# XCITE
# Owner's Manual

Xcite 1200-1 & 1200-6 Linear Exciter System

- 1206-8-T/C Exciter Head (1200-1 Exciter System)
- 1207-8-T/C Exciter Head (1200-6 Exciter System)
- 1204-MOD4 Master Controller
- 1201B Hydraulic Power Supply
- 5022 Load Cell

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# 1. Warranty

## 1.1. Xcite Products

Xcite Systems Corporation warrants that any Xcite manufactured product will conform to Xcite's written specifications applicable at the time of shipment and will be free from defects in material or workmanship for one year.  During the Xcite warranty period, Xcite, or its agent, will repair or replace, at its option, any defective product when returned to the factory, freight prepaid by the buyer, and will return the product freight collect.  Xcite assumes no liability for loss or damage during shipment to and from the factory.  If insurance on the return shipment is required, it must be specified by the buyer.

## 1.2. Third Party Hardware Products

Xcite will transfer the original manufacturer's warranty for third party hardware (not manufactured by Xcite) to the buyer.  The warranty policy of those companies in effect at the time of shipment will apply to their products, and Xcite assumes no additional responsibility.  Xcite will indicate on its invoice the warranty terms relevant to specific Third Party Hardware items.

## 1.3. IMPORTANT LIMITATIONS

**1.3.1.** The warranty period commences upon the day of shipment from Xcite without respect to any acceptance criteria or payment provisions in any particular contract.

**1.3.2.** The warranty period does not apply to normal wear items or to damage caused by abuse, neglect or accident.

**1.3.3.** Xcite's responsibility is limited to the above obligations, and Xcite cannot be held responsible for special or consequential or other damages.

ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY AND FITNESS FOR PURPOSE, ARE EXCLUDED.

### 1.4. NOTICE OF LIMITED WARRANTY

THE FOLLOWING ITEM(S) INCLUDED IN THIS XCITE PRODUCT OR SYSTEM ARE EXCLUDED FROM OUR ONE YEAR WARRANTY BECAUSE THEY ARE NORMAL WEAR ITEMS:

1) All system seals
2) Servovalve*

*The servovalve used on this system will be damaged if any particle(s) larger than 10 microns are permitted to enter the valve. Extreme care should be exercised when the hydraulic hoses are connected to ensure no foreign particles enter the connections. It is recommended to always wipe the hydraulic couplings with lint free towel before making connections. Always use the protective dust covers on the hoses (the dust covers can be connected together when operating the system). Any damage to the servovalve as a result of contamination is specifically excluded from warranty.

## 2. Receiving

### 2.1. Receiving Inspection Procedure

Xcite Systems Corporation products are shipped in a manner designed to protect against all normal shipping hazards. Immediately upon receipt, inspect all equipment and note any visible damage. In accordance with the instructions in this manual, test its functional operation. Keep all documents in relation to this shipment. If shipping damage is apparent, file a claim with the carrier’s claim agent and send a copy to Xcite Customer Service. Be sure to include the product name, model number and serial number on all correspondence.

### 2.2. Shipping Container

Shipping containers are supplied with all Xcite products. Store these containers and inserts in a dry area for possible later use.

# 1200-1 and 1200-6
# Linear Exciter System
# Setup and Operation

# *1200-1 and 1200-6 Linear Exciter System*

## 1. Introduction

The function of this system is to impart a controlled force into structures such as machine tools, automobiles and truck suspensions. The force generation is accomplished by a closed loop electrohydraulic system which can apply a static preload in addition to dynamic force up to 1000 Hz under either sine or random conditions.

The static control loop of the system utilizes either the built-in Displacement Transducer (LVDT) or strain gage load cell as feedback and controls the static position of the mass while the dynamic control loop utilizes the built-in load cell as feedback to measure and control the dynamic force applied to the structure under test.

## 2. System Description

The 1200-1 System consists of the Xcite 1206-8-T/C Exciter Head, the Xcite 1204-Mod4 Master Controller, and the Xcite 1101P Field Test Power Supply or the 1201B Laboratory Power Supply. The 1200-6 System consists of the 1207-8-T/C Exciter and the same combinations of Master Controller and Hydraulic Power Supplies. This manual contains a section of detailed information on each of these components, and the user should familiarize himself or herself with this information before using the system.

If the user has purchased the Exciter Head and Master Controller without an Xcite Hydraulic Power Supply, any reference to the power supply in this manual applies to whatever source of hydraulic power the user has elected.

## 3. Setup Procedure

### 3.1. Mounting the 1206-8-T/C or 1207-8-T/C Exciter Head

**3.1.1.** Either Exciter head may be mounted in any orientation but care must be taken to provide strain relief on hoses and cables if the unit is mounted at heights which would add significant loads to the hoses and cables.

**3.1.2.** The exciter mounting base has clearance holes for mounting. Secure the unit so that it will not “walk” when exciting resonant frequencies of the structure.

**3.1.3.** **CAUTION!** Care must be taken that the exciter is firmly and squarely attached to the back up fixturing. Any clearances or dead zones in the attachment or dynamics of any fixtures will cause distortion of the force waveform.

## 3.2. 1201B Hydraulic Power Supply Commissioning Procedure

**3.2.1.** Remove all packing material from inside and outside the pump cabinet.

**3.2.2.** Remove the main power cable from inside of cabinet.

**3.2.3.** Fill oil reservoir with 20 gallons of new, clean Mobile DTE-24 hydraulic fluid (or equal). Check oil sight gage for proper oil level.

**3.2.4.** Connect main power cable to main electrical service. The 1201B Hydraulic Supply is wired for 380V, 50 Hz, 3 phase mains. The 3 phase wire colors are Red, Black and White. Ground (Green Wire) must be connected or ground loops will exist in instrumentation causing 60 Hz.

**3.2.5.** Connect the 1204-MOD4 pump control cable (B-11921) to the hydraulic power supply and to the rear panel connector of the Master Controller.

**3.2.6.** Turn on the Main Power Switch (large red switch) located on the Hydraulic Power Supply.

**3.2.7.** Verify that the yellow *PHASE CORRECT* light is lit. If not, reverse the Red and Black wires at the main power connection. The pump will not start until the “phase correct” lamp is illuminated.

## 3.3. 1001P Field Test Power Supply Commissioning Procedure

**3.3.1.** Remove the covers from the front and rear of the unit.

**3.3.2.** Select either 115 VAC or 220 VAC with the *VOLTAGE SELECTOR* switch on the electrical cabinet at the top, rear of the power supply.

**3.3.3.** Connect the power cord to a 115 VAC (30 A service) or 220 VAC (15 A service) source. Be sure to connect the green wire to a solid ground lug.

**3.3.4.** The power supply front panel green light should be illuminated indicating that power has been applied.

**3.3.5.** Remove the cap fitting on the hydraulic fill hose and insert the hose in a 5 gallon container of Mobil DTE-24 clean oil and set the ball valve located at the rear, bottom of the pump cabinet to the *FILL* position. (See Drawing B-30015 located at the end of the Field Test Power Supply Manual Section - Item #04)

**3.3.6.** Turn on the *TRANSFER PUMP* switch above the *VOLTAGE SELECTOR* switch.

**3.3.7.** It will take approximately 5 minutes for the oil to reach the sight gage at the top of the reservoir. Be careful to NOT OVERFILL THE PUMP RESERVOIR! Fill to the top gradicule and turn off the *TRANSFER PUMP* switch.

**3.3.8.** Replace the fill hose cap fitting.

**3.3.9.** Connect the 1204-Mod4 pump control cable (B-11921) to the *CONTROLLER* connector of the power supply and the rear panel connector of the Master Controller.

## 3.4. Starting the Hydraulic Power Supply

**3.4.1.** Check to see that the Red *EMERGENCY STOP BUTTON* located on the Power Supply is pulled out. The unit will not start if this switch is pushed into its *STOP MODE*.

**3.4.2.** Push the Red *POWER* button on the Master Controller. It should light up along with the *PUMP STOP* light.

**3.4.3.** Push the *PUMP START* button on the Master Controller and the Power Supply should start up.

**3.4.4.** Allow approximately 30 seconds to 1 minute for the pump to prime and come up to 3000 psi. Check the pressure on the gage located on the side of the Hydraulic Power Supply.

**3.4.5.** Verify that the fan motor located in the Hydraulic Power Supply is operating.

**3.4.6.** The 1001P or 1201B Hydraulic Power Supply is now running correctly.

**3.4.7.** Push the *PUMP STOP* button. The power supply will shut down and the *PUMP STOP* switch will stay lit.

**3.4.8.** Push the *POWER* switch of the Master Controller to turn it off.

## 3.5. Hydraulic Hookup

**3.5.1.** Connect the Hydraulic Power Supply pressure and return hoses to the Exciter Head pressure and *Return* hoses via the polarized quick disconnects supplied with the system hoses.

**3.5.2.** Take care to maintain cleanliness by always attaching caps to the quick disconnects when disconnected.

**3.5.3.** When in doubt about hose polarity, the convention is:

Supply Pressure - Coupler
Supply Return - Nipple

**3.5.4.** Take care that hoses will not rub against sharp objects when pulsating.

## 3.6. Cable Hookup

**3.6.1.** Connect cable C-11226 to the Master Controller rear panel connector and to the servovalve and load cell of the Exciter Head.

**3.6.2.** Connect cable B-11689 to the rear panel connector of the Master Controller and the displacement connector of the Exciter Head.

# 4. Operation Procedure

## 4.1. Switch Settings

**4.1.1.** Set the switches on the back of the Master Controller to the following:

| | |
|---|---|
| CONTROLLED VARIABLE | |
| STATIC | EXTERNAL (Static Displacement Control) |
| | INTERNAL (Static Force Control) |
| DYNAMIC | INTERNAL |
| STATIC PRELOAD | COMPRESSION |
| POWER AMP | INT |

**4.1.2.** Set the switches on the front of the Master Controller to the following:

| | |
|---|---|
| DITHER | OFF |
| STATIC SETPOINT | 0.0 |
| STATIC GAIN | VARIABLE (For Displacement Control) |
| | FIXED (For Force Control) |
| VARIABLE GAIN | 5.0 |
| LOAD CELL | OPERATE |
| EXCITATION MODE | STANDBY/ RESET |
| FREQUENCY | HIGH |
| DYNAMIC SETPOINT | 0.0 |

**4.1.3.** Connect a 1.0 Vrms variable frequency oscillator to the Program Input J308. (1 Hz to 1200 Hz)

**4.1.4.** Press *POWER* on Master Controller. The *POWER* light will be illuminated.

**4.1.5.** Press *PUMP START* on the Master Controller.

**4.1.6.** Turn the *EXCITATION MODE* to *STATIC*. The *STATIC SIGNAL LEVEL* should remain at 0% since the *STATIC SETPOINT* is set to 0.0. Turn the *STATIC SETPOINT* to the position desired of the piston (or static force level if in *FORCE CONTROL MODE*).

**4.1.7.** Turn *EXCITATION MODE* to *STATIC + DYNAMIC.*

**4.1.8.** Slowly increase the *DYNAMIC SETPOINT* until the desired force is monitored at the *DYNAMIC SIGNAL LEVEL* meter and is measured at the *LOAD CELL OUTPUT BNC*. The output voltage is calibrated at 250 lb/ volt.

## 5. Shutdown Procedures

**5.1.** Turn *EXCITATION MODE* to *STANDBY/ RESET.*

**5.2.** Push *PUMP STOP* of the Master Controller.

## 6. Troubleshooting Guide

| Problem | Action |
|---|---|
| Static meter does not indicate piston is retracted when system is turned on in Standby/ Reset mode.<br>OR<br>Static meter does not show changes in displacement or force when the set point is changed. | Check that the hydraulic power supply is turned on and reading 3000 psi. **See 3.4.**<br><br>Check that all hoses and cables are connected. **See 3.5. and 3.6.**<br><br>Verify that all Master Controller switches are in the correct position. **See 4.1.1. and 4.1.2.** |
| No force is measured at the Force Output BNC or is indicated on the Dynamic meter when the system is in the Static + Dynamic Mode. | Verify that the 1 V rms signal from the signal source is connected to the Program Input BNC on the back of the Master Controller. **See 4.1.3.**<br><br>Verify that the Dynamic Set Point potentiometer is turned up. **See 4.1.8.** |

## 7. Storage Instructions

Be sure to attach the caps and plugs to all hydraulic quick disconnects to protect from contamination when not in use.

Keep the system in a clean and low humidity environment when not in use.

# 1100, 1200 & 1300 Exciter Heads

## 1. Introduction

The linear single-ended exciter head is a high-force, wide frequency response, linear actuator designed to be used in a closed loop control system. It is ideally suited for mechanical impedance and component testing. Using the latest design concepts in force transducers and servovalves has resulted in a compact Exciter Head that is suited to simulate the level and direction of input forces encountered in complex machinery. A load cell provides a force feedback signal for monitoring and closed loop force control of the actuator. A tandem mounted displacement kit provides a feedback signal for closed loop displacement control of the exciter.

The Displacement Kit is designed to provide a displacement feedback signal for an exciter head. When used with the MOD4 version of the Xcite Master Controller, the Displacement Kit provides a means of monitoring or controlling low-frequency displacements. Also, the kit may be used to maintain a static or mean position while controlling another dynamic variable, such as force, velocity, or acceleration. The Kit is constructed such that it becomes an integral part of the exciter head. It is mounted along-side of the actuator to maintain the small total package size.

The Exciter Head, supplied with all necessary electrical and hydraulic connectors, is designed so that wrong connections cannot be made. Also included on all standard exciter heads is a miniaturized strain-gauge force transducer that permits continuous monitoring of static and dynamic forces.

Use the following table to determine the force capacity for your model.

| **Model** | **1106** | **1107** | **1206** | **1207** | **1352** | **1306** |
|---|---|---|---|---|---|---|
| Static Force (lbs) | 1000 | 1000 | 2000 | 2000 | 5000 | 20,000 |
| Dynamic Force (lbs) | 1000 | 1000 | 2000 | 2000 | 5000 | 20,000 |

**WARNING**

*Precautions regarding the test specimen should be considered.*

*Although exciter heads are rated for static plus a peak dynamic force, exciter heads are capable of compressive forces in excess of 200% of their rating, and tensile forces in excess of 100% of that rating if instability in the control loop occurs.*

# 2. Theory of Operation

## 2.1. Introduction

The major function of the exciter head is to apply a controlled static force preload and a controlled random or sinusoidally varying dynamic force (variable frequency), to a test structure. The cylinder rod is the actual output device. The force transducer and servovalve control this output. The load cell provides an output signal proportional to static loads, but unlike a piezo-electric transducer, operates from DC to 1500 Hz. Thus, the cell is well suited to provide a constant monitor of the exciter's preload for use in the control circuitry. The load cell provides a signal proportional to time-varying forces (dynamic) and therefore provides complete signal information on the output force.

The servovalve is supplied a constant source of pressure (3000 psi) which is applied to either side of the exciter's cylinder in a differential manner. The driving signal to the servovalve is provided by the system controller.

## 2.2. Circuit Description ( Electric)

### 2.2.1. Head

The load cell and servovalve are separately connected to their respective cable connectors. Shielded cable is used throughout to provide optimum reduction of externally induced noise voltage.

### 2.2.2. Displacement Kit

All connections to the Displacement Kit are through a single connector mounted in the Displacement Kit cover. Pins A and B of this connector are +15 VDC and ground respectively. These bring power from the Controller to the LVDT. On selected models, a filtering capacitor (68 mfd) across these pins is used to reduce noise generated by the LVDT from getting back to the controller circuitry. Pins C and D are the displacement feedback signal leads to the Controller.

## 2.3. Circuit Description (Hydraulic)

### 2.3.1. Head

Oil is supplied to the exciter head at 3000 psi by the hydraulic power supply. The servovalve controls the flow of oil into the cylinder ports, creating a differential pressure according to the force demands of the control system. Oil from the servovalve is routed back to the hydraulic supply.

#### 2.3.2. Displacement Kit

The Displacement Kit consists of an Exciter Head top plate, an LVDT-type displacement transducer, and a cover with electrical connector. The top plate contains a means for clamping the LVDT and a self lubricating bronze impregnated bushing which prevents side loading of the LVDT core. The displacement transducer is an integrated package consisting of a solid-state oscillator, and a phase-sensitive demodulator. The coils of the transformer are connected in series opposition so that output resulting from a displacement is a DC voltage proportional to the core position with respect to the electrical center. The polarity of the voltage is a function of the direction of the core displacement with respect to the electrical center.

## 3. Major Components

### 3.1. Actuator

The hydraulic actuator consists of a cylinder, a single ended piston, a specially designed bearing to minimize oil leakage and increase seal life, and a manifold for routing the oil from the external supply hoses to the servovalve and hydraulic cylinder. The built-in oil routing from external hoses to the servovalve is designed for safety and to meet the response and force requirements of the system. Cylinder specifications for Xcite heads discussed in this manual are in the following table.

| **Model** | **1106** | **1107** | **1206** | **1207** | **1352** | **1306** |
|---|---|---|---|---|---|---|
| Bore | 1" | 1" | 1.5" | 1.5" | 1.75" | 5" |
| Stroke | 1" | 2" | 1" | 2" | 3" | 1" |

### 3.2. Servovalve

The servovalve is a dual-stage flow-control device using electromagnetic drive in the first stage to control the hydraulically amplified second stage. This second stage provides the differential pressure flow to control the piston. Hydraulic fluid entering the valve must be filtered to 3 micron absolute to prevent damage to the servovalve. The unit is NOT customer-serviceable.

### 3.3. Load Cell

The load cell is a force transducer which incorporates a 350 ohm 4-leg strain gage. By applying a voltage across the strain-gage bridge, a differential voltage proportional to force is developed at the bridge output. The load cell excitation voltage is provided by a precision voltage reference in the Master Controller.

The Load Cell may be used for testing in tension, compression, or a combination of both. The cell is sized so that the maximum load of the exciter head cannot damage the unit.

Calibration is performed by simulating bridge unbalance with a known value of resistance. The excitation voltage of the bridge is then adjusted to obtain the force value stated on the load cell resistor calibration plug. The Calibration Plug, showing the calibration value unique to the load cell used in your unit, is included with the system. The “Cal Plug” is inserted in its appropriate receptical located on the rear of the Master Controller.

### 3.4. Displacement Transducer Kit

The Displacement Kit consist of a Linear Variable Displacement Transducer (LVDT) and the hardware necessary to mount it to the exciter head.

The LVDT is a sealed assembly which contains all necessary solid-state electronics required to develop a voltage proportional to the stroke of the piston. The unit consists of a stationary coil assembly which is clamped to the cylinder and a core (rod) which is attached to the piston. An oil impregnated bronze bushing prevents the piston from turning and causing misalignment in the core/coil assemblies.

The core position is adjusted so that the LVDT output is equal and of opposite polarity at the extreme limits of piston position. A voltage null represents mid-stroke of the piston. The output is nominally +/- 12 VDC for an input of 15 VDC which is supplied by the Master Controller via the displacement cable. Internal amplifiers in the Master Controller convert the +/- 12 VDC signal from the LVDT to 0 to +10 VDC for monitoring of the displacement signal. Calibration is such that +10 volt output always equals the overall stroke of the exciter head. For example, a 2” stroke exciter head will have an output sensitivity of 2 in/ 10V or .2 in/ Volt.

## 4. Operation

All operations of the Exciter Head are controlled by the appropriate Xcite Controller. Please refer to the Master Controller section in this manual for proper use of the system.

**WARNING**

*Before performing any test, check the mounting of the load cell to the actuator. The load cell must be firmly mounted to the actuator or fatigue failure of the actuator mounting stud may occur.*

## 4.1. Operating Precautions

**4.1.1.** Unless the Load Cell is attached to the test specimen, the peak dynamic force should not exceed the static force. This can cause the Load Cell to pull away from the test piece every half cycle, and impact or hammer the test piece on the other half cycle. Damage inflicted on the load cell in this manner is not covered under any Xcite warranty.

**4.1.2.** If the feedback signal is broken or the controller malfunctions, the exciter can output full force. Since the servovalve functions as a differential device, the full 3000 psi applied to the bottom side of the piston will produce in excess 100% of the rated forces.

**4.1.3.** Proper selection of feedback signal can improve exciter performance and provide data with greater dynamic range.

**EXAMPLE:**
A vibration test is to be performed on a test specimen requiring static preload that must be held as accurately as possible to 5000 pounds. The test specimen has a static stiffness (k) of 20,000 pounds per inch. Should the static loop of the controller use force feedback or displacement feedback? Consider the following:

The usable range of most control loops is approximately 40 dB (ratio of 100:1). An exciter with a one inch stroke and 58,000 pound total force capability used to perform this test would result in displacement control down to .01 inch or force control down to 580 pounds.

Therefore, if force is used to control the static loop, accuracy should be easily held to 5,000 pounds, +/-580 pounds.

However, if displacement is used to control the static loop, accuracy could be held to .01 inch. With a static stiffness of $2 \times 10^4$ lbs/ in, this would result in force control accuracy of 5,000 pounds, +/-200 pounds (.01 inch x $2 \times 10^4$ lbs/ in = 200 pounds).

In conclusion, it is very important that you understand how to operate the system and make proper decisions on test methods to be used.

## 5. Care and Maintenance

Maintenance is minimal. Precautions for cleanliness are the major considerations.

### 5.1. Each Usage

End/ Dust covers should always be kept on the Exciter Head hoses when they are not connected because contaminates larger than 3 micron can damage the servovalve.

The top plate should always be kept clean to prevent piston scouring. Additionally, dirt on the top plate will affect the LVDT.

### 5.2. Each Month

Place a few drops of any lubrication oil on the linear guide bearing for the Displacement Transducer.

### 5.3. Periodic

Periodically replace the piston rod seals. These can be expected to last a minimum of 100 hours of operation and longer if side load is kept at a minimum. When leakage from the top of the exciter head becomes excessive, the seals should be replaced by returning the Exciter Head to the factory.

## 6. Specifications

| | |
|---|---|
| Output Response | The force output is both a function of frequency, and test specimen stiffness. (See enclosed Response curve) |

| **Model** | **1106** | **1107** | **1206** | **1207** | **1352** | **1306** |
|---|---|---|---|---|---|---|
| Dimensions | | | | | | |
| Height | 5.87” | 6.87” | 9.75” | 10.75” | 23” | 20.5” |
| Width | 6” | 6” | 7.87” | 7.87” | 14” | 13” |
| Depth | 3.75” | 3.75” | 4.18” | 4.18” | 12” | 10” |
| Stroke (Peak to Peak) | 1” | 2” | 1” | 2” | 3” | 1” |
| Displacement Kit | MT-302 | MT-303 | MT-302 | MT-303 | MT-305 | MT-302 |

| **Displacement Kit Model Number** | **MT-302** | **MT-303** | **MT-305** |
|---|---|---|---|
| Displacement Transducer | | | |
| LVDT rated linear range | +/-.5” | +/-1” | +/-1.5” |
| LVDT maximum usable range | +/-.75” | +/-1.5” | +/-2.0” |
| Input (fixed by controller) | +15 VDC | +15 VDC | +15 VDC |
| Output | 0-10 VDC | 0-10 VDC | 0-10 VDC |
| Frequency Response (3 dB point) | 110 Hz | 100 Hz | 75 Hz |
| Linearity | +/-.5% of full scale output at rated linear range (deviation from best straight line passing through 0) | | |

XCITE SYSTEMS CORPORATION

# CERTIFICATE OF CALIBRATION

| | | | |
|---|---|---|---|
| **Transducer Model:** | 5022 | | |
| **Serial Number:** | 1037 | | |
| **Capacity:** | 5000 | LBS | |
| **Calibration Date:** | 6/19/2009 | | |
| **Excitation:** | 10 | VDC | |
| **Calibration Factor:** | 1.1050 | MV/V | Compression |
| **Input Resistance:** | 354 | Ohms | |
| **Output Resistance:** | 356 | Ohms | |
| **Temperature Range:** | 60-160 | Degrees F | |

An output of **0.2964** **MV/V** is induced when
A shunt resistor of 301K ohms is applied across (-) Excitation and (-) Signal.

**Special Instructions:** 0.2964 MV/V W/ 301K OHM RESISTOR ACROSS (-)EXC. AND (-) SIG EQUALS 1341.086 LBS

| | | | |
|---|---|---|---|
| **Wiring Code:** | RED | **(+)Excitation** | A |
| | BLACK | **(-) Excitation** | B |
| | GREEN | **(+)Signal** | C |
| | WHITE | **(-) Signal** | D |

*This is to certify that the following instrument was calibrated using loading equipment traceable to NIST through one or more of standards. The unit was found to meet or exceed all published sales literature accuracy specifications.*

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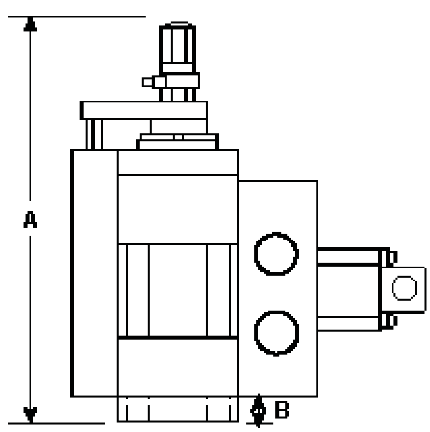
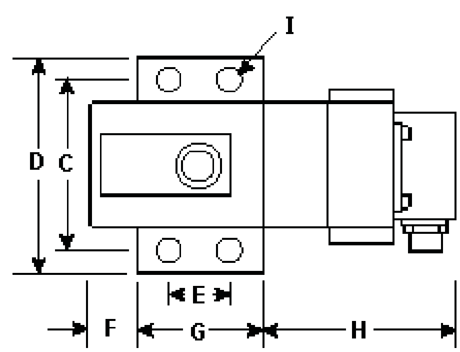
# Xcite 1200 Laboratory Series

The Xcite 1200 Series provides medium levels of force for testing vehicles such as trucks, locomotives, off road construction equipment and power generation equipment such as turbines and generator rotors, stators and bearings. The larger force capability is still coupled with a frequency response in the 500 Hz to 1000 Hz range for modal studies of highly damped and non-linear structures.

The 1200 Series systems are used extensively in the automotive industries for component and system sub-assembly modal testing for correlation of damping and non-linear characteristics with simulation models.

| | Xcite 1200-1 System | Xcite 1200-3 System | Xcite 1200-6 System |
|---|---|---|---|
| Hydraulic Power Supply | 1201B 5 GPM (20 l/m) | 1201B 5 GPM (20 l/m) | 1201B 5 GPM (20 l/m) |
| Master Controller | 1204-Mod4 | 1204-Mod4 | 1204-Mod4 |
| Exciter Head | 1206-8-T/C | 1215-8-T/C | 1207-8-T/C |
| Static Force | 2,000 lb (8,900 N) | Total Static & Dynamic | 2,000 lb (8,900 N) |
| Dynamic Force | 2,000 lb (8,900 N) | Force =2,000 lb (8,900 N) | 2,000 lb (8,900 N) |
| Stroke | 1.0 in (25 mm) | 2.0 in (50 mm) | 2.0 in (50 mm) |
| Rod | 1.0 in (25 mm) | 1.0 in (25 mm) | 1.0 in (25 mm) |
| Bore | 1.5 in (37 mm) | 1.5 in (37 mm) | 1.5 in (37 mm) |
| Thread | .50 - 20 | .50 - 20 | .50 - 20 |
| Load Cell | 5,000 lb (22,250 N) | 5,000 lb (22,250 N) | 5,000 lb (22,250 N) |
| LVDT | 1.0 in (25 mm) | 2.0 in (50 mm) | 2.0 in (50 mm) |
| Exciter Design | Single Ended | Double Ended | Single Ended |

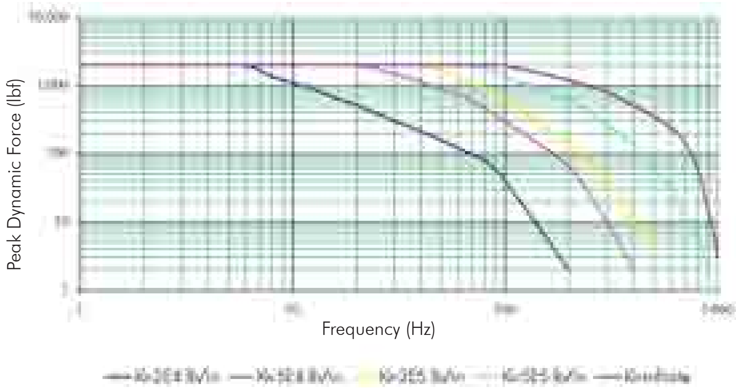


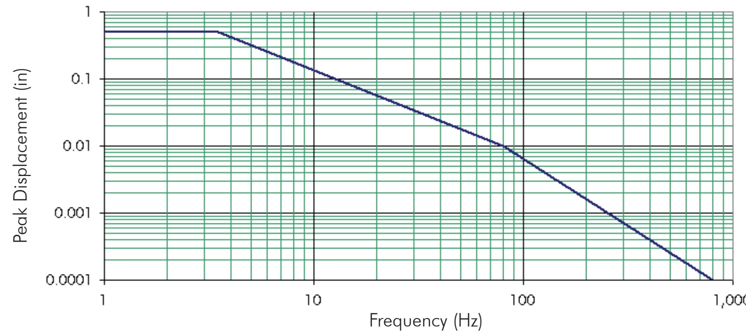

| Exciter Head | A | | B | | C | | D | | E | | F | | G | | H | | I | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in | mm | in(dia) | mm(dia) | in(dia) | mm(dia) |
| 1206-8-T/C | 9.75 | 244 | 0.60 | 15 | 3.50 | 88 | 4.18 | 105 | 1.62 | 41 | 1.12 | 28 | 2.50 | 63 | 4.25 | 106 | 0.48 | 12 |
| 1215-8-T/C | 12.50 | 313 | 0.60 | 15 | 3.50 | 88 | 4.18 | 105 | 1.62 | 41 | 1.12 | 28 | 2.50 | 63 | 4.25 | 106 | 0.48 | 12 |
| 1207-8-T/C | 10.75 | 269 | 0.60 | 15 | 3.50 | 88 | 4.18 | 105 | 1.62 | 41 | 1.12 | 28 | 2.50 | 63 | 4.25 | 106 | 0.48 | 12 |

# Xcite 1200-1 Laboratory System

## Peak Dynamic Force vs. Frequency

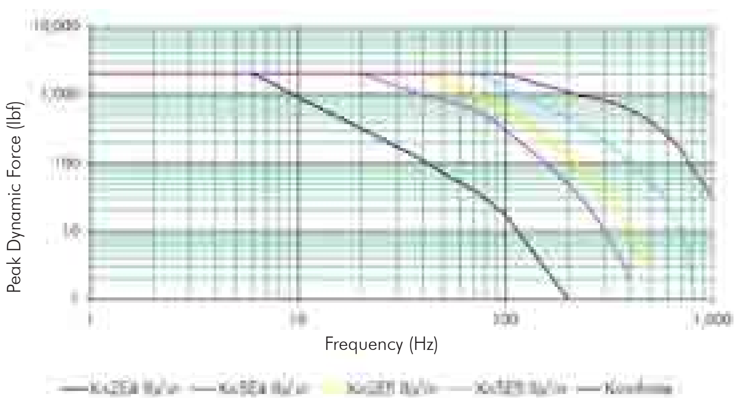



## Peak Displacement vs. Frequency

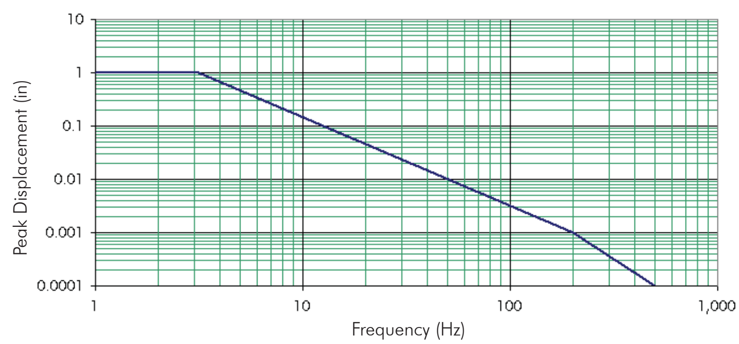



# Xcite 1200-3 Laboratory System

## Peak Dynamic Force vs. Frequency

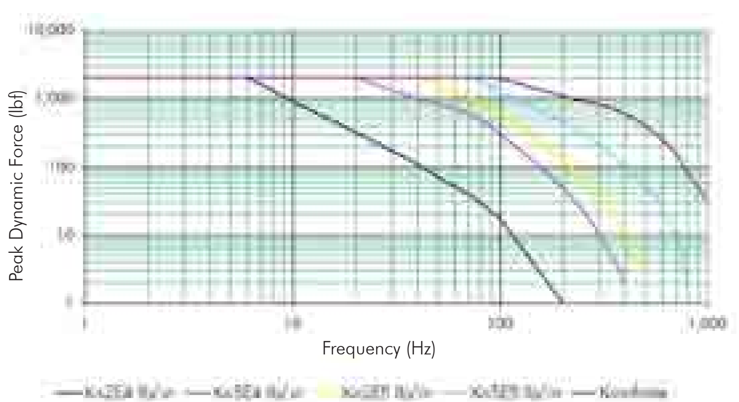



## Peak Displacement vs. Frequency

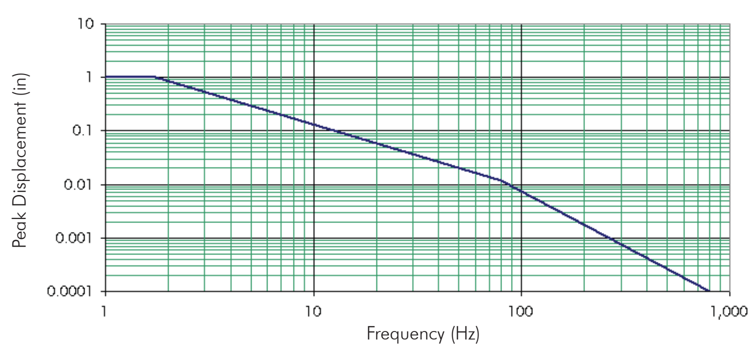



# Xcite 1200-6 Laboratory System

## Peak Dynamic Force vs. Frequency




## Peak Displacement vs. Frequency



# 1201B Hydraulic Power Supply

# 1. Introduction

The XCITE Hydraulic Power Supplies are designed to fulfill the power requirements of exciter heads using the most energy-efficient and maintenance free components available. All units use a highly reliable, variable volume, pressure compensated, axial-piston pump to deliver only the energy demanded by the load, thus reducing power consumption.

# 2. Commissioning Procedure

## 2.1. Initial Setup of Hydraulic Power Supply is as follows:

**2.1.1.** Remove all packing material from inside and outside the pump cabinet.

**2.1.2.** Remove the main power cable from inside of cabinet.

**2.1.3.** Fill oil reservoir with 20 gallons of new, clean Mobile DTE-24 hydraulic fluid (or equal) (See drawing B-30251, item 3 for location of filler cap). Check oil sight gage for proper oil level.

**2.1.4.** Connect one of the exciter head 20 foot hoses to both the pressure out and return quick disconnects. This procedure effectively “short circuits” the output to the return and allows for all entrapped air in the pump to be removed on initial startup. Remove this connection after 5 to 10 minutes of running time.

**2.1.5.** Connect main power cable to main electrical service. The 1201B Hydraulic Power Supply is wired for 380V, 50Hz 3-phase mains. The 3-phase wire colors are Red, Black and White. Ground (Green Wire) must be connected or ground loops will exist in instrumentation causing 60Hz or 50Hz signal noise.

**2.1.6.** Connect the 1104-MOD2 pump control cable (B-11921) to the Hydraulic Power Supply and to the rear panel connector of the Master Controller.

**2.1.7.** Turn on the Main Power Switch (large red switch) located on the Hydraulic Power Supply.

**2.1.8.** Verify that the yellow *PHASE CORREC*T light is lit. If not, reverse the Red and Black wires at the main power connection. The pump will not start until the *PHASE CORRECT* lamp is illuminated.

## 2.2. Starting the Hydraulic Power Supply

**2.2.1.** Check to see that the Red *EMERGENCY STOP BUTTON* located on the Power Supply is pulled out. The unit will not start if this switch is pushed into its *STOP MODE*.

**2.2.2.** Push the Red *POWER* button on the Master Controller. It should light up along with the *PUMP STOP* light.

**2.2.3.** Push the *PUMP START* button on the Master Controller and the Power Supply should start up. The *GREEN* voltage applied light should be illuminated at this time. (Pump pressure will be *ZERO* due to the short circuit hose). After 5 to 10 minutes, shut down the pump. **See 2.1.4.**

**2.2.4.** Remove the hose connecting the pressure out to the return. Restart the Power Supply. Allow approximately 30 seconds for the pump to prime and come up to 3000 psi. Check the pressure on the gage located on the side of the Hydraulic Power Supply. It should read approximately 3000 psi.

**2.2.5.** Verify that the fan motor located in the Hydraulic Power Supply is operating.

**2.2.6.** The 1201B Hydraulic Power Supply is now running correctly.

**2.2.7.** Push the *PUMP STOP* button. The Power Supply will shut down and the *PUMP STOP* switch will stay lit.

**2.2.8.** Push the *POWER* switch of the Master Controller to turn it off.

## 2.3. Hydraulic Hookup

**2.3.1.** Connect the Hydraulic Power Supply pressure and return hoses to the Exciter Head pressure and *RETURN* hoses via the polarized quick disconnects supplied with the system hoses.

**2.3.2.** Take care to maintain cleanliness by always attaching caps to the quick disconnects when disconnected.

**2.3.3.** When in doubt about hose polarity, the convention is:

Supply Pressure - Coupler
Supply Return - Nipple

**2.3.4.** Take care that hoses will not rub against sharp objects when pulsating.

### 2.4. Cable Hookup

**2.4.1.** Connect cable C-11226 to the Master Controller rear panel connector and to the servovalve and load cell of the Exciter Head.

**2.4.2.** Connect cable B-11689 to the rear panel connector of the Master Controller and the displacement connector of the Exciter Head.

## 3. Theory of Operation

The purpose of the XCITE Hydraulic Power Supply is to supply clean hydraulic oil at a constant pressure under the varying flow demands of the force exciter head. The system was designed to do this is the most efficient manner, considering power requirements, reliability, safety, ease of maintenance, and operator convenience.

### 3.1. Circuit Description (Hydraulic)

An oil reservoir provides storage for all necessary supply oil and provides some oil cooling. (See Drawing B-30251 and B-30252) Mounted on the reservoir are oil level and oil temperature gauges, a temperature sensitive switch, and a reservoir fluid level detector switch for motor shut down. A 3000 psi pressure is achieved by a variable volume, pressure-compensated pump that has a factory set delivery rate.

Fluid from the pump first passes through a three-micron (absolute) filter. Should this filter become clogged, a pressure drop builds up across the sensor, causing a switch to trip. This causes the *FILTER* light to illuminate. The system should not be operated until the filter element is changed. After passing through the filter, oil flows to the pressure output disconnect.

### 3.2. Circuit Description (Electric)

The electrical input is 380V, 50Hz, 3 phase (See drawing B-30253). The fourth wire (green) is a ground wire and must be tied to earth ground to prevent floating grounds due to an unbalanced load.

The pump motor uses the high voltage 3-phase power, while the remaining loads derive 120 volt, single-phase from the step-down Transformer T-1 (designated 14), appropriately connected to the incoming power to provide 120 VAC on the secondary of the transformer.

Two-way protection of the three-phase power is provided. A magnetic circuit protector provides over current protection. It is also connected to the electrical box operating handle to disconnect power in the electrical box.

Pump motor overload protection is provided by thermal overload heaters in the motor starter, which were specifically designed for the pump motor. A *RESET* button is conveniently located inside the electrical box, should be thermal over-load trip. The pump start relay, 1CR, (designated 5), is a latch-up design so that momentary switches may be used for pump start and pump stop operations.

A phase sequence relay 1PM (designated 1) is connected to and monitors the 3-phase incoming line to determine if the phasing is connected correctly to provide proper motor rotation. If the *START* light is off, any two legs of the incoming lines should be reversed.

If the phase is incorrect, 1PM (1) remains de-energized, thus preventing the system from being energized. If the phasing is correct, 1PM (1) energizes, allowing 120 VAC from T-1 (14) to be applied to the pump unit.

The T-1 (14) Transformer is fused by 4FU and 5FU. The system *POWER* switch connects power to the control circuits. If oil temperature is normal, relay 2CR (designated 10) is not energized. Momentarily, pressing the *START* button will energize 1CR (designated 5) if oil level, temperature, filter, and pressure selec-tion are correct.

Relay 1CR (5) energizes the motor starter 1M. Auxiliary contact 1M closes, latching 1CR. A normally closed CR1(5) contact opens, turning off the *STOP* light.

Momentarily pressing the *STOP* button breaks the latch-up circuit and de-energize 1CR (5) and the pressure relief solenoid. After a short delay, an *OFF DELAY* contact on 1CR opens, de-energizing the motor-starter coil and causing the pump to stop.

Relay 3CR (designated 10) is normally not energized unless the oil level drops. If the *RED OIL LEVEL LOW* light illuminates, the system must be reset by pushing the *STOP BUTTON* on the Master Controller and oil must be added to the reservoir. When a low oil level is detected, the pump is turned off.

Relay 2CR (10) is normally not energized unless the oil temperature exceeds 160 degrees F. If the *RED OIL OVERTEMP* is illuminated, the system must be reset by pushing the pump *STOP BUTTON* on the Master Controller after the system cools down.

If the differential pressure drop across the filter exceeds approximately 50 psi, the *RED FILTER* restriction light will illuminate. The Power Supply will **NOT** shut off, however the filter should be changed when the filter light is illuminated.

## 4. Description

Included on the hydraulic power supply are an oil supply line pressure gauge and a timer which records pump running time. Mounted on the side of the reservoir is an oil level sight gauge with an integral oil temperature thermometer. A reservoir drain is also located on the reservoir. All motor controls and associated electrical equipment are located in the electrical control box. Connections for pressure and return hoses are attached with quick disconnect style connectors.

### 4.1. Major Components

- Oil Reservoir
- Motor
- Variable volume pressure-compensated Pump
- Three-micron Filter Assembly
- Heat Exchanger
- Motor Control Box
- Hydraulic Hoses

### 4.2. Control Components

#### 4.2.1. Emergency Stop Switch

This switch de-energizes the motor-starter relay, bypassing all shutdown logic; thus causing the motor to stop. Use it only in an emergency situation.

**WARNING** *Some operating conditions cause the system to shutdown.*

### 4.3. Monitoring Devices

#### 4.3.1. Phase Sequence Relay (PHASE Indicator)

A phase sequence relay monitors the 3-phase power applied to the unit. If the phasing of the wires is incorrect, the relay will prevent the pump from being energized, and the *PHASE CORRECT* lamp will not illuminate.

**4.3.2. Filter Pressure Drop Sensor (FILTER Indicator)**

This sensor sends a signal if the differential pressure across the filter element is excessive. This occurs when the differential pressure drop across the replaceable filter element exceeds 50 psi. Excessive differential pressure occurs when the filter element is clogging, fluid viscosity is too high, fluid temperature is too low, or any combination. At that time, the *FILTER* light illuminates.

***Note:*** There may be times when the system is first started and the oil is cold that the filter light will illuminate. Allow 10 to 20 minutes of operation and if the filter light goes off, then the filter is not dirty and does not need replaced.

**4.3.3. OIL OVERTEMP Indicator**

The temperature sensor monitors the oil temperature of the reservoir and prevents the pump from running if the oil temperature exceeds 160 degrees F. The *OIL OVERTEMP* light illuminates, indicating that the maximum allowable oil temperature has been exceeded.

**4.3.4. LOW OIL Indicator**

The level sensor monitors the oil level in the oil reservoir and prevents the pump from running if the oil level is low. The pump will shut down or fail to start until additional oil is added. The red *LOW OIL* indicator lamp illuminates during this condition.

**4.3.5. Voltage Applied Indicator**

A green light indicating power is switched onto the pump motor. The light will ONLY illuminate after depressing the *PUMP START* button on the Master Controller.

## 5. Care and Maintenance

**WARNING**

*Electrocution or severe electrical shock may occur.*

*When the MAIN power is plugged in, the line side of the motor starter is at line voltage.*

The XCITE Hydraulic Power Supply was designed so that no periodic lubrication on mechanical parts is required. Cleanliness is very important when using sophisticated hydraulic systems, and although a clean room environment is far from necessary, general cleanliness is recommended. Routine maintenance on the overall system should include the following.

## 5.1. Operating Care

**5.1.1.** Wipe off all cables after each use.

**5.1.2.** Never drag cables across the floor.

**5.1.3.** Immediately after the hydraulic hoses are disconnected, cover all hydraulic connectors with the covers provided.

**5.1.4.** During operation, the oil temperature should never rise above 160 degrees F. (The oil temperature thermal relay shuts down the system at 160 degrees F.)

**5.1.5.** Before each test, check the oil pressure to make sure it is at 3000 psi. A flow screw adjustment is located on the top of the pump compensator assembly. This control is preset at the factory and should not be adjusted (slotted screw with locknut).

**5.1.6.** Before each test, check to make sure that the air heat exchanger blower is operational, that pump maintenance warning lights are not illuminated, and that the phase sequence indicator show proper motor phasing.

If for some reason the system has overloaded, the pump motor started thermal overload will trip. Reset it by opening the access door, and pushing the reset button located on the motor starter.

## 5.2. Maintenance

**5.2.1.** To keep the system operating within the specified limits, it is necessary to periodically check the oil level by observing the oil level gauge. Fluid should fill the gauge.

**5.2.2.** Oil should be changed after every 1000 hours of pump operation.

**5.2.3.** The condition of the filter is displayed by the light on the electrical control box inside the cabinet. The filter requires replacement only when the *FILTER* light is illuminated.

**WARNING**

*All oil should be completely drained from the reservoir during transportation. (See drawing B-30251, item 31 for location of reservoir drain hose)*

# 6. Troubleshooting

Listed below are some of the common problems which may be experienced with a Power Supply.

## 6.1. Unit Overheats

Overheating may be caused by a clogged heat exchanger, restricted air flow, malfunction of the check valves, or failure of the heat exchanger fan.

The efficiency of an oil/ air heat exchanger decreases as the ambient temperature increases. The maximum ambient temperature at which the heat exchange can effectively maintain the oil temperature below 160 degrees F is approximately 100 degrees F. If continuous operation in ambient temperature above 100 degrees F is desired, it is recommended that an oil/ water heat exchanger be added externally to cool the return line oil before it is returned to the oil reservoir.

## 6.2. Pump de-energizes

The pump de-energizing for no apparent reason can be caused by a noisy 3-phase power line where the 3-phase voltage drops below the rated voltage for more than 10 milliseconds. This results in the phase monitor relay 1PM momentarily de-energizing, shutting off the system.

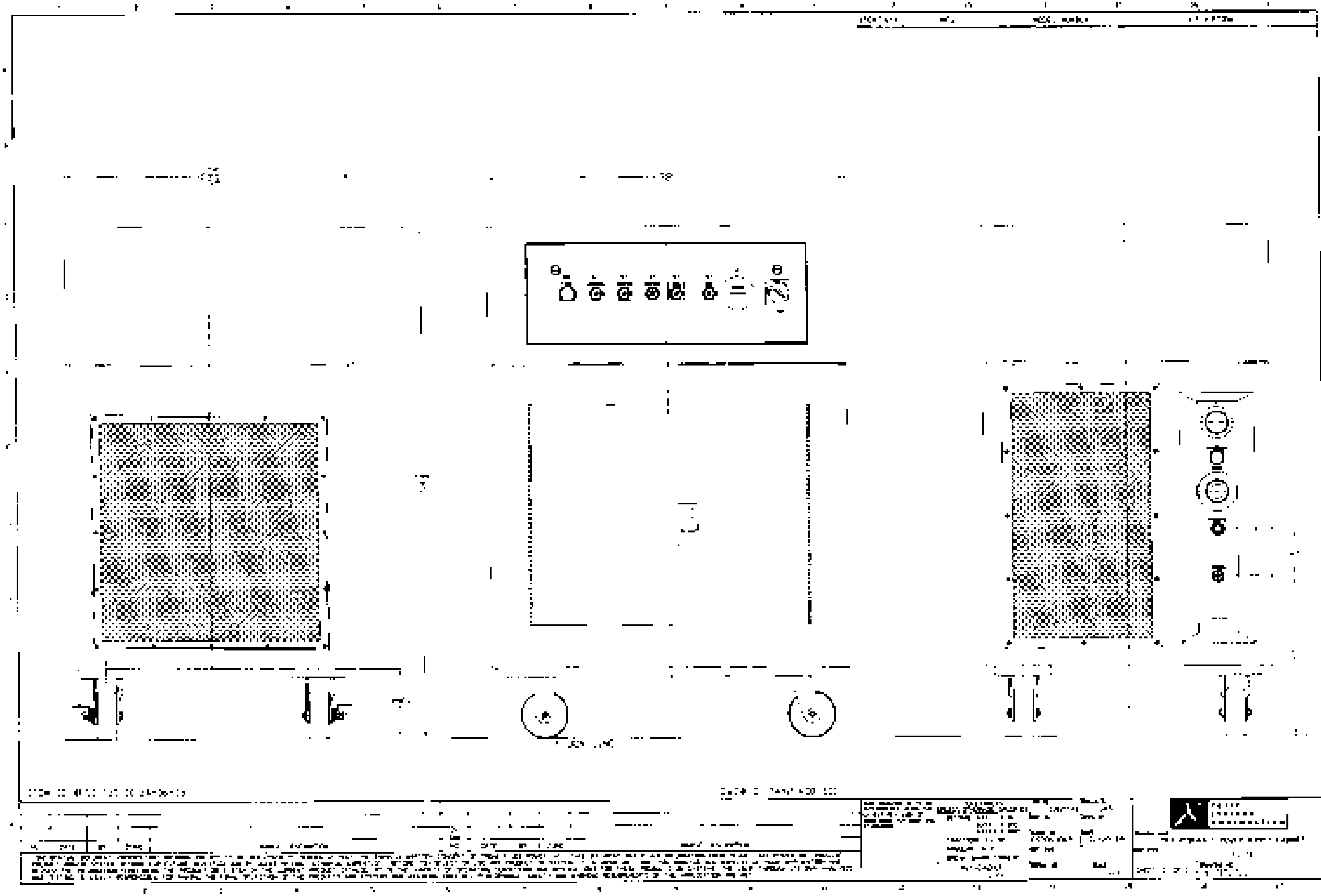
## 7. Specifications

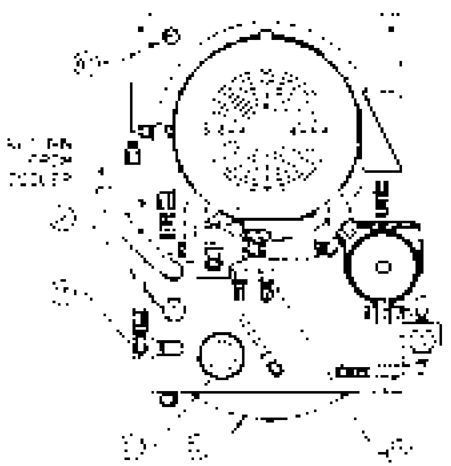
| **Item** | **Specifications** |
|---|---|
| Dimensions | |
| Height | 54.25” |
| Width | 38.00” |
| Depth | 30.13” |
| Weight | 863 lb (without oil) |
| Hydraulic Oil | 20 gallons of Mobil DTE-24 |
| Pump Pressure-compensated variable flow axial piston | 5 GPM @ 2800 psi |
| Motor, 380V, 50Hz | 10 HP |
| Reservoir | 20 gallon |
| Cooling | Air (Maximum ambient room temperature 100 degrees F) |

## 8. Drawings

***Model 1201B***

Outline Dimensions ........ B-30250
Pump/ Reservoir ........ B-30251
Hydraulic Schematic ........ B-30252
Electrical Schematic ........ B-30253
Electrical Box Layout ........ B-30254



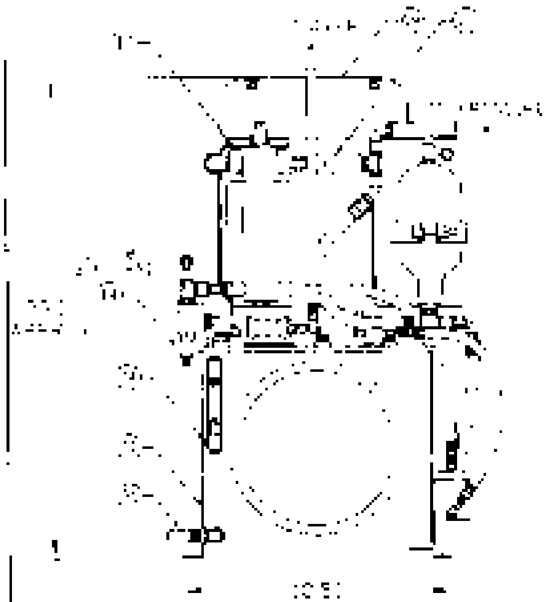


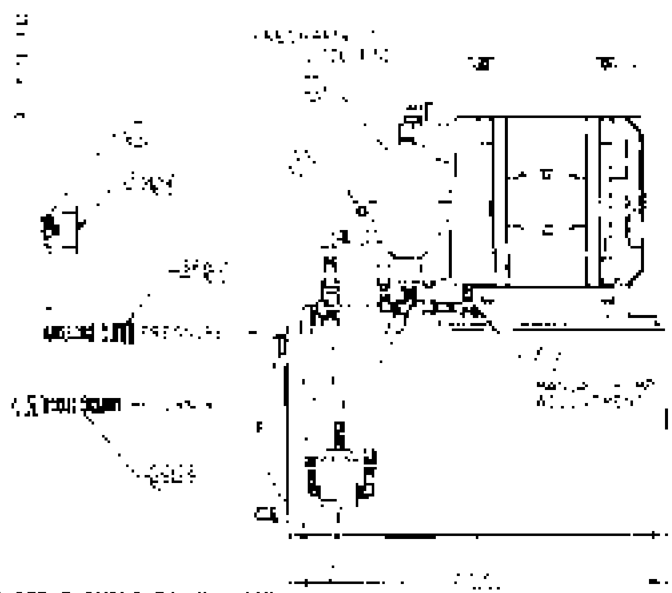
SYSTEM REQUIREMENTS

SYSTEM OPERATING PRESSURE

PRESSURE SWITCH SETTING

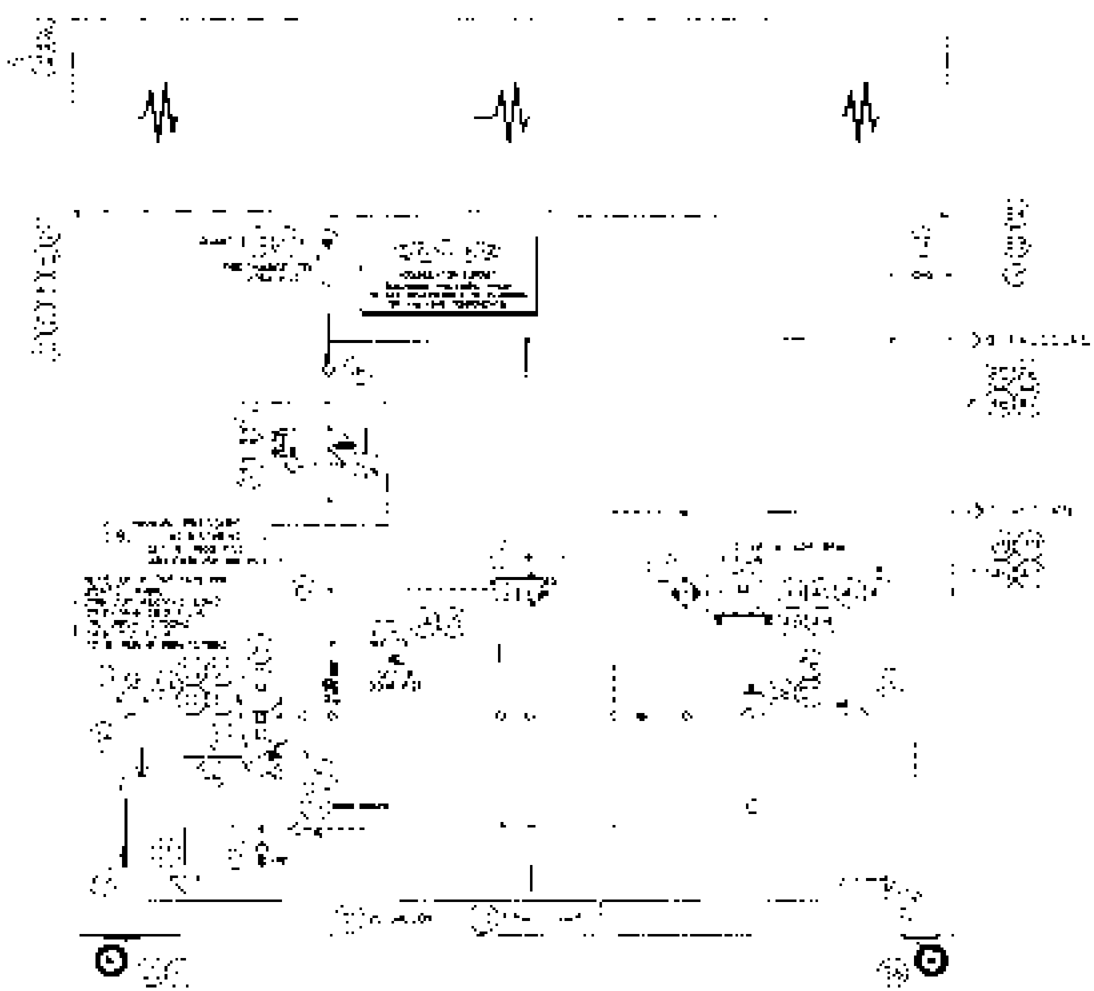
NOTE: NOT ALL COMPONENTS ARE SHOWN FOR CLARITY

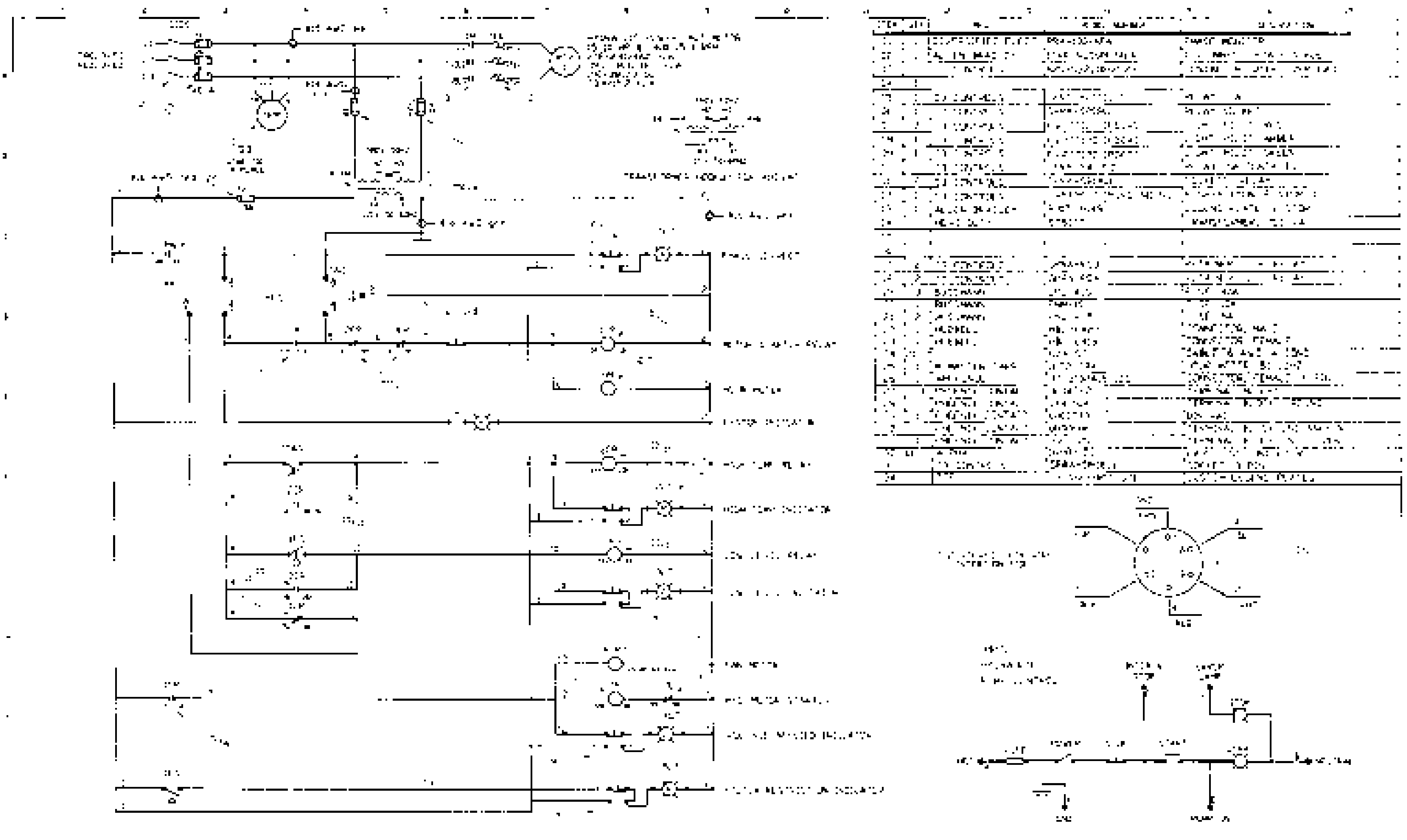




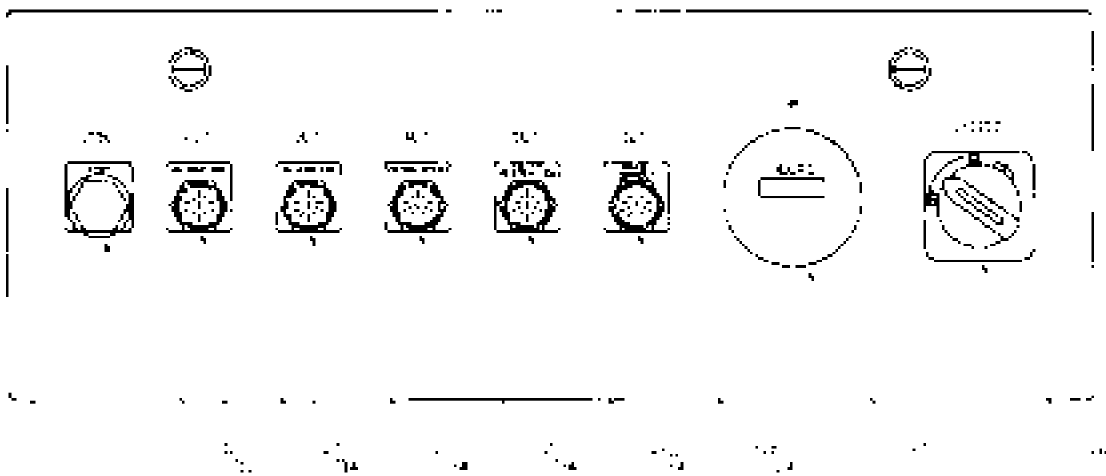
NOTE: REPLACEMENT FILTER ELEMENT P/N

* DENOTES ITEMS NOT SHOWN ON THIS VIEW

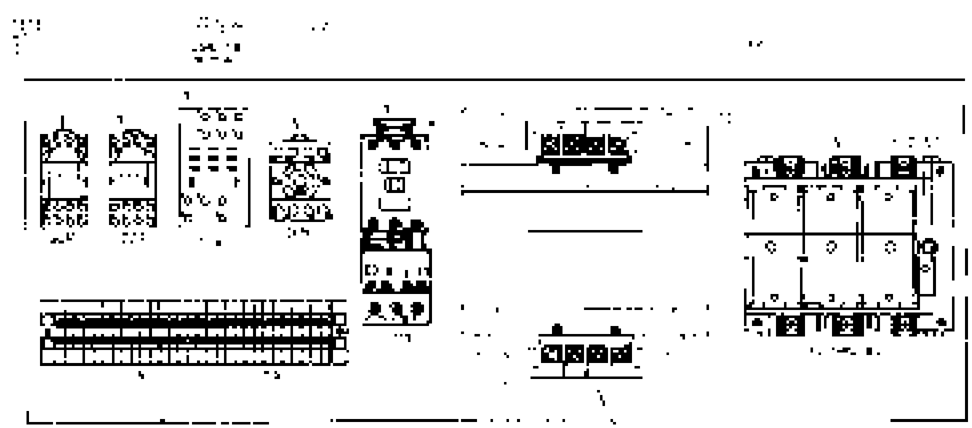




## ELECTRICAL ENCLOSURE DOOR



## ELECTRICAL ENCLOSURE PANEL



# 1100, 1200 and 1300 Master Controller

# 1. Introduction

The Xcite Master Controller is a compact electronics control package designed to provide all the controls and displays necessary to operate an Xcite exciter system. The latest concepts in electronic design, including plug-in printed circuit boards, flexible systems interface and easy-to-use operator controls, are incorporated in the unit.

The Master Controller represents the heart of the closed loop hydraulic exciter system. It enables two variables to be independently controlled simultaneously via the Static Level and Dynamic Level controls. It incorporates automatic gain control in the dynamic loop which allows a constant amplitude of the dynamic variable to be maintained even as the reference frequency of excitation is changed.

# 2. Theory of Operation

The major design concept used in the Xcite Master Controller is one of providing accurate feedback control of an exciter head's capability, such as force, displacement, velocity, acceleration, etc.

The Master Controller senses the feedback signals from the appropriate transducers and provides an output drive signal to the exciter head servovalve which will cause the exciter to maintain the desired levels of the static and dynamic variable as determined by the dynamic and static level controls.

## 2.1. Configurations

The master controller can be operated in either a single- or dual-loop configuration.

### 2.1.1. Single Loop

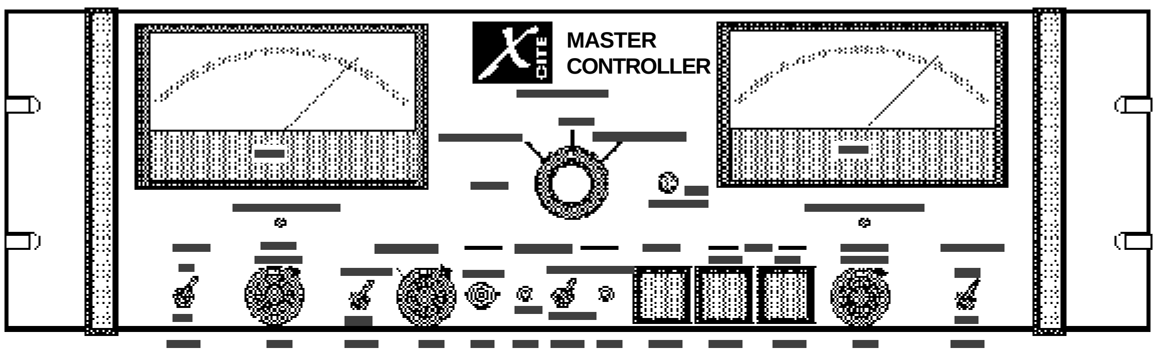
Single-loop operation is selected by placing the Frequency Range switch to the *LOW* position. This mode is generally used to control a single variable, usually force or displacement. In this *LOW FREQUENCY* mode of operation, a dynamic signal is generated by summing the reference frequency present at the *PROGRAM INPUT* with the Static Level set point signal.

### 2.1.2. Dual Loop

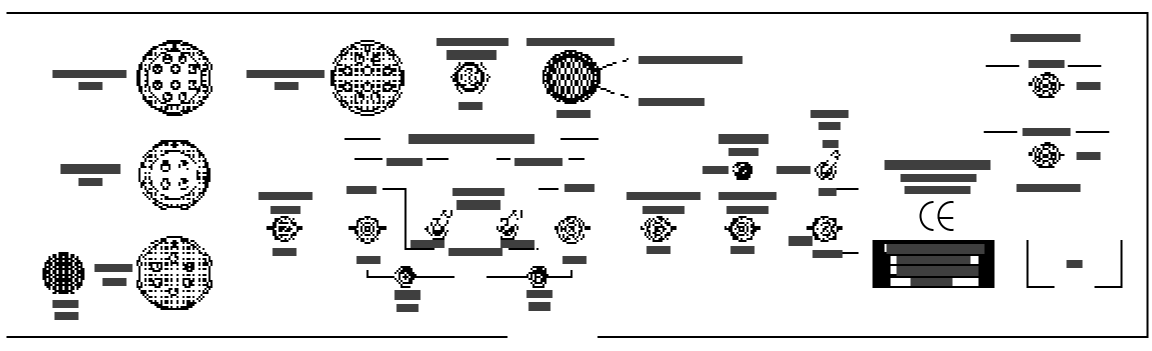
Dual-loop operation is selected by placing the *FREQUENCY RANGE* switch to the *HIGH* position. This mode applies the dynamic feedback signal to the dynamic control loop which incorporates an automatic gain control circuit. This allows a desired dynamic amplitude variable to be set and maintained over a broad frequency range and structure stiffnesses.

## 3. Description

The Xcite Master Controller (Model 1104, 1204 and 1304) has a variety of inputs and switch selectors which allows the various operational modes of the Exciter Head. Listed below is a description of each connector, switch and indicator located on the Master Controller.

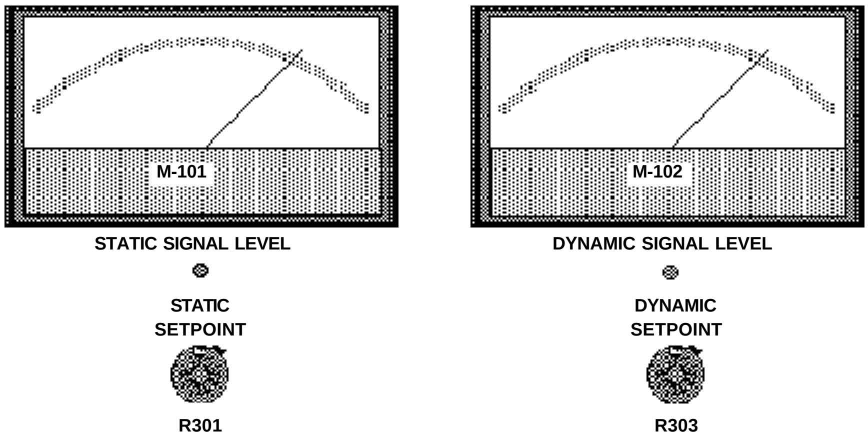



***Front Panel***



***Outside Rear Panel***

## 3.1. Front Panel *(Left and Right Top Section)*




### 3.1.1. Static Signal Level Meter (M-101)

The Static Signal Level is displayed on this meter in Static Force Pounds or Static Displacement.

### 3.1.2. Static Set Point (R301)

Potentiometer used to set value of desired static variable. The Static Set Point potentiometer is calibrated in percent full scale.

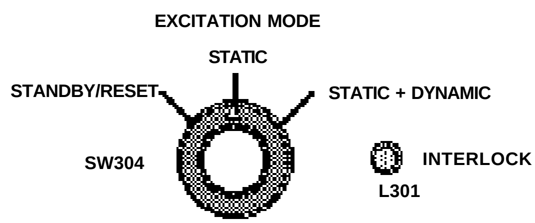
### 3.1.3. Dynamic Signal Level Meter (M-102)

The Dynamic Signal Level is displayed on this meter in Peak Dynamic Force Pounds.

### 3.1.4. Dynamic Set Point (R303)

Potentiometer used to set value of desired dynamic variable. The Dynamic Set Point potentiometer is calibrated in Peak Dynamic Force Pounds.

### 3.1.5. Excitation Mode (SW304)




Used to select operating mode of exciter head. Turn the switch so that the arrow points to the mode of interest.

**Standby/ Reset**
Exciter head is at (or returns to) standby position, as preset by set-screw potentiometer on rear of Master Controller. The interlock circuits are also reset in this mode.

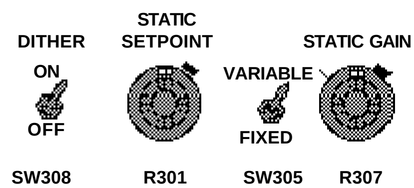
**Static**
Only the static control loop is activated.

**Static + Dynamic**
The static and dynamic control loops are activated.

### 3.1.6. Interlock (L301)

Light indicates when interlock circuits are activated, causing exciter head to return to standby position. Excitation mode control switch must be moved to Reset position to continue operation.

### 3.1.7. Dither - ON/ OFF (SW308)




*Front Panel (Left) - Bottom Section*

Toggle switch which, when in *ON* position, provides 400 Hz signal to exciter servovalve. It is used primarily to overcome exciter stiction at low frequencies of operation. (Below 5 Hz)

### 3.1.8. Static Set Point (R301)

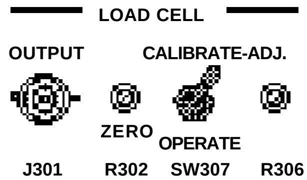
Indicates desired static level. Calibrated in percent full scale.
**See 3.1.2.**

### 3.1.9. Static Gain

**Static Gain - Variable/ Fixed (SW305)**
Toggle switch. In *VARIABLE* position actuates loop static gain potentiometer (R307).

**Static Gain (R307)**
Potentiometer used to set static control loop gain based on the stiffness of the structure under test. Used to eliminate control loop instabilities when using exciter in Static Displacement Mode on a weak structure.

### 3.1.10. Load Cell




*Front Panel (Middle) - Bottom Section*

**Output (J301)**
BNC connector providing load cell output signal for monitoring of the force signal (varies from -10V to +10V depending on the actual value of the force). Duplicated on back of controller.

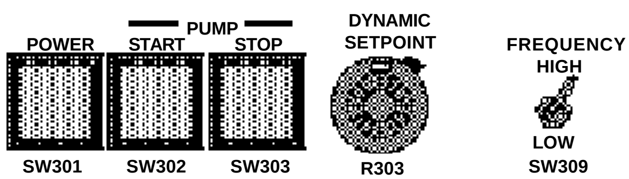
**Zero (R302)**
Set screw potentiometer used to zero the load cell output when there is no load applied.

### 3.1.11. Calibrate/ Operate (SW307)

**Adj. (R306)**
Set screw potentiometer used to adjust the master controller for the calibration value of the load cell when (SW307) is in the calibrate mode. (See load cell calibration plug for calibration value).

**Operate**
Select the operate mode of load cell once calibration is complete.

### 3.1.12. Power (SW301)




*Front Panel (Right) - Bottom Section*

Push switch for supplying power to master controller.

### 3.1.13. Pump

**Start (SW302)**
Push switch with internal red indicator light to energize power supply.

**Stop (SW303)**
Push switch to de-energize hydraulic power supply.

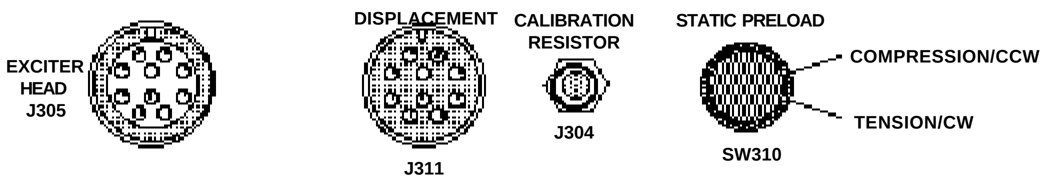
### 3.1.14. Dynamic Set Point (R303)

Indicates desired peak dynamic level. Calibrated in engineering units. **See 3.1.4.**

### 3.1.15. Frequency Range - HIGH/ LOW (SW309)

HIGH - Compressor control of dynamic signal at 5 Hz and above.
LOW - Single loop control of force or displacement.

## 3.2. Rear Panel




*Rear Panel - Top Section*

### 3.2.1. Exciter Head (J305)

Input connection for servovalve and load cell cable from exciter head.

### 3.2.2. Displacement (J311)

Input connection for displacement transducer cable from exciter head.

### 3.2.3. Calibration Resistor (J304)

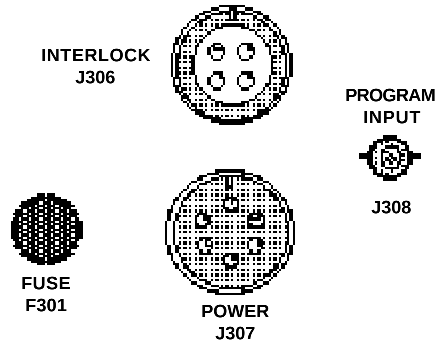
Jack input for calibration plug provided with Load Cell Transducer.

### 3.2.4. Static Preload (SW310)

Dual-position switch establishes sign convention of static preload. When exciter head is operated by “pushing” on the test article, this switch should be in the *COMPRESSION* position. If exciter head is operated by “pulling” on the test structure, this switch should be in the *TENSION* position.

### 3.2.5. Interlock (J306)

Input connect for interlock function. If external control of this function is not desired, an Xcite supplied mating connector with pins C and D shorted must be used. If user supplied external control is desired, then appropriate contact closure between pins C and D must be supplied. Pins A and B are supplied for interlock of additional external equipment, as required.




*Rear Panel (Left) - Bottom Section*

### 3.2.6. Power (J307)

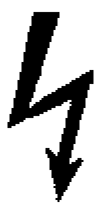
Input connection for cable from hydraulic power supply. When a non-Xcite hydraulic power supply is used, this is the input connection for the direct 110V AC power cord.

### 3.2.7. Fuse (F301)

Use 3 amp fuse for 115 VAC. Use 1.5 amp fuse for 230 VAC.

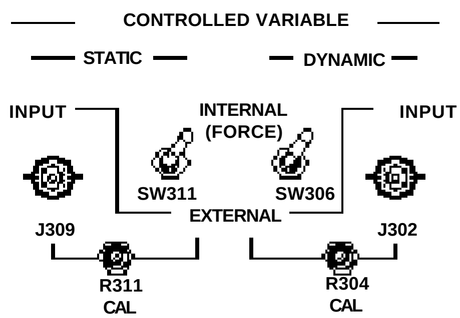
### 3.2.8. Program Input (J308)

Input connection for signal from reference oscillator.



*A 1 volt RMS signal must be provided to ensure system control calibration.*

### 3.2.9. Controlled Variable - Static




*Rear Panel (Middle) - Bottom Section*

**Input (J309)**
Input BNC connection for externally supplied user-specified static feedback variable. Input signal level should be 5 volts minimum full scale. Also used for Displacement Transducer feedback from the Exciter Head.

**Internal/ External (SW311)**
Toggle switch to select as the static controlled variable either the internally available load cell transducer signal or an externally supplied user-specified static feedback signal.

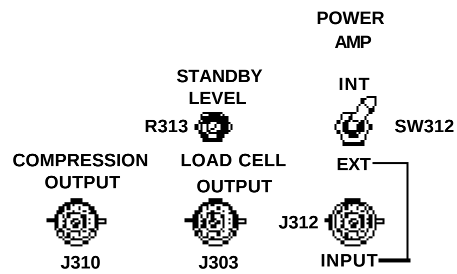
**Cal. (R311)**
Set screw potentiometer used to scale externally supplied static feedback variable to 5 volts full scale. Factory set for scaling 10 volts to 5 volts.

### 3.2.10. Controlled Variable - Dynamic

**Input (J302)**
BNC connection for externally supplied user-specified dynamic feedback variable. Input signal level should be 5 volts peak (minimum) full scale.

**Internal/ External (SW306)**
Toggle switch to select as the dynamic controlled variable either the internally available load cell transducer signal or an externally supplied user-specified dynamic feedback signal such as acceleration.

**Cal. (R304)**
Set screw potentiometer used to scale down externally supplied dynamic feedback variable to 5 volts peak full scale.




*Rear Panel (Left) - Bottom Section*

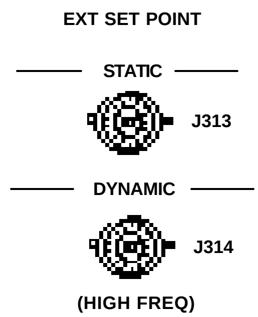
**3.2.11. Compression Output (J310)**
BNC connection providing an output signal which is proportional to dynamic forward control signal (servovalve drive signal) after multiplication by reference oscillator signal.

**3.2.12. Standby Level (R313)**
Set screw potentiometer determining static level when Master Controller is in standby or interlock mode.

**3.2.13. Load Cell Output (J303)**
BNC connector providing load cell output signal for monitoring of the force signal (+/- 10V max). Duplicated on front of controller.

**3.2.14. Power Amp - INT/ EXT (SW312)**
Toggle switch to select input signal to power amplifier. *INTERNAL* position is used for normal operation and provides dynamic control signal proportional to level requested on the front of the Master Controller at the reference oscillator frequency. *EXTERNAL* position is used for external dynamic control applications such as random or shaped random signals from an FFT Analyzer or random noise generator. In *EXTERNAL* position, the *DYNAMIC SET POINT (R303)* potentiometer on the front panel attenuates the external dynamic control signal and the *DYNAMIC SIGNAL LEVEL METER (M-102)* indicates 1.41 times the true RMS voltage of the dynamic variable feedback level.

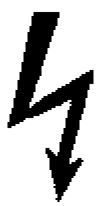
**3.2.15. Power Amp - INPUT (J312)**
BNC connector used to supply external control signal source with *POWER AMP* toggle switch on *EXTERNA*L. Use only J308 *PROGRAM INPUT* with toggle switch on *INTERNAL*.




*Rear Panel (Right) - Top Section*

### 3.2.16. EXT Set Point - Static (J313)

Allows computer control of the Static Set Point by inputing a voltage from a DAC (Digital to Analog Convertor). Typically this function is used when it is desired to have an automatic test sequence from a computer controlled FFT Analyzer.



***CAUTION:*** *This input is ALWAYS live and will activate the static control loop whenever a DAC voltage is present.*

The EXT Static Set Point has the following characteristics:

- It is ***ALWAYS*** operable in the Standby, Static and Static + Dynamic modes.

- The input voltage from the DAC should be 0 to +5VDC, +/-5% to achieve full scale control of the Static Controlled Variable.

  **Note:** Always use a positive DC DAC voltage for this function.

- The input voltage from the DAC will add to the Static Set Point. (ie - If the Static Set Point Dial is set to 5.0 (1/2 of full stroke in displacement mode) then the EXT DAC voltage input will add to the Set Point on the Set Point Dial.

### 3.2.17. EXT Set Point - Dynamic (J314)

Allows computer control of the Dynamic Set Point by inputing a voltage (NOT frequency) from a DAC (Digital to Analog Convertor). Typically this function is used when it is desired to have an automatic test sequence from a computer controlled FFT Analyzer.

***CAUTION:** This input is live when the Mode Control Switch is in the Static + Dynamic Mode. Dynamic Force output will occur whenever a DAC voltage is present at this input.*

The EXT Dynamic Set Point has the following characteristics:

- It operates in the Static + Dynamic Mode.
- It only operates in the High Frequency Range

  **Note:** Never use in the Low Frequency Range Mode
- The input voltage from the DAC should be 0 to -5VDC, +/-5% to achieve full scale control of the Dynamic Controlled Variable.

  **Note:** Always use a negative DC DAC voltage for this function.
- The input voltage from the DAC will add to the Dynamic Set Point. (ie - If the Dynamic Set Point Dial is set to 5.0, then the EXT DAC voltage input will add to the Set Point value. In this example a DAC voltage of -2.5V will make the Set Point 100%).

# 4. Operation

## 4.1. Concept of Operation

The Xcite Master Controller is designed so that the variables to be controlled can be readily selected by the positions of the Controlled Variable switches located on the rear panel of the controller.

When the Controlled Variable switches are in the Internal position, the controlled variable will be force. The force feedback signal is internally routed to the static and dynamic control loops. The composite force signal is separated by a low-pass and high-pass filter, with the DC and AC levels of the composite signal being displayed by the Static and Dynamic meters, respectively.

If a variable(s) other than force is to be controlled, the Controlled Variable switches can be placed in the External position and feedback from the variable to be controlled can be applied to the External Static and/ or External Dynamic inputs. This allows alternate variables such as displacement to be statically and dynamically controlled, or two variables such as static displacement and dynamic force to be controlled.

### 4.2. System Interconnection

Mount the exciter head to be operated securely in its test configuration and connect the hydraulic pump hoses to the exciter.

**4.2.1.** Exciter head cable (J305 to servovalve and load cell)

**4.2.2.** Displacement kit cable (J311 to exciter displacement kit)

**4.2.3.** Power cord or pump cable (J307 to J501 or 110 VAC)

**4.2.4.** Reference oscillator to Program input J308 (1 V RMS +/- 50 MV)

**4.2.5.** Connect an oscilloscope and/ or D.V.M. to Load Cell outputs J301 or J303.

### 4.3. Operation - Force Control

To operate the exciter under force control, place the following switches and controls in the positions given.

#### 4.3.1. Set Controls

| | |
|---|---|
| MODE CONTROL | STANDBY/RESET |
| DITHER | OFF |
| LOOP GAIN | FIXED (If test specimen static stiffness is less than 10,000 lbs/inch, place in variable & set variable gain control at 5.00) |
| FREQUENCY RANGE | HIGH |
| STATIC SET POINT | 0 |
| DYNAMIC SET POINT | 0 |
| STATIC CONTROLLED VARIABLE | INTERNAL |
| DYNAMIC CONTROLLED VARIABLE | INTERNAL |
| TENSION/ COMPRESSION | COMPRESSION |

**4.3.2. Depress the Power switch**

The controller will energize and a momentary deflection of the meter pointers may occur.

**4.3.3. Adjust Load Cell**

- Adjust the load cell zero adjust for 0 Volts on a digital volt meter. Refer to the Calibration plug located on the rear of the controller for the load cell calibrate value and the output sensitivity of the controller.

- Place the load cell calibrate switch in the calibrate position. If necessary, adjust the load cell calibrate screw until the voltage measured by the digital volt meter equals the calibration volt age. The calibration voltage equals the calibration value divided by the output sensitivity.

  **Example:**
  Cal. Value = 742 lbs
  Output Sens. = 250 lbs/ v
  therefore: 742/250 = 2.968v at J301/ J303

- Return the load cell calibrate switch to the operate position.

**4.3.4. Depress Pump Start Button**

The Hydraulic Power Supply should energize.

- Set the Mode Control switch to the Static position.

- Slowly turn the Static Set Point clockwise until the required static force is obtained, as indicated on the Static Meter. If operating into a “weak” structure, static force instability may occur. If this should happen, adjust the Variable loop gain counterclockwise until static stability is achieved.

- Set the reference oscillator to the desired excitation frequency.

- Set the Mode Control switch to Static + Dynamic position.

- Turn the Dynamic Set Point clockwise until the desired dynamic force is obtained.

**Note:** Refer to the Exciter Head specifications for maximum peak force versus frequency.

- If swept sine test are to be run, the sweep rate of the oscillator will have to be adjusted so that the dynamic level does not decrease as the frequency is swept upward. If this occurs, lower the sweep rate until the dynamic level is maintained as the oscillator frequency is swept.

### 4.4. Operation - Displacement Control

If the exciter head is to be operated under displacement control, place the controller switches in the following positions.

#### 4.4.1. Set Controls

| | |
|---|---|
| MODE CONTROL | STANDBY/RESET |
| DITHER | OFF |
| LOOP GAIN | VARIABLE (Variable loop gain control at 5.00) |
| FREQUENCY RANGE | LOW |
| STATIC LEVEL | 0 |
| DYNAMIC LEVEL | 0 |
| STATIC CONTROLLED VARIABLE | EXTERNAL |
| DYNAMIC CONTROLLED VARIABLE | INTERNAL |
| TENSION/ COMPRESSION | COMPRESSION |

- Energize the controller and the hydraulic power supply.
- Switch the Mode Control to the Static position.
- Turn the Static Set Point potentiometer until the desired static position is reached. The static position can be read on the Static Meter in percent of full stroke. For instance, if the exciter head being used has a 1 inch stroke and the Static meter reads 40%, then the exciter piston is extended 40% of one inch or .4 inch.

The exciter piston position can be dynamically varied by turning the Mode Control switch to the Static + Dynamic position and adjusting the Dynamic Level control for the desired stroke. The Dynamic meter will not indicate the peak displacement in this mode of operation. It will be necessary to monitor the displacement signal at the External Static Variable input jack J309. The input signal at this point will be 0 - 10 VDC. If the exciter has a 1 inch stroke, then full stroke will be equal to 10 VDC. On torsional exciters, 10 VDC represents 100 degrees of rotation.

If compressor control is desired, the Frequency Range should be set to the High position and the displacement input also connected to the Dynamic External Static input J302. At frequencies below approximately 5 Hz full stroke of the exciter may not be obtained inthe High Frequency mode. However, the amplitude of the 1 V RMS signal from the reference oscillator may be increased to obtain a slightly larger dynamic stroke.

### 4.5. Operation - External Variable

Operation using the External Static and Dynamic controlled variable inputs is very similar to the operation using the internal controlled variable. One requirement, however, is that the external variables be scaled to the full scale value of the Static and Dynamic meters. This is accomplished by adjusting the External Cal. potentiometers. A 5 VDC signal is required for full scale deflection of the Static meter and a 5 V peak signal is required for full scale deflection of the Dynamic meter. The Static External Cal. potentiometer is factory adjusted for 10 VDC full scale static signal. The Dynamic Cal. potentiometer is adjusted for a 5 V peak dynamic signal. If signals larger than these are to be used, the Cal. potentiometer should be readjusted so that those signals will cause full scale deflection of the meters.

### 4.6. Computer Control - External Set Points (Static and Dynamic)

As explained in Section 3.2.16. and Section 3.2.17., it is possible to have a computer controlled FFT Analyzer control the Static and Dynamic Set Points of the Master Controller. Separate DAC output voltages are required for the Static Set Point and Dynamic Set Points. The Static DAC output must be a positive voltage and the Dynamic DAC output must be a negative voltage.

When using an external computer to input the Static and Dynamic Set Points, attention must be paid to the consequences of inputing a DAC voltage when the Hydraulic Power Supply is turned on. The Exciter Head will attempt to operate when these signals are present even with the Mode Control Switch in Standby. **STRUCTURE DAMAGE OR PERSONAL INJURY CAN OCCUR IF THE TEST SEQUENCE IS NOT THOROUGHLY PLANNED.**

# 5. Theory of Operation

The Xcite Master Controller consists of seven major circuits. They are:

- Static control circuitry
- Dynamic control circuitry
- Power amplifier
- Load cell amplifier
- Displacement transducer buffer/ amplifier
- Interlock circuitry
- Pump/ start/ stop

Each section is described in detail as follows.

## 5.1. Circuit Descriptions

Refer to the Master Controller block diagram and to the appropriate printed circuit board schematics for the following circuit descriptions.

### 5.1.1. VR101 (Voltage Regulator)

Provides the excitation voltage for the load cell. The regulated voltage is determined by the values of R169 and R170.

$$V\ out = \frac{1.25V(1 + R170)}{R169}$$

To calibrate the load cell, place a precision shunt resistance (Cal. Plug provided with each load cell) into J304 and place the load cell calibrate/ operate switch SW307 in the calibrate position. This causes an imbalance of the load cell bridge and results in an output of the load cell amplifier A109. The excitation voltage to the load cell is then varied by adjusting R306 until the output of A109 corresponds to the calibration value of the load cell, as given on the calibration plug.

### 5.1.2. SW310 (Preload Switch)

Allows the outputs of the load cell to be reversed before being applied to A109. This will cause the exciter head to operate in a tension mode, instead of a compression mode.

### 5.1.3. A109 (Amplifier)

A109 is a precision differential instrumentation amplifier used to amplify the differential voltages from the load cell bridge. R166 and A108 allow the output of A109 to be scaled to a convenient engineering unit for monitoring purposes. The output of A108 is available at BNC jacks on the front and rear of the Master Controller.

The output of A109 is also applied to SW311 and SW306. When these switches are in the *INTERNAL* position, the force signal is applied to the static and dynamic loops as the feedback signal and controlled variable.

### 5.1.4. A104 and A105 (Static Control Loop)

The static control loop consists of A105 and A104. A105 is a dual op-amp. A105B is a low-pass filter which allows the static portion of the feedback signal to be indicated by the static meter. A105A is an inverter/ buffer stage. R137 allows calibration of the dynamic level control when operating in the *LOW FREQUENCY* force control. R135 allows calibration in the *LOW FREQUENCY* displacement control.

The feedback signal from A105A is summed with the static level signal at the summing junction of A104. A104 is a low-pass filter which provides high DC gain which rolls off at 6DB/ octave at a breakpoint determined by R174 and C108. R176, R102 and R113 determine the DC gain of A104. The output of A104 is applied through SW311 and / or K201 and to the appropriate feedback path as determined by the controlled variable.

The output of A104 is also applied to R133 and enables the static loop gain to be adjusted for optimum operation of the exciter head under force control. Further operator adjustment of the static loop gain is provided by R307 when the *GAIN* switch SW305 is in the *VARIABLE* position.

### 5.1.5. A401 and A402 (Dynamic Loop)

The dynamic loop has two main circuits. One circuit, consisting of A401 and A402, demodulates the incoming reference frequency and converts it to a DC reference signal which is applied to the Dynamic Level Control, R303.

The dynamic demodulator circuit consist of a low-pass filter A103, and a true RMS-to-DC converter, U102. The DC portion of the force signal is blocked by C109. The output of U102 is a DC signal. This DC is summed with the dynamic set point signal from the wiper of R303. The resultant error signal is integrated by A012 and C104. This DC error signal is applied to one input of the four-quadrant multiplier, U101. The reference frequency supplied by the reference oscillator is supplied to the other input of U101. The output of U101 is a signal with a frequency identical to the reference frequency and with an amplitude equal to the product of the two input signals. A101A converts the current output of U101 to a voltage. A101B provides output offset capabilities. C101 and C102 allow the dynamic signal to have two breakpoints at higher frequencies, as required to prevent the servovalve drive signal from clipping.

The output of U101 and A104 are applied to summing amplifier A201. The dither signal is also summed at this point if it is selected by the dither switch. The output of A202 is a composite error signal which is then applied to the power amplifier.

The power amplifier is a voltage-to-current converter circuit. The output current will remain constant for a given input voltage, even though the load impedance (servovalve coils) changes.

### 5.1.6. A107 (Inverter Buffer)

This circuit allows the displacement transducer to be offset and scaled to convenient engineering units. The scaled displacement signal is fed out through J311/ G into a BNC cable which is then connected to J309. By placing the Static controlled variable switch in the External position, displacement will become the static controlled variable.

### 5.1.7. A106 and U103 (Peak Detector Circuit)

A106 and U103 form a peak detector circuit which can be adjusted if an absolute value of displacement is exceeded. It is primarily used with inertial mass exciter heads, and only appears in Master Controllers with the MOD2 option.

The interlock circuitry provides a means of insuring that the systems always power up to a preset level, determined by Standby level pot. If power is applied to the Master Controller with the Mode Control switch in either the Static or Static + Dynamic position, the system will interlock. The Mode Control switch must then be placed in the Standby/ Reset position. The Hydraulic Power Supply must also be energized before proceeding to the desired mode of operation.

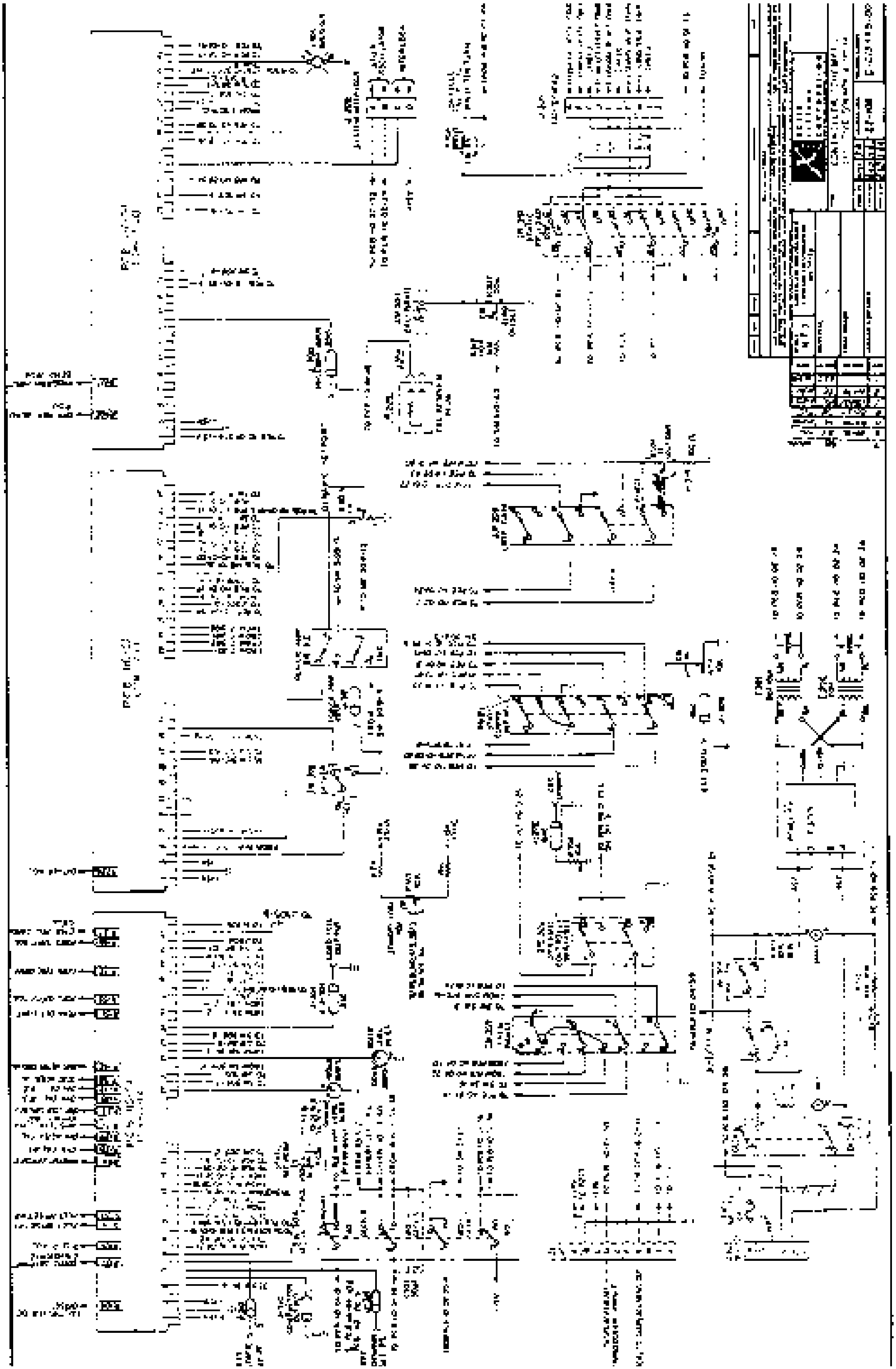
## 6. Specifications

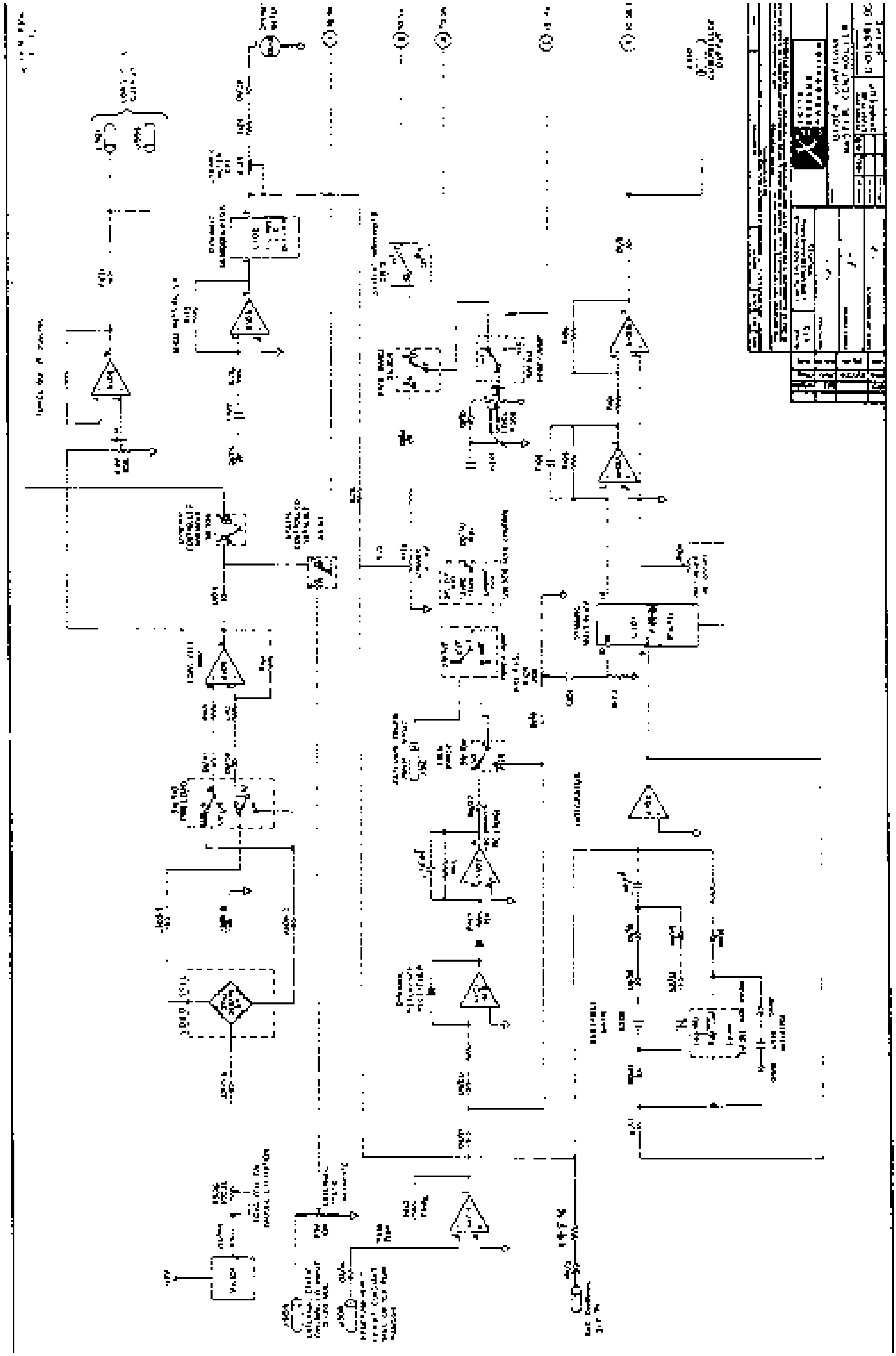
**Modes:**

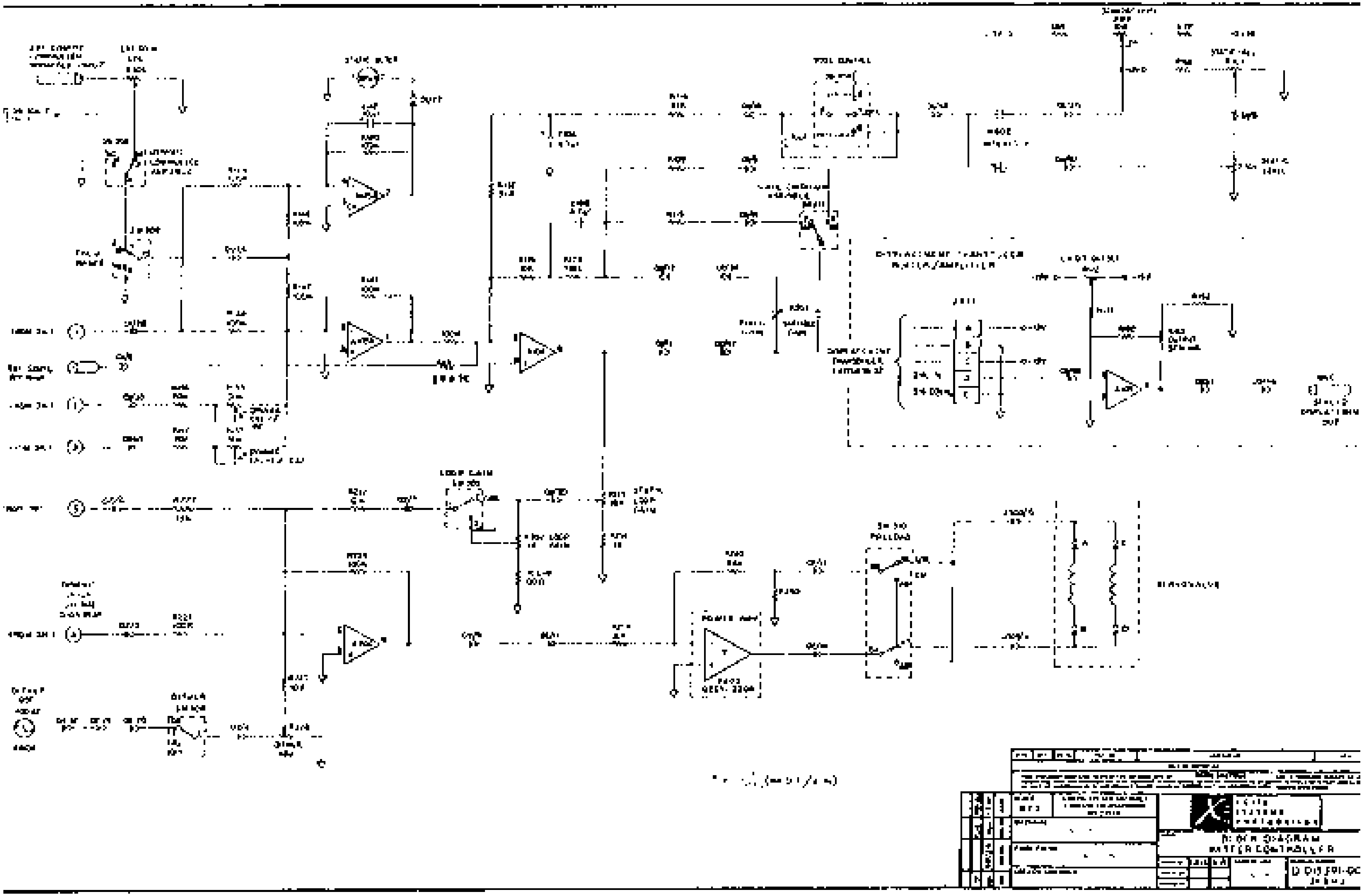
| | |
|---|---|
| • Standby/ Reset | Continuously variable standby level |
| • Static | Continuously variable static level |
| • Static + Dynamic | Continuously variable static level and dynamic level |
| • External Static Input | 10 K ohms input impedance<br>Positive polarity 0 - 10V |
| • External Dynamic Input | 10 K ohms input impedance<br>10 V peak AC |
| • Dither | 400 Hz +/- 10% |
| • Control Accuracy | 40 dB of full scale controlled variable |
| • Program Input Reference Signal | 1.0 VAC RMS +/- 50 MV - sinusoidal<br>5.0 V peak maximum - random |
| • Power Amp Input Reference Signal | 0 to 5 Volt Peak |
| • EXT Static Set Point | 0 to +5VDC for full scale operation |
| • EXT Dynamic Set Point | 0 to -5VDC for full scale operation |

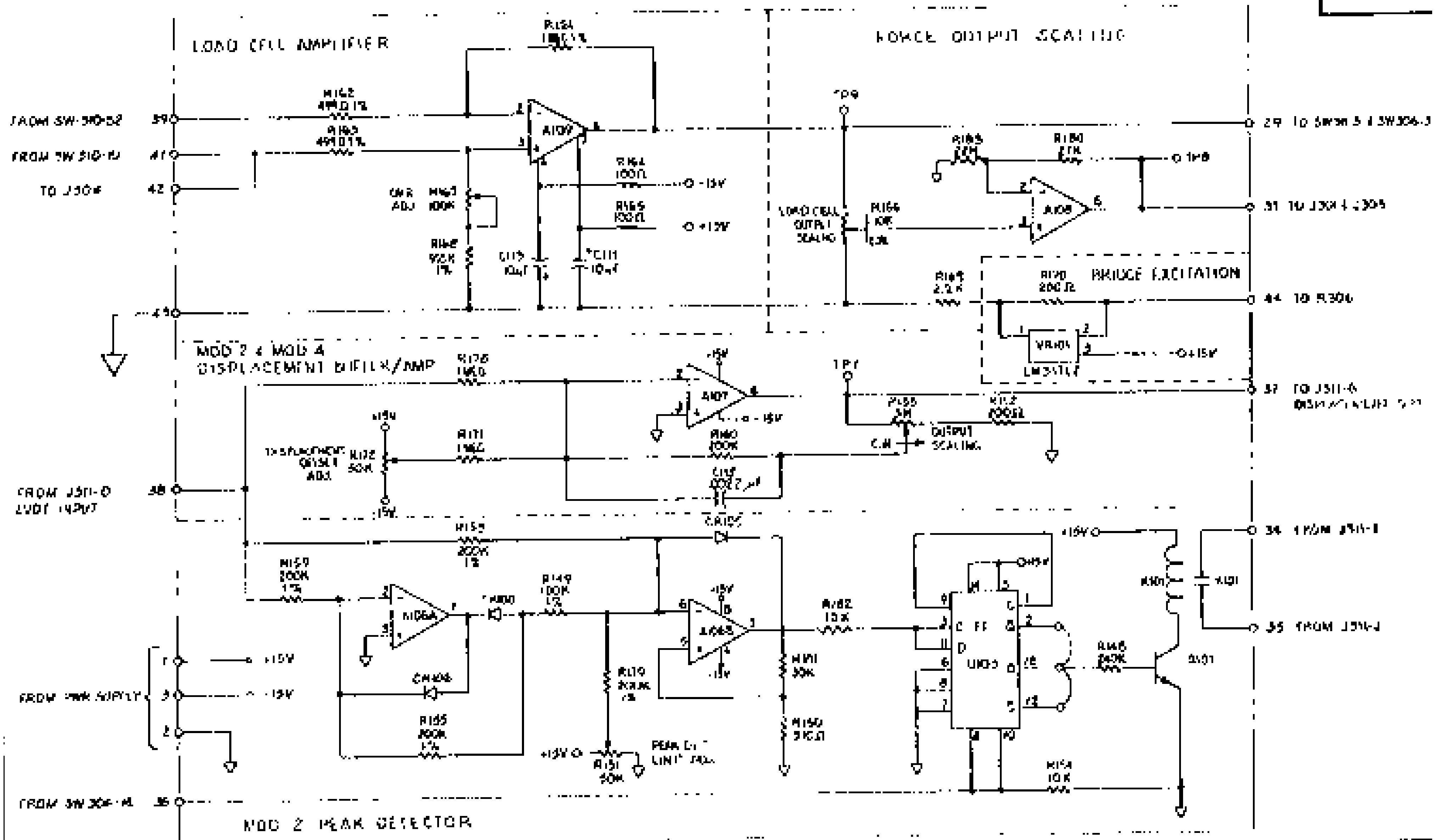
## 7. Drawings

| | |
|---|---|
| Printed Circuit Board Location | ——— |
| Controller Schematic | D-015393 |
| Block Diagram Master Controller (2 sheets) | D-015391 |
| Schematic PCB 110-01 Sheet 3 - Load Cell Amp & Peak-Detector | C-015358 |
| Schematic PCB 110-01 Sheet 1 - Static Loop | C-015358 |
| Schematic PCB 110-01 Sheet 2 - Dynamic Loop | C-015358 |
| PCB 110-01 (Component Location) | D-015384 |
| Schematic PCB 110-02 | C-014893 |
| Assy PCB 110-02 (Component Location) | C-014881 |
| Schematic PCB 110-04 | C-010660 |
| Assy PCB 110-04 (Component Location) | C-014882 |






BLOCK DIAGRAM
MOTOR CONTROLLER




1. ALL DIODES ARE 1N914.
2. ALL RESISTORS SHALL BE 1/4W 5% UNLESS OTHERWISE SPECIFIED.

BILL OF MATERIAL

SCALE NTS

MATERIAL - HEAT TREAT

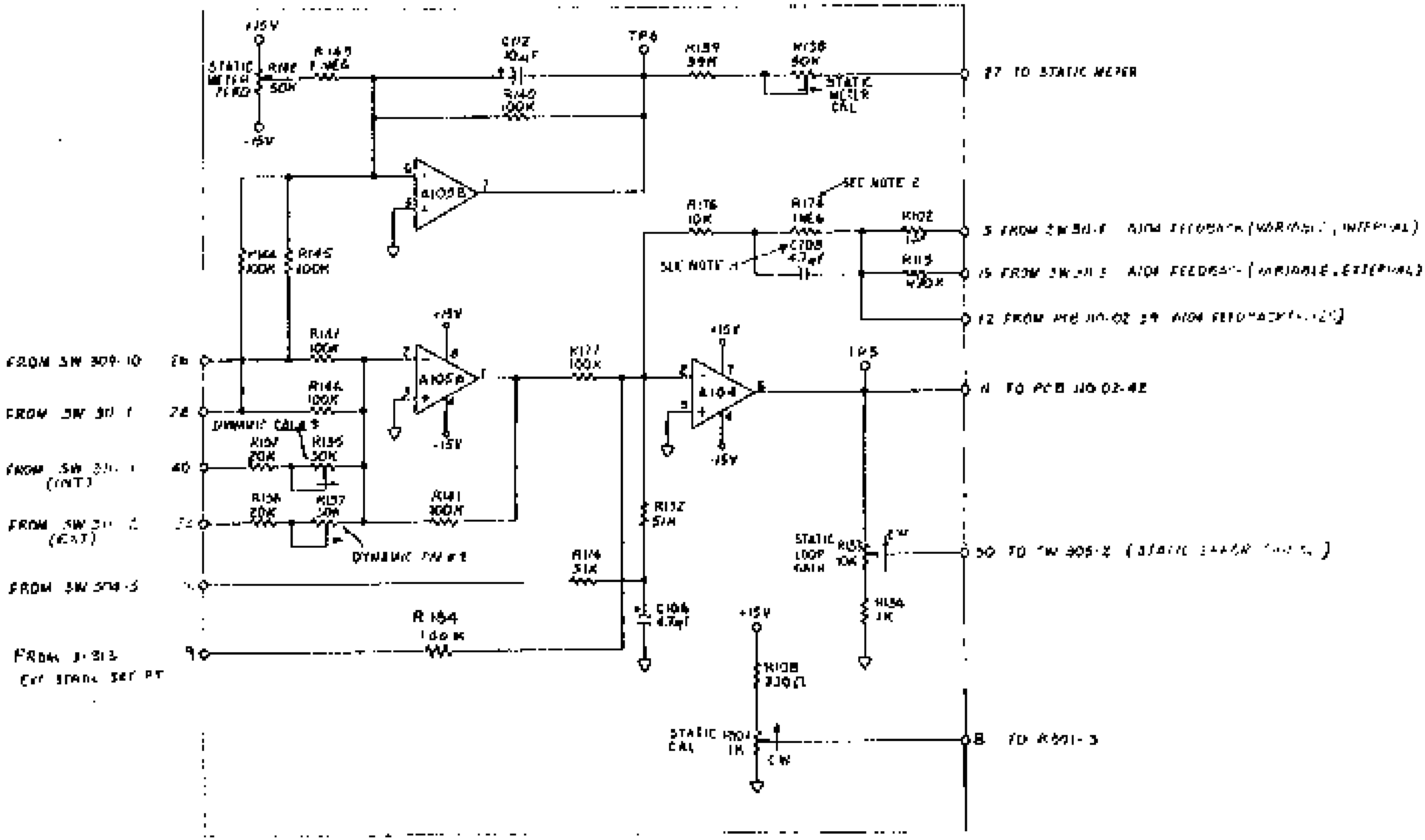
FINAL FINISH

USED ON ASSEMBLY

KEITH SYSTEMS CORPORATION

C-15558-08
SH 3 OF 3

C-15358-




# STATIC LOOP

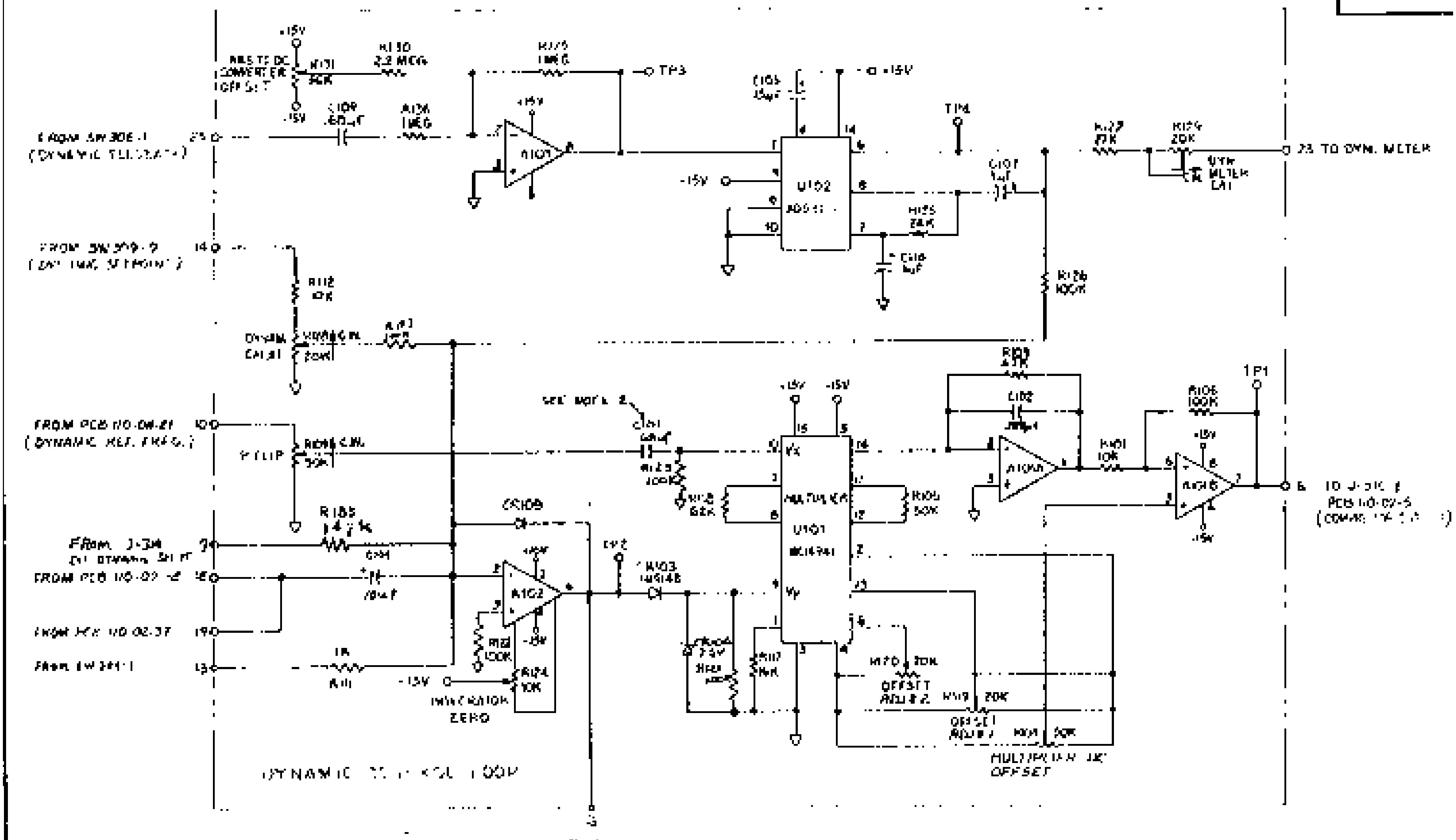
1. ALL RESISTORS SHALL BE 1/4W ± 5% UNLESS OTHERWISE SPECIFIED.
2. R174 IS 100K ON PCB 110-01 CONFIGURED WITH MOD 2 OPTION
3. C108 IS REMOVED ON PCB 110-01 CONFIGURED WITH MOD 2 OPTION.

| | |
|---|---|
| MATERIAL - HEAT TREAT | |
| FINAL FINISH | |
| USED ON ASSEMBLY | |

XCITE SYSTEMS CORPORATION

SCHEMATIC
PCB 110-01-

C-15358-



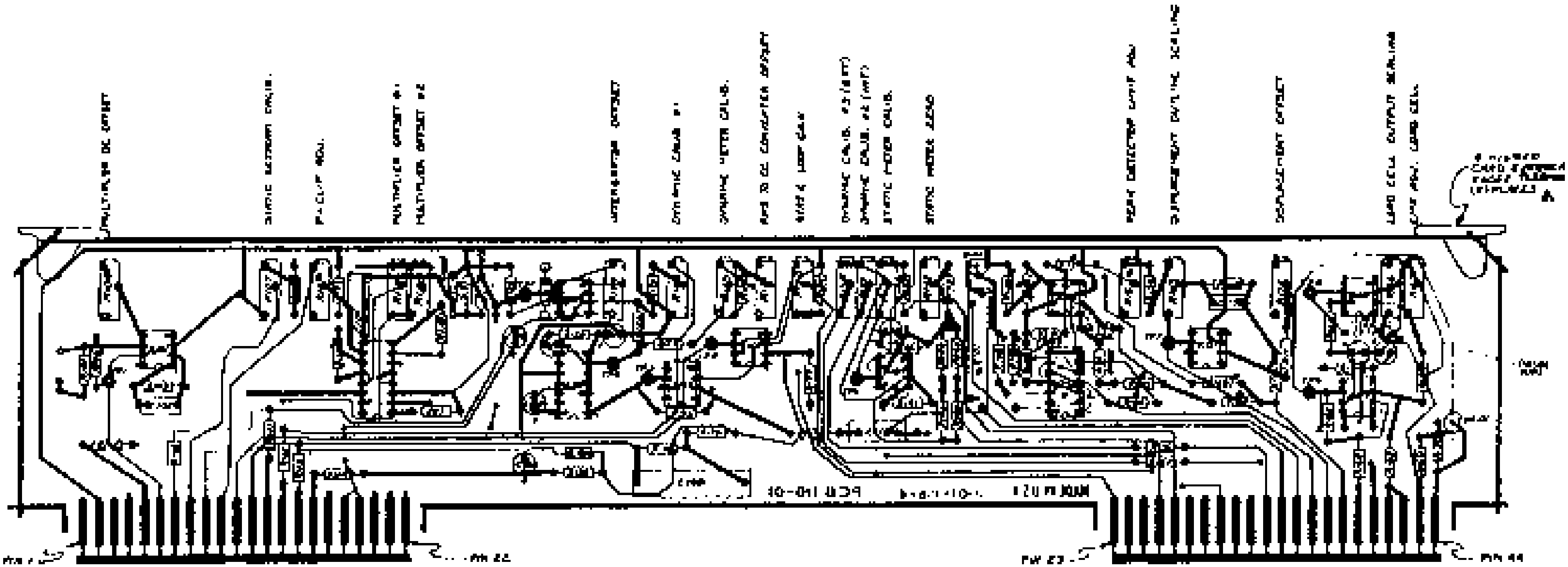

1. ALL RESISTORS ... UNLESS OTHERWISE SPECIFIED.
2. C101 IS .068µF FOR PCB 110-01 CONFIGURED WITH MOD 2 OPTION.

| SCALE | N.T.S. |
|---|---|
| UNITS | DECIMALS UNLESS OTHERWISE SPECIFIED |
| MATERIAL - HEAT TREAT | |
| FINAL FINISH | |
| USED ON ASSEMBLY | |

KEITH SYSTEMS CORPORATION

SCHEMATIC PCB 110-01

C-10558-009



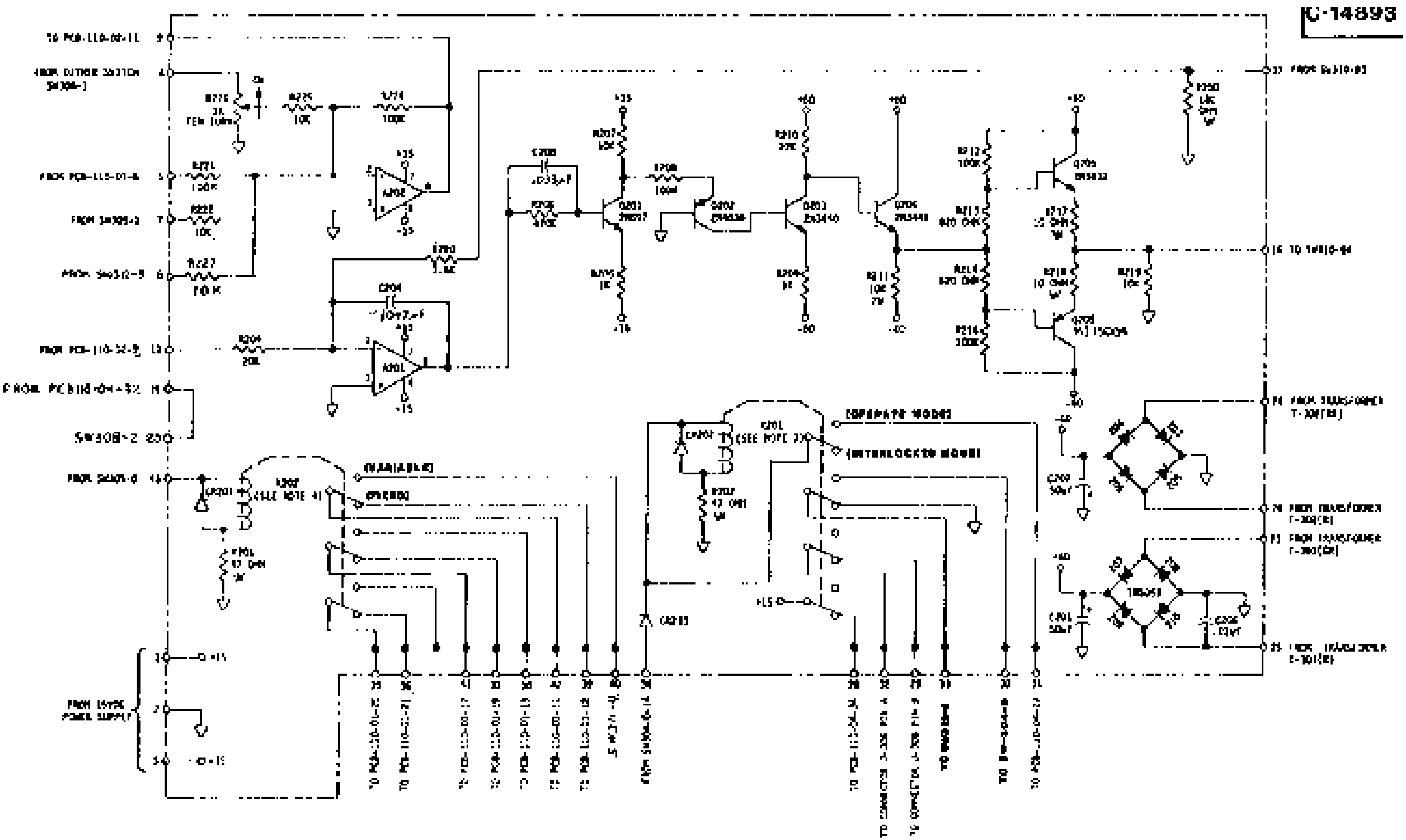

NOTE:

1) * THESE ITEMS ARE ONLY REQUIRED WHEN [illegible] OPTION IS USED

2) THE FOLLOWING ARE REQUIRED FOR MOD 2 [illegible]

3) ALL [illegible]

PCB 110-01 COMPONENT LOCATION




NOTES

1. ALL RESISTORS ¼ WATT, 5% CARBON COMPOSITION UNLESS OTHERWISE NOTED.
2. AMPLIFIERS A201 & A202, FAIRCHILD 741C.
3. K201 IS DE-ENERGIZED WHEN SYSTEM IS INTERLOCKED.
4. K202 IS ENERGIZED WHEN LOOP GAIN IS IN "VARIABLE" POSITION.
5. OPTIONAL JUMPER REQ'D FOR CONST. CURRENT MODE OF POWER AMP.
6. REMOVE JUMPER FOR CONST. CURRENT MODE.

BILL OF MATERIAL

UNLESS OTHERWISE SPECIFIED

MATERIAL – HEAT TREAT

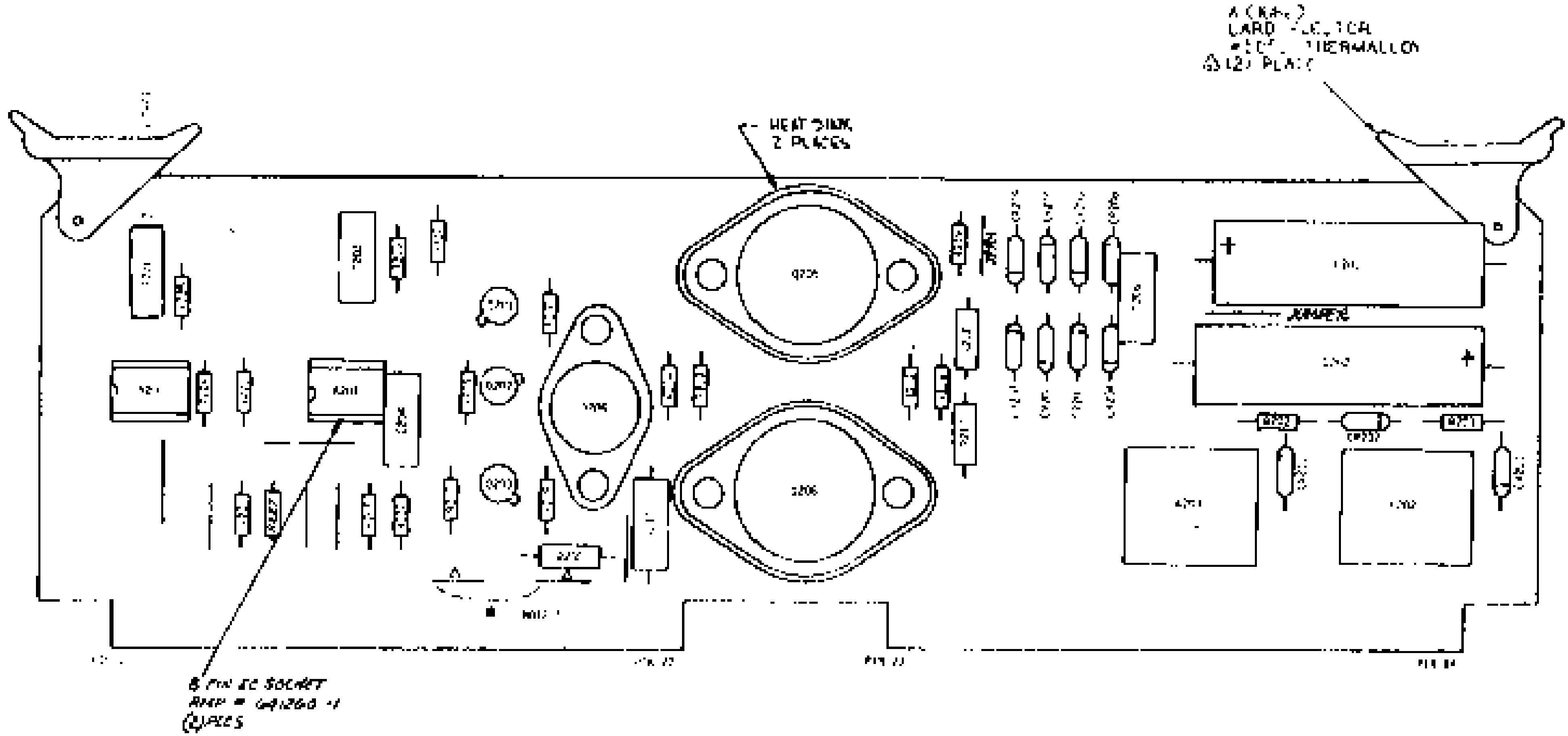
FINAL FINISH

WELD-ON ASSEMBLY

SCALE

TITLE: SCHEMATIC - PCB - 110 - 02

C-14893



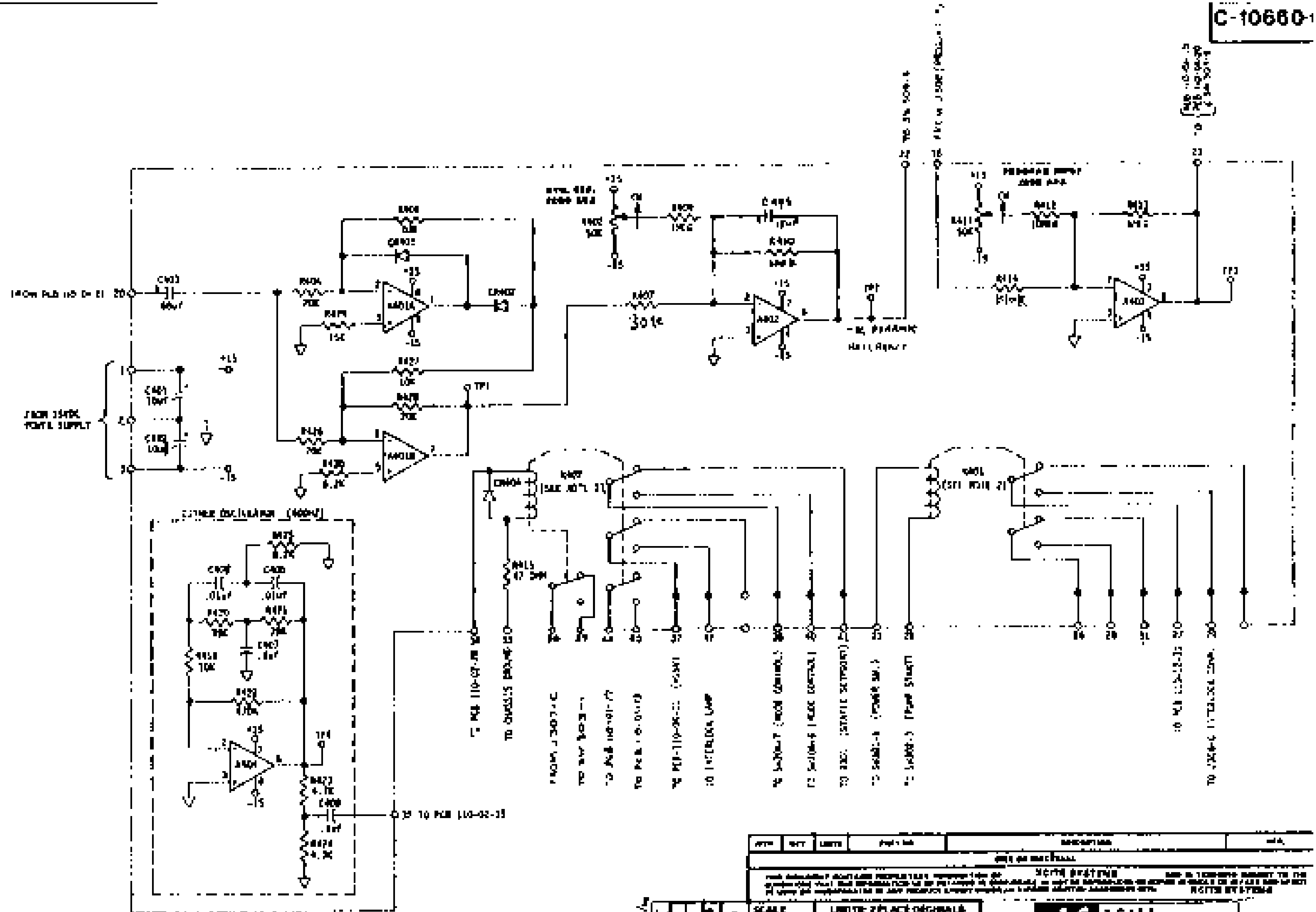

NOTES

| | |
|---|---|
| BILL OF MATERIAL | |
| SCALE | UNLESS OTHERWISE SPECIFIED |
| MATERIAL | A-01106 |
| FINAL FINISH | |
| USED ON ASSEMBLY | |

EXCITE SYSTEMS CORPORATION

ASSY - PCB - 110 - 02

C-14881-7




NOTES:

1. RELAY K402 IS OPERATED WHEN SYSTEM IS IN INTERLOCK MODE.
2. RELAY K401 PUTS SYSTEM INTO INTERLOCK MODE IF HYDRAULIC PUMP IS STOPPED.
3. A401 - A404 ARE 741C. ALL RESISTORS ARE 1/4W CARBON COMPOSITION UNLESS OTHERWISE NOTED. CR401 - CR403 ARE 1N914, CR404 IS 1N4002.
4. K401 IS [illegible]

| SCALE | LIMITS: 2 PLACE DECIMALS ±.010 UNLESS OTHERWISE SPECIFIED |
|---|---|
| MATERIAL – HEAT TREAT | |
| FINAL FINISH | |
| USED ON ASSEMBLY | |

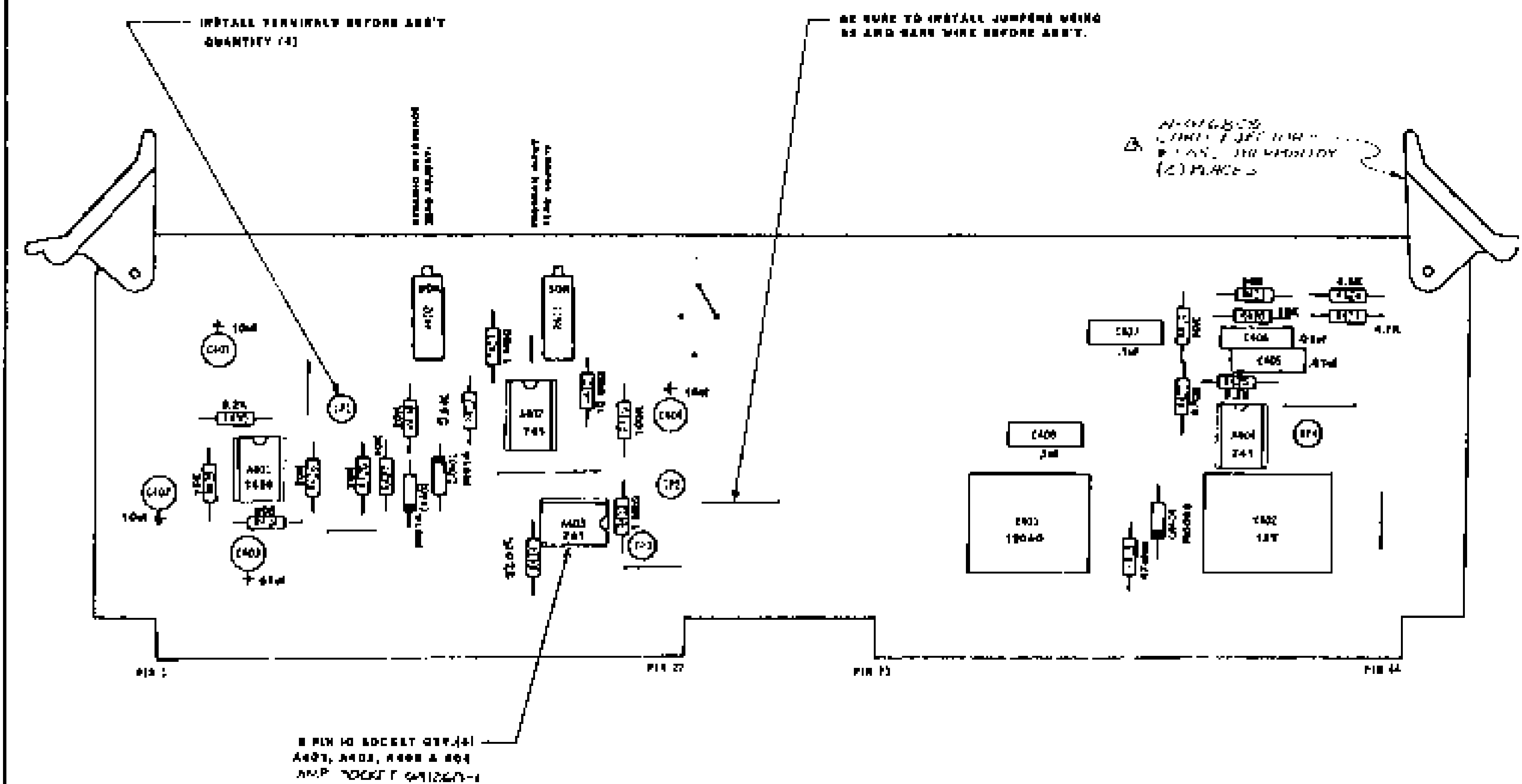
XCITE SYSTEMS CORPORATION

TITLE: SCHEMATIC - PCB - 110 - 04

EFFECTIVE S/N 250 AND ABOVE

C-10660-1

C-14882-5




NOTES
1. STAMP ASSY NO. AND S/N ON BOARD.

SCOTT SYSTEMS CORPORATION

ASSY - PCB-110-04

UNLESS OTHERWISE SPECIFIED

MATERIAL - HEAT TREAT

FINAL FINISH

USED ON ASSEMBLY

C-14882-6

## 8. Parts List

Xcite reserves the right to substitute parts without notice.

| Component Part Number | Description |
|---|---|
| **Chassis** | |
| R301, 303, 307 | 1K, 10 Turn 5000 Series Pot |
| R302 | 50K, Trim Pot 3059J-1-503-M |
| R304, 311, 313 | 10K, Trim Pot 3059J-1-103-M |
| R305 | Load Cell Dependent Phone Jack |
| R306 | 500 Ohm, Trim Pot 3059J-1-501-M |
| R308, 309, 310 | 47K, 1/2W, 5% |
| R312 | 110K, 1/4W, 5% |
| R314 | 100 Ohms, 1/4W, 5% |
| C301 | 50 MFD, 50V 7121L (39D) |
| T301, 302 | Transformer, F-90X |
| T303 | Supply, HAA-15-8 |
| F301 | Fuse, AGC 3, 3 amp |
| SW301 | 5A DPDT, 520-101G-51-A1H |
| SW302, 303 | 5A SPUT, 518-1016-51-A1H |
| SW304 | Rotary 4P3T, 44A60-04-1-3N |
| SW305, 309, 311 | 4PDT Locking Toggle, MTL-406N |
| SW306, 312 | DPDT Locking Toggle, MTL-206N |
| SW307, 308 | SPDT Locking Toggle, MTL-106D |
| SW310 | Rotary 5PDT, 71B30, 01-5-02N |
| M101, 102 | 100 Microamp, 4.5", 7045-3602-0000 API |
| J301, 302, 303 | BNC Connector, UG-1094A/U |
| J304 | Phone Jack, 12-B |
| J305 | MS3102A-18-1S |
| J306 | MS3102A-18-4S |
| J307 | MS3102A-18-12P |
| J311 | MS3102A-18-1P |
| KN301 | Knob, DS70-2BD-2 (Rear) |
| KN302 | Knob, DS70-3-2 (Front) |

| Component Part Number | Description |
|---|---|
| KN303, 304, 305 | Dial, Turns Counting, 2606 |
| L301 | 515-0012, Lamp, 6.5. Lamp Holder |
| L302 | RA877 Crimp Lug |

## PCB 110-01

| Component Part Number | Description |
|---|---|
| R101, 102, 112, 176 | 10K, 1/4W, 5% |
| R103 | 47K, 1/4W, 5% |
| R104, 131, 135, 137, 138, 142, 151, 172 | 50K, Trim Pot, 784 Series |
| R105 | 30K, 1/4W, 5% |
| R106, 121, 122, 123, 126, 140, 141, 144, 145, 146, 147, 173, 177 | 100K, 1/4W, 5% |
| R107 | 1K, Trim Pot, 784 Series |
| R108 | 330 Ohm, 1/4W, 5% |
| R109 | 50K, Trim Pot |
| R110, 115, 116 | Not used |
| R111, 134 | 1K, 1/4W, 5% |
| R113 | 470K, 1/4W, 5% |
| R114, 132 | 51K, 1/4W, 5% |
| R117 | 16K, 1/4W, 5% |
| R118 | 62K, 1/4W, 5% |
| R119, 120, 128, 129 | 20K, Trim Pot, 784 Series |
| R124, 133, 166 | 10K, Trim Pot, 784 Series |
| R125 | 24K, 1/4W, 5% |
| R127, 180 | 27K, 1/4W, 5% |
| R130 | 2.2M, 1/4W, 5% |
| R136, 143, 171, 175, 178 | 1M, 1/4W, 5% |
| R139 | 39K, 1/4W, 5% |
| *R148 | 240K, 1/4W, 5% |
| *R149 | 100K, 1/4W, 1% |
| *R150 | 510 Ohm, 1/4W, 5% |
| R152, 170 | 200 Ohm, 1/4W, 5% |
| R153 | 5K, Trim Pot, 784 Series |
| *R154, 182 | 10K, 1/4W, 5% |
| *R155, *158, *159, 160, 179 | 200K, 1/4W, 5% |
| R156, 157 | 20K, 1/4W, 5% |
| R161 | 1M, 1/4W, 1% |
| R162, 163 | 499 Ohms, 1/4W, 1% |
| R164, 165 | 100 Ohms, 1/4W, 5% |
| R167 | 100K, Trim Pot, 784 Series |

| Component Part Number | Description |
|---|---|
| R168 | 953K, 1/4W, 1% |
| R169 | 2.2K, 1/4W, 5% |
| R174 | 1M, 1/4W, 5%, Mod 4, 100K, 1/4W, 5%, Mod 2 |
| *R181 | 30K, 1/4W, 5% |
| *R182 | 10K, 1/4W, 5% |
| R183 | 22K, 1/4W, 5% |
| R184 | 100K, 1/4W, 5% |
| R185 | 147K, 1/4W, 5% |
| | |
| C101 | .68 MF Mod 4, .068 MF Mod 2 |
| C102 | .001 MF, 160-.015-20-400-C |
| C103, 110 | Not Used |
| C104, 111, 112, 113 | 10 MF, 20V Dipped Tant. |
| C105 | 15 MF, 20V Dipped Tant. |
| C106 | 4.7 MF, 20V Dipped Tant. |
| C107, 114 | 1 MF, 20V Dipped Tant. |
| C108 | 4.7 MF, 100V 160-4.7-20-100-H |
| | (Mod 4 option only) (Not used for Mod 2) |
| C109 | .68 MF, 100V 160-.68-20-100-D |
| C115 | .0022 MF, 160-.0022-400-C |
| | |
| CR101, 102, 107 | Not Used |
| CR103, *105, *106, *108 | IN914 |
| CR104 | IN4737A |
| CR109 | |
| | |
| U101 | MC1494L |
| U102 | AD536AJD |
| *U103 | MC14013B |
| | |
| VR101 | LM317LZ |
| | |
| A101, 105, *106 | MC1458CP1 |
| A102, 108 | MC1741CP |
| A103, 104, 107 | LF13741N |
| A109 | LM308AN |
| | |
| K101 | SPST, 360-12-1A |
| | |
| *Q101 | MPSA13 |

| Component Part Number | Description |
|---|---|
| **PCB 110-02** | |
| R201, 202 | 47 Ohm, 1/2W, 5% |
| R203 | Not Used |
| R204 | 20K, 1/4W, 5% |
| R205 | 470K, 1/4W, 5% |
| R206, 209 | 1K, 1/4W, 5% |
| R207, 219, 222, 225 | 10K, 1/4W, 5% |
| R208, 212, 216, 221, 224 | 100K, 1/4W, 5% |
| R210 | 220K, 1/4W, 5% |
| R211 | 10K, 2W, 5% |
| R213, 214 | 820 Ohm, 1/4W, 5% |
| R215, 223 | Not Used |
| R217, 218 | 10 Ohm, 1/2W, 5% |
| R220 | 3.6K, 1/4W, 5% |
| R226 | 1K, Trim Pot, 784 Series |
| R227 | 10K, 1/4W, 5% |
| R250 | Valve Dependent, 1/4W, 5% |
| C201, 202 | 50 MF, 75V TVA-1343 |
| C203, 205, 207 | Not Used |
| C204 | .047 MF, 160-.015-400-C |
| C206 | .01 MF, 160-.01-630-C |
| C208 | .033 MF, 160-.033-250-C |
| CR201 thru 211 | IN5059 |
| A201, 202 | LF356N |
| K201, 202 | Relay, 4PDT 1315-4C-12VDC |
| Q201 | 2N697 |
| Q202 | 2N4036 |
| Q203 | 2N3440 |
| Q204 | 2N3441 |
| Q205 | 2N5632 |
| Q206 | 2N6229 |

| Component Part Number | Description |
|---|---|
| **PCB 110-04** | |
| R401, 403, 405, 408, 416, 417, 418 | Not Used |
| R402, 411 | 50K, Trim Pot, 784 Series |
| R404, 406, 426, 428 | 20K, 1/4W, 5% |
| R407 | 30K, 1/4W, 5% |
| R409, 413 | 1M, 1/4W, 5% |
| R410 | 100K, 1/4W, 5% |
| R412 | 10M, 1/4W, 5% |
| R414 | 140K, 1/4W, 5% |
| R415 | 47 Ohm, 1/4W, 5% |
| R419, 427 | 10K, 1/4w, 5% |
| R420, 421 | 39K, 1/4W, 5% |
| R422 | 470K, 1/4W, 5% |
| R423 | 4.7K, 1/4W, 5% |
| R424 | 4.3K, 1/4W, 5% |
| R425 | 8.2K, 1/4W, 5% |
| R429 | 15K, 1/4W, 5% |
| R430 | 6.2K, 1/4W, 5% |
| C401, 402 | 10 MF, 20V, Dipped Tant. |
| C403 | 68 MF, 20V, Dipped Tant. |
| C404 | 15 MF, 20V, Dipped Tant. |
| C405, 406 | .01 MF, 160-.01-10-630-C |
| C407, 408 | .1 MF, 160-.1-10-100-C |
| CR401, 402 | N914 |
| CR403 | Not Used |
| CR404 | IN5059 |
| K401 | Relay, 1310-4C-210AG |
| K402 | Relay, 1315-4C-T2VDC |
| A401 | MC1458CP |
| A402, 403, 404 | LF356 or LM741 |

# 9. Calibration

The Xcite Master Controller is calibrated at the factory. Recalibration is required only if certain active components are replaced, or if a potentiometer is replaced.

Calibration need not be done in the order listed, nor are all adjustments required if one circuit is to be re-calibrated. Individual calibration may be performed as needed.

- Before beginning calibration, disconnect the head cable from J305.
- With power off, zero the static and dynamic meters, using the adjustment screw beneath each meter face.
- With power on but the pump off, check the following adjustments and readjust as described, if necessary. Place the following switches and controls in the positions given:

| | |
|---|---|
| DITHER | OFF |
| STATIC SET POINT | 0 |
| DYNAMIC SET POINT | 0 |
| MODE CONTROL | STATIC |
| STATIC CONTROLLED VARIABLE | EXTERNAL |
| DYNAMIC CONTROLLED VARIABLE | EXTERNAL |
| TENSION/ COMPRESSION | COMPRESSION/ CCW |

## 9.1. Equipment Needed

**9.1.1.** Stiff Test Structure (capable of w/standing the full rated force of the Exciter Head)

**9.1.2.** A 4 ½ digit Digital Multimeter

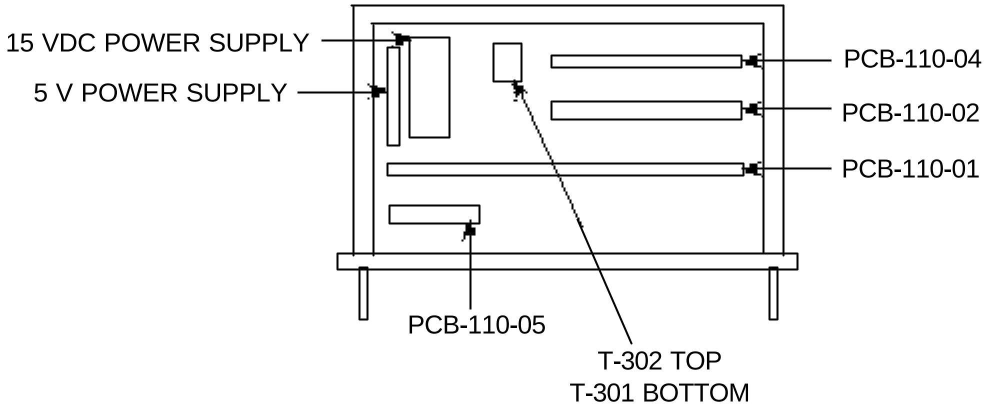
**9.1.3.** Oscilloscope

**9.1.4.** Signal Generator (audio frequency range)

**9.1.5.** FFT Spectrum Analyzer (if curves are to be run)

**9.1.6.** Trim pot adjustment tool or a small screwdriver

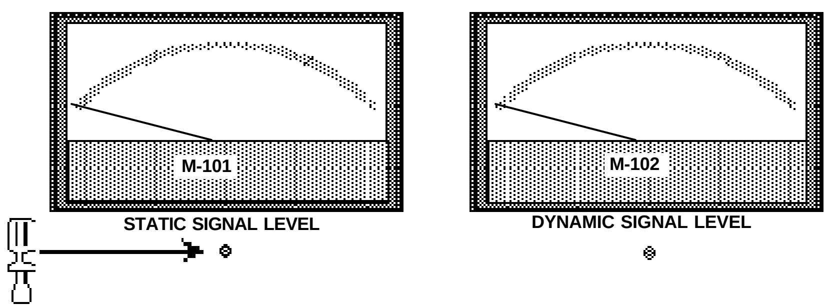
**PRINTED CIRCUIT BOARD LOCATION**




## 9.2. Master Controller

### 9.2.1. Meter Zero Adjustments

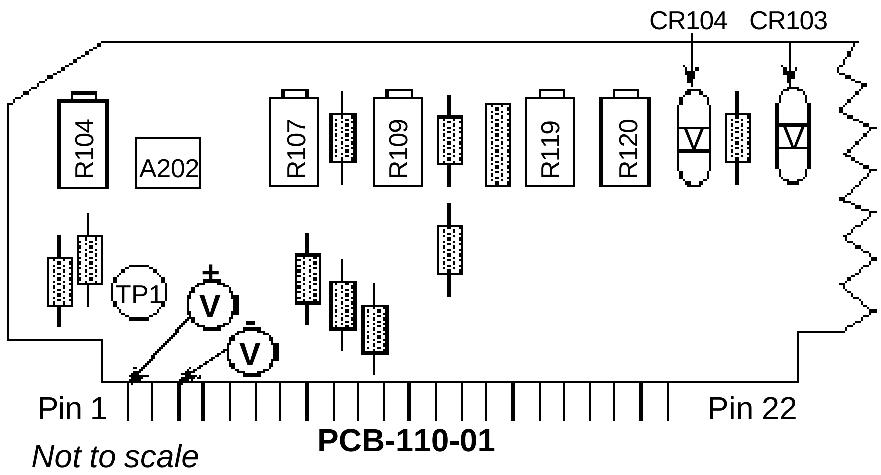
- Turn the Master Controller off.
- The Static and Dynamic meters should be resting precisely at zero.




- If necessary, adjust the meters to zero using the small holes centered under each front panel meter.
- Turn the Master Controller on.

### 9.2.2. +/-15 Volt Supply Check

- Check for +15.00 Volts at 110-01-1 and -15.00 Volts at 110-01-3.
- If necessary adjust the supplies to within +/-10mV using the trim pots located on the power supply (mounted to the left rear of the chassis).




**9.2.3. +/-60 Volt Supply Verification**

Check for roughly +/-60 Volts at the large capacitors on the upper right corner of the 110-02 board. *No adjustment is possible.*

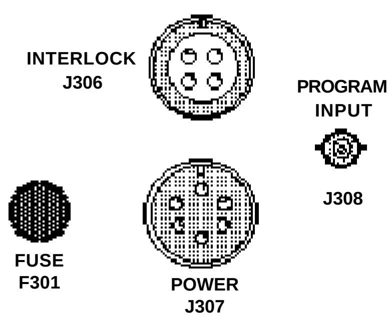
**9.2.4. Load Cell Excitation Voltage Verification**

Check for 12.0V +/-.3V at 110-01-44

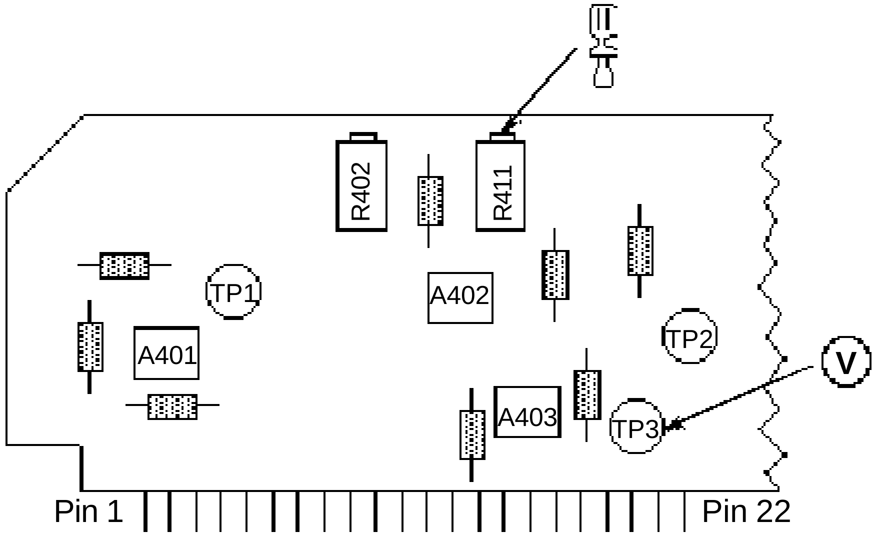
**9.2.5. Master Controller Board 110-04 Calibration Procedure**

**Initial Setup**

Apply a shorted BNC cable or a 50Ω BNC terminator to the Program Input (J308).



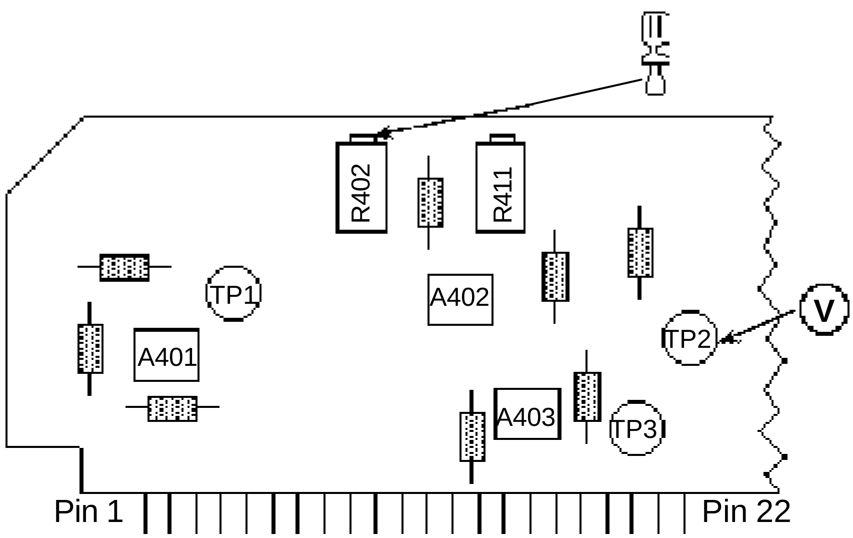
**Program Input Offset Adjustment**
Adjust R411 for 0mV at TP3.




**PCB-110-04**

*Not to scale*

**Dynamic Reference Offset Adjustment**
Adjust R402 for 0mV at TP2.




**PCB-110-04**

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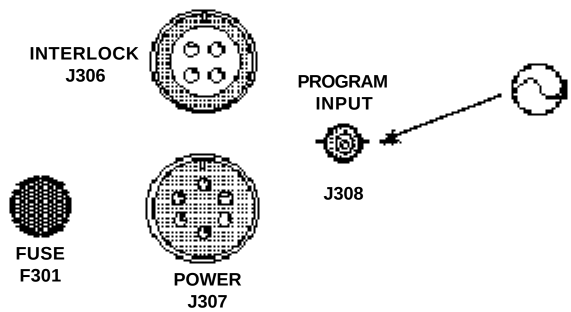
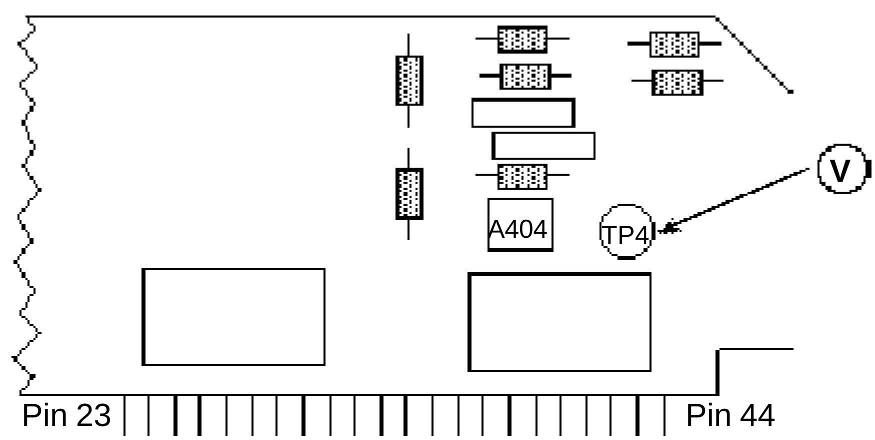
### Dynamic Reference AC to DC Level Verification




- Apply 1.000V rms to the Program Input (J308).
- Check for roughly -10.8V DC at TP2.
- Remove signal from the Program Input (J308).

### Dither Oscillator Verification

Check for a 26V peak to peak, 360 Hz Triangle wave (+/-20 Hz) at TP4.

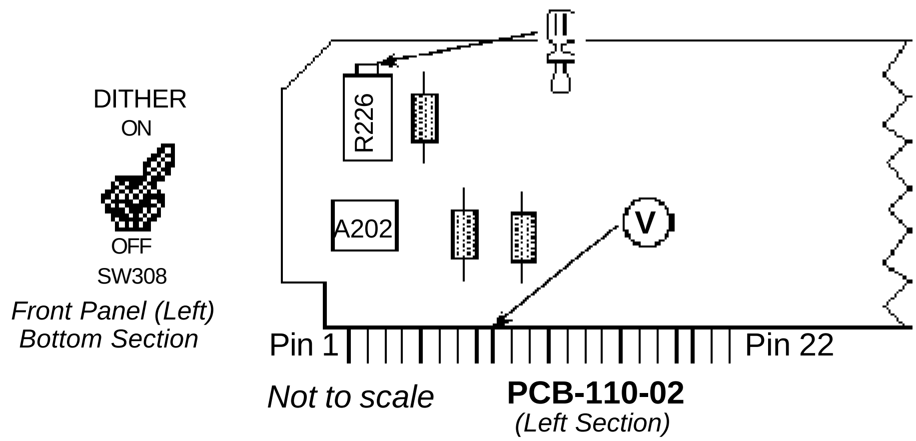



*Not to scale* **PCB-110-04**

### 9.2.6. Master Controller Board 110-02 Calibration Procedure

**Dither Level Calibration**

- Set *DITHER* switch (SW308) to *ON.*
- Adjust R226 for 0.500V rms at 110-02-9.
- Set *DITHER* switch to *OFF*.



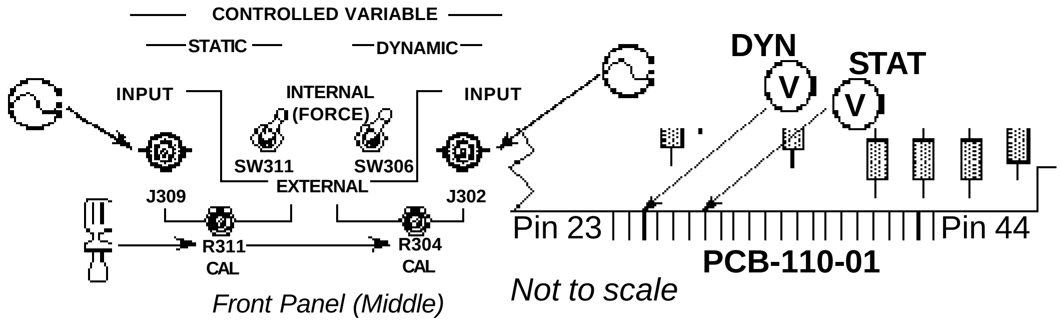

### 9.2.7. Master Controller Board 110-01 Calibration Procedure

Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Dither | (SW308) | Off |
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | Low |
| Power Amp Input | (SW312) | Internal |
| Static Preload | (SW310) | Compression |
| Static Controlled Variable | (SW311) | External |
| Dynamic Controlled Variable | (SW306) | External |
| Static Gain | (SW305) | Fixed |
| Standby Level | (R313) | Full CCW |
| Static Set Point Level | (R301) | 0.0 |
| Dynamic Set Point Level | (R303) | 0.0 |
| Static Gain Level | (R307) | 5.0 |

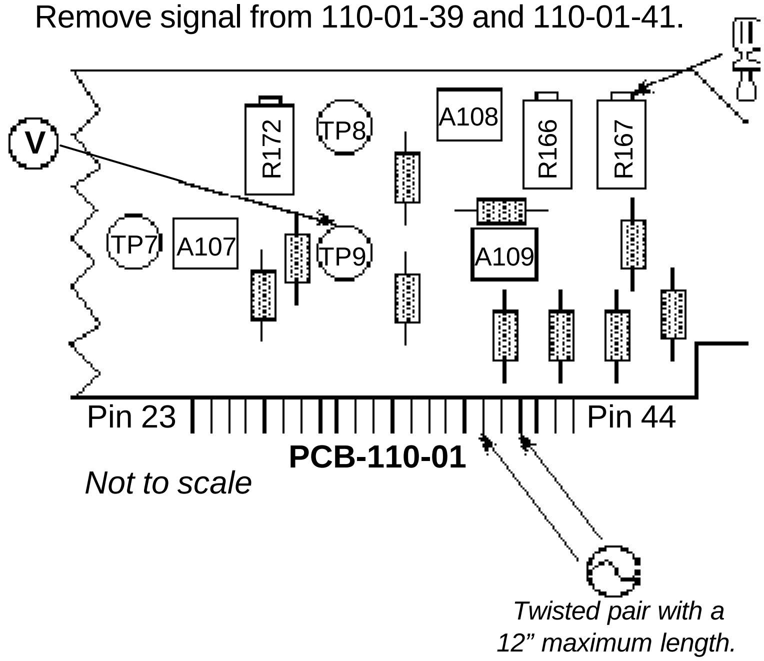
### External Static and Dynamic Variable Input Calibration

- Apply a 1.000V rms, 100 Hz sine wave to the External Static Variable Input (J309).
- Adjust External Static Cal (R311) for .500V rms at 110-01-28 (WHT/ RED wire).
- Apply a 1.000V rms, 100 Hz sine wave to the External Dynamic Variable Input (J302).
- Adjust External Dynamic Cal (R304) for .500V rms at 110-01-25 (WHT/ BLK wire).
- Remove signal




### Load Cell Amplifier Common Mode Null Adjustment

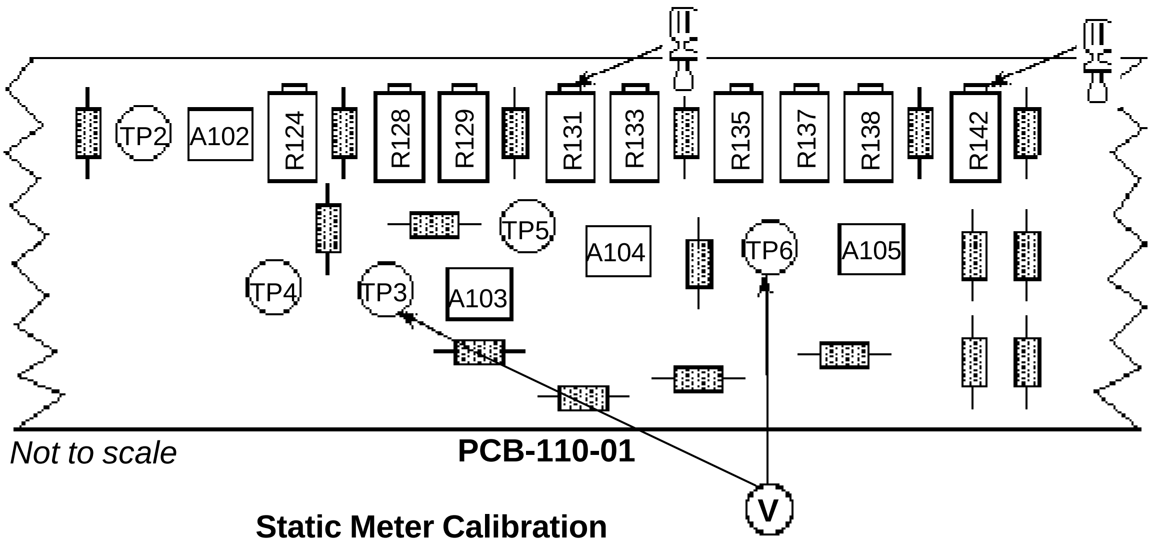
- Apply a 1.000V rms, 100 Hz sine wave to 110-01-39 (BLK wire) and 110-01-41(SILVER wire).
- Adjust R167 for minimum 100 Hz signal at TP9.
- Remove signal from 110-01-39 and 110-01-41.



**Meter Amplifier Zero Offset Adjustments**
With no signals applied, make the following settings:

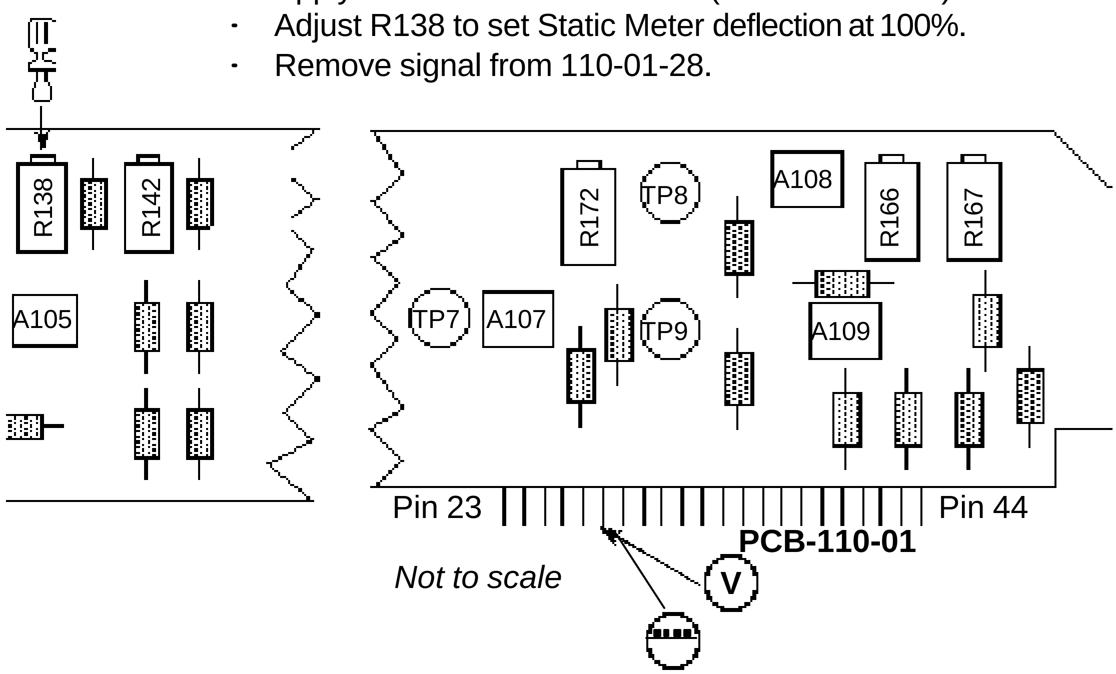
| | | |
|---|---|---|
| Static Set Point Level | (R301) | 0.0 |
| Dynamic Set Point Level | (R303) | 0.0 |
| Static Controlled Variable | (SW311) | External |
| Dynamic Controlled Variable | (SW306) | External |

- Adjust (Static Offset) R142 for 0mV at TP6.
- Adjust (Dynamic Offset) R131 for 0mV at TP3.




**Static Meter Calibration**

- Apply 5.000V DC at 110-01-28 (WHT/ RED wire).
- Adjust R138 to set Static Meter deflection at 100%.
- Remove signal from 110-01-28.

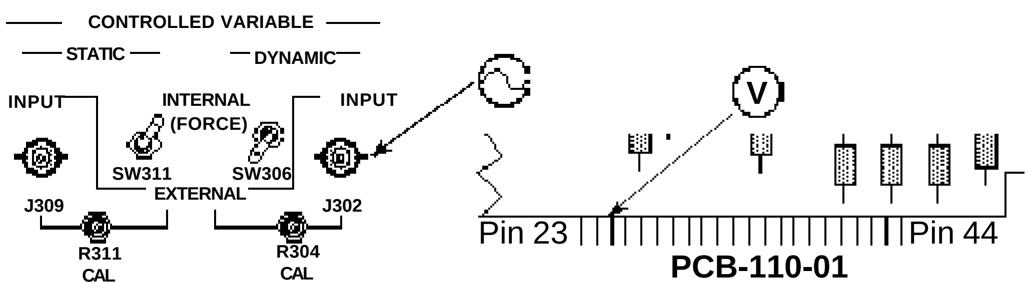


**Dynamic Meter Calibration**

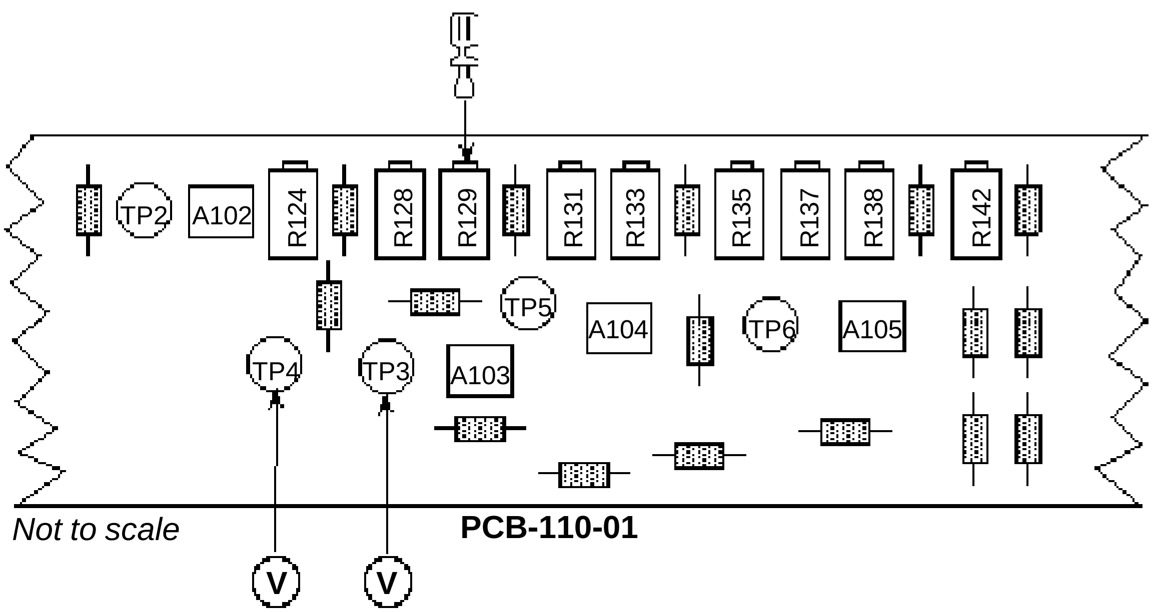
**Pre RMS Converter Check**
- Set the Dynamic Control Variable (SW306) to External.
- Apply a 100 Hz sine wave to the Dynamic Variable Input (J302).
- Adjust Signal level for 1.000V rms at 110-01-25 (WHT/ BLK wire).
- Check for an inverted 1.0V rms +/-5% signal at TP3.

**RMS Converter Check**
Check for 1.00V DC at TP4.

**Dynamic Meter Calibration Adjustment**
- Adjust the signal level for 1.77V rms at 110-01-25 (WHT/ BLK wire).
- Adjust R129 for 50% full scale deflection of Dynamic Meter.
- Remove signal from Dynamic Variable Input (J302).



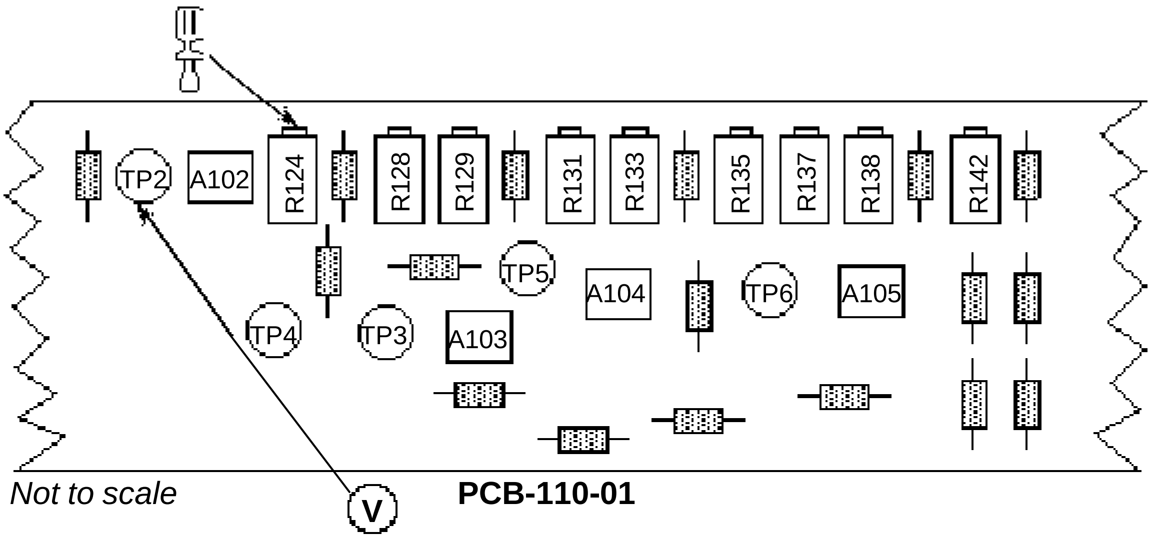

**PCB-110-01**
*Not to scale*




*Not to scale* **PCB-110-01**

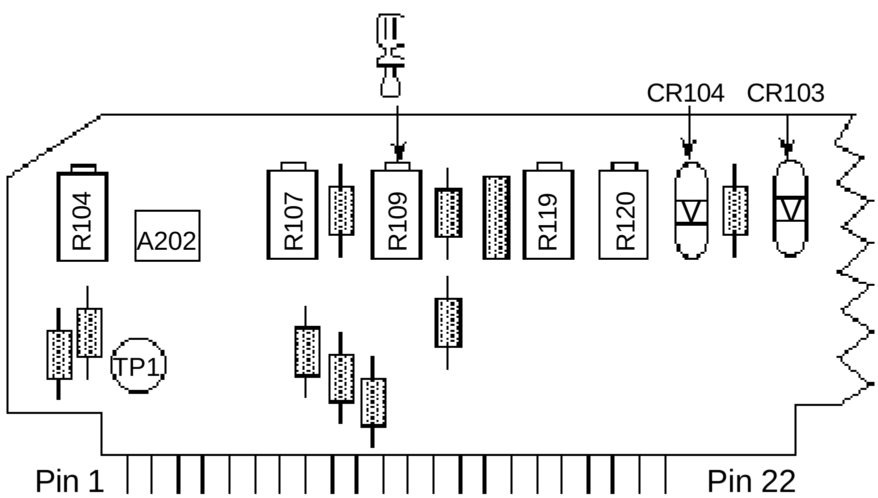
**Dynamic Multiplier Calibration**

**Integrator Bias Calibration**
Adjust R124 for -10mV DC at TP2.



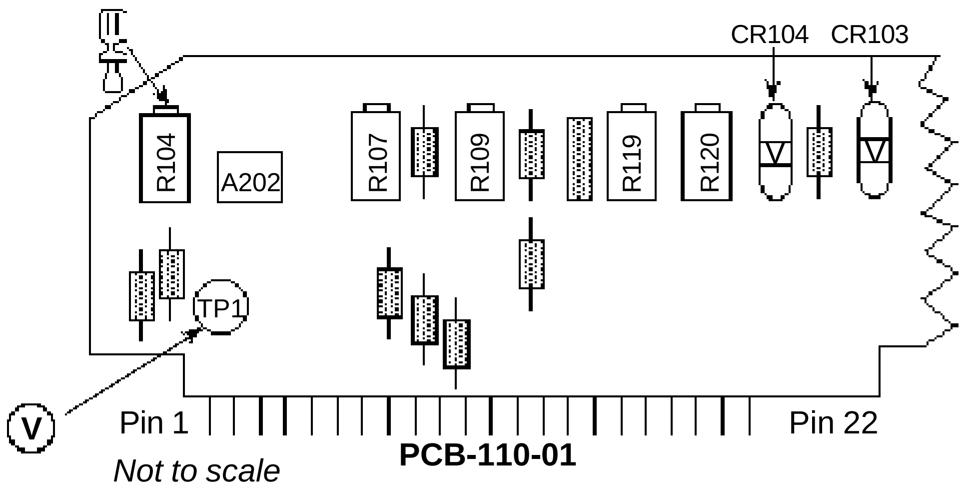

*Not to scale* **PCB-110-01**

**P-Clip Adjustment**
Adjust R109 fully clockwise (to Maximum).



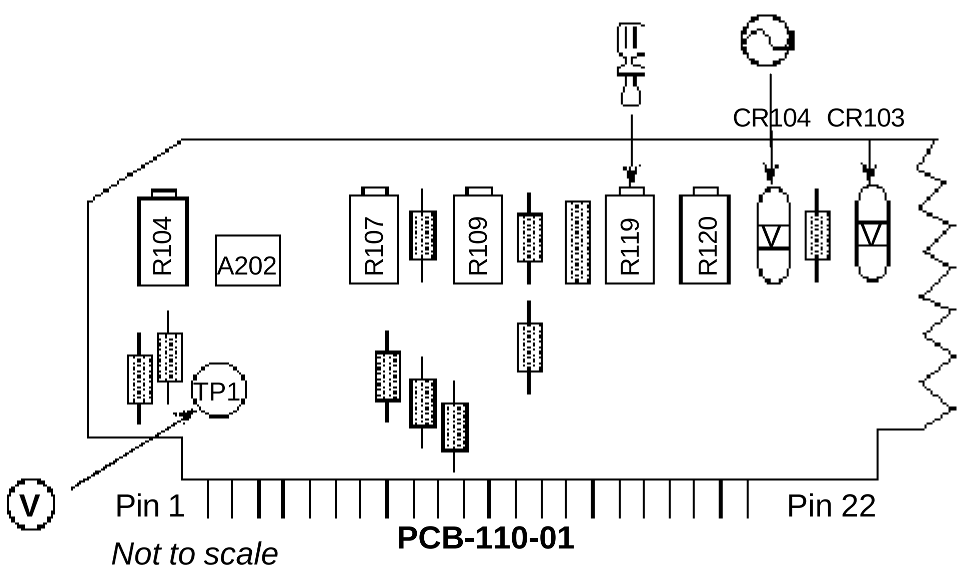

**PCB-110-01**
*Not to scale*

**Initial Multiplier Offset Adjustment**
Adjust R104 for 0mV DC +/-100mV at TP1.



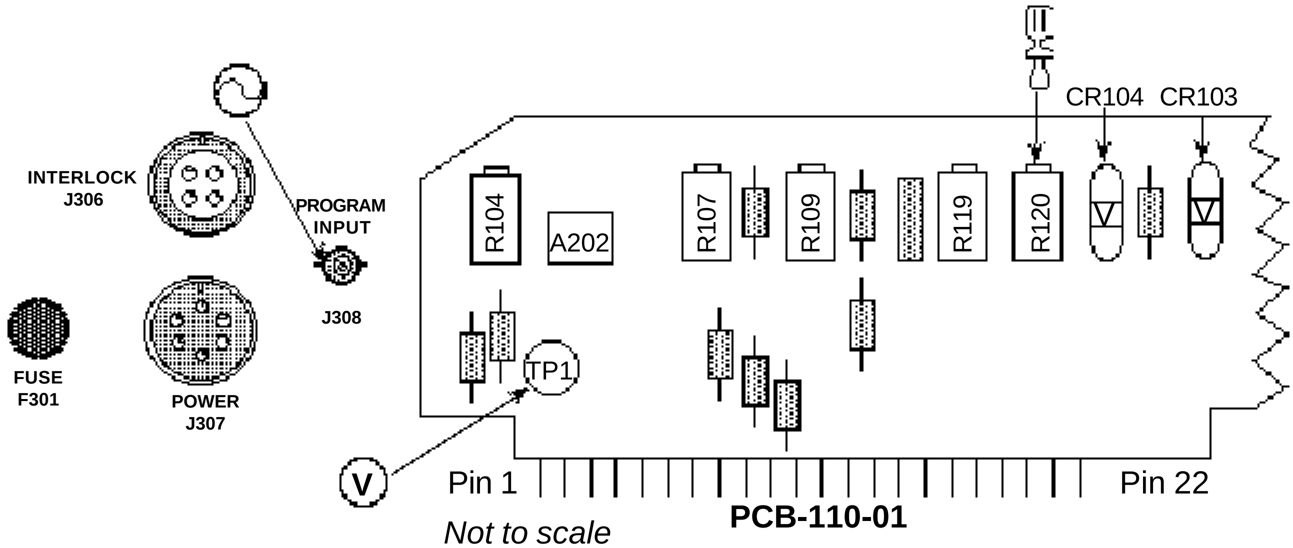

**Multiplier X Input Null**

- Apply a 1.0V rms, 120 Hz sine wave to the Cathode side of CR104.
- Adjust R119 for minimum 120 Hz signal at TP1.



**Multiplier Y Input Null**

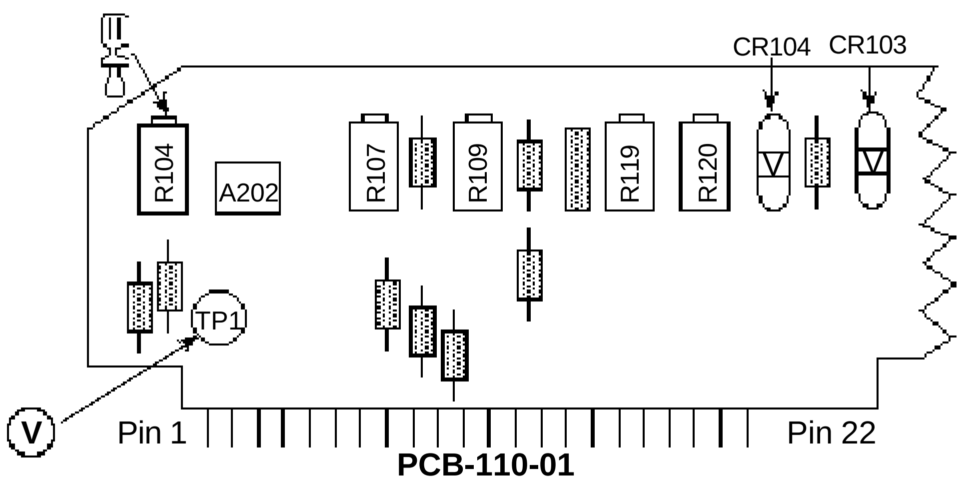
- Remove the signal from CR104.
- Apply a 1.0V rms, 120 Hz sine wave to the Program Input (J308).
- Adjust R120 for minimum 120 Hz signal at TP1.




**NOTE:** Steps 2.4.7.4. and 2.4.7.5. may be slightly interactive. Repeat both adjustments until both inputs are nulled.

**Final Multiplier Offset Adjustment**

- Remove signal generator.
- Adjust R104 for 0mV +/-10mV at TP1.



## 9.3. Exciter Head Calibration Procedure

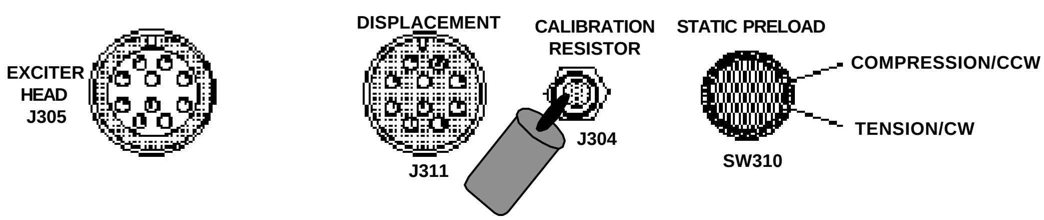
Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Dither | (SW308) | Off |
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | Low |
| Power Amp Input | (SW312) | Internal |
| Static Preload | (SW310) | Compression |
| Static Controlled Variable | (SW311) | Internal |
| Dynamic Controlled Variable | (SW306) | Internal |
| Static Gain | (SW305) | Variable |
| Standby Level | (R313) | Full CCW |
| Static Set Point Level | (R301) | 8.0 |
| Dynamic Set Point Level | (R303) | 5.0 |
| Static Gain Level | (R307) | 5.0 |

### 9.3.1. Load Cell Amplifier Calibration

**Initial Setup**

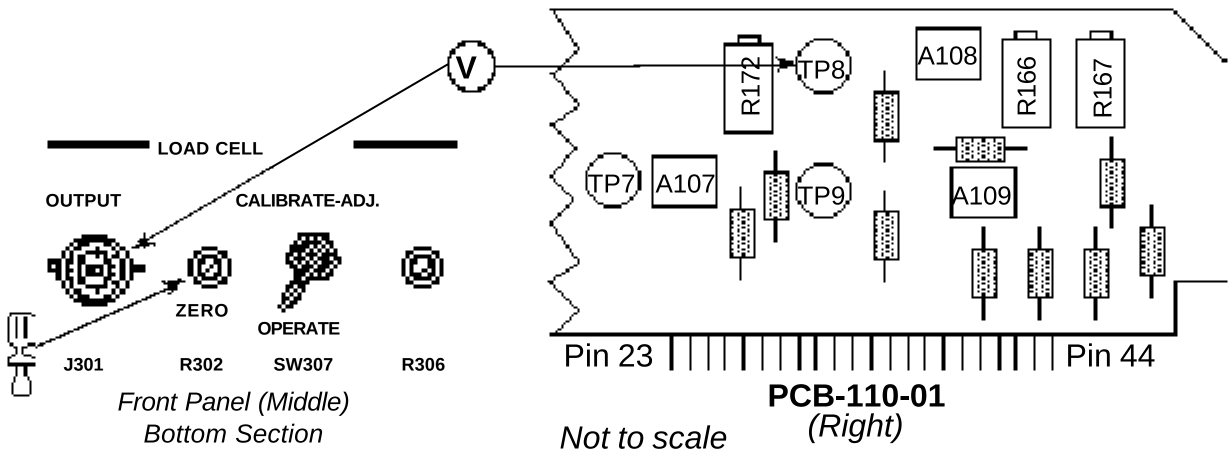
- Connect P305 end of the Controller Cable to J305 (Rear Panel).
- Connect the 4-pin cable to the load cell.
- Insert the Cal Plug into J304.




**NOTE:** The following two adjustments are very interactive; it will be necessary to repeat both adjustments until an acceptable balance is achieved.

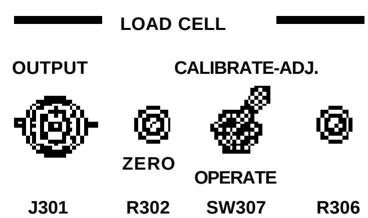
### Adjust Load Cell Zero Calibration

- Set the Load Cell Operate/ Calibrate Switch (SW307) to *OPERATE.*
- Adjust the Load Cell Zero (R302) for 0mV at TP8 or *LOAD CELL* outputs on Front or Rear Panel (J301 or J303).

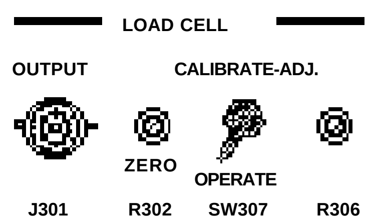



### Load Cell Meter Calibration

- Set Load Cell Operate/ Calibrate Switch (SW307) to *CALIBRATE.*
- Adjust the Load Cell Calibration (R306) until the Static Meter reads the Force value (expressed in lbs or Kg) that is supplied on the Load Cell Cal Plug.




- Repeat Load Cell Zero and Load Cell Meter Calibration until calibration and zero balance is achieved.
- When finished leave the Load Cell Operate/ Calibrate Switch in the *OPERATE* position.

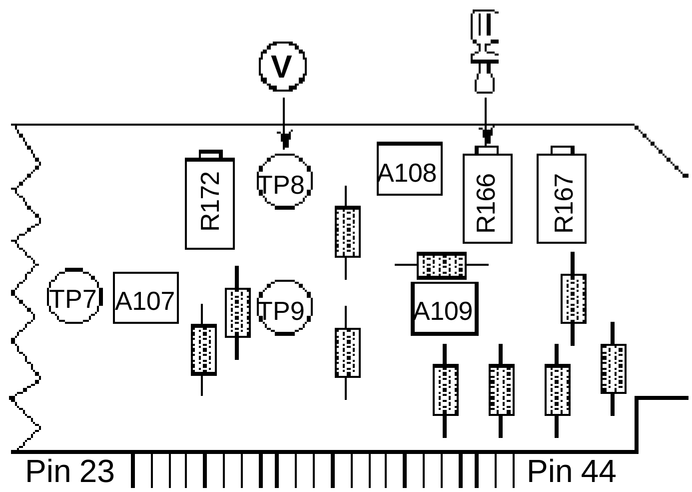


**Load Cell Amplifier Scaling**
Adjust R166 for Load Cell Calibration voltage at TP8 or *LOAD CELL OUT* using the following formula to determine values:

[Calibration Force (on Cal Plug)/Sens (on Cal Plug)]

**Examples:**
[357lbs per 300Ω/ 250lbs per Volt]
= 1.428 Volts per 300 KΩ

$$\frac{2558\ \text{Kg}}{1000\ \text{Kg/V}} = 2.558\text{V}$$



**PCB-110-01**

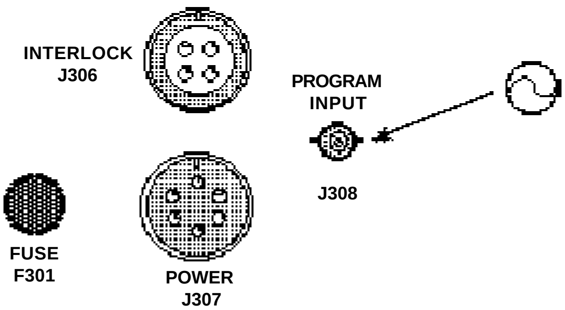
*Not to scale*

## 9.3.2. Static Loop Gain Calibration

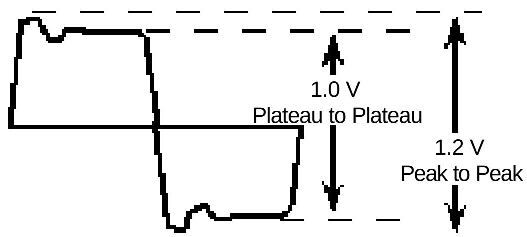
Set the front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Excitation Mode Switch | (SW304) | Standby |
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | Low |
| Static Preload | (SW310) | Compression |
| Static Controlled Variable | (SW311) | Internal |
| Dynamic Controlled Variable | (SW306) | Internal |
| Static Gain | (SW305) | Variable |
| Static Set Point Level | (R301) | 8.0 |
| Dynamic Set Point Level | (R303) | 5.0 |
| Static Gain Level | (R307) | 5.0 |

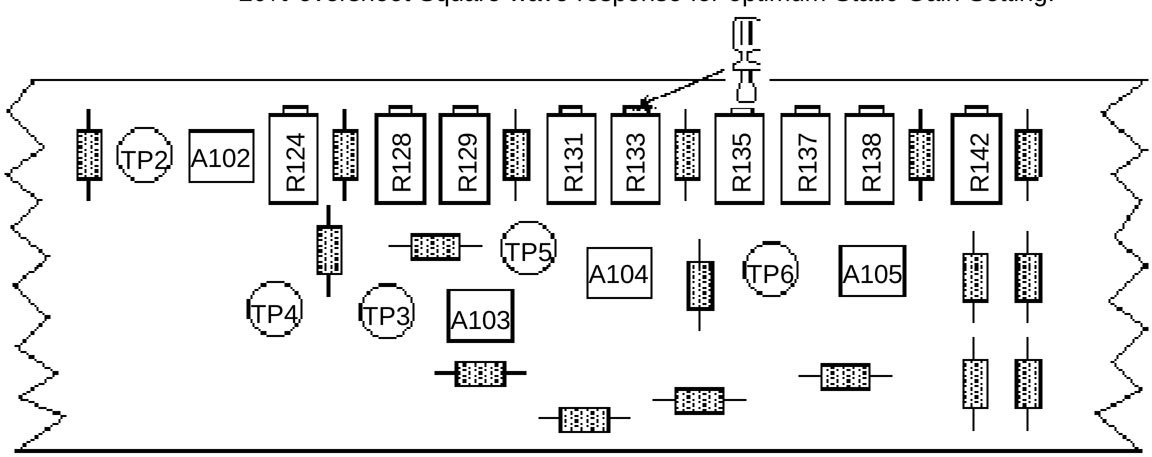
- Fixture the exciter head for compression into a rigid structure.
- Connect J305, J311, J309 (with BNC Pigtail to static variable input).
- Connect cables to the exciter head.
- Apply a 1.00V peak-peak, 5 Hz square wave to the Program Input (J308).




- Start the Hydraulic Supply.
- Set the Excitation Mode Switch (SW304) at *STATIC + DYNAMIC.*
- Adjust Dynamic Setpoint for 1 Volt Plateau to Plateau then adjust (R133) for 20% overshoot (1.2 volts Peak to Peak - as illustrated below). Measure at Load Cell output BNC on Front Panel.




20% overshoot Square wave response for optimum Static Gain Setting.



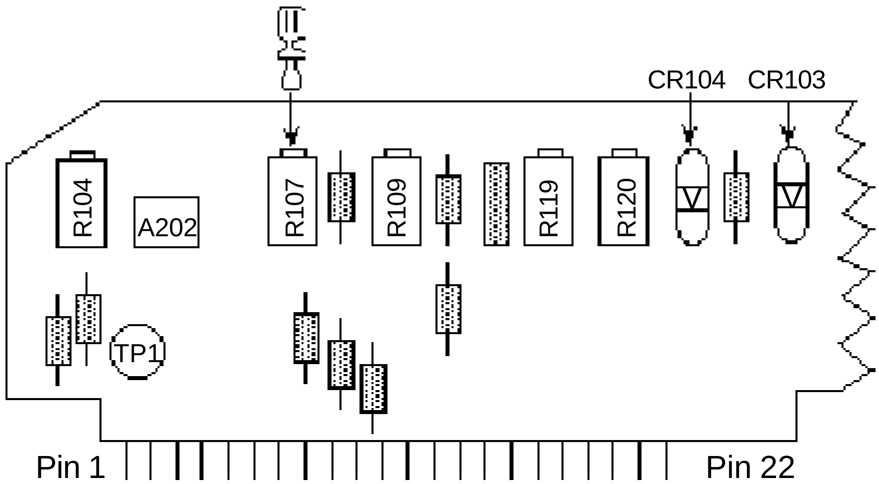

*Not to scale* **PCB-110-01**

**9.3.3. Static Set Point Level Calibration**

Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Excitation Mode Switch | (SW304) | Static |
| Static Gain | (SW305) | Fixed |
| Static Gain Level | (R307) | 5.0 |
| Static Set Point Level | (R301) | 5.0 |

- Adjust R107 (Static Cal) for a 50% Static Meter Reading.



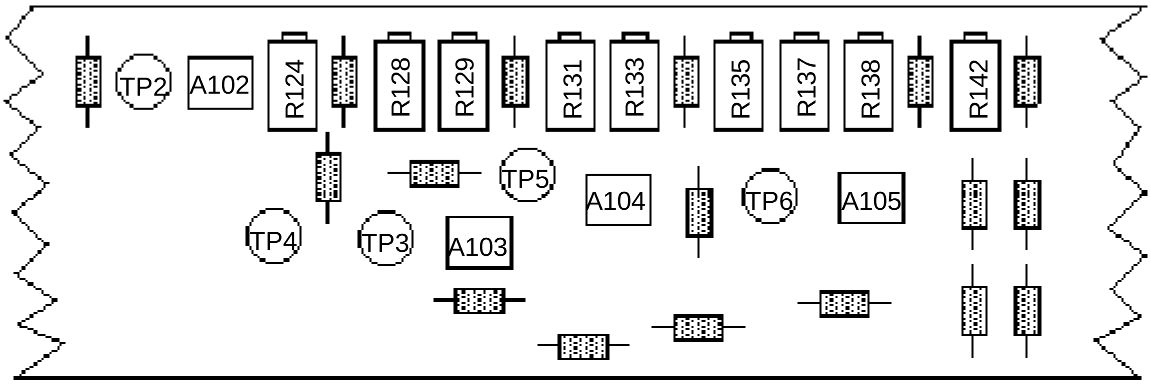

*Not to scale*

**9.3.4. High Frequency Dynamic Level Calibration**

Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | High |
| Static Gain | (SW305) | Fixed |
| Static Set Point Level | (R301) | 8.0 |
| Dynamic Set Point Level | (R303) | 5.0 |

- Apply a 1.000V rms, 60 Hz sine wave to the Program Input (J308).
- Set the Excitation Mode Switch (SW304) to the *STATIC + DYNAMIC* position.
- Adjust R128 for a 50% Dynamic Meter reading (1.77V rms at 110-01-25).



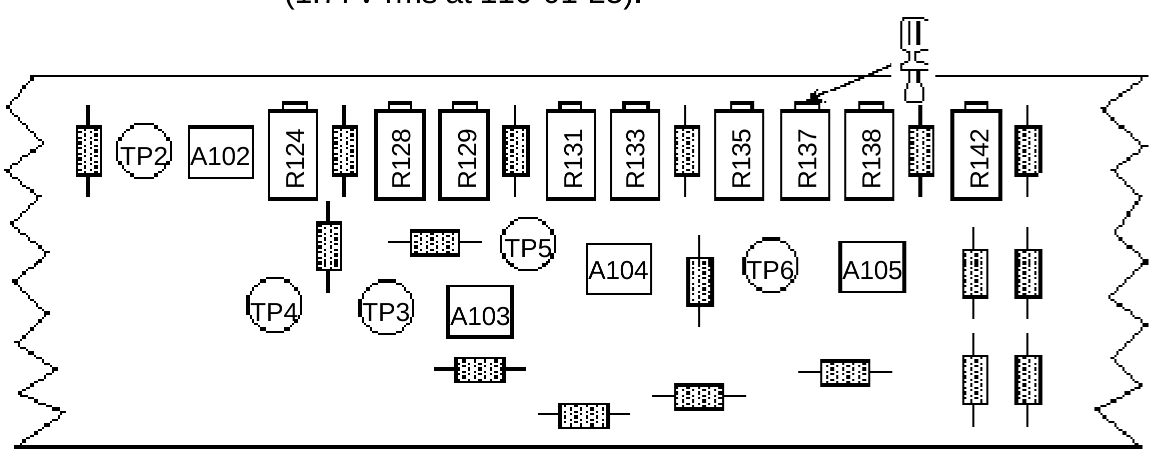

*Not to scale* **PCB-110-01**

**9.3.5. Low Frequency Dynamic Calibration**

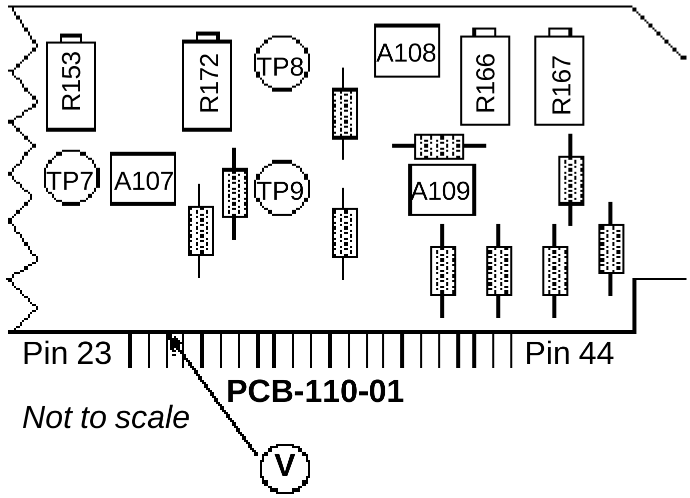
Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | Low |
| Static Gain | (SW305) | Fixed |
| Static Set Point Level | (R301) | 8.0 |
| Dynamic Set Point Level | (R303) | 5.0 |

- Apply a 1.000V rms, 10 Hz sine wave to the Program Input (J308).
- Set the Excitation Mode Switch (SW304) to the *STATIC + DYNAMIC* position.
- Adjust R137 for a 50% Dynamic Meter reading (1.77V rms at 110-01-25).




*Not to scale* **PCB-110-01**




**9.4. Displacement Calibration Procedure**
***Note: Fixture Exciter head for full Stroke.***

**9.4.1. LVDT Symmetry Verification and Adjustment**

Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Excitation Mode | (SW304) | Standby/ Reset |
| Load Cell Calibrate/ Operate | (SW307) | Operate |
| Frequency | (SW309) | Low |
| Static Preload | (SW310) | Compression |
| Static Controlled Variable (Disconnect Displacement Feedback Signal for this set up) | (SW311) | External |
| Static Gain | (SW305) | Variable |
| Static Set Point Level | (R301) | 10.0 |
| Static Gain Level | (R307) | 5.0 |

- Set the Static Preload Switch (SW310) to *TENSION* (CW). The head should fully extend.
- Set the Static Preload Switch to *COMPRESSION* (CCW). The head should fully retract.
- While monitoring 110-01-38 (WHT/ YEL wire) with a DC volt meter, you should observe a NEGATIVE voltage when the head is fully extended and a POSITIVE voltage when the head is retracted. These two voltages should be equal and opposite in magnitude.

**NOTE:** The importance is in the equality of the numerical values not in their values. (i.e. +3 and -3 are just as good as +6 and -6)

- If the balance is off by more than 10%, the LVDT Rod or the postion of the LVDT on the Exciter Head should be adjusted.

**WARNING**

*Do not make mechanical adjustments to an exciter head while the hydraulic power supply is active. Serious personal injury could result.*

### 9.4.2. Displacement Zero Calibration

- Set the Static Setpoint (R301) to 10.0.
- Set the Excitation Mode switch (SW304) to *STATIC.*
- Set the Static Preload switch (SW310) to *TENSION*. The head should fully retract.
- Adjust R172 for 0mV at TP7.

### 9.4.3. Displacement Scaling Calibration

- Set the STATIC PRELOAD SWITCH (SW310) to *COMPRESSION*. The head should be fully extended.
- Adjust R153 for 10.000V at TP7.
- The static meter should read 100% full scale deflection.
- Repeat steps 4.2. and 4.3. until balance is achieved.

### 9.4.4. Final External Static Control Variable Calibration

- Verify 10.000V DC at TP7 (accurate to within 1.0mV)
- If necessary, adjust the Static Variable Cal (R311) for 0.5V DC at 110-01-28

### 9.4.5. Dynamic Displacement Calibration

Set front and rear panel switches and adjustments as follows:

| | | |
|---|---|---|
| Frequency | (SW309) | Low |
| Power Amp Input | (SW312) | Internal |
| Static Preload | (SW310) | Compression |
| Static Controlled Variable | (SW311) | External |
| Dynamic Controlled Variable | (SW306) | Internal |
| Static Gain | (SW305) | Variable |
| Static Set Point Level | (R301) | 5.0 |
| Dynamic Set Point Level | (R303) | 5.0 |
| Static Gain Level | (R307) | 5.0 |

- Set the Excitation Mode Switch (SW304) to the *STATIC + DYNAMIC* position.
- Apply a 1V rms, 5 Hz sine wave to the Program Input (J308).
- Adjust R135 for a 5V peak-peak at TP7.

### 9.4.6. External Static and Dynamic Set Point Calibration

There are no adjustments or calibrations for the External Static and Dynamic Set Point inputs. Verify that the static controlled variable achieves full scale output with a +5VDC, +/-5% signal and that the dynamic controlled variable achieves full scale ouput with a -5VDC, +/-5% signal.