Eico 950B - precision caps?

Author	Message
Roy J. Tellason Member Joined: 07 Mar 2014 14:26 Posts: 238 Location: Palmyra / Doylesburg PA	**Post subject:** Eico 950B - precision caps? **Posted:** 22 Sep 2015 16:35 I have a recently-acquired Eico 950B that I'm preparing to re-cap, and I'm wondering about those "precision" caps in there. I'm also preparing an order for Mouser for some other stuff (that thermistor for the Predicta I mention in another thread for example) and so Mouser part numbers would be ideal, if you got 'em. I haven't looked to see how those things are marked yet. But figured maybe some of you guys would have this info handy... REPORT Top PROFILE PM EMAIL QUOTE
Alan Douglas Member Joined: 31 Dec 1969 17:00 Posts: 30698 Location: Pocasset, Cape Cod, MA	**Post subject:** Re: Eico 950B - precision caps? **Posted:** 22 Sep 2015 17:16 I remember this was discussed in some detail six months or a year ago. You might try a search and see if you can find it, though there have been lots of threads on the 950B that wouldn't be relevant. It's somewhat like looking for a needle in a haystack, except I guarantee there is actually a needle there. REPORT Top PROFILE PM QUOTE
Jim Mueller Member  Joined: 15 Sep 2013 18:42 Posts: 3355 Location: Tucson, Arizona U.S.A.	**Post subject:** Re: Eico 950B - precision caps? **Posted:** 22 Sep 2015 17:54 The ones in mine looked like ordinary paper capacitors. Perhaps they were selected to make them "precision". For mine, I tested a selection of mylar capacitors with my DMM and used ones that were within 1%. You could also pick a capacitor that tested low and parallel it with a smaller capacitor to bring it within 1%. Or, you could just buy 1% capacitors. If you get all the parts within tolerance, the 950B is remarkably accurate for what it is. Jim Mueller _____ Jim Mueller REPORT

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Leigh

Post subject: Re: Eico 950B - precision caps?

Posted: 22 Sep 2015 18:09

Member

Joined: 31 Dec 1969 17:00
Posts: 34387
Location: Maryland 20709, USA

There are three "precision" caps in the 950B with values of 2mfd, 0.02mfd, and 0.0002mfd (200pfd).

Back when this was new they matched the various caps as close as they could.

They're only "precision" in the sense that they're matched in their significant digits.
For example, they may all be multiples of 2.00 or 1.98 or 2.01 or some such.

The actual value is not significant. The goal is to have the same error in the same direction for all three.
So they can be +3% or -1.5% or whatever, as long as that percentage is the same for all three.

If the percentage error was the same for all three, all the ranges could be brought to 0 error with one adjustment.

If I were doing one now, I would order 1% or tighter capacitors.

- Leigh

_____

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REPORT

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easyrider8

Post subject: Re: Eico 950B - precision caps?

Posted: 22 Sep 2015 20:22

Member

Joined: 31 Dec 1969 17:00
Posts: 12549
Location: Mpls, Minnesota

> **Leigh wrote:**
>
> The actual value is not significant. The goal is to have the same error in the same direction for all three.
> So they can be +3% or -1.5% or whatever, as long as that percentage is the same for all three.
>
> If the percentage error was the same for all three, all the ranges could be brought to 0 error with one adjustment.
>
> If I were doing one now, I would order 1% or tighter capacitors.
>
> - Leigh

In order to get the dial calibration correct the resistors in the bridge circuit must match the capacitors error value. If all the capacitors were +3% the resistors have to be +3%.

Just order 1% for the caps and the bridge resistors and call it a day.

Dave

REPORT

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Chris108

Member

Joined: 19 Jun 2009 10:34
Posts: 8593
Location: Long Island

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 04:02

Note that the Eico uses nominal 2.0-uF, 0.02-uF, and 200-pF caps which were commonly available when it was made. Those values are not so common any more, having been superceded by the E-series numbers like 2.2-uF, 0.022-uF, etc. The bridge will be a real pain to calibrate if you substitute modern value caps, even if they are all selected to be exact multiples.

So what to do is put two smaller caps together to replicate the original values, eg. two 0.01's in parallel to make 0.02, and so forth.

"Hell, there are no rules here--we're trying to accomplish something!"

Thomas A. Edison

REPORT

Top PROFILE PM EMAIL QUOTE

Alan Douglas

Member

Joined: 31 Dec 1969 17:00
Posts: 30698
Location: Pocasset, Cape Cod, MA

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 06:18

But then anybody who actually uses a 950 to measure capacitance is nuts. It's fine for leakage tests, or if you enjoy shocking yourself (positive HV is grounded, not negative. Surprise!)

REPORT

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Chris108

Member

Joined: 19 Jun 2009 10:34
Posts: 8593
Location: Long Island

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 07:32

Actually, the Eico 950B is like many other capacitor testers, leakage testers, and megohm meters that elevate the voltage on the negative lead instead of the positive. And even when doing R or C measurements, the test leads can be at some voltage with respect to the case, so one should not touch any bare terminals and the instrument at the same time. Shorting the leads to the case, or even just resting a metal can capacitor on top while connected can result in internal damage.

And I've been called 'nuts' before and undoubtedly will be again, but I still use similar bridges to measure capacitors. Small digital capacitance meters are notorious for rolling capacity, leakage, and ESR into one wrong number from which you cannot tell if an electrolytic just has a wide tolerance but is otherwise perfectly good, or if it has a serious defect. And one can buy a truckload of Eico 950s or similar bridges for the price of one used digital LCR bench meter that can separate ESR from capacitance and measure leakage at high voltages.

"Hell, there are no rules here--we're trying to accomplish something!"

Thomas A. Edison

REPORT

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Leigh

Member

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 08:38

Joined: 31 Dec 1969 17:00
Posts: 34387
Location: Maryland 20709, USA

> **Chris108 wrote:**
>
> ...I still use similar bridges to measure capacitors.
> Small digital capacitance meters are notorious for rolling capacity, leakage, and ESR into one wrong number from which you cannot tell if an electrolytic just has a wide tolerance but is otherwise perfectly good, or if it has a serious defect.

Yep... what he said ^ ^ ^

I use an ESI or GR bridge when I want an accurate reading.

My HP 4271B is good for small caps that I know are not leaky, like ceramic.

- Leigh

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REPORT

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Roy J. Tellason

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 09:18

Member

Joined: 07 Mar 2014 14:26
Posts: 238
Location: Palmyra / Doylesburg PA

For capacitance measurement I have an older B&K unit (the autoranging one with LCD, and in retrospect I think I'd have preferred the manually-ranged unit with LEDs), a much newer L/C tester out of China that seems to work better, and a Blue ESR meter. I've wanted something for a while to test leakage at full working voltage on older parts, so this will be my primary use for this unit.

I'm hoping that with new electrolytics in there the eye tube will get a bit brighter.

REPORT

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Alan Douglas

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 11:36

Member

Joined: 31 Dec 1969 17:00
Posts: 30698
Location: Pocasset, Cape Cod, MA

> **Quote:**
>
> Small digital capacitance meters used to be notorious for rolling capacity, leakage, and ESR into one wrong number

Fixed it for you.

I just measured a .01 orange drop polypropylene on the two hand-held digital meters on the bench. The ECG CX920A (cap ranges only) read 10.03nF, and if I shunted it with 1 megohm it read 9.77. Wow, 2.6% off. 1 megohm would be a *lot* of leakage for that size capacitor.

The Wavetek 27XT (LCR ranges) read 9.99nF, and if I shunted it with 10k (!) it read 9.66.

REPORT

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Jim Mueller

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 17:39

Member

Joined: 15 Sep 2013 18:42
Posts: 3355
Location: Tucson, Arizona U.S.A.

> **Leigh wrote:**
>
> There are three "precision" caps in the 950B with values of 2mfd, 0.02mfd, and 0.0002mfd (200pfd).
>
> Back when this was new they matched the various caps as close as they could.
>
> They're only "precision" in the sense that they're matched in their significant digits.
> For example, they may all be multiples of 2.00 or 1.98 or 2.01 or some such.
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> The actual value is not significant. The goal is to have the same error in the same direction for all three.
> So they can be +3% or -1.5% or whatever, as long as that percentage is the same for all three.
>
> If the percentage error was the same for all three, all the ranges could be brought to 0 error with one adjustment.
>
> - Leigh

That's not correct. The instrument is calibrated using a precision resistor, so in order for the ratio argument to be correct, the capacitors need to be matched to each other and to the resistors. If you want it to be accurate on all ranges, the capacitors need to be within their absolute tolerance, not just a ratio tolerance, unless you want a really big matching job.

> **Quote:**
>
> But then anybody who actually uses a 950 to measure capacitance is nuts.

Also not true. Most people don't have laboratory grade instruments. The 950 does a much better job of measuring small capacitors than a typical DMM, even if the capacitor isn't leaky. It's great for measuring the capacitors inside IF transformers that have silver mica disease (the failure mode is from one capacitor to the other, so each capacitor can be accurately tested individually).

Jim Mueller

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Jim Mueller

REPORT

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easyrider8

Post subject: Re: Eico 950B - precision caps?

Posted: 23 Sep 2015 18:29

Member

Joined: 31 Dec 1969 17:00
Posts: 12549
Location: Mpls, Minnesota

> **Jim Mueller wrote:**
>
> That's not correct. The instrument is calibrated using a precision resistor, so in order for the ratio argument to be correct, the capacitors need to be matched to each other and to the resistors. If you want it to be accurate on all ranges, the capacitors need to be within their absolute tolerance, not just a ratio tolerance, unless you want a really big matching job.Jim Mueller

Sorry to burst your bubble but Leigh was correct. I suggest you study up on bridge circuits.

Dave

REPORT QUOTE

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codefox

Member

Joined: 27 Nov 2010 10:15
Posts: 5449

Post subject: Re: Eico 950B - precision caps? **Posted:** 24 Sep 2015 18:09

I use the ancient Eico bridge more for curiosity about the general condition of old electrolytics than anything else. A bad one, or one that cannot be 'reformed' in a minute or two whilst setpping up voltabe shows up easily. Well, check a few sections and pieces, and at least you know what you're up against, if there is any doubt about whether to do a wholesale recap or not on a particular set. So far as pricise measurements of capacitance, modern inexpensive digital meters are an order of magnitude more accurate, but totally useless for determining patency under operating voltages.

REPORT QUOTE

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Alan Douglas

Member

Joined: 31 Dec 1969 17:00
Posts: 30698
Location: Pocasset, Cape Cod, MA

Post subject: Re: Eico 950B - precision caps? **Posted:** 24 Sep 2015 18:43

I think Jim is correct, if you want the R and C ranges to be accurate. You can slip the dial to make the C ranges come out, but then the R would be off. But, to repeat, anyone who uses a bridge to measure R is nuts too.

Neither of my hand-held cap meters is a lab instrument; both were cheap purchases at the MIT Flea, and I expect you can buy a modern Chinese equivalent for even less than I paid.

As to measuring capacitance at operating voltage, I have a bridge that will do it (Clough-Brengle military model ZM-11), I tried it, and never found any difference worth worrying about.

I have no experience measuring flaky silver micas in IF transformers.

REPORT QUOTE

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easyrider8

Member

Joined: 31 Dec 1969 17:00
Posts: 12549
Location: Mpls, Minnesota

Post subject: Re: Eico 950B - precision caps? **Posted:** 24 Sep 2015 19:47

> **Alan Douglas wrote:**
> I think Jim is correct, if you want the R and C ranges to be accurate. You can slip the dial to make the C ranges come out, but then the R would be off. But, to repeat, anyone who uses a bridge to measure R is nuts too.

What Leigh and I were saying is the capacitors and resistors must be off by the same amount in order for the dial to calibrate. What Jim said is "*the capacitors need to be within their absolute tolerance, not just a ratio tolerance, unless you want a really big matching job.*" which I disagreed with.

Dave

REPORT QUOTE

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Johnnysan

Member

Joined: 31 Dec 1969 17:00
Posts: 18544
Location: Albuquerque, NM 87123

Post subject: Re: Eico 950B - precision caps? **Posted:** 24 Sep 2015 19:58

If I remember correctly, the last two 950s I worked on had bad capacitors and I replaced the 2uf with two 1uf mylar caps (250 volt). These measured within about 2% and the accuracy was quite good afterwards. It's been my experience that most mylar caps are fairly close to their ratings, so 'precision' caps may not be needed.

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easyrider8 — **Post subject:** Re: Eico 950B - precision caps? — **Posted:** 24 Sep 2015 22:45

Member

Joined: 31 Dec 1969 17:00
Posts: 12549
Location: Mpls, Minnesota

I have a large selection of capacitors so it is pretty easy to match up a pair for the 2mfd and the .02mfd to make them perfect. The 200 pf is usually still good but if it needs replacing 1% is easy enough to find.

Dave

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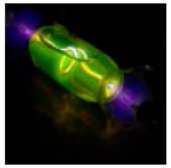
Jim Mueller — **Post subject:** Re: Eico 950B - precision caps? — **Posted:** 30 Sep 2015 22:16

Member



Joined: 15 Sep 2013 18:42
Posts: 3355
Location: Tucson, Arizona U.S.A.

Sorry to take so long to get back to this, but not everyone has time to be on ARF every day.

> Quote:
> Sorry to burst your bubble but Leigh was correct. I suggest you study up on bridge circuits.
>
> Dave

If bridge theory were the only thing involved, you would be correct. However, that isn't the problem. The issue is with the calibration procedure.

The owner's manual, which contains simplified schematics on page 8, is here: [url][/url]

The construction manual, which contains the calibration procedure on page 10, is here:
http://bama.edebris.com/download/eico/950bconst/950bconst.djvuhttp://bama.edebris.com/download/eico/950b/eico950b.djvu

As you can see from the simplified schematics in figures 1, 2, and 3, the unknown capacitor is directly compared to the standard capacitor in the bridge. If these internal capacitors were ratio matched and the bridge were calibrated using a precision capacitor and the pointer set accordingly, everything would be fine on the capacitance scales.

However, precision capacitors are not as common as precision resistors and someone restoring one of these instruments is likely to follow the calibration instructions in the manual. This brings simplified schematic figure 4 into the discussion. The calibration is done by comparing two resistors, an external one and the standard in the bridge. Therefore, if the capacitors were off value, even if they were matched to each other, the measurements taken would be off by the same amount. The only way for ratio matching to work is if the resistors were off by the same amount as the capacitors.

It is easier to just use 1% parts and be done with it. This is what I said in the first place. Selecting a group of resistors to be off by the same amount as the capacitors is a bigger job than just selecting on-value capacitors.

> Quote:
> I have no experience measuring flaky silver micas in IF transformers.

I've done it and it woks fine. Of course, this means you have to disconnect the windings inside the transformer or get the capacitor out without damaging it, but it can be done. It also means using short leads to connect it, but that applies whenever you are measuring small capacitors.

> Quote:

> There are three "precision" caps in the 950B with values of 2mfd, 0.02mfd, and 0.0002mfd (200pfd).
>
> Back when this was new they matched the various caps as close as they could.
>
> They're only "precision" in the sense that they're matched in their significant digits.
> For example, they may all be multiples of 2.00 or 1.98 or 2.01 or some such.

Do you have any documentation or other evidence that the did this? Besides the labor of doing the testing, there would also be the inventory control problem of keeping the sets together, probably by bagging them. Then there is the question of what to do with the ones that didn't match anything; 2 uF capacitors aren't used in too many tube circuits.

I think it is more likely, without any evidence, that they just had the capacitors selected by the capacitor manufacturer or a value-added distributor to be within a specified tolerance (which we also don't know). These companies would be set up for this kind of work and would have no problem with selling the "out of tolerance" parts.

Jim Mueller

_____
Jim Mueller

REPORT

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easyrider8

Member

Joined: 31 Dec 1969 17:00
Posts: 12549
Location: Mpls, Minnesota

Post subject: Re: Eico 950B - precision caps? **Posted:** 30 Sep 2015 22:42

"Jim Mueller" The only way for ratio matching to work is if the resistors were off by the same amount as the capacitors.
I think a couple of us have already expressed this

"Jim Mueller"They're only "precision" in the sense that they're matched in their significant digits.
For example, they may all be multiples of 2.00 or 1.98 or 2.01 or some such.[/quote]
Do you have any documentation or other evidence that the did this? Besides the labor of doing the testing, there would also be the inventory control problem of keeping the sets together, probably by bagging them. Then there is the question of what to do with the ones that didn't match anything; 2 uF capacitors aren't used in too many tube circuits.
This is in some of the Heathkit documentation, if I can find it I will post it.

"Jim Mueller"I think it is more likely, without any evidence, that they just had the capacitors selected by the capacitor manufacturer or a value-added distributor to be within a specified tolerance (which we also don't know). These companies would be set up for this kind of work and would have no problem with selling the "out of tolerance" parts.

I stand by what I said: If the resistors and capacitors are off by the same amount the unit will calibrate fine, I really don't see your discrepancy as you seem to agree with me.

Dave

REPORT

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