MODEL A6

Frequency Converter

USER'S HANDBOOK

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Contents

Safety Considerations

General

This product and related documentation must be reviewed for familiarisation before operation. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuse is installed.

Before Cleaning

Disconnect the product from operating power before cleaning.

WARNING

Bodily injury or death may result from failure to heed a warning. Do not proceed beyond a warning until the indicated conditions are fully understood and met.

CAUTION

Damage to equipment, or incorrect measurement data, may result from failure to heed a caution. Do not proceed beyond a caution until the indicated conditions are fully understood and met.

This equipment must be earthed

An uninterruptible safety earth ground must be maintained from the mains power source to the product's ground circuitry.

WARNING

When measuring power line signals, be extremely careful and use a step down isolation transformer whose output is compatible with the input measurement capabilities of this product. The product's front and rear panels are typically at earth ground. Thus, never try to measure AC power line signals without an isolation transformer.

WARNING

Instructions for adjustments when covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

WARNING

Any interruption of the protective grounding conductor (inside or outside the instrument) or disconnecting of the protective earth terminal will cause a potential shock hazard that could result in personal injury. Grounding one conductor of a two conductor out-let is not sufficient protection.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If the instrument is to be energised via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while the covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protections against fire, replace the line fuse(s) with fuses of the same current rating and type (for example, normal blow time delay). Do not use repaired fuses of short-circuited fuse holders.

Voltage, Frequency and Power Characteristics

Voltage 220-240V AC

Frequency 40-50Hz

Power characteristics 500mA Max

Environmental Conditions

Temperature

Operating (ambient)	-10°C to +55°C (-65 to +65 op)
Storage	-40°C to +85°C

Magnetic Field

Sensitivity	$\leq 2x10^{-11}$/ Gauss
Atmospheric Pressure	-60m to 4000m
	$<1x10^{-13}$/ mbar

Replaceable Fusing Characteristics

800mA time lag HBC

Cleaning Instructions

To ensure long and trouble operation, keep the unit free from dust and use care with liquids around the unit.

Be careful not to spill liquids onto the unit. If the unit does get wet, turn the power off immediately and let the unit dry completely before turning it on again.

Clean with a damp (with water) cloth.

Never spray cleaner directly onto the unit or let liquid run into any part of it. Never use harsh or caustic products to clean the unit.

Frequency Converter A6

Operating Procedure

Introduction

The Quartzlock model A6 is a frequency converter and distribution amplifier for use with frequency standards such as Rubidium, Cesium, or Hydrogen maser standards. Sine and square wave outputs are provided at frequencies of 10 MHz, 5 MHz, 1 MHz, and 100 kHz as standard. Frequencies of 2048 kHz, 13 MHz and 1 Hz are available as factory configured options. A pulse input at 1 pps may be used to synchronize the square wave outputs.

The spectral purity of the outputs is very good (including square wave outputs) with spurii generally less than -75 dBc. The sine outputs all have a 50∧ source impedance and nominal 13 dBm level. Harmonics are typically less than -40 dBc. The square wave outputs are internally terminated in 50∧ and will give a voltage level of at least 2.4V into an external 50∧ load. Output level into open circuit is 5V nominal. These levels are TTL and CMOS compatible. Rise times are less than 1.5ns in all cases. Complementary pairs of outputs are provided on each frequency, which enables differential line driving of a screened twisted pair.

Option 005 is available which provides tuned output amplifiers. This further reduces harmonic and spurious levels.

Inputs

The primary input is a sine wave at 5MHz from the frequency standard. This should be at a level between +5 dBm and +15 dBm. The input impedance of the model A6 is 50∧.

Two other input sockets are provided. These are the external input and the sync input. Both are TTL/CMOS compatible with a threshold of 1.4V. These inputs are used as follows:

Sync

This input is used to synchronise the divider chains that generate 5 MHz, 1 MHz, 100 kHz, and 1 Hz from the internal 10 MHz clock. The internal clock is obtained by doubling the 5 MHz sine input using an analogue multiplier, filtering, and converting to a square wave. The next positive clock edge after the SYNC input goes high is used to generate a reset pulse of about 30ns width. This will reset all the dividers, and the rising edges of the square wave outputs will then be synchronised to the rising edge of the SYNC input to within the following limits:

5MHz:	+25ns to +125ns
1MHz:	+30ns to +130ns
100kHz:	+60ns to + 160ns
1Hz:	+50ns to +150ns

It will be seen from the above figures that up to 100ns of jitter may occur. If the SYNC input is fed from the 1pps output from the frequency standard, the phase relationship between the 5 MHz input and the 1 pps input will determine whether jumps of 100ns will occur.

External

This input may be routed to the normally 100kHz square wave outputs by a user configuration of the model **A6.** (See section 2). The propagation delay is less than 10ns. The SYNC and EXTERNAL inputs may be connected in parallel to the 1pps output of the frequency standard if required.

Outputs

The 5 MHz outputs are obtained from 3 channels of a 4-way distribution amplifier. The output levels will follow the input levels, as the distribution amplifier is a wide band linear amplifier. The harmonic levels and spurii will be directly related to the purity of the 5 MHz input (but see specification for option 005 This option replaces the wideband distribution amplifier with a tuned distribution amplifier).

The 4th channel of the distribution amplifier drives a balanced mixer type doubler. The required component at 10 MHz is extracted by filtering, and the level is raised to +13 dBm nominal. Note that there is no level control on the 10 MHz output, and the output level will depend upon the amplitude of the 5 MHz input (see setting up procedure in next section). A 10 MHz square wave is derived from the 10 MHz sine wave using a high-speed comparator (zero crossing detector).

The remaining sine wave outputs are obtained by division of the 10 MHz signal to 5 MHz, 1 MHz and 100 kHz, filtering using low pass filters, and amplifying to +13dBm. Individual output level adjustments are provided.

Setting up

The only user adjustment required is to set the output levels. To do this proceed as follows:

1. Connect desired 5MHz input between +5 dBm and +15 dBm
2. Connect a spectrum analyser, oscilloscope with 50∧ input impedance, or RF power meter to any of the 5 MHz sine wave outputs.
3. Adjust output level to 13 dBm (1V rms) using the preset VR1 on the isolation amplifier board. Check output level at 10 MHz sine wave output. This should be between +13 dBm and +16 dBm.
4. Adjust output level at 1 MHz sine wave output socket to +13 dBm using preset VR2 on analogue board.
5. Adjust output level at 100 kHz sine wave output socket to +13 dBm using preset VR1 on analogue board.

Remote output fail

A 9 pin D connector on the rear panel provides a remote output fail connection. This output can sink a maximum of 100mA. 24V is present on the output when the front panel indicator is off.

Specification

1) Inputs:
a) 10 MHz sine wave, 10 dBm nom into 50∧ nom.
b) 1pps, pulse width 10 to 20µs, rise time <30ns >2.5Vpeak

2) Outputs:
a) 1 off 5 MHz sine wave
b) 3 of 10 MHz sine wave
c) 1 of 1 MHz sine wave
d) 1 of 100 kHz sine wave
e) 2 of 10 MHz square wave, complementary outputs
f) 2 of 5 MHz square wave, complementary outputs
g) 2 of 1 MHz square wave, complementary outputs
h) 2 of 100 kHz square wave, complementary outputs

3) Input characteristics:

a) **Sine wave Impedance**: 50∧ nominal
Level: +5 dBm to +13 dBm adjustable
Input SWR: <1.2: 1

b) **Pulse** TTL /CMOS compatible

4) Output characteristics:

a) Sine wave: impedance: 50∧ nominal
Level: 13 dBm nominal into 50∧ (1volt RMS)
Output SWR: <1.2:1

b) Square wave: unipolar (CMOS/TTL logic)
Impedance: 50∧ internally terminated
High level: 5V +/-0.2V into open circuit 2.4V min into50∧
Rise/fall times: <1.5ns
Overshoot/ringing: <15%

5) Harmonics and spurious outputs (sine wave outputs): (Source harmonics <-60dBc)

a) 10 MHz outputs
Second harmonic < -50dBc
Third harmonic < -40dBc
Spurious outputs < -75dBc

b) 5 MHz output
Second harmonic < -50dBc
Third harmonic < -40dBc
Spurious outputs < -75dBc

c) 1 MHz output
Second harmonic < -50dBc
Third harmonic < -40dBc
Spurious outputs < -65dBc

d) 100 kHz output
Second harmonic < -40dBc
Third harmonic < -50dBc
Spurious outputs < -75dBc

6) Broadband noise (sine wave outputs): <-150dBm/Hz

7) Output failure alarm: Front panel LED + common active low logic output

8) Synchronisation Square wave outputs are synchronised to rising edge of 1pps input to within ±300ns

Options

OPTION 001 **1Hz square wave**
Option 001 provides complementary 1 Hz square wave instead of 100 kHz square wave.

OPTION 002 **2048kHz square wave**
Option 002 provides complementary 2048 kHz square wave instead of 100 kHz square wave.

OPTION 003 **2048kHz sine wave**
Option 003 provides 2048 kHz sine wave instead of 100 kHz sine wave.

Output level: 13dBm nominal into 50∧

Harmonic and spurious outputs:

Second harmonic < -50dBc
Third harmonic < -40dBc
Spurious outputs < -65dBc

OPTION 004 **1pps outputs**

Option 004 provides 1 pps complementary outputs instead of 100 kHz square waves. These outputs will be delayed no more than 10ns relative to the 1pps input.

OPTION 005 **Tuned output amplifiers**

Option 005 provides tuned output amplifiers on the 10 MHz sine wave output. This will provide the following improved harmonic and spurious specification:

Harmonics and spurious outputs: (Source harmonics <-60dBc)
10MHz outputs

Second harmonic < -75dBc
Third harmonic < -60dBc
Spurious outputs < -75dBc