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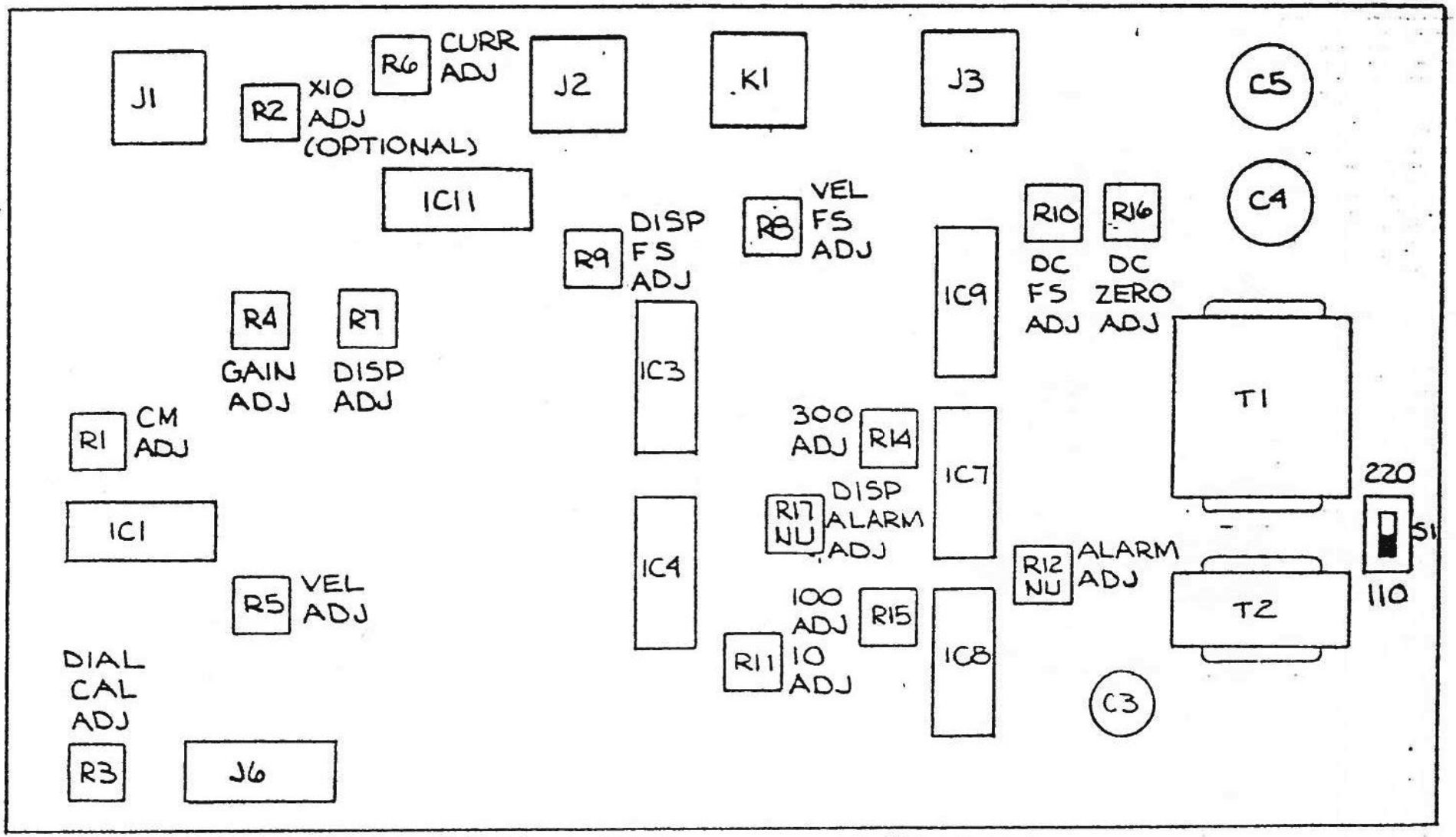
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MODEL 610
VIBRATION MONITOR
ADJUSTMENT LOCATION
DRAWING
FIGURE #4-1

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VIBRATION MONITOR

CIRCUIT DESCRIPTION

The circuits for the Vibration Monitor are all contained on the main printed circuit board except the DVM Assembly 1620. The main board assembly circuits are shown on Schematic 1219 and the DVM Assembly on Schematic 1621.

Charge Converter

The input to the charge converter is from the (PICO COULOMB) ACCEL INPUT jack to E6 and E7 via R21 and C11 to the input Pin 2 of operational amplifier AR1. To accomplish a floating input, the common side of the circuit is maintained off (signal) ground. The charge conversion is accomplished by the AC voltage feedback across C13. The DC gain of the circuit is established via two paths, one R22 and R27, the other R24 and R28. The output is restored to a single-ended configuration referenced to signal ground by the common-mode amplifier 1/4 of IC1; the single-ended charge converter output is at TP10.

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Circuit Description - Vibration Monitor

Low Pass Filter

The signal from Pin 7 of IC1 is filtered by the low pass filter made up of two sections of quad amplifier IC10 and components. The filter is a four section butterworth design with a -3 dB cutoff frequency of 5 kHz. Other cutoff frequencies can be accomplished by changing the resistive component of each section according to the chart shown on the schematic.

Current Supply

The current supply circuit uses the regulated 20 Volts supplied to a pair of FETS Q1 and Q2 connected to provide a constant current output at Pin 4 of J1. This circuit, adjustable by R6, provides from 5 - 10 mA current with up to 18 Volts compliance.

X10 and Variable Sensitivity Amplifiers and Acceleration Buffer Amplifier

The signal from the low pass filter at Pin 7 of J1, or from the current supply Pin 5 of J1, is selected by the INPUT switch S2.

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This signal is then fed to the X10 sensitivity amplifier through the SENSITIVITY switch S5 where the sensitivity control setting is multiplied by either X1 or X10 as selected by S5. The X10 position of S5 routes the signal via Pin 6 of J1 to the low-gain setting of X10 amplifier, 1/4 of IC2. The X1 position of S5 routes the signal via Pin 3 of J1 for an X10 increase in the gain of the X10 sensitivity amplifier. The output signal is fed via R4 and R35 to the INPUT Pin 13 of IC1 which is the variable sensitivity amplifier. A front panel potentiometer sets the voltage feedback across R42. The full travel of the sensitivity pot varies the gain of the amplifier approximately 11:1. The output of the variable sensitivity amplifier is Pin 14 of IC1 and when properly adjusted to the input pickup, is normalized for 10 mV/g input. This signal is brought out via the acceleration buffer amplifier AR2 to Pin 5 of J2. The 10 mV/g - 100 mV/g switch, mounted on the rear panel, provides either 10 mV or 100 mV/g sensitivity at the acceleration output.

Accel-Vel Integrator and Velocity Buffer Amplifier

The signal at the variable sensitivity amplifier is fed to the acceleration-to-velocity integrator, via C17, to the adjustment R5, to be used to set the proper gain relationship between the acceleration voltage and the velocity voltage. The integration is

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accomplished by the capacitor C60 in the AC feedback of the integrator amplifier, 1/4 of IC1. The DC feedback path is R44. A multi-section, high-pass filter is accomplished by the combination of C60 and R44; R45, R47, and C21; and C17 and R43 in series with R5. These three sections are selected to provide a -6 dB/oct response above 5 Hz and then roll off at approximately -12 dB/oct below 3 Hz. The velocity output with a sensitivity of 10 mV rms for 1 peak in/sec is at Pin 1 of IC1. This signal is brought out via the Velocity Buffer Amplifier AR7 to Pin 8 of J2.

Vel-Displacement Integrator and Displacment Buffer Amplifier

The input to the Displacement Integrator is from the Velocity Integrator output across C39 to the adjust R7 used to set the relationship between the Velocity Input Voltage and the Displacement Output Voltage from the Integrator. The integration is accomplished by the AC feedback capacitor C52 across the operational amplifier 1/4 of IC2. The amplifier DC feedback is across R118. The circuit uses three high-pass sections made up of R118 and C52, R120 and C40, and C39, R117 in series with R7 to roll the output off at approximately -12 dB/oct below 5 Hz. The output at Pin 14 of IC2 is calibrated for 5 mV rms for 1 peak-peak mil of displacement. This signal is brought out via the Displacement Buffer Amplifier AR8 to Pin 4 of J2.

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Units Selector

The acceleration, velocity, or displacement signal is selected by the Unit Selector as the input to AR3. They are at Pin 2 of IC3, Pin 10 of IC3, and Pin 10 of IC4, respectively. The velocity input is selected when the control line at Pin 14 of J6 is at +5. The proper voltage scaling is set for velocity by R8 and displacement by R9.

X1, X100 Selector

This circuit selects either R60, or R11 and R59 as the input of AR4. When the control line at Pin 14 of J4 is at -5, R60 is the input to AR4 to set the gain at one. When the control line at Pin 14 of J4 is +Volts, R11 and R59 are in parallel with R60. This sets the gain of AR4 at ten. The amplified signal is at Pin 6 of AR4.

X1, X3, X10 Selector

The X1, X3, X10 Selector circuit selects R70, R14 in series with R71, or R15 in series with R69 as the input to AR6.

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When the X3 line Pin 13 of J4, and the X10 line Pin 12 of J4 are both at -5 Volts, the input to AR6 is across R70 for a circuit gain of 1. When the X3 line is at +5 Volts, R14 and R71 are placed in parallel with R70 to provide a circuit gain of 3.16. When the X10 line is at +5 Volts, R15 and R69 are placed in parallel with R70 to provide a gain of 10. The AC acmplifier output at Pin 6 of AR6 is at TP7.

Rectifier and DC Amplifier

The signal at TP7 from the AC amplifier circuitry is the input to the Rectifier made up of two sections of IC9. The gain of IC9(3) linearizes the characteristics of diode CR16 to provide a second input to amplifier IC9(4), one across R161, the other across R82. The phase and gain from each input is such to cause a full-wave rectified version of the input signal at TP8. Operational amplifier IC9(1) and circuit is connected as an inverting amplifier with a capacitor C30 across the feedback resistor R86 to provide a filter to reduce the ripple of the full-wave rectified signal at Pin 1 of IC9. Adjustment R10 allows setting the gain to provide a 10 V DC output for the full-scale input of each selected range. The DC output of IC9(1) is at TP9, and is also brought off the board at Pin 1 of J2.

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Overload Amplifier

The Overload Amplifier has input from four places: the Acceleration output, the Velocity output, the Displacement output, and the DC Amplifier output. The inputs are across CR21, CR22, CR23, and CR17, respectively. When any of these inputs reach the preset levels, the output of the overload amplifier IC9 Pin 7 goes positive. This positive voltage drives Pin 4 of IC15, the flasher unit, which causes the overload light to flash on and off to warn of an overload condition.

Alarm Circuit

The normalized acceleration signal is the input to the AC to DC Converter made up of AR6 and IC6 and circuitry. The proper gain is set by the ALARM ADJ R12. This DC voltage is the input to the alarm. The alarm circuit has the comparator circuit made up of IC6(2) and components. The level from the front panel alarm set potentiometer is compared with the DC signal from the AC-DC Converter. The output Pin 7 of IC6 stays positive until the signal from the AC-DC converter exceeds the alarm set level. When this occurs, the comparator output goes negative, causing the integrator output to go positive at a rate set by C42 and R112. When the integrator output Pin 8 of IC6 reaches the level to turn on transistor Q3, it pulls in the relay K1. The current to operate K1 also lights the front panel LED.

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Circuit Description - Vibration Monitor

Power Supply

The input to the power supply is from the power buss at E1 and E2 to the primary of T1 and T2. The secondary of T2 drives the full-wave rectifiers CR1 and CR2 which is filtered by C3 and has its output at TP5. This voltage drives the LED displays, and is the input to the 5 Volt regulator U1.

The Secondary of T1 drives the full-wave rectifiers for the +15 Volt and -15 Volt supplies which are filtered by C4 and C5, respectively. The +15 Volt supply is regulated by U2 and has its output at TP1; the -15 Volts supply is regulated by U3 and has its output at TP2. The +5 Volt supply has the filtered voltage at C3 as its input to Regulator U1 and the +5 Volt output is at TP4. The -5 Volt supply has the -15 Volts as its input to Regulator U4 and the -5 Volt output is at TP3.

The primary is split to accommodate either 110- or 220-Volt rms operation. A slide switch near transformers T1 and T2 labeled S1 provides a means of selecting 110 or 220 operation.

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DVM CIRCUIT AND INDICATOR (LEVEL) Assembly 1620

The DVM circuitry is packaged on two printed circuit boards. The two boards are held together by the interconnections between the two boards made through SIP connectors.

The DVM consists of an analog to digital converter with BCD to seven segment decoders built-in, and the indicators.

The analog to digital conversion is accomplished by integrated circuit U3. The complete converter is in the one chip except four capacitors: capacitors C2 and C4 are for the automatic zeroing, C5 is the integrating capacitor, and C1 is the timing element for the internal oscillator, which is used to time the converter. The input to the converter is at Pin 7 of J1. The voltage divider, made up of R8, R7, and R2, provides a range change when Pin 10 of J1 is grounded. This is used for scaling the 3 Volt of 300 mV ranges. The three digits of data at the end of conversion is latched in memory and is connected to the displays by individual lines.

The Polarity information is on Pin 20 of U3, which drives the polarity indicator on the display. The over range, which is the 200 count and up, blanks all the digits except the over range digit "one" stays on to indicate overload.

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Circuit Description - Vibration Monitor

The indicator board contains indicators U1 and U2 and U3 which have three digits, over range and polarity indication. The data is displayed on 0.6 inch high LED's. Also on the indicator board is DS 1, 2, 3, and 4. These are LED lights to be used for optional display purposes with the input lines via J1.

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