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सत्यमेव जयते

भारत सरकार – रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226011
Government of India - Ministry of Railways
Research, Designs & Standards
Organization, LUCKNOW - 226011

No. EL/11.5.5/2 Date: 19.05.09

Chief Electrical Engineer,

1. Northern Railway, Baroda House, New Delhi-110 001
2. East Central Railway, Hajipur (Bihar)-844 101
3. Central Railway, HQs Office, 2nd floor, Parcel Office Bldg., Mumbai-400 001
4. South Central Railway, HQs Office, Rail Nilayam, Secunderabad-500 071
5. West Central Railway, HQs Office, Opp. Indira Market, Jabalpur-482 001
6. South East Central Railway, Bilaspur-495 004
7. Chittaranjan Locomotive Works, Chittaranjan-713 331

SPECIAL MAITENANCE INSTRUCTION No. RDSO/2009/EL/SMI/ 0256 (Rev.'0'), Dtd. 19.05.09

1.0 TITLE

Testing of WRE gate unit card of Auxiliary converter of 3-phase electric loco to analyze the failure of gate unit card.

2.0 Background:-

Failures of auxiliary converter take place due to intermittent messages of inverter over current without inverter being over loaded. This is found to be due to following defects on WRE gate driver cards.

- Improper or missing firing pulse to GTO
- Defective optic fiber Transmitter receiver
- Defective VAC transformer of WRE gate card
- ON and OFF delay being out of limits prescribed. (Due to improper gain of Opto-coupler on the gate card).
- Defective optic fiber cable jumper.
- Malfunction of level shifter PCB.
- Burning of zener diode on the gate card.

The failure analysis is to be made by testing the card separately for all the above test parameters as prescribed in the OEM test procedure to identify defective component.

The test setup has been developed to test the gate card parameters like firing signal, magnitude of G-K voltage, ON/OFF delay timings, optical output level and magnitude, VAC transformer output, G-K current wave form and voltages at various points.

3.0 Objective:

To detect the defective component on WRE gate unit cards of Auxiliary Converter of 3-phase Electric Locomotive.

4.0 Test Equipments Required:

1. 555 based timer module to generate firing pulse of 250 Hz.
2. Load resistors 100 Ohms, 50W

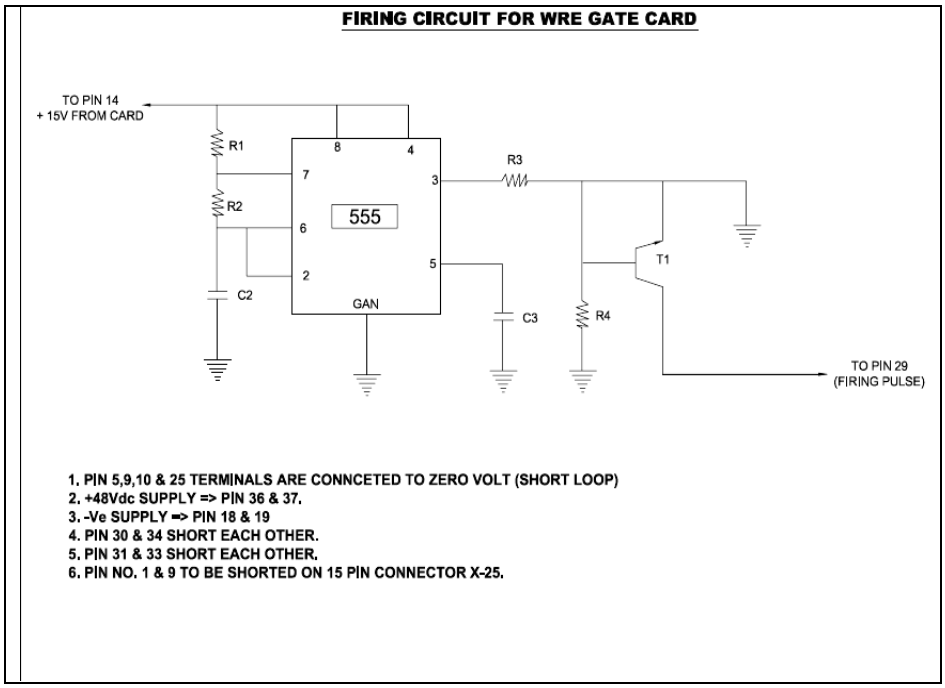
3. 48 V DC power supply.
4. Oscilloscope (Minimum 2 channel)

5.0 Test Set up:

a. Firing circuit of WRE gate card (555-timer module) as shown below, may be directly mounted on WRE gate card and connected with the help of 37 pin female sub-D connector. A dummy sub-D connector (15 pin) on connector X-25 of WRE gate card has to be provided with pin No 1 and 9 shorted.

b. Connect the load resistor of 100Ω/50W across G-K of WRE gate cards of each channel A&B.

c. Connect capacitor (C1) of value 0.1K/63V between pin 14 and ground.



Details of components of firing circuit

A Resistors:	**B** Capacitors:	**C** Transistor
R1—2.8K, 1/4W	C1—0.1K/63V	Type BCY59
R2— 68K, 1/4W	C2—47nK/100V	
R3—4.7K, 1/4W	C3—10nK/63V	
R4—3.9K, 1/4W		

(This 555 based timer module card is readily available with M/s Bombardier Transporters India, Limited and firm have agreed to supply free of cost to sheds).

5.1 Instructions: The WRE gate card of Auxiliary converter is to be tested as per following procedure to identify the failed component on the card:

A. Put ON the supply voltage (48 V) and check two yellow LEDs (one each on channel A and B of gate card) are lit. If both LEDs are ON, both channels of the gate card are working.

B. Check on Oscilloscope whether the wave-forms for both channels are available. If any of the waveform is missing or distorted, channel has to be checked thoroughly for various test points mentioned below to identify defective

component. Check following points even if above test does not indicate any defect and card still fails for "Inverter Over current" on loco.

5.1.1. Connect Oscilloscope probe across each resistor terminals and measure time delay between falling edge of one channel and rising edge of other channel. The time should lie between 60 to 90 micro-seconds. If the timings measured are out of prescribed limits, Opto-coupler (OP-120) gain needs to be adjusted.

5.1.2 Check parameters at measuring points A to H provided on gate card for both channels as under and verify the results as mentioned in OEM document No. 3EYP600155 (copy enclosed)

i) Measure Feedback Signal at measuring point **'A'** for frequency and magnitude as shown in graph at page 31 of OEM document No. 3EYP600155.

ii. Measure at point **'B'** and check that the voltage is -15V on this point.

iii. Measure 'ON' signal at point **'C'** for frequency and magnitude. Square wave of about 30V pk-pk of input frequency is expected.

iv. Measure at point **'D'** and check that the voltage is +15V on this point.

v. Measure optic fiber signal at point **'E'**. Signals for both channels should be ON. If signal found missing, check optic fiber transmitter/receiver or optic fiber jumper for healthiness.

vi. Measure –9V at measuring point **'F'**.

vii. Measure Bias Signal at point **'G'**.

viii. Measure OFF signal at measuring point **'H'** and compare waveform for magnitude and frequency.

ix. If above tests are found within limits, check starting current by connecting probes across each resistor terminals and with current probe. Starting current should be 11A ±3A. The waveform should be compared with starting (maintenance) current graph as shown in OEM document No. 3EYP600155 and should not be distorted. (copy enclosed)

6.0 Application to:
WAP5, WAP7, WAG9 and WAG9H locomotives.

7.0 Agency of implementation:
All sheds holding WAP5, WAP7, WAG9 and WAG9H locomotives.

(Sandeep Srivastava)
for Diector General (Elect)

Copy to:

1. Secretary (Elec. Engg./RS), Railway Board, Rail Bhawan, New Delhi-110 001
2. Chief Works Manager, Electric Loco Workshop, Central Railway, Bhusawal-425 201
3. Sr. DEE (TRS), Electric Loco Shed, East Central Railway, Gomoh-828 401
4. Sr. DEE (RS), Electric Loco Shed, Northern Railway, Ghaziabad-201 001
5. Sr. DEE (TRS), Electric Loco Shed, Central Railway, Ajni, Nagpur-440 008
6. Sr. DEE (TRS), Electric Loco Shed, South Central Rly., Lallaguda, Secunderabad 500071
7. Sr. DEE (TRS), Electric Loco Shed, West Central Railway, Tuglakabad, New Delhi-110044
8. Sr. DEE (TRS), Electric Loco Shed, South East Central Rly., Bhilai, Durg-490 025

(Sandeep Srivastava)
for Director General (Elect.)

Encl: As above

O/C

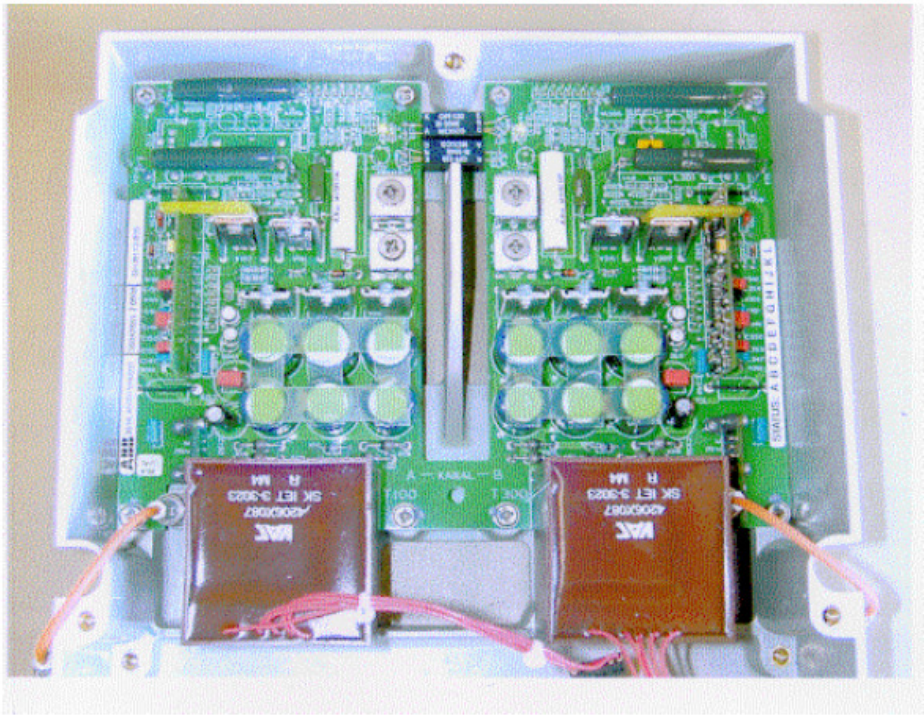
Visual Inspection

Check the Identification Label :

Id no. **3EHL400012R0001**	Type : **GH B173 B35**	**Serial Nos**
Id no. **3EHL400009R0001**	Type : **XV B175 B32**	**Serial Nos**

Check the mechanical condition. Check the positioning of the identification and status labels in accordance with figures.

Figure 3



Check polarized capacitor orientation in accordance with figure 4 (C130 through C136 and C331 through C336). Capacitors C131 and C136 must be affixed to each other with a piece of stiff material to reduce vibration effects. The same for C331 and C336 as well.

Figure 4

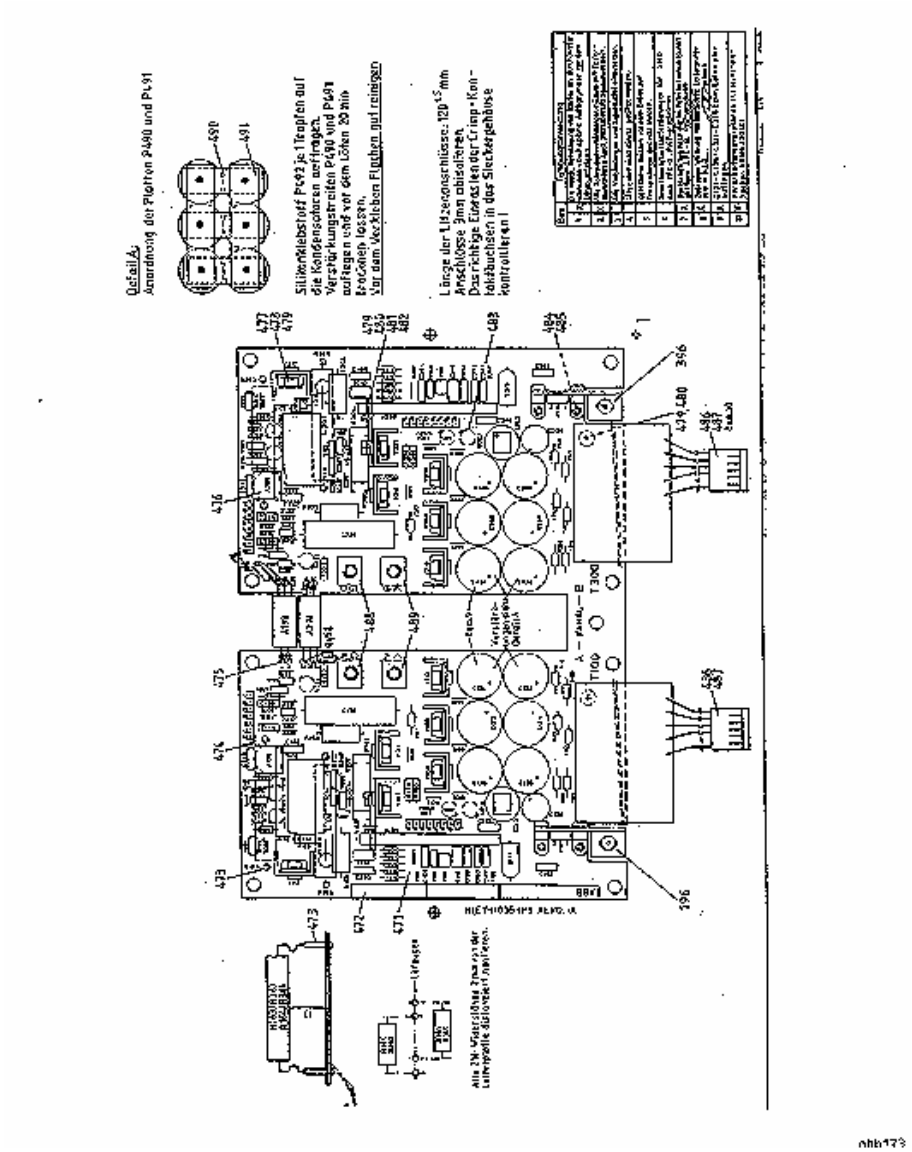
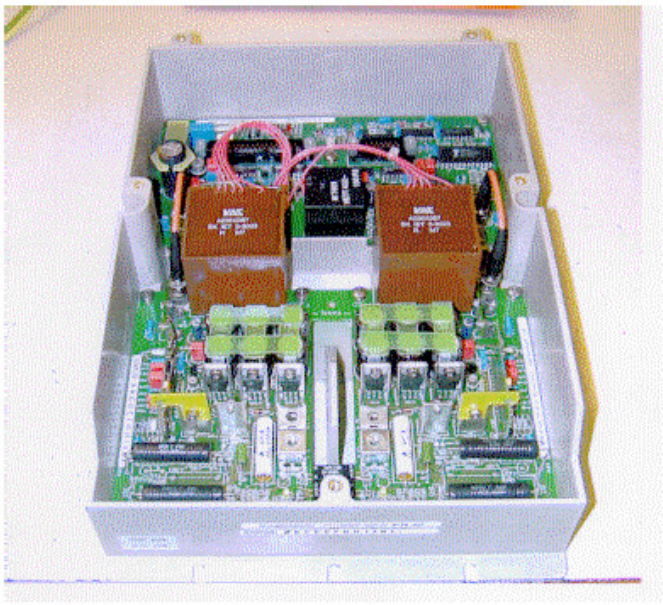

Detail A:
Anordnung der Platten P490 und P491
Silikonklebstoff P693 je 1 Tropfen auf die Kondensatoren anfragen. Verarbeitungszeiten P490 und P691 auftragen sind vor dem Löten 20 min Trocknen lassen. Vor dem Verkleben Flächen gut reinigen
Länge der Litzenanschlüsse: 120 +5 mm
Anschlüsse 3mm abisolieren
Das richtige Einrasten der Crimp-Kontaktbuchsen in das Steckergehäuse kontrollieren!
T300
T100
A – Panel – B

Figure 5

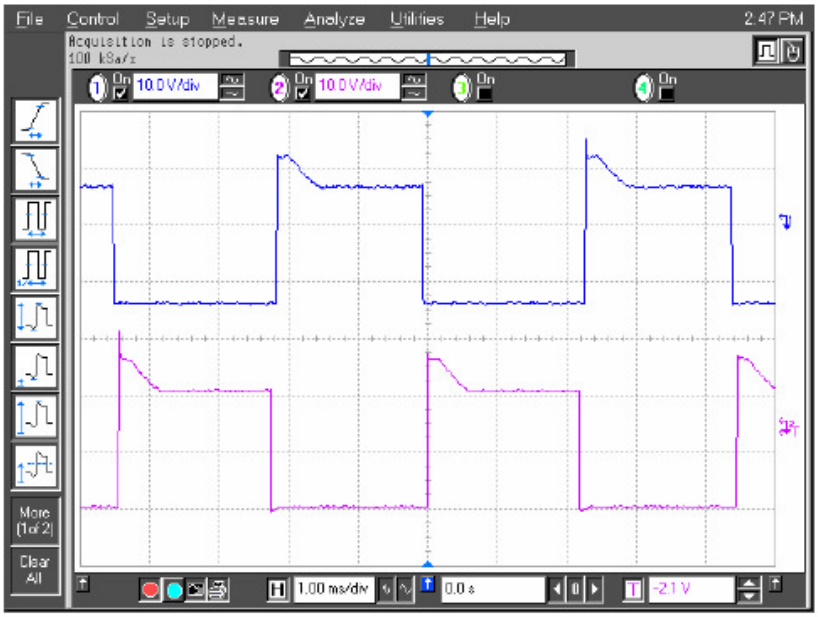


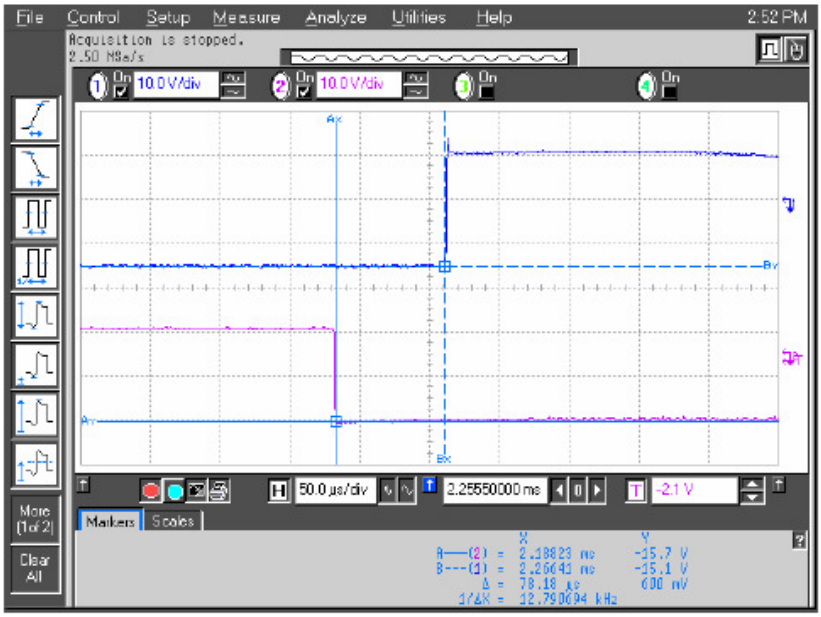
Preparations :

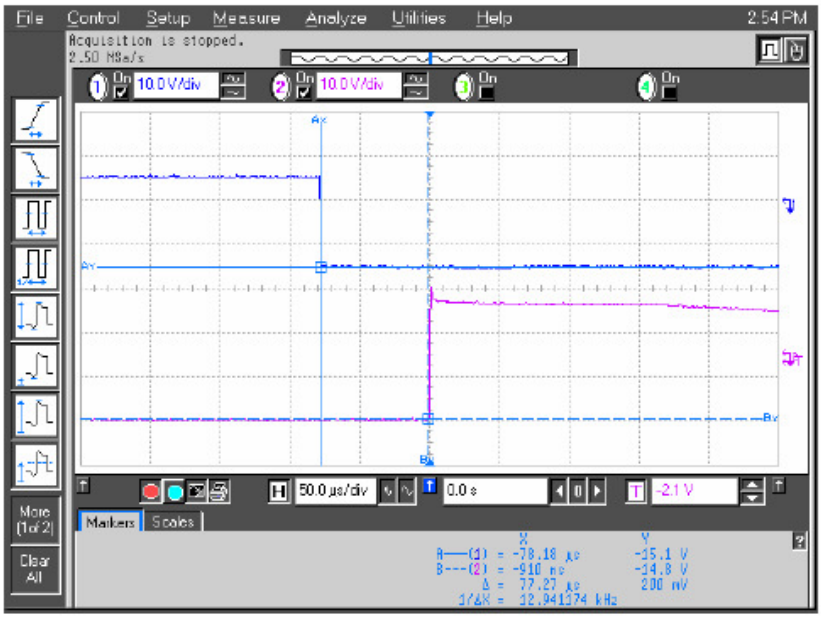
- Take XD B172 B42 (already tested) and GH B173 B35 and assemble the complete unit XV B175 B32
- Connect fiber optic cables across the two boards
- Connect T100 (channel A) to X680 and T300 (channel B) to X681
- Mount load resistors (100R) across G-K of channels A and B
- Connect the 555 timer module onto connectors X20 and X25
- Put on the supply voltage and check that the two yellow LEDs are lit

1. **Gate-Cathode waveforms** (check for channels A and B)

Settings	Measurements
Connect probes across each resistor (100 R) terminals	Observe waveforms of each channel and Measure the tolerance (btw falling edge of one channel and rising edge of other) 60us < T < 90us

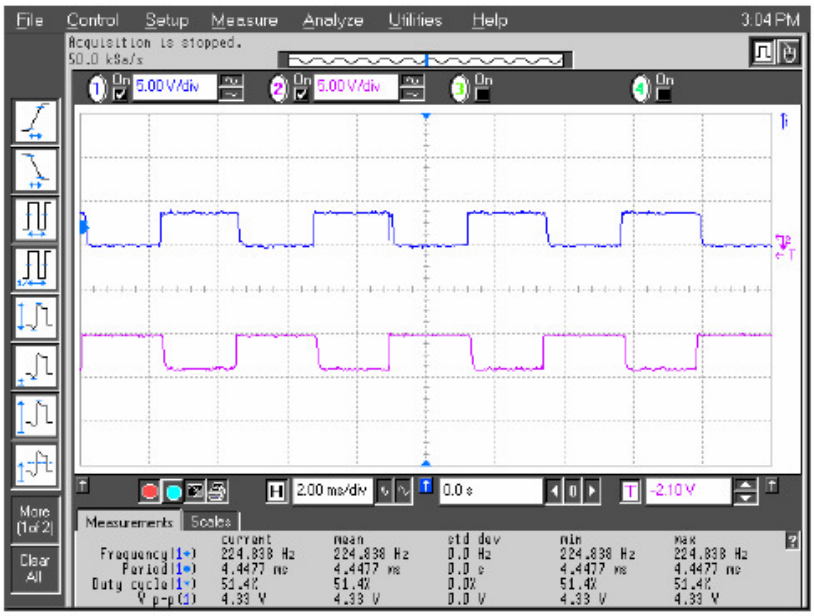



File Control Setup Measure Analyze Utilities Help 2:52 PM
Acquisition is stopped.
2.50 MSa/s
10.0 V/div
10.0 V/div
50.0 µs/div
2.25550000 ms
-2.1 V
Markers Scales
More (1 of 2)
Clear All
A---(2) = 2.18823 ms -15.7 V
B---(1) = 2.26642 ms -15.1 V
Δ = 78.18 µs 600 mV
1/ΔX = 12.790694 kHz

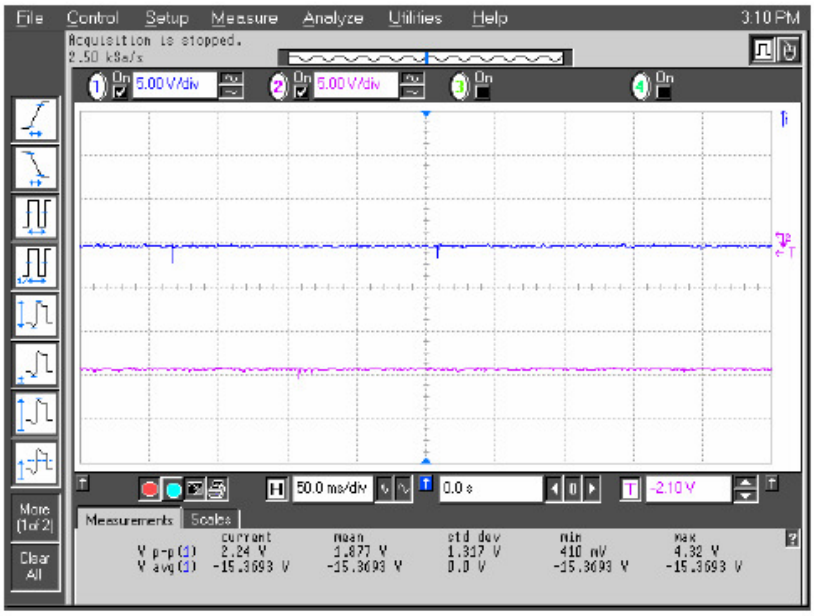

File Control Setup Measure Analyze Utilities Help 2:54 PM
Acquisition is stopped.
2.50 MSa/s
10.0 V/div
10.0 V/div
50.0 µs/div
0.0 s
-2.1 V
Markers Scales
More (1 of 2)
Clear All
A---(1) = -78.18 µs -15.1 V
B---(2) = -910 ns -14.8 V
Δ = 77.27 µs 200 mV
1/ΔX = 12.941174 kHz

2. Measuring Points A-H

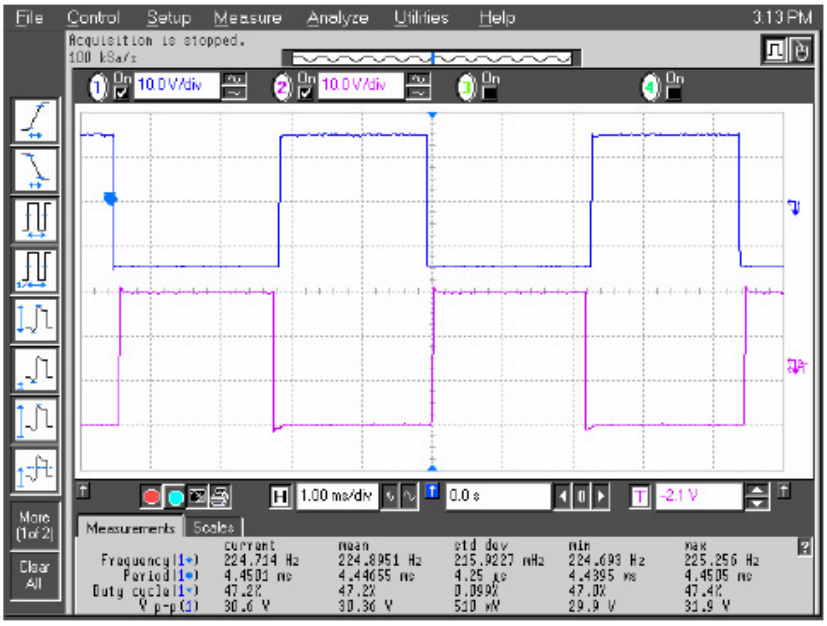
- **Feedback Signal at Point A** (check for channels A and B)



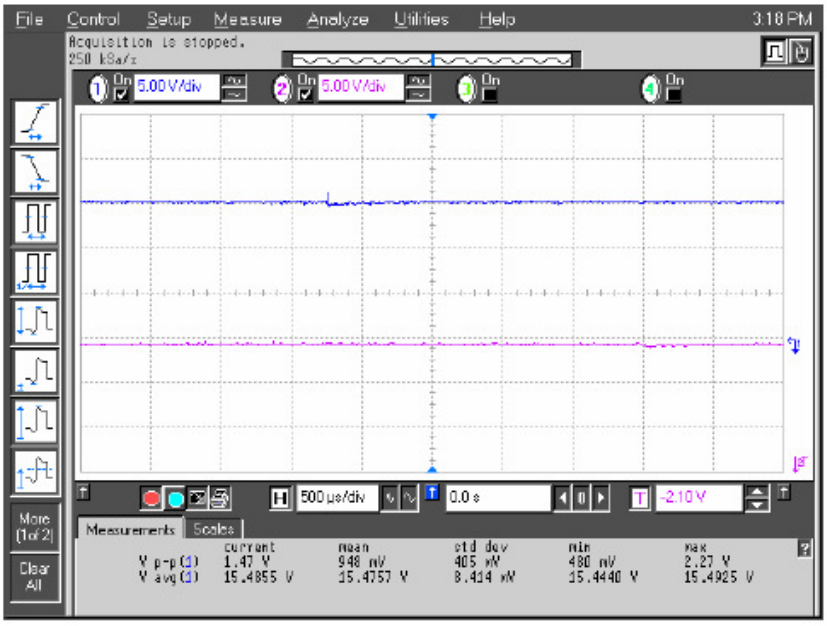
- **Measure at Point B , -15 V** (check for channels A and B)



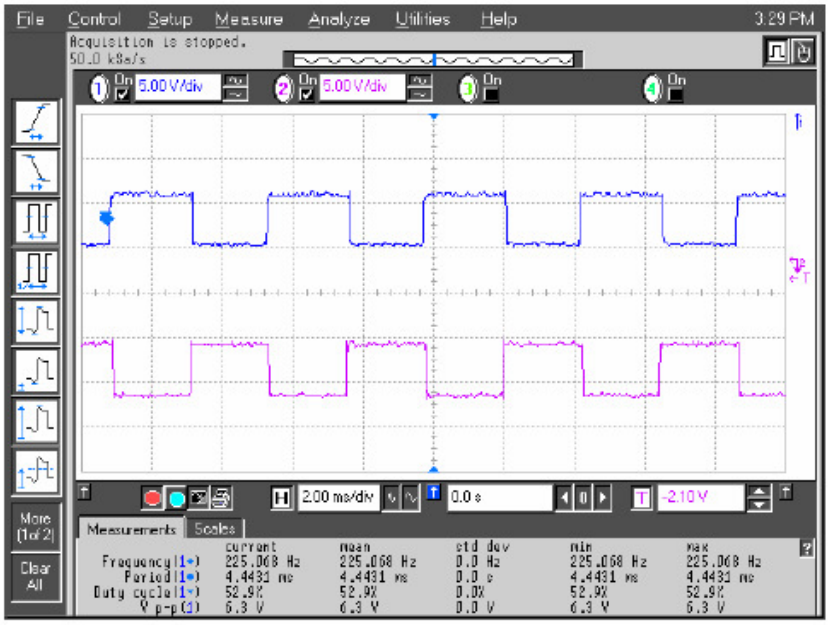
- **Measure at Point C, the ON signal** (check for channels A and B)



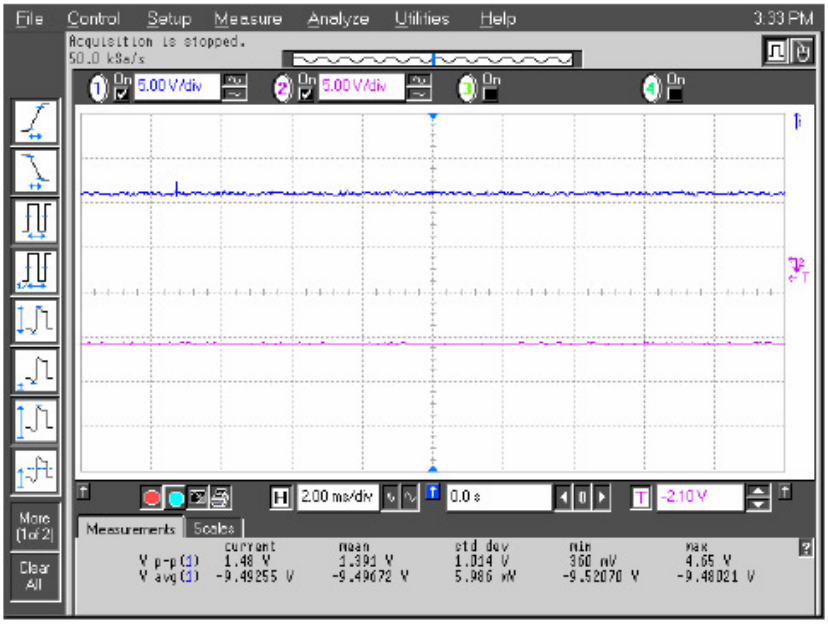
- **Measure at Point D, +15 V** (check for channels A and B)



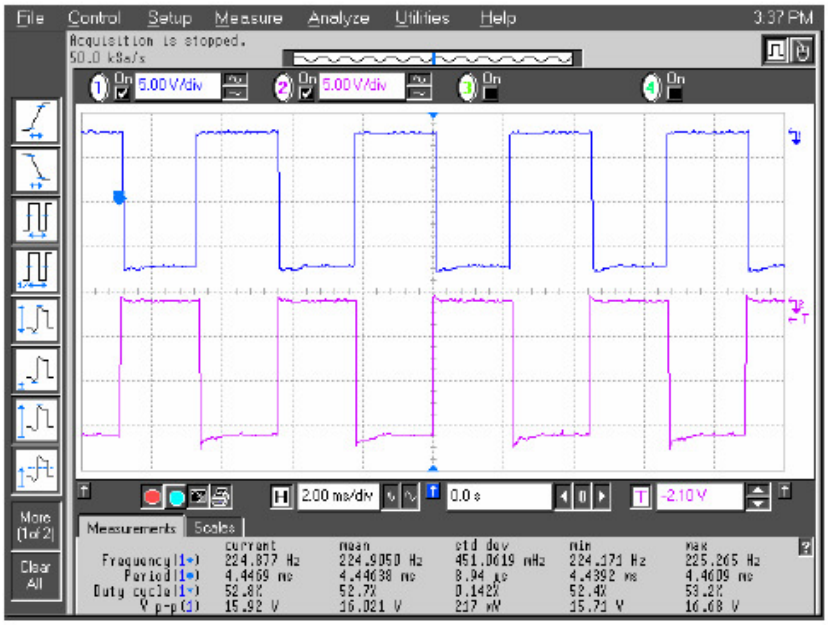
- **Measure at Point E, the fibre optic signal** (check for channels A and B)



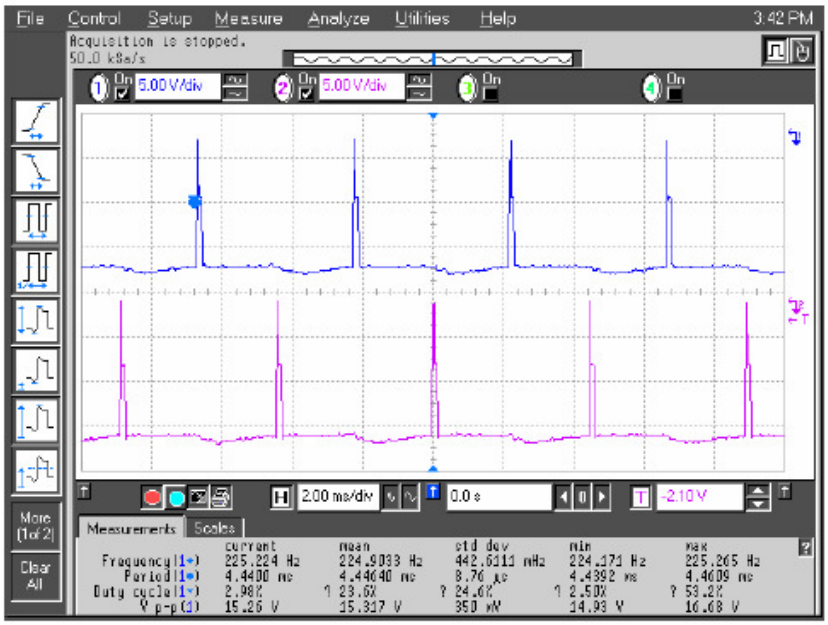
- **Measure at Point F, -9 V** (check for channels A and B)

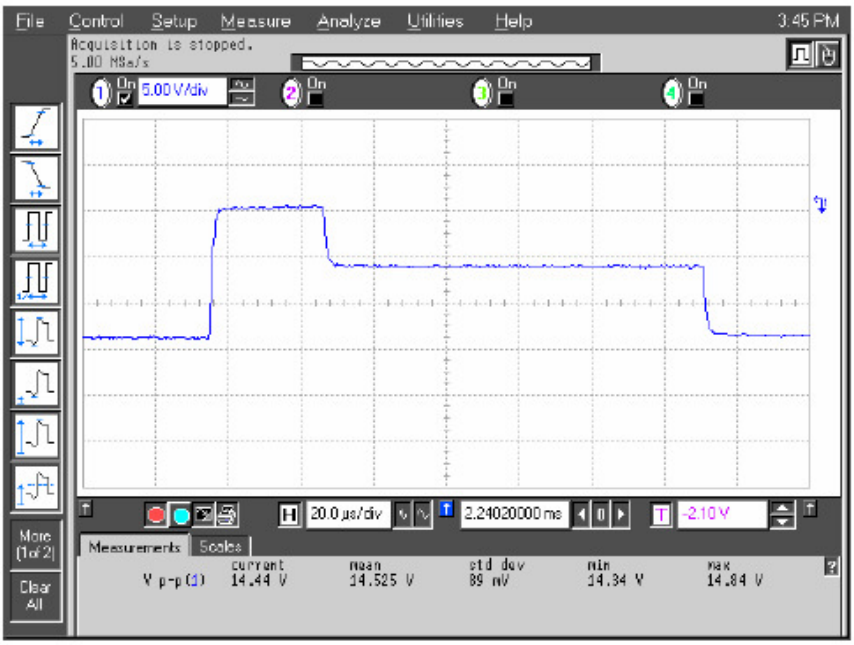


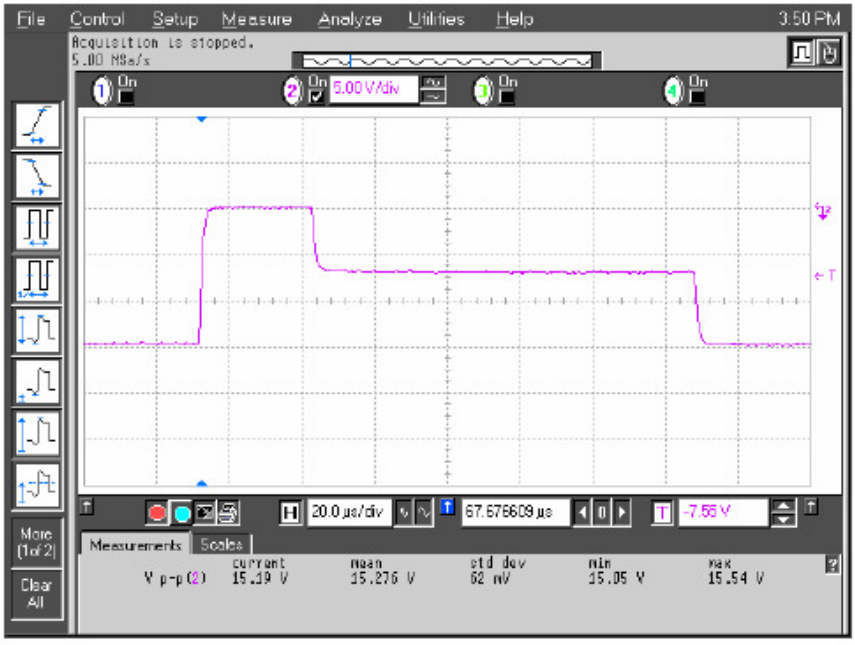
- **Measure at Point G, Bias signal** (check for channels A and B)



- **Measure at Point H, the OFF signal** (check for channels A and B)




File Control Setup Measure Analyze Utilities Help 3:45 PM
Acquisition is stopped.
5.00 MSa/s
1 On 5.00 V/div
2 On
3 On
4 On
H 20.0 µs/div
2.24020000 ms
T -2.10 V
Measurements Scales
current mean std dev min max
V p-p(1) 14.44 V 14.525 V 89 mV 14.34 V 14.84 V
More (1of 2)
Clear All


File Control Setup Measure Analyze Utilities Help 3:50 PM
Acquisition is stopped.
5.00 MSa/s
1 On
2 On 5.00 V/div
3 On
4 On
H 20.0 µs/div
67.676609 µs
T -7.55 V
Measurements Scales
current mean std dev min max
V p-p(2) 15.19 V 15.276 V 62 mV 15.05 V 15.54 V
More (1of 2)
Clear All

3. **Starting (Maintenance) Current** (check for channels A and B)

Scale : 200mV=2A

Settings	Measurements
Connect probes across each resistor (0.1R) terminals	Measure the starting (maintenance) current = 11A ± 3A