Actuation Test Equipment

ATE-14E/EK-217 Closed Loop Box
442153-1 & 2
Equipment Manual

Actuation Test Equipment
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Change Record and Tool List

Modifications to ATE-14C for Rev B.

1. Switched ends of feedback selector switch.
2. Flipped torque motor meter input polarity.
3. Installed new bias circuit for LVDT Signal Conditioners.
4. Changed R25 to 2k.
5. Changed ends of I Gain pot to make CW = increase gain.
6. Added C51=.1uF and R50=2k to improve power amplifier stability.
7. Enlarged rearmost vent hole on left end of box to accommodate Air Purge fitting.

Modifications to ATE-14C for Rev C.

1. Add BNCs and 10k Ohm resistors for Follower input to the power amplifier.
2. Add meter polarity switch to front.

Mods to ATE-14C for Rev D.

Change R66 and R67 to 3.48k. Add power supply test points.

Mods to ATE-14C for Rev E.

Change current limit from 5 Ohm sense resistor to pin 8 of OPA541 to a 50 Ohm snubbing resistor in series with output current.

Proposed mods for upcoming revision:

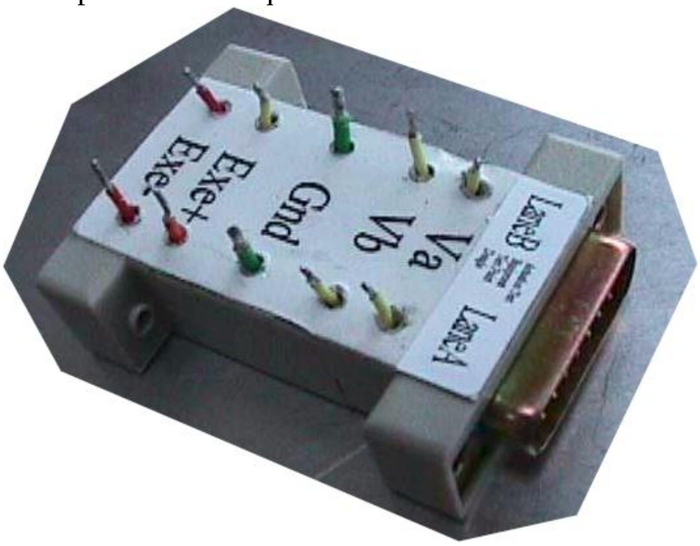
1. Change R13 to 1.7k (1.5k+.2k) and VR2 and VR4 to .5k.
2. Change oscillator circuit to use AD 2S99 IC and SSM2142 differential amps to get trimpot adjustment of excitation parameters.
3. Add card edge connector and mux IC on LVDTTool calibrator to automate calibration procedure power supply checks. The card edge connector will conduct the power supply test point signals to the LVDTTool circuit board. The mux on the LVDTTool board will connect the power supply test points to the multimeter inputs under computer control. The Visual Basic program will then be able to measure all power supply voltage and ripple values automatically.

Mods Proposed for LVDTTool upgrades

A D/A converter (DAC) will be designed into the LVDT simulator circuit to adjust gain of the Main amplifier under control of the software running in the PC. This would allow the computer to correct Va and Vb errors automatically at each test point. The DAC IC would replace all of the trimpots that adjust the individual sinusoidal values now, greatly simplifying setup and use of the simulator.

Special Tooling

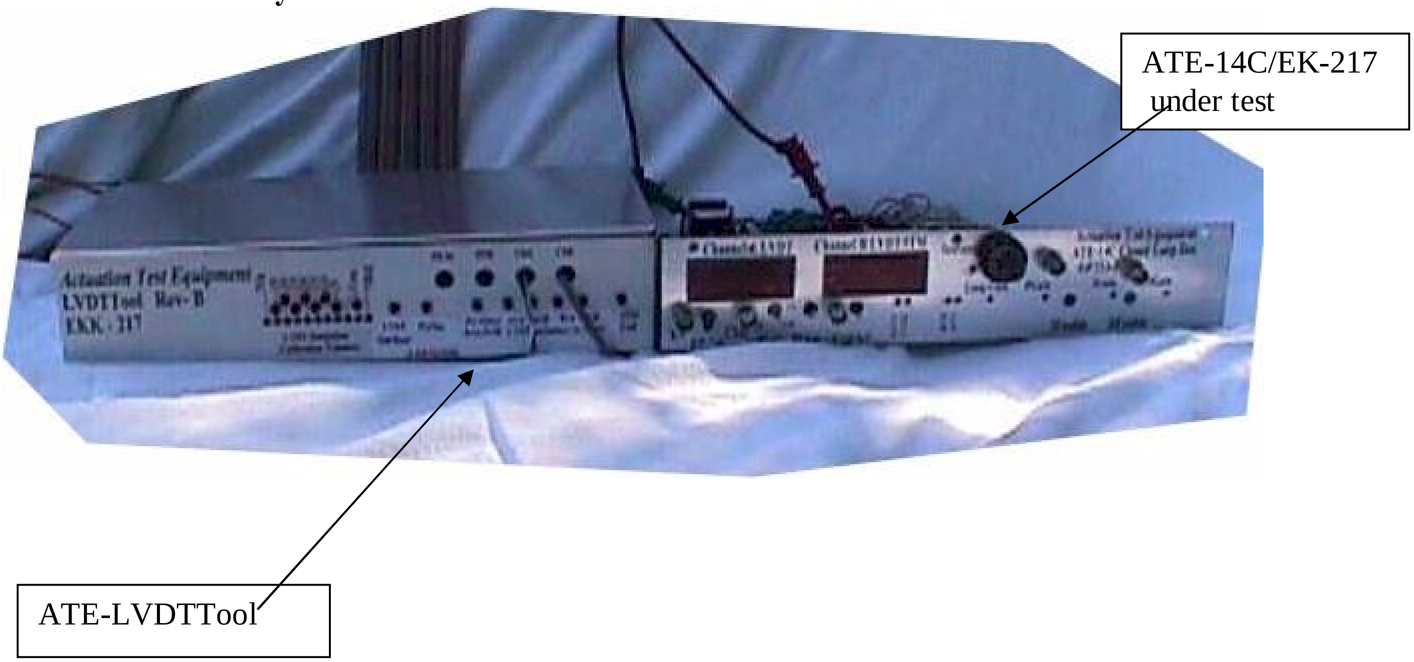
Test point dongle. This is inserted directly between the test cable and The LVDT input to the ATE-14C test box to provide access to all LVDT input and output signals. This is useful for providing a second means to verify FMV position when questions arise.



LVDT simulator.

A manual LVDT simulator for stand-alone use as a direct replacement of an LVDT in a mike stand. The circuit is the LVDT simulator from the LVDTTool calibration rig for the ATE-14C. Op-amp circuitry is used to make this device inexpensive and uncomplicated. The LVDT simulator has been demonstrated to provide more accurate and repeatable calibration input signals to the ATE-14C test box, at lower cost with less hassle than using a master LVDT in a mike stand. This tool provides two sinusoidal outputs at preset AC rms levels to simulate up to eight preset VR values of the LVDT output.

LVDTTool calibration system.



Shown above are the LVDTTool calibrator and an ATE-14C test box connected together for calibration. The LVDT and torque motor connectors on the side of the ATE-14C plug directly into mating connectors on the side of the LVDTTool. Three BNC cables are used to connect signals between the two test boxes during the calibration procedure.

The ATE-14C functions are separated into three areas for testing: power supply checks, LVDT calibration, and torque motor current test. Multimeter test leads and BNC cables are used for connections to test point signals during all three phases of the calibration procedure. The LVDT and torque motor tests meter readings are entered into the keyboard when prompted.

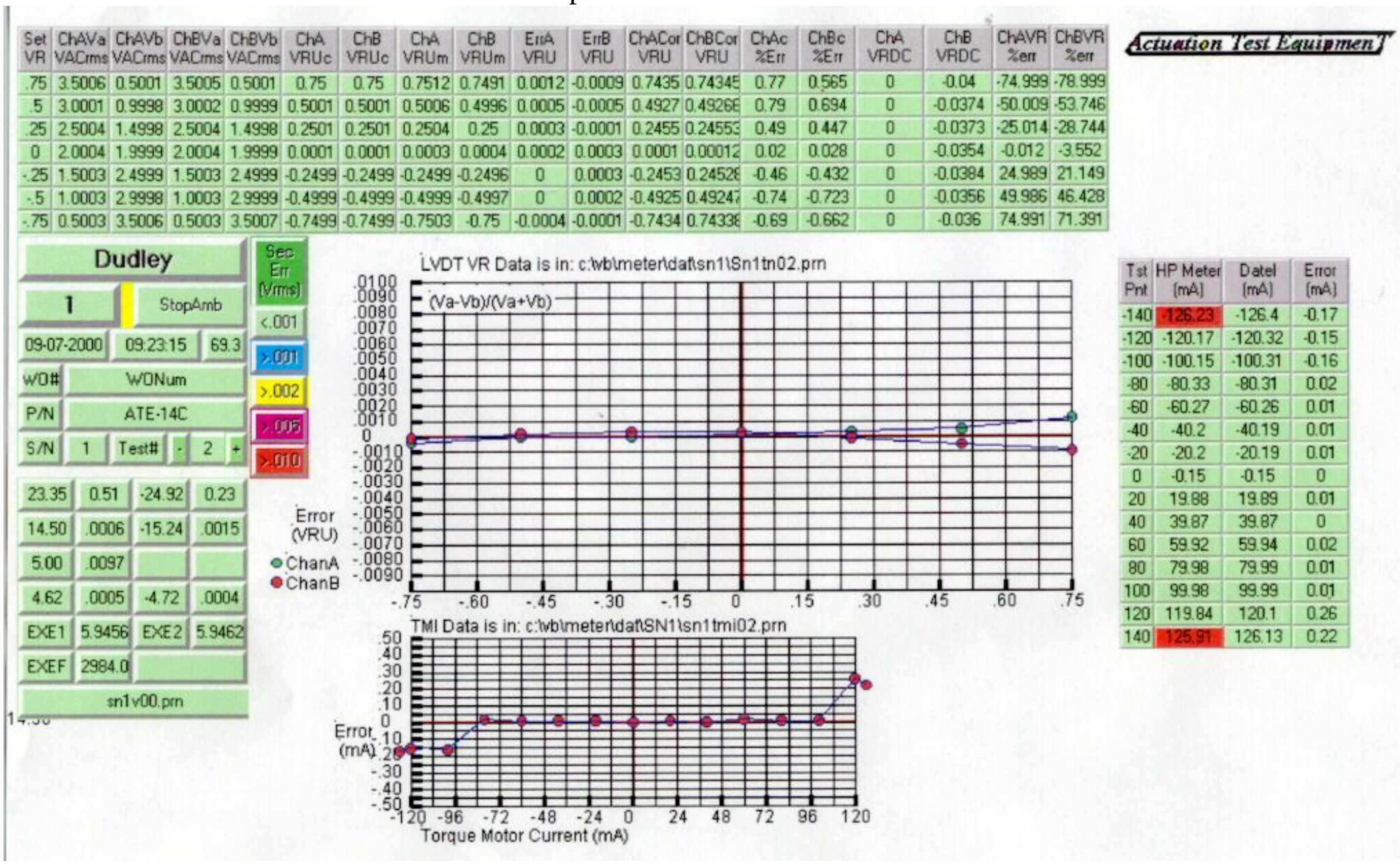
Step by step operator instructions for the calibration procedure appear on the PC monitor just at the time they are needed to explain what the operator is supposed to do. The automated test sequence, which runs all three tests in sequence, uses pop-up menus, pictures and text display panels to explain what the operator is supposed to do, and what the program is doing. This documentation method speeds up the learning process over using a hardcopy text to accompany the hardware. An embedded help system provides immediate information on each feature on the Visual Basic form.

The PC controls a standard bench-top multimeter to make the measurements. Setup and measure commands are sent, then measurement data is uploaded using either a GPIB or RS-232 communication port.

The program then computes the LVDT voltage ratio at each test point for both channels of the LVDT using the measured Va and Vb values.

A simulated cosine correction routine and display panel provides a direct readout of the values that would be obtained from a system with a synchronous demodulator.

LVDT measurements are taken at seven simulated positions across the stroke of the LVDT. Power supply, LVDT and torque motor calibration results are displayed in data tables and graphically on the screen of the PC monitor, then printed out as a permanent hardcopy record when the test is completed. Printout format is shown on the next page.



Set VR	ChAVa VACrms	ChAVb VACrms	ChBVa VACrms	ChBVb VACrms	ChA VRUc	ChB VRUc	ChA VRUm	ChB VRUm	ErrA VRU	ErrB VRU	ChACor VRU	ChBCor VRU	ChAc %Err	ChBc %Err	ChA VRDC	ChB VRDC	ChAVR %err	ChBVR %err
.75	3.5006	0.5001	3.5005	0.5001	0.75	0.75	0.7512	0.7491	0.0012	-0.0009	0.7435	0.74345	0.77	0.565	0	-0.04	-74.999	-78.999
.5	3.0001	0.9998	3.0002	0.9999	0.5001	0.5001	0.5006	0.4996	0.0005	-0.0005	0.4927	0.49268	0.79	0.694	0	-0.0374	-50.009	-53.746
.25	2.5004	1.4998	2.5004	1.4998	0.2501	0.2501	0.2504	0.25	0.0003	-0.0001	0.2455	0.24553	0.49	0.447	0	-0.0373	-25.014	-28.744
0	2.0004	1.9999	2.0004	1.9999	0.0001	0.0001	0.0003	0.0004	0.0002	0.0003	0.0001	0.00012	0.02	0.028	0	-0.0354	-0.012	-3.552
-.25	1.5003	2.4999	1.5003	2.4999	-0.2499	-0.2499	-0.2499	-0.2496	0	0.0003	-0.2453	0.24528	-0.46	-0.432	0	-0.0384	24.989	21.149
-.5	1.0003	2.9998	1.0003	2.9999	-0.4999	-0.4999	-0.4999	-0.4997	0	0.0002	-0.4925	0.49247	-0.74	-0.723	0	-0.0356	49.986	46.428
-.75	0.5003	3.5006	0.5003	3.5007	-0.7499	-0.7499	-0.7503	-0.75	-0.0004	-0.0001	-0.7434	0.74338	-0.69	-0.662	0	-0.036	74.991	71.391

23.35	0.51	-24.92	0.23
14.50	.0006	-15.24	.0015
5.00	.0097		
4.62	.0005	-4.72	.0004
EXE1	5.9456	EXE2	5.9462
EXEF	2984.0		

Tst Pnt	HP Meter (mA)	Datel (mA)	Error (mA)
-140	-126.23	-126.4	-0.17
-120	-120.17	-120.32	-0.15
-100	-100.15	-100.31	-0.16
-80	-80.33	-80.31	0.02
-60	-60.27	-60.26	0.01
-40	-40.2	-40.19	0.01
-20	-20.2	-20.19	0.01
0	-0.15	-0.15	0
20	19.88	19.89	0.01
40	39.87	39.87	0
60	59.92	59.94	0.02
80	79.98	79.99	0.01
100	99.98	99.99	0.01
120	119.84	120.1	0.26
140	125.91	126.13	0.22

Data from the LVDT calibration procedure is shown across the top of the display and on the upper graph. Power supply results appear on the lower left data table below the test identification panel. Torque motor data is displayed in the table is on the right side of the display and on the lower graph.

WARRANTY

Actuation Test Equipment warrants that this product is free from defects in material and workmanship for a period of one (1) year from the date of shipment.

Actuation Test Equipment's sole obligation under this warranty shall be limited to repair or replacement of ATE merchandise.

Repairs or replacements will be made dependant on the outcome of preliminary inspection at the discretion of Actuation Test Equipment.

If upon inspection, Actuation Test Equipment determines that the product is not defective within the terms of this warranty, the Buyer agrees to pay the cost of all repairs.

Actuation Test Equipment is not obligated to furnish service under this warranty:

to repair damage resulting from improper handling during transport, installation or operation of the product;

to repair damage resulting from connecting the product to incompatible equipment;

if personnel other than Actuation Test Equipment representatives modify the product.

This warranty excludes any product that has been subject to neglect, misuse, improper installation or accidental damage.

There is no implied warranty of fitness for a particular purpose other than those specified in this document.

Actuation Test Equipment is not liable for consequential damages.

Actuation Test Equipment shall not be liable for loss or damages other than the above stated, whether ordinary or exemplary, caused either directly or indirectly by use of this product.

This warranty supersedes and is in lieu of all other warranties expressed or implied, including the warranty of merchantability.

No other liabilities may be assumed unless expressly authorized in writing by Actuation Test Equipment.

SERVICE POLICY

Actuation Test Equipment will repair any product returned to the factory, subject to normal time and material charges for repairs out of warranty. Field service is available. Transportation and per diem as necessary will be added to standard hourly rates for field work.

Introduction

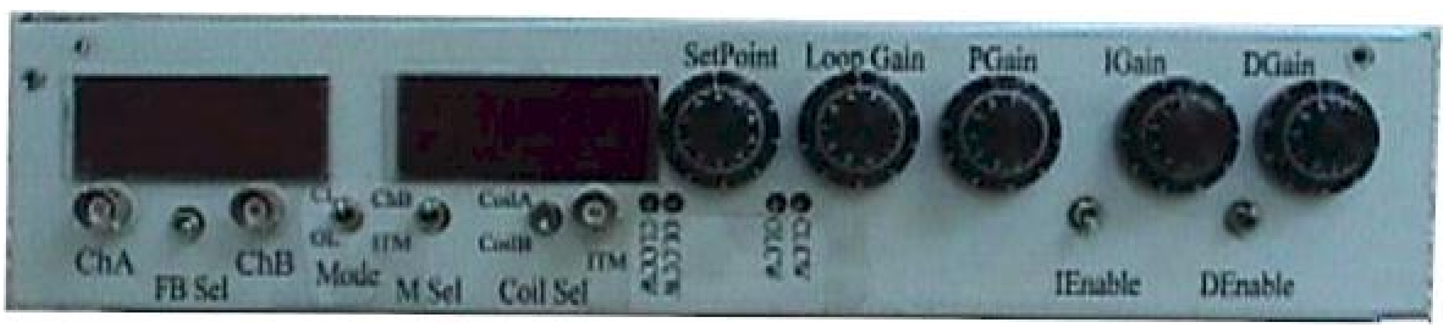
The ATE-14C closed loop box is a custom design for the AS907 development project for Allied Signal. This control system has a two channel LVDT signal conditioner, a automatic PID closed loop circuit, a ±120 mA power amplifier and 110/220 VAC input power supply, all built onto a 5.8 x 10.6 inch circuit board housed in a 2 ½ x 6 x 12 inch Bud® Converta-Box.

Two 4½-digit Datel® meters display the output of the two LVDT signal conditioners. The left meter is for channel A LVDT. The right meter is switched between channel B LVDT and torque motor current.

Two BNC connectors provide DC voltage output for Channel A and Channel B LVDT output signals. A third BNC connector outputs an amplified torque motor sense signal at 10mV/mA

A SetPoint pot provides an input setpoint signal to the PID closed loop to control the position of the fuel valve in the closed loop mode, and sets torque motor output current in the open loop mode. Four trimpots set the endpoint values for the SetPoint pot in both the Open Loop and Closed Loop modes.

Four trimpots are used to adjust Loop, Proportional, Integral and Derivative gain amplifiers to set dynamic response. Switches are provided to turn the Integral and Derivative amplifiers on and off.



As an option, 10 turn pots with calibrated dials can be provided. These controls provide repeatable settings for the P, I and D gains that can be read directly from the trimpots. The above picture shows the prototype faceplate artwork for this configuration.

Fuses for circuit protection.

Three fuses are used to protect electronic circuits and the torque motor. Fuses are located in the power entry module on the rear of the box, and on the circuit board next to the cord terminal strip to provide short circuit protection for the 110VAC input. A spare fuse is located in the fuse carrier in the power entry module. All fuses are 1A or less. Original assembly fuses are both .5A. If either of them blows, replace with the next higher size, not to exceed 1A.

A .25A Pico® fuse on the circuit board next to the torque motor output connector protects the torque motor from overcurrent due to circuit failure. Replace only with .25 A Pico® fuse.

Description of LVDT Circuits

For reference, check the AD598 spec at Analog Devicesô web site: www.Analog.com. The LVDT circuits are wired per this spec.

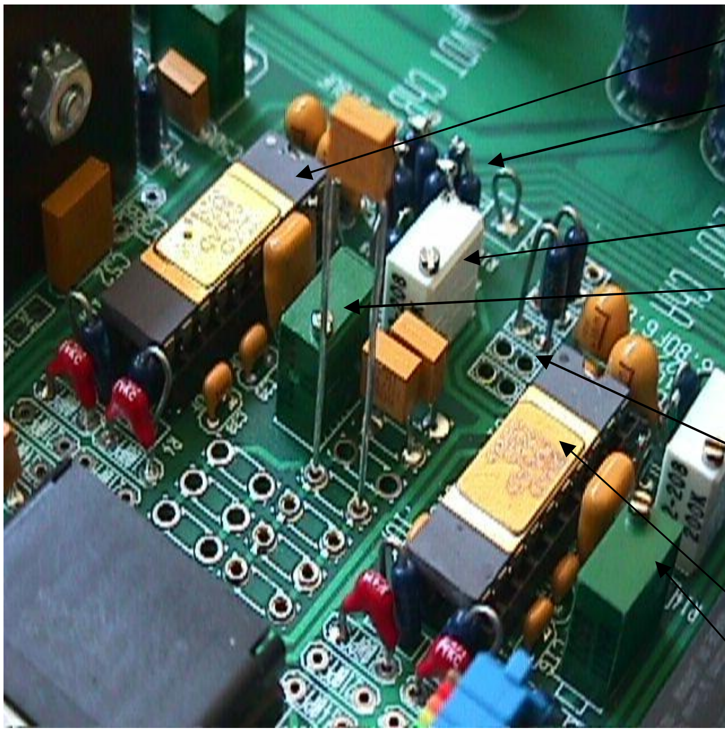
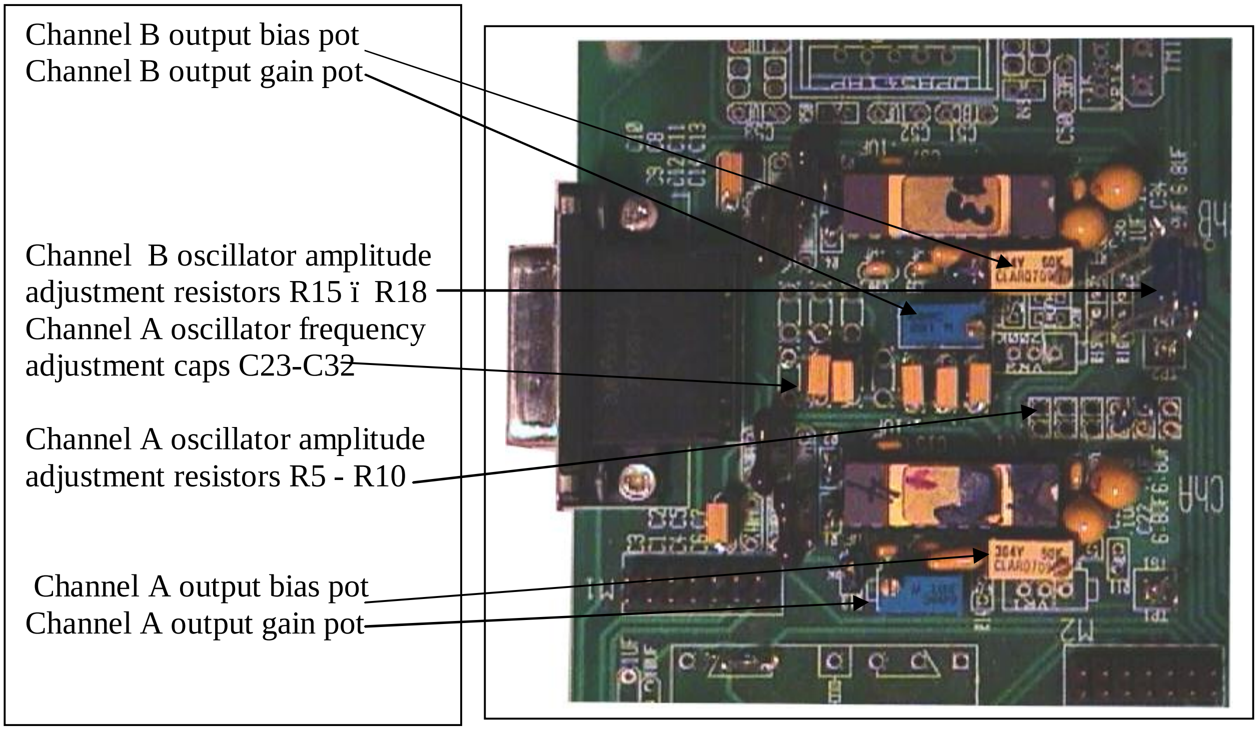


Figure 1 AD598 LVDT Signal Conditioners

The picture above shows the circuit board layout of the two LVDT signal conditioners. Refer to the attached schematic of the test box. The oscillator of U1 is the master. The oscillator of U2 is slaved to the oscillator output of U1. Operating both LVDTs at the same frequency and phase prevents magnetic cross talk and zero-beat between the two LVDT channels.

LVDT excitation frequency and amplitude are adjusted by adding resistors and capacitors to trim the AD 598ôs (U1) on-chip oscillator. Frequency of U1 is adjusted by the combined parallel capacitance of C23 through C32. The combined parallel value of R5 through R10 set excitation oscillator in U1ôs amplitude. The combined series resistance of R15 and R18, and R16 and R19 set excitation output of U2. Several of these capacitor and resistor footprints are provided with sockets to allow these parts to be installed in the circuit without being soldered. This allows these parts to be installed quickly to check their effect on circuit operation, and prevents the parts from being exposed to the heat of soldering. This heat can cause shifts in component values and makes fine adjustments difficult and unpredictable. Note the molded monolithic capacitor plugged into the sockets in the picture above. This allows quick-checking its effect on frequency. Once a capacitor is found to give the desired result, solder it into one of the unsocketed footprints, and then use the sockets to test more. When soldering caps into the board using this procedure, leave the last 5-10 Hz of adjustment for plug-in caps for added adjustment flexibility. When soldering resistors into the board leave the last .02 - .03Vrms worth of resistors plugged into the sockets.



Overview of calibration procedure for the dual AD598 LVDT signal conditioners

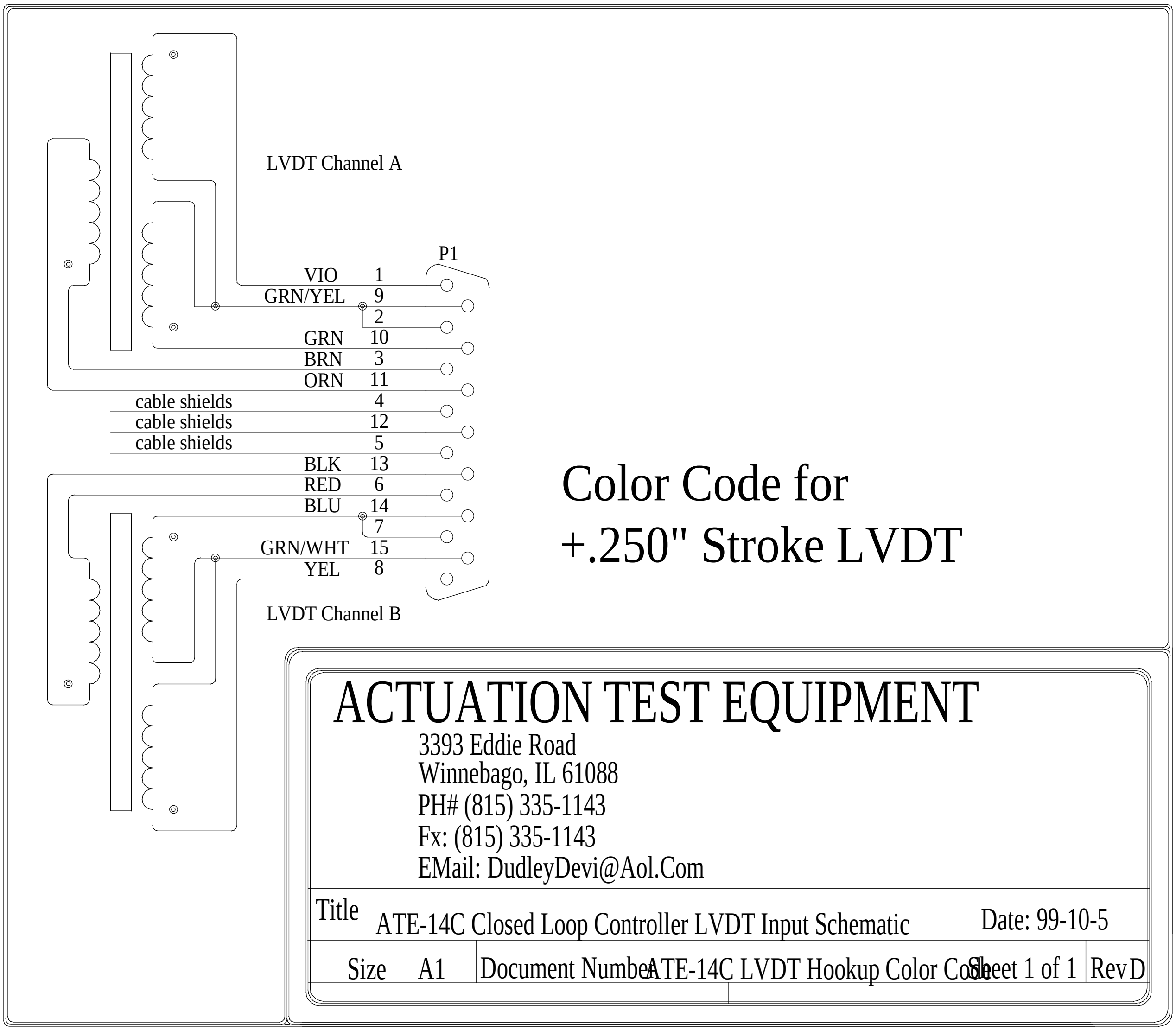
These circuits are calibrated in four basic areas.

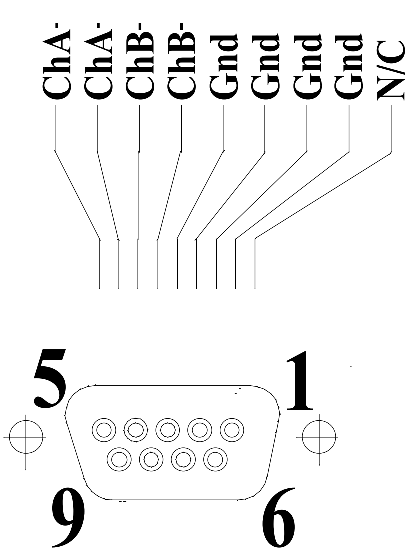
1. U1 oscillator output frequency and amplitude.
2. AD598 signal conditioner DC output gain and offset for U1.
3. Excitation oscillator output amplitude of U2. (U2 output frequency is slaved to U1's output frequency)
4. AD598 signal conditioner DC output gain and offset for U2.

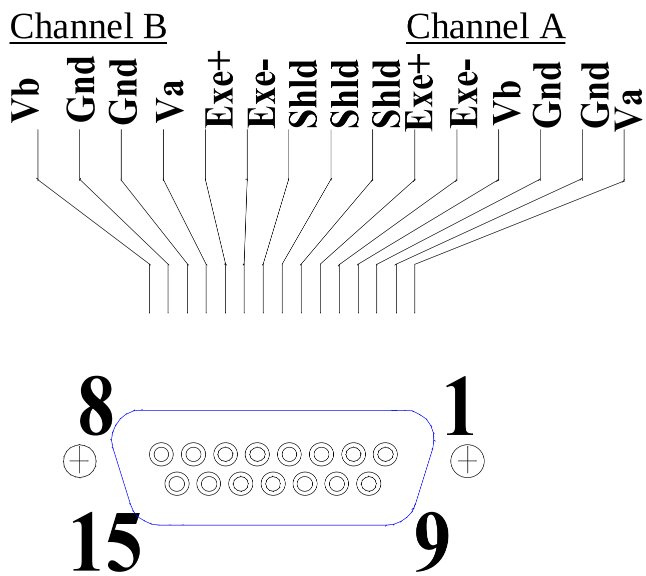
If you are calibrating this circuit for the first time, preset values for U1 oscillator are a .01uF cap and a 6.5k-Ohm resistor. Preset value for U2 oscillator amplitude R15 and R16 = 14.7k,

Calibration Procedure

Connect LVDT as shown:







Connector pinouts for the LVDT and torque motor connectors are shown above.

Calibration Procedure for LVDT Signal Conditioners using ATE-LVDTTool as signal source.

I. Calibrate Channel A AD598 oscillator frequency and amplitude.

1. Connect to ATE-LVDTTool as shown in Fig ____.
2. AC RMS voltmeter and frequency meter across output of oscillator U1 at pins 3 and 11 of LVDT connector P1.
3. Adjust U1 AD598 oscillator output frequency and amplitude by adding capacitors and resistors. Pin sockets are provided for both of these to facilitate plugging caps and resistors in to quickly check their effect on oscillator output.
4. Calibrate excitation frequency adding and removing capacitors at C23 to C32 to trim U1 AD598 on-chip oscillator.
5. Adjust U1 output amplitude by adding and removing resistors at R5 to R10.
6. Repeat steps 3 and 4 until no further improvement can be obtained.

II. Calibrate U1 DC output.

III. Calibrate U2 oscillator.

7. Connect AC RMS voltmeter across output of oscillator U2 at pins 6 and 13 of P1.
8. Calibrate U2 AD598 oscillator output amplitude by adjusting the series resistance of R15 + R17 and R16 + R18. Keep these two values equal to maintain balanced output of U2.

IV. Calibrate U2 DC output.
Same as II. above.

Calibration Procedure for LVDT Signal Conditioners using LVDT in micrometer stand.

--noteð This procedure is not recommended. Use LVDT simulator tool described in attached ATE-LVDTTool brochure.

I. Position Micrometer and LVDT at mechanical and electrical center.

1. Connect AC Voltmeter across the tops of R1 and R2.
2. Connect an LVDT mounted in a dial micrometer to the LVDT I/O connector on the test box.
3. Adjust the micrometer to indicate the mechanical center of the LVDT.
4. Move the LVDT in the fixture to position its slug to its electrical center. (This can be found by moving the LVDT position to null the AC voltage at the tops of R1 and R2 on voltmeter.)
5. Note and record the AC Voltage at the tops of R1 and R2. (Typical reading is 14-15 mV AC.) AC Minimum =____________mV AC.
6. Connect DC Voltmeter to TP1.
7. Adjust VR1 to zero DC voltage at TP1.

II. Determine Error between the electrical center of the two LVDT coils.

1. Connect an AC Voltmeter across the tops of R3 and R4.
2. Record the AC Voltage across the tops of R3 and R4.
   AC output of coil 2 =____________mV AC.
3. Rock the micrometer to null the AC Voltage at the tops of R3 and R4.
4. Note and record the AC Voltage across the tops of R3 and R4. (Typical reading is about 14-15 mV AC.) AC Minimum =____________mV
5. Note and record mechanical position of micrometer at electrical null of coil 2 of the LVDT. Micrometer reading = ___________ò.
6. Connect DC Voltmeter to TP2.
7. Adjust VR3 to zero DC voltage at TP2.

III. Adjust span of AD598 DC output.

1. Dial micrometer to fully engage the LVDT slug. (For the sample LVDT provided this is 0ò on dial indicator.)
2. Note and record the AC Voltage across the tops of R1and R2. AC =____________V .
3. Connect DC Voltmeter to TP1.
4. Adjust VR2 for .5 Volts DC at TP1.
5. Dial micrometer to add or subtract indicated error from step II.-5 to position coil 2 at its electrical center.
6. Note and record the AC Voltage at the tops of R3 and R4. AC =____________V .
7. Connect DC Voltmeter to TP2.
8. Adjust VR4 for .5 Volts DC at TP2.

9. Repeat entire procedure until no further improvement can be made.

--notesð

As a rule of thumb for both procedures, leave the last 10 Hz worth of frequency reducing capacitors and the last .04 VRMS worth of amplitude increasing resistors plugged into the sockets to ease future trimming.

The oscillators of all AD598ôs do not work exactly the same, so they are not directly interchangeable. Due to subtle differences in these ICs U1 oscillator amplitude and frequency, and U2 oscillator amplitude, and DC output bias and gain for both must be recalibrated whenever these ICs are changed.

The procedure adjusts Bias at zero volts output, and gain at the end point of the LVDT. Values for AC rms injection values can be computed for, or the mike stand can be positioned at any other stroke location where the greatest accuracy is desired.

Gain and bias adjustments of this circuit interact, so calibration procedures should be repeated until no further improvement can be obtained.

SetPoint Generator.

The four amplifiers of A2 provide endpoint voltages for the SetPoint pot in both Open Loop (OL) and Closed Loop (CL) operation.
In Open Loop mode the output from the SetPoint pot is connected directly to the input of the power amplifier.

PID Closed Loop Controller

In the closed loop mode the output from the SetPoint pot and the feedback signal from the LVDT channel selected by the FeedBack selector switch are summed by the Loop Gain amplifier A1B. The Loop Gain pot provides an overall gain adjustment for the PID controller.

This error signal output from A1B is input to the three dynamic signal-processing amplifiers, A1C, A1D and A5A. These are the Proportional, Integral and Derivative signal amplifiers. Each of these is controlled by itôs own individual potentiometer, accessible through holes in the front panel.

Control Relays

RY1 controls the meter on the right side of the test box. This relay switches the input source of the meter from either Channel B of the LVDT or the torque motor current sense amplifier. Another contact of the relay selects the decimal point for the meter.

RY2 sets the operating mode of the test box under control of the Mode switch. This relay selects the endpoint voltages of the SetPoint pot and the input to the power amplifier. Power amplifier inputs are the SetPoint pot in Open Loop mode, or the summed outputs of the Proportional, Integral and Derivative amplifiers in Closed Loop mode.

Functional Description of Power Amplifier circuit.

The power amplifier circuit used in the closed loop box is the same as that used in the ATE-7C/442153-2 dual signal conditioner boxes. Gain resistors have been chosen to provide gain and bias ranges of this amplifier from 0 to +30 to ±150 mA.

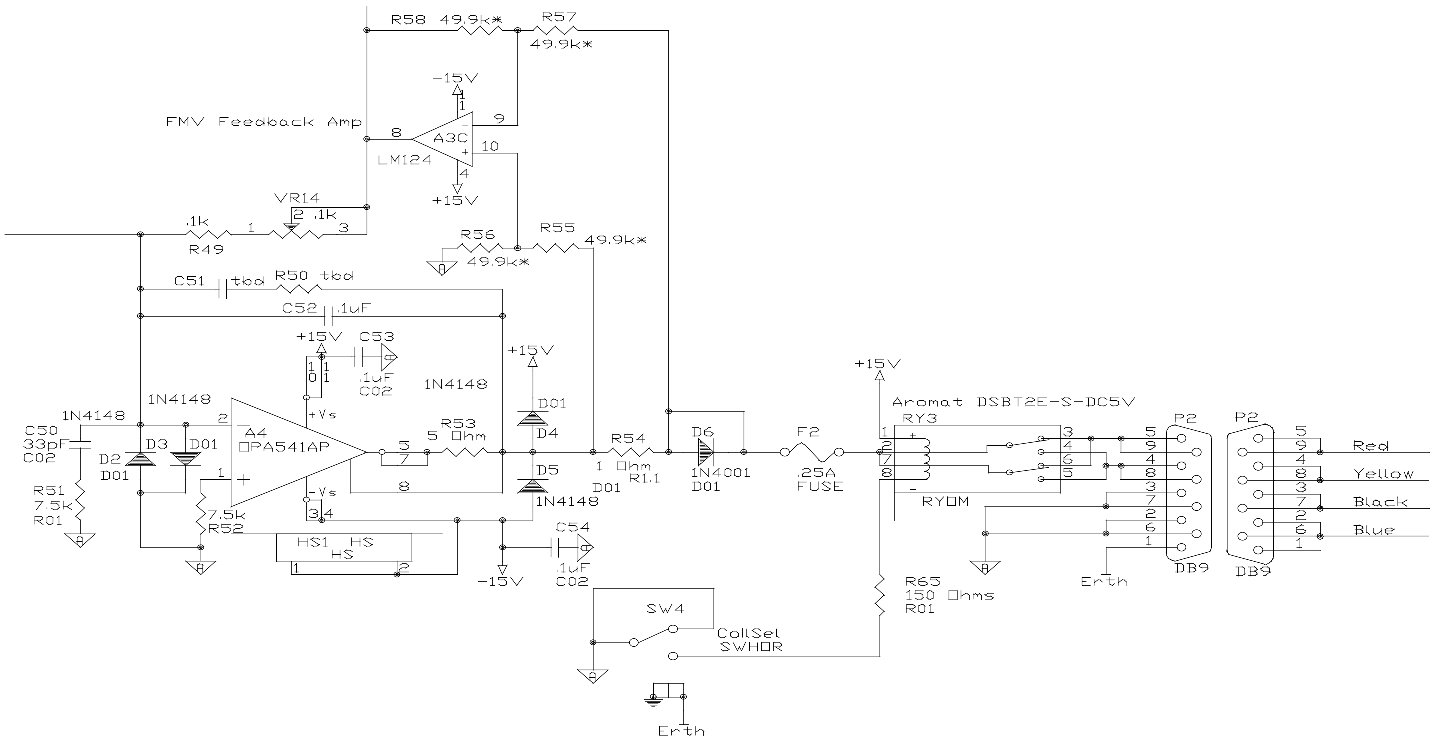
Channel A output from the test box comes out pins 5 and 9. Channel B comes out pins 4 and 8. Torque motor return ground for both channels is pins 2, 3, 6 and 7. Pin 1 is not connected.

RY3 selects which coil channel is active, controlled by the Coil Sel switch on the front panel.

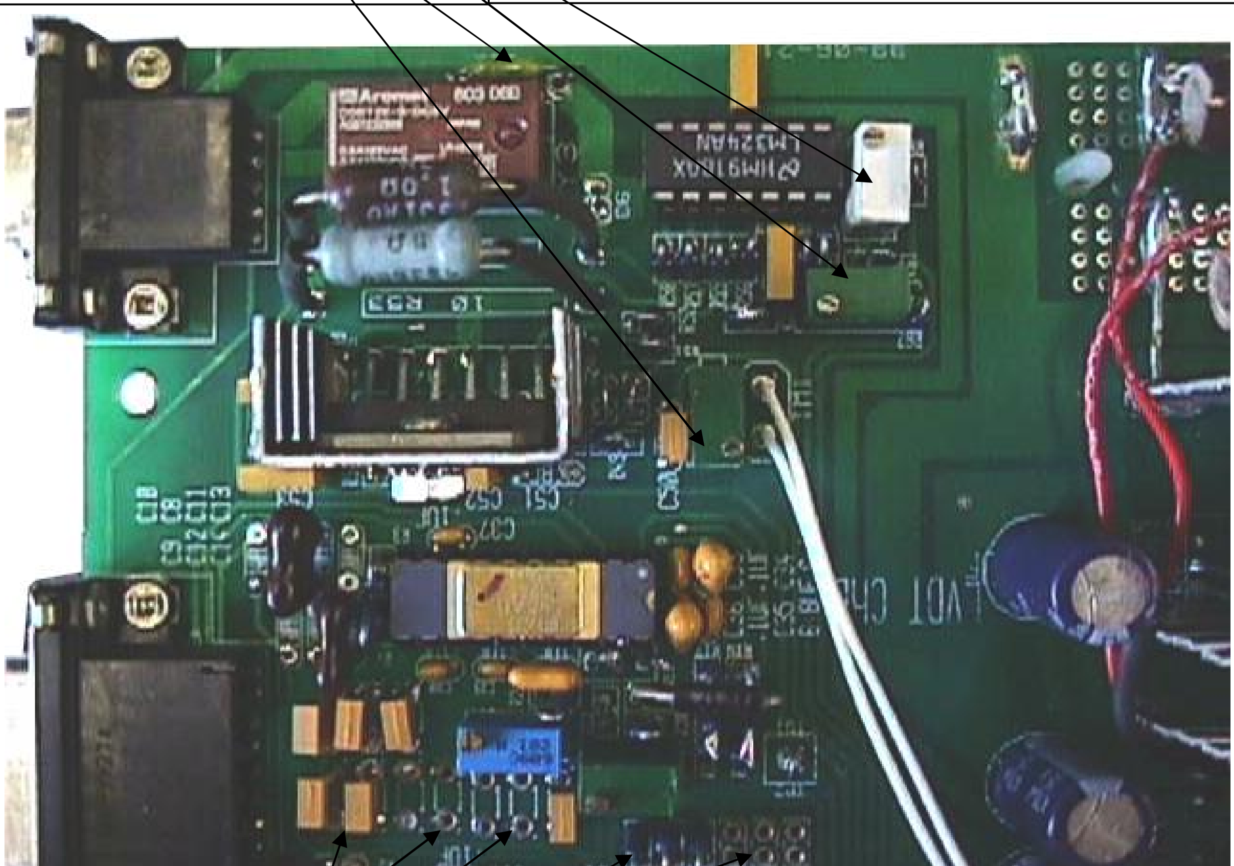
Gain and offset authority for the power amplifier are set by the resistance values chosen for the Amplifier Bias and Amplifier Gain circuits. Gain of this circuit is set by VR14, a 500 Ohm trimpot. This value is used in the closed loop box instead of the 200 Ohm trimpot used in the signal conditioner to get a greater output gain range.

Torque motor current sense amplifier A3D is a differential input circuit with a gain of 1. Input to this amplifier is the voltage drop across the current sense resistor, R54. Output of this amplifier is the feedback for the power amplifier and the input signal to the meter amplifier.

Meter drive amplifier A3D provides an adjustable gain of 10 and a bias offset to calibrate the torque motor current meter display.



TMCurrent meter bias pot
TMCurrent meter gain pot
.25A Fuse
Output Amplifier gain pot



Oscillator frequency cap sockets
Oscillator amplitude resistor sockets

Torque motor overcurrent protection is provided in two ways. A standard function of the Burr Brown OPA541 power amplifier IC is an internal current limit. Output current flows through the series 5 Ohm 3W resistor. The voltage drop across this resistor is sensed by pin 8. When the voltage drop across this resistor equals approximately 1 diode drop (.6V) the output of the OPA541 is clamped.

The second protection is a .25 Amp Pico Fuse in the output line to the torque motor. The fuse is socketed for easy replacement. The fuse is located on the circuit board next to the Relay RY3 and the OPA541 power amplifier IC.

The easiest way to verify the torque motor connections is to check it in Open Loop mode. Set the Mode switch to OL for Open Loop. As shipped the SetPoint will drive 0 to 30 mA in Open Loop mode when turned from full CCW to full CW.
Set M Sel switch down to select ITM or torque motor current.
Set Coil Sel switch to Coil A.
Connect torque motor wires as shown on the partial schematic above.

Calibration of power amplifier circuit.

I. Open loop Power Amplifier gain calibration

1. Select Open Loop operation.
2. Switch M Sel switch to ITM.
3. Turn SetPoint pot full CW.
4. Adjust OLCW pot to the desired output current for this position.
5. If output current cannot be adjusted far enough, increase power amplifier gain with VR14.
6. Turn SetPoint pot full CCW.
7. Adjust the OLCCW pot to the desired output current for the max CCW position of the SetPoint pot.

II. Calibration of Torque Motor Current Meter

--noteð Torque motor current meter calibration is adjusted at two current levels.
The zero adjustment pot, VR16 has the same effect on meter display at all current levels.
The scale adjustment VR15 has no effect at zero current, and increasing effect at higher current levels.

8. Adjust the SetPoint pot to the desired low value of torque motor current.
9. Zero torque motor current meter by adjusting VR16.
10. Adjust the SetPoint pot to the desired high value of torque motor current.
11. Adjust VR15 to make the Datel meter agree with the external reference meter.
12. Repeat steps 8 through 11 until no further improvement can be made.

Power supply

Input power to this power supply can be either 110 VAC or 220VAC, selected by jumpers J1, J2 and J3. For 110VAC install J1and J2. For 220VAC input remove J1 and J2, and install J3.

200 Ohm resistor Rvd was added to the design during construction of the 6 test boxes to reduce the operating temperature of the two positive voltage regulators. The +5Volt supply provides over 200mA of current to power the two Datel meters. The voltage drop across Rvd reduces the voltage drop/thermal load on Vreg1. Because both positive voltage regulators are mounted on the same heat sink, this reduces operating temperature/thermal stress on both positive voltage regulators.

Air Purge Vent Option

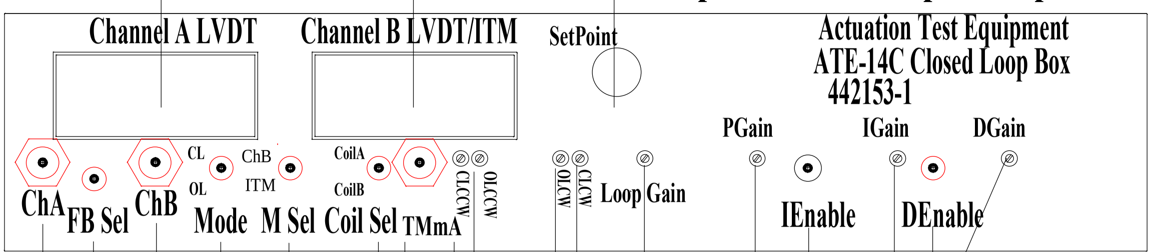
Because this is the first batch of this test box design, a fan was added to make sure there was not a heat problem. If you would like to air purge the enclosure, one of the vent holes on the left side of the box is larger than the others. A ï 4 Fitting will just fit in this hole. Cover all other holes with tape, disconnect fan wire and blow air into this fitting.

Cut the wire to the fan, and then cover the holes for the fan and the vent holes on the opposing side with masking tape to block them off. The air nipple is positioned to blow on the two 10Watt resistors on the rear of the circuit board.

Channel A LVDT meter displays Channel A LVDT voltage.

Channel B LVDT/ITM meter displays Channel B LVDT voltage or Torque Motor current under control of M Sel switch.

Setpoint pot adjusts LVDT setpoint in ClosedLoop mode, and output current in Open Loop mode.



D Gain adjusts derivative input to torque motor current.

D Enable turns D gain on and off.

I Gain adjust integrator speed dmA/dv(sp-fb)

I Enable switch turns integrator on and off.

P Gain adjusts proportional gain.

Loop Gain controls input to P, I and D amplifiers.

CLCW adjusts ClockWise endpoint of Setpoint pot in Closed Loop mode.

OLCW adjusts ClockWise endpoint of Setpoint pot in Open Loop mode.

OLCCW adjusts CounterClockWise endpoint of setpoint pot in Open Loop mode.

CLCCW adjusts CounterClockWise endpoint of Setpoint pot in Closed Loop mode.

TMmA BNC jack is Torque Motor output current.

Coil Sel switch selects which coil of the Torque Motor is used.

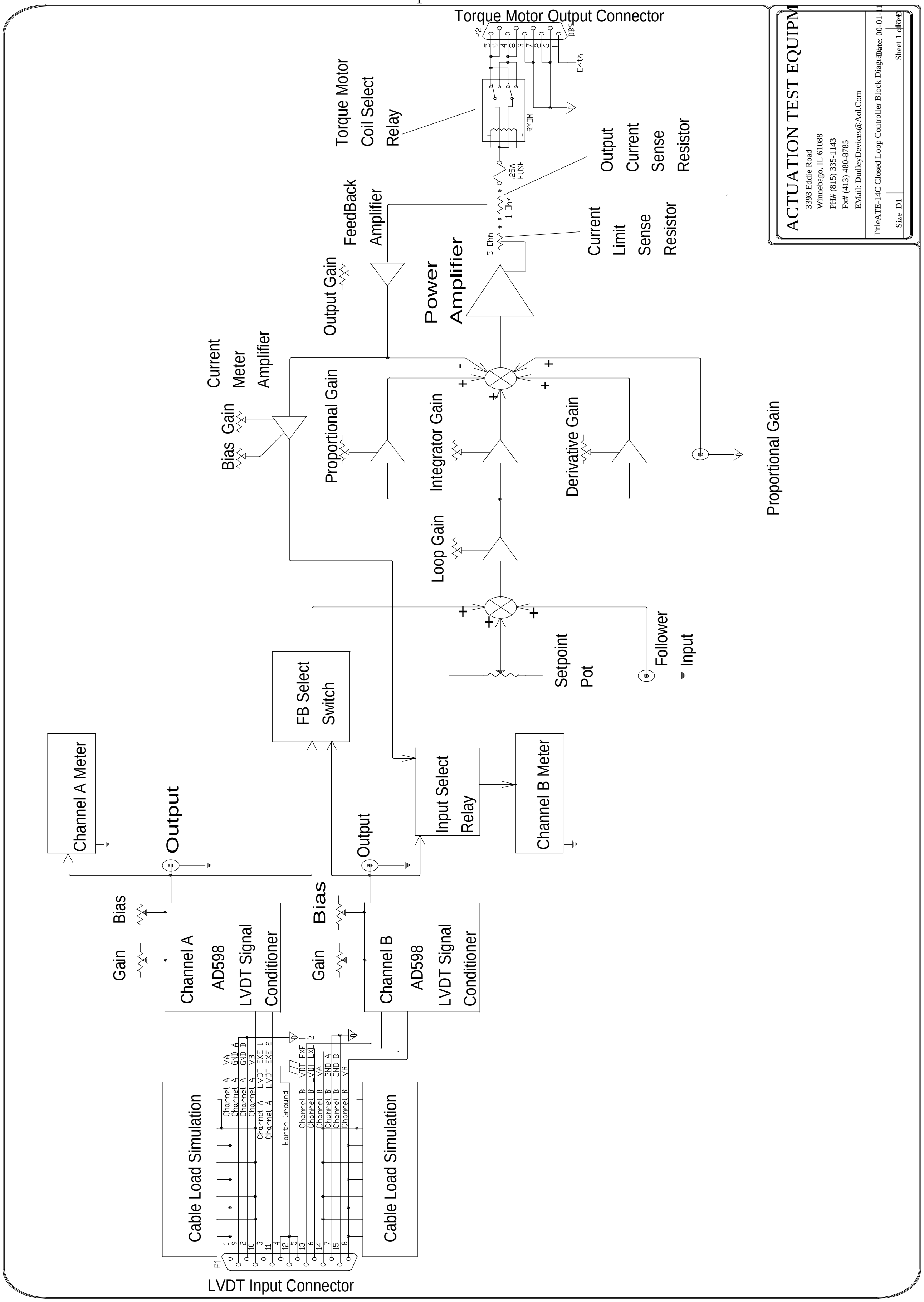
M Sel switch selects whenter right meter displays Lane B of LVDT or Torque Motor Current.

Mode switch selects either ClosedLoop or OpenLoop operation.

ChB outputs Channel B LVDT signal.

ChA outputs Channel A LVDT signal.

FB Sel selects Channel A or Channel B for feedback signal.


Torque Motor Output Connector
Torque Motor Coil Select Relay
Output Current Sense Resistor
Current Limit Sense Resistor
FeedBack Amplifier
Output Gain
Power Amplifier
Current Meter Amplifier
Bias Gain
Proportional Gain
Integrator Gain
Derivative Gain
Proportional Gain
Loop Gain
Setpoint Pot
Follower Input
FB Select Switch
Channel A Meter
Output
Input Select Relay
Channel B Meter
Output
Bias
Gain
Channel A AD598 LVDT Signal Conditioner
Bias
Gain
Channel B AD598 LVDT Signal Conditioner
Cable Load Simulation
Cable Load Simulation
LVDT Input Connector
ACTUATION TEST EQUIPM
3393 Eddie Road
Winnebago, IL 61088
PH# (815) 335-1143
Fx# (413) 480-8785
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