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Northern Telecom GPS Satellite Simulator STR2760

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Background

The first GPS simulator I got was the Stanford Telecom 5001A Navstar Test Transmitter made to test their GPS ICs. This one was one of a group being sold on eBay for the scrap metal value.

Description

This is a 10 channel (5 L1 & 5 L2) simulator that does C/A & P-Code. There are I & Q modulators for both L1 and L2 frequencies.
Capable of simulating:
Velocity: +/1 120km/s
Acceleration: +/- 3600m/s^2 (350 g)
Jerk: +/- 5,000 m/s^3 (500 g/s)

Guess as to how it functions:
An external computer uses IEEE-488 to send commands to the two VME computers in the unit. The two VME computers have custom ROMS for (1) VME operation and (2) GPS signal simulation. The parameters passed to the VME computers describe what signals each of the 5 L1& 5 L2 signal generators are to simulate probably including doppler shiift profile as well as orbital elements, PRN assignments for each signal generator. Once loaded and turned on the simulator would continue to run until unplugged. Note 5 signals are enough to fill up all the channels of the PLGR GPS receiver. But they would only be available while overhead and after a couple of hours would all set. It would take 3 or 4 of these to simulate the full GPS constilation.

This type of unit may have been used to caputer the RQ-170 Sentinel aka "Beast of Kandahar" (Wiki) spy drone.

From Jane's

GPS test equipment (United Kingdom), AIRSPACE MANAGEMENT - NAVIGATIONAL AND ELECTRONIC LANDING AIDS

Corporate structure
Formerly known as Nortel plc, a subsidiary of Northern Telecom Inc of Schaumburg, Illinois, USA, the company was acquired by Bowthorpe plc in 1997 and renamed Global Simulation Systems Ltd (GSSL).In 2000, the company changed its name to Spirent Communications (SW) Ltd.

Product
A range of simulators has been developed by Spirent Communications for testing GPS equipment.The STR 2760 multichannel GPS simulator is supplied as a turnkey system including the computer workstation, signal generator and all operating software. The unit can be configured for C/A code, at L1 and L2 and, with the SAAS upgrade kit (for authorised users), Y code simulation. Up to 20 channels can be installed in one chassis. The simulator can also be supplied or upgraded for Differential GPS and attitude testing.

Other options for the STR 2760 include a multimode, multichannel jammer, closed-loop real-time upgrade, Ethernet interface (for aiding and logging data), various receiver interfaces and Wide Area Augmentation System (WAAS) simulation.The STR 2720 and STR 2775 are single-channel GPS simulators developed for maintenance and production testing. These units enable GPS receivers to be checked and provide the opportunity for automated testing of equipment.

DOA

When plugged in and the rear 1/0 switch turned on nothing happens. Maybe a fuse?





The Blue "Host" connector is HP-IB (IEEE-488) interface to control computer
The fan runs on 24 VDC.

Inside Top



VME Card Cage Wiki: VMEbus

GPS I/O card	58 (coax) 59 (coax)
	L1 P-Code Sig Gen
	L1 P-Code Sig Gen
	L1 P-Code Sig Gen
	L1 P-Code Sig Gen
	L1 P-Code Sig Gen
	L2 P-Code Sig Gen
	L2 P-Code Sig Gen
	L2 P-Code Sig Gen
	L2 P-Code Sig Gen
	L2 P-Code Sig Gen
MVME 316A	I/O Channel Interface
	empty
MVME 300A	HP-IB Interface
	empty
MVME 143S-2	CPU2 Motorola 68030?
	empty
MVME 143S-2	CPU1 Motorola 68030?

VME GPS I/O card



This card is the source for the ribbon cable that drives the front panel LCD.

In the lower left are 2 ZN439 8-bit A to D converters.
That means the "58" and "59" coax cables are inputs to the VME system.

On this, and I think all other, VME cards the upper left connector is for the analog GPS signals
and the upper right connector is for the digital intercard communication.

VME bus L1 P-Code Sig Gen



The VME cards for L1 and L2 appear to be identical in terms of their layout and chip compliment.
Although I haven't checked my guess is that there might be differences in the ROMs.

VME bus L2 P-Code Sig Gen



In the upper left there are 4 each AD9713B - 12-Bit, 80 MSPS, TTL Compatible DAC
just below them are 4 each MCM62974 - 12 Bit Synchronous Static RAMs
In the rwo below them are 4 each "NCO-CK 50C" (guess) Numerically Controlled Oscillators
at the bottom of the VME card are 2 each CDGEN3 50C (guess) Carrier Data Generators

MVME 143S-2 Motorola VME CPU board with STR2760 ROMs

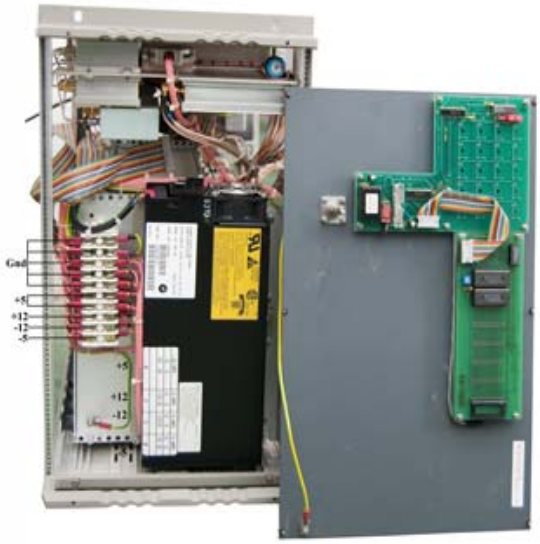


This is one of the two CPU cards in this system. Probably one for L1 and the ohter for L2 signal generation.

ROMs:
U5: STR2760
U3: STR2760
U2: VME1439
U1: VME1439



Inside Front
The black box is a power supply rated 5V/60A, +12V/12A, +5V/12A.
There is continuity between the line cord and the 110VAC input, but there appears to be no output.
EN60950
BS7002
LR91780
p/n: E25025



The PCB for the front panel must be a standard unit that supports a number of LED/Buttons
and this implementation just has the LCD.

Coutant Lambda Omega MML 400 Power Supply

To get to the input fuse inside the MML 400 power supply it's necessary to:

- Remove 3 ea hex head cap screws (4mm driver) that hold mounting plate to simulator chassis.
- Remove 4 ea screws holding mounting plate to MML 400 power supply [5.5 mm (-) driver]
- Remove 5 sheet metal screws from power supply c
- over [PZ1 (+) driver] & 1 Fan screw. note : one under warranty sticker.

Operation

The input 120 VAC is rectified (how?) to DC less than 200 V.
That's used to power an oscillator that drives T1 primary.
T1 secondary powers the output modules.

Input/Main Chassis

There are 6 Printed Circuit Boards.

Input

Line Hot -> Fuse FS70 half of L70 -> Main Board
Neutral --> 110 ----> half of L70 -> Main Board

Angle Board

passes MLU+, MLU- & 110(dot) to Main Board

Main Board

Line Hot -> TH50 (37 Ohm) ->
MLU+ <- L50 <- C50, C51, C53, C54 (200 WV) <- D1 cathode, TR1 drain
MLU- <- C52, C?? <- D2 anode TR2 source (by way of ferrite bead & 1T primary of T3

Active Board (MLU Rectifier Board)

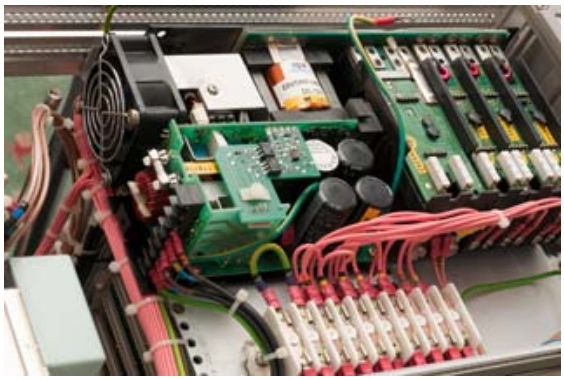
Has D1, D2, TR1, TR2, T3, PL1 (fan)
Primary of T1 main high frequency transformer

Opto Board

Connected to Active Board

Output Board

Secondary of T1.
Provisioin for 7 outputs, on my version T1 only has 4 outputs, one very high current & three lower current outputs.

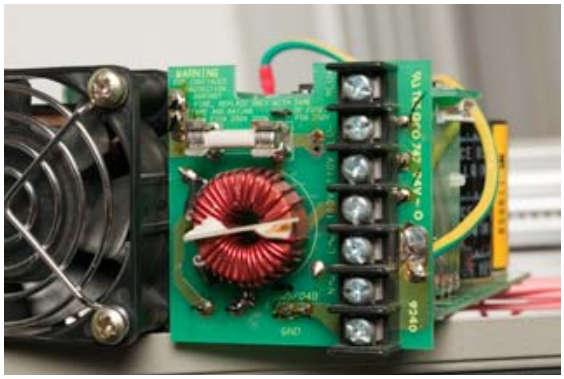


The input protection fuse can be seen next to the fan. It tests good, so there's some other problem.
The fan runs on 12 VDC.

Next remove all the output modules.
On the bottom of the power supply there are a 5 pairs of screws, 3 pairs are for the narrow modules and 2 pair for the double width module.
On the back there is a insulating paper held by a plastic fastener which when squeezed easily comes out exposing the input connecting screws shown below.



To remove the input module from the sheet metal chassis you need to use a real Philips #1 screwdriver (a nut driver has too big a shaft to get past power supply parts.

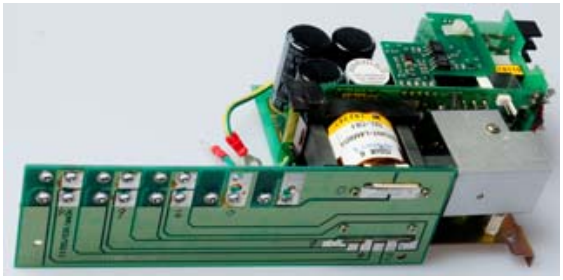


Input Wiring Table

Wire	Lbl	Term	IEC 110	IEC 220
nc	-	MLU+	nc	nc
nc	-	MLU-	nc	nc
Brown	3	110 Jump	Jump	Open
Blue	4			
Brown	1	L~	Line Hot	
Blue	7	N~	Neutral	
Green	-	Gnd	Ground	

To the upper right of the input PCB there is a white connector with 4 pins. This is for the Opto Isolated mains failed & Inhibit options.





I'm thinking of using external power supplies (+5, and two floating 12V) for power, thus bypassing the the dead supply module. Another option would be to use an external source of an H.F. signal (what frequency?) to drive the output transformer.

Links

Spirent's GPS/GNSS History - STR2760 launched at the ION-GPS-1991, uses ASIC technology (replaced the STR2740). The 1997 STR4760 uses DSP technology

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