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« previous next »

Pages: 1 2 [All] Go Down REPLY NOTIFY MARK UNREAD SEND THIS TOPIC PRINT SEARCH

Author Topic: Fluke 732B repair. (Read 15421 times)

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kkayser
Contributor
Posts: 23

Fluke 732B repair.
« **on:** August 15, 2015, 04:21:49 pm »
Say Thanks Reply Quote

My 732B has a defective battery charger. It will not go into the constant current (fast) mode unless the unit has been run, on battery, for over 36 hours. Less than 36 hours, it charges on the trickle charger.

Does anyone know of any company (except Fluke) who will repair this? Fluke wants $300 to "evaluate" then they will quote a price for repair. THEN they insist on calibrating the unit for about $1100.00. So, the total price will be $1400.00 + the repair cost !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! For repairing a battery charger

Report to moderator Logged

TheElectricChicken
Frequent Contributor

Posts: 480
Country:

Re: Fluke 732B repair.
« **Reply #1 on:** August 15, 2015, 04:27:56 pm »
Say Thanks Reply Quote

Try a different lead acid battery first, beyond that you could just include some hefty switch to an external charger. Is the battery ruled out as the cause?

Report to moderator Logged

TiN
Super Contributor

Re: Fluke 732B repair.
« **Reply #2 on:** August 15, 2015, 05:16:09 pm »
Say Thanks Reply Quote

Also including your location would help people to suggest possible company around.

Report to moderator Logged

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Posts: 4045
Country:

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kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #3 on:** August 16, 2015, 03:38:19 am »
Say Thanks Reply Quote

> **Quote from: TheElectricChicken on August 15, 2015, 04:27:56 pm**
>
> Try a different lead acid battery first, beyond that you could just include some hefty switch to an external charger. Is the battery ruled out as the cause?

The old battery had the same malfunction as the new one. The new battery will run the 732B for 70 hours. The charger does charge the battery, but slowly if the battery has not run the 732b for 36 hours. Over 36 hours it works fine.

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #4 on:** August 16, 2015, 03:40:21 am »
Say Thanks Reply Quote

> **Quote from: TiN on August 15, 2015, 05:16:09 pm**
>
> Also including your location would help people to suggest possible company around.

I live in the greater Milwaukee, WI area. I have no problem shipping the unit anywhere in the lower 48.

Report to moderator Logged

TheElectricChicken
Frequent Contributor

Posts: 480
Country:

Re: Fluke 732B repair.
« **Reply #5 on:** August 16, 2015, 04:26:53 am »
Say Thanks Reply Quote

> **Quote from: kkayser on August 16, 2015, 03:38:19 am**
>
> The old battery had the same malfunction as the new one. The new battery will run the 732B for 70 hours. The charger does charge the battery, but slowly if the battery has not run the 732b for 36 hours. Over 36 hours it works fine.

By the time it has run the machine for 36 hours what state of charge is in the battery ?

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #6 on:** August 17, 2015, 09:27:58 pm »
Say Thanks Reply Quote

I don't know if you want to or if you have the necessary skills to work on the Regulator Circuit board? But if you read the "Theory of Operation" section of the 732B manual P/N 869321 Rev 3, 11/97 at the bottom of the section on how the "battery charger" works, paragraph 4-16, they tell you:

"?Constant I to Float Voltage at 14.6V
Float Voltage to Constant I at 12.0V
Any time ac power is applied, a transient is injected into comparator U501 pin 6 via C541. This results in the constant current recharge mode being enabled regardless of the battery voltage."

From your description of the problem with the circuit I would replace C541 before going any further. This forces the supply to go into the constant current mode whenever AC power is removed and then reconnected. If the battery is fully charged it will go from constant I to constant V within a few seconds. My guess is that this capacitor has lost it's capacitance or is open. If the LM 339 comparator U501 was bad the whole circuit would never work correctly. As you can see the battery voltage has to drop to below about 12 volts before the supply goes into the constant I mode which fits with you observation of it taking about 36 hours to get into that state. This battery takes quite a long time to drop to below 12 volts and 36 hours would seem about correct.
Good Luck!

Bill

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #7 on:** August 18, 2015, 02:33:36 pm »
Say Thanks Reply Quote

By the time it has run the machine for 36 hours what state of charge is in the battery ?
[/quote]

At 36 hrs the voltage is 12.67, loaded. State of charge is approx 50%. At 12.04 volts the charge light blinks (67 hours). This battery has slightly higher MAH than the Fluke OEM. I have run the unit for 70 hours before the "in cal" light goes out.
« *Last Edit: August 18, 2015, 04:17:54 pm by kkayser* »

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #8 on:** August 18, 2015, 02:38:13 pm »
Say Thanks Reply Quote

Quote from: Bill158 on August 17, 2015, 09:27:58 pm

I don't know if you want to or if you have the necessary skills to work on the Regulator Circuit board? But if you read the "Theory of Operation" section of the 732B manual P/N 869321 Rev 3, 11/97 at the bottom of the section on how the "battery charger" works, paragraph 4-16, they tell you:

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Float Voltage to Constant I at 12.0V
Any time ac power is applied, a transient is injected into comparator U501 pin 6 via C541. This results in the constant current recharge mode being enabled regardless of the battery voltage."

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Good Luck!
Bill

That is extremely helpful. I was going to try a new comparator, but this is much easier.

Thanks

kk

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #9 on:** August 20, 2015, 01:15:01 pm »
Say Thanks Reply Quote

I could not find C541 on the board. I looked at the component layout. There it was. But, it is not on the board. Nor are U516 and C544. That part of the board is empty. The manual is dated 1997, 18 years ago. Apparently, Fluke modified the board, and I have a newer version. I'll call Fluke and see if I can get a schematic for this version.

Help would be appreciated.

Report to moderator Logged

ManateeMafia
Frequent Contributor
Posts: 719
Country:

Re: Fluke 732B repair.
« **Reply #10 on:** August 20, 2015, 02:45:44 pm »
Say Thanks Reply Quote

kkayser,

I have seen your symptoms on a 732B. It essentially won't go into the CC mode if the power is cycled. I have seen other 732B's go immediately into CC after a power bump.
Since the charger was missing some of the components from the schematic, I had guessed the CC mode may have been an added feature later on in the newer revs. I would be interested in seeing if you truly have an issue with the board.

Also, I have had to replace the regulator on the charge circuit for a 732B-7001 due to a short between the input and output terminals.

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #11 on:** August 20, 2015, 09:28:11 pm »

Say Thanks Reply Quote

> **Quote from: kkayser on August 20, 2015, 01:15:01 pm**
>
> I could not find C541 on the board. I looked at the component layout. There it was. But, it is not on the board. Nor are U516 and C544. That part of the board is empty. The manual is dated 1997, 18 years ago. Apparently, Fluke modified the board, and I have a newer version. I'll call Fluke and see if I can get a schematic for this version.
>
> Help would be appreciated.

kk:
My 732B S/N is 6785005 and my Power Supply Board A-5 is P/N 869185 rev K. I don't see anything missing on mine nor do I see a place for U516. My only assumption is that your 732B has a different A-5 board. I just don't see any Engineering Change Orders or anything else from earlier units. I would put a C-541 in, if the ends of that cap go to the right places, and see what happens. I doubt a capacitor in there can hurt anything. Why it would not be installed doesn't make sense to me, but what do I know?
Bill

Report to moderator Logged

kkayser
Contributor

Posts: 23

Re: Fluke 732B repair.
« **Reply #12 on:** August 21, 2015, 03:35:08 pm »

Say Thanks Reply Quote

> **Quote from: Bill158 on August 20, 2015, 09:28:11 pm**
>
> > **Quote from: kkayser on August 20, 2015, 01:15:01 pm**
> >
> > I could not find C541 on the board. I looked at the component layout. There it was. But, it is not on the board. Nor are U516 and C544. That part of the board is empty. The manual is dated 1997, 18 years ago. Apparently, Fluke modified the board, and I have a newer version. I'll call Fluke and see if I can get a schematic for this version.
> >
> > Help would be appreciated.
>
> kk:
> My 732B S/N is 6785005 and my Power Supply Board A-5 is P/N 869185 rev K. I don't see anything missing on mine nor do I see a place for U516. My only assumption is that your 732B has a different A-5 board. I just don't see any Engineering Change Orders or anything else from earlier units. I would put a C-541 in, if the ends of that cap go to the right places, and see what happens. I doubt a capacitor in there can hurt anything. Why it would not be installed doesn't make sense to me, but what do I know?
> Bill

I'm sorry is was unclear. There is *nothing* on that part of the board, no holes, no conductors on the back. An engineer at Fluke told me there is an upgrade on the charger. My serial is lower than yours, 5535205. So, it looks like my unit was made before the upgrade. If I can get the upgrade specs, I can probably do it myself. Since the P/N of yours is Rev. K. Is the "K" printed in yellow? My board has nothing printed after "Rev." but does have something written in black that appears to be a "C".

Many thanks for your help.

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #13 on:** August 21, 2015, 05:21:37 pm »

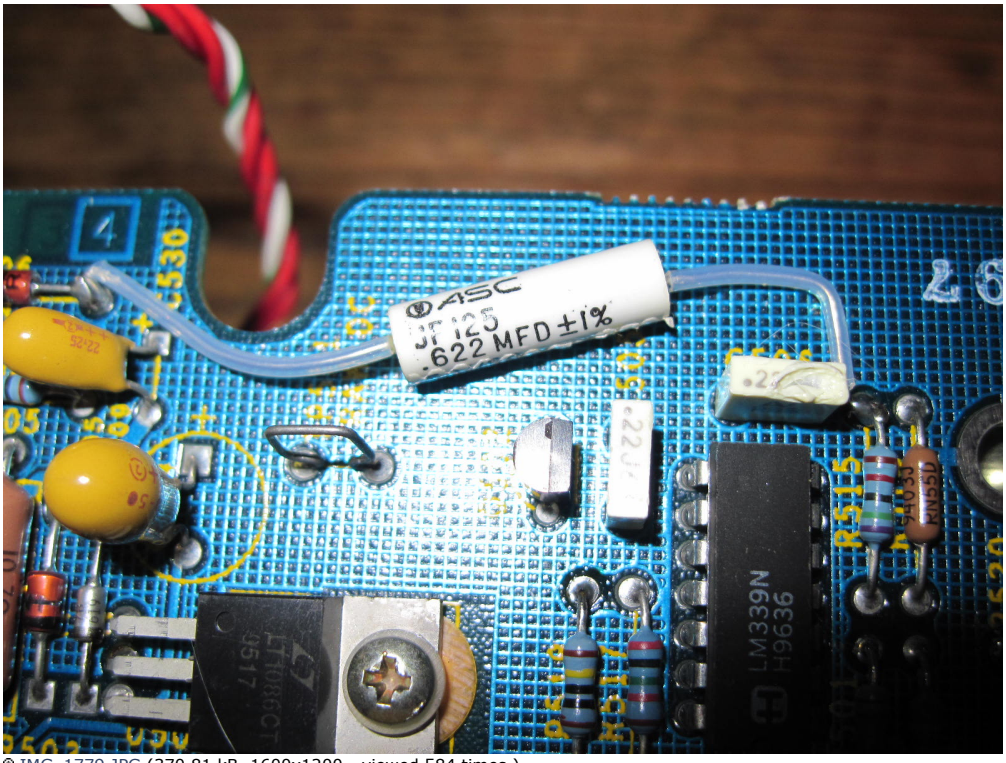
Say Thanks Reply Quote

> **Quote from: kkayser on August 21, 2015, 03:35:08 pm**
>
> > **Quote from: Bill158 on August 20, 2015, 09:28:11 pm**
> >
> > > **Quote from: kkayser on August 20, 2015, 01:15:01 pm**
> > >
> > > I could not find C541 on the board. I looked at the component layout. There it was. But, it is not on the board. Nor are U516 and C544. That part of the board is empty. The manual is dated 1997, 18 years ago. Apparently, Fluke modified the board, and I have a newer version. I'll call Fluke and see if I can get a schematic for this version.
> > >
> > > Help would be appreciated.
> >
> > kk:
> > My 732B S/N is 6785005 and my Power Supply Board A-5 is P/N 869185 rev K. I don't see anything missing on mine nor do I see a place for U516. My only assumption is that your 732B has a different A-5 board. I just don't see any Engineering Change Orders or anything else from earlier units. I would put a C-541 in, if the ends of that cap go to the right places, and see what happens. I doubt a capacitor in there can hurt anything. Why it would not be installed doesn't make sense to me, but what do I know?
> > Bill
>
> I'm sorry is was unclear. There is *nothing* on that part of the board, no holes, no conductors on the back. An engineer at Fluke told me there is an upgrade on the charger. My serial is lower than yours, 5535205. So, it looks like my unit was

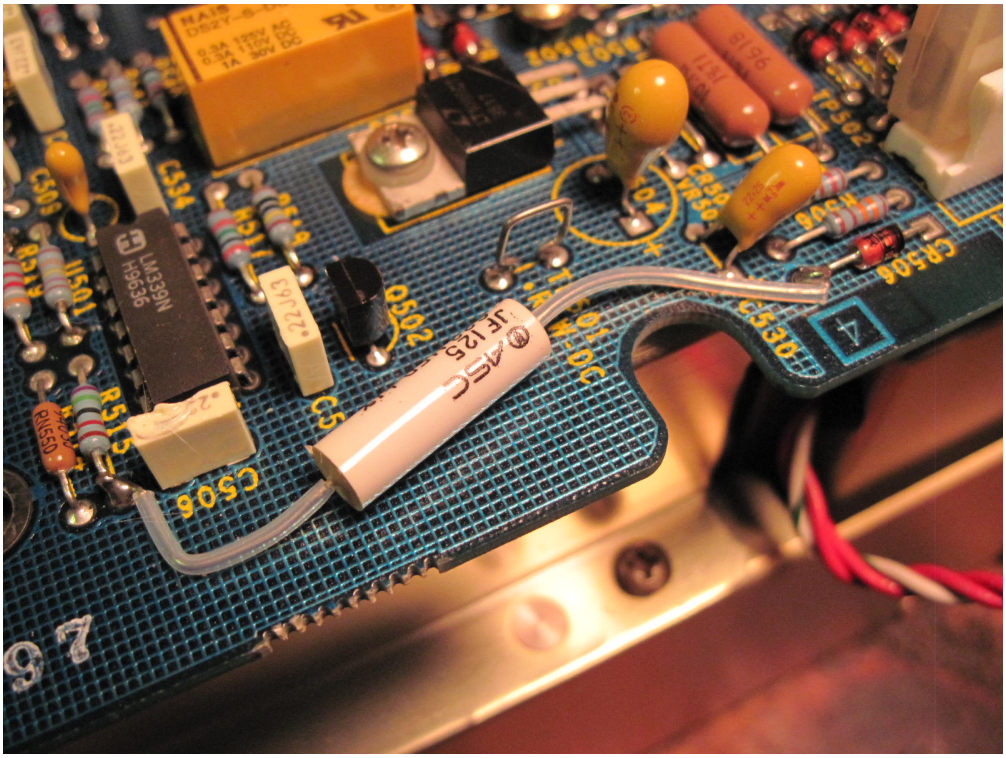
made before the upgrade. If I can get the upgrade specs, I can probably do it myself. Since the P/N of yours is Rev. K. Is the "K" printed in yellow? My board has nothing printed after "Rev." but does have something written in black that appears to be a "C".

Many thanks for your help.

Ah Ha, Now I see what your problem is perfectly. See the attached photos of where the cap has been soldered in on my A5 board. It is connected between R515 and CR506 as shown in the photos. There are NO holes provided on the PC Board, but just an "after thought" that makes the whole charger work a LOT better and the way it is described in the Theory of Operation. I hope this gets you going finally. I didn't realize what this cap did before you asked. I had seen it there but the circuit worked perfectly for the constant I/V operation when plugged in to AC line. The reason I had been working on my PC Board was that the switch over point from constant I to V was about 15 volts which is way to high. I just trimmed the divider circuit by replacing R514 with a better value that allowed the comparator to trip at 14.6 volts.
Bill



IMG_1779.JPG (370.81 kB, 1600x1200 - viewed 584 times.)



IMG_1780.JPG (322.46 kB, 1600x1200 - viewed 547 times.)

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #14 on:** August 22, 2015, 01:20:55 pm »
Say Thanks Reply Quote

Quote from: ManateeMafia on August 20, 2015, 02:45:44 pm

kkayser,

I have seen your symptoms on a 732B. It essentially won't go into the CC mode if the power is cycled. I have seen other 732B's go immediately into CC after a power bump.
Since the charger was missing some of the components from the schematic, I had guessed the CC mode may have been an added feature later on in the newer revs. I would be interested in seeing if you truly have an issue with the board.

I think you are right. There is nothing wrong with my board. It is just an earlier version. My board looks like Bill158's in the area pictured. I'll get the cap, connect it and see what happens.

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #15 on:** August 22, 2015, 02:25:04 pm »
Say Thanks Reply Quote

I surprissed that Fluke shipped unit with C506 damaged (melted) by soldering iron.

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68

Re: Fluke 732B repair.
« **Reply #16 on:** August 22, 2015, 02:59:08 pm »
Say Thanks Reply Quote

Quote from: plesa on August 22, 2015, 02:25:04 pm

I surprissed that Fluke shipped unit with C506 damaged (melted) by soldering iron.

That happened when I was troubleshooting the comparator not changing over from CI to CV mode at 14.6 volts, but up around 15.0 volts. I was measuring all resistors in the circuit and couldn't find any that were out of tolerance. I finally guessed that the comparator input VOS had drifted, but was never able to confirm that theory. While removing and resoldering I managed to do damage to C506.

Country:

Sorry about that!
Bill

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #17 on:** August 22, 2015, 04:00:07 pm » Say Thanks Reply Quote

Ah, thats makes sense. Thanks for explanation!

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #18 on:** September 03, 2015, 01:16:17 pm » Say Thanks Reply Quote

I talked to Fluke tech support person, Pat Stewart. He was very good, as helpful as he could be under Fluke policy. I asked if there was anything else that was changed when the capacitor was added. Here is his email reply:

There was a PCN (product change notice) for the charging circuit. Unfortunately, we are not allowed to send out PCN's to anyone other than a Fluke service center. As well as the capacitor, there are two resistors that are also changed in that circuit.

Good old Fluke.

There are not that many resistors that I can't check them all. I will start with r514. My charger cuts off near 15volts, so that has to be corrected regardless. Is 13 Volts reasonable?

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #19 on:** September 03, 2015, 06:24:51 pm » Say Thanks Reply Quote

I do not have 732B but for lead acid sealed batteries is recommended to charge them max to 14,5V - 14,9V. And for continuous charging (trickle) mode is voltage lower 13,6V-13,8V, but this is not the case.

So 13V is too low I suppose.
Check what type of batery is used and adjust voltage according to datasheet, values above and for common types for UPS at 25°C.

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #20 on:** September 03, 2015, 06:29:58 pm » Say Thanks Reply Quote

Quote from: kkayser on September 03, 2015, 01:16:17 pm

> I talked to Fluke tech support person, Pat Stewart. He was very good, as helpful as he could be under Fluke policy. I asked if there was anything else that was changed when the capacitor was added. Here is his email reply:
>
> *There was a PCN (product change notice) for the charging circuit. Unfortunately, we are not allowed to send out PCN's to anyone other than a Fluke service center. As well as the capacitor, there are two resistors that are also changed in that circuit.*
>
> Good old Fluke.
>
> There are not that many resistors that I can't check them all. I will start with r514. My charger cuts off near 15volts, so that has to be corrected regardless. Is 13 Volts reasonable?

kkayser:
In reviewing what I did to change the switchover voltage I now see that I changed the value of R-520 from the original 18.1k to around 16.5k. This got my switchover voltage down to around 14.5 volts. The sealed lead acid battery spec is from 14.4 to 14.7 for a "full charge" of the battery. It is interesting that yours also does not switch until around 15 volts, just like mine did. Isn't nice of FLUKE that they won't let the end user know about any PCNs that would affect the end user! I paid for this thing so I should get full support. This is just like automobile manufacturers, they just don't want to tell the owner anything unless NHTSA forces them to disclose defects!
Bill

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #21 on:** September 04, 2015, 01:04:23 pm »
Say Thanks Reply Quote

Fluke seems to have the attitude that they, and only they, should repair "their" equipment. My son has problems getting parts. Fluke wants to "repair" the instrument then charge you an arm and a leg to calibrate it. Their excuse it that they cannot be sure the device is properly repaired unless they calibrate it. I think the real reason is that Fluke spent a large sum building their Josephson array and now has to get their money back. So they coerce everyone to pay for calibrations.

This will work until someone comes out with a good competitor to the 732B. Also, this policy sours me on all other Fluke products. All of my 6 1/2 to 8 1/2 digit meters are Keysight.

Report to moderator Logged

Bill158
Regular Contributor
Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #22 on:** September 04, 2015, 03:22:28 pm »
Say Thanks Reply Quote

Quote from: kkayser on September 04, 2015, 01:04:23 pm

> Fluke seems to have the attitude that they, and only they, should repair "their" equipment. My son has problems getting parts. Fluke wants to "repair" the instrument then charge you an arm and a leg to calibrate it. Their excuse it that they cannot be sure the device is properly repaired unless they calibrate it. I think the real reason is that Fluke spent a large sum building their Josephson array and now has to get their money back. So they coerce everyone to pay for calibrations.
>
> This will work until someone comes out with a good competitor to the 732B. Also, this policy sours me on all other Fluke products. All of my 6 1/2 to 8 1/2 digit meters are Keysight.

I just got my 732B "Calibrated" early in August 2015 by FLUKE. I took the Z540.1:1994 cal because it was the least expensive. The Z540.1:1994 gives "as-found" and "as-left" readings. I fully expected FLUKE to adjust the 732B to output exactly 10.000000 volts. Instead they just measured the output voltage to their standards (a bank of 4 ea 732Bs) and reported that value was 10.000023 volts (high by 2.3 ppm) for my 732B. So this covered the "as-found" and "as-left" portion of Z540, with the "Result Summary: In Tolerance". Of course this is fine also as I can now assigned output voltages to my other 732As. Then I can track any drift between all of these units. But for $695 you would expect a little more. You are right, they need to cover all those on-going costs of maintaining a Josephson Junction Array. FLUKE did cover the return shipping (overnight) and a proper shipping box, which I can use when I decide to send the 732B in again, in a few years from now.
Has anyone else out there had the Z540 cal also and experienced the same results in service from FLUKE? Just wondering? At least I have a good idea what a "volt" is. My last cal was 10 years ago when FLUKE had a Cal Lab in the SF Bay Area. I had adjusted my newly acquired/used 732B to what I "thought" was 10 volts, from my 732As, before I sent it in for Calibration. So during the last 10 years I was only 2.3 ppm high which is probably pretty good over that period of time.
Bill

Report to moderator Logged

kkayser
Contributor
Posts: 23

Re: Fluke 732B repair.
« **Reply #23 on:** October 03, 2015, 02:00:10 pm »
Say Thanks Reply Quote

We soldered the capacitor in and it seems to work fine. The charge light goes on whenever the unit is connected to line voltage. I ran it 74 hours and the low batt light did not go on. (I know it works). Charge took somewhere between 24 and 36 hrs. Now off to Tektronix for calibration. They do both voltages for $439.00.

Report to moderator Logged

ManateeMafia
Frequent Contributor
Posts: 719
Country:

Re: Fluke 732B repair.
« **Reply #24 on:** October 03, 2015, 02:14:59 pm »
Say Thanks Reply Quote

I shipped mine to Tektronix with a new battery and the in-cal light out. They adjusted the output as close to 10V as possible, or the output just happened to be within .2 ppm of nominal. They noted the light was out but they never noted it was adjusted.

Report to moderator Logged

Bill158
Regular Contributor

Re: Fluke 732B repair.
« **Reply #25 on:** October 03, 2015, 04:21:03 pm »
Say Thanks Reply Quote

Quote from: ManateeMafia on October 03, 2015, 02:14:59 pm

> I shipped mine to Tektronix with a new battery and the in-cal light out. They adjusted the output as close to 10V as possible, or the output just happened to be within .2 ppm of nominal. They noted the light was out but they never noted it was adjusted.

Posts: 68
Country:

I didn't think about the "in-cal" light being on with my 732B. I would bet that Fluke made the assumption that I had a "cal" from somewhere and didn't want to adjust it further so that I could keep a record of "drift". I would guess that I should have asked to have the 732B be adjusted to exactly 10.000000 as Fluke perceived 10 volts with their local standards which was a bank of 4 732Bs which seems to be "certified" every 3 months. This is simply a "philosophy" in how to calibrate or certify. Since I have no requirements to maintain the "cal" seals I have opened it up and looked at the adjustment switch settings and they were set to 2755 which is exactly the same as when I shipped it to Fluke. Thanks for your experience.
Bill

Report to moderator Logged

dacman
Frequent Contributor

Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #26 on:** October 11, 2015, 02:21:20 am »
Say Thanks Reply Quote

Fluke has a document (on the Fluke website in the 732B documents section) on 0.3 PPM accuracy for the 732B. It basically states that it takes 7 calibrations to reach this. These would be without adjustments. These calibrations would be tracked and trended. If the unit were to be adjusted, it would be back at calibration number one. With one calibration, the accuracy at 1 year would be 2 PPM (from the manual) combined with the uncertainty of the calibration. If the standard is tracked, then it could be shown to an auditor what the stability actually is, what the trend is, and statistical analysis could be employed to calculate a predicted value and the uncertainty of that value. We could claim 0.3 PPM uncertainty where I work. If I were to send a unit off, and it were to arrive dead, they'd better not adjust it. We have data on units dating to the 1990's. (The last time I checked, Fluke with the JVA was NVLAP accredited and Fluke with the bank of 4 732Bs was A2LA accredited. They are not going to adjust your zener, and it has nothing to do with the JVA.)

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #27 on:** October 11, 2015, 09:39:46 am »
Say Thanks Reply Quote

> **Quote from: dacman on October 11, 2015, 02:21:20 am**
>
> Fluke has a document (on the Fluke website in the 732B documents section) on 0.3 PPM accuracy for the 732B. It basically states that it takes 7 calibrations to reach this. These would be without adjustments. These calibrations would be tracked and trended. If the unit were to be adjusted, it would be back at calibration number one. With one calibration, the accuracy at 1 year would be 2 PPM (from the manual) combined with the uncertainty of the calibration. If the standard is tracked, then it could be shown to an auditor what the stability actually is, what the trend is, and statistical analysis could be employed to calculate a predicted value and the uncertainty of that value. We could claim 0.3 PPM uncertainty where I work. If I were to send a unit off, and it were to arrive dead, they'd better not adjust it. We have data on units dating to the 1990's. (The last time I checked, Fluke with the JVA was NVLAP accredited and Fluke with the bank of 4 732Bs was A2LA accredited. They are not going to adjust your zener, and it has nothing to do with the JVA.)

Interesting reading. I did not found how long and how many calibration Fluke is performing for example on their 732B/H or on 732B/C where drift rate should be provided.
Based on my last few month investigation it is quite difficult to find used 732B on market.
Fluke also did not respond to quotation request, but I will expect something 4-6 kUSD (depends on the version).
What was your cost of new or used unit?

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #28 on:** October 13, 2015, 07:48:32 pm »
Say Thanks Reply Quote

> **Quote from: plesa on October 11, 2015, 09:39:46 am**
>
> > **Quote from: dacman on October 11, 2015, 02:21:20 am**
> >
> > Fluke has a document (on the Fluke website in the 732B documents section) on 0.3 PPM accuracy for the 732B. It basically states that it takes 7 calibrations to reach this. These would be without adjustments. These calibrations would be tracked and trended. If the unit were to be adjusted, it would be back at calibration number one. With one calibration, the accuracy at 1 year would be 2 PPM (from the manual) combined with the uncertainty of the calibration. If the standard is tracked, then it could be shown to an auditor what the stability actually is, what the trend is, and statistical analysis could be employed to calculate a predicted value and the uncertainty of that value. We could claim 0.3 PPM uncertainty where I work. If I were to send a unit off, and it were to arrive dead, they'd better not adjust it. We have data on units dating to the 1990's. (The last time I checked, Fluke with the JVA was NVLAP accredited and Fluke with the bank of 4 732Bs was A2LA accredited. They are not going to adjust your zener, and it has nothing to do with the JVA.)
>
> Interesting reading. I did not found how long and how many calibration Fluke is performing for example on their 732B/H or on 732B/C where drift rate should be provided.
> Based on my last few month investigation it is quite difficult to find used 732B on market.
> Fluke also did not respond to quotation request, but I will expect something 4-6 kUSD (depends on the version).
> What was your cost of new or used unit?

I have read and reread that document many times. Ray Kletke really gets into environmental conditions that you could only detect changes to the 732B output by having a JJVS sitting in the same room and being able to access the 10 volt output whenever you wanted. But his basic information about having 4 or more 732B/A units to inter-compare can give you the overall drift slope of each unit. Repeated "calibrations" at Fluke then can also give you the drift of the single 732B that you return at regular intervals. I have used his basic ideas, without a regular calibration at Fluke for over 10 years, and managed to be only 2.3 ppm high according to the value of my 732B when returned last August from Fluke. Since up to this time I only had 732A references I could not return one to Fluke WA. because of the lack of battery time involved (12 - 15 hours). By using the NBS/NIST technical note 430 and the technique described in "Calibration-Philosophy in Practice Volume 1 (Fluke)" pg. 34 I was able to predict changes during those 10 years. My offset from my 732B after cal could also be error introduced by using the local Fluke Cal Lab, when it was local, and the 732A could be transported by hand to and from the lab and battery life was not a consideration. However that local Lab was one more 732B/A cal away from Fluke WA. because their units were sent in on a regular basis. So all in all I was very happy with my results. I have 10 years worth of delta readings between all units and have a very good regression slope for all units. But I agree that I lack the absolute knowledge of which unit was drifting other than making an intelligent interpretation of the data, as described in the Philosophy in Cal book. It should be interesting to see where my 732B is next time I send it in for Cal.
I got my 732B off of ebay for US$2,000. I was very happy that it worked, almost, correctly. There was a problem with isolation from guard/ground which turned out to be a missing thermal insulator pad under the voltage regulator U504 which allowed chassis ground to be connected to the Guard/Low of the 732B. This was probably someone's failed attempt to remove the battery by trying to take the A5 Power Supply PCA off and getting to the battery that way. They obviously didn't have the 732B manual! The insulator was just laying on the A5 PCA next to U504. But I did consider a lot of other 732B units that were on ebay before buying this one. I sure haven't seen any come up on ebay for a while.

Bill

Report to moderator Logged

dacman
Frequent Contributor
Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #29 on:** October 14, 2015, 12:47:08 am »
Say Thanks Reply Quote

I don’t know how much our 732Bs cost (they were there when I got there).

NBS TN 430 shows how to do the intercomparisons. The document from Fluke shows how to do the trend uncertainty calculations. Over time, the calculation for uncertainty of the projected value of the 732B will get larger and larger, and once the uncertainty gets to a certain value, the unit can be recalibrated.

Intercomparisons can not only detect anomalies with the units, but it is also used to lower the uncertainty using pooled uncertainty. The 732B values used in calculations are the predicted values (today's values) from the trend charts (with charted calibrations of the units). After intercomparisons, pooled values are assigned.

For calibrating a Fluke 5720A or 5730A (or even 5700A), the 10 V output of the 732B needs to be known to within ± 1.5 PPM. For calibrating a Keysight 3458A, it needs to be known to within 2 PPM. Where I work, we have to know what the 10 V value is and what its uncertainty is, which is statistically calculated.

Report to moderator Logged

Bill158
Regular Contributor
Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #30 on:** October 14, 2015, 07:30:34 pm »
Say Thanks Reply Quote

> **Quote from: plesa on October 11, 2015, 09:39:46 am**
>
> Interesting reading. I did not found how long and how many calibration Fluke is performing for example on their 732B/H or on 732B/C where drift rate should be provided.
> Based on my last few month investigation it is quite difficult to find used 732B on market.
> Fluke also did not respond to quotation request, but I will expect something 4-6 kUSD (depends on the version).
> What was your cost of new or used unit?

The last price list I can find for a new Fluke 732B was 4/2001. It shows the 732B/C at US$5,990 and the 732B/H at US$5,330. You can bet that these prices would be around US$9k to $10k now.
Bill

Report to moderator Logged

plesa
Frequent Contributor

Re: Fluke 732B repair.
« **Reply #31 on:** October 14, 2015, 07:53:31 pm »
Say Thanks Reply Quote

Posts: 965
Country:

Thanks Bill and Dacman for information. I will post actual price when Fluke send me quote. Today I also found lab close to me with JJA, what a surprise.

Report to moderator Logged

dacman
Frequent Contributor

Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #32 on:** October 19, 2015, 02:42:56 am »
Say Thanks Reply Quote

If you want to know how accurate the 732B can be, NIST is using them to certify some (what NIST calls) CJVAs and PJVAs (Conventional Josephson Voltage Array or Programmable Josephson Voltage Array). In a North American Interlaboratory Comparison run by NIST, by using a bank of four 732Bs as the traveling standard, agreement to within +0.022 / -0.018 ppm was achieved. (Using a PJVA as the traveling standard, agreement within 0.0005 ppm was achieved.) Some labs do not need the accuracy, or do not have the space for another JVA to compare against. It was stated that this approximately 0.02 ppm comparison was achieved by developing coefficients for the 732Bs, such as for pressure.

Where I work, we get our 732Bs calibrated using the Fluke DVMP program. They send us one 732B, we make the measurements using our meters, and Fluke gives us a NVLAP certified report. The last report we got had a stated uncertainty of the measurement of 0.06 ppm.

If you want to know how those seemingly continuous comparisons are made on lab 732As or 732Bs, a system already exists that does that (you don't need to build one yourself). We have a 32 channel scanner from Data Proof and VoltRef software from Data Proof. (We got the guarded scanner and I'm glad we did.)

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #33 on:** October 19, 2015, 07:12:31 pm »
Say Thanks Reply Quote

Quote from: dacman on October 19, 2015, 02:42:56 am

> They send us one 732B, we make the measurements using **our meters**, and Fluke gives us a NVLAP certified report. The last report we got had a stated uncertainty of the measurement of 0.06 ppm.

Very impressive indeed. I was wondering how good this method was. Fluke must have the 732B that they send you characterized very closely.
Question? What make and model of **"our meters"** do you use to make the measurement between the 732B outputs? I have tried several different methods to make these uV measurements but the random noise from both units makes it difficult to get a measurement much below approximately 0.1 ppm repeatability. Right now I am using a 3458A set to 100 PLC, 40 measurements with the MATH turned on and then take the "mean" value from the 3458A stats. But my "low" to "high" readings are around 0.8 uV apart, with the "mean" being somewhat in the middle of those.
Bill

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #34 on:** October 19, 2015, 08:24:21 pm »
Say Thanks Reply Quote

Quite simple method!! Thanks for posting. The uncertainty you mentioned is amazing (compare to the 732B 30day spec.). What is annular fee to be in DVMP?

Report to moderator Logged

The following users thanked this post: vindoline

dacman
Frequent Contributor

Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #35 on:** October 20, 2015, 01:40:32 am »
Say Thanks Reply Quote

Quote from: Bill158 on October 19, 2015, 07:12:31 pm

> Very impressive indeed. I was wondering how good this method was. Fluke must have the 732B that they send you characterized very closely.
> Question? What make and model of **"our meters"** do you use to make the measurement between the 732B outputs? I

have tried several different methods to make these uV measurements but the random noise from both units makes it difficult to get a measurement much below approximately 0.1 ppm repeatability. Right now I am using a 3458A set to 100 PLC, 40 measurements with the MATH turned on and then take the "mean" value from the 3458A stats. But my "low" to "high" readings are around 0.8 uV apart, with the "mean" being somewhat in the middle of those.
Bill

About any high end meter should so. We presently use a Data Proof scanner and VoltRef software and a Keysight 34420A to get the measurements. VoltRef is designed to follow NBS TN 430 (the document is on the Data Proof website). If you get two or more Zeners calibrated, then there will be three or more in the system, and the measurements that Fluke wants will follow NBS TN 430. (Fluke also wants negative readings, which also follow TN 430, but are from the Lo terminals vice Hi.) The instruction from Fluke is to take 36 (or is it 72) measurements over a three day period, which should help cancel out noise and short term drift of the Zeners. (If I were calibrating the 1 V tap using the 10 V tap, I would want to use a 3458A.)

The uncertainty of the 3458A at zero is 1 µV (if not nulled) and it is not important to null the 3458A, because this will fall out due to checking each Zener on both channels A and B. Zeners are also noisy. That is one reason why so many measurements are required. (Although they can be too noisy.) (VoltRef averages about 20 readings for one measurement.)

Here is the Fluke NVLAP scope of accreditation. At the bottom of page 21 is the uncertainty of the on-site calibration, which they just send a 732B.
http://assets.fluke.com/download/nvlap_certs/NVLAP_scope.pdf

« Last Edit: October 20, 2015, 09:44:13 am by dacman »

Report to moderator Logged

dacman
Frequent Contributor
Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #36 on:** October 20, 2015, 01:56:43 am »

Say Thanks Reply Quote

Quote from: plesa on October 19, 2015, 08:24:21 pm

Quite simple method!! Thanks for posting. The uncertainty you mentioned is amazing (compare to the 732B 30day spec.). What is annular fee to be in DVMP?

I think the cost is for a single on-site calibration, and I think it is about $1k for just the 10 V tap, and we just order one as required (and it may only be available in the USA). Fluke will give a prediction formula after three calibrations, although we calculate this ourselves.

« Last Edit: October 20, 2015, 09:39:59 am by dacman »

Report to moderator Logged

Bill158
Regular Contributor
Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #37 on:** October 21, 2015, 08:06:06 pm »

Say Thanks Reply Quote

Quote from: dacman on October 20, 2015, 01:40:32 am

The uncertainty of the 3458A at zero is 1 µV (if not nulled) and it is not important to null the 3458A, because this will fall out due to checking each Zener on both channels A and B. Zeners are also noisy. That is one reason why so many measurements are required. (Although they can be too noisy.) (VoltRef averages about 20 readings for one measurement.)

I do reverse the connections from each 732B (REF HI and UUT LO) into the 3458A so that any offsets from the connections or the 3458A should be nulled out. I then take the sum of the two readings, observing signs, and divide by 2 to get the final reading. This follows what FLUKE says to do when "standardizing" one 732B to the "certified" 732B which is detailed in the manual paragraph 5-9 and replacing fig. 5.1 with fig 5.1 which is in Change #1 at the end of the manual. I can see why the DATA PROOF and the software makes this MUCH easier to accomplish, especially when you have to take 36 (or 72) readings and then average those readings. Then when you have to apply TN 430 and do all inter comparisons between 4, or more, units in a bank it could take a day or more, when waiting for thermals and other issues to settle down. So I guess now I need a DATA PROOF to add to my collection. Or just ignore the small variations and work with that and use the long term drift trends over years of observation. My guess is that the DATA PROOF is expensive so I think I will just use my method, which has shown me very good drift trends over 10 years.
At least you answered my question about what meters to use and the "noise" of the zeners. I had tried the analog low pass filter in the 3456A and the MATH software low pass filter of the 3458A and didn't get significant improvement in stability. Therefore I was pretty sure that multiple readings was the only way to accomplish all of this.
Thanks,
Bill

Report to moderator Logged

ManateeMafia
Frequent Contributor

Re: Fluke 732B repair.
« **Reply #38 on:** October 21, 2015, 08:16:25 pm »

Say Thanks Reply Quote

Posts: 719
Country:

Bill158

Data Proof quoted about $2K for the software. I am guessing that for most people it is easier to do manually.

Report to moderator Logged

dacman
Frequent Contributor

Posts: 396
Country:

Re: Fluke 732B repair.
« **Reply #39 on:** October 22, 2015, 03:38:49 am » Say Thanks Reply Quote

Bill,
You did not mention the LFILTER function of the 3458A. Is that the one you meant? Also, have you read change 3 for the 732B? It basically states that for the 732B to meet stability specifications that either line power conditioning needs to be used or it needs to be run on the battery. And I hope you were talking generally about the reversal formula. The reverse reading is supposed to be subtracted from the forward reading (or the sign reversed and then added) before dividing by 2.

Report to moderator Logged

Bill158
Regular Contributor

Posts: 68
Country:

Re: Fluke 732B repair.
« **Reply #40 on:** October 22, 2015, 04:30:29 pm » Say Thanks Reply Quote

Quote from: dacman on October 22, 2015, 03:38:49 am

> Bill,
> You did not mention the LFILTER function of the 3458A. Is that the one you meant? Also, have you read change 3 for the 732B? It basically states that for the 732B to meet stability specifications that either line power conditioning needs to be used or it needs to be run on the battery. And I hope you were talking generally about the reversal formula. The reverse reading is supposed to be subtracted from the forward reading (or the sign reversed and then added) before dividing by 2.

I was using the MATH operation FILTER. My interpretation of the LFILTER was for filtering high frequency noise from the change of level for triggering a sample to be taken. I tried several constants for DEGREE for the FILTER operation. Results were mixed when trying the FILTER operation, but not much improvement as the first reading seems to set the initial value of the difference voltage between units. The FILTER does decrease the total difference between RMATH 2 (LOWER) and RMATH 13 (UPPER) values but the RMATH 4 (MEAN) still is not that stable. I hope I have made myself clear on this.
Yes, I was reversing the sign on the reverse measurement, "adding" the two values and dividing by 2 as you were talking about in the last sentence. So if the first reading was -1.024 uv and the reverse reading was +0.635uv the total is -1.659 uv and then dividing by 2 the result is -0.8295 uv which I round up to -0.830 uv. I have seen Change #3 and read it but I have never tried taking readings on battery power when doing measurements. I will have to try this to see if I get any short term improvement between readings. My knowledge of "power line conditioners" is that they modify the input sine wave by distorting the peak to keep the RMS value under the sine wave constant and then they also have a Faraday shield in their transformer to filter out any high frequency noise coming in from the power line. The schematic of A4 shows something in the transformer TX1 primary hooked to the power line GND. I assumed that this is a Faraday copper shield, which is what I would expect to be designed into the transformer. Then there is something shown on the secondary which has a connection to VGUARD. But without have the drawing and build components for the transformer it is not clear what is happening here. But since I am not operating in an industrial environment (i.e. at home) I would not expect much improvement, but I will try this. Thanks for the suggestion.
Bill

Report to moderator Logged

plesa
Frequent Contributor

Posts: 965
Country:

Re: Fluke 732B repair.
« **Reply #41 on:** November 07, 2015, 05:06:07 am » Say Thanks Reply Quote

Someone win in lottery
http://www.ebay.com/itm/Fluke-732B-DC-Standard-T70017-/361390435649?hash=item54248c6d41:g:WJIAAOSwWnFV-vgZ
http://www.ebay.com/itm/Fluke-732B-DC-Standard-T70016-/351518993668?hash=item51d82a2d04:g:qg0AAOSwQTVV-voA

I needs to check ebay more often

Report to moderator Logged

Vgkid
Super Contributor

Re: Fluke 732B repair.
« **Reply #42 on:** November 07, 2015, 05:34:33 am » Say Thanks Reply Quote

Damn, even I could afford those.

Report to moderator Logged

If you own any North Hills Electronics gear, message me. L&N Fan

Posts: 2509
Country:

eas
Frequent Contributor

Posts: 592
Country:

Re: Fluke 732B repair.
« **Reply #43 on:** November 07, 2015, 06:11:44 pm » Say Thanks Reply Quote

I'm guessing they sold less than 60 minutes after being listing. Much like a few 3458a DMMs that sold for $1000-1500 in the last six months.

Report to moderator Logged

Awesome14
Regular Contributor

Banned!
Posts: 192
Country:

Re: Fluke 732B repair.
« **Reply #44 on:** January 10, 2017, 01:29:11 am » Say Thanks Reply Quote

> **Quote from: Bill158 on October 14, 2015, 07:30:34 pm**
>
> > **Quote from: plesa on October 11, 2015, 09:39:46 am**
> >
> > Interesting reading. I did not found how long and how many calibration Fluke is performing for example on their 732B/H or on 732B/C where drift rate should be provided.
> > Based on my last few month investigation it is quite difficult to find used 732B on market.
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> > What was your cost of new or used unit?
>
> The last price list I can find for a new Fluke 732B was 4/2001. It shows the 732B/C at US$5,990 and the 732B/H at US$5,330. You can bet that these prices would be around US$9k to $10k now.
> Bill

I received a quote on a new 732B in early 2015 for 9,100.00USD. I saw 2 on eBay from the same seller go for around 200.00USD each. The seller obviously didn't know what he had!

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Anything truly new begins as a thought.

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