

## Model 931A Power System Analyzer

with

*PowerDSA™*

**Digital Signal Analysis**



Model 931A shown with included accessories

Arbiter Systems®, Inc. Model 931A, with state-of-the-art *PowerDSA™* Digital Signal Analysis, makes more measurements, more accurately, more easily, and at a lower price than ever before. Basic accuracy is 0.05% of reading and 0.05° phase, harmonic analysis, and full three-phase capability are standard. The 931A also incorporates 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
- LOG DATA to internal memory (or an RS-232 printer), time and date tagged from the internal real-time clock

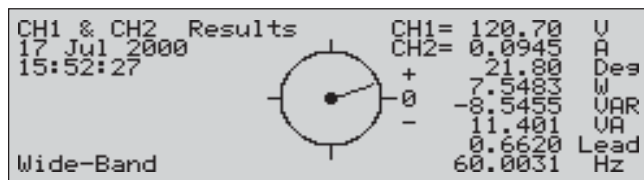
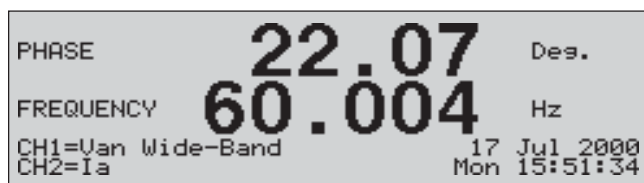
### Accessories

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, an adjustable tilt handle/bail assembly for the transit case, and an RS-232 cable.

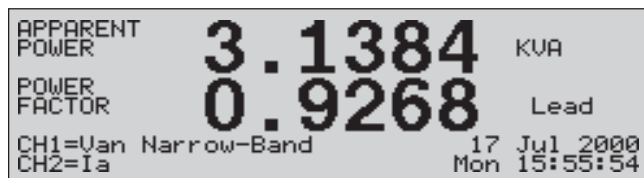
All of this, and more, is ready to help you do your job better and in less time. Put an Arbiter Systems® Model 931A with *PowerDSA™* Digital Signal Analysis, to work for you soon!

## Model 931A

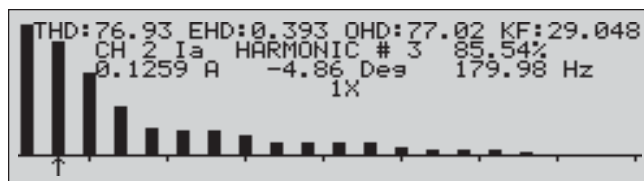
### Basic Measurements



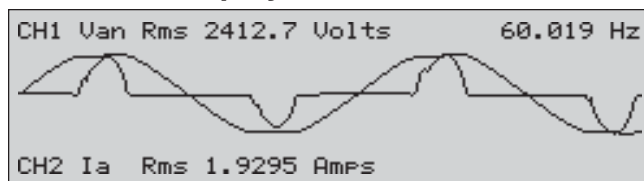
### Power Quantities



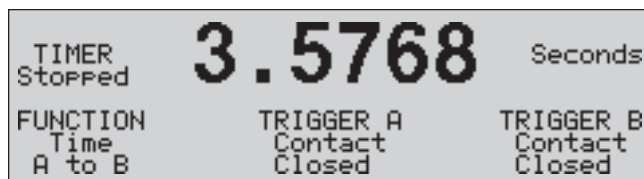
### Harmonics



### Waveform Display



### Timer



The 931A measures 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 50<sup>th</sup> 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 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

### Three-Phase Measurement

```

A:122.70 B:121.95 C:121.90 * 122.18 U
10.753 10.112 8.6162 * 9.8275 A
-26.96 -38.56 -27.64 * -31.05 Des
1.1752 0.9629 0.9287 T 3.0669 KW
0.6001 0.7704 0.4906 T 1.8612 KUVR
1.3195 1.2332 1.0504 T 3.6031 KVA
0.8906 0.7808 0.8842 * 0.8519 Lag
60.00Hz Wide-Band ABC 3P 4W 3E LOG 1

```

```

A: 122 U REF C
6.48 A -24
B: 122 U -118
6.47 A -159
C: 122 U 118
6.47 A 85
3P 4W 3E B VOLTAGE C CURRENT

```

```

A:122.57 B:121.67 C:121.71 N: LOG U
REF -119.71 120.93 3
10.700 10.010 8.5273 0.1331 A
-26.81 -158.04 92.62 22.30 Des
U1: 121.98 U2: 0.8144 U0: 0.4328 U
REF -32.40 -103.15 Des
I1: 9.7055 I2: 1.2664 I0: 0.0444 A
-30.82 7.40 -157.70 Des

```

```

A:117.45 B:120.04 C:118.11 * 118.53 U
8.6627 11.491 10.558 * 10.237 A
-23.62 -23.44 -39.54 * -28.87 Des
930.70 1264.7 961.02 H 40.438 W
411.17 550.79 794.72 H 21.927 UVR
1017.4 1379.4 1247.0 H 46.315 VU
0.9147 0.9168 0.7706 * 0.8674 Lag
60.00Hz Wide-Band ABC 3P 4W 3E LOG 6

```

### Transducer Calibration

```

TRANSDUCER INPUT 120.05 U rms
OUTPUT 0.46 % ERROR
CH1=Van Wide-Band 29 Aug 1996
CH2=Ib Thu 07:21:32

```

### CT/PT Ratios

```

CH1/CH2 201.15 P/U
PHASE 0.38 Des
CH1=Ia Wide-Band 25 Aug 1996
CH2=Ib Sun 13:11:40

```

### Extended Measurement Ranges

```

ACTIVE POWER 207.53 KWatt
REACTIVE POWER 119.85 KVar
CH1=Van Wide-Band 29 Aug 1996
CH2=Ia Thu 09:14:42

```

The Model 931A includes 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 current input connectors and may be used for one, two or three of the current inputs, depending on your needs.

## 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
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<sup>1</sup>

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

#### Transducer

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

#### Waveform

Display	Channel 1 and/or Channel 2
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#### 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

Accuracy	0.05% of reading + 0.01% of range
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## Model 931A Specifications

### Measurements (Continued)

#### Timer

Range	0.0001 to 9999.9 seconds, or 0.01 to 999999 cycles
Accuracy	0.005% of reading + 1 digit
AC Trigger	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

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	Nickel-Metal Hydride, NiMH
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 483 x 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

### Accessories

#### Included

Description	Order No.
Operation Manual	PD0017400
Power Cord	P01R-P10R
RS-232 Null Modem Cable, DB9F-DB9F, 2 m (6 ft) length	CA0019806
Safety Ground Lead	812HC-8

#### Available

Description	Order No.
400 Amp 20:1 Precision CT, 0.1% Accuracy	09311A
400 Amp CT Bracket (each)	AS0036000
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	817AA
3-Phase Clamp-On CT Test Lead Set	817AT
3-Phase Safety C-Hook Current Lead Set	818AT

Additional Test Leads are available. Contact factory.