NEW 2630 Fourier Analyzer: complete spectrum, network, and waveform analysis from dc to 20 kHz.

NEW 2630 Fourier Analyzer

TYPICAL APPLICATIONS

- **Structural Analysis**
- **Control Systems**
- **Machine Vibration**
- **Audio and Acoustic Tests**
- **General Purpose Signal and System Analysis**

BENEFITS

- **Spectrum Analysis, Network Analysis, and Waveform Recording for Complete Signal and System Analysis**
- **Easy-To-Learn User Interface Requires Minimum Operator Training**
- **Completely Programmable for Fast, Accurate, and Repeatable Production Testing**

FEATURES

- **2 or 4 Channels**
- **DC to 20 kHz Frequency Range**
- **10 kHz Realtime Bandwidth**
- **75 dB Dynamic Range**
- **Full Alias Protection**
- **Works With Any IBM PC™ or Compatible**
- **Zoom Capability (Options 2H & 3H)**
- **Programmable Source (Option 4H)**

- **Extensive Programming Library for Developing Custom Measurements and Displays (Option 2S)**

The 2630 Fourier Analyzer represents a new generation signal analyzer that links the power of high-performance dedicated signal acquisition and analysis with the value of PC mass storage and graphics. The result is a high-quality, cost-effective measurement solution for electrical, mechanical, and electromechanical applications in the DC to 20 kHz frequency range.

Measurement Power When You Need It—Where You Need It

When you run the 2630's "IP" application program, the PC and its peripherals become the display, mass storage, keyboard, and hardcopy devices of a highly integrated signal analysis system. Measurement setups are entered quickly and easily from the PC using an instrument style user interface provided by the IP program. The PC's monitor also displays the 2630's measurements results—but that's where the 2630's dependance on the PC stops. All of the data acquisition, data management, signal processing and other computationally intensive operations are reserved for the 2630's high-performance measurement and analysis hardware.
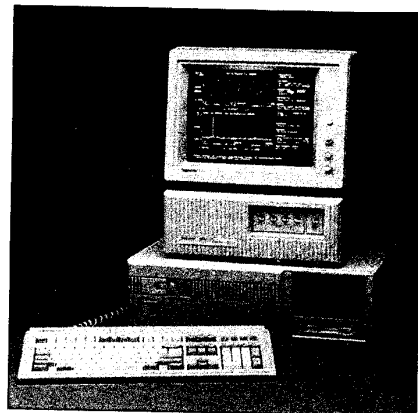
Connected to the PEP 301 System Controller, the 2630 forms a powerful signal analysis workstation.

And the 2630 is well equipped to handle the toughest measurement problems. A full 12-bit A/D in each input channel (up to 4) provides accurate waveform recording and a full 75 dB dynamic range free of spurs and distortion products. Simultaneous sampling on all channels provides accurate gain and phase data within ± 0.2 dB and ± 2 degrees. When the measurement situation requires that large amounts of data be recorded for

for later analysis, the 2630's optional parallel interface allows A/D data to be stored directly to the PC's hard disk. The data can then be played back into the 2630 at any time and analyzed using the 2630's wide variety of analysis functions.

For accurate frequency domain measurements, built-in analog and digital anti-alias filters automatically track all of the 2630's bandwidth settings from 5 Hz to 20 kHz. A selection of frame sizes from 64 to 4096 samples allow you to choose the best trade-off between acquisition time and frequency resolution for your particular application. When high frequency resolution around a specific signal is needed, the optional "zoom" feature is the solution. It allows you to focus up to 1600 spectral lines within a span as small as 10 Hz about the frequency of interest. The result is detailed analysis with a resolution of up to 0.00625 Hz!

But measurement performance also means signal processing speed and the 2630 is at the top of its class. It performs a 1024 point FFT in 28 milliseconds. Even more important, the 2630 supports that level of performance right through to the averaging process to provide a 10 kHz realtime bandwidth. That's the kind of performance typically reserved for analyzers costing two to three times more.

## Complete Time and Frequency Domain Analysis

All of the key analysis functions are built into the 2630, and are easily selectable from the on-screen display. A few menu-driven keystrokes is all it takes to apply any of the 2630's powerful built-in features. Standard analysis functions include: transfer function (frequency response), auto and cross spectra, coherence, impulse response, as well as auto and cross correlation measurements. No programming is needed.

Time-domain data can also be analyzed with the Tektronix 2630 Fourier Analyzer. Up to four graphs on the screen allows signals in all four channels to be monitored simultaneously. Triggering is easy too. Selectable threshold, slope, and hysteresis allow signals acquisitions to be triggered on a variety of waveform conditions. Triggering can also be used to capture exactly the portion of the signal desired.

Many complimentary features such as versatile display scaling, engineering units, data cursors and data labeling allow you to extract and retain important information about your data. Data and instrument setup storage to the PC's hard or floppy disks is also easy and convenient. When data is stored, complete setup information, including all display parameters, is also saved with the data. This

means when you recall the data it will be displayed just as it was when you stored it. To document your efforts, complete screen dumps with data and setup information can be sent to a plotter or dot-matrix printer.

For stimulus/response testing, the 2630 provides an optional built-in source with arbitrary function generation and playback capability. You can either choose one of the many standard stimulus signals or create the special signal you may need by either programming it directly or simply regenerating previously acquired data.
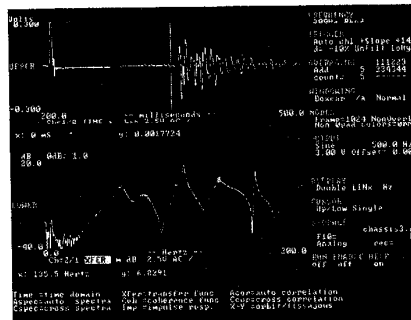
Any standard EGA™ compatible display will allow multiple waveforms to be viewed simultaneously. Here the stimulus and response waveforms (top) are displayed with the computed frequency response (bottom).

Additional Tools and Applications

While the extensive set of standard features listed above will meet most measurement and analysis requirements, more power can be added. The 2630 can be individualized to specific applications with the optional TurboPac Application Library software. This programming library allows you to obtain full control of the 2630, acquire data, and develop custom operator interfaces using Borland's efficient TurboPascal™ programming language. In addition to basic commands, TurboPac includes example application programs which can serve as building blocks for developing your own custom programs. The example programs include:

- Third octave analysis
- Spectral mapping
- System identification (curve fitting)
- Swept sine transfer function analysis
- Waveform math functions

The waveform math example application is an extremely advanced program and will generally provide a complete solution to most waveform calculation needs. This program can be used with any data file that is in the 2630's Instrument Program format, and provides the same easy operation as the 2630's operator interface, including interactive displays and

graphic output of results. Math functions include: define and modify waveforms; add, subtract, and multiply waveforms; add a constant or multiply by a constand; raise to a power; sine or cosine (real or complex); log and exp (real or complex); complex conjugation; integrate and differentiate; direct and inverse Fourier transforms; arctangent with phase unwrapping; magnitude of complex data; closed-loop to open-loop transforms; phase randomization; and group delay. The math program can be involked easily from the instrument program by using the F10 key, allowing math to access any data available in the 2630. There is even an option for sending modified waveforms to the 2630's optional arbitrary signal generator.

Open System Advantages

The 2630 uses a standard PC for general tasks such as display and mass storage. All that's needed is an IBM PC™, XT, AT, PS/2, or compatible with a serial port, one floppy drive, at least 512K RAM, and an Enhance Graphics Adapter (EGA)™ display.

The 2630 connects directly to the PC's serial port; no special interface is needed. The Instrument Program software supplied with the 2630 provides all the operating software and equips the 2630 with all the standard analysis features. No additional software is necessary.

By integrating the PC into the 2630 design, the 2630 provides an extremely flexible and cost effective measurement solution. The high quality display, keyboard and mass storage units are all components of your measurement system that can be economically upgraded as PC component technologies advance in capability and value. You can also take advantage of low-cost networking to other PCs and mainframes.
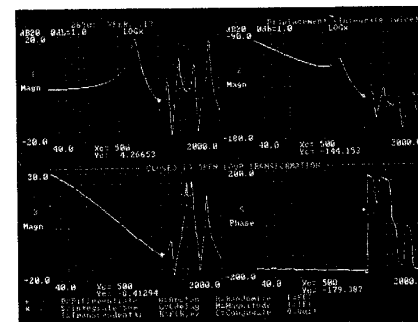
Using the example Math program provided with the optional TurboPac Application Library, waveforms can be manipulated quickly and easily. Here the upper-left acceleration trace is integrated twice to provide a displacement vs frequency trace (upper right). The lower traces represent the open-loop frequency response of a control system calculated from a closed-loop measurement.

The availability and value of complementary software to support your design, analysis, test and documentation needs further contributes to the value of your 2630 system. Borland's TurboPascal is an excellent example. When teamed with the TurboPac programming library, this consumer-priced package provides a powerful environment for the rapid development of custom analysis routines and measurement automation programs.

Another benefit of the 2630 design is that the acquisition and analysis capabilities are not limited by the performance of the PC. All of the acquisition and analysis is done in the 2630 itself, passing only interum and final results to the PC. As a result, you can access the full power of the 2630 with any properaly configured PC.

However, when using complementary software packages such as TurboPac or other application software, consider Tek's PEP 301 instrument controller.

The PEP Series provides the full power of the Intel 80386 running at 16 MHz to quickly handle even the most intensive analysis problems.

For portability, laptop computers are the way to go. The 2630 together with a laptop computer adds up to a complete system weighing less than 35 pounds. This lets your complete analysis system be carried to the field with shoulder bag convenience.

Of course, no job is complete without documentation. That's why the 2630 provides complete screen dump capabilities. All screen graphics and text, including setup information, can be copied to a dot-matrix printer or digital plotter like the Tektronix HC100 Color Plotter.

A Friendly Control Panel with Built-in Help.

The 2630 is so easy to learn that inexperienced operators will be using it in a matter of minutes. They only need to know one command, "IP". When IP is typed, the 2630's Instrument Program puts a dual-grid display on the screen (see illustration above). The 2630's entire setup and processing status is shown on the screen along with current plots. A simple single-level menu lets the operator change anything—from acquisition parameters to processing selections—by just typing the first letter of the highlighted menu item.

The built-in Help function is smart enough to supply exactly the information needed, when it's needed. It's context sensitive. There's always a Help message at the bottom of the screen to describe the current selection when you want it.
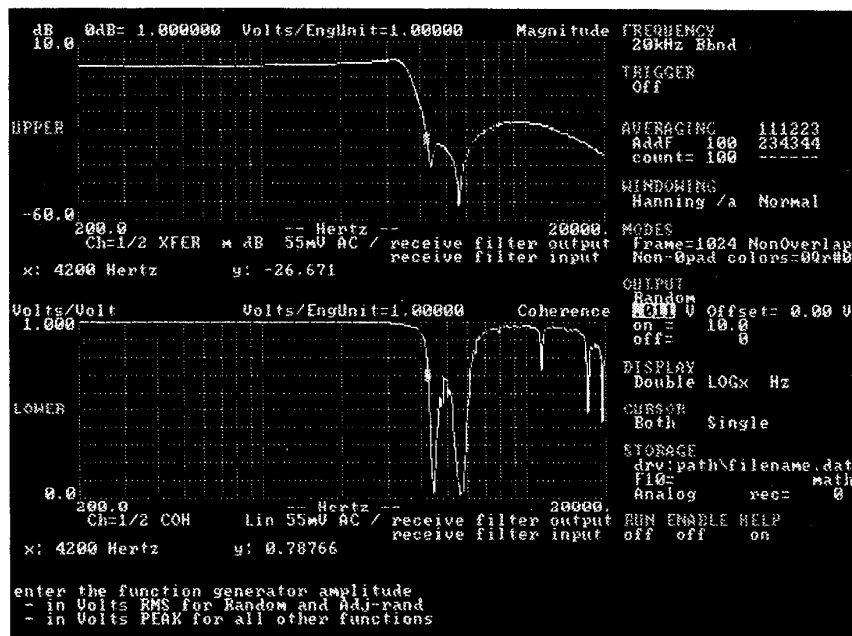
To show how easy the 2630 is to operate, a free demonstration disk is available for exploring the entire Instrument Program. A few minutes with this disk will demonstrate the 2630's capabilities and operation, without ever looking at a manual. Copies are available by calling the nearest Tektronix sales office.

CHARACTERISTICS

INPUT SUBSYSTEM
Channels—Two (four optional).
Sample Rate—51.2 kHz per channel, with simultaneous sampling on each channel.
Bandwidth—DC to 20 kHz, with 12 range selections from 5 Hz to 20 kHz in a 1,2,5 sequence.
Input Type—Differential with low side returned to chassis through 10 ohms.
Input Impedance—100 kΩ, 200 pf.
Common Mode Rejection—60 dB at 1 kHz.
Maximum Input Voltage—30 Volts continuous.
Coupling—DC or AC coupling, individually selectable or programmable for each channel.
Sensitivity—16 ranges in 3 dB steps from 55 mV to 10 V full scale, individually selectable or programmable for each channel.
Dynamic Range—>75 dB (two tone test).
Channel Matching—Gain matched within 0.2 dB, phase matched within 2 degrees.
Crosstalk—>90 dB isolation between channels.
Frequency Accuracy—Better than 0.01%.
Zoom (optional)—to 0.006 Hz resolution for any center frequency between DC and 20 kHz. Center frequency resolution is better than 1 Hz.

Antialiasing Filters—Analog elliptic filter with 20 kHz cutoff followed by TMS320-based digital filters. Provides 400 alias-free lines from a 1024-point FFT. Overall ripple $< \pm 0.2$ dB.
Autocalibration—Done by internally zeroing the input to measure amplifier DC offset and by internal connection to the optional output channel for gain calibration.
Triggering—Internal: Pre or post delay, selectable threshold, slope, and hysteresis. Trigger source may be any channel, filtered or unfiltered. External: TTL input.

CONTROL PROCESSOR
Central Processing Unit—National 32016 with NS32202 Interrupt Control Unit, NS32081 Floating Point Coprocessor, and four Direct Memory Access channels.
Memory—1 Mbyte RAM, 8 Kbyte PROM. (PROM contains diagnostics and code to download the RAM over the serial interface.)
Serial Interface-Primary (to Personal Computer): supports RS-232, 422, 423 at rates from 1.2 to 115 Kbaud. Auxiliary: supports RS-232, 422, 423 at 1.2 to 38.4 Kbaud.
Parallel Interface (optional)—16-bit parallel, with sustained transfers to disk at 100 Kbytes/sec (nominal). Speed determined by PC disk. Includes a 4096-word input FIFO and a 4096-word output FIFO.

ARRAY PROCESSOR
Central Processing Unit—Texas Instruments TMS32010.
Memory—4K×16 control store (static RAM) and 8K×16 data store (static RAM) with address sequencer.
Interface—Direct Memory Access to system bus, processor interrupts.

Functions—FFT, windowing, and auto-spectrum.

Fast Fourier Transform (FFT)—Block floating point with 80 dB dynamic range. Power-of-two frame sizes between 64 and 4096 points. Choice of 12 different windows. A 1024-point real transform with windowing takes 28 mS.

Real-Time Rate—10 kHz real-time bandwidth for single-channel measurements, including an FFT with full floating-point autospectral averaging.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	381	15
Height	147	5.8
Depth	394	15.5

Weight ≈	kg	lb
Net	7.7	17

POWER REQUIREMENTS
Line Voltage—115 or 230 V. ±10%.
Power Comsumption—>120 W.

ENVIRONMENTAL
Operating Temperature—0 to 50° C.
Electromagnetic Interference—Conforms to VDE 0871 Class B.
Shock and Vibration—Conforms to MIL-T-28800C Type 3 Class 5 Style E.

CONNECTORS AND INDICATORS
Front Panel—One output BNC connector with output channel option, up to four input BNC connectors, three LED indicators (Power, Active, Transfer).
Rear Panel—Two female 9-pin D-type connectors (serial ports),f two male 9-pin D-type connectors (external sampling, external trigger), reset switch, power switch, fuse, ISO power cable connector.

OUTPUT SUBSYSTEM OPTION
Channels—One analog output channel.
Output Functions—User-defined functions of preprogrammed sine, square, sawtooth, triangle, impulse, random, translated random, and burst psuedo random functions.
Output D/A—16-bit digital-to-analog converter with 14-bit linearity and 75 dB dynamic range.
Smoothing Filters—Analog smoothing filters with same characteristics as input subsystem antialiasing filters. Includes sin (×) /× correction.
Drive—20 mA drive capability, unconditionally stable.
Level—10 V full scale with 12-bit MDAC for level attenuation.
Output Impedance—50 ohms.
Protection—To 20 Volts continuous. Relay shorts the output under power fail conditions to protect external equipment.

MINIMUM SYSTEM REQUIREMENTS
The 2630 Fourier Analyzer operates with an IBM PC, XT, AT, PS/2 (or compatible) having the following minimum requirements:

• DOS 3.0 or higher
• 512 Kbytes of Ram
• One serial port

• Flexible diskette drive
• Intel 8087, 80287, or 80387 coprocessor
• Enhanced Graphics Adapter (EGA)
• Monochrome or color EGA monitor

ORDERING INFORMATION

When ordering the 2630 fourier Analyzer, please use the exact nomemclature given here:
2630—Fourier Analyzer with two input channels **$9,950**
Includes: Instrument Program Software and 90 days of upgrades; 2630 Users Guide (070-6910-00); System Simulator Box (020-1651-00);1 Power Cord (please specify); Serial Interface cable (please specify)

OPTIONS
Option 1B—Serial Cable for IBM PC or XT (25-pin, D-type, 020-1648-00).[1]
Option 2B—Serial Cable for IBM AT or PS/2 (9 pin, D-type, 020-1649-00).[1]
Option 1C—Soft Carrying Case 020-1646-00. **+ $125**
Option 2C—Transit Case 020-1647-00. **+ $475**
Option 1H—Two additional input channels 020-1639-00. **+ $3,000**
Option 2H—Two-channel zoom 020-1640-00. **+ $1,000**
Option 3H—Four-channel zoom (four-channel systems only) 020-1641-00. **+ $2,000**
Option 4H—One output channel 020-1642-00. **+ $2,000**
Option 5H—Parallel Interface (for high-speed disk acquisition, requires Option 25). 020-1643-00. **+ $3,000**
Option 25—PEP 301 System Controller. **+ $7,995**

SOFTWARE OPTIONS
Option 2S—TurboPac, Application Library 020-1644-00 (includes one year update service) and TurboPac Reference Guide 070-6911-00. **+ $1,100**
Option 2R—TurboPac Run-Time License for addisional 2630s 020-1652-00. **+ $250**
Option 3S—PC-Matlab (includes Control Systems Toolkit.) 020-1645-00. **+ $1,100**

INTERNATIONAL POWER PLUG OPTIONS
Option A1—Universal Euro 220 V, 50 Hz.
Option A2—UK 240 V, 50 Hz.
Option A3—Australian 240 V, 50 Hz.
Option A4—North American 240 V, 60 Hz.
Option A5—Switzerland 220 V, 50 Hz.

WARRANTY-PLUS SERVICE PLANS
1M—Plus 1 year of hardware warranty **+ $900**
1U—Plus 1 year of update service for Instrument Program Software **+ $250**
2U—Plus 1 year of update service for TurboPac Application Library Software **+ $250**

[1] *Contact your local sales representative.*

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MATRIX is a trademark of Integrated System.

Lightweight and rugged, the 2630 can be used with a portable PC to make an easily transportable system.