GSI Lumonics

Analog Servo Driver
(OATS)
User Manual

Component Products Group
39 Manning Road
Billerica, Massachusetts 01821

PRELIMINARY

1. Electrical Design and Features

NOTE: The Analog Servo Driver, if requested as part of a tuned package, has been optimized to meet your scanning specifications. Do not attempt to retune this servo or change the Power Supply requirements. The Analog Driver heat sink must be mounted to a surface of your chassis which has a thermal resistivity of 5°C / Watt or less. Power up sequence for the power supplies is 15 volts then 24 volts. Reverse this process for power down. Please contact General Scanning's Technical Services Group should you have any questions.

Power Supplies

The configuration of your Driver has been factory set to optimize the galvo, servo, mirror combination. Power supply requirements, for your application, will be noted on the Scanner Performance Outline sheet. The Driver requires a minimum of 15 volts at 1 amp per channel for low duty cycle step and vector applications, this supply voltage is for the analog circuits and the current for the scanner. For other applications, the board has been configured for 15 volts and volts. The 15 volts will now control the analog circuitry and the 24 volts (Push-Pull Power Op Amp configuration) will supply the output stage current for the scanner. Power supply configurations for the Driver are controlled through the jumper placement of W19 and W20. Jumper center to pin 1 for 15 volts only and center to 2 for dual supplies. The power connections are made through the 6 pin connector, J3. The mating connector is Molex P/N MX 39-01-2060 and the pins are Molex P/N MX 39-00-0060. The connector and pins necessary to supply power to the Analog Driver are included in your package.

Servo Architecture

The M1 Analog Driver is based around the PID (Proportional-Integrator-Differentiator) closed loop servo controller, shown in block diagram form in Figure 2.

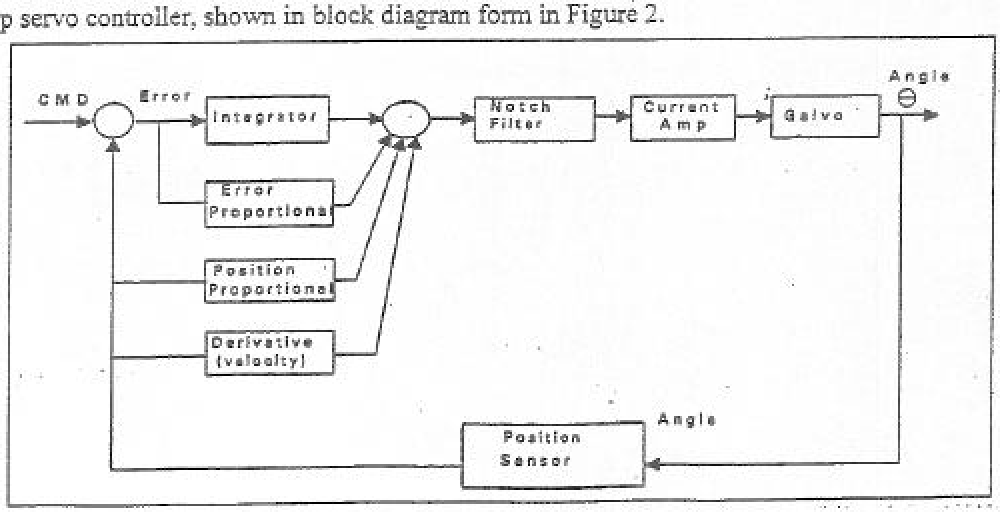

Figure 2. Block Diagram of Analog Servo Driver.

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The basic concept behind the PID controller is to take a input command and sum this command with position feedback information from the Galvanometer, which in turn creates an error signal. The servo attempts to correct this error by forcing the value to Zero, through the rotation of the Galvanometer shaft. The continuing effort by the servo to correct the error yields a controlled motion of the Galvanometer. The traditional sections of the PID along with some performance improvements are listed below:

Damping (Derivative term):	This block takes the derivative of position to get velocity, i.e. the slope of the change in position. This "warns" the servo of changes in speed so that the servo does not over respond (reduces overshoot).
Integrator (Integral term):	This block takes the integral of the error between where you are and where you want to be. The integrator continues to charge up until a current is generated which overcomes any DC errors.
Proportional (two terms):	In general, the Proportional term is equivalent to servo loop gain and increases the servo bandwidth. The M1 driver uses two proportional terms.
	Error Proportional: Provides greater acceleration for equivalent bandwidth and is useful in raster tuning.
	Position Proportional: Provides more accurate settling in the presence of loop gain variations (more accurate across the entire field of view). Useful for vector and step tuning.
Notch Filter:	This circuit eliminates signals in a narrow band of frequencies. Primarily used to attenuate sharp resonances resulting from a torsion between the rotor and load.
Current Amp:	Supplies current to the drive coils which interacts with the field of the rotor magnetized across a diameter to produce a reaction torque on the rotor.
Position Sensor:	A capacitive sensor which produces a capacitive imbalance during angular motion of the rotor. The current created is converted to a voltage by the transimpedance stage on the driver and is used to generate the error signal.

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2. Mechanical Design and Features

J1 (Scanner Connector)

Pin	Signal
1	Galvo Hi
2	Galvo Lo
3	Position (+)
4	Thermistor Rtn (GND)
5	Heater Blanket Hi
6	NC
7	Heater Blanket Lo
8	OSC Pwr
9	Galvo Hi
10	Galvo Lo
11	Position (-)
12	AGC (Ref) Signal
13	OSC Rtn (GND)
14	NC
15	Thermistor Hi/Lo

J2 (Control Connector)

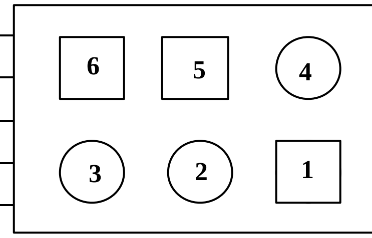
Pin	Signal
1	Command (+5V for max scan angle)
2	NC
3	Servo OK (Position in limits)
5	Temp OK
6	Command (-5V for maxscan angle)
7	NC
8	NC
9	GND

Jumpers (standard option in bold)

W17	C-1:Single-ended	**C-2: Push-Pull**
W18	**C-1: +Ref**	C-2: AGC Ref
W19	**C-1: +15V**	C-2: +24V
W20	**C-1: -15V**	C-2: -24V
W21	Not Used	

J3 (Power Connector)

Pin	Signal
1	+ 15V
2	GND
3	- 15V
4	GND
5	+ 24V
6	- 24V



Tuning and Scaling Ref Designators

Ref	Signal
R17	Position
R13	Damping
R36	Position Error
R49	Integrator
A2	Course Gain
R8	Fine Gain
A4	Course Offset
R9	Fine Offset

Test Points

TP	Signal
1	Velocity
2	Position
3	Command
4	Position Error
5	Heater Blanket Hi
6	- Ref (not used)
7	+ Ref (not used)
8	OSC Pwr
9	GND
10	Galvo Hi
11	Galvo Lo
12	Reset

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