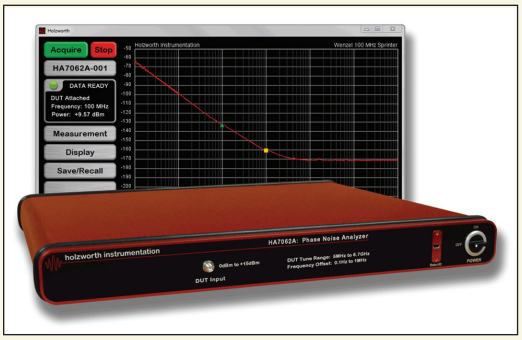

INTUITIVE PHASE NOISE ANALYZER

Holzworth Instrumentation has developed a fully automated phase noise analyzer with an integrated, cross correlation engine that responds to the most common issues of modern phase noise test systems. The HA7062A provides ease of use, fast measurement speeds, high reliability, high stability and pricing that makes an easy decision of implementation into the manufacturing environment.

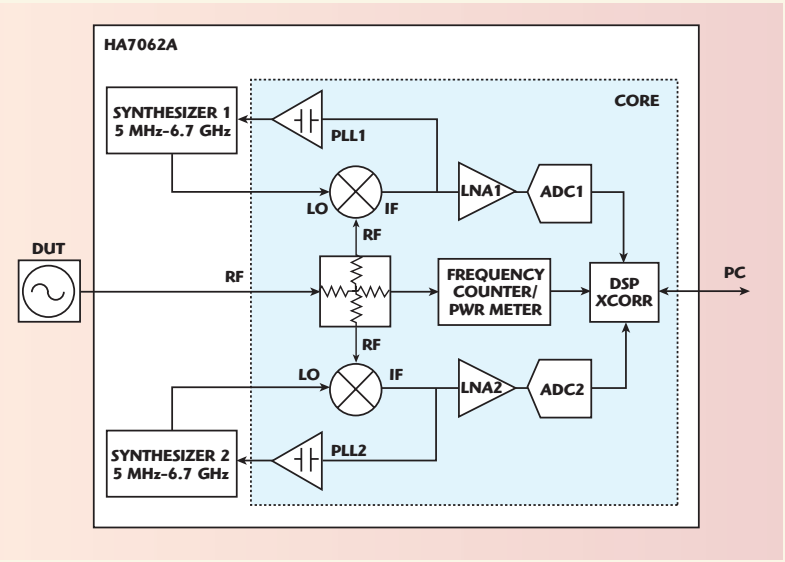

Fig. 1 Simplified system block diagram.

HARDWARE BASICS

The HA7062A design follows a basic Holzworth philosophy of creating unique, high performance products. The core engine of the HA7062A combines the best of traditional analog phase noise measurement front-ends (being virtually spur free) with the latest technology in cross correlation analysis. The digital analysis system leverages a proprietary DSP with a powerful cross correlation engine that achieves sub -165 dBc/Hz$^{1/2}$ measurements in less than 20 seconds.

The unparalleled stability of the HA7062A is credited to a pair of Holzworth RF synthesizer modules. Holzworth RF synthesizers are known for industry-leading stability due to proprietary non-PLL designs. These high performing RF sources complement the core engine to provide an advanced (yet simple) phase noise analyzer (see ***Figure 1***). For high speed measurements that require lower noise floors, the synthesizers can be bypassed for direct access to the core cross correlation engine with user-supplied LOs (see ***Figure 2***).

The entire test system is enclosed in a 1U high, fan-less chassis. Developing the product on a fully integrated, low power platform has

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eliminated fan-cooling requirements, which also eliminates non-valid measurement spurs caused by microphonics. The integrated chassis further eliminates test system noise ground loops. The 20 lb (9 kg) chassis is fully sealed, rugged and portable for field applications. It provides consistent results from location to location without the worry of recalibration support or repair.

The HA7062A is a virtual instrument from a command/control perspective. Holzworth eliminates proprietary motherboards, displays, etc. from all test instrument products as a means to reduce product costs while increasing reliability. The USB controlled, non-driver, Human Interface Device (HID) installation is "plug-and-play" with any standard PC that runs JAVA™.

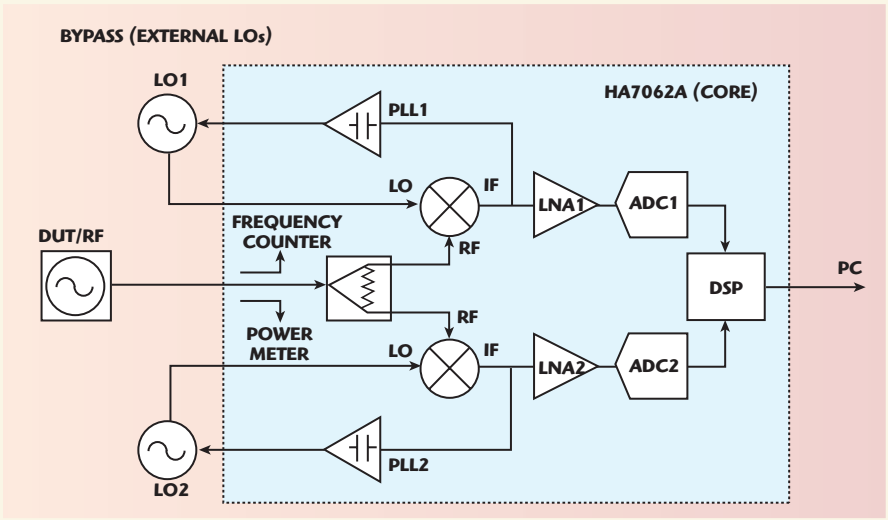

Fig. 2 Internal LO bypass when using fixed LOs.

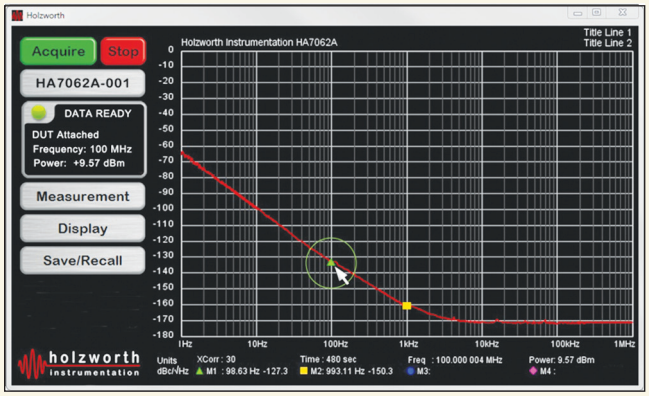

Fig. 3 HA7062A virtual front panel.

Fig. 4 HA7062A display settings window.

INTERFACE BASICS

Holzworth Instrumentation has been measuring the phase noise of 100 percent of its shipped products since the company was founded in 2004. We understand that the quality of the user interface is as important as the capabilities of the hardware. The interface GUI to the HA7062A was developed to be highly intuitive based on Holzworth's own lessons learned as well as feedback from industry users who regularly measure phase noise. The result is an application GUI that is easy to navigate and operate (see ***Figure 3***). There are simple indicators for DUT lock status and that the test results are valid.

Embedded diagnostic hardware provides the information the software needs to auto-detect, lock, calibrate, acquire data, and even warn if the data is "out of character" or if more correlations are required to achieve a valid measurement. Interface highlights include:

- DUT lock status indicator, power level & frequency
- Frequency offset control
- Drag and drop markers
- Overlay imported ASCII data
- Auto-scale graph, quick cursor zoom or manual set
- Data saves in both CSV (delimited) and PDF image file
- Touch-screen optimized GUI
- User-defined test limits with pass/fail flagging (see ***Figure 4***)

If the need for support were to arise, the HA7062A GUI maintains a detailed system log file that can be used for remote diagnostics. The user simply exports the file (ASCII format) and emails it to the factory. Real time trouble-shooting eliminates questions relative to the analyzer so that the user can be up and running as quickly as possible.

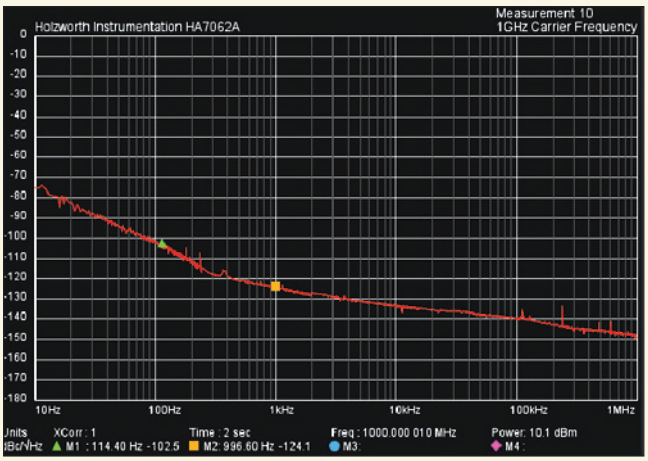

Fig. 5 Saved PDF image from HA7062A measurement.

TABLE I

PERFORMANCE PARAMETERS (TUNABLE LOs VS. EXTERNAL FIXED LOs)

Parameter	LO Configuration	
	Internal (Tunable Sources)[1]	Bypass (Fixed LO Inputs)[2]
DUT Tuning Range	5 MHz to 6.7 GHz	
Measurement Floor	< -165 dBc/Hz$^{1/2}$	<-175 dBc/Hz$^{1/2}$
Signal Acquisition Time	~100 ms	
Measurement Speed	1.4 s (1 kHz to 1 MHz) 18 s (1 Hz to 1 MHz)	
Measurement Offset	0.1 Hz to 1 MHz	

[1] Measurement Floor and Signal Acquisition Time are carrier frequency dependent.
[2] Measurement Floor and Signal Acquisition Time are dependent on performance of external LO. Example values based on 100 MHz OXCO pair (-175 dBc/Hz$^{1/2}$ at 100 kHz OS).

TABLE II

HA7062A SENSITIVITY LEVELS (dBc/Hz$^{1/2}$)

RF Input Frequency	Offset Frequency						
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
10 MHz	-94	-125	-156	-160	-164	-165	-165
100 MHz	-74	-105	-136	-154	-164	-165	-165
1 GHz	-54	-85	-116	-133	-144	-149	-150
3 GHz	-44	-75	-106	-127	-135	-140	-141
6.7 GHz	-37	-68	-99	-121	-129	-134	-135

Sensitivity levels based on use of internal synthesizers. Improved levels are possible with use of external LOs.

PERFORMANCE BASICS

The HA7062A is a phase noise measurement workhorse that was designed to consistently provide clean, accurate absolute phase noise data. The standard unit has an operating range of 5 MHz to 6.7 GHz. The user can achieve improved phase noise floors with decreased measurement times by bypassing the internal synthesizers and directly accessing the cross correlation core with a matched pair of user supplied fixed LOs (see ***Table 1***).

The phase noise data shown in ***Figure 5*** is data collected from a Holzworth HSM6001A synthesizer set to a 1 GHz carrier frequency. The sensitivity of the system is dependent on both the carrier frequency of the DUT and the desired measurement offset (i.e. measurement time). ***Table 2*** demonstrates the typical sensitivity when using the internal (tunable) LO sources to make a measurement assuming an approximate 18 second measurement with an offset from 1 Hz to 1 MHz.

The HA7062A is designed to quickly and reliably measure absolute phase noise. There are other phase noise test systems available that offer some additional functionality, not to mention offering many more buttons, menus and sub-menus. The HA7062A gives users a highly reliable, dedicated phase noise analyzer at a very reasonable price. List price starting at $35,500 (US), Holzworth's HA7062A is a cost-effective phase noise analyzer that is an excellent fit for dedicated manufacturing phase noise test as well as advanced product development.

Holzworth Instrumentation,
Boulder, CO
(303) 325-3473,
www.holzworth.com.