Virgo

Demodulation Board
User Manual

, November 8, 2006 Electronics Group, Faculty of Sciences *Vrije* Universiteit *Amsterdam*, the Netherlands	**Project ID : 2006 20 01** Filename : UserManual.doc Pages : 7 Last save : Voet (November 29, 2006)
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1 Precautions

Safety check has been done following the NEN-EN 50110-1 and NEN 3140.

Hazardous voltages may exist in this apparatus. Besides the regular safety precautions the following should be observed when working with this unit:

1. When power is required, the unit should be plugged into an outlet with a properly grounded receptacle. The use of two prong plug adapters is not recommended.

2. The use of extension cords may compromise the safety of the operator and is not recommended.

3. Ensure that the fuses installed in the unit are of the correct rating.

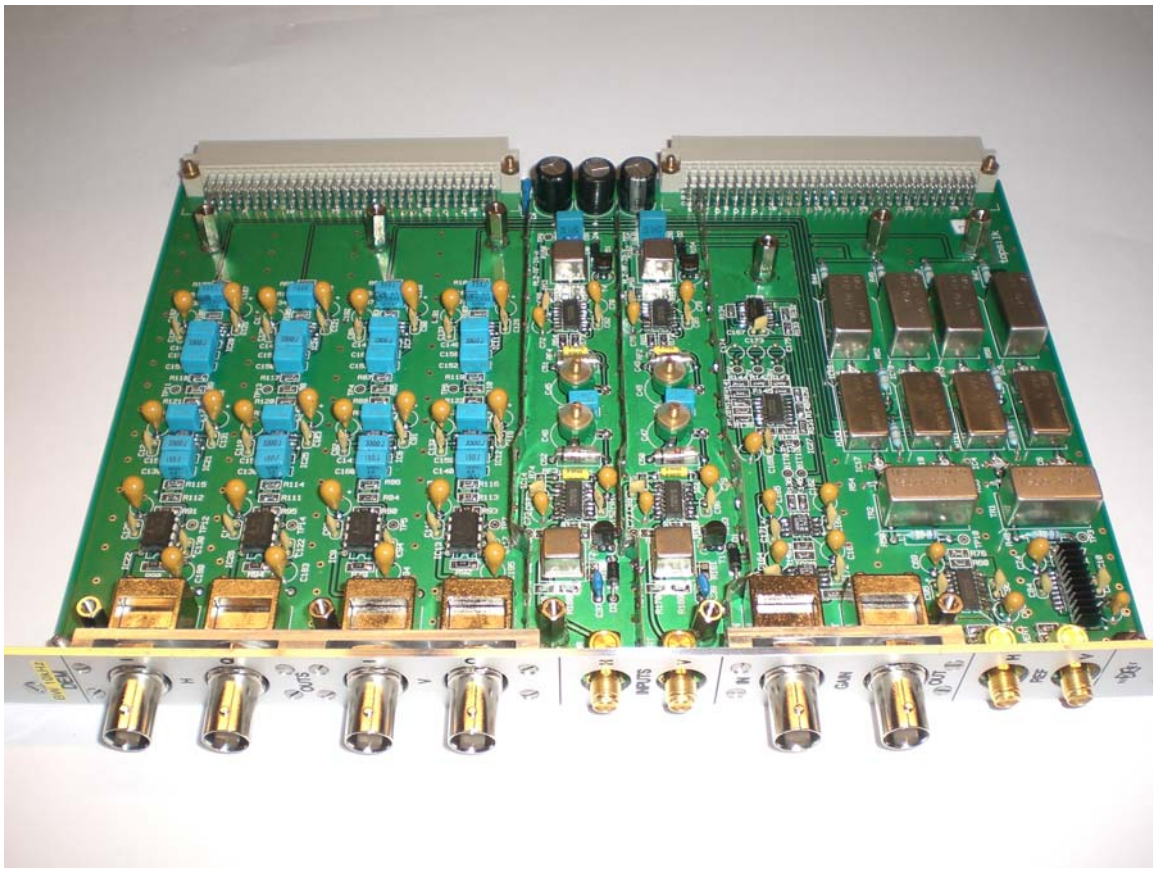
4. A damaged power cord or plug may constitute a shock or fire hazard. Do not allow continued operation of the unit until the damaged cord or plug has been replaced.

5. Ensure that none of the ventilation openings in the apparatus are blocked. Excessive heat build up in the unit may cause failures.

6. Do not exceed maximum allowable mains input voltage.

7.

8.



2 General Description

The demodulator board is part of the linear alignment system of the Virgo interferometer at Cascina (near Pisa) in Italy. The goal of the whole project is to measure gravitational waves.
The board receives its 6.26 MHz input signals from a front end module, which is equipped with a quadrant photo diode.
The quadrant photo diode is exposed to laser light which is modulated with the 6.26 MHz signal. The control system tries to keep the light spot in the center of the quadrant photo diode.

3 Description of Controls

The demodulator board fits into a two connector VME crate. Only the -12 Volts and +12 Volts are used.
On the front there are horizontal and vertical 6.26MHz inputs and horizontal and vertical 6.26 MHz reference inputs.
The board has an I&Q detector (quadrature detector) for the horizontal signal and also for the vertical signal. Each I&Q detector has an I-output and a Q-output.

The conversion gain of board can be set at four different levels in 20dB steps.
This is done by applying the appropriate voltage on the gain-input. To see in what gain setting the board is, one can read the voltage of the gain-output.

4 Installation Procedure

When the board is installed in the VME crate, it is wise to do this while the power is turned off.

The only thing to be tuned is the horizontal and vertical 6.26 MHz band pass filter.
Monitor either the I-output or Q-output of the horizontal and vertical sections and tune the horizontal and vertical band pass filters to maximum output.

5 Specifications

Voltage on gain-in:

Between 0 Volts..2 Volts	conversion gain = 2	voltage gain-out = about 0 Volts
Between 2 Volts..5Volts	conversion gain = 20	voltage gain-out = about 2.5 Volts
Between 5 Volts..8 Volts	conversion gain = 200	voltage gain-out = about 5 Volts
Between 8 Volts..10 Volts	conversion gain = 2000	voltage gain-out = about 7.5 Volts

The correct signal level on 6.26 MHz reference input: 0 dBm.

Conversion gain is the ratio between the amplitude on a I or Q output divided by the RF 6,26 MHz input signal amplitude.

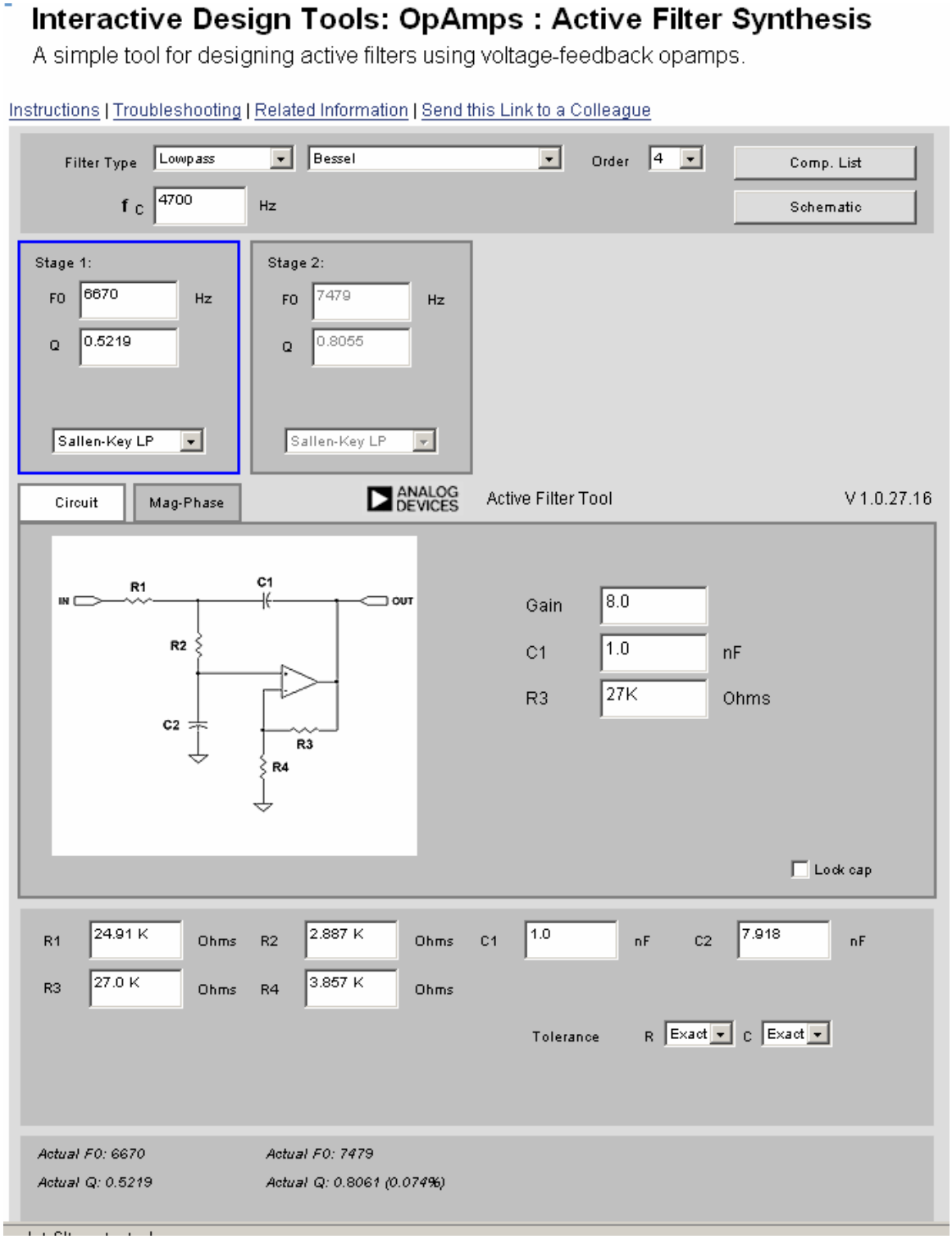
The board runs on +12 Volts and – 12 Volts.

Current +12V with large signal and maximum gain: ~0.6 A
Current -12V with large signal and maximum gain: ~0.4 A

Nominal current +12V: 0.2 A
Nominal current -12V: 0.14 A

6 Low pass output filter

The band width of the low pass output filters can be chosen by the used capacitor values. See list below, which is made with this Interactive Design Tool from Analog Devices.



Values for a 4-th order low pass Bessel filter.
The list is made with an Interactive Design Tool from Analog Devices.
URL:
http://www.analog.com/Analog_Root/static/techSupport/designTools/interactiveTools/filter/filter.html
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1000Hz -3dB Bessel gain: 8x8=64

Stage 1: Sallen-Key LP
R1=24.91 K R2=2.887 K C1=4.7 nF C2=37.21 nF R3=27.0 K R4=3.857 K
Stage 2: Sallen-Key LP
R1=34.29 K R2=1.789 K C1=4.7 nF C2=34.71 nF R3=27.0 K R4=3.857 K

2000Hz -3dB Bessel gain: 8x8=64

Stage 1: Sallen-Key LP
R1=24.91 K R2=2.887 K C1=2.35 nF C2=18.61 nF R3=27.0 K R4=3.857 K
Stage 2: Sallen-Key LP
R1=34.29 K R2=1.789 K C1=2.35 nF C2=17.36 nF R3=27.0 K R4=3.857 K

2000Hz -3dB Bessel gain: 8x8=64 (different R1, R2 resistor values)

Stage 1: Sallen-Key LP
R1=39.02 K R2=4.524 K C1=1.5 nF C2=11.88 nF R3=27.0 K R4=3.857 K
Stage 2: Sallen-Key LP
R1=53.72 K R2=2.803 K C1=1.5 nF C2=11.08 nF R3=27.0 K R4=3.857 K

4700Hz -3dB Bessel gain: 8x8=64

Stage 1: Sallen-Key LP
R1=24.91 K R2=2.887 K C1=1.0 nF C2=7.918 nF R3=27.0 K R4=3.857 K
Stage 2: Sallen-Key LP
R1=34.28 K R2=1.789 K C1=1.0 nF C2=7.385 nF R3=27.0 K R4=3.857 K

10kHz -3dB Bessel gain: 8x8=64

Stage 1: Sallen-Key LP
R1=24.91 K R2=2.887 K C1=0.4700 nF C2=3.721 nF R3=27.0 K R4=3.857 K
Stage 2: Sallen-Key LP
R1=34.29 K R2=1.789 K C1=0.4700 nF C2=3.471 nF R3=27.0 K R4=3.857 K