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ROTARY CONTROL CHALLENGE



SRV02 + BB01= Rotary Ball & Beam Experiment

Product Information Sheet R2 - 1 - rev. C



Description

The Ball & Beam (BB01) module consists of a steel rod in parallel with a nickel-chromium wire-wound resistor forming the track on which the metal ball is free to roll. The position of the ball is obtained by measuring the voltage at the steel rod. When the ball rolls along the track, it acts as a wiper similar to a potentiometer resulting in the position of the ball. When coupled to the SRV02 plant, the DC motor will drive the beam such that the motor angle controls the tilt angle of the beam. The ball then travels along the length of the beam.

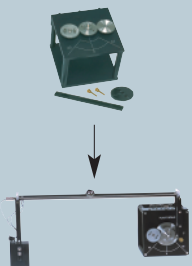
Key Features

- Fully compatible with MATLAB/Simulink
- Modular design (experiments are easily interchangeable)
- High quality precision crafted parts
- Robust machined aluminum casing with stainless steel rod
- Fully documented system models and parameters
- Fast and easy attachment to the SRV02 plant
- Open architecture design
- Optional Master/Slave Configuration with SS01

Curriculum Topics

- Position Control
- Disturbance Rejection
- Tracking Control & Regulation
- PID Controller Design
- Multiple Control Loops
- Lead / Lag Compensation
- State-Feedback
- System Modeling & Simulation
- Root Locus Design
- Nyquist Stability
- 2 Bar Linkage Model
- Real-Time Control
- Discrete Time Sampling
- System Identification
- Multivariable Control Design

Range of SRV02 Challenges



SRV02 Model Range

The SRV02 series serves as the base of Quanser's Rotary Control Challenges. With easily interchangeable modules, you can transform the SRV02 into any of these experiments:

SISO Configurations (Single Input, Single Output)

- SRV02: Position Control
- SRV02-T: Rate Control
- BB01: Ball & Beam**
- ROTFLEX: Rotary Flexible Joint
- FLEXGAGE: Rotary Flexible Link
- ROTPEN: Rotary Gantry
- ROTPEN: Rotary Inverted Pendulum
- ROTPEN-SE: Rotary Self-Erecting Inverted Pendulum
- DBPEN: Double Inverted Pendulum

MIMO Configurations (Multiple Input, Multiple Output)

- 2D ROBOT: 2 SRV02 modules coupled together to control 2 axis
- 2D GANTRY: Use the 2D ROBOT to control the position of the gantry in 2 planes
- 2D PENDULUM: Control the Inverted Pendulum with 2 degrees of freedom
- 2D BALL BALANCER: Control the position of the ball on a plate moving with 2 degrees of freedom

Some configurations require specific SRV02 model, please confirm at time of order

All SRV02 models are supplied with additional gears to configure the required ratio as well as an extra set of external loads to vary the inertia. The following models are available:

Model	Description
SRV02	Standard Servo plant. Instrumented with a continuous turn potentiometer to measure output/load angular position.
SRV02-E	Same as the SRV02 with an optical encoder measuring the output shaft position.
SRV02-EHR	Same as the SRV02 model equipped with a high resolution optical encoder to acquire high precision position data.
SRV02-ET	Same as the SRV02-E with a tachometer attached to measure the speed of the motor.
SRV02-ETS	Same as the SRV02-ET but with a slip-ring mounted to the load gear allowing a continuous 360° motion.



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Options & Customization

Typical Response

System Requirements

System Specifications

ROTARY CONTROL CHALLENGE



SRV02 + BB01= Rotary Ball & Beam Experiment

Product Information Sheet R2 - 2 - rev. C

The Ball & Beam module can be operated in standalone mode where the ball position may be commanded via the user interface.



The Ball & Beam module can also be accompanied with a separate module (SS01) in which case the system may operate in Master/Slave mode where the ball position will follow the reference position.

The following plot demonstrates the typical response of the system to a given position command:

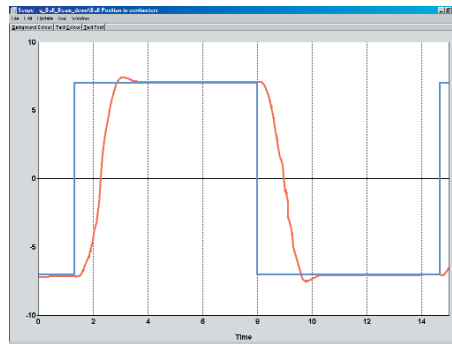


Figure 1 - Ball Response to a given Command

The Ball & Beam Module (BB01) is designed as an attachment to the SRV02 plant. Along with the SRV02 plant, the following components are required to complete the experimental setup.

Component	Quanser Recommended (Common Configuration)	Alternative
Power Module	Quanser UPM 1503/2405	Alternate Power Amplifier (Minimum requirements: +/- 12V, 3A)
Control Hardware	Quanser Q4, Q8 Series Quanser Q3 ControlPaQ-FW*	dSPACE DS1104** National Instruments E- or M-Series DAQs**
Control Software	Quanser QuaRC	The Mathworks – RTWT, xPC dSPACE – ControlDesk National Instruments – LabVIEW

* configuration with Q3 ControlPaQ-FW amplifier-on-board control unit does not require UPM power module

** Quanser offers interface boards for NI E- and M- series & dSPACE DS1104 boards.

Specification	Value	Units
Calibrated Base Dimensions	50 x 22.5	cm ²
Beam Length	42.5	cm
Lever Arm Length	12	cm
Support Arm Length	16	cm
Ball Diameter	2.54	cm
Beam Sensor Bias Power	±12	Volts
Beam Sensor Measurement Range	±5	Volts
SS01 Sensor Bias Power	±12	Volts
SS01 Measurement Range	±5	Volts
Ball & Beam Module mass	0.65	kg
Ball mass	0.064	kg

For SRV02-Series specifications please refer to Product Information Sheet R1

With Quanser the possibilities are infinite

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