$12.00

OPERATING AND SERVICE MANUAL

EL301

ELECTRONIC LOAD CONTROL MODULE

EMERSON

acdc electronics

Division of Emerson Electric Co.

401 Jones Road, Oceanside, California 92054 • Tel. 619-757-1880 • TLX 350227

2/85/500

WARRANTY

When used within specified operating conditions, this ACDC Electronic instrument is warranted to be free from defects in materials and workmanship for a period of 1 year. This warranty shall not apply to any product or parts which have been subjected to misuse, accident or abnormal conditions of operation. This warranty covers all parts of the module, including semiconductors and capacitors.

If at any time the instrument is in need of warranty service the purchaser should promptly notify ACDC or its authorized representative describing the conditions. The method and place of warranty service will be specified by ACDC at its sole discretion. Authorized returns for warranty service should be forwarded to the specified service location freight prepaid, where, without charge, the unit will be repaired. The sole obligation of ACDC and purchaser's exclusive remedy under this or any other warranty, expressed or implied, is the repair or replacement or defective modules as provided above. ACDC shall not be responsible for incidental or consequential damage, whether or not foreseeable, caused by defects in the instrument. In-warranty units requiring calibration or mechanical damage repair will be charged.

ELECTRICAL STANDARDS

All ACDC instrument standards are either certified directly or traceable to certification by the National Bureau of Standards.

CLAIMS FOR DAMAGE IN SHIPMENT

This instrument received comprehensive visual, mechanical and electrical inspection prior to shipment from the factory. Please examine it carefully for external damage or evidence of internal damage immediately upon receipt from the carrier and prior to operation. Claims for damage should be filed with the carrier with a copy of the report forwarded to ACDC. Advice of disposition and/or arrangement for repair or replacement of the instrument will be made by ACDC or its authorized representative. Please include model and serial numbers in all correspondence.

DOCUMENTATION POLICY STATEMENT

ACDC reserves the right to change, add or delete components, materials or processes for the purpose of product improvement or replacement of obsolete material without prior notification to the customer.

INTRODUCTION

This manual contains the information necessary to operate, test, calibrate and service the ACDC Model EL301 Electronic Load Instrument Control Module. The Model EL301 is a sophisticated unit that requires competent technical personnel for servicing.

Model EL301 is wired for 115 VAC input. Model EL301-A for 220/240 VAC input and Model EL301-J for 100 VAC input are also available.

If any problem occurs that is not covered in this manual, please contact the nearest ACDC sales representative or write directly to ACDC Electronics Engineering Department.

Please include instrument serial number when writing for information.

EMERSON.
ACDC Electronics
Engineering Department
401 Jones Road
Oceanside, California 92054
Phone: (619) 757-1880

TABLE OF CONTENTS

SECTION I
SPECIFICATIONS

SECTION II
OPERATING INSTRUCTIONS

SECTION III
CIRCUIT DESCRIPTION

SECTION IV
APPLICATION NOTES

SECTION V
CALIBRATION AND MAINTENANCE

SECTION VI
REPLACEABLE ELECTRICAL PARTS AND COMPONENTS
SCHEMATIC DIAGRAMS

SPECIFICATIONS

EL 301

POWER REQUIREMENTS

105 to 125 VAC, 47 to 63 Hz, 1φ, 95W. Transformer tapped for 100/117/220/230/240 VAC.

OPERATING MODE

Constant current.

DYNAMIC LOADING

Allows switching between two current levels at a switch-selected rate of 60 Hz (line frequency). The two current levels are set by front panel controls.

DYNAMIC LOAD RESPONSE TIME

One microsecond per amp or 50 microseconds, whichever is greater.

REMOTE PROGRAMMING

(Constant Current) 0 to 10V is equal to 0 to 60A. Program voltage input impedance approximately 10KΩ.

METER RANGES

0 to 19.99A, 0 to 60A.

METER ACCURACY

±0.5% ±1 count.

OPERATING TEMPERATURE

0 to 40°C.

FRONT PANEL CONTROLS

Toggle switches turn Power On/Off and change meter range. Push button switches select load module. Rotary switch selects function.

FRONT PANEL INDICATORS

3-1/2 digit load current meter.

REAR PANEL

AC power connector, Fuse, Remote Program, and 6 input/output connectors.

ACCESSORIES

EL3SC - Bench top enclosure
EL3QR - Four position RETMA rack
EL3DP - Blank Dress Panel
EL3RC - 14" ribbon cable
EL3LC - Optional 12" line cord (115 VAC)
EL3AS - 8 position AC power strip
EL3PC - 5' DC power cables (pair)
EL3SB - Shorting bar

EL3SC - Bench top case for the EL300 and EL301. Steel enclosure with carrying handle and mounting pads. Painted textured blue. Size 14 1/4" x 5 3/4" x 5 1/8". The 5 3/4" height includes mounting pads.

EL3QR - Four-position rack. Accommodates any combination of up to four EL300 or EL301 units. Plated steel, unpainted. Size 19" x 5 1/4" x 13 3/8".

EL3DP - Blank panels for EL3QR rack. Used to blank out unused positions. Aluminum, black anodized.

EL3RC - Ribbon cable with connectors to interconnect EL301 to EL300 loads. One supplied with each EL301.

EL3LC - All units shipped with standard 7 ft. line cords. 12" optional cord used to eliminate lengthy power cords when EL300/EL301 units are rack mounted and connected to AC power strip.

EL3AS - Eight position power strip. Accommodates up to 8 EL300/EL301 instruments. Contains protective circuit breaker.

EL3PC - Pre-assembled load cables with terminals. AWG #6 wire.

EL3SB - Shorting bar for conducting short circuit tests on the EL300.

CONTROLS, CONNECTORS AND DISPLAYS

(REFERENCE FIGURES 1-1 AND 1-2)

THE CONTROL FUNCTIONS OF THE EL301 CAN BE USED FOR ONLY ONE OF THE SIX POSSIBLE EL300'S AT A TIME.

ITEM NO.	DESCRIPTION	FUNCTION
(1)	Digital Ammeter	Displays load current for the selected EL300.
(2)	Ammeter Range Switch	The ammeter range is selectable to approximately 20 amps and then 60 amps.
(3)	High Current Adjust	Is a 0-60 amp constant current adjust, and is for setting the upper load current for dynamic operation.
(4)	AC POWER Switch	Controls input power to run the EL301.
(5)	Function Switch	Is used to select the desired function for the chosen EL300.
(6)	Low Current Adjust	Is a 0-60 amp constant current adjust, and is for setting the lower load current for dynamic operation.
(7)	LOAD SELECT Switches	Six push button switches (are on when pushed in) that correspond to the six load jacks. Items 9 & 10.
(8)	External Program Jack	BNC Jack. By applying 0-10 VDC for controlling the selected EL300 from 0-60 amps.
(9)	Load Interconnect Jack #1	An EL300 connected to this jack is always supplied with an external bias from one of the two bias supplies in the EL301.
(10)	Load Interconnect Jacks #2-6	Only supply external bias to one EL300 at a time.
(11)	AC Cord Connector	For connecting the AC line cord.
(12)	Line Fuse	For 115 VAC, use 1.5 amp fuse; for 230 VAC, use 0.75 amp fuse.

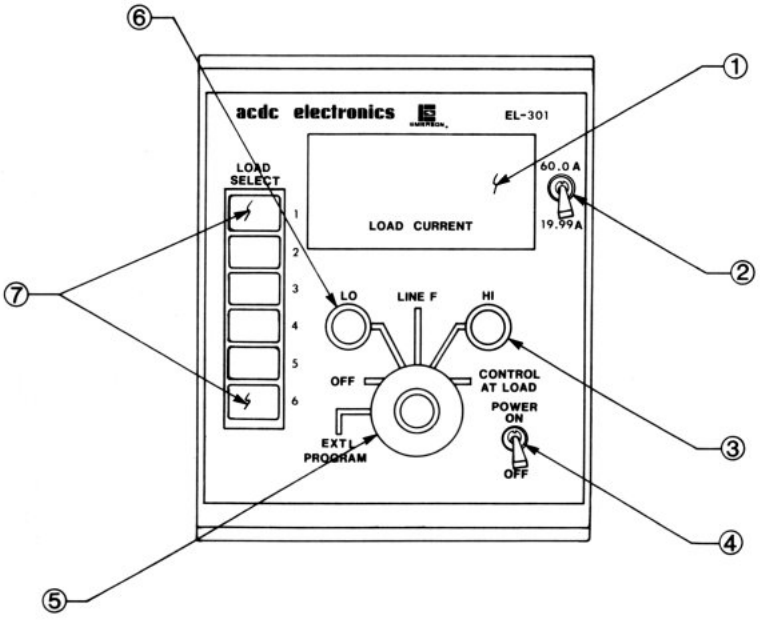


Figure 1-1

FRONT VIEW

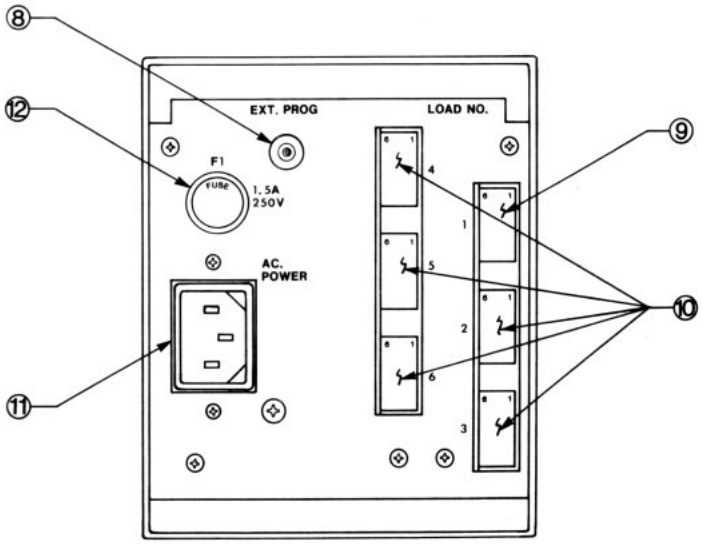


Figure 1-2

REAR VIEW

OUTLINE DIMENSIONS

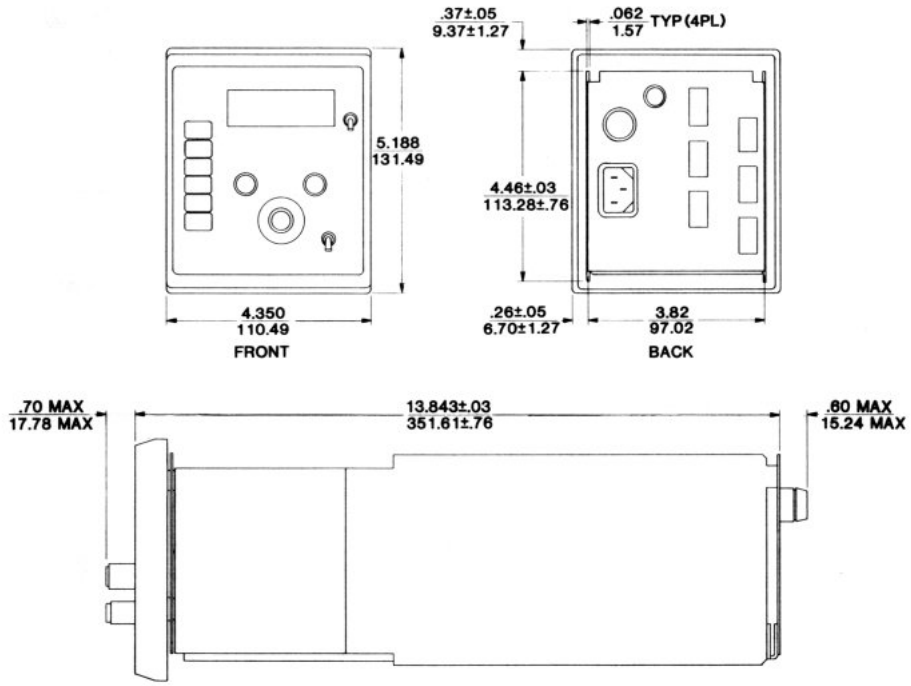


FIG. 1-3

NOTES:

1. XX.XX–INCHES
   XXX.XX–MILLIMETERS

SECTION II

OPERATING INSTRUCTIONS

OPERATING INSTRUCTIONS

(REFER TO FIGURE 1-1, CONTROLS, CONNECTORS AND DISPLAY)

SUMMARY OF OPERATION

An EL301 is an electronic load control module that is designed to control any one of up to six EL300 electronic loads. The EL301 expands the versatility of the EL300 from the standard resistive load to one that will maintain a constant load current independent of voltage. It also provides constant current 60Hz dynamic step loading from 0 to 100%; external 0 to 10 volt programming; remote load turn off; and a digital ammeter display of load current. In addition, the EL301 provides two 5 volt, 3 amp bias supplies for low voltage and zero (no load) current operation. One of the bias supplies is permanently connected to the number one interconnect jack. The second supply is switched between jacks 1 through 6 depending upon which load was selected with the front panel buttons for EL301 control. When using an EL300 with an EL301, the load switch on the EL300 functions normally so the switch must be in the "on" position for the load to be operational.

INTERCONNECTING AND SET-UP

The EL301 control module has six labeled interconnect sockets or jacks marked 1 through 6 on the rear panel to interface with up to six EL300's. The self bias programming plug must be removed from the EL300's in order to use the 14 inch ribbon interconnect cable (70-779-001). Each EL300 should have an interconnect cable plugged into the appropriate EL301 jack. Turn the AC POWER switch on the EL301 to the "on" position. Access a specific EL300 by depressing the appropriate LOAD SELECT switch on the EL301. The LOAD switch on the EL300 must be in the "on" position for remote access from the EL301.

LOW VOLTAGE OPERATION

The EL301 has two 5 volt, 3 amp bias supplies for operating up to two EL300's at full load (60 amps) with an EL300 terminal voltage as low as 1.8 volts. The number one interconnect jack has one of the two bias supplies connected to it at all times for loading low input voltages and assuring that no current will be drawn at no load. One of the remaining five sockets will be supplied a 5 volt, 3 amp bias voltage only when one of the LOAD SELECT positions 2 through 6 is choosen.

CONSTANT CURRENT OPERATION

The EL301 HI and LO load current settings give constant signal voltages. These constant current signals are independent of the load's input voltage; thus the load current can be set and used for a wide range of input voltages.

To operate in the constant current mode, turn on the AC power to the EL301 and to the EL300.

a. Set the EL300 front panel range and meter switches for the desired settings.
b. Turn on the power supply under test.
c. Set the LOAD switch on the EL300 to "on".
d. Push in the LOAD SELECT button on the EL301 that corresponds to the EL300 that is to be used, and set the EL301 ammeter range switch.
e. Turn the FUNCTION SELECT switch to either the HI or LO position and adjust the appropriate potentiometer for the desired load current.

RESISTANCE MODE

The EL300 will be supplied with external bias voltage when used in conjunction with the EL301. The front panel COARSE and FINE controls on the EL300 are still used for the resistive mode even with the load interfaced to the EL301. The EL301 in this case will display the load current and supply a bias voltage for low voltage supplies and for checking overload.

To operate in the resistive mode, apply AC power to the EL301 and EL300.

a. Turn the FUNCTION SELECT switch on the EL301 to CONTROL AT LOAD.
b. Set the ammeter range switch and the desired LOAD SELECT button on the EL301.
c. Adjust the COARSE and FINE controls fully counterclockwise and set the LOAD switch in the "on" position on the EL300.
d. Set the front panel meter and range switches to the desired positions on the EL300 and then turn on the power supply under test.
e. While monitoring the current, adjust the COARSE control clockwise until the EL300 starts to draw current.
f. Adjust the FINE control clockwise to the desired current.
g. If the FINE adjust will not reach the desired current, back off on the FINE control and increase the gain by turning the COARSE control clockwise.
h. Readjust the FINE control for the desired current.
i. Better resolution on the FINE control is achieved by adjusting the COARSE control counterclockwise, depending upon input voltage.

DYNAMIC LOADING IN THE CURRENT MODE

The EL301 has a constant current dynamic load feature that alternates between the HI and LO potentiometer settings at a 60Hz rate. The duty cycle for the dynamic load is fixed at 50%. Refer to the dynamic loading notes, section 2 of the EL300 manual, for additional information.

To use the constant current dynamic loading feature, turn on the AC power to the EL301 and the EL300.

a. Set the EL300 meter and range switches for the desired ranges.
b. Set the EL300 load switch to "on".
c. Set the EL301 LOAD SELECT button for the desired load and set the ammeter for the proper current range.
d. Turn the FUNCTION SELECT switch to HI and adjust both the HI and LO potentiometers fully counterclockwise.
e. Turn the power supply under test "on".
f. Adjust the HI potentiometer for the maximum current level, then switch to LO and adjust the minimum current level.
g. Turn the FUNCTION SELECT switch to LINE FREQUENCY for the 60Hz dynamic switching function.

EXTERNAL PROGRAM

The EL301 can be used to externally program an EL300 by using a 0 to 10 volt source for a proportional load current of 0 to 60 amperes. The external program signal is connected to the BNC connector located on the rear panel of the EL301. The input impedance for the program signal is greater than 10K ohms. To use the external program mode, the AC power to the EL301 must be on with the EL301 set up as follows:

a. Set the FUNCTION SELECT switch to EXTERNAL PROGRAM.
b. Set the ammeter range switch for the appropriate range.
c. Depress the LOAD SELECT button for the desired load.
d. Set the selected EL300 LOAD switch to "on" and follow the procedures outlined for the EL300 to handle the required power and for the proper meter settings.

A DC signal level or a combination of DC and AC signal levels can be applied to the program input of the EL301.

The peak input voltage must be limited to 10 volts for whatever combination of DC load and dynamic load conditions wanted. Refer to application notes for suggested methods to apply these signals.

DIGITAL AMMETER

The digital ammeter is used to measure the load current and give a digital indication of it with 2% accuracy ± 1 count. The accuracy of the ammeter is dependent upon the accuracy of the setting of the calibrated meter output of the EL300. The accuracy difference between inputs for the various loads going to an EL301 is minimal.

The ammeter processes the -2.5mV/A current signal that is taken from the shunt of the selected EL300. The LOAD SELECT buttons are used to switch the ammeter current signals one at a time or none at all. The ammeter has two manually selected current ranges labeled 19.99 amps and 60 amps. The 60 ampere range is only a label that is a reminder that the useful range of the EL300 is limited close to this point. In actuality the 60A range is limited at 199.9 amperes. When the ammeter reaches its overflow point, the most significant digit will display a "1" and blank the least significant digits.

SECTION III

CIRCUIT DESCRIPTION

EL301 CIRCUIT DESCRIPTION

INTRODUCTION

The circuitry used in the EL301 control module is described in the order that the circuit boards process the load control signals from the EL301. The description starts off with the switch board assembly and how the signal paths are brought into the EL301. The power supply board assembly is then described with its two external bias supplies for powering two EL300's, the ±5 volt supplies that power the EL301, and the external program amplifier. The meter board assembly covers the functions and descriptions of the "FUNCTION SELECT" switch, the "HI" and "LO" adjust, and digital ammeter. Finally, the meter board assembly is described with its chopper-stabilized DC amplifier and dynamic switching logic. All descriptions are referred initially to the simplified overall schematic and associated board schematics.

SWITCH BOARD ASSEMBLY

(Refer to the simplified and switch PCB schematics)

All the internal input and output voltage signals enter and leave by way of the six interconnect sockets located on the rear panel of the EL301. The six sockets are labeled one through six and correspond with the six front panel "LOAD SELECT" buttons. When the load select buttons are off (out), the EL300's connected through the interconnect sockets are in their standard resistive mode. The EL301 is in essence not connected to the EL300's in this condition because the switch arrangement routes the signals back for individual resistive load control; however, the EL301 supplies a 5 volt/3 amp isolated bias voltage from the "B" supply to the EL300 connected to the number one jack. The bias voltage allows low voltage operation for the one load while the other EL300's draw bias current from their respective power supplies under test. Pushing in (on) one of the six load select buttons mechanically locks out the remaining five and switches in the 5 volt/3 amp bias "A" supply for low voltage operation. When a load is selected, the load current will be displayed on the digital ammeter and the load will then be under the control of the EL301.

POWER SUPPLY BOARD ASSEMBLY

(Refer to simplified and power supply schematics)

EXTERNAL PROGRAM CIRCUIT

A female BNC connector located on the rear panel of the EL301 is used for externally inputting a 0 to 10 volt source to control the selected EL300 from 0 to 60 amperes. The external program input is fed to the input of a voltage divider comprised of R20 and R21, then fed to the non-inverting input of IC4-a. The zero point of the circuit is set by R22 so that the output of IC4-a is 60mV into a 11.5K load impedance for zero volts external program input. The output of IC4-a is then directed to the "FUNCTION SELECT" switch. When "EXTERNAL PROGRAMMING" is selected, the signal goes directly to the EL300.

"A" AND "B" BIAS SUPPLIES

The two 5 volt/4 amp bias supplies used in the EL301 for low voltage operation are standard series pass, linear regulators. The regulators, comprised of IC1 and IC2, use the 723 with its overload capabilities, and POWER TRANSISTORS AS PASS ELEMENTS, Q1 and Q2. The output voltage of IC1 and IC2 is set by the individual voltage dividers (R4 and R6) across the reference of the 723. The output voltage is sensed by the error amplifier via pin 4 of the 723.

INTERNAL 5 VOLT BIAS SUPPLIES

The EL301 requires ±5 volts to operate its amplifiers, display and logic circuits. The +5 volt supply is a three-pin series-pass regulator, IC3. The -5 volt supply consists of R7 and CR7 forming a shunt regulator. Both the positive and negative supplies share a common ground with the "A" supply.

FRONT PANEL BOARD ASSEMBLY

(Refer to the simplified and front panel schematics)

FUNCTION SELECT SWITCH

The function switch (S2) is a two pole, six position rotary switch located on the front panel of the EL301. It selects the proper load control signal to apply to the selected EL300 from one of the following functions:

1. Local control at load.
2. High adjust.
3. Dynamic switching at 60Hz.
4. Low adjust.
5. Off.
6. External program.

In the "CONTROL AT LOAD" position, the resistive load current signal coming from the selected EL300 via J1/P1-10 is returned to P1/J1-5 so that the load can be operated by its controls and yet display the load current. For the "HIGH" and "LOW" positions the load control signal is a constant current signal from R4 and R3 respectively. When the "FUNCTION SELECT" switch is in either of these modes the 60Hz sync signal is grounded on one side and toggles the analog switch IC7 on the metering PCB assembly.

The dynamic switching position on the EL301 alternates the constant current signals between the "HIGH" and "LOW" settings at a 60Hz repetition rate and with a fixed 50 percent duty cycle.

The "OFF" position grounds the load control signal to the "A RETURN" or "POWER COMMON". This prevents the load from drawing any current.

The "EXTERNAL PROGRAM" position connects the output of IC4-a from the power supply board assembly directly to the EL300 connected to it. Thus for a 0 to 10 volt input signal to the external program connector, IC4-a outputs a proportionally linear signal to the EL300 for a respective 0 to 60 amp load current.

"HI" AND "LO" CURRENT ADJUST

R4 and R3 are the "HIGH" and "LOW" constant current adjust potentiometers respectively. The control signal is taken from the divided down positive bias voltage and is dependent upon the settings of R4 and R3. The voltage signal then goes to the metering PC board assembly to the analog switches of IC7. When the function switch is set in either the "HI" or "LOW" positions, it grounds one of the 60Hz sync lines which forces IC6 to toggle, turning on the appropriate pair of analog switches of IC7 on the metering PC board assembly. The selected current signal then goes to the respective load.

DIGITAL AMMETER CIRCUIT

The digital ammeter uses the ICL7107, 3 1/2 digit A/D converter (IC1) as the heart of the circuit with an external one volt reference, comprised of CR1, R10 through R12, that provides added stability. The input to the A/D converter (pins 30 and 31) comes from the chopper-stabilized meter amplifier on the metering PC board. The amplified current signal from the shunt resistor of an EL300 is then compared with the one volt reference and processed in the A/D converter giving the displayed current value. The current is displayed on the four seven-segment displays, D4 through D1. The decimal point and the current range are selected with the double-pole, double-throw switch S1.

METERING BOARD ASSEMBLY

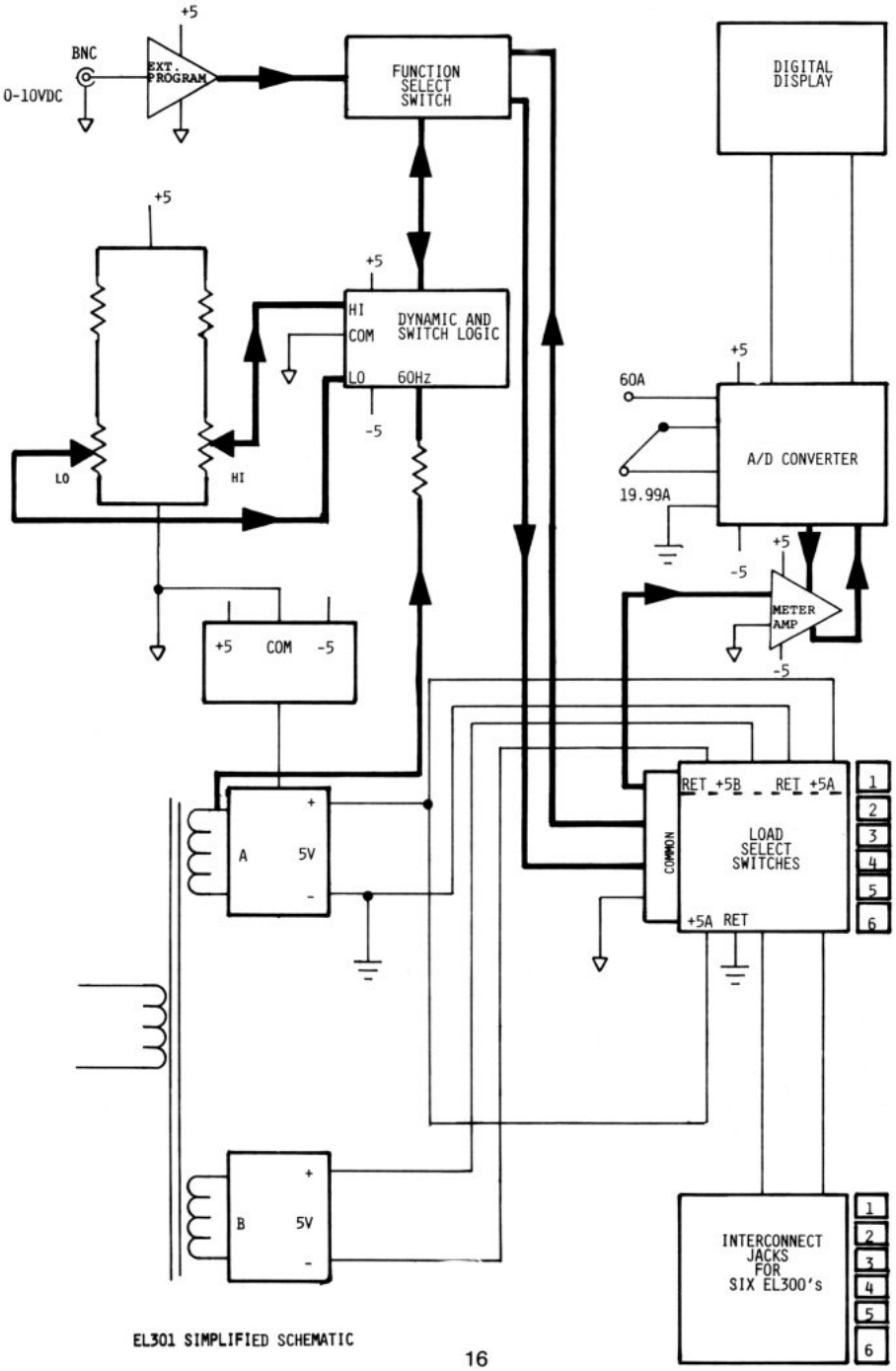
(Refer to the simplified and metering PCB schematics)

CHOPPER-STABILIZED DC METER AMPLIFIER

This amplifier takes the low -2.5mV/A meter shunt signal and amplifies it to a level that can be read directly by the A/D converter. The active components of the amplifier are IC1 through IC3, and IC4, IC5 and Q1 which form the frequency divider to provide the 100Hz modulator and demodulator switching signal from the oscillator output of the A/D converter. The meter shunt signal is first conditioned by the low pass filter comprised of R9, C1 and R10, then applied to the input of the modulator (IC3) which then chops the DC signal into two AC square waves. The two AC signals are then applied to the inputs of their respective op-amps (IC2) whose gain is selected by the ammeter range switch S1-A. The amplified AC signal is reassembled into the appropriately amplified DC current signal that is seen at the A/D converter input. The advantage of using a chopper-stabilized DC amplifier over other designs is its inherent low drift and excellent stability.

DYNAMIC AND SWITCH LOGIC

The functional components for the switching logic are IC6, IC7 and the "FUNCTION SELECT" switch (S2) located on the front panel. When S2 is set to "LINE FREQUENCY", two 60Hz sync signals that are 180 degrees out of phase are applied to the set (pin 8) and reset (pin 10) inputs of IC6. The two 60Hz signals originate from T1 on the power supply PC board assembly and cause IC6 to toggle the Q and $\overline{Q}$ outputs (pins 13 and 12) at a 60Hz rate. The outputs of IC6 then drive the analog switch pairs of IC7 to alternate between the "HIGH" and "LOW" current signal settings. If S2 is turned to either the "HI" or "LO" position, the set or reset pins of IC6 will be grounded respectively thus toggling IC6 to turn on the appropriate pair of analog switches and hold their state.



EL301 SIMPLIFIED SCHEMATIC

APPLICATION NOTES

AC AND DC DRIVE SIGNALS

The circuit in figure 4-1 demonstrates how to mix an "AC" square wave with a "DC" drive signal for a composite dynamic drive signal. The dynamic load signal can be maintained on an EL300 for a variable duty cycle or for switching frequency other than what is provided by the EL301. For the circuit indicated in figure 4-1, the minimum load current is set by the 0 to 10 VDC programmable, and the maximum load current step and frequency are set by the 20Hz-50KHz waveform generator where 10 volts equals 60 amps and 1 volt equals 6 amps. The peak amplitude of the input waveform to the EL301 should be limited to 10 volts peak. For additional information, see the section on external programming under the operating instructions for the EL301.

RESISTIVE DRIVE SIGNALS

Using the circuit in figure 4-2, the EL301 can be used to program the EL300 to act as a fix resistor within the range of 0.012 to 55 ohms. Connect the sense leads, noting polarity, and connect to the load terminals of the EL300 being used. Then connect the circuit to the external program input of the EL301.

To compute the program resistor, Rp, the following expression is to be used:

$$Rp = 1.5 \times 10^{4} R$$

Where R is the actual resistance that the load is to simulate.

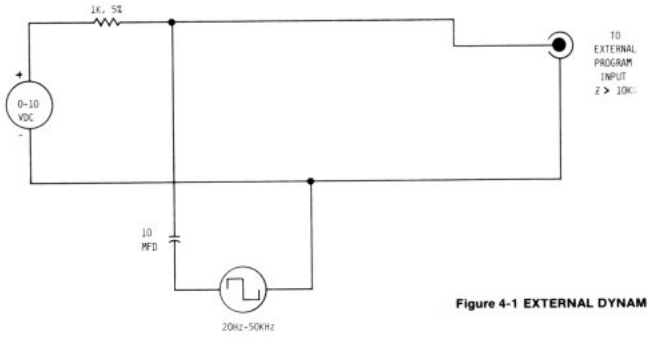


Figure 4-1 EXTERNAL DYNAMIC LOADING

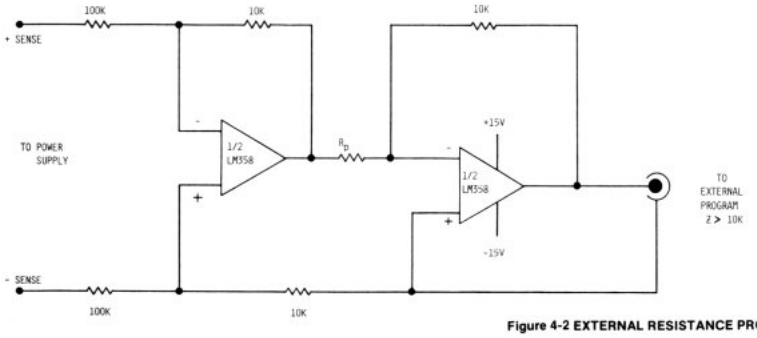


Figure 4-2 EXTERNAL RESISTANCE PROGRAMMING

SECTION V

MAINTENANCE AND CALIBRATION

CALIBRATION

The following procedure is used for calibrating the EL301 Electronic Load Control Module.

TEST EQUIPMENT

The following test equipment (or equivalent substitute) is required for performing the tests described herein.

Voltmeter, 4 1/2 digit, Fluke 8050A
Oscilloscope, Tektronics 5440
Plug-in, Vertical, Tektronix 5A48
Plug-in, Horizontal, Tektronix 5B48
14 inch programming cable (70-779-001)
Shunt, 50mV/5 amps
Shunt, 100mV/100 amps
Calibrated EL300
Hipot, 1414 VDC and 707 VDC slaughter 103/105-1.0
0-10 VDC, 50mA programmable power supply, HP6291A
5V; 60A power supply, RS5N60

HIPOT (DIELECTRIC WITHSTAND TEST)

Hipot tests must be performed with the number one and two interconnect jacks shorted as described below, with the AC Power Switch in the ON position and the number 2 LOAD SELECT button in. Make two shorting plugs by connecting pins 1,3,4,5,6,8,9, and 10 with #24 AWG TC wire on each connector. Connector housing ACDC part number 70-820-010; pins for connector ACDC P/N 70-352-002. Slowly increase the hipot voltage for the following tests.

1414 VDC: AC input to number 1 and 2 interconnect jacks, and AC input to chassis.

707 VDC: Number 1 and 2 interconnect to chassis.

A AND B BIAS SUPPLIES

This test is to verify the functionability of the two bias supplies. Use the test set-up in Figure 5-1 with a voltmeter and an oscilloscope. Monitor the output during full load and no load tests at the number 1 interconnect jack.

Have all the LOAD SELECT switches out to test the B supply and load it to full load, 3 amps. Note that the output voltage at no load and at full load is within 4.6-6.0 volts.

Verify that the overload is folding the current back with 3.3-3.9A.

Verify with an oscilloscope that no high frequency waveforms exist in the output when going from no load to full load with the exception of the 120Hz ripple component.

Push the number one LOAD SELECT switch in to connect the A supply to the test set up and repeat the above test procedure for the B supply.

HI, LO AND DYNAMIC FUNCTIONABILITY

Use the test set-up in Figure 5-1 with the bias supplies at no load. Measure across R1 on the test set-up with an oscilloscope and check for spurious noise signals while adjusting potentiometers.

Verify that the HI and LO potentiometers both adjust up to 1.35-1.65V without any frequency components above 120Hz.

Check dynamic switching by setting the HI to its maximum output and the LO to zero then switch to LINE FREQUENCY and verify that there is a 60Hz signal.

Disconnect the test plug from the number one jack and connect it to the next jack until all six have been accessed, and push in the respective LOAD SELECT switch to verify that the 60Hz signal and the 5 volt bias supply are present at all jacks.

AMMETER CALIBRATION

Use the test set-up in Figure 5-2 to perform the following tests. Set the FUNCTION SELECT switch to CONTROL AT LOAD with the number one select switch pushed IN and the ammeter range to 19.99A with power ON, on the EL301.

Leave the load switch OFF and adjust the load controls fully counterclockwise initially, on the EL300, with the power on.

Apply power to the 5 volt, 60 amp power supply.

Verify that the ammeter display on the EL301 reads 0.00 ±1 digit, when zero current is being drawn.

If the ammeter does not read zero for zero load current, adjust R11 on the metering PCB for 0.00 ±1 digit on the display.

Flip the load switch ON and adjust the load controls on the EL300 to draw 10.00±0.005 amps according to the external shunt. Adjust R5 on the metering PCB for 10.00 ±1 digit if the display is not reading correctly. Change the ammeter range switch on the EL301 to 60A. Adjust the load controls on the EL300 for 60.0±0.05 amps.

The ammeter on the EL301 should now read 60.0 ±1 digit. To adjust the 60 amp meter reading adjust R2 on the metering PCB.

Flip the load switch OFF and change the EL301 ammeter scale back to 19.99 and verify the zero current reading.

EXTERNAL PROGRAM CALIBRATION

Use the test set-up in Figure 5-2 to perform the following tests. Apply zero volts or a short to the J4 BNC connector (external program input) that is located on the rear panel of the EL301, with the function select switch turned to EXTERNAL PROGRAM.

Apply AC power to the EL300 and the 5 volt, 60 amp power supply and flip the EL300 load switch ON.

Push in the number 1 LOAD SELECT button on the EL301 and note that 0.0-0.1mA is being drawn. If not, adjust R22 on the power supply board assembly.

Apply 100±1 millivolts to J4; the load current according to the external shunt should read 0.6±0.01 amps. Adjust R22 if necessary for the 0.60 amp load current.

Apply 10.0±0.01 volts to J4, the load current should be 60.0±0.05 amps according to the external shunt. If not, adjust R21 on the EL301 power supply PCB.

Recheck load current for programmed inputs of 100mV and 0.0mV.

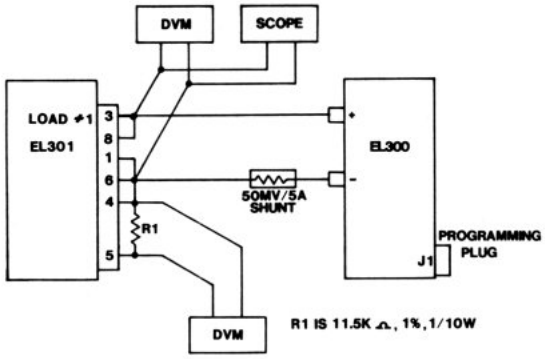


Figure 5-1

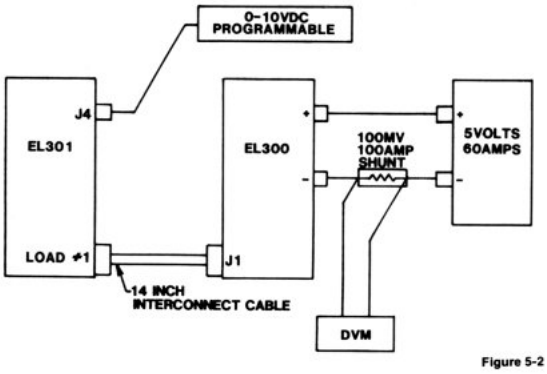
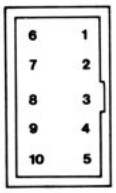


Figure 5-2



PIN LAYOUT OF THE
INTERCONNECT CONNECTORS

Figure 5-3

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, calibration and corrective maintenance for the EL300/EL301.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of the instrument. The severity of the environment to which this instrument is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding adjustment of the instrument.

CASE REMOVAL

********** WARNING **********

Dangerous voltages exist at several points throughout this instrument. When the instrument is operated with the case removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect power before cleaning the instrument or replacing parts.

The case is held in place by one screw located on the back panel. To remove the case, remove the pan head screw and washers. The instrument will slide out the front of the case.

HEAT RADIATOR ACCESS (EL300)

To gain access to the power transistors on the heat radiator, remove the right side panel. First loosen the two 7/64 inch Allen-head screws holding the panel onto the front bezel at the top and bottom. Next, remove the four pan-head screws that hold the panel to the heat radiator extrusion. The panel can now be removed to expose the power and driver transistors.

CLEANING

This instrument should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient head dissipation which can cause overheating and component breakdown.

********** CAUTION **********

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

EXTERIOR

Loose dust accumulated on the front panel can be removed with a soft cloth or small brush. Dirt that remains can be removed with a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

INTERIOR

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low pressure air. Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

VISUAL INSPECTION

This instrument should be inspected occasionally for such defects as broken connections, improperly seated connectors, damaged circuit boards and heat-damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

SECTION VI

SCHEMATICS

COMPONENT LISTS

REPLACEABLE ELECTRICAL PARTS

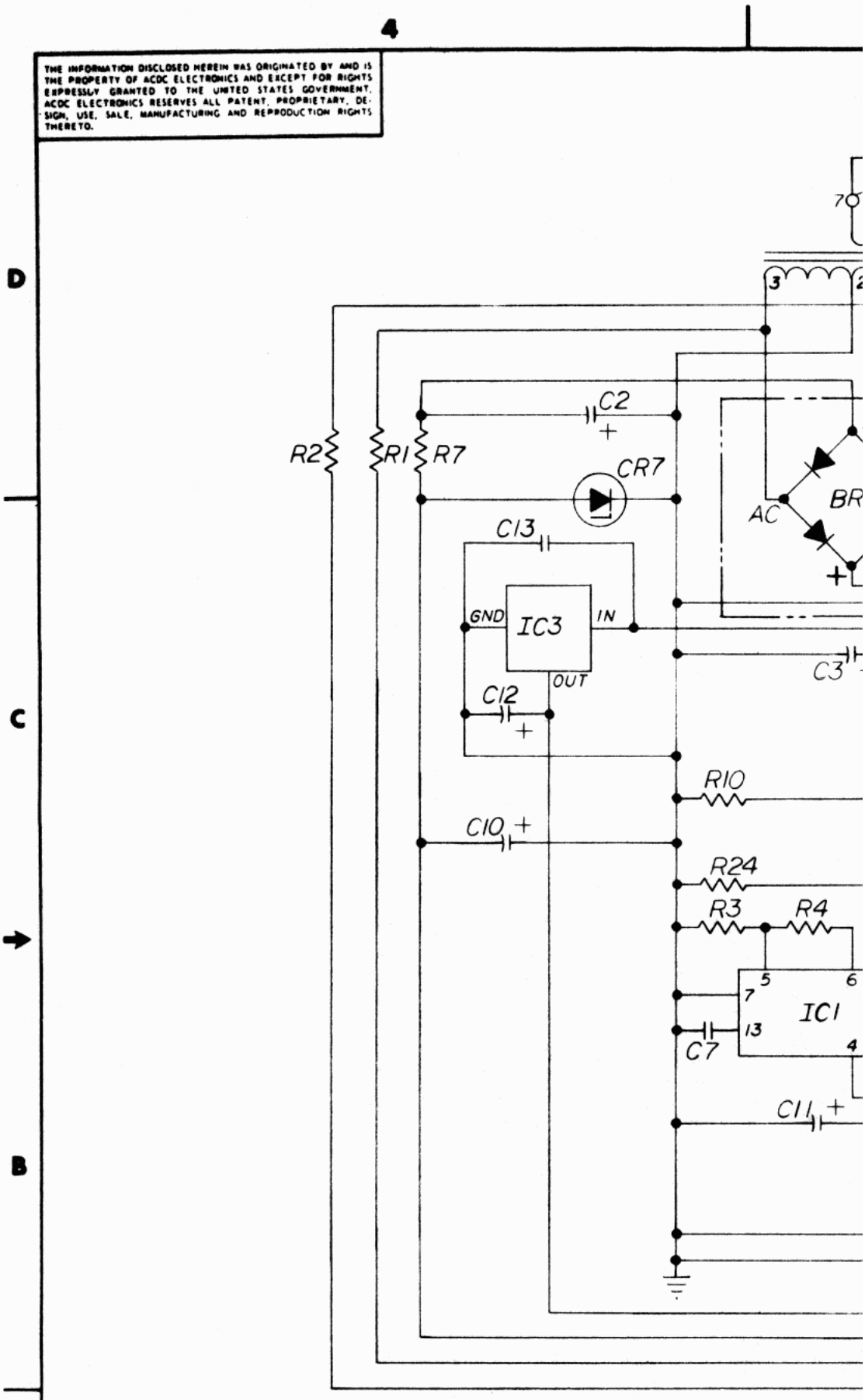
The information in this section is for reference only. Schematics may or may not include all revisions. Contact the factory for information pertaining to the current list of materials.

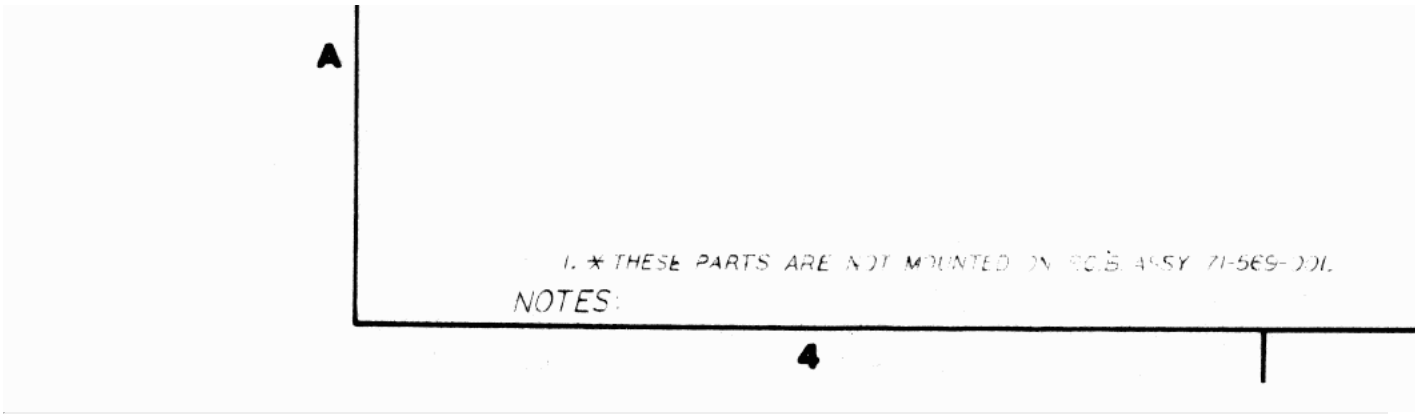
Manufacturer call-outs are for reference only. The equipment may or may not use listed manufacturers.

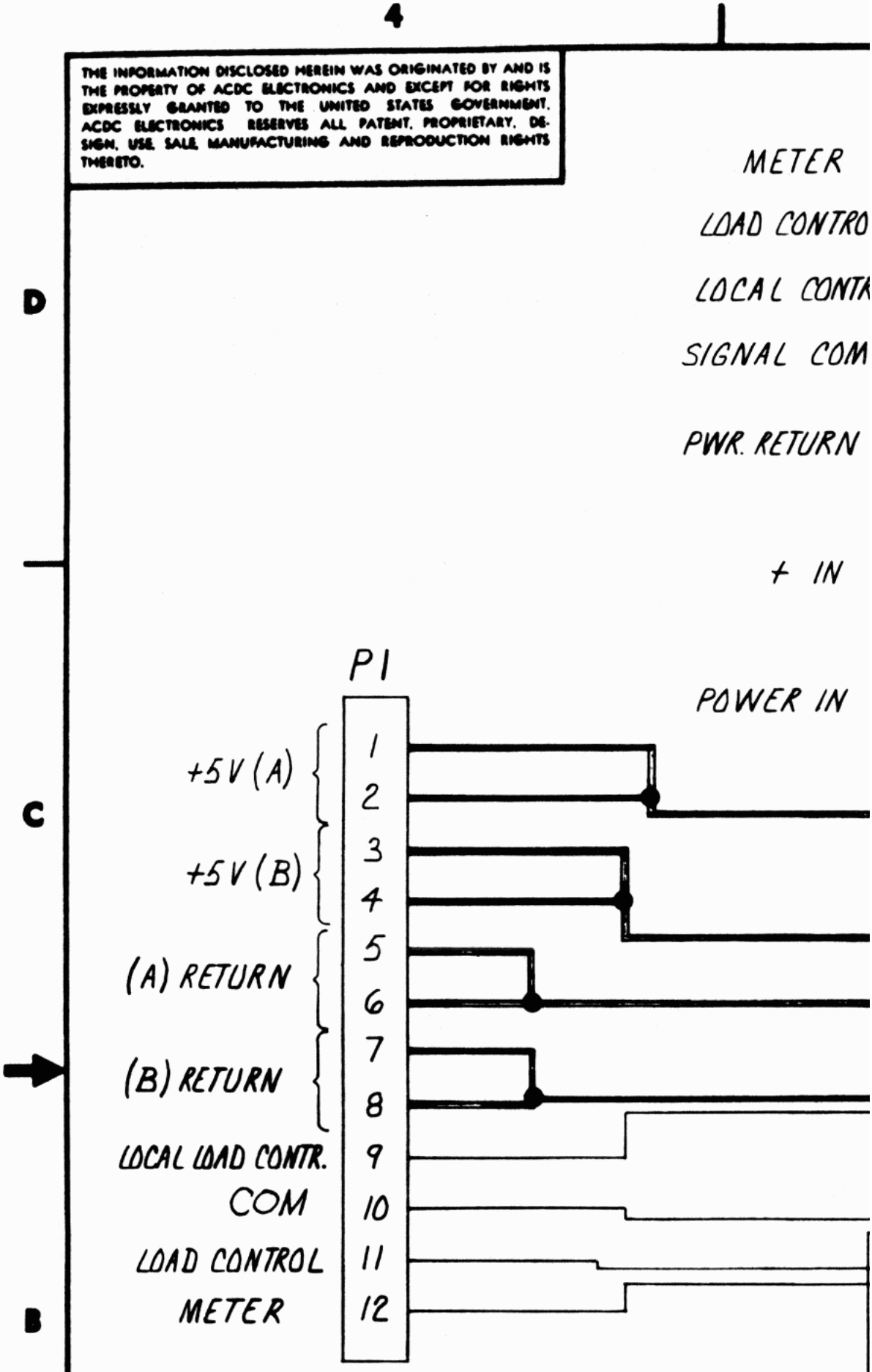
Replacement parts are available from ACDC Electronics, 401 Jones Rd. Oceanside, Calif. 92054. Direct all enquiries to the CSO department when ordering parts; include model number, ACDC part number, reference designator, and component value or description.

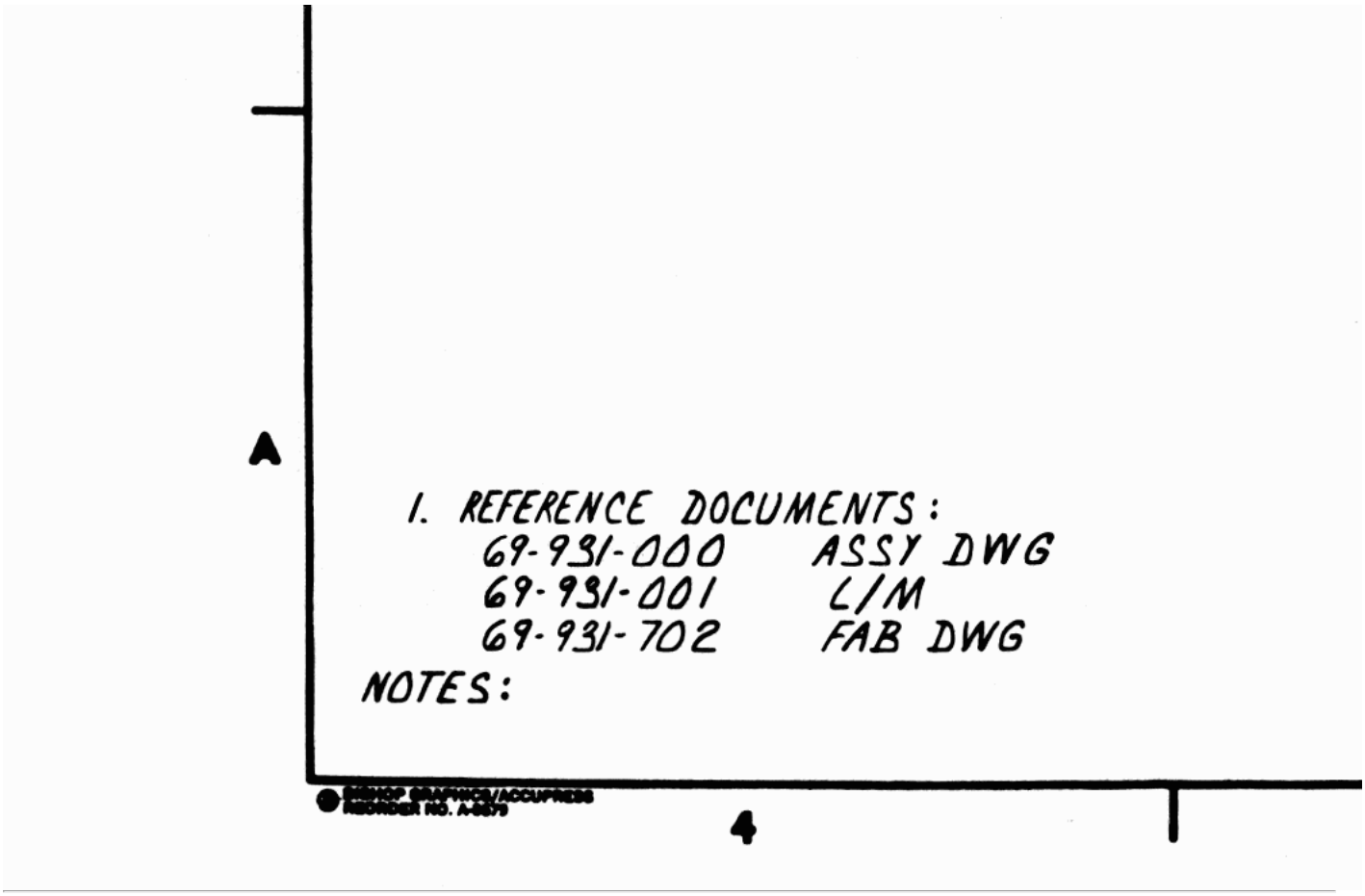
LIST OF MANUFACTURERS

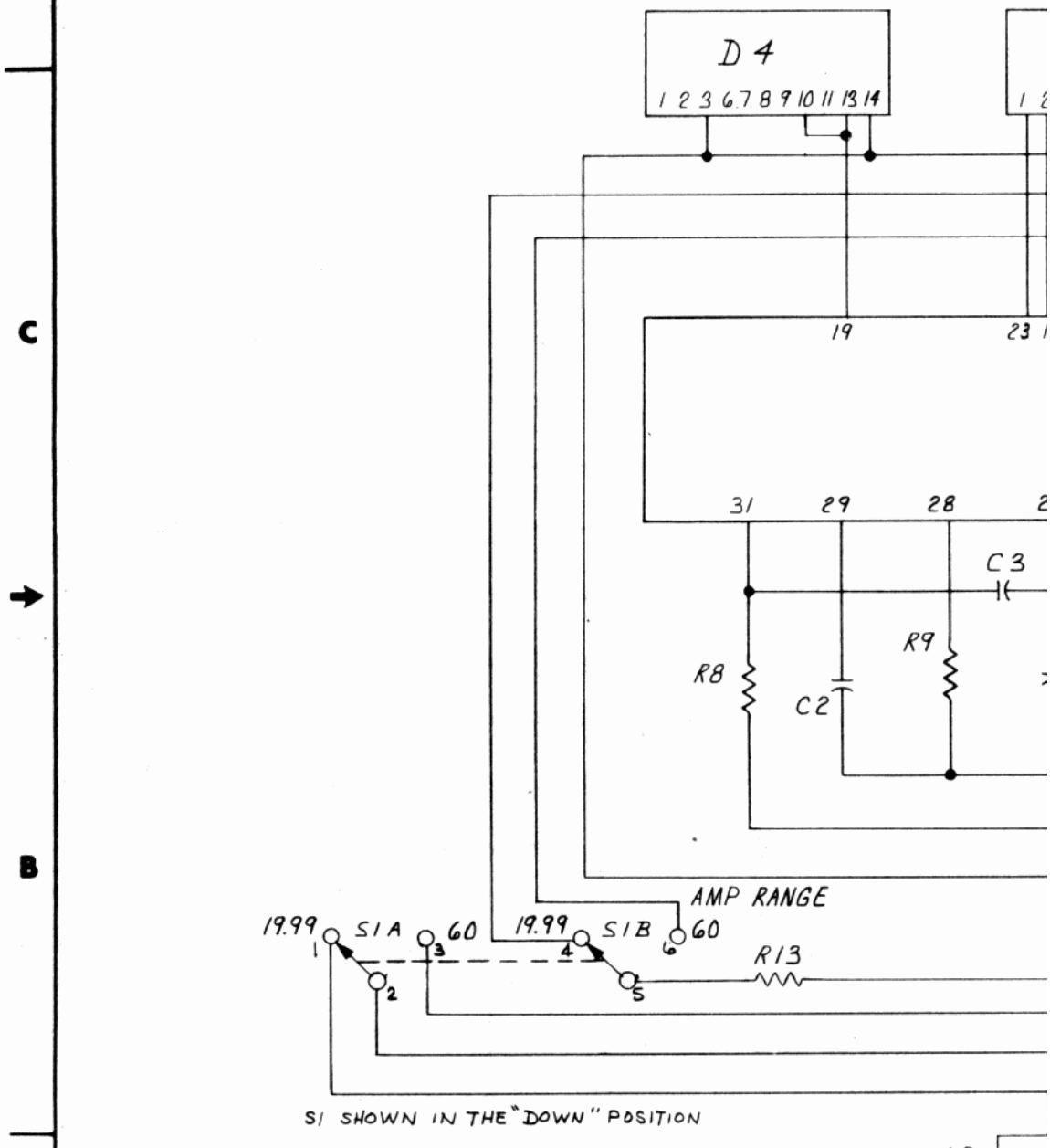
ACDC	ACDC Electronics, Div. of Emerson Oceanside, Calif. 92054
AD	Analog Devices, Inc. Norwood, Mass. 02062
AVX	AVX Ceramics Myrtle Beach, So. Carolina 29577
BOU	Bourns. Inc. Riverside, Calif. 92507
BUSS	Bussman Manufacturing St. Louis, Mo. 63178
CK	C & K Components, Inc. Newton, Mass. 02158
CRL	Centralab Electronics Div. Milwaukee, Wisc. 53201
CTS	CTS Corp. Elkart, Ind. 46514
DALE	Dale Electronics, Inc. Norfolk, Nebraska 68701
FAIR	Fairchild Camera & Instruments Mountain View, Calif. 94042
GI	General Instrument Optoelectronics Palo Alto, Calif. 94304
ILL	Illinois Capacitor Inc. Morton Grove, Ill. 60053
IMC	IMC Magnetics Rochester, N.H. 03867
MAL	Mallory Capacitor Co. Huntsville, Ala. 35801
MEP	Mepco/Electra, Inc. Morristown, N.J. 07960
MOD	Modutec, Inc. Norwalk, Conn. 06854
MOL	Molex, Inc. Lisle, Ill. 60532
MOT	Motorola Semiconductor Products Phoenix, Ariz. 85036
NSC	National Semiconductor Corp. Santa Clara, Calif. 95051




A
1. ★ THESE PARTS ARE NOT MOUNTED ON P.C.B. ASSY 71-5ES-001.
NOTES:
4




A
1. REFERENCE DOCUMENTS:
69-931-000 ASSY DWG
69-931-001 L/M
69-931-702 FAB DWG
NOTES:
4



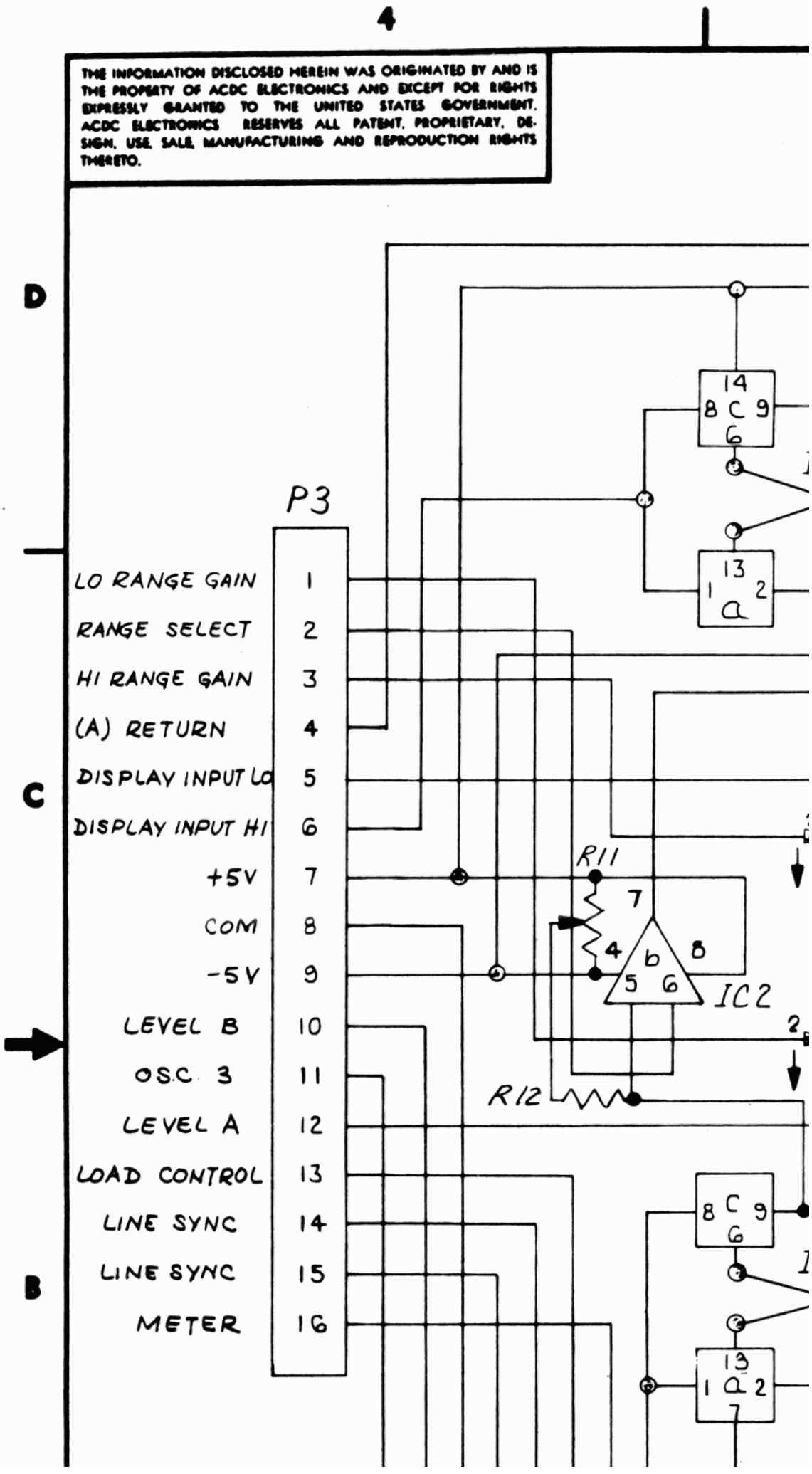
A

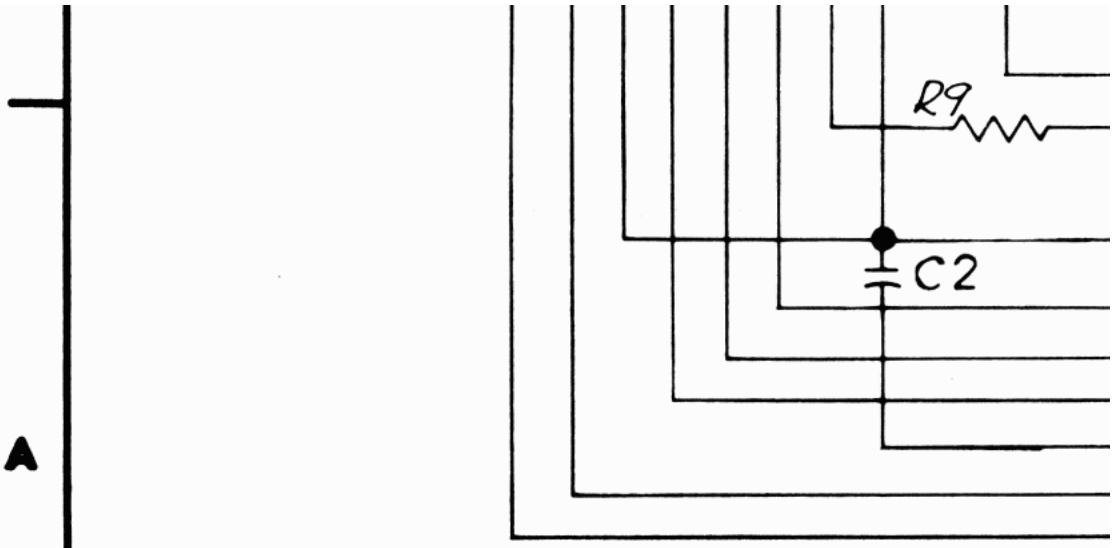
1. REFERENCE DOCUMENTS:

69-932-000	ASSEMBLY DRAWING
69-932-001	L/M
69-932-702	FAB DRAWING

NOTES:

4





A

1. REFERENCE DOCUMENTS
69-933-000 ASSEMBLY DRAWING
69-933-001 L/M
69-933-702 FAB DRAWING

NOTES:

4

EL301B
PCB PWR SPLY ASSEMBLY
71-569-001 (REV.B)

REF.DES.	DESC.	SUGGESTED MANUF/TYPE		ACDC P/N
C1	Cap	ILL 228RMR025M	2200mf/25V	62-708-029
C2	Cap	ILL 336RAR016B	33mf/16V	62-708-021
C3,5	Cap	MAL CG113U015R3C3PH	11000mf/15V	59-238-113
C4,6	Cap	ILL 227RAR035B	220mf/35V	62-708-009
C7,8	Cap	MUR RC1-332	0.0033mf/100V	67-159-332
C9,11	Cap	ILL 337RAR010B	330mf/10V	62-708-022
C10,12	Cap	MAL TDC225M020NSE	2.2mf/20V	58-577-006
C13	Cap	CERA 563CY5SRE250EH104Y	0.1mf/16V	58-929-006
CR5,6	Diode	MOT 1N4004		50-464-003
CR7	Diode	MOT 1N751A		51-739-023
IC1,2	Int.Ckt.	FAIRCHILD 723		66-780-000
IC3	Int.Ckt.	MOT MC7805CT		64-067-105
IC4	Int.Ckt.	MOT MLM358P1		62-331-013
Q1,2	Trans	RCA 2N3771		54-031-016
Q3,4	Trans	MOT TIP31A		54-031-074
R1,2	Res	220.0K 5% 1/4W		55-675-224
R3,5	Res	1.74K 1% 1/10W		57-757-324
R4,6	Res	825.0 Ohm 1% 1/10W		57-757-289
R7	Res	150.0 Ohm 5% 1/4W		55-675-151
R8,9	Res	100.0 Ohm 5% 1/4W		55-675-101
R10,14	Res	3.57K 1% 1/10W		57-757-354
R11,15	Res	470.0 Ohm 5% 1/4W		55-675-471
R12,16	Res	OMIT		
R13,17	Res	0.12 Ohm 5% 5W		52-441-128
R18,19	Res	10.0K 1% 1/10W		57-757-401
R20	Res	15.0K 1% 1/10W		57-757-418
R21	Pot	SPEC 63P202T010	2.0K 10% 1/2W	68-715-202
R22	Pot	SPEC 63P201T010	200.0 Ohm 10% 1/2W	68-715-201
R23	Res	12.4K 1% 1/10W		57-757-410
R24,25	Res	10.0K 5% 1/4W		55-675-103
S3	Switch	CKU21-AV2-P3-Q-E		58-964-010

PCB ASSEMBLY FRONT PANEL
69-932-001 (REV. G)

REF.DES.	DESCRIPTION	SUGGESTED MANUF/TYPE	ACDC P/N
C1	Capacitor	120pf/1KV MUR GPK-121KA	52-231-121
C2	Capacitor	0.047mf/80V MAL M192P473R8	54-435-473
C3	Capacitor	0.1mf/100V MUR RC1-104	67-159-104
C4	Capacitor	0.22mf/80V MAL M192P224R8	54-435-224
C5	Capacitor	0.1mf/80V MAL M192P104K1R	54-435-104
CR1	Diode,Zener	MOT 1N823A	51-739-006
CR2,3	Diode	MOT 1N5297	60-471-004
D1-4	Dig.Display	MON MAN71A	69-686-001
IC1	Int.Ckt.	INT ICL107CPL	69-336-001
R7	Resistor	100K 1% 1/10W	57-757-501
R8	Resistor	1 Meg 5% 1/4W	55-675-105
R9	Resistor	470K 5% 1/4W	55-675-474
R10,13	Resistor	470 Ohm 5% 1/4W	55-675-471
R11	Resistor	3.48K 1% 1/10W	57-757-353
R12	Resistor	17.8K 1% 1/10W	57-757-425
R3,4	Pot	2.5K 30% 2W CTS ST7563	69-683-003
S1	Toggle Switch	CK U21-P3-D9C-Q-E	58-964-013
S2	Rotary Switch	6 Pos 2 ckt CTS SP10856	69-684-001

PCB ASSEMBLY - METERING BOARD
69-933-001 (REV.B)

REF.DES.	DESCRIPTION	SUGGESTED MANUF/TYPE	ACDC P/N
C1	Capacitor	0.047mf/50V CRL CY15C473M	56-137-008
C2	Capacitor	0.01mf/25V SPR HY-520	58-929-003
IC1,3,7	Int.Ckt.	RCA CD4066B	69-298-004
IC2	Int.Ckt.	MOT LM358N	62-331-013
IC4,6	Int.Ckt.	RCA CD4013B	69-298-001
IC5	Int.Ckt.	RCA CD4518B	69-298-006
Q1	Transistor	MOT 2N4403	52-725-013
R1	Resistor	10.5K 1%,1/10W	57-757-403
R3	Resistor	7.50K 1% 1/10W	57-757-385
R4	Resistor	20.5K 1% 1/10W	57-757-431
R6	Resistor	845 Ohm 1% 1/10W	57-757-290
R7	Resistor	4.7K 5% 1/4W	55-675-472
R8	Resistor	100K 5% 1/4W	55-675-104
R9	Resistor	1K 1% 1/10W	57-757-301
R10	Resistor	10.0K 1% 1/10W	57-757-401
R12	Resistor	1 Meg 5% 1/4W	55-675-105
R2	Pot	1K 10% 1/2W SPEC 63X102T010	68-716-102
R5	Pot	100 Ohm 10% 1/2W SPEC 63X101T010	68-716-101
R11	Pot	50K 10% 1/2W SPEC 64X503	68-192-503

CHASSIS ASSEMBLY (REAR)
70-399-001 (REV. A)

REF.DES.	DESCRIPTION	SUGGESTED MANUF/TYPE	ACDC P/N
F1	Fuse	1.5A/250V BUSS AGC1-1/2	51-533-037
J3	AC Pwr. Conn.	SWITCHCRAFT EAC-302	65-737-000
J4	BNC Conn.	AMP 31-010	69-687-001

PCB ASSEMBLY - SWITCH BOARD
69-931-001 (REV. F)

REF.DES.	DESCRIPTION	SUGGESTED MANUF/TYPE	ACDC P/N
J4-6	Header Conn.	AMP 87576-2	70-558-010
P1	PCB Conn.	AMP 86105-3	69-911-012
S4	Switch	CRL PB10-6S-8PPC	69-685-001

FINAL ASSEMBLY
69-689-115/230 (REV.C/C)

REF.DES.	DESCRIPTION	SUGGESTED MANUF/TYPE	ACDC P/N
	Line Cord(115V)	Belden 17250	65-736-000
	Line Cord(230V)	Pac C-2123-02M-GY	65-736-001
	Harness AssY	ACDC	70-779-001
T1	Transformer	ACDC	53100
	Knob-Control	GR 100SK	70-546-000
	Knob-Control	GR 100SK	70-545-001