Gravity meter S-99

Power Supply & Platform Control Unit test points

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You need at least a multimeter to perform these tests; an oscilloscope is, however, best.

1. Power supply test

The power supply has three testpoints, phase A, B and C. These are the gyro spin motor excitation voltages. The motor is 3-phase AC, driven by 200 Hz sinusoids, 120º phase shifted.

The phase voltages can be measured in two ways, a) Neutral (0V) to Line, or b) Line to Line.

1.1 Phase voltage

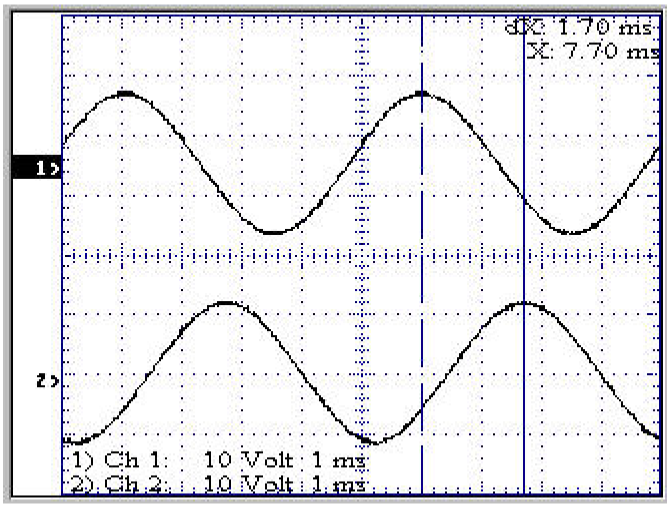
1.1.1 Using multimeter.

Meter setup: AC. Measure between 0V and each phase. Also measure frequency, if the multimeter has this capability.

Test Point	Voltage	Frequency
φA	8.1 ± 0.3 Vrms	200 Hz ± TBD
φB	8.1 ± 0.3 Vrms	200 Hz ± TBD
φC	8.1 ± 0.3 Vrms	200 Hz ± TBD
φA_ φB	14.1 ± 0.2 Vrms	
φA_ φC	14.1 ± 0.2 Vrms	
φB_ φC	14.1 ± 0.2 Vrms	

TBD = To be determined.

1.1.2 Using oscilloscope.



Measure between 0V and each phase.

Note: Do not measure between phases by attaching the probe's ground clip to one of the phases - you risk making a short circuit if the scope's ground is tied to power supply 0 V. Instead make a differential measurement using two probes, ground clips to 0V, and then subtract ch.2 from ch.1.

The figure on the right shows phase A and B. Peak-to-peak value is approx 24 V. The phase difference can be measured to (1.7ms/5ms)*360º = 122º; the cursor readout is however not very accurate, so this just indicates the 120º phase shift.

The signals are not "pure" 200 Hz sinusoids. If a spectral decomposition (FFT) is performed the harmonic distortion can be measured. The amplityde of the 3rd harmonic (600 Hz) should be less then 1% of the 1st harmonic (200 Hz). It was mesured to 1.22% (refer to figure on the right).

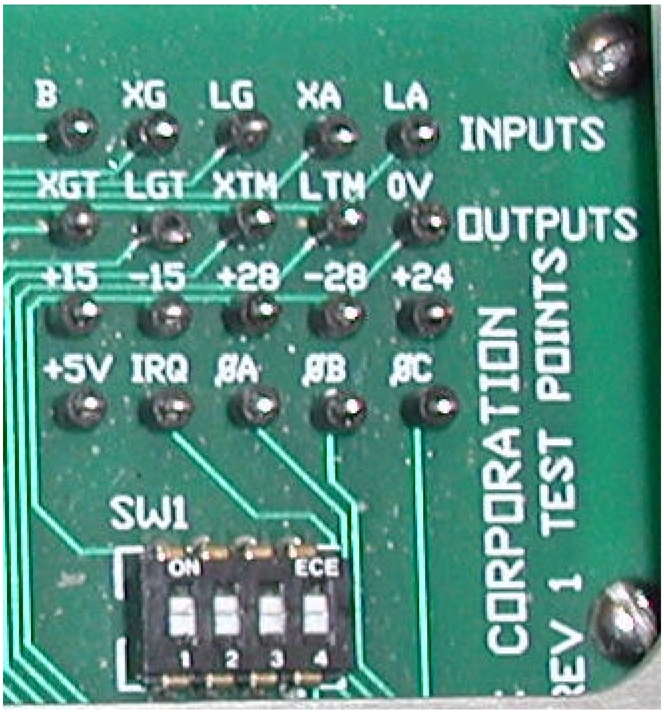
Voltage = 8.21 Volts Current = Power =

Voltage THD = 1.28% Current THD =
Power Factor = Displacement Power Factor =
Instantaneous Power = Reactive Power =

	Freq	Voltage RMS	Voltage % F	Voltage Phase	Current RMS
Fundamental	200 Hz	8.2 V	100.00%	0.0	
Harmonic 2	400 Hz	23.7 mV	0.29%	110	
Harmonic 3	600 Hz	99.9 mV	1.22%	4.09	
Harmonic 4	800 Hz	4.9 mV	0.06%	130	
Harmonic 5	1000 Hz	19.8 mV	0.24%	16.8	
Harmonic 6	1.2 kHz	3.06 mV	0.04%	-173	
Harmonic 7	1.4 kHz	8.42 mV	0.10%	27.8	
Harmonic 8	1.6 kHz	4.8 mV	0.06%	144	
Harmonic 9	1.8 kHz	2.29 mV	0.03%	173	
Harmonic 10	2 kHz	1.68 mV	0.02%	-107	

Data from Tektronic oscilloscope TDS210. Calculated by Tektronix's WaveStar software.

2. Platform control unit tests



The testpoints are located on a small printed circuit board inside the Platform Control Unit, below the metal lid - see the figure to the right.. Learn the "nomenclature" - it makes testing easier:

X = Cross
L = Long
G = Gyro
A = Accelerometer
T = Torque
M = Motor

Note that "torque" applies to two components: a) The motors that keep the platform level, and b) the gyros, where the torque input signal is used to compensate for long-term horizontal reference changes (e.g. earth rotation). If you're not aware of this it can be a bit confusing.

Program switches SPRING TENSION and ALARM set to OFF.

No.	Test-points	Ref.	Scope image	Description
1	B	0V		CPI sensor output, identical to front panel meter. Slew the beam to end positions. Range: -9.8 Vdc .. 9.9 Vdc.
2	XG	0V	Yes	Cross Axis Gyro output signal By turning off the Cross Torque Motor switch you can see a 200Hz, 1V peak-to-peak sine wave on an oscilloscope, when the platform is rotated in the cross axis direction. Chooce IRQ as trigger for the oscilloscope. Multimeter (select AC measurements): 0.4 Vrms max. output.
3	LG	0V		Long Axis Gyro output signal, similar to XG.
4	XA	0V		Cross Axis Accelerometer output. By turning off the Cross Torque Motor switch you can see a DC-voltage on an oscilloscope or a voltmeter, when the platform is rotated in the cross direction. Signal range: -12.6Vdc .. 11.9Vdc.
5	LA	0V		Long Axis Accelerometer output, similar to XA. Signal range: -12.6Vdc .. 12.0Vdc.
6	XGT	0V	Yes	Cross Axis Gyro Torque - input signal to gyro. Due to time integral this signal build slowly to saturation. Cross Torque Motor switch = OFF. Signal range: -6.5 Vdc .. 8.7 Vdc
7	LGT	0V		Long Axis Gyro Torque, similar to XGT. Signal range: -6.0 Vdc .. 8.2 Vdc
8	XTM	0V	Yes	Cross Axis Torque Motor. Signal to motor that keeps platform level in cross axis. Cross Torque Motor switch = OFF. Signal range: -1.6 Vdc .. 1.5 Vdc
9	LTM	0V		Long Axis Torque Motor, similar to XTM. Signal range: -1.9 Vdc .. 1.6 Vdc
10	IRQ	0V	Yes	Interrupt Request. This is a digital clock signal. Only measure with oscilloscope! Square wave, approx. 50% duty cycle, 200 Hz, 0-4V peak-to-peak.
11	φA	0V		Gyro spin motor excitation voltage. 200 Hz, 24V peak-to-peak, 8.1V +/- 0.3V rms. > 40dB attenuation of 3rd harmonic 600Hz (means that 3rd harmonic's amplitude should be less then 1% of 1st harmonic's amplitude). Note: Identical to the Power Supply Unit testpoints!
12	φB	0V		As Phase A, with 120° phase shift.
13	φC	0V		As Phase B, with 120° phase shift.

DC voltages ±28V, ±15, +24V, +5V can also be checked via UltraSys program.

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