iv) Current Monitor — Motor armature current returning to the thyristor bridge fluxes a DC current transformer employing a fast, linear, Hall Effect device IC5. The Hall Effect signal is scaled by IC4 pin 14 where a positive swing represents a move towards current limit. The output of this current monitor is used to trip the over-current latch IC3 pin 13 via R58, also to give continuous current feed-back via R48 to the current amplifier IC2 pin 9 and via R46/C19, which form a filter, to provide an IR compensation term, adjustable by RV4, to the speed amplifier input IC2 pin 2 via R35. The Hall Effect device has an adjustable offset which is carefully preset at the factory on RV7. Do **not** readjust.

v) Ramp Circuit — Speed reference input voltage is fed via terminal 3, which requires a 0 to +10 volt DC signal. R38 ties the input down so that if the speed reference is lost the motor speed falls to zero. In effect IC4 pin 7 and IC2 pin 7 form a balanced loop integrator with capacitor C21/RV3A/RV3B introducing a controllable integration time in both up and down ramp modes. Loop gain is unity, consequently the ramped speed reference signal is fed to the speed amplifier input IC2 pin 2 via R34.

vi) Feedback Selection — The LYNX controller can be switched between normal armature voltage feedback (AVF) and tachogenerator feedback by link LK1. Armature voltage feedback is derived through IC4 pin 8 whose input looks differentially across the motor's armature voltage via a very high impedance source R67/66/70/79. This technique is known as impedance isolation, leakage currents to power circuitry being negligible. RV8 adjusts the null output of the system and is factory preset. It should **not** be re-adjusted. The output of IC4 pin 8 can be scaled down to suit 180 volt (240 volt AC supply) motors by selecting link LK3. Voltage feedback via resistor R25 and link LK1 (tacho-AVF) is filtered by C17 and scaled for maximum motor speed by RV1 to provide a balancing feedback term to speed amplifier input IC2 pin 2 via R30. This point is the summing point of required speed, from the ramp output IC2 pin 7 and the actual speed as indicated by the feedback. The speed amplifier output on IC2 pin 1 swings negative when an increase in speed is required, being clamped to a −7.5 maximum by zener D17. The stability of the total loop can be varied by changing the AC gain around the speed amplifier using RV6 — stability preset.

The speed amplifier output feeds off to the Ixt overload circuit and current limit potentiometer RV5 and is really a measure of demand. R47 feeds the current limit set point to the summing point of the current amplifier, IC2 pin 9, where it is compared with the current feedback via R50. The current amplifier output, IC2 pin 8, swings positive to increase the motor voltage (speed) via the 'ramp & pedestal, trigger amplifier IC1 pins 8 & 10. However if the motor current is too high then IC2 pin 8 swings negative, being clamped at −.5 volts by diode D32, reducing the motor voltage progressively to zero. The AC gain of the current amplifier is limited by R49 & C23. Re-positioning link LK1 selects the Tacho feedback mode. Polarity of the DC tacho is not important due to the tacho rectifier bridge comprising D27-D30 fitted for use in reversing systems. The output of the tacho bridge is negative going, as is the AVF feedback when selected. For use with low levels of feedback voltage, i.e 0 to 10 volts or so, it is useful to avoid the rectifiers D27-D30 to prevent a significant feedback voltage loss. In this case diode D27 & D30 should be fitted with shorting links and feedback voltage connected so that input terminal 8 is always negative and 9 is always positive polarity. Resistor R28 scales the tacho voltage into the circuit and should be of the correct value. See Sec. 3.5.

vii) Overload & Peak Current Trip — If the speed demand cannot be satisfied, i.e. current limit pot set too low, motor current too high or feedback lost the speed amplifier output, IC2 pin 1, swings fully to −7.5 volts. This negative level is fed via R51 to the Ixt integrator comprising IC2 pin 14, C25 and R51/52. The output integrates positively until D19 zeners giving an increased positive level on latch IC3 pin 11. The latch output, IC3 pin 13, swings to +10 volts zenering D22 and completing the latch action. LED 2 'OVERLOAD' comes on and the +10 volt latch output is fed via D21 & R50 to the current amplifier input quickly inhibiting the Thyristor trigger pulses. IC3 pin 14 swings to −10 volt resetting the speed reference input to zero demand via R55.

Peak current caused by shock loads etc. result in the same action of rapid shutdown. The presence of a trip condition also de-energises the status relay RL1 via the inverting action of IC3 pin 2 resulting in status relay drop-out, i.e. control terminals 10 & 12 closed.

Run-Inhibit Input — With LYNX control inputs 5 & 7 open, a positive level from R63 via R12 and D25, ensures a no-run condition via the action of IC3 pin 14, R55 on the ramp circuit and R50 on the current amplifier. With 5 & 7 closed these conditions are removed and motor speed will ramp up to set point. Input 7 is filtered by R12 & C7.

viii) No-Volt Release & Power-up Reset — At initial power switch-on C26 ensures that IC3 pin 1 swings high to reset the ramp and current amplifier. Once C26 has charged the motor is ready to run. If the no-volt release facility is to be used — see Sec. 3.2 — then the initial state of C26 causes IC3 pin 1 to latch high because of D33. Momentarily connecting plug PL1 pins 3 & 4 together will cause the circuit to de-latch ready for the run condition.

ix) Torque Control — Moving Link LK2 to the Torque position allows a 0 volt to 10 volt input reference signal to control the LYNX's output current over a 0 to 100% range respectively. As control input number 6 is taken towards zero volts inverting amplifier IC4 pin 1 contributes positively via R47 offsetting the load demand signal progressively with consequent reduction in available output current. Removing D20 disables the Ixt overload trip.

4.3 TEST INSTRUMENTATION

Take care when connecting test instruments, although the control inputs of the LYNX are isolated, power circuits are not. Remember also that neither the LYNX's output voltage or current are pure DC. This can give misleading results when using certain test instruments, in general though an electronic voltmeter will give reliable output voltage readings. Current readings taken from the AC supply will vary considerably from DC readings taken in the armature circuit. The relationship between the two varies with speed setting. Consequently when establishing motor load conditions it is best to measure DC armature current. A conventional "clip-on" test ammeter cannot be used for measuring in DC circuits; only use a true DC ammeter such as a Hall Effect probe.