

SYSTEM PARAMETERS

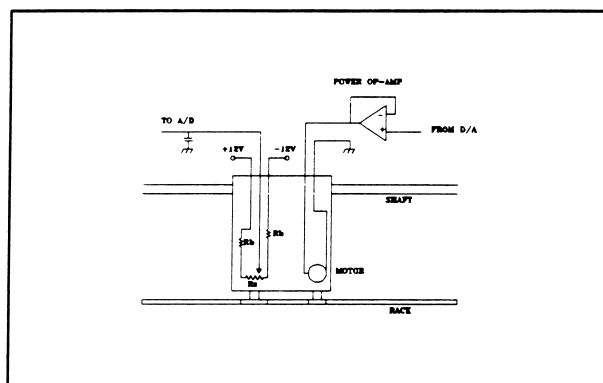
5.2.1 LINEAR POSITION SERVO

| PARAMETER | SYMBOL | VALUE | UNITS |
|--|----------|--------------|-----------------------|
| MOTOR TORQUE CONSTANT BACK EMF CONSTANT | Kt,Km,Kb | .00767 | Nm/amp V/(rad/sec) |
| EFFICIENCY | Eff | 0.9 | |
| ARMATURE RESISTANCE | Rm | 2.6 | Ω |
| ARMATURE INDUCTANCE | Lm | 0.18 | mHenry |
| MAXIMUM VOLTAGE | Vmax | 6.0 | Volts |
| INTERNAL GEAR RATIO | Kg | 3.7:1 | |
| ARMATURE INERTIA | Jm | $3.87e^{-7}$ | Kgm ² |
| MOTOR GEAR RADIUS | r | 0.635 | cm |
| CART MASS | M | 0.455 | Kg |
| CART POSITION POTENTIOMETER | Rs | 10 | K Ω |
| BIAS VOLTAGE | Vb | +/- 12 | Volts |
| BIAS RESISTORS | Rb | 7.15 | K Ω |
| ROTATIONAL RANGE | | 3600 | Deg |
| POTENTIOMETER GEAR DIAMETER | | 1.48 | cm. |
| LINEAR RANGE | | 93.0 | cm. |
| TRACK LENGTH | | 99.0 | cm. |
| CART TRAVEL | | 91.4 | cm. |
| POTENTIOMETER SENSITIVITY | Ks | 0.107 | V/cm. |

CAUTION

High frequency voltage applied to a (any) motor will eventually damage the gearbox or the brushes. The most likely source for high frequency noise is derivative feedback. If the derivative feedback gain is too high, a noisy voltage will be fed to the motor. You should have a band-limited differentiator rather than a pure differentiator running in the feedback loop (See section 4.5). If you hear a "buzz" in the motor you are feeding high frequency noise to the motor and will damage it. Turn the motor off immediately and reconsider your design! Select a low pass filter frequency that eliminates the "buzz" or reduce the derivative gain. Always have an anti-aliasing filter connected to the input of the A/D. This could simply be a capacitor as shown in the wiring diagrams. The capacitor will filter out high frequency noise before it is processed.

The equivalent circuit that is achieved using the Quick Connect Module (QCM) is shown below in figure WI 7.



WI- 7 Wiring the inverted pendulum cart motor and cart position sensor