

示波器校正装置

BK-1400 Oscilloscope Calibrator

William 05-12-2018

最近(04-10-2018)在 Essex 的 White Elephant 古董店买到一台 BK PRECISION 1400 Oscilloscope Calibrator (\$19)。见下图。



Fig. 1 BK-1400

在网上找到了 BK-1400 Instruction Manual 和具体的线路图. 指标如下:

The Heathkit Model IG-4244 Precision Oscilloscope Calibrator is an accurate, crystal-controlled, fast-rise time square wave generator. It provides you with the accurate time and amplitude signals you need to calibrate Heathkit Oscilloscopes, as well as most other oscilloscopes.

The time (or period) signals (.5 s to 10 ns) are the fast-rise (less than 1 ns) square waves you need to adjust oscilloscope sweep speeds, delay line terminations, and high frequency compensation. A terminated output cable prevents ringing and assures a good frequency response of the time signal.

The accurate voltage signals (1 mV to 100 V) are used for oscilloscope vertical calibration and attenuator compensation. The sine wave signal (approximately 1 V @ 1kHz) is used to adjust trigger circuits.

The Calibrator also serves equally well as a bench standard. It can be used to calibrate other test equipment or as a signal source when you build or test experimental circuits.

BK PRECISION 1400 Oscilloscope Calibrator 的前身是 Heathkit Model IG-4244 Precision Oscilloscope Calibrator. Heathkit 当时提供很多低价半成品供用户自行装配, 所以在 Instruction Manual 中有完备的装配图. 面板开关如下图.

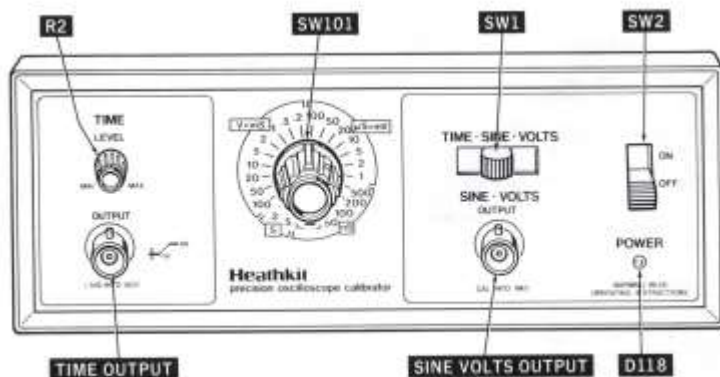


Fig. 2 BK-1400

I. BK-1400 输出信号:

- 1) Time Signal - (Square Wave) 0.5s to 10ns
用于校正水平扫描的速度, 延迟扫描期以及垂直放大器高频补偿.
 - . SW1 at TIME
 - . SW101 selects time base
 - . Signal out - TIME OUTPUT
- 2) Accurate Voltage signal (Square Wave) - 1mv to 100v
用于校正垂直放大器 V/DIV
 - . SW1 at VOLTS
 - . SW101 selects output voltage
 - . Signal out - SINE VOLTS OUTPUT
- 3) Sine Wave (1v @ 1KHz)
用于校正水平扫描的触发电路.
 - . SW1 at SINE
 - . SW101 at any position
 - . Signal out - SINE VOLTS OUTPUT

II. 测试 BK-1400 本身的精确度

1. 测试 BK-1400 的 Time Signal

测试用仪器:

- 1) FLUKE 87 **True RMS Multimeter.**
- 2) HP-8046B Signal Generator 高精度高频信号发生器. 见下图.



Fig. 3 FLUKE 87



Fig. 4 HP-8046B Signal Generator

2. 测试结果见表 2-1 所示. 应该说 BK-1400 的精度不错, 各挡都在 0.01% 上下, 可以作校正仪器使用.

表 2-1

	Time Signal	Expected	FLUKE 87	HP-8046B
1	10ms	100Hz	100.0	100.0
2	5ms	200Hz	200.0	200.0
3	2ms	500Hz	500.0	500.0
4	1ms	1KHz	1,000.1	1000.0
5	500 μ s	2KHz	2,000.0	
6	200 μ s	50KHz	5,000.0	
7	100 μ s	10KHz	10,001	Out of Range
8	50 μ s	20KHz	20,000	Out of Range
9	20 μ s	50KHz	50,000	
10	10 μ s	100KHz	100,100	
11	5 μ s	200KHz	200,000	
12	2 μ s	500KHz		
13	1 μ s	1MHz		
14	500ns	2MHz		
15	200ns	5MHz		
16	100ns	10MHz		
17	10ns	100MHz		

III. 用 BK-1400 校正示波器 Tek-453 (50MHz)



Fig. 5 Tek-453

1. 校正 Tek-453 Sweep A(扫描时基 A)

BK-1400 的 Time Signal 输出与示波器 Ch1 的输入连接须注意必要用带 50 欧姆终端阻抗的电缆. 见下图.

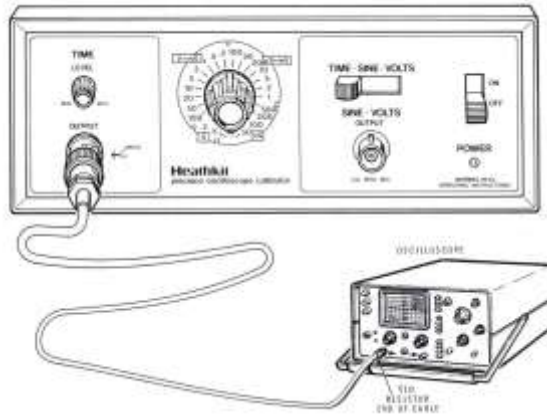


Fig. 6 BK-1400 接 Tek-453

校正設置

- 1) 用帶 50 欧姆終端阻抗的電纜連接 BK-1400 的 Time Signal 輸出到示波器 Ch1 輸入.
- 2) BK-1400 的 Time Signal 設為 1ms
- 3) Tek-453 示波器面板各開關設置如下圖.



Fig. 7 Tek-453 示波器面板各開關設置

校正步骤

- 1) 校正 扫描时基 A x 1, 调节 R835
- 2) 校正 扫描时基 A x 10, 调节 R845
- 3) 用 HP-8046B Signal Generator 信号发生器产生 1000KC 信号

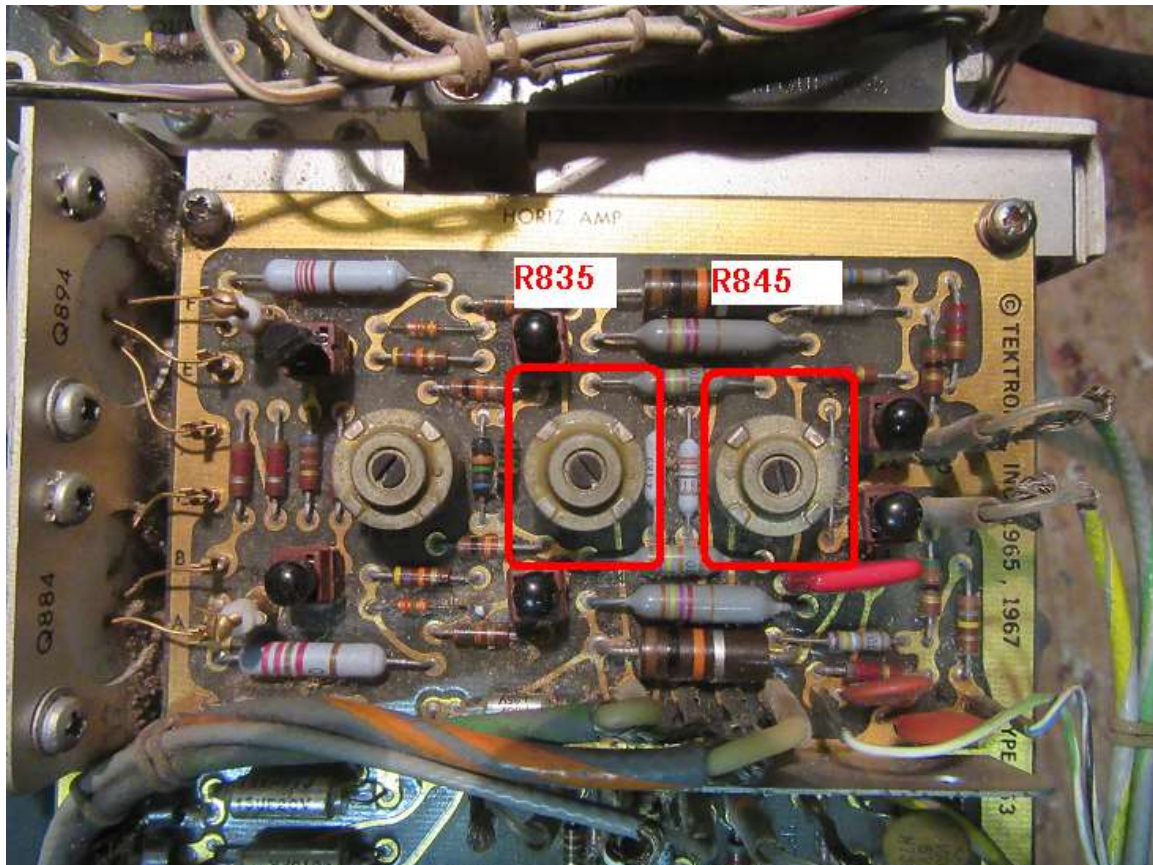


Fig. 8 校正 Tek-453 Sweep A 扫描时基 调节 R835 & R845

NEW Use the IG-4244 Precision Oscilloscope Calibrator to accurately calibrate oscilloscopes

\$149.95

- Crystal-controlled oscillators for precise time signals
- Square wave output with less than 1 nanosecond rise time
- Accurate voltage signals plus sine wave signal output
- Doubles as a bench standard or experimental signal source

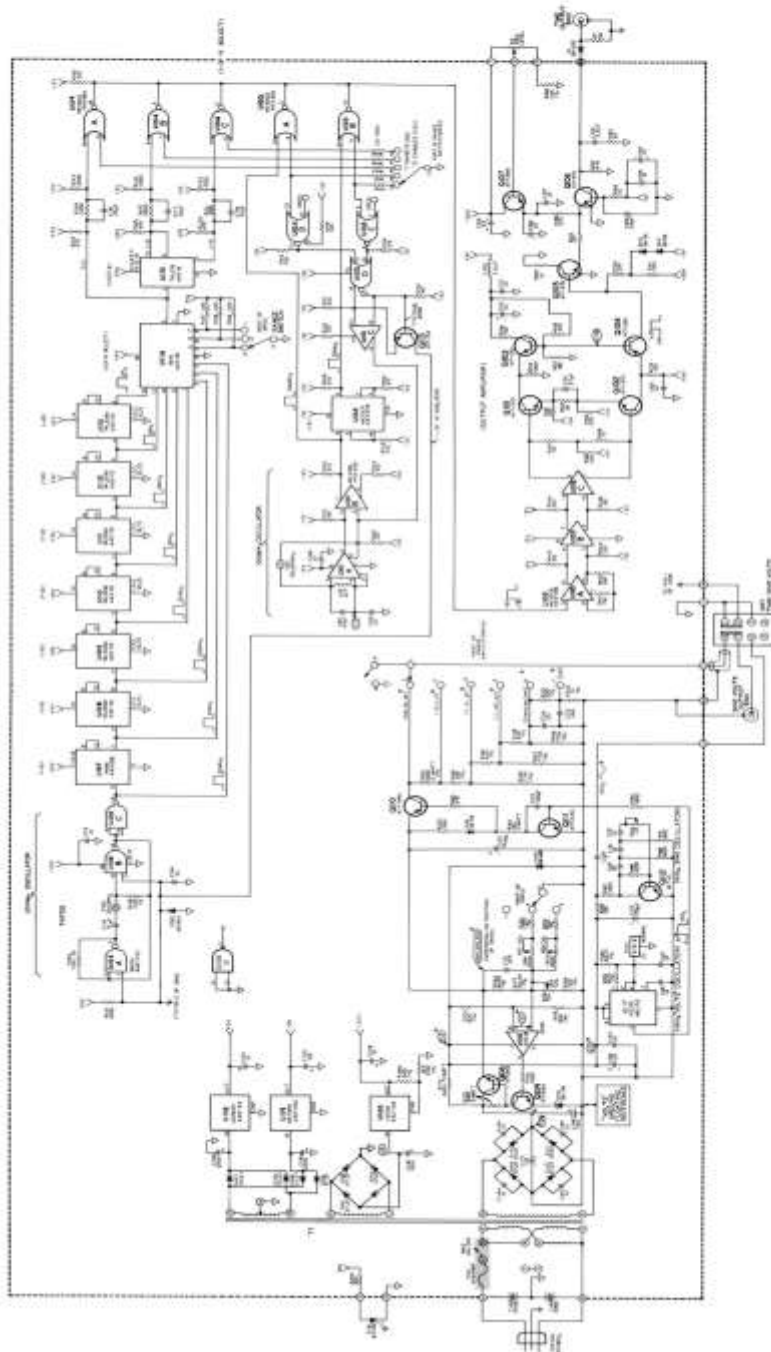
Precise time signals: The IG-4244 uses two crystal-controlled oscillators to generate square waves from 0.5 s to 10 ns with an accuracy of 0.015%. Because the leading edge of its square waves has less than a 1 ns rise time and less than 2% or 10 mV aberration (whichever is greater), the IG-4244 is exceptionally equipped for calibrating scopes above 100 MHz.

Accurate amplitude signals: For vertical scope calibrations and attenuator compensation adjustments, the Calibrator has an accurate and wide range of output voltages. In a 1-2-5 sequence, a 1 kHz square wave output is available from 1 mV to 300 V peak and are accurate to within 1% into a 1 megohm load.

Kit IG-4244, Shpg. wt. 6 lbs. 149.95
SG-4244, Assembled and tested, Shpg. wt. 6 lbs. 249.95

IG-4244 SPECIFICATIONS: Time Range: 0.5 s to 20 ns. Amplitude: 0.5 s to 20 ns, 300 mV to 1 V peak, 10 mV, 100 mV to 0.5 V peak. Rise Time: <1 ns. Leading Edge Aberration: <2% of peak to peak amplitude or 10 mV, whichever is greater. Output Impedance: 50 ohms, matching. Voltage Range: 1 mV to 300 V peak in a 1-2-5 sequence. Accuracy: $\pm 1\%$. Rise Time: <1 ns. Frequency: Approx. 1 kHz. Sine Wave Frequency: Approx. 1 kHz. Amplitude: Approx. 1 V P-P. Power Requirements: 120-240 VAC, 70-60 Hz, 25 watts maximum. Dimensions: 3" H x 7 1/2" W x 10 1/2" D.

Fig. 9 1983 Catalog AD



SCHEMATIC OF THE HEATKIT PRECISION OSCILLOSCOPE CALIBRATOR MODEL IC-4344

- NOTES:
1. VOLTAGE VALUES ARE IN RMS UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITOR VALUES ARE IN μ UNLESS OTHERWISE SPECIFIED.
 3. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
 4. CURRENT COMPONENTS ARE IN THE TOLERANCE RANGE.
 5. 100 OHMS ARE TO BE USED IN THE TOLERANCE RANGE.
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Part of Kit 2500000