Model 931A
Power System Analyzer

Model 930A
Three Phase Power Analyzer

Model 929A
Three Phase Power Meter

with

PowerDSA™

Digital Signal Analysis

Model 931A shown with included accessories

Arbiter Systems®, Inc. Models 931A, 930A, and 929A, with state-of-the-art *PowerDSA*™ Digital Signal Analysis, make more measurements, more accurately, more easily, and at a lower price than ever before. Basic accuracy of 0.05% of reading and 0.05° phase, harmonic analysis, and full three-phase capability are standard on all three models. The 930A and 931A also incorporate full two-way serial communication for use in power quality trend monitoring. For complete power system analysis, the 931A also includes transducer calibration and timer features.

Portability

Thanks to the high level of integration made possible with *PowerDSA*™, our instruments are lighter, smaller, and run longer on a charge than any others in this class. Smaller than a lunchbox and weighing only 5.8 kg (12.8 lbs), you can take any of our *PowerDSA*™ instruments with you wherever you go, operate it continuously for a full eight-hour shift from its internal sealed lead-acid battery, and then recharge it completely in eight hours.

Safety

Built in a rugged, nonconductive, high-impact polyethylene case, and with all inputs isolated from instrument common by transformers, optical isolators or high-value series resistors, these instruments were designed with safety in mind. A front-panel ground terminal provides a sink for leakage currents.

Convenience

The outstanding features do not end with lightweight, measurement flexibility, or unprecedented accuracy. Many other user conveniences ease your workload.

- Bright, easy to read CCFL-backlit graphic display, with big, easy-to-read numeric results
- STORE, RECALL and LAST SETUP capability
- Built-in HELP text
- Opto-isolated serial interface (Models 931A and 930A)
- LOG DATA to internal memory (or an RS-232 printer with Models 931A and 930A), time and date tagged from the internal real-time clock

Options and Accessories

Available options include an additional 16 megabytes of internal data memory to provide storage for data logging (not available for the Model 929A), 931A Application Software, 930A Application Software, and an adjustable tilt handle/bail assembly for the transit case.

Available accessories include a 400 Amp 20:1 precision CT, mounting brackets to provide for mounting of CTs inside the cover of the transit case, a wide selection of test leads, and an RS-232 cable.

All of this, and more, is ready to help you do your job better and in less time. Put an Arbiter Systems® Model 931A, Model 930A, or Model 929A, all with *PowerDSA*™ Digital Signal Analysis, to work for you soon!

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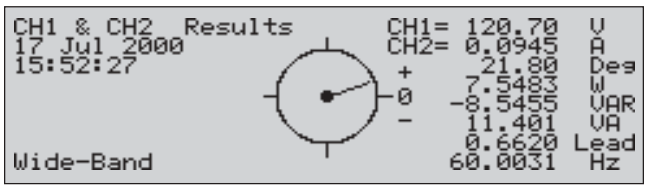
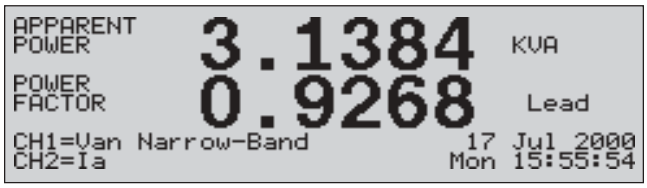
Model 931A/930A/929A

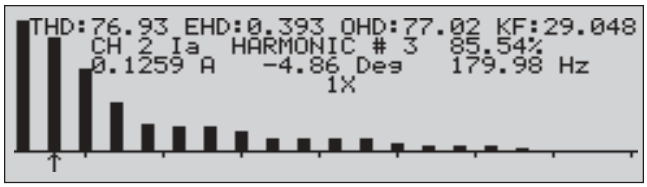
Basic Measurements



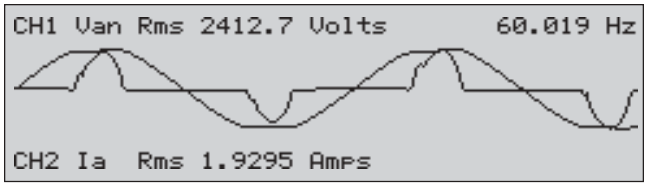
Power Quantities



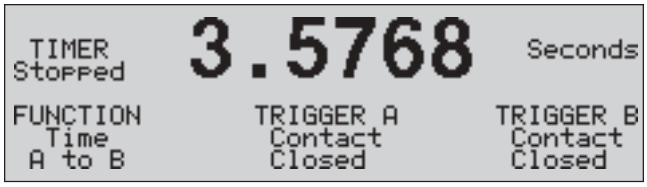
Harmonics



Waveform Display



Timer (Model 931A)



The 931A, 930A, and 929A measure all of the basic quantities: true-rms voltage and current, frequency and phase angle. *PowerDSA*™ analysis measures these quantities more accurately than ever before. Accuracy is 0.05% for voltage and current and 0.05° for phase.

The proprietary *PowerDSA*™ narrow-band mode even measures the fundamental signal alone, rejecting the effects of harmonics and noise. In wide-band mode, the effects of all harmonics and noise are included. Phase angle is always true, fundamental phase, and frequency is accurate even with large harmonics causing multiple zero crossings. Accuracy is never degraded, even with real-world signals.

The *PowerDSA*™ instruments measure power quantities, too, with accuracy unprecedented for a lightweight, portable instrument. Measurements are made in accordance with IEEE standards, including the effects of harmonics and reactive power. Watts (W), watthours (Wh), volt-amperes (VA), volt-ampere hours (VAh), volt-amperes reactive (VAR), volt-ampere reactive hours (VARh), and power factor (PF): *PowerDSA*™ analysis measures them all, with 0.11% basic accuracy.

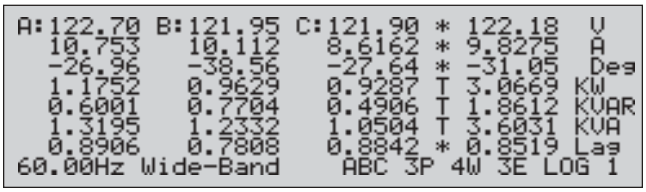
Measure harmonics and view the results graphically; as summary numbers, such as total harmonic distortion (THD), even harmonic distortion (EHD), odd harmonic distortion (OHD) or K-factor; or as individual harmonic amplitude and phase. The bandwidth extends to over 3 kHz for accurate measurement to the 50th harmonic on 50 or 60 Hz systems, now you can know for sure what is really happening on your system.

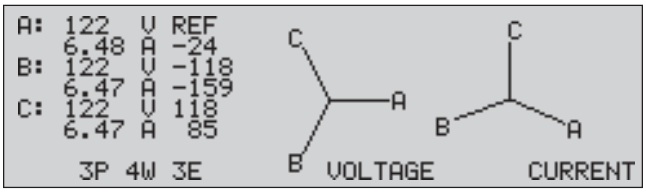
You can view the signal waveforms for both channels on the high contrast 240x64 graphic display. Both channels are normalized to Channel 1 fundamental phase, so you can see, for example, the relationship between current waveform distortions and voltage phase.

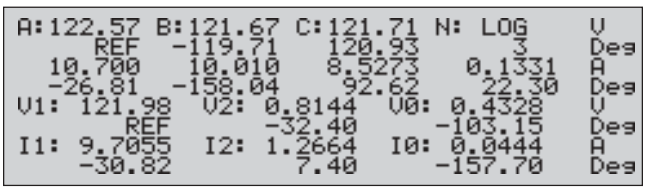
The Model 931A's timer/counter (not available on the Model 930A or Model 929A) measures relay operating times or elapsed test times, or counts input rates and events. View times in seconds or in terms of power-line cycles. Both inputs are independently opto-isolated for safety and flexibility.

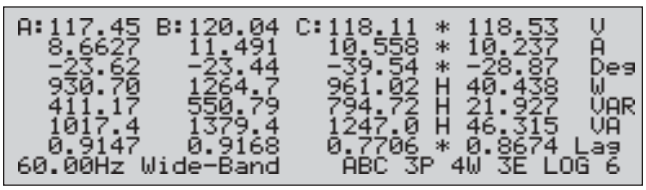
Model 931A/930A/929A

Three-Phase Measurement

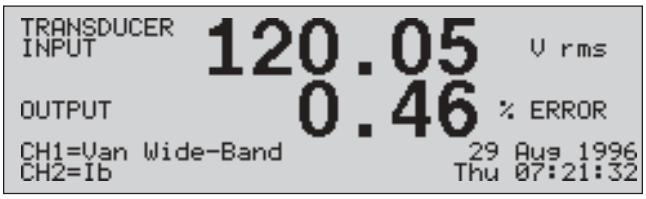








Transducer Calibration (Model 931A)



CT/PT Ratios

Extended Measurement Ranges

The Models 931A, 930A, and 929A include a full three-phase input section, for automated three-phase measurement sequences. PowerDSA™ analysis measures two signals at a time, and the results are combined into four complete three-phase displays.

You can select from the following three-phase display modes:

- Basic three-phase display
  View voltage, current, phase, frequency and power quantities on one convenient display.
- Vector display
  View voltages, currents and phase angles with their vector representation.
- Voltage/Current Sequence display
  View voltage, current and phase along with positive, negative and zero sequence values.
- Energy display
  View voltage, current, phase, frequency and energy quantities on one convenient display.

As a power trend monitor and recording system, these PowerDSA™ instruments can verify phase relation, phase rotation, power direction, load balance and positive, negative, and zero sequence of voltage and/or current as well as calibrating and verifying in-service performance of Disturbance, Fault and Transient Recorders.

The outstanding accuracy of the Model 931A with PowerDSA™ is ideal for transducer calibration. The Model 931A includes the necessary dc voltage and current measurements to accurately measure transducer outputs, using a separate opto-isolated input section. With only an external source or load box, or when making in-service measurements, the Model 931A provides complete field transducer calibration.

Correction factors for external CTs and/or PTs can be entered to display the measured results in input-side units. You can even measure ratios using the instrument's CH1/CH2 function. This example shows a nominal 200:1 (or 1000:5) current ratio; if Channel 1 is a CT burden voltage and Channel 2 CT secondary current, the result is the loop resistance in ohms.

For greater accuracy, the Model 09311A Auxiliary CT allows measurement of signals up to 400 amps with total basic accuracy of 0.1%. This CT mounts directly to the Model 931A, 930A, or 929A current input connectors and may be used for one, two or three of the current inputs, depending on your needs.

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Model 931A Specifications

Input

Basic Inputs

The Arbiter Systems®, Inc. Model 931A Power System Analyzer has two main measurement channels, Channel 1 and Channel 2. Any voltage or current input signal may be selected for either channel. For basic measurements (voltage, current, frequency, phase angle) any combination of inputs may be used. For power and energy measurements (active power, apparent power, reactive power and power factor), one voltage and one current must be selected. For three-phase measurements, the input configuration is selected automatically, based on the measurement type (for example, 3-phase 4-wire 3-element).

Voltage

Input Range	1.5 to 750 Vrms (underrange to 200 mV) 2 to 1000 Vdc[1]
Inputs	Four; A, B, C, N: Phase-to-Phase Phase-to-Neutral Phase-to-Synthesized Neutral (A+B+C)/3
Impedance	1 megohm
Leakage	< 3.5 mA per IEC348 and UL1244

Current

Input Range	0.04 to 20 Arms (underrange to < 1 mA)
Inputs	Three; A, B, C, plus synthesized neutral
Burden	0.01 ohm maximum
Isolation	Transformer, 1000 Vrms
Neutral	Synthesized, -(A+B+C)

Timer[1]

Inputs	Two; 4 to 300 Vdc; 20 to 300 Vrms; or dry contact/thyristor output
Isolation	Optical, 300 Vrms, each channel

Transducer[1]

Range	0 to 1, 0 to 100 mAdc and 0 to 10 Vdc
Protection	Overvoltage to 120 V, both inputs
Isolation	Optical, 300 Vrms

Measurements

Voltage and Current

Method	Wideband: True rms, 3 kHz Bandwidth Narrowband: Fundamental magnitude
Accuracy	0.05% of reading
Underrange	< 1% of reading, typical at 0.3 mArms
DC voltage[1]	0.1% of reading + 25 mVdc, typical

Phase Angle

Input	Channel 1 to Channel 2
Range	0 to 360° or ±180°
Accuracy	0.05°
Underrange	< 1°, typical at 0.3 mArms

Frequency

Input	Channel 1
Range	20 to 500 Hz (underrange to 5 Hz)
Accuracy	0.005% of reading

Harmonics

Input	Channel 1 or Channel 2
Range	2nd to 50th Harmonic (50 or 60 Hz fundamental)
Accuracy	5% of THD reading + 0.01%
Display	THD; K-factor; Amplitude bar graph; and individual harmonic magnitude and phase (simultaneous)

Waveform

Display	Channel 1 and/or Channel 2

Power / Energy Quantities

Range	0 to 99999 MVA or MVAh ±99999 MVAR or MVARh ±99999 MW or MWh ±1.0000 PF, lead or lag
Accuracy	0.11% of VA, for VA, VAR, and W 0.001 PF

Transducer[1]

Accuracy	0.05% of reading + 0.01% of range

[1] Model 931A only

Model 931A Specifications

Measurements (Continued)

Timer[1]

Range	0.0001 to 9999.9 seconds, or 0.01 to 999999 cycles
Accuracy AC Trigger	0.005% of reading + 1 digit Add 1 ms max., 0.15 ms at 120 Vrms

Interface

Operator Interface

Display	240x64 graphic LCD with cold-cathode fluorescent lamp (CCFL) backlight
Keyboard	21 function keys plus On/Off
Memory	EEPROM (calibration data) Battery backup RAM (setup and stored results) Real-time clock
Data	Instrument calibration data User setups (up to six) Logged data (15 to 200); time-tagged

System Interface[2]

RS-232	1200 to 115,200 baud; 7/8 data bits; 1/2 stop bits; even/odd/no parity
Isolation	Optical, 300 Vrms

Power Requirements

Internal Battery

Type	Sealed lead-acid
Operation	8 hours typical
Charge	8 hours typical; fast + float charge

External Power

Range	85 to 264 Vac, 47 to 440 Hz, 15 VA max. 110 to 250 Vdc, 15 W maximum
Safety	Designed to meet UL, CSA, VDE

General

Physical

Size	205 x 305 x 225 mm (8 x 12 x 8.75 in.) 483 x 483x 483 mm (16 x 16 x 16 in.), shipping
Weight	5.8 kg (12.8 lbs), maximum 8.2 kg (18 lbs), shipping

Environmental

Temperature	Operating: -10° to +50° C Nonoperating: -40° to +75° C
Humidity	Noncondensing

Options

Description	Order No.
16 MB Internal Data Memory	931Aopt01

Accessories

Included

Description	Order No.
Operation Manual	PD0017400
Power Cord (see page 49)	P01R-P10R
RS-232 Null Modem Cable, DB9F-DB9F, 2 m (6 ft) length	CA0019806
Safety Ground Lead	812H

Available

Description	Order No.
400 Amp 20:1 Precision CT, 0.1% Accuracy	09311A
400 Amp CT Bracket (each)	AS0036000
100:1 Clamp-on CT, 100 Amp	AP0009800
931A Application Software: PowerCSV	AS0060000
Adjustable Tilt Handle/Bail Assembly	AS0035901
3-Phase Safety Voltage Lead Set	813AT
3-Phase Spade-Lug Current Lead Set	816AT
3-Phase Univ. Test Plug Current Lead Set	811AT
1-Phase Clamp-On CT Test Lead	AS0060100

Additional Test Leads are described starting on page 60.

[1] Model 931A only

[2] Models 931A and 930A only

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Model 930A Specifications

The Arbiter Systems®, Inc. Model 930A Three Phase Power Analyzer is an economical alternative to the Model 931A Power System Analyzer when the dc voltage measurement, transducer calibration and timer features are not required. The Model 930A has the same ac accuracy as the Model 931A with PowerDSA™ Digital Signal Analysis. The Model 930A with serial communication capability and available application software, in conjunction with a laptop computer, is a valuable tool for use in power quality trend monitoring, as well as being a complete diagnostic tool for use in the substation and industrial power environment.

Options

Description	Order No.
16 MB Internal Data Memory	930Aopt01

Accessories

Included

Description	Order No.
Operation Manual	PD0024400
Power Cord (see below)	P01R-P10R
RS-232 Null Modem Cable, DB9F-DB9F, 2 m (6 ft) length	CA0019806
Safety Ground Lead	812H

Available

Description	Order No.
400 Amp 20:1 Precision CT, 0.1% Accuracy	09311A
400 Amp CT Bracket (each)	AS0036000
100:1 Clamp-on CT, 100 Amp	AP0009800
930A Application Software: PowerCSV	AS0060000
Adjustable Tilt Handle/Bail Assembly	AS0035901
3-Phase Safety Voltage Lead Set	813AT
3-Phase Spade-Lug Current Lead Set	816AT
3-Phase Univ. Test Plug Current Lead Set	811AT
1-Phase Clamp-On CT Test Lead	AS0060100

Additional Test Leads are described starting on page 60.

Model 929A Specifications

The Arbiter Systems®,Inc. Model 929A Three Phase Power Meter is an economical alternative to both the Model 931A Power System Analyzer and the Model 930A Three Phase Power Analyzer when serial communication, dc voltage measurement, transducer calibration and timer features are not required. The Model 929A has the same ac accuracy as the Model 931A with PowerDSA™ Digital Signal Analysis, and is a complete diagnostic tool for use in the substation and industrial power environment.

Accessories

Included

Description	Order No.
Operation Manual	PD0024400
Power Cord (see below)	P01R-P10R
Safety Ground Lead	812H

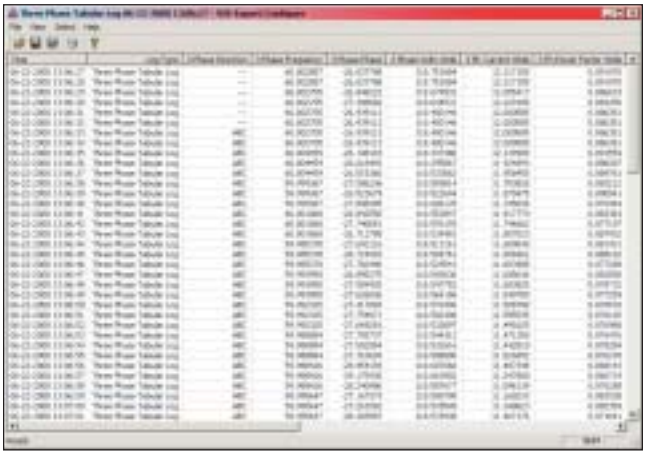
Available

Description	Order No.
400 Amp 20:1 Precision CT, 0.1% Accuracy	09311A
400 Amp CT Bracket (each)	AS0036000
100:1 Clamp-on CT, 100 Amp	AP0009800
Adjustable Tilt Handle/Bail Assembly	AS0035901
3-Phase Safety Voltage Lead Set	813AT
3-Phase Spade-Lug Current Lead Set	816AT
3-Phase Univ. Test Plug Current Lead Set	811AT
1-Phase Clamp-On CT Test Lead	AS0060100

Right Angle Power Cord styles:

No.	Country	Specification	Rating
P01R	Cont Europe	CEE7/7	220V
P02R	Aust/NZ/PRC	AS 3112-1981	240V
P03R	U.K.	BS 1363	240V
P04R	Denmark	Afsnit 107-2-01	240V
P05R	India	BS 546	220V
P06R	Israel	SI 32	220V
P07R	Italy	CEI 23-16-VII 1971	220V
P08R	Switzerland	SEV 1011.1959	220V
P09R	N America and ROC	NEMA 5-15P CSA C22.2 #42	120V
P10R	Japan	JIS8303	120V

POWERCSV SOFTWARE



Enhance the performance of your Model 931A Power System Analyzer or Model 930A Three Phase Power Analyzer with the new PowerCSV software (order number AS0060000). The PowerCSV software allows a computer, via the serial port, to import and view data from the extended memory of the Models 931A and 930A. The PowerCSV also has the ability to export a comma-delineated file of the data for easy viewing in any spreadsheet program.

Requires that the Optional 16 MB of Internal Data Memory is installed.

The PowerCSV software is available on our web site: "http://www.arbiter.com".

16 MB Internal Data Memory

Add another useful feature to the Models 931A and 930A with the 16 MB Internal Data Memory option (order number 931Aopt01 and 930Aopt01). The 16 MB of storage space can turn the Models 931A and 930A into stand alone Trend Monitors. The characteristic flexibility of the Model 931A Power System Analyzer and the Model 930A Three Phase Power Analyzer is incorporated into the 16 MB Internal Data Memory options allowing for custom and user friendly configuration.

When equipped with the Extended Memory option, the 931A and 930A can be configured to log data at a set interval, on a valid timer trigger (Model 931A only), when the front panel log key is pressed or via the RS-232 LOG command. Two different types of data sets are available for storage, normal and custom. Normal data sets include four data modes:

- Standard data, Narrow-Band and Wide-Band parameters for Channel 1 and Channel 2 along with Timer (Model 931A only) and Transducer (Model 931A only) parameters
- Harmonic data, adds the harmonic information from Channel 1 and Channel 2 to the standard data record
- Waveform data, includes standard data, harmonic data, plus the waveform records for Channel 1 and Channel 2
- Three-phase data, the three-phase measurement data for the selected three-phase display mode

The Custom data set allows the user to select any combination of the thirty available individual parameters to log. Record size is dependent on the selected parameters.

The logged data can be reviewed from the front panel of the Models 931A and 930A or downloaded via the RS-232 port to a computer. Exported data can be easily incorporated into a spreadsheet or word processor for inclusion into reports. The PowerCSV Application Software is a useful tool to transfer the data stored in the internal memory to a computer.

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