Module Name	Experiment #	Experiment Name	Description
Solar Tracker	16	Various	Transfer function parameters are found using frequency response and the obtained model is used to design a servo position control. The light sensor characteristics are identified and then used to perform light tracking.
2D Ball Balancer	17	Position Control	Control the position of a ball that is free to move on a swiveling 2-DOF plate. The plate angles are controlled by attached servo units and the ball position is measured using an overhead digital camera with image processing software.

Table 2: Modules in the rotary family package.

3. SRV02 Components

The SRV02 components are identified in Section 3.1. Some of the those components are then described in Section 3.2.

3.1. SRV02 Component Nomenclature

The SRV02 components listed in Table 3 below are labeled in figures 2, 3, 4, 5, and 6. Note that Figure 2 shows the SRV02 in the low-gear configuration and Figure 6 is the SRV02 in the high-gear configuration. These different gear setups will be explained later in Section 5.1.

ID #	Component	ID #	Component
1	Top plate	13	Tachometer
2	Bottom plate	14	Ball-bearing block
3	Posts	15	Motor connector
4	Motor pinion gear: 72-teeth (low-gear)	16	Tachometer connector
5	Load gear: 72-teeth (low-gear)	17	Encoder connector
6	Potentiometer anti-backlash gear	18	S1 & S2 connector (i.e. potentiometer)
7	Anti-backlash springs	19	Motor pinion gear: 24-teeth (high-gear)
8	Load shaft (i.e. output shaft)	20	Load gear: 120-teeth (high-gear)
9	Motor	21	Bar inertial load.
10	Gearbox	22	Disc inertial load.

ID #	Component	ID #	Component
11	Potentiometer	23	Thumb screws.
12	Encoder		

Table 3: SRV02 components.

Figure 2: Top view of components on the SRV02 in low-gear configuration.

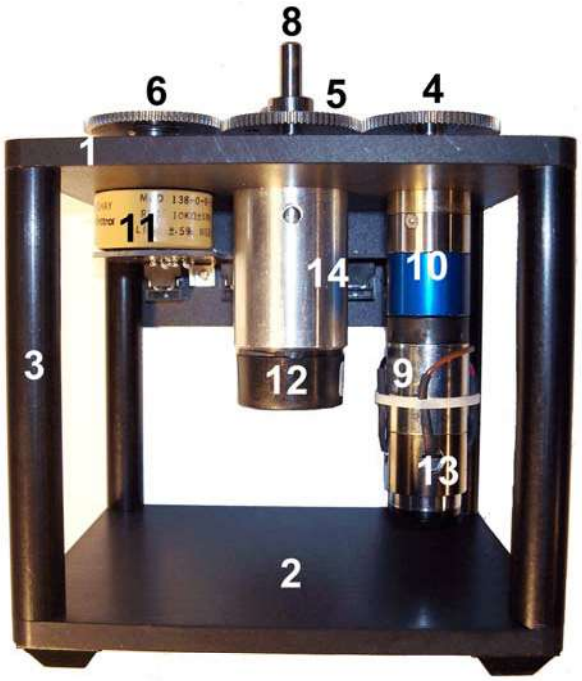

Figure 3: Front view of the SRV02 components.

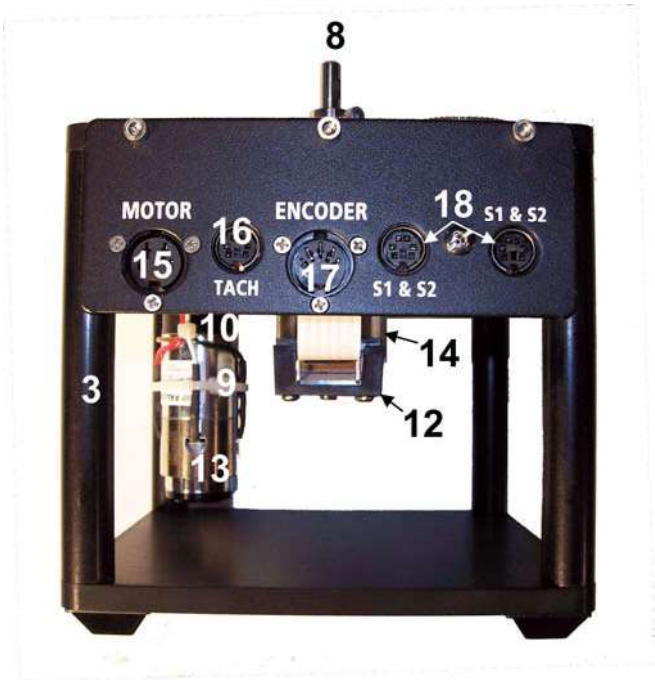

Figure 4: Connectors view of the SRV02.

Figure 5: Top view of the components on the SRV02 in high-gear configuration.

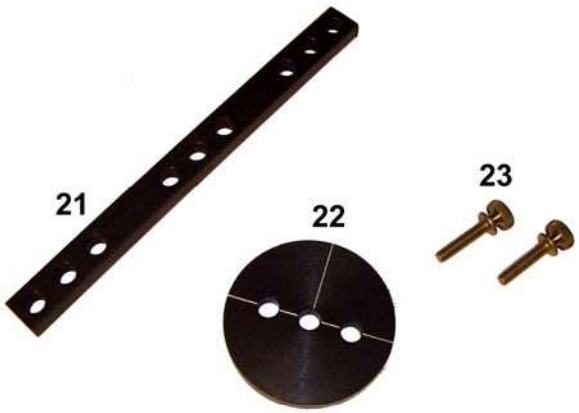

Figure 6: Inertial loads supplied with SRV02 system.

3.2. Component Description

3.2.1. DC Motor (Component #9)

The SRV02 incorporates a Faulhaber Coreless DC Motor model 2338S006 and is shown in Figure 3 with ID #9. This is a high efficiency, low inductance motor with a small rotor inductance. Therefore it can obtain a much faster response than a conventional DC motor. The complete specification sheet of the motor is included in Appendix A.

CAUTION: High frequency signals applied to a motor will eventually damage the gearbox and/or the motor brushes. The most likely source for high frequency noise is derivative feedback. If the derivative gain is set too high, a noisy voltage will be fed into the motor. To protect your motor, you should always band limit your signal (especially derivative feedback) to a value of 50Hz.

CAUTION: Input: ±15V, 3A peak, 1A continuous.

CAUTION: Exposed moving parts.

3.2.2. Potentiometer (Component #11)

All SRV02 models are equipped with a Vishay Spectrol model 132 potentiometer, shown in Figure 3 with label #11. It is a single turn 10 kΩ sensor with no physical stops and has an electrical range of 352 degrees. The total output range of the sensor is ±5 V over the full 352 degree range. Note that a potentiometer provides an absolute position measurement as opposed to a relative measurement from, for instance, an incremental encoder. See Appendix C for a full listing of the potentiometer specifications.

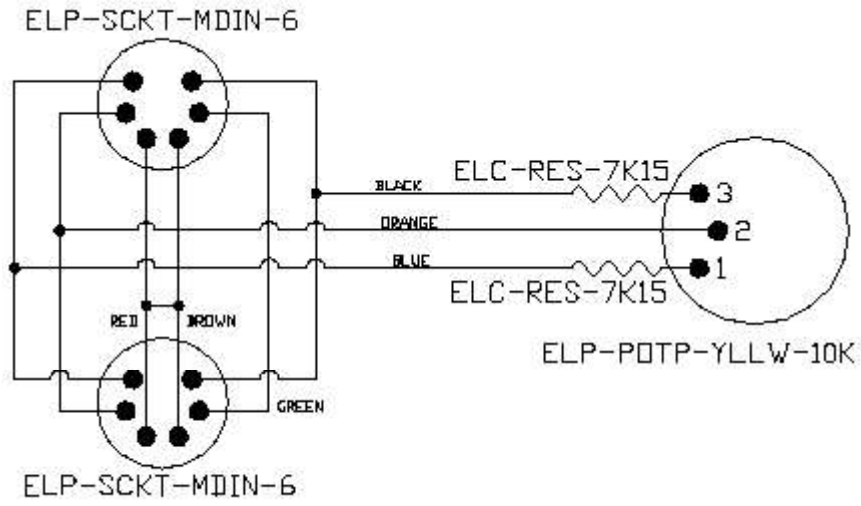

Figure 7: SRV02 potentiometer wiring.

As illustrated in Figure 7, the potentiometer is connected to a ±12 V DC power supply through two 7.15 kΩ bias resistors. Under normal operations, terminal 1 should measure -5 V while terminal 3 should measure +5 V. The actual position signal is available at terminal 2.

3.2.3. Tachometer (Component #13)

The SRV02-T and SRV02-ET models come equipped with a tachometer that is directly attached to the DC motor and is depicted with ID #13 in Figure 3. This prevents any latencies in the timing of the