



# ***XCITE*** ***Owner's Manual***

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**1300T-1 System**  
**1300T-2 System**  
**1300T-3 System**

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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) Servo valve\*

\*The servo valve 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 servo valve 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.





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# **1300T Torsional Exciter System Setup and Operation**

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## **1300T Torsional Exciter System**

**Applies to 1300T-1, 1300T-2 and 1300T-3**

### **1. Introduction**

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

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

### **2. System Description**

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. The 1300T torsional excitation systems are configured as follows:

	1300T-1 System	1300T-2 System	1300T-3 System
Hydraulic Power Supply	1301 or 1302	1301 or 1302	1301 or 1302
Master Controller	1304-Mod4	1304-Mod4	1304-Mod4
Exciter Head	1307-15-Tor	1314-15-Tor	1318-15-Tor

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 Exciter Head**

- 3.1.1.** The 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.
- 3.1.4.** The Exciter Head may be used with either Static Torque Control or Static Angular Displacement Control. When choosing the type of control the following conditions should be considered:

**HIGH STATIC STIFFNESS:** if the Static Torsional Stiffness of the test structure is such that less than  $1^\circ$  or  $2^\circ$  of motion will be experienced with full Load Torque, then it is advisable to use the exciter with the Master Controller set to “*INTERNAL*” *STATIC CONTROLLED VARIABLE* (see 4.1.1.) This setting will provide for static torque feedback to the Master Controller and static torque will be the static controlled variable.

**LOW STATIC STIFFNESS:** if the Static Torsional Stiffness of the test structure is such that static motion of over  $2^\circ$  to  $50^\circ$  is expected (ie. free-free) then it is advisable to use the exciter with the Master Controller set to “*EXTERNAL*” *STATIC DISPLACEMENT CONTROL* (see 4.1.1.) This setting will provide for static angular displacement feedback to the Master Controller and angular displacement will be the static controlled variable.

**Hint:** When attempting to mount the torque cell to the test structure bolt hole pattern, use the exciter head in the “*EXTERNAL*” *STATIC DISPLACEMENT* control mode. Under these conditions, the actuator can be easily rotated to align the load cell mounting holes for proper fit of the structure’s mounting bolts (customer supplied).

**Note:** When using the exciter in “*EXTERNAL*” *STATIC DISPLACEMENT*, the position of the rotary actuator with the system in “*STANDBY*” is full counter clockwise (ccw) when looking at the actuator from the end that **does not** have the Torque Load Cell mounted. When the Master Controller is switched to *STATIC*, the rotary actuator will rotate clockwise (cw) as determined by the *STATIC SETPOINT* control knob.

**3.1.5. PROCEDURE FOR CHANGING FROM STATIC DISPLACEMENT CONTROL TO STATIC TORQUE CONTROL**

If after aligning and affixing the torque cell bolt holes to the test structure by using static displacement control it is desired to control static torque, the following procedure should be followed to start up the system.

1. Leave the Excitation mode selector in the *STATIC* position
2. Press *PUMP OFF* and turn off the Hydraulic Power Supply
3. Switch the interlock selector switch mounted just below the red interlock lamp to the *OFF* position (SW in the down position)
4. Turn the static setpoint knob to the Zero (0) setting
5. Change the *STATIC CONTROLLED VARIABLE* switch on the rear panel to *INTERNAL*
6. Restart the Hydraulic Power Supply and the system will start up in the *STATIC TORQUE MODE* with Zero torque applied
7. Set the static torque to the desired torque setting by adjusting the static setpoint knob

**3.2. Hydraulic Power Supply Commissioning Procedure**

- 3.2.1. Remove all packing material from inside and outside the pump cabinet.
- 3.2.2. Locate the main power cable attached to the Electrical Control Box.
- 3.2.3. Fill oil reservoir with new, clean Mobile DTE-24/25 hydraulic fluid (or equal). Check oil sight gage for proper oil level. (Approximately 40 gallons)
- 3.2.4. Connect main power cable to main electrical service. Be sure that the proper voltage is applied to the Hydraulic Power Supply. 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 or 50 Hz signal noise.
- 3.2.5. For a 1302 supply, which is water cooled, connect a source of water supply to the water/oil heat exchanges mounted at the rear end of the Power Supply. The inlet water supply should have a minimum water pressure of 50PSI, a minimum flow capacity of 8 GPM and a maximum water temperature of 70°F.

The return line from the water/oil heat exchanger should be connected to a suitable water drain.

**WARNING**

**Note:** Water hoses are included if it is desired to not hard plumb the water connection to the water/oil heat exchanger.

**Warning:** Be sure to always turn on the water supply before starting the pump or it will overheat and shut off for several hours before it can be restarted.

- 3.2.6. Connect the pump control cable (B-11921) to the Hydraulic Power Supply and to the rear panel connector of the Master Controller.
- 3.2.7. Turn on the Main Power Switch (large red/ yellow switch) located on the front of the Hydraulic Power Supply.
- 3.2.8. 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.
- 3.2.9. Connect one of the Exciter Head 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.

### 3.3. Starting the Hydraulic Power Supply

- 3.3.1. 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*.
- 3.3.2. Push the Red *POWER* button on the Master Controller. It should light up along with the *PUMP STOP* light.
- 3.3.3. Push the *PUMP START* button on the Master Controller and the Power Supply should start up.

- 3.3.4.** Allow approximately 30 seconds for the pump to prime. There will be no pressure on the pressure gage because the supply and return are connected. (Section 3.2.9.) The pump will exhibit some loud noises as the entrapped air is purged. These noises will abate after 1 or 2 minutes of running time.

After all priming noises have abated, shut off the pump and disconnect the “shorting” hose. Start the pump back up and it should come up to 3000PSI. Some additional priming noise might last for 1 or 2 minutes and this is normal. After all priming noises have abated, the pump should be running smoothly at a pressure of 3000 - 3400PSI.

- 3.3.5.** For a 1301 Supply, which is air cooled, verify that the fan motor located in the Hydraulic Power Supply is operating.

**Note:** the fan is temperature operated and will only turn on when the oil temperature is above a preset limit.

- 3.3.6.** The Hydraulic Power Supply is now running correctly.

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

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

### **3.4. Hydraulic Hookup**

- 3.4.1.** 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.

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

- 3.4.3.** When in doubt about hose polarity, the convention is:  
Supply Pressure - Coupler  
Supply Return - Nipple

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

### 3.5. Cable Hookup

**3.5.1.** Connect cable C-12202 to the Master Controller rear panel connector and to the servovalve and Torque Cell of the Exciter Head.

**3.5.2.** Connect cable C-12201 to the rear panel connector of the Master Controller and the displacement connector of the Exciter Head.  
**Caution:** The connector for the Displacement Transducer and the connector for the Torque Cell is the same size and configuration. Be sure to connect the cables correctly as specified in **3.5.1. and 3.5.2.**

## 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 (see 3.1.4.)

EXTERNAL

(Static Displacement Control)

INTERNAL

(Static Torque Control)

DYNAMIC

INTERNAL

STATIC PRELOAD

COMPRESSION/CCW

POWER AMP

INT

CALIBRATION RESISTOR

Plug inserted for Torque Load Cell

- 4.1.2. Set the switches on the front of the Master Controller to the following:
- |   |  |
|---|--|
| INTERLOCK<br>(Located below the Red Interlock Lamp) | ON (Up Position)   |
| DITHER  | OFF  |
| STATIC SETPOINT (see 3.1.4.)                        | 0.0 for static torque control<br>0.0 for static angular displacement control |
| STATIC GAIN   | VARIABLE<br>(For Displacement Control)<br>FIXED<br>(For Torque 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* clockwise to the desired amount of static torque or static displacement if using displacement feedback.
- 4.1.7. Turn *EXCITATION MODE* to *STATIC + DYNAMIC*.
- 4.1.8. Slowly increase the *DYNAMIC SETPOINT* until the desired torque is monitored at the *DYNAMIC SIGNAL LEVEL* meter and is measured at the *TORQUE CELL OUTPUT BNC*.  
**Note:** The torque cell calibration value and sensitivity is marked on the calibration resistor plugged into the Master Controller.



## 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 rotor is full counter clockwise when system is turned on in Standby/ Reset mode.	Check that the hydraulic power supply is turned on and reading 3000 psi. <b>See 3.4.</b>
OR	
Static meter does not show changes in displacement or torque when the set point is changed.	Check that all hoses and cables are connected. <b>See 3.5. and 3.6.</b>  Verify that all Master Controller switches are in the correct position. <b>See 4.1.1. and 4.1.2.</b>
No torque is measured at the Torque 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. <b>See 4.1.3.</b>  Verify that the Dynamic Set Point potentiometer is turned up. <b>See 4.1.8.</b>
1302 Pump turns off and oil overtemp light illuminates.	Check to see if water supply is turned on to water/oil heat exchanger. If pump has shut down due to overheating, it will require several hours of natural cooling before the pump will restart.

## 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.

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## 1300T Exciter Heads



## 1. Introduction

The Xcite Torsional Exciter Head is a high torque rotary actuator capable of a wide range of static and sinusoidally varying dynamic torques (see specifications).

Incorporation of the latest design concepts in torque transducers and servo-valves result in a compact Exciter Head that is ideally suited to simulate the level and direction of input torques encountered in complex machinery. The Load Cell permits continuous readout of static and dynamic torques. The Exciter Head is equipped with all necessary hydraulic and electrical connectors. System design is such that it is impossible to connect hydraulic or electrical connectors incorrectly. The Exciter Head is designed for use in industrial environments and, as such, is extremely rugged.

## 2. General Description

The Exciter Head is comprised of three major components; a limited rotation rotary actuator, a servo-valve and a torque transducer. A brief description of each individual component follows:

### 2.1. Rotary Actuator

The rotary actuator is essentially a limited rotation hydraulic motor permitting angular displacements of +/- 50 degrees. Oil is routed to the actuator through a manifold mounted on top. This system is designed for torsional loading only. Axial forces can severely damage the actuator.

### 2.2. Servo-Valve

The servo-valve is a double stage device with electromagnetic control in the first stage and the 3000PSI hydraulic pressure used for power amplification in the second stage. The device uses differential pressure to control the actuator.

### 2.3. Torque Transducer

The torque transducer is a specially designed load cell which exhibits the electrical characteristics of a four-arm bridge. This bridge has a 350 ohm nominal resistance which changes linearly with torque. The supply voltage for the bridge comes from the Master Controller.

Bridge calibration is accomplished by simulating bridge unbalance with the calibration resistor supplied with the torque cell and adjusting the Master Controller as described in the Master Controller section of this manual. A calibration certificate for the transducer is included on all Heads supplied with torque cells.

### 3. Specifications

Model	1307-15-Tor	1314-15-Tor	1318-15-Tor
Static Torque	20,000 in-lb(2,225 N-m)	2,000 in-lb(222 N-m)	6,000 in-lb (666 N-m)
Dynamic Torque	20,000 in-lb(2,225 N-m)	2,000 in-lb (222 N-m)	6,000 in-lb (666 N-m)
Stroke	100 deg (1.75 rad)	100 deg (1.75 rad)	100 deg (1.75 rad)
Torque Cell	50,000 in-lb(5,550 N-m)	5,000 in-lb(555 N-m)	15,000 in-lb(1,660 N-m)
Torque Cell Sensitivity	5,000 in-lb/v (555 N-m/v)	500 in-lb/v (55 N-m/v)	2000 in-lb/v (222 N-m/v)
RVDT	100 deg (1.75 rad)	100 deg (1.75 rad)	100 deg (1.75 rad)
RVDT Sensitivity	10 deg/v (.175 rad/v)	10 deg/v (.175 rad/v)	10 deg/v (.175 rad/v)
Exciter Design	2 Vane Torsional	2 Vane Torsional	2 Vane Torsional

### 4. Head Operating Instructions

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

#### 4.1. Rotation Convention

The rotary actuators used in all three Torsional Exciter Systems adhere to the following rotation convention:

When SW310 *STATIC PRELOAD* is set to *COMPRESSION/CCW* mode the actuator rotates as follows:

##### 4.1.1. For Angular Displacement Control

The actuator rotates clockwise (CW) when viewed from the rear of the actuator (the end without the Torque Cell)

##### 4.1.2. For Torque Control

The actuator rotates clockwise (CW) when viewed from the rear of the actuator and produces positive voltage torque readings in the CW position.

### 5. Theory of Operation

The major function of the Exciter Head is to apply static torque preload and/ or a controlled sinusoidally varying dynamic torque (variable frequency) to a test specimen. The actuator shaft is the actual output device. The torque transducer, displacement transducer (optional), and servo-valve provide the control on this output. The torque cell provides an output signal proportional to static loads, but unlike a peizo-electric transducer, has no charge leak-off. The cell is therefore well-suited to provide a constant monitor of the exciter's preload for use in the control circuitry. The torque cell provides a signal proportional to time varying torque (dynamic) and thus provides complete signal information on the output force.

The servo-valve is supplied a constant source of pressure (3000PSI) to apply to either side of the exciter vanes in a differential manner. The driving signal to the servo-valve is provided by the system controller.

**5.1. Electric Circuit Description**

The torque cell, displacement transducer and servo-valve are separately connected to their respective cable connectors. Shielded cable is used throughout to provide optimum reduction of externally induced noise voltage.

**5.2. Hydraulic Circuit Description**

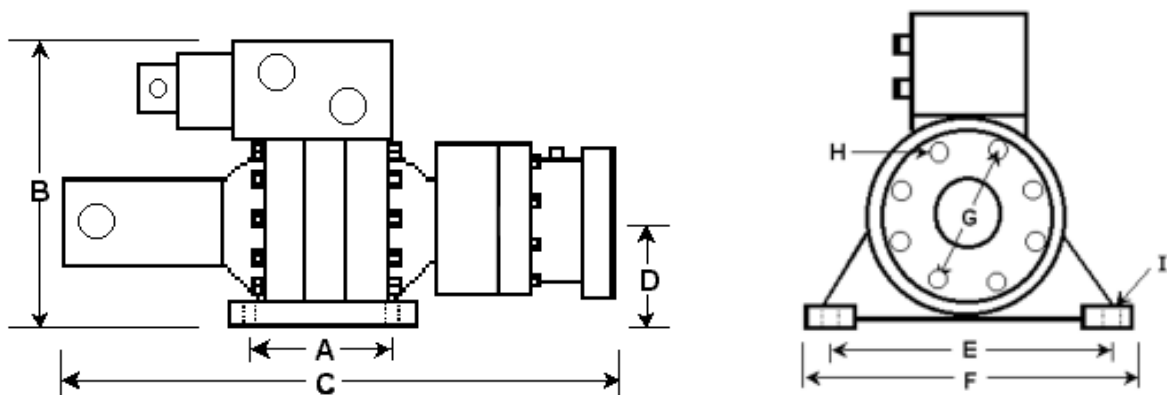
Oil is supplied to the Exciter Head at 3000PSI by the Hydraulic Power Supply. The servo-valve controls the flow of this oil into the actuator ports, creating a differential pressure according to the torques demands of the control system. Oil from the servo-valve is routed back to the hydraulic supply.

**6. Maintenance**

Exciter Head maintenance is minimal. Precautions for cleanliness are the major considerations. End caps should always be kept on the Exciter Head hoses when they are not connected. If any problems are encountered with any of the head components, the manufacturer should be contacted.

**7. Drawings**

**7.1. Outline Dimensions for 1307, 1314 and 1318 Heads**

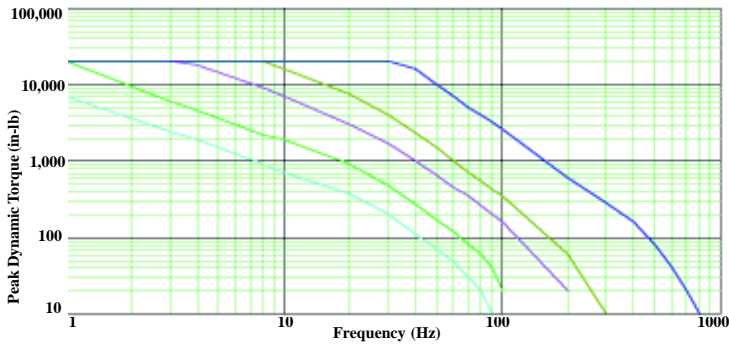


Exciter Head	A		B		C		D		E		F		G		H		I	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in (dia)	mm (dia)	in (dia)	mm (dia)
1307-15-Tor	6.12	155.4	12.38	314	23.50	597	4.61	117.3	10.12	257.0	12.00	305	4.25	107.9	0.39	9.9	0.78	19.8
1314-15-Tor	3.25	82.6	8.50	215	15.50	394	2.50	63.5	5.50	127.7	6.50	163	3.50	88.9	0.33	8.3	0.41	10.4
1318-15-Tor	4.62	117.3	9.69	242	15.81	395	3.38	85.8	7.50	190.5	9.00	225	4.25	107.9	0.39	9.9	0.53	13.4

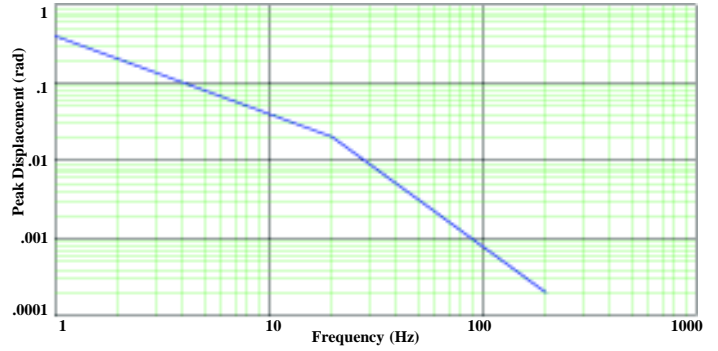
- 7.2. Torque Cell Certificate of Calibration**
- 7.3. Displacement (Radians) vs. Frequency of 1307-15-TOR Head**
- 7.4. Torque (in-lbs) vs. Frequency of 1307-15-TOR Head**
- 7.5. Master Controller Output Sensitivities (1307-15-TOR Only)**  
Torque Cell: 5000 in-lb/ Volt and 555 N-m/ Volt  
Displacement Transducer: 0.175 Rad/ Volt

## Xcite 1300T-1 Torsional System - 1307-15-TOR Exciter Head

**Peak Dynamic Torque vs. Frequency**



**Peak Displacement vs. Frequency**

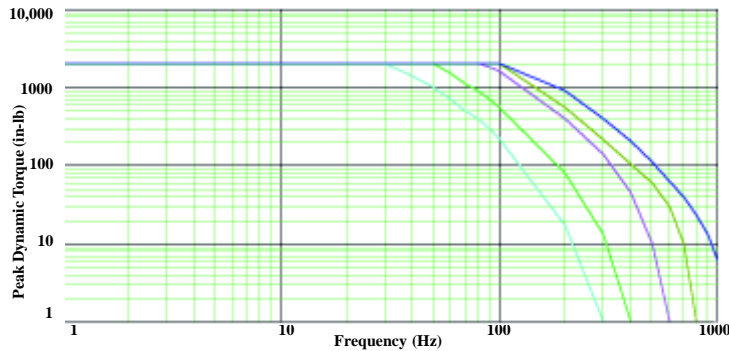


**Structure Stiffness:**

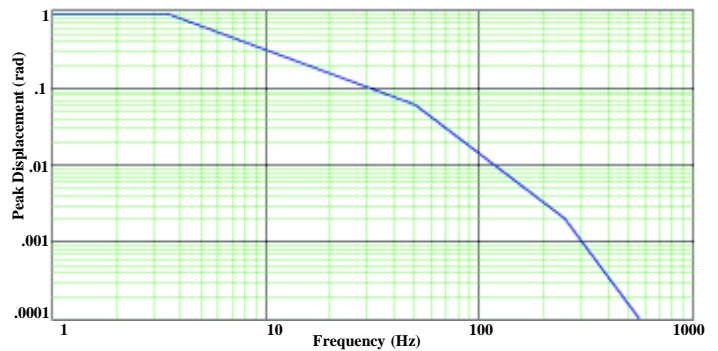
- K=2E4 in-lb/rad
- K=5E4 in-lb/rad
- K=2E4 in-lb/rad
- K=5E5 in-lb/rad
- K=infinite

## Xcite 1300T-2 Torsional System - 1314-15-TOR Exciter Head

**Peak Dynamic Torque vs. Frequency**



**Peak Displacement vs. Frequency**

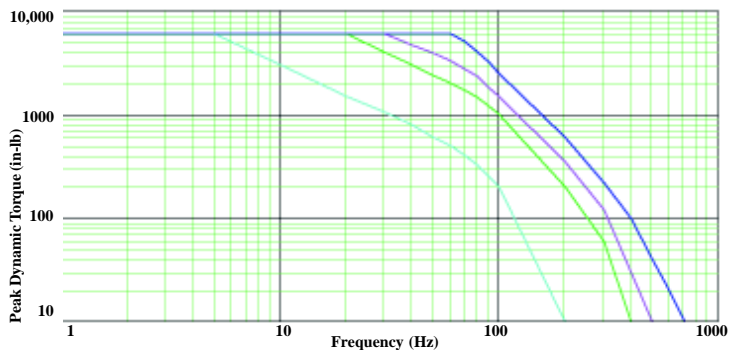


**Structure Stiffness:**

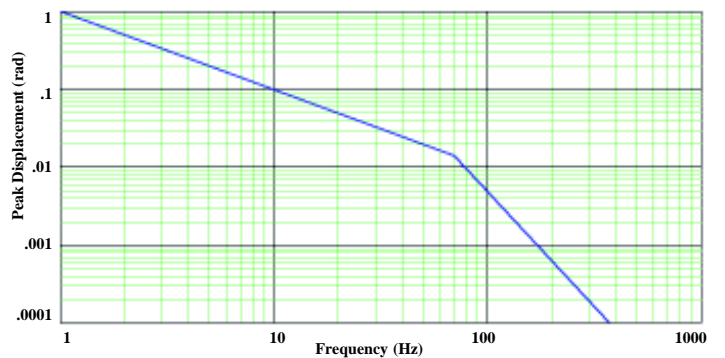
- K=2E4 in-lb/rad
- K=5E4 in-lb/rad
- K=2E4 in-lb/rad
- K=5E5 in-lb/rad
- K=infinite

## Xcite 1300T-3 Torsional System - 1318-15-TOR Exciter Head

**Peak Dynamic Torque vs. Frequency**



**Peak Displacement vs. Frequency**



**Structure Stiffness:**

- K=1E5 in-lb/rad
- K=5E5 in-lb/rad
- K=1E6 in-lb/rad
- K=infinite



# CERTIFICATE OF CALIBRATION

**Transducer Model:** LXT 932  
**Serial Number:** 10955  
**Capacity:** 50000 IN-LBS  
**Calibration Date:** 3/28/2006  
**Excitation:** 10 VDC  
**Input Resistance:** 350 Ohms  
**Output Resistance:** 350 Ohms  
**Temperature Range:** 72-150 Degrees F

	Applied Load in IN-LBS	CCW MV/V	CW MV/V
RUN #1	0.00	0.0000	0.0000
	25000.00	-1.2063	1.2016
	50000.00	-2.4132	2.3988
	25000.00	-1.2035	1.2034
	0.00	-0.0006	0.0005

An output of **0.7335 MV/V** is induced when a shunt resistor of 120K ohms is applied across (-) Excitation and (-) Signal.

**Notes:** 0.7335 MV/V SIMULATES A TORQUE OF 15,250 IN-LB

**Wiring Code:**  
 (+)Excitation A  
 (-) Excitation D  
 (+)Signal B  
 (-) Signal C

*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.*

Approved by: \_\_\_\_\_



---

## 1302C 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. 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 in the most efficient manner, considering power requirements, reliability, safety, ease of maintenance, and operator convenience.

### 2.1. Circuit Description (Hydraulic) - See Drawing B-30066

An oil reservoir provides storage for all necessary supply oil and provides some oil cooling. 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 3000PSI 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 five-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.

### 2.2. Circuit Description (Electric) - See Drawing B-30068

The electrical input is specified at the time of purchase as either 200-230 or 380-460 volt, 50/60 Hz, three phase. 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 three-phase power, while the remaining loads derive 120 volt, single-phase from the step-down Transformer T-1 (designated 5), 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 overload trip. The pump start relay (1CR), (designated 09), 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 04) 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 *PHASE CORRECT* light is off, any two legs of the incoming lines should be reversed.

If the phase is incorrect, 1PM (04) remains de-energized, thus preventing the system from being energized. If the phasing is correct, 1PM (04) energizes, allowing 120 VAC from T-1 (05) to be applied to the pump unit.

The T-1(05) Transformer is fused by 4FU and 5FU (designated 21). The system POWER switch connects power to the control circuits. If oil temperature is normal, relay 2CR (designated 09) is not energized. Momentarily, pressing the START button will energize 1CR (designated 09) if oil level, temperature, filter, and pressure selection are correct.

Relay 1CR (09) energizes the motor starter 02. Auxiliary contact 1M closes, latching 1CR. A normally closed CR1(09) contact opens, turning off the *STOP* light.

Momentarily pressing the STOP button breaks the latch-up circuit and de-energize 1CR (09) 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 09) 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 pump *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 (09) is normally not energized unless the oil temperature exceeds 140 degrees F. If the *RED OIL OVERTEMP* light 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 50PSI, 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.

### 3. Description

Included with the hydraulic power supply are an oil supply line pressure gauge and a timer which records actual 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.

#### 3.1. Major Components

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

#### 3.2. Control Components

##### 3.2.1. 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.*

#### 3.3. Monitoring Devices

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

A phase sequence relay monitors the three-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.

##### 3.3.2. 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 50PSI. 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 and the filter should be replaced.

**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.

**3.3.3. OIL OVERTEMP Indicator**

The temperature sensor monitors the oil temperature of the reservoir and prevents the pump from running if the oil temperature exceeds 140degrees F. The *OIL OVERTEMP* light illuminates, indicating that the maximum allowable oil temperature has been exceeded.

**3.3.4. 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. 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.

### 4.1. Operating Care

4.1.1. Wipe off all cables after each use.

4.1.2. Never drag cables across the floor.

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

- 4.1.4. During operation, the oil temperature should never rise above 145 degrees F. (The oil temperature thermal relay shuts down the system at 150 degrees F.)
- 4.1.5. Before each test, check the oil pressure to make sure it is at 3000PSI. 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 (knob with locknut).
- 4.1.6. Before each test, check to make sure that the water supply is turned on and the supply water temperature is below 70 degrees F, that the pump maintenance warning lights are not illuminated, and that the phase sequence indicator shows 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.

#### **4.2. Maintenance**

- 4.2.1. 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.
- 4.2.2. Oil should be changed after every 1000 hours of pump operation.
- 4.2.3. 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.
- 4.2.4. Oil should be drained from the reservoir during transportation.

### **5. Troubleshooting**

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

**5.1. Unit Overheats causing Pump To Turn Off and Oil Overtemp To Illuminate**

Overheating may be caused by an interruption in water flow to the water/oil heat exchanger or supply water temperatures above 70 degrees F. Check to see that water is flowing through the water/oil heat exchanger at 8GPM when the oil temperature is above 135 degrees F. If pump has shut down due to overheating, it will require several hours of natural cooling before the pump will restart.

**5.2. Pump de-energizes**

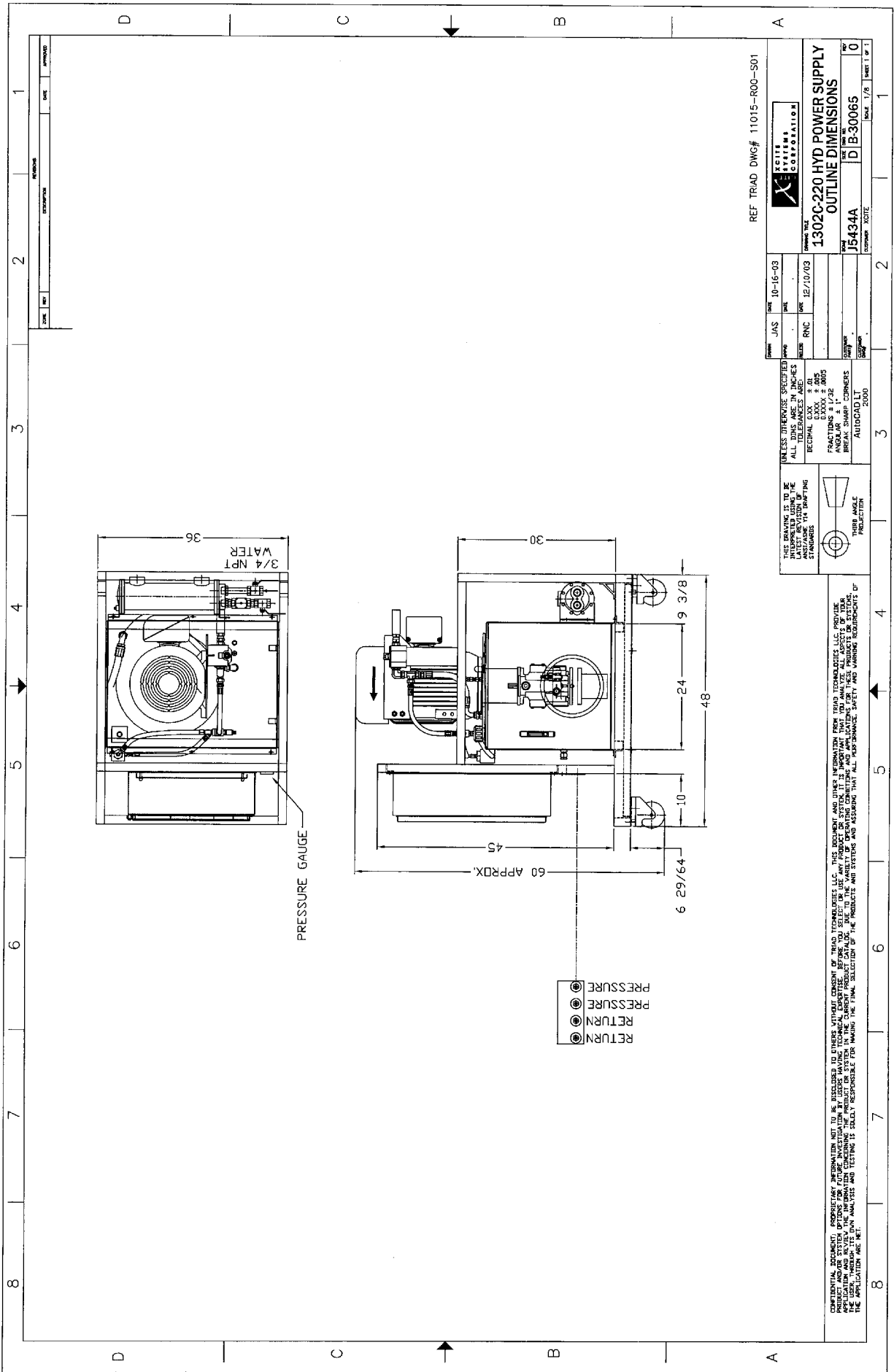
A pump de-energizes for no apparent reason can be caused by a noisy 3-phase power line at which the 3-phase voltage drops below 220 VAC (60 Hz) for more than 10 milliseconds. This results in the phase monitor relay 1PM momentarily de-energizing, shutting off the system.

**6. Specifications**

<u>Item</u>	<u>Specifications</u>
Dimensions	
Height	60"
Width	36"
Depth	48"
Weight	1500 lb (without oil)
Hydraulic Oil	Mobil DTE-24
Filter	5 Micron
Pump	15 GPM
Pressure-compensated variable flow axial piston	
Motor, 220, 3-Phase, 60 Hz	30 HP
Reservoir	40 gallon
Cooling	Water (50 PSI, 70 degrees F, 8GPM Flow)
Noise Level (at 3 feet with full pump flow at 3000PSI)	81 to 88 dBA depending on location

**7. Drawings*****Model 1302C-220***

Outline Dimensions	B-30065
Hydraulic Schematic	B-30066
Electrical Schematic 220 VAC, 60 Hz	B-30068
Electrical Box Layout	B-30067



DATE	BY	DESCRIPTION	REV	APPROVED

REF TRIAD DWG# 11015-R00-S01

**ACITE CORPORATION**

**1302C-220 HYD POWER SUPPLY**

**OUTLINE DIMENSIONS**

DATE: 10-16-03  
 DRAWN BY: JAS  
 CHECKED BY: RNC  
 DATE: 12/10/03

PROJECT: J5434A  
 DRAWING NO: DIB-30065  
 SHEET NO: 10  
 TOTAL SHEETS: 10

(UNLESS OTHERWISE SPECIFIED)  
 ALL DIMS ARE IN INCHES  
 TOLERANCES ARE:  
 DECIMAL 0.005 ± .005  
 FRACTIONS 3/32 ± .005  
 ANGULAR ± 1°  
 BREAK SHARP CORNERS  
 UNLESS NOTED OTHERWISE  
 AUTODIAGONAL

THIS DRAWING IS TO BE INTERPRETED USING THE PRACTICES AND STANDARDS LISTED IN THE FIRST ANGLE PROJECTION.

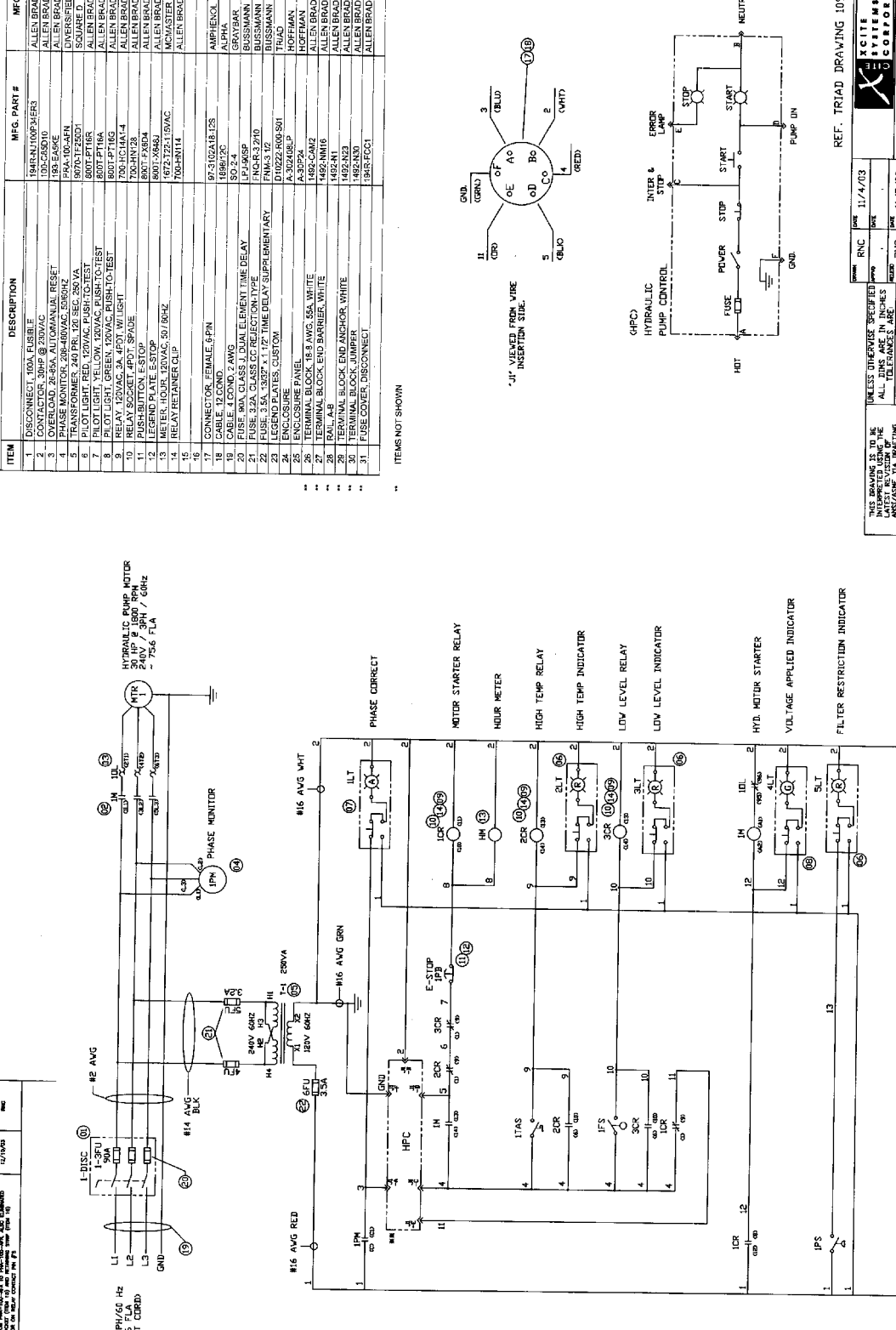
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- RETURN
- RETURN
- PRESSURE
- PRESSURE





1 2 3 4 5 6 7 8



ITEM	DESCRIPTION	MFG. PART #	MFG.	QTY.	UNITS
1	DISCONNECT, 100A, 600V, 1P	184RN100P3HER3	ALLEN BRADLEY	1	EA
2	CONTACTOR, 30HP @ 230VAC	183-BA30	ALLEN BRADLEY	1	EA
3	OVERLOAD, 20-85A, AUTOMANUAL RESET	183-BA30	ALLEN BRADLEY	1	EA
4	PHASE MONITOR, 208-480VAC, 50/60HZ	PHM-100-4FN	DIVERSIFIED ELECT	1	EA
5	TRANSFORMER, 240V PRI, 120 SEC, 250VA	9076-TF250D1	SQUARE D	1	EA
6	PILOT LIGHT, GREEN, 120VAC, PUSH-TO-TEST	8007-PT168R	ALLEN BRADLEY	1	EA
7	PILOT LIGHT, YELLOW, 120VAC, PUSH-TO-TEST	8007-PT168Y	ALLEN BRADLEY	1	EA
8	RELAY, 120VAC, 3A, 4PDT, W/ LIGHT	700-HC14A-4	ALLEN BRADLEY	3	EA
9	RELAY SOCKET, 4PDT, SP/IDE	700-HV28	ALLEN BRADLEY	3	EA
10	LEGEND SYMBOL, STOP	8007-FXB4	ALLEN BRADLEY	1	EA
11	LEGEND SYMBOL, STOP	8007-FXB4	ALLEN BRADLEY	1	EA
12	METER, HOUR, 120VAC, 50/60HZ	700-EN114	ALLEN BRADLEY	1	EA
13	RELAY RETAINER CLIP	700-EN114	ALLEN BRADLEY	3	EA
14	CONDUIT, 1/2" DIA, 10 FT	97-3102A1B12S	AMPHENOL	1	EA
15	CABLE, 12 COND, 2 AWG	183-BA30	ALPHA	40	FT
16	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	9	EA
17	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
18	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
19	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
20	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
21	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
22	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
23	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
24	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
25	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
26	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
27	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
28	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
29	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
30	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA
31	TERMINAL BLOCK, END BARRIER, WHITE	SP-2-X	BUSSMANN	2	EA

ITEMS NOT SHOWN

REF. TRIAD DRAWING 10988-R01-S01

1302C-220 HYD POWER SUPPLY ELECTRICAL SCHEMATIC

J5434A

15-30068

THIS DRAWING IS TO BE INTERPRETED USING THE STANDARDS INDICATED HEREIN UNLESS OTHERWISE SPECIFIED. ALL DIMS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. FRACTIONS SHALL BE 1/16" ANGULAR ± 1° BUCK SHARP CORNERS AUTOMATIC 20X00 PROJECTION



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## 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

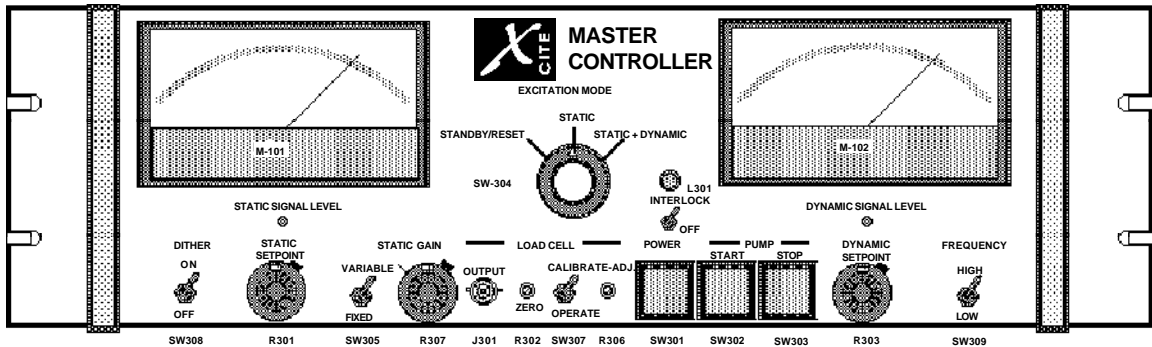
Single-loop operation is selected by placing the Frequency Range switch to the *LOW* position. This mode is generally used to control a single variable, usually force or displacement. In this *LOW FREQUENCY* mode of operation, a dynamic signal is generated by summing the reference frequency present at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

#### 2.1.2. Dual Loop

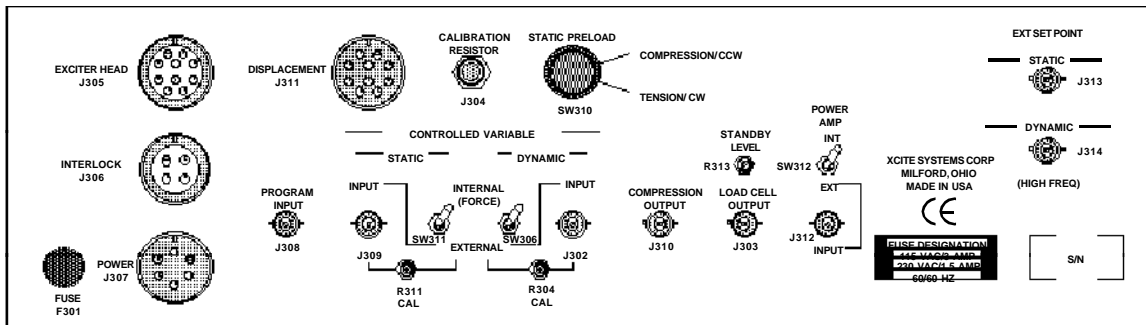
Dual-loop operation is selected by placing the *FREQUENCY RANGE* switch to the *HIGH* position. This mode applies the dynamic feedback signal to the dynamic control loop which incorporates an automatic gain control circuit. This allows a desired dynamic amplitude variable to be set and maintained over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



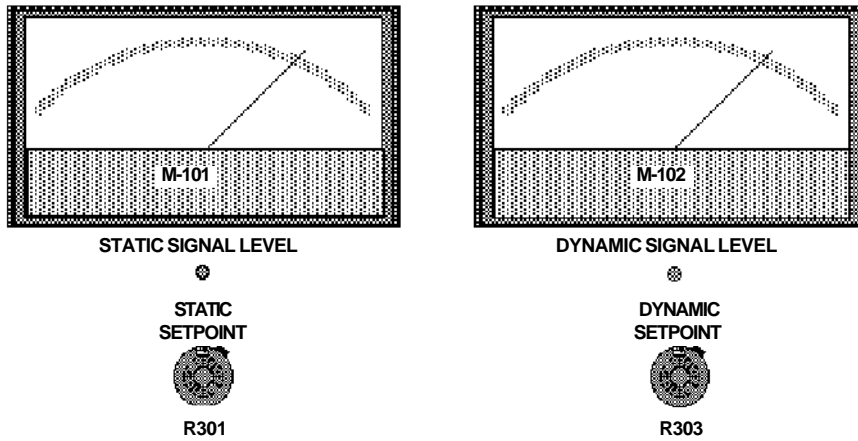
*Front Panel*



MASTER CONTROLLER REAR PANEL (OUTSIDE VIEW)

*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.

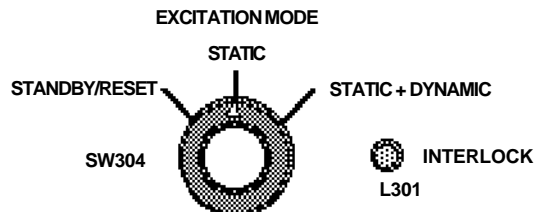
**3.1.3. Dynamic Signal Level Meter (M-102)**

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.

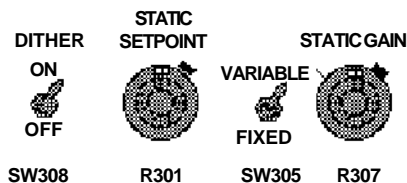
**Static + Dynamic**

The static and dynamic control loops are activated.

**3.1.6. Interlock Selector Switch (Optional) and Light 301**

The Interlock Selector Switch (provided only on Master Controllers operating torsional Exciter Heads) located directly below the red Interlock Light is used to disable the Interlock system when in the *STATIC MODE* position. Normal Interlock occurs when the switch is in the *UP* position. Disabled Interlock occurs when the switch is in the *DOWN* position.

The Interlock 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)**

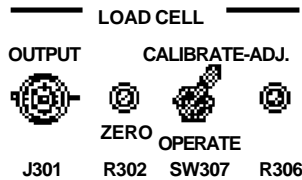
Toggle switch. In *VARIABLE* position actuates loop static gain potentiometer (R307).



**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)**

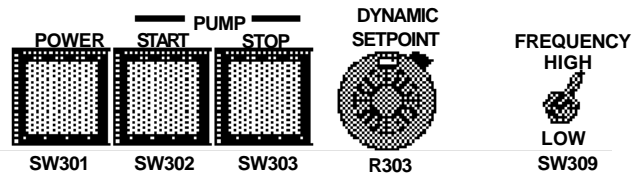
**Adj. (R306)**

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)**

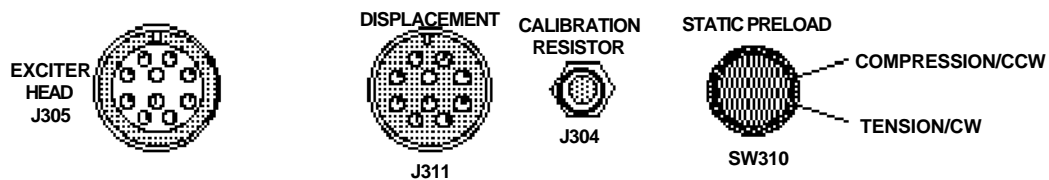
Push switch to de-energize hydraulic power supply.

**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)**

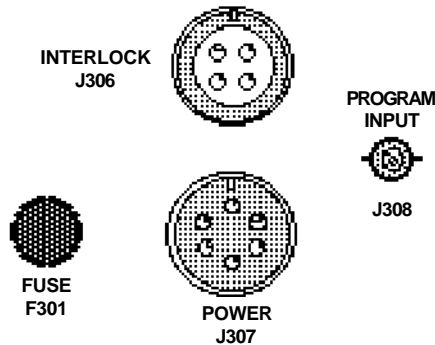
Jack input for calibration plug provided with Load Cell Transducer.

**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.

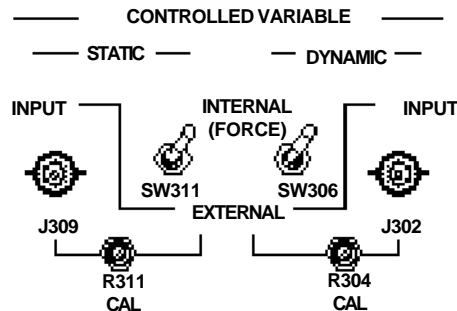
**3.2.8. Program Input (J308)**

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)

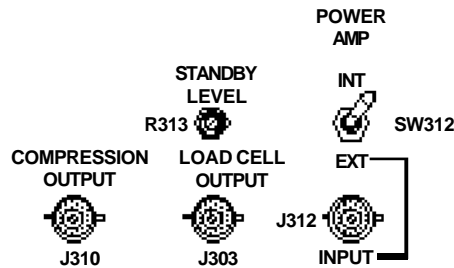
BNC connection for externally supplied user-specified dynamic feedback variable. Input signal level should be 5 volts peak (minimum) full scale.

#### 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.

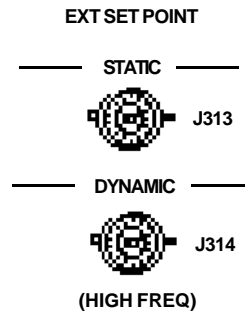
#### Cal. (R304)

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 *EXTERNAL*. 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 inputting a voltage from a DAC (Digital to Analog Converter). 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. (For the ES-315 Torsional Head, 2.5 volts)

**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 inputting 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, +/-10% 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 voltage. 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 in the 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 inputting 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

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
PCB110-05 Romass Schematic	C-015528-3





**8. Parts List**

Xcite reserves the right to substitute parts without notice.

<b>Component Part Number</b>	<b>Description</b>
<b><u>Chassis</u></b>	
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
<b><u>PCB 110-01</u></b>	
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

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**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.

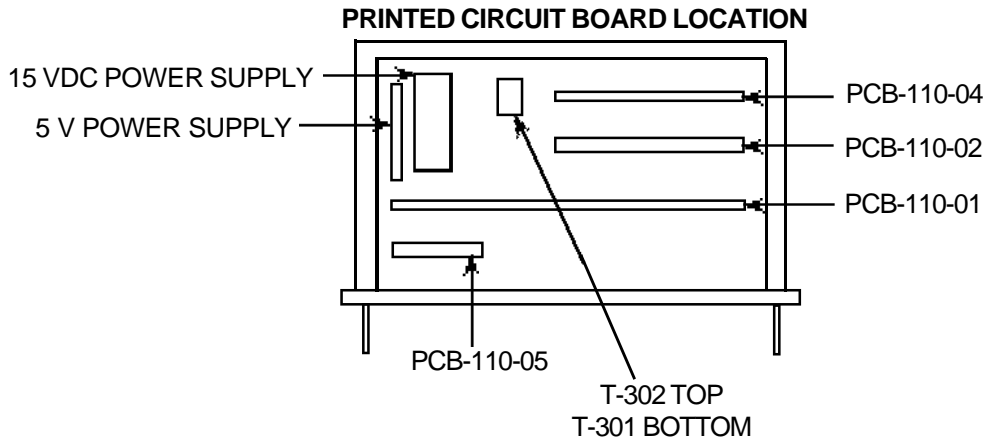
Calibration need not be done in the order listed, nor are all adjustments required if one circuit is to be re-calibrated. Individual calibration may be performed as needed.

- 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

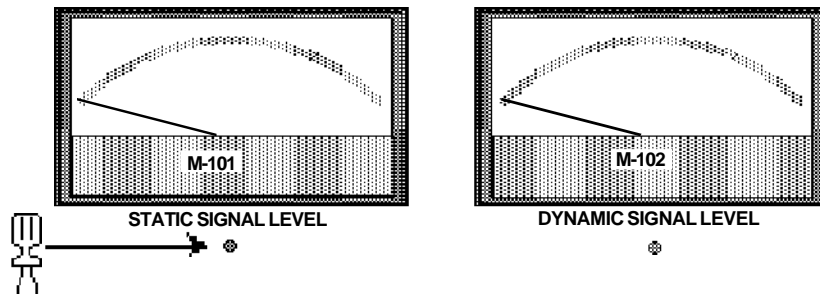
- 9.1.1. Stiff Test Structure (capable of w/standing the full rated force of the Exciter Head)
- 9.1.2. A 4 ½ digit Digital Multimeter
- 9.1.3. Oscilloscope
- 9.1.4. Signal Generator (audio frequency range)
- 9.1.5. FFT Spectrum Analyzer (if curves are to be run)
- 9.1.6. Trim pot adjustment tool or a small screwdriver



## 9.2. Master Controller

### 9.2.1. Meter Zero Adjustments

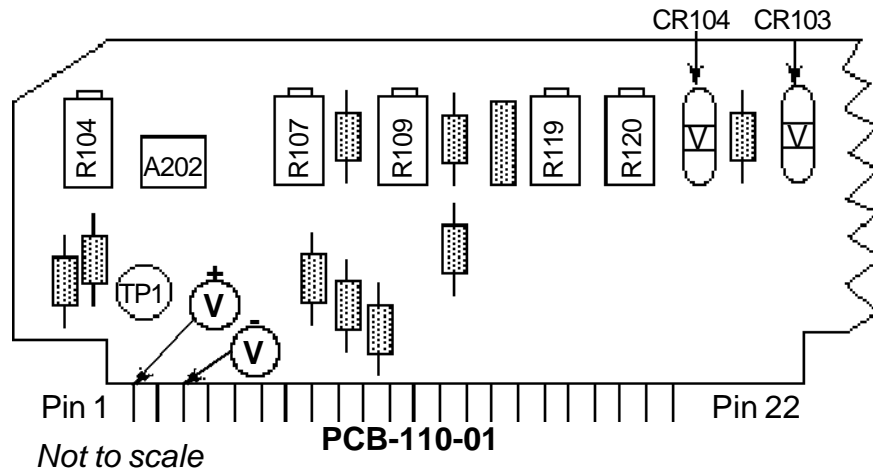
- Turn the Master Controller off.
- The Static and Dynamic meters should be resting precisely at zero.



- 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.*

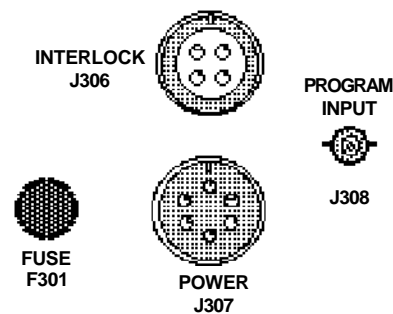
**9.2.4. Load Cell Excitation Voltage Verification**

Check for 12.0V +/-0.3V at 110-01-44

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

**Initial Setup**

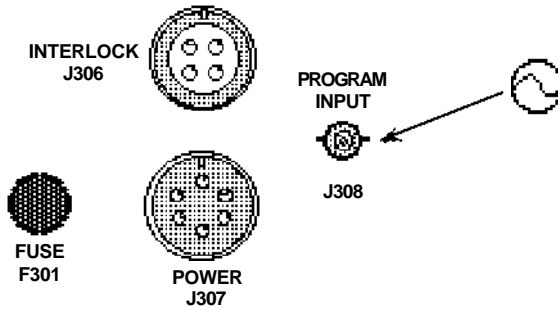
Apply a shorted BNC cable or a 50Ω BNC terminator to the Program Input (J308).







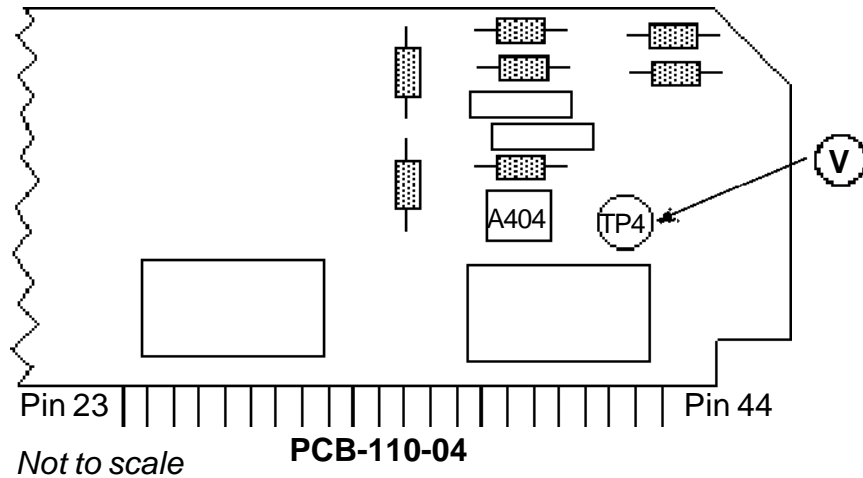
**Dynamic Reference AC to DC Level Verification**



- 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**

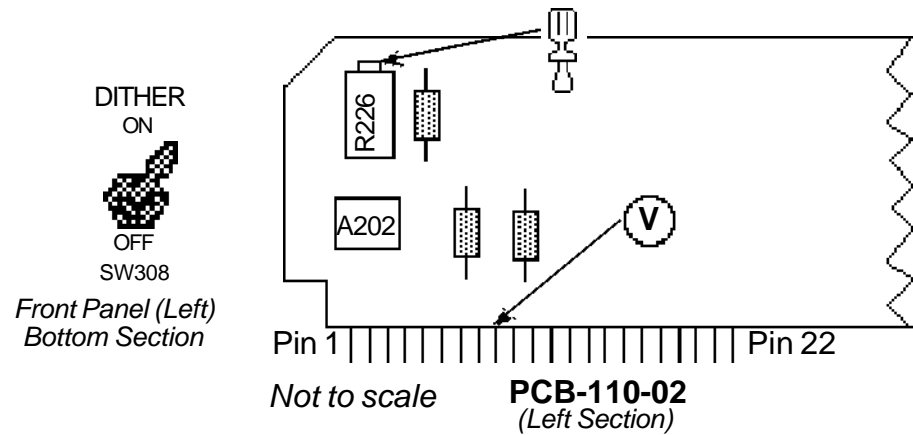
Check for a 26V peak to peak, 360 Hz Triangle wave (+/-20 Hz) at TP4.



**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*.



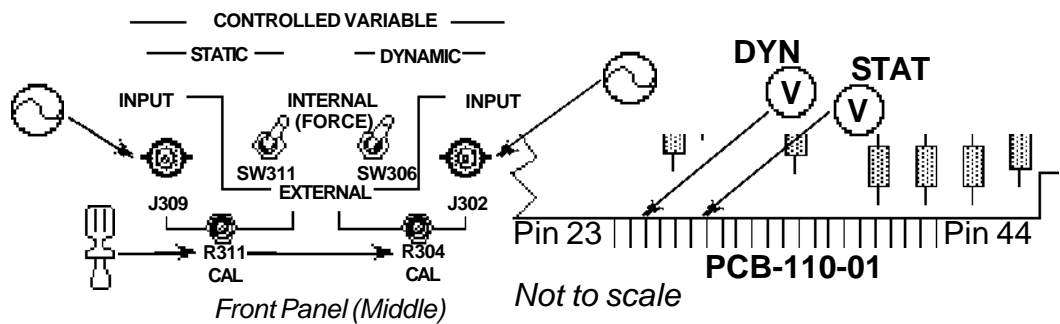
**9.2.7. Master Controller Board 110-01 Calibration Procedure**

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

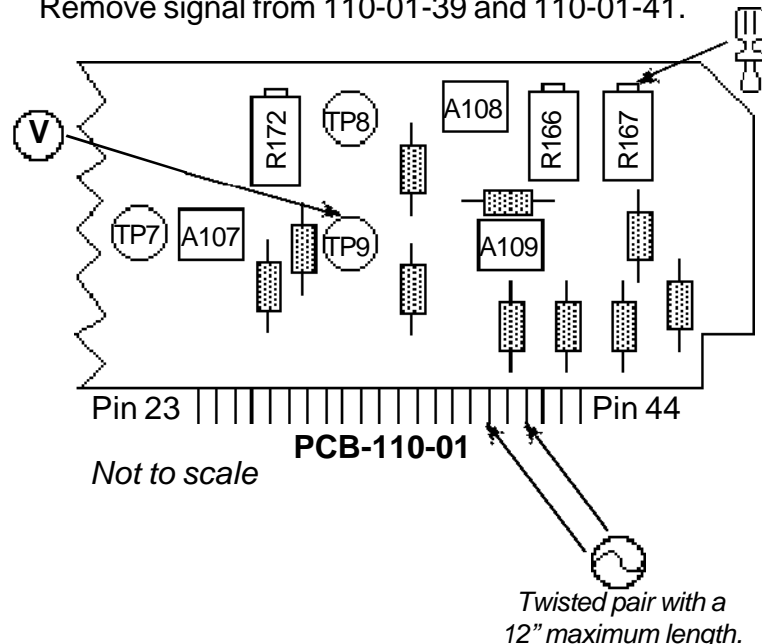
**External Static and Dynamic Variable Input Calibration**

- 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.

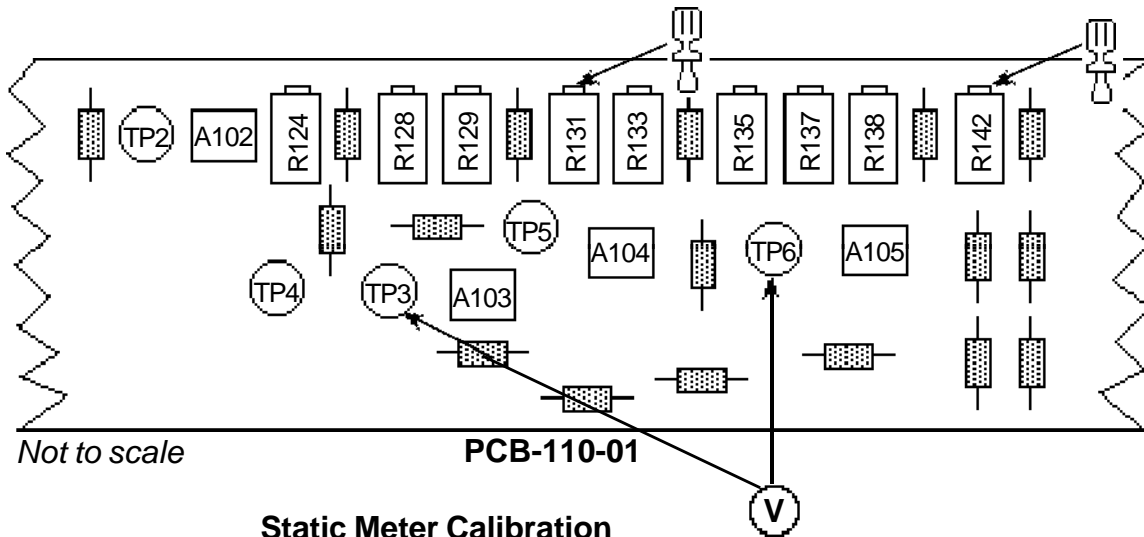


**Meter Amplifier Zero Offset Adjustments**

With no signals applied, make the following settings:

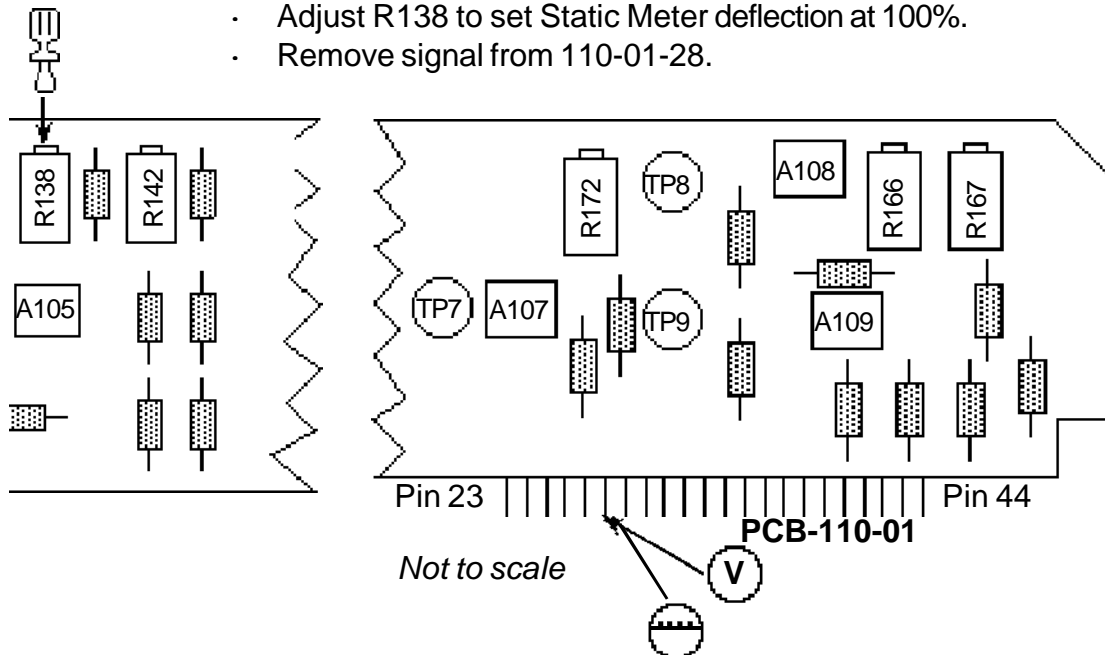
Static Set Point Level	(R301)	0.0
Dynamic Set Point Level	(R303)	0.0
Static Controlled Variable	(SW311)	External
Dynamic Controlled Variable	(SW306)	External

- 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**

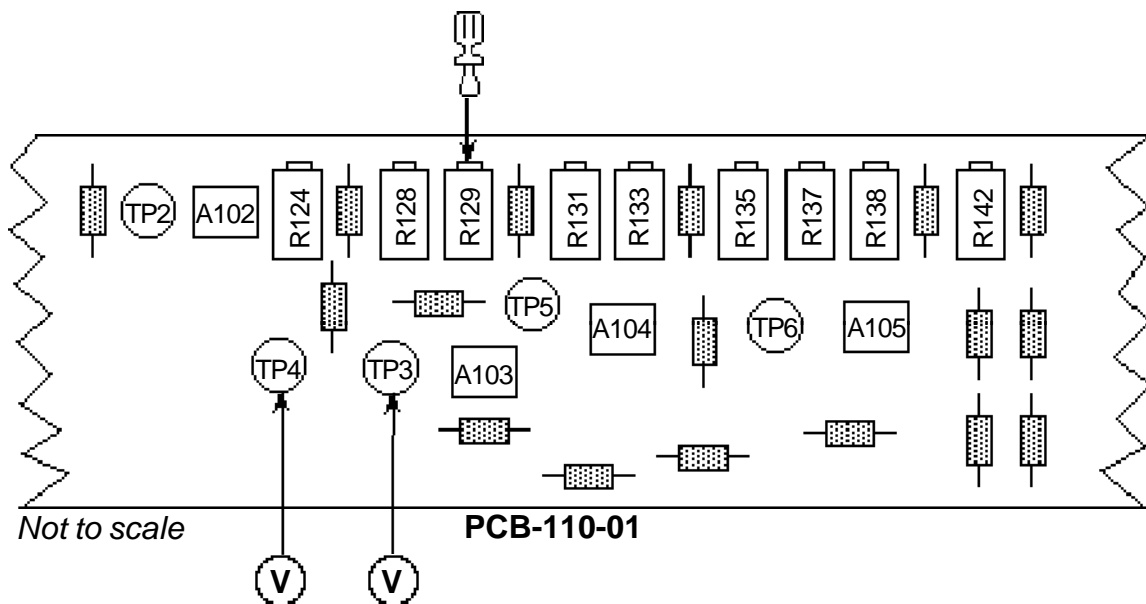
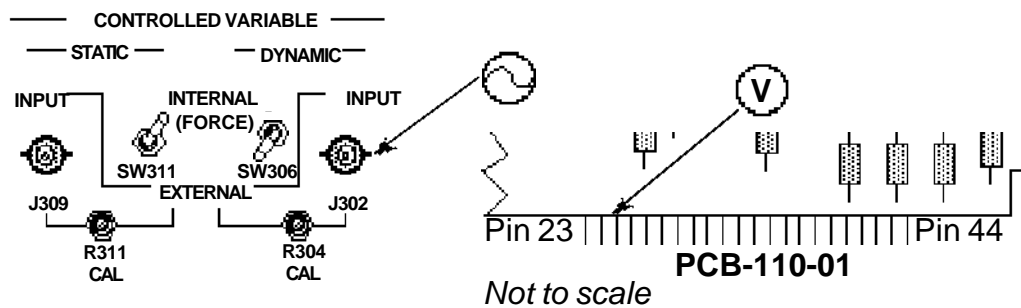
- Set the Dynamic Control Variable (SW306) to External.
- Apply a 100 Hz sine wave to the Dynamic Variable Input (J302).
- Adjust Signal level for 1.000V rms at 110-01-25 (WHT/ BLK wire).
- Check for an inverted 1.0V rms +/-5% signal at TP3.

**RMS Converter Check**

Check for 1.00V DC at TP4.

**Dynamic Meter Calibration Adjustment**

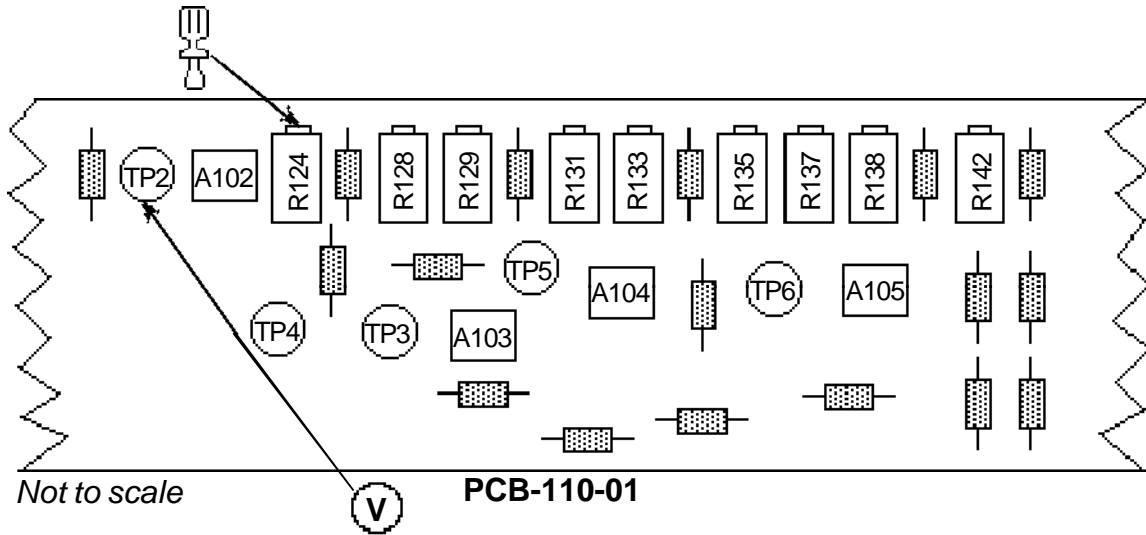
- Adjust the signal level for 1.77V rms at 110-01-25 (WHT/ BLK wire).
- Adjust R129 for 50% full scale deflection of Dynamic Meter.
- Remove signal from Dynamic Variable Input (J302).



**Dynamic Multiplier Calibration**

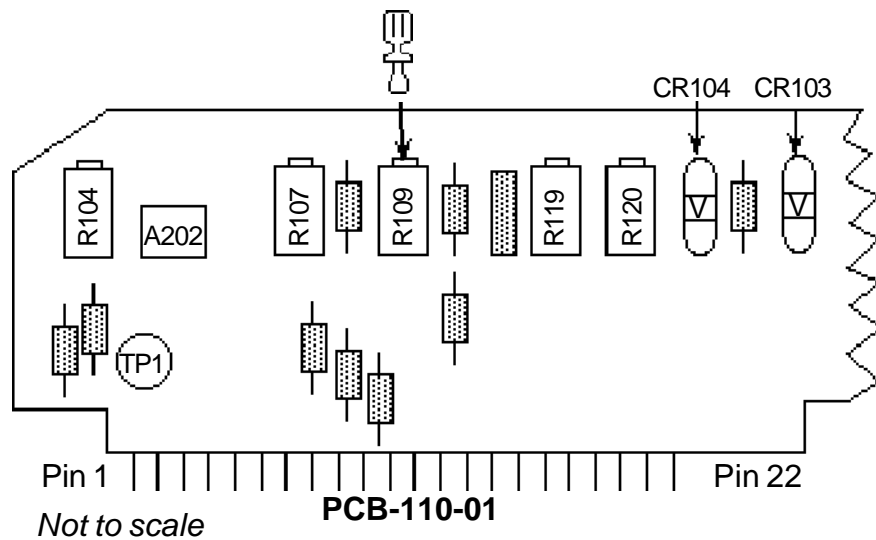
**Integrator Bias Calibration**

Adjust R124 for -10mV DC at TP2.



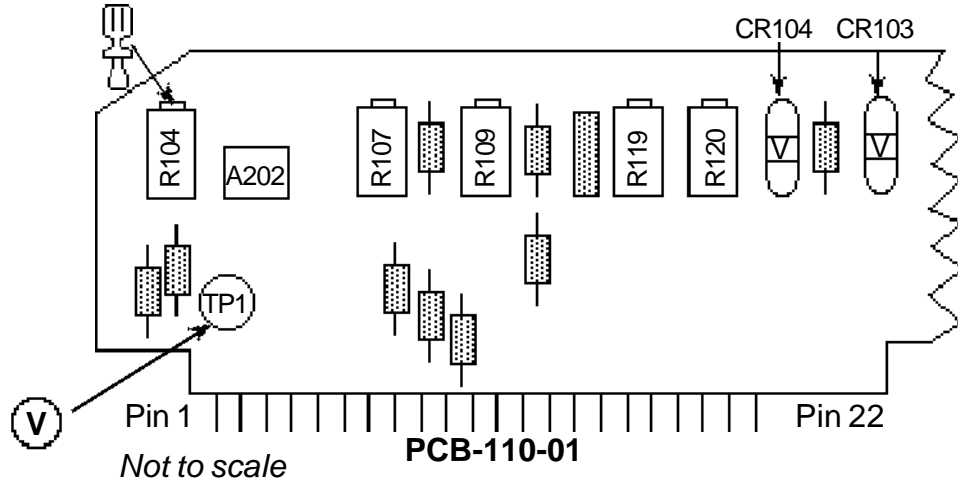
**P-Clip Adjustment**

Adjust R109 fully clockwise (to Maximum).



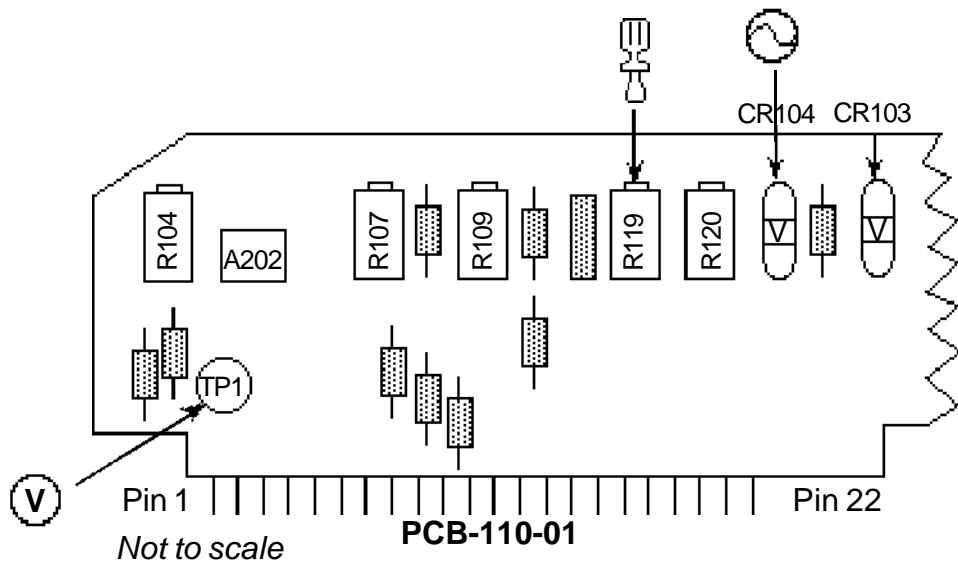
**Initial Multiplier Offset Adjustment**

Adjust R104 for 0mV DC +/-100mV at TP1.



**Multiplier X Input Null**

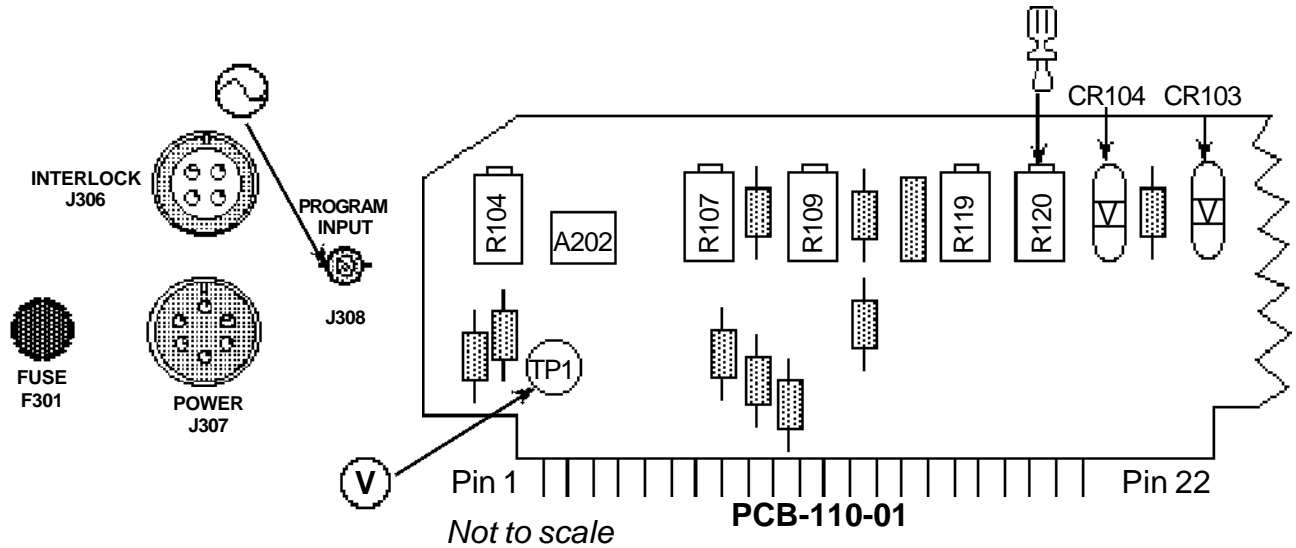
- Apply a 1.0V rms, 120 Hz sine wave to the Cathode side of CR104.
- Adjust R119 for minimum 120 Hz signal at TP1.





**Multiplier Y Input Null**

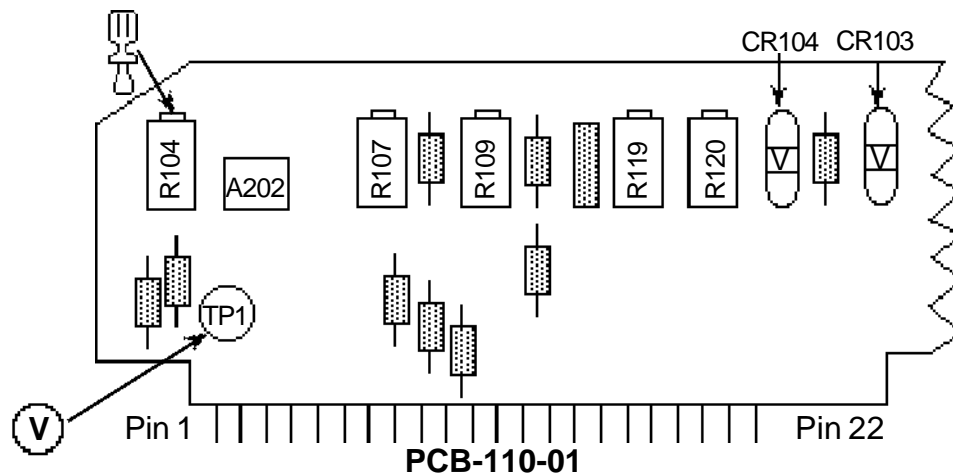
- Remove the signal from CR104.
- Apply a 1.0V rms, 120 Hz sine wave to the Program Input (J308).
- Adjust R120 for minimum 120 Hz signal at TP1.



**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

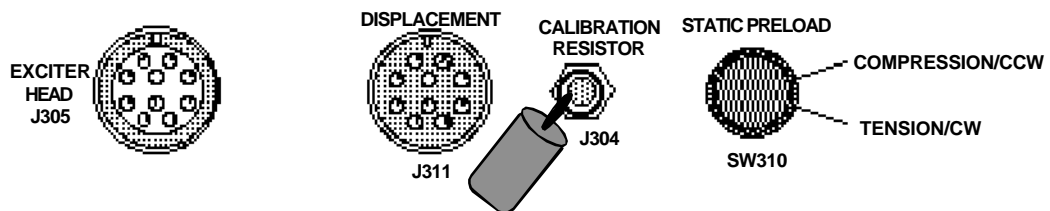
Set front and rear panel switches and adjustments as follows:

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

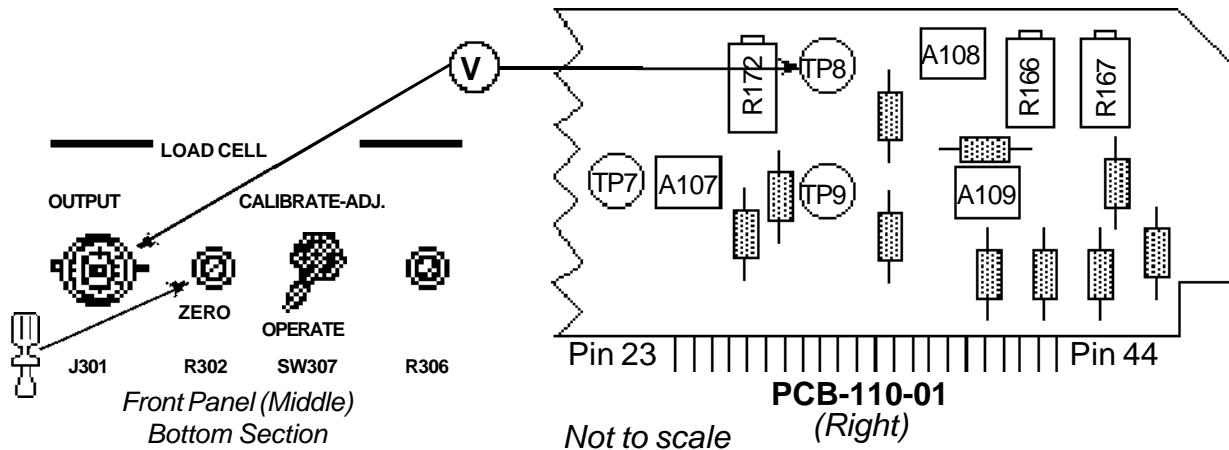
- Connect P305 end of the Controller Cable to J305 (Rear Panel).
- Connect the 4-pin cable to the load cell.
- Insert the Cal Plug into J304.



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

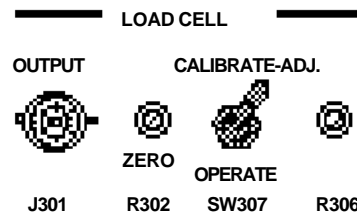
**Adjust Load Cell Zero Calibration**

- 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).

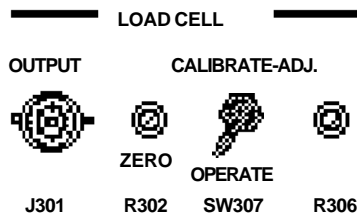


**Load Cell Meter Calibration**

- 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:

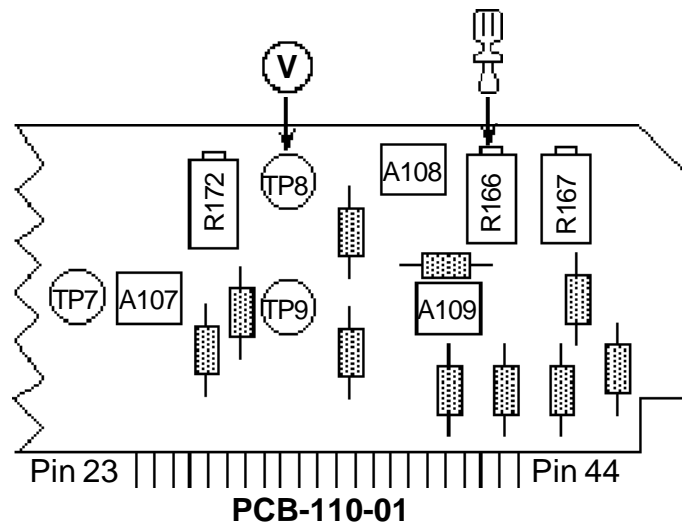
$$[\text{Calibration Force (on Cal Plug)}/\text{Sens (on Cal Plug)}]$$

**Examples:**

$$[357\text{lbs per } 300\Omega / 250\text{lbs per Volt}]$$

$$= 1.428 \text{ Volts per } 300 \text{ K}\Omega$$

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



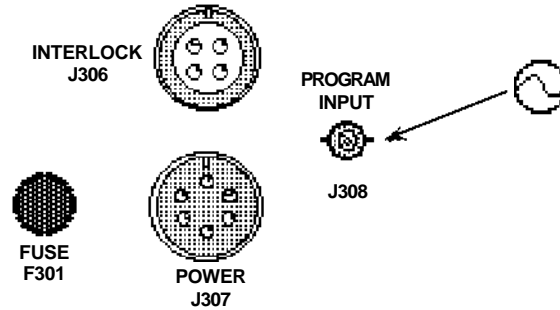
*Not to scale*

**9.3.2. Static Loop Gain Calibration**

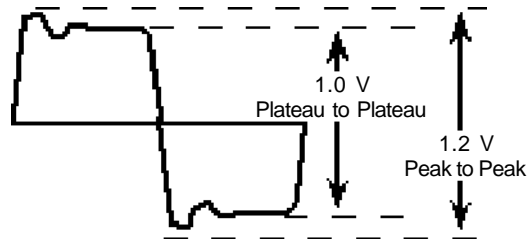
Set the front and rear panel switches and adjustments as follows:

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

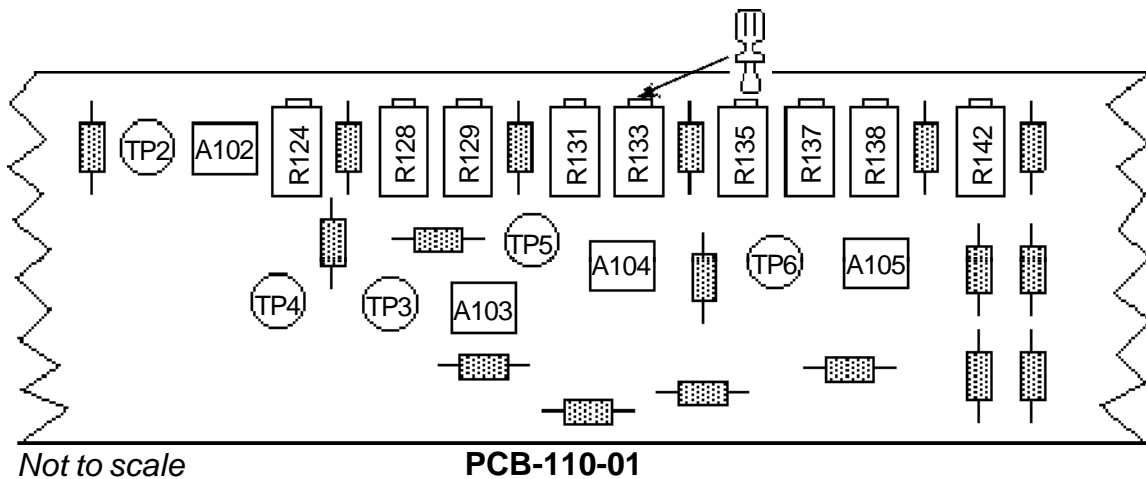
- Fixture the exciter head for compression into a rigid structure.
- Connect J305, J311, J309 (with BNC Pigtail to static variable input).
- Connect cables to the exciter head.
- Apply a 1.00V peak-peak, 5 Hz square wave to the Program Input (J308).



- 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

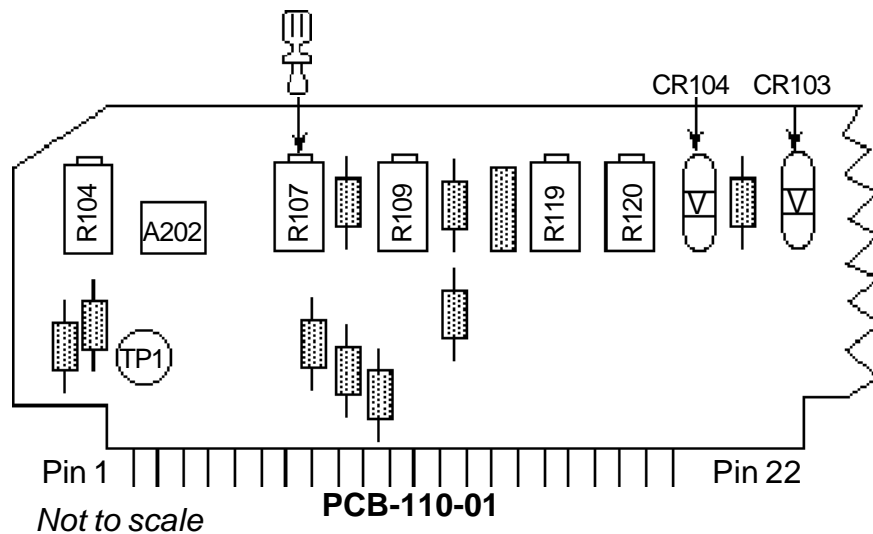
PCB-110-01

**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

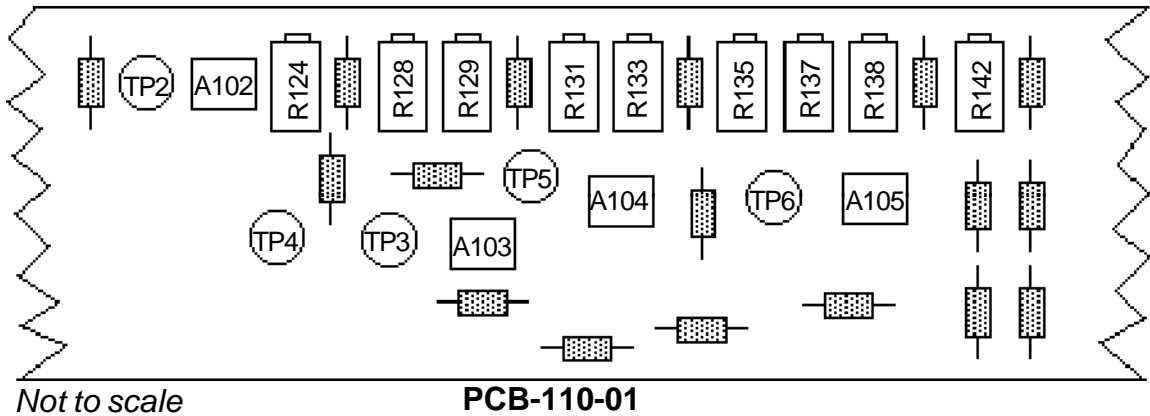
- Adjust R107 (Static Cal) for a 50% Static Meter Reading.

**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).

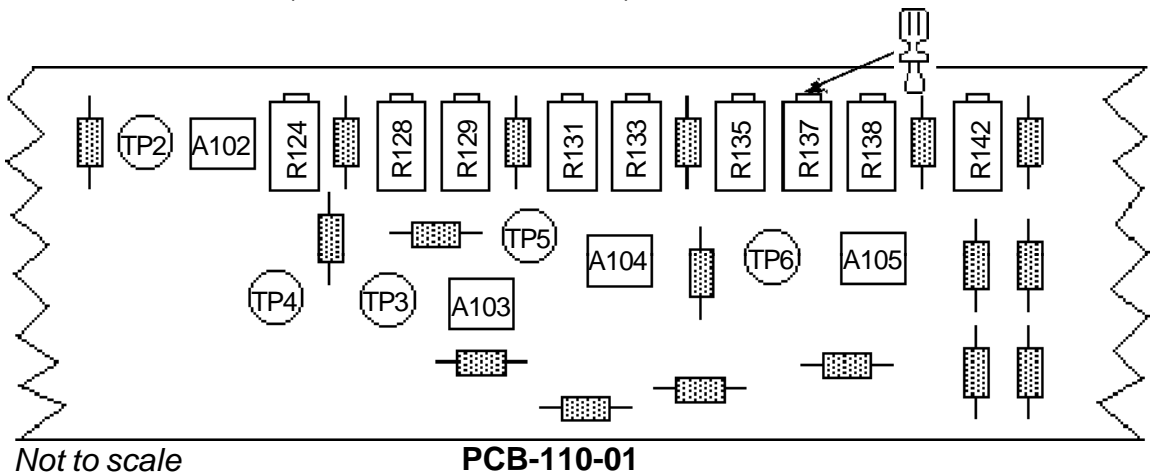


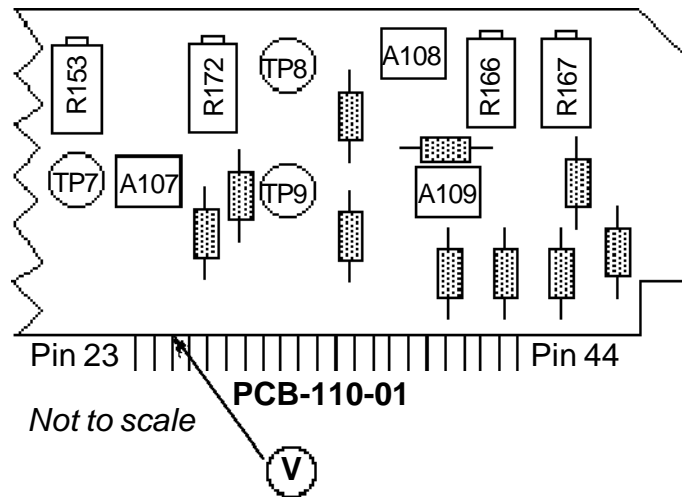
**9.3.5. Low Frequency Dynamic Calibration**

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).





#### 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 position 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 output with a -5VDC, +/-5% signal.