.S., brass
2	#6-32 X1/4" B.H.M.S., brass, with lockwasher
6	#2-56 Self-Tapping Screw
1	Mod. 55 200 MICROAMP. meter, for external mounting (not furnished with systems for use with Continental transmitters)
1	3300 ohm, 2 watt, Resistor
1	DD-502 Centralab 0.005 mfd. Capacitor
1	1417 USECO Standoff Insulator, for mounting above
40 ft.	RG-62/U Coaxial Cable
4	UG-260/U Cable Plug

Installation Parts List (Continued)

Quantity	Description
	5/10 KW COUPLER
1	19810-E MAGNIPHASE Line Coupler
3	1/4-20 x 1/2" B.H.M.S., brass, with nut and lockwasher
	50 KW COUPLER
1	19791-E MAGNIPHASE Line Coupler
3	1/4-20 x 3/8" B.H.M.S., brass, with nut and lockwasher

PRELIMINARY ADJUSTMENTS

Because of varying conditions encountered in the field, with respect to transmission line impedance and normal standing wave ratio, it is impossible to completely adjust the bridge unit at the factory. For this reason, it is suggested that the unit be adjusted outside the transmitter before installation is completed.

The following adjustment procedure applies:

1. Connect the bridge unit in the normal manner, but do not mount in the transmitter cabinet.

2. Place PROTECT-DISABLE switch S1 in DISABLE position, and rotate SENS control to maximum counter-clockwise position. Place transmitter on the air, at full power output, unmodulated.

3. Tune MAGNI and PHASE controls for minimum indication on null meter. If null is not obtained, measure the RF voltage across C3 and across L1 by checking between V1 pins 1 and 2, respectively, to ground, with a vacuum-tube voltmeter. A meter such as the Hewlett-Packard Model 410B should be used.

4. If a voltage difference exists, in most cases the voltage across C3 will be found to be the higher, even with C3 set for maximum capacity. The C3 voltage should be reduced to approximately the same voltage as at L1, by experimentally shunting divider capacitor C8 with small padder capacitors, and readjusting. It will not usually be necessary to obtain exact equality of the two voltages. Indeed, slightly dissimilar voltages may be found to produce a proper null. This dissimilarity is due to the adjustment of magnitude control C3 to produce a slightly higher or lower voltage, a portion of which is, in effect, used to offset the inherent phase shift within the bridge circuit components.

5. It should now be possible to produce a meter null reading with the two front panel controls. If the meter still cannot be nulled, the input connections to toroidal transformer T1 should be reversed at T1-1 and 12. If more convenient, the same effect can be produced by reversing the toroid coil leads at the line coupler unit, or by physically reversing the position of the coupler in the transmission line, end-for-end.

   The action of the two null adjustments will indicate the need for phase reversal. After the MAGNI control is tuned for minimum indication, should the PHASE control produce a peak reading in its normal range of adjustment (not at ends of range), a phase reversal is indicated and the connections should be interchanged.

6. A minimum indication of about 5% or below should now be obtainable on the null meter "percent of normal" scale.

7. With the meter at null, advance the sensitivity control until the relay begins to operate, and the front panel lamp flashes rapidly. Reduce the control setting until the action ceases.

8. A bridge unbalance may be simulated by changing either the MAGNI or PHASE controls, causing the lamp to again flash. Return both controls to normal.

9. Place switch S1 in PROTECT position, and manually unbalance the bridge until the lamp flashes. Note that the transmitter is cut-off each time the MAGNIPHASE unit operates. Note especially that the P.A. plate current does not rise abnormally high, due to feedback set up by improperly by-passed cables, etc.

10. Installation of the bridge unit may now be completed.

Should additional access be required within the bridge unit chassis, for subsequent servicing, this is easily obtained. The mounting bracket for the two variable capacitors may be readily withdrawn as a sub-assembly, by removing the two retaining screws, and unsoldering three connecting wires. Internal components are then fully exposed. Additionally, the chassis right side panel is removable.

OPERATION

After installation, the MAGNIPHASE system requires little attention. It is possible to check the system for proper operation at any time, by placing switch S1 in the DISABLE position. The operator may the adjust sensitivity, and may purposely unbalance the bridge at will, without affecting transmitter operation.

Should sudden and continuous operation of the protective system begin, the operator should immediately reduce transmitter power. If MAGNIPHASE cycling continues, the transmitter should be shut down until the fault is discovered.

Never disable the protective system in order to keep the transmitter on the air. The transmitter is capable of destroying a great amount of costly antenna tuning equipment before it will be disabled by internal overload devices. Care should be taken to never leave the protective system disabled.

System sensitivity should be set with the unit disabled, to prevent unnecessary program interruptions. To establish proper sensitivity, advance the control until the normally lighted lamp flashes, and reduce the setting until flashing ceases. It is advisable to set sensitivity such that the unit will operate on a 10 to 15 percent change in antenna impedance, unmodulated. The unit will be more sensitive, of course, at 100% modulation.

The system sensitivity should not be so great as to cause operation on high-frequency modulation peaks. It should also be noted, especially for unattended operation, that such anomolies as antenna icing will result in sufficient change in impedance to cause spurious operation if sensitivity is too great.

It is suggested that the proper sensitivity setting be established experimentally, by producing momentary short circuits with a grounded "hot-stick," at the various points in the antenna system where sustained arcing is known to be troublesome. It is unnecessary, of course, to adjust the sensitivity to protect against arcing at a point where the RF level would be insufficient to sustain an arc in any case.

It should always be remembered that the MAGNIPHASE system will not protect the antenna and tuning equipment from the initial damage of an arc. It is not a "lightning rod." The system can only prevent the arc from being sustained and from producing extensive damage to components within the original area of air-path ionization.

Very careful attention should be given to the adjustment of tower base and tuning equipment ball gaps, in order to minimize the effect of an arcover at these points. Over a period of time, many stations tend to increase ball gap spacing from the most effective position for lightning protection, in order to prevent interruptions due to rain, flying insects, etc.

With MAGNIPHASE protection, it is advisable to restore ball gap spacing to the correct point. Should arcovers result from such minor sources, the MAGNIPHASE system will instantaneously react and the resulting slight interruption will go unnoticed on the air.

SPECIAL PURPOSE ARRANGEMENTS

The operation of the MAGNIPHASE system in the event of an arc, is quite rapid, and the resulting interruption is likely to go unnoticed by the transmitter operator. Since the frequency of operation of the protective system is an indication of antenna system stability, it may be desirable to install a warning alarm system.

The MAGNIPHASE bridge unit has a spare relay contact appearing at unit terminal TB1-2, which is available to actuate such an alarm. From this terminal, a simple bell or chime may be connected, to sound at each operation of the unit. Alternately, a latching relay may be utilized to give a continuous alarm on unit operation, until manually reset.

A further variation of interest is the inclusion of an electrically operated counter, to register the number of interruptions experienced within a given period. Typical circuits for these arrangements are shown on Drawing No. 19939-A.

EQUIPMENT WARRANTY

WARRANTY: Continental Electronics Manufacturing Company warrants the equipment to be free from defects in workmanship and material under normal and proper use and service for the uses and purposes for which it is designed, and agrees to repair or replace at the place of manufacture, without charge, all parts thereof showing such defects which are returned for inspection to the Company's factory, transportation prepaid, within a period of one (1) year from date of delivery, provided that such inspection discloses to the satisfaction of the Company that the defects are as claimed, and provided also, that the equipment has not been altered, repaired, subjected to misuse, negligence or accident, or damaged by lightning. No material will be accepted for return or replacement without the written authorization of the Company. Upon such authorization and in accordance with instructions of the Company, parts or material for which replacement is requested shall be returned to the Company for examination, with all shipping charges prepaid by the Purchaser. Replacements made under this warranty shall be shipped F.O.B. Dallas, Texas. Tubes and batteries shall be deemed to be covered by the manufacturer's standard warranty applicable thereto, and such items shall be and are hereby excluded from the provisions of this warranty.

The Company shall not be liable for any consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with otherequipment or materials, or from any other cause. The foregoing warranty is in lieu of all other warranties not expressly stated herein.

INSTALLATION: The Company's prices do not include installation. The equipment shall be installed by the Purchaser, who assumes all responsibility for installation and operation of the equipment, as well as for obtaining all permits, licenses, and certificates required by any regulatory agency or any other body, for the installation and use of the equipment.

CONTINENTAL ELECTRONICS MFG. CO.

TYPE 19876-B "MAGNIPHASE"

UNIT Line Protection Unit

ELECTRICAL PARTS LIST NO. 7738

REF. DWG. NO. 19876-B ENGR. RPB

SYMBOL	FUNCTION	NAME OF PART	DESCRIPTION	PART NO.	MANUFACTURER
C1	Not Used		Not Used		
C2	Grid Bypass	Capacitor	.005 mfd., 1000 WVDC, fixed, disc	DD-502	Centralab
C3	Magnitude Control	Capacitor	5.5 - 100 mmfd., variable, 600 volts	APC-100B	Hammarlund
C4	Phase Control	Capacitor	Same as C3		Hammarlund
C5	Bias Bilter	Capacitor	25 mfd., 50 WVDC	TVA 1306	Sprague
C6	Filter	Capacitor	20 mfd., 250 WVDC	TVA 1508	Sprague
C7	Time Delay	Capacitor	2 mfd., 200 WVDC, Metapup	MPM-2W2	Cornell Dubilie
C8	Divider	Capacitor	10 mmfd., 500 WVDC	5W5Q1	Cornell Dubilie
CR1	Bias	Rectifier	750 MA, silicon diode	1N2070	Texas Instru.
CR2	Clipping	Rectifier	Same as CR1		Texas Instru.
CR3	Supply Voltage	Rectifier	Same as CR1		Texas Instru.

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ELECTRICAL PARTS LIST NO. 7738
REF. DWG. NO. 19876-B ENGR. RPB

SYMBOL	FUNCTION	NAME OF PART	DESCRIPTION	PART NO.	MANUFACTURER
DS1	Test	Lamp	Neon	NE51	
F1	Line	Fuse	Holder with #31201.5, 1-1/2 amp. fuse	342003	Littlefuse
J1	Input	Jack	BNC series	UG-290A/U	Amphenol
J2	Input	Jack	Same as J1		Amphenol
K1	Switching	Relay	7000 ohm coil, 4PDT contacts, per CEMC Spec. No. 10705-C	CR2791G122AL1	General Electric
L1	RF Suppressor	Choke	2.5 MH, R.F. choke	R-100	National
L2	RF Suppressor	Choke	Same as L1		National

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TYPE 19876-B "MAGNIPHASE"
UNIT Line Protection Unit

ELECTRICAL PARTS LIST NO. 7738
REF. DWG. NO. 19876-B ENGR. RPB

SYMBOL	FUNCTION	NAME OF PART	DESCRIPTION	PART NO.	MANUFACTURER
P1	Coax Connecting	Plug	BNC series	UG-260A/U	Amphenol
P2	Coax Connecting	Plug	Same as P1		Amphenol
P3	Coax Connecting	Plug	Same as P1		Amphenol
P4	Coax Connecting	Plug	Same as P1		Amphenol
R1	Loading	Resistor	2000 ohm, 10 watt, non-inductive, wirewound, Koolohm	10N1T	Sprague
R2	Sensitivity Control	Potentiometer	500 ohm, 2 watt, locking shaft	CLU 5011	Ohmite
R3	Meter Shunt	Resistor	330 ohm, 1 watt, 10%		Ohmite
R4	Grid Leak	Resistor	100,000 ohm, 1 watt, 10%		Ohmite
R5	Voltage Dropping	Resistor	1500 ohm, 10 watt, wirewound		Ohmite
R6	Limiting	Resistor	2200 ohm, 2 watt, 10%		Ohmite
R7	Limiting	Resistor	100 ohm, 2 watt, 10%		Ohmite
R8	Bias	Resistor	3300 ohm, 1 watt, 10%		Ohmite
R9	Loading	Resistor	300 ohm, 10 watt, Koolohm, non-inductive, wirewound	10N1T	Sprague

CONTINENTAL ELECTRONICS MFG. CO.

TYPE 19876-B "MAGNIPHASE" | ELECTRICAL PARTS LIST NO. 7738

UNIT Line Protection Unit | REF. DWG. NO. 19876-B ENGR. RPB

SYMBOL	FUNCTION	NAME OF PART	DESCRIPTION	PART NO.	MANUFACTURER
S1	Disable	Switch	DPDT, bat handle, 3 amperes at 250 volts	12TS11-3	Micro
T1	RF Coupling	Transformer	Toroid coil assembly	19804-B	CEMC
T2	Power	Transformer	117 volt, 60 cy pri., 117 volt at 30 MA, and 6.3 volt at 2 amperes sec.	P-3045	Merit
TB1	Connecting	Terminal Board	8 point	8-140	Cinch-Jones
TB2	Interconnecting	Term. Board	4 mounting holes	2004	Cinch Jones
TB3	Interconnecting	Term. Board	5 mounting holes	2005	Cinch Jones
V1	Rectifier	Tube	Twin diode	6AL5	General Electri
V2	Switching	Tube	Thyratron	2D21	General Electri
XDS1	Test	Lamp Assembly	Pilot lamp assembly, with built-in 100,000 ohm resistor	147-408-6	E. F. Johnson

CONTINENTAL ELECTRONICS MFG. CO.

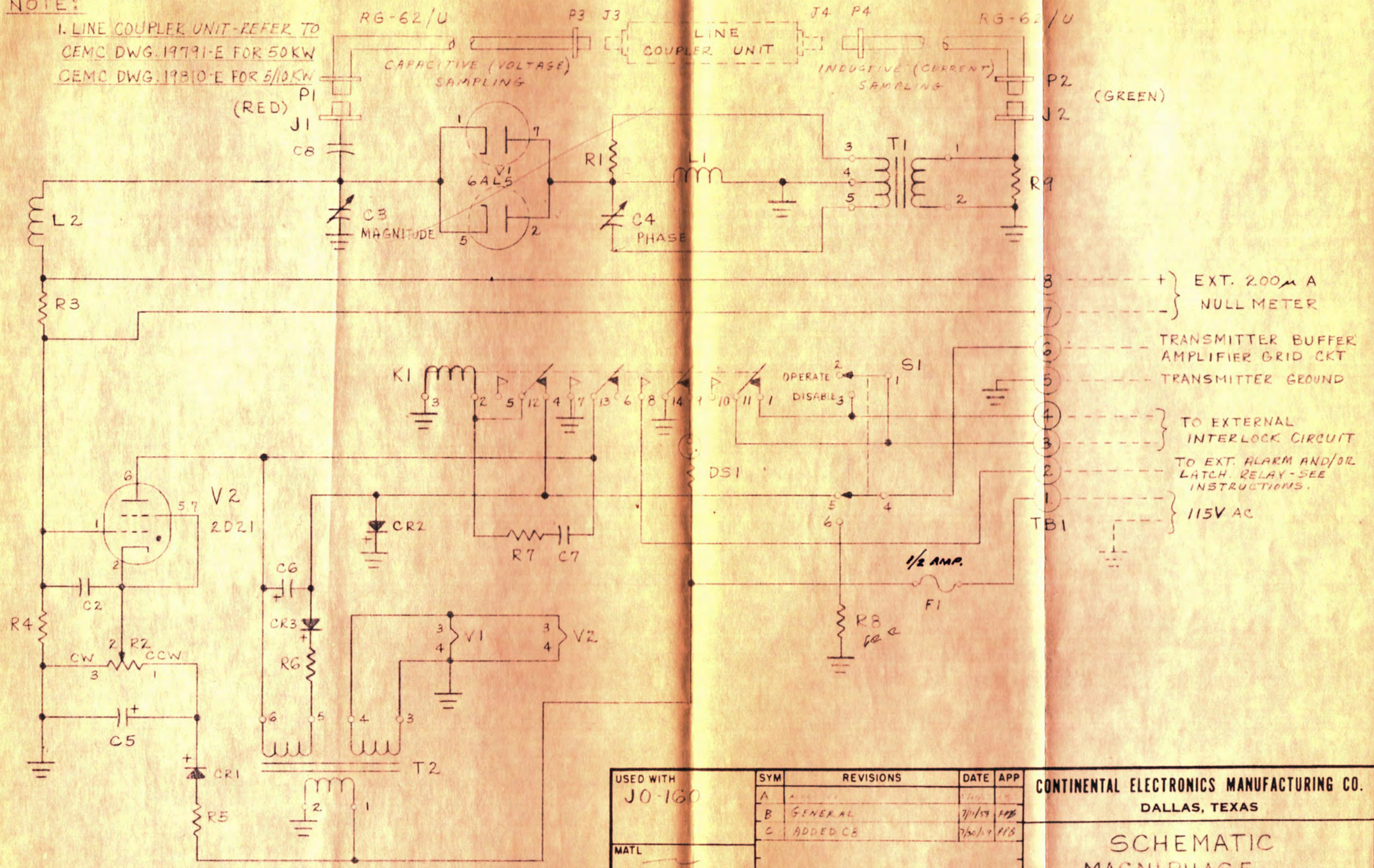
TYPE 19876-B "MAGNIPHASE"
UNIT Line Protection Unit

ELECTRICAL PARTS LIST NO. 7738
REF. DWG. NO. 19876-B ENGR. RPB

SYMBOL	FUNCTION	NAME OF PART	DESCRIPTION	PART NO.	MANUFACTURER
XK1	Relay	Socket	14 pin mica, bottom mount	699PHSPTD	Elco
XV1	6AL5 Tube	Socket	7 pin miniature, top mount, with 1-3/8" shield	TS102P01 TS102U01	Elco Elco
XV2	2D21 Tube	Socket	Same as XV1, except with 1-3/4" shield	TS102P01 TS102U02	Elco Elco
	Shaft Extension	Shaft	1/4" x 1/4" shaft extender (fiber)	No. 130	H. N. Smith

NOTE:

1. LINE COUPLER UNIT - REFER TO CEMC DWG. 19791-E FOR 50 KW CEMC DWG. 19810-E FOR 5/10 KW



USED WITH JO-160

MATL

FIN

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES FRACT. ±1/64 DEC. ±.015 ANG. ±1/2°

SYM	REVISIONS	DATE	APP
A	[illegible]	[illegible]	[illegible]
B	GENERAL	7/1/59	[illegible]
C	ADDED C8	7/30/59	[illegible]

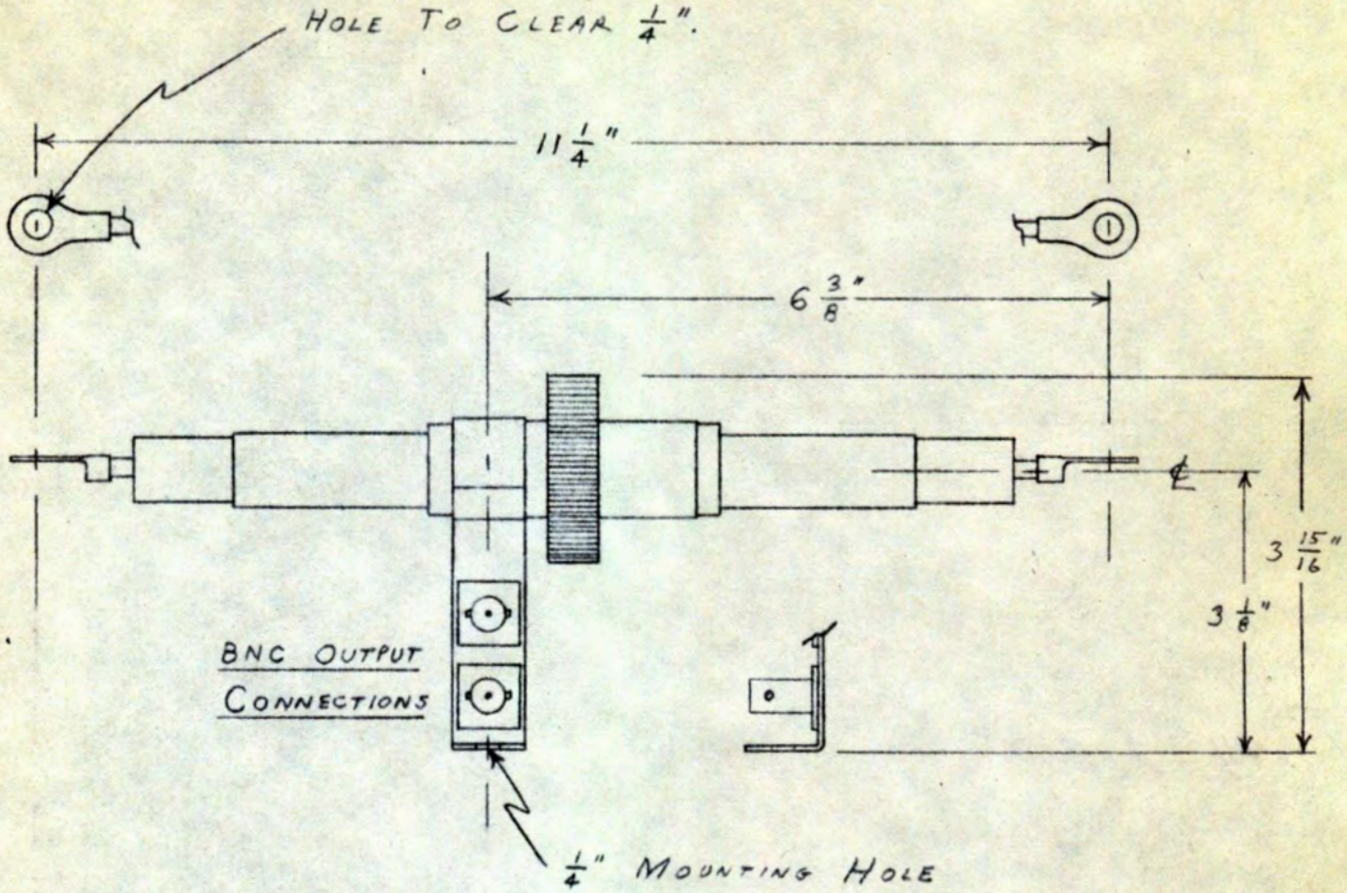
CONTINENTAL ELECTRONICS MANUFACTURING CO.
DALLAS, TEXAS

SCHEMATIC MAGNIPHASE LINE PROTECTION UNIT

SCALE:

APP'D	ENG.	DRAWN
		MDF
		2-20-59

19876-B



USED WITH 19876-B, 19810-E	SYM	REVISIONS	DATE	APP
	A		11 JUN 59	RPB
	B		30 JUL 59	RPB

MATL

FIN

UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES
TOLERANCES
FRACT. ±1/64 DEC. ±.015 ANG. ±1/2°

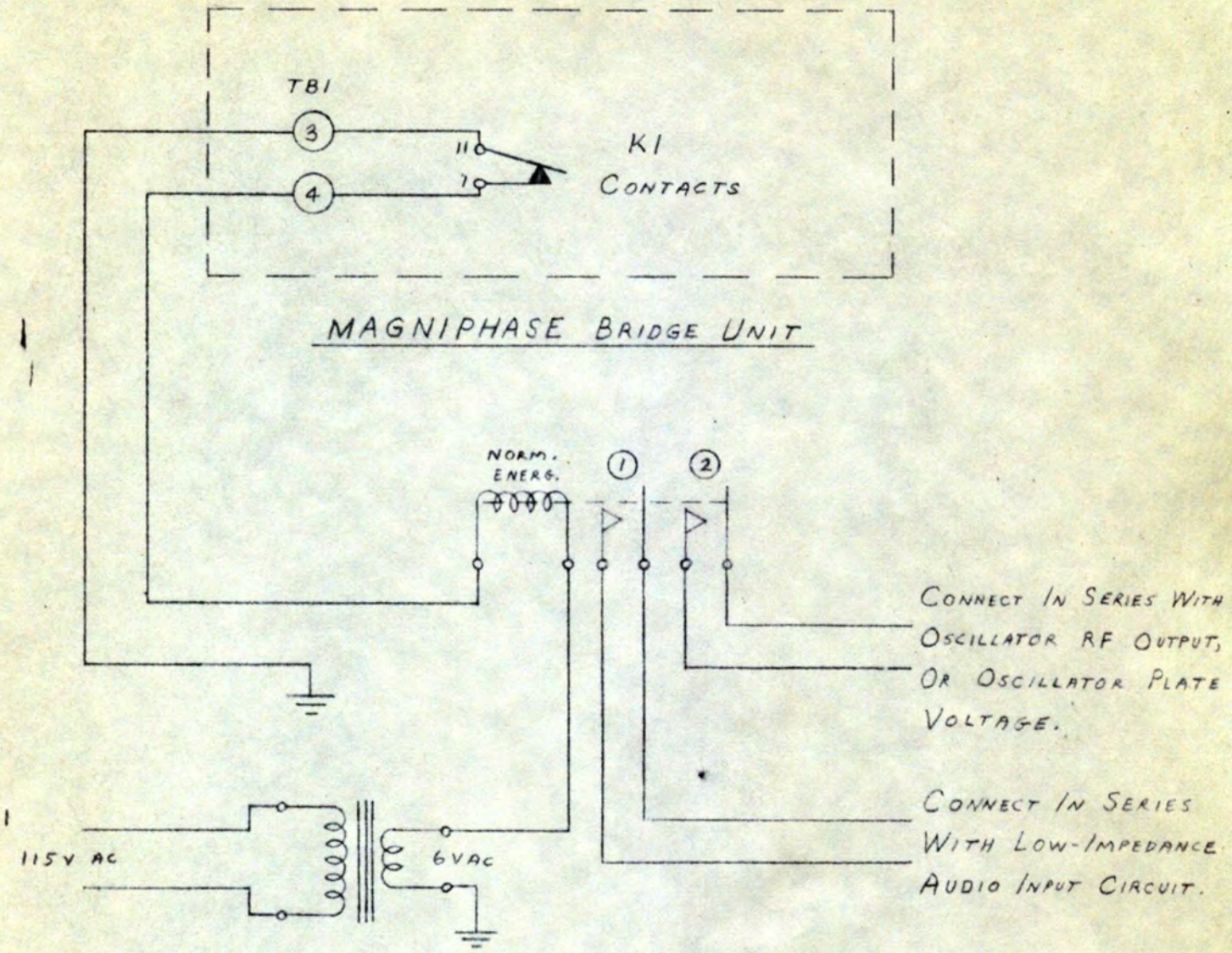
CONTINENTAL ELECTRONICS MANUFACTURING CO.
DALLAS, TEXAS

OUTLINE DIMENSIONS
TYPE 19810-E
MAGNIPHASE 5/10 KW COUPLER

SCALE: HALF

APP'D.	ENG.	DRAWN
		RPB 6 MAY 59

19931-A



NOTE:

CONTACT (1) MUST OPEN BEFORE (2) OPENS, AND (2) MUST CLOSE BEFORE (1) CLOSES.

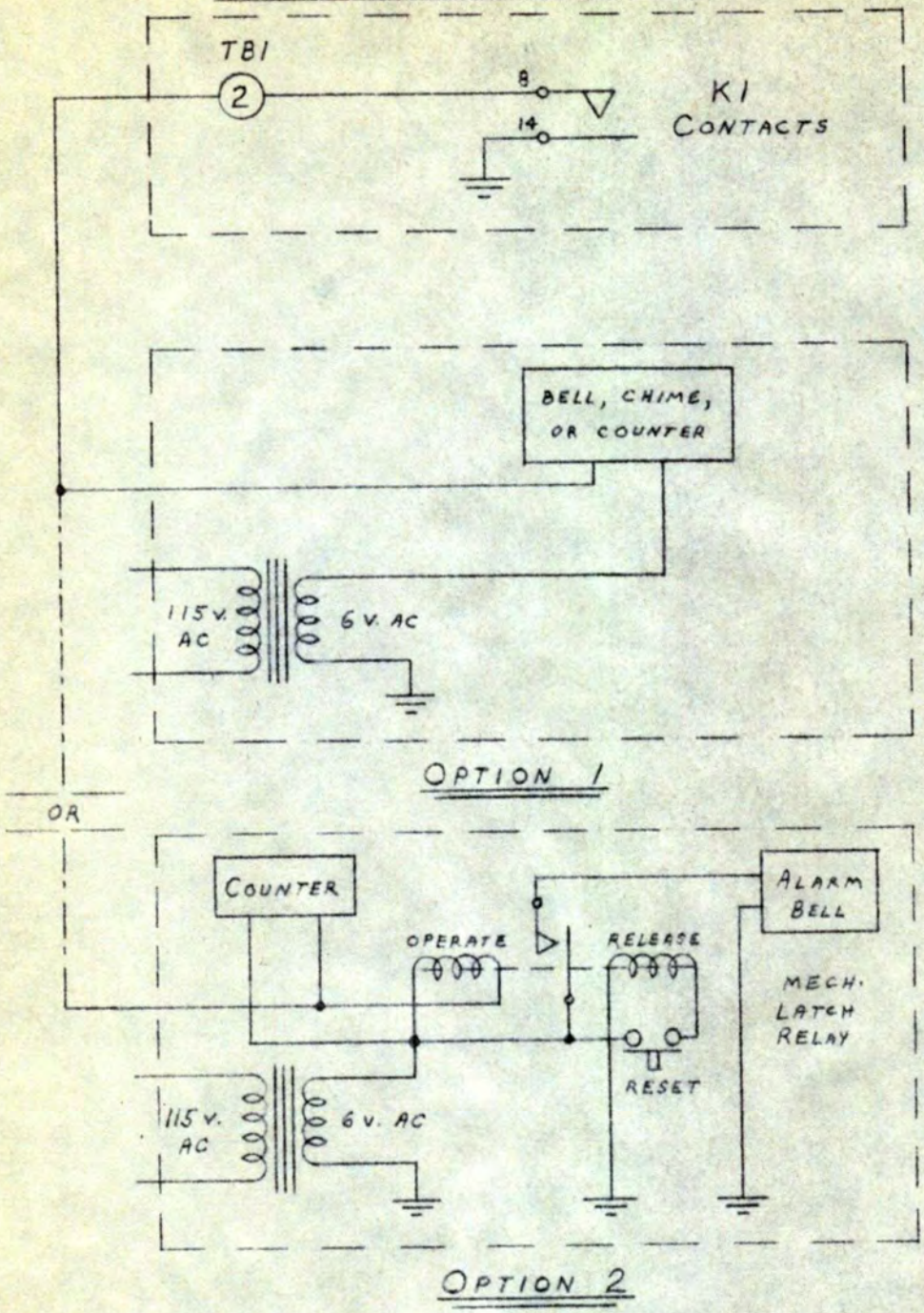
USED WITH 19876-B	SYM	REVISIONS	DATE	APP
MATL ~				
FIN ~				
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES FRACT. ±1/64 DEC. ±.015 ANG. ±1/2°				

CONTINENTAL ELECTRONICS MANUFACTURING CO.
DALLAS, TEXAS

MAGNIPHASE
RELAY CUT-OFF CIRCUIT

SCALE: ~			
APP'D.	ENG.	DRAWN MPB 11 July 59	19938-A

MAGNIPHASE BRIDGE UNIT



OPTION 1

OR

OPTION 2

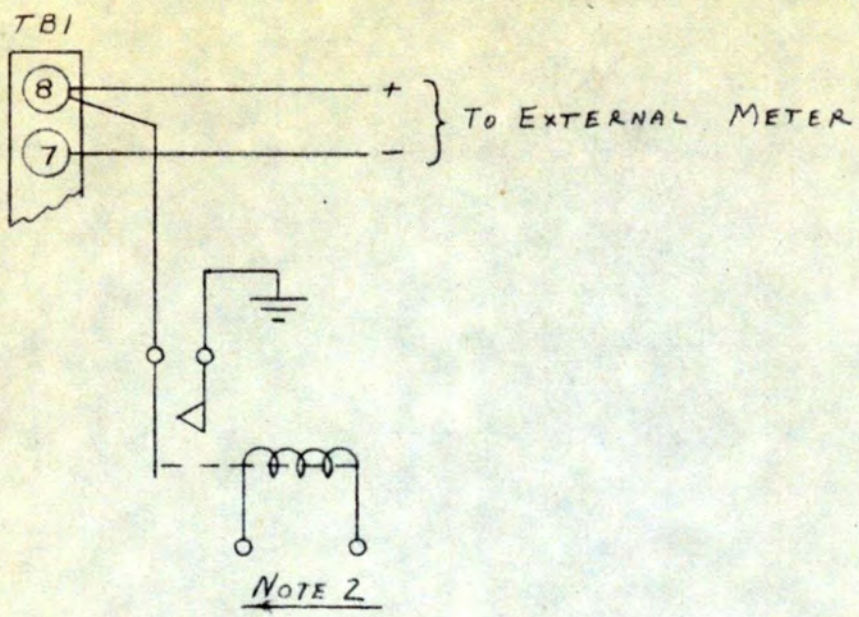
USED WITH 19876-B	SYM	REVISIONS	DATE	APP
MATL ~				
FIN ~				
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES FRACT. ±1/64 DEC. ±.015 ANG. ±1/2°				

CONTINENTAL ELECTRONICS MANUFACTURING CO.
DALLAS, TEXAS

MAGNIPHASE

EXTERNAL ALARM CIRCUIT

SCALE: ~			
APP'D.	ENG.	DRAWN PPB 7-11-59	19939-A



Note:

1. When MAGNIPHASE Is Used With Transmitters Which Switch To Conelrad Frequency, Resulting Bridge Unbalance May Cause Spurious Operation. Above Connection Is Used To Disable MAGNIPHASE System When Operating Under These Conditions.
2. Connect Relay Coil To Be Energized When On Conelrad. In Continental Type 315B/316B, Relay K204 Is Used For This Purpose.

USED WITH 19876-B, 19002-E	SYM	REVISIONS	DATE	APP
MATL ~				
FIN ~				
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES TOLERANCES FRACT. ±1/64 DEC. ±.015 ANG. ±1/2°				

CONTINENTAL ELECTRONICS MANUFACTURING CO.
DALLAS, TEXAS

MAGNIPHASE

Conelrad Squelch Connection

SCALE: ~

APP'D.	ENG.	DRAWN
		MAB 14SEP59

19954-A