सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(For Official Use)

A Pocket book on

MAINTENANCE OF LED SIGNAL



CAMTECH/S/Proj/2013-14/PB-LEDS/1.0
October 2013

अआमागर्RDSO
रेल अग्रदूत Transforming Railways
EXCELLENCE IN MAINTENANCE
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FOREWORD

This Pocket Book on Maintenance of LED Signal has been prepared for the object of imparting knowledge to the maintenance personnel of signaling department of Indian Railways to maintain the LED based signals in better way to avoid signal failures and maintain punctuality of trains.

This pocket size book covers operating parameters, maintenance instructions, installation, testing, pre-installation check list etc.

I hope that this pocket size handbook will really be useful to the signaling personnel of Indian Railways.

CAMTECH
GWALIOR
30.10.2013

A .R.Tupe
Executive Director

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PREFACE

On Indian Railways failures of Signals affects the punctuality of trains.

This pocket size maintenance handbook has been prepared to disseminate knowledge to maintenance staff to maintain the LED based Signals in better way to avoid signal failures.

It is clarified that this handbook does not supersede any existing provisions laid down in “Signaling Engineering Manual”, Railway Board publications and RDSO publications. This handbook is not statutory and information given in it are for the purpose of guidance only.

We are sincerely thankful to Shri Satyender Kumar D.S.T.E./MGS/ECR and Shri Surender Singh D.S.T.E./Agra/NCR and field personnel who helped us to prepare this maintenance handbook.

CAMTECH ***D.K.M.YADAV***
GWALIOR ***Jt. DIRECTOR(S&T)***
30.10. 2013

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M/s Efftronics Systems Pvt. Ltd. Vijayawada

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LED Signal

1. Introduction:

This Pocket Book covers detailed description of installation, testing and Maintenance instructions of LED/Signals.

2. Operating Parameters:

Operating parameters of various type of LED/Signal Lighting units used with ECRs.

Sr. No.	Parameter		Main Signal	C-On Signal	Route Lighting unit	Shunt Lighting unit
1.	Rated voltage at Input terminals of Current Regulator		110 V±25%	110 V±20%	110 V±20%	110 V±20%
2.	Current at rated voltage per unit at Input terminals of Current Regulator	For AC	140 mA +10%, -20% (rms)*	150 mA +10%, -20% (rms)	25 mA ±5%, (rms)	55 mA ±5%, (rms)
		For DC	125 mA +10%, -15% *	125 mA +10%, -15%	23 mA ±5%	50 mA ±5%

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3.	Illumination measured at 1.5 m from LED Signal lighting in axial direction at rated voltage	150 LUX -10% +40%	175 LUX -10% +40%	150 LUX -10% +40%	50LUX-10%+40%	50LUX-10%+40%	30LUX-10%+40%
4	Colour	Red	Yellow	Green	Yellow	Lunar White	Lunar White

As per RDSO specification no. RDSO/SPN/153/2002/Amt-1
Input Current:- 125 mA ±5% and
LED Current :- 40 mA

As per RDSO specification no.RDSO/SPN/153/2004/Rev.3.0

Input Voltage: 82.5 V to 137.5V AC, 50 Hz
Input Current: 112 mA to 154 mA

The DC lit signal lighting units have AC immunity of 300 V, 50 Hz.

2.1. Wattage of LEDs:

- Wattage of Main LED Signal Lighting units Red, Yellow and green aspect: around 20 W.
- Wattage of Red and Yellow LED: approx. 6mw
- Wattage of Green and white LED: approx. 10mw

2.2. ECR pick up and drop away current

Make	Conv. ECR	Suitability with LED Signal				PU Current	DA Current
		Main	C-on	Route	Shunt		
M/s ABB	ON-Metal to Metal	Yes	Yes	----	----	160 to 180 mA	110 to 130 mA
M/s Siemens	OFF-Metal to Metal	Yes	Yes			160 to 180 mA	50 to 70 Ma
M/s	ON-Metal	Yes	Yes	Yes	Yes	110 to	70 to

CGL & M/s Hytronics	to Carbon					150 mA	95 mA
LED ECR							
M/s CGL & M/s Hytronics	LED ECR AC Metal to Carbon	Yes	Yes	Yes	Yes	80 to 90 mA	60 to 70 mA

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3. Installation:

Items to be removed

- CLS Transformer
- Bulb and bulb holder
- Inner colour lens
- Outer clear lens

Items to be fitted

- Current regulator
- LED lighting unit
- Health Monitoring Unit

LED Signal Lighting Unit:

Red Aspect Yellow Aspect Green Aspect



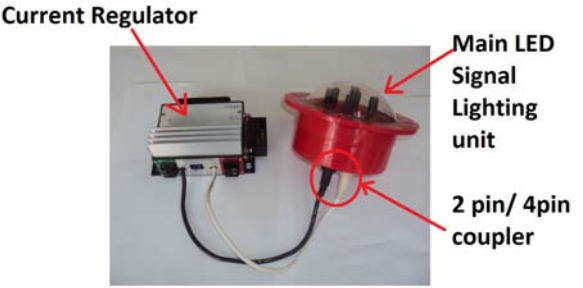
Main LED Signal lighting units

Route Indicator Calling-On Shunt Signal



Auxiliary LED Signal Lighting units

Current Regulator:



Current Regulator connected with LED/Signal lighting unit



Current Regulator of
Urban Engineering Association Kolkata

- Install Current Regulator on the existing mounting screw of signal transformer.
- Connect 4 and 2 pins coupler of the current regulator with the pins of proper match on the aspect.
- Connect110V supply AC or DC from indoor section to the input terminals of the current regulator.
- Open transparent cover with two screws and provide jumpers as per requirement using with different type of ECRs as described on the body of the CR.

- Provide jumpers for blanking mode for OFF aspect and Non–blanking mode for most restrictive aspect (ON aspect) as described on the body of the CR.

- In case of auxiliary signal such as Calling–on LED/Signal, Shunt LED/Signal and Route indicator LED/Signal, current regulator is not a separate unit but it is inbuilt in lighting unit.
- In case of auxiliary signal short pins by providing jumpers using with different ECRs as described on the body of the lighting unit.
- Provide jumpers for shorting the pins available on the body of the lighting unit after opening the transparent cover for using different type of ECRs.

ECRs:

- ECR (AC LED ECR, AC Conv. ECR, DC LED ECR) is connected in series with each aspect of LED/Signal lighting unit.
- It remained picked up at 50% illumination of LED/Signal Lighting Unit.



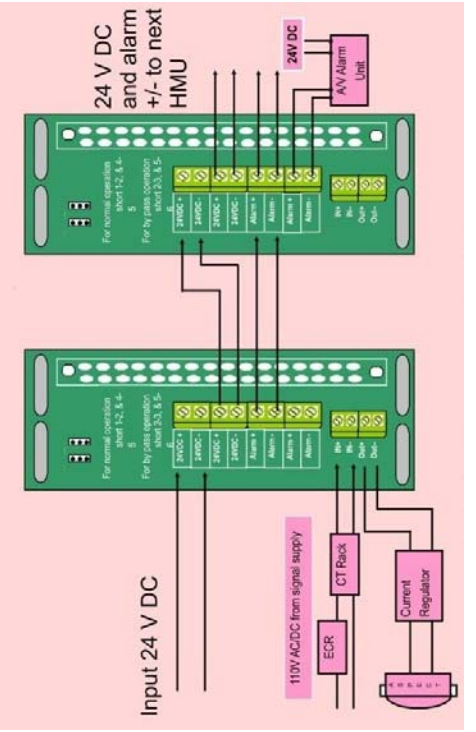
LED ECR
(M/s Urban Engg. Association, Kolkata)

Health monitoring Unit:

- Health monitoring unit is connected in series with each aspect through cable pair between ECR and LED/Signal lighting unit.
- Aspect feed is connected and then out on the mother board for respective aspect.
- The '*signal feed voltage'* as well as the '*circuit current'* is monitored by this unit.
- This is to evaluate the overall functionality of a particular aspect.
- Individual Health Monitoring Units are to be connected for each signal aspect.

Wiring diagram of HMU and Terminal block diagram of mother board

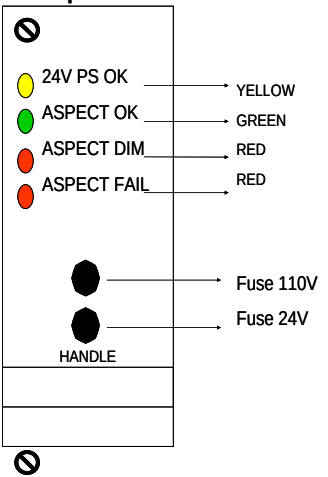
1. Mother board of HMU has 4 terminals for input and out put of LED/Signal lighting unit, 8 terminals for 24 volt and alarm.
2. 24volt parallel terminals are given for mother board of next HMU mother board input.
3. Connect all HMU alarm +/- in parallel.
4. Last HMU alarm +/- terminal is to go to ASM room and connect with the alarm.



Wiring diagram of Health monitoring unit

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Front View of Aspect Sensor Card



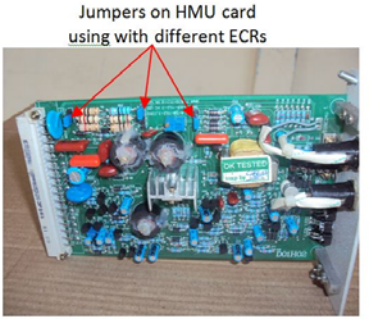
Front View Detail of HMU

HMU has four types of indications as shown in figure above.

- **24V PS OK (yellow Indication)–**It indicates 24V power supply connected at motherboard is OK.
- **Aspect OK (Green Indication)–** It indicates signal lighting unit at site is OK.

- **Aspect Dim (Red Indication)**–It indicates signal lighting unit at site, but aspect glowing with 50% illumination or Current Regulator drawing low I/P current.
- **Aspect Fail** (**Red Indication**)– It indicates Aspect lighting unit at site blank and also indicates for 110V fuse blown.
- Yellow indication will disappear on fuse blown off of 24V supply, but Audio Visual Alarm will appear at ASM's room.

  Pins on HMU Card (inside) are shorted by jumpers using with different type of ECRs as shown below.



Health monitoring unit Card

Selection of Jumpers inside HMU Cards using with different ECRs:

For AC LED ECR- short pins 2-3,5-6, & 9-10
For AC Con. ECR- short pins 2-3,4-5, & 9-10
For DC LED ECR- short pins 1-2,7-8, & 10-11

Audio Visual Alarm Unit:



Alarm Unit of Urban Engg. Association, Kolkata

For any failure, the Alarm Unit starts alarming and also the specific HMU latches the fault even after the signal is withdrawn.

Common audio visual alarm unit shall be kept in ASM's room and shall have following features.

- 24 Volt supply OK: yellow indication.

- Visual indication: Indicate failure condition.
- Piezoelectric buzzer: to give audio alarm of failure.
- Acknowledge button: to silence the audio alarm.
- The HMU unit will alert the operating person in the event of “aspect DIM” (predictive failure) or “aspect Fail” (complete failure).
- Audio/visual Alarm will start when illumination of the LED/Signal lighting unit become 50% of original value.
- The audio alarm can be silenced by pressing acknowledgement button but visual Red indication will remain as long as the failure remains.
- Also one red LED of the concerned HMU will remain lit as long as the fault exists.
- When all the potential free contacts of the HMUs are closed, the alarm unit senses ‘OK’ condition.
- At the event of failure (when aspect dim or blank) one contact of HMU gets open and alarm unit senses failure condition.

- Therefore, essentially all the potential free contacts of the HMUs must be connected in series and the final ends should be connected to the alarm unit.

4. Maintenance

Number of LEDs used in LED/Signal lighting units are as follows.

Power Technologies Corporation, Ltd New Delhi

- Main signal Red aspect - 54 LEDs
- Main signal yellow aspect - 54 LEDs
- Main signal Green aspect - 30 LEDs
- C-On Signal - 30 LEDs
- Route Indicator - 16 LEDs
- Shunt Signal - 13 LEDs

Minimum visibility distances of different type of LED/Signals.

- Main Signal - 600 meter
- Route Indicator with three lit LED/Signals - 400metre.

- C-on Signal - 200meter
- Shunt Signal - 200meter

Operating Voltage Range

- Minimum glow voltage is > 60V & $\leq$ 82.5V
- Maximum glow voltage -

  150V < AC < 175V

  190V < DC < 210V

Operating voltage range- 65V-137V

- ECR remains picked-up up to 50% illumination and Alarm is given to the user.
- Non Blanking facility for ON Aspects and forced I/P current < 30mA to ensure dropping of ECR.
- Blanking facility for OFF Aspects.
- Tighten two and four pins coupler on the back side of the LED/Signal lighting unit properly.
- Tighten 4 nut and bolts properly to secure LED/Signal lighting unit on the existing CLS unit.
- Shut and lock signal housing door properly
- Maintain >95volt at signal for good operation

- Ensure that mounting bolts/screws have been securely tightened for LED signal lighting unit, current regulator as well as Health monitoring unit.
- Properly clean the LED signal lighting units, all terminals and current regulator periodically with soft cloth.
- Ensure that LED signal does not vibrate during the running of trains.
- Ensure that the all LEDs of LED signal lighting unit are properly lightening.
- LED signal lighting unit should be stored in suitable cover provided with thermocol packing on the inner side surface.
- Ensure that the protection cover is provided on the current regulator terminals to avoid external interference.
- The connections in the location boxes should be cleaned for removing oxidation, rusting etc.
- After any check opening/refitting CRC spray should be provided.

- The LED signal lighting unit clear lens should be cleaned once in a six month to remove the dust with anti-static soft cloth.
- Ensure that correct polarity is connected while connecting power supply in case of DC lit signals.
- Signal housing door should be kept shut and locked.

5. Do's & Don'ts

Do's

- Use 600mA fuse in signaling circuit.
- Select Blanking Mode for OFF aspects and Non Blanking mode for ON aspect in current regulator of main LED signals.
- Ensure all terminations in CT rack, Junction Box, LED Signal Lighting Unit, Current Regulator, HMU, Route Signals, Shunt Signals & Calling- on are tight and clean.
- Poly Carbonate cover of LED Signal Lighting Unit may be cleaned with soft and antistatic cloth periodically.

- Check installation once a year by disconnecting the interconnecting Cable between CR & LED Signal Lighting Unit of Main Signal to check audio-visual alarm and correspondence of ECR.
- Ensure upgradation / modification, If any, as advised by RDSO.
- Always spray CRC spray after every tightening / opening of terminals of LED signal lighting unit and current regulator.
- Check health monitor device on each visit.
- Check all connections and screws are tightened.
- Operate audio alarm and check acknowledge button to silence the alarm.
- Select AC/DC mode in AC/DC current regulator as desired.
- Keep shut the signal-housing door properly.

Don’ts

- Don’t leave loose connectors between LED Signal lighting unit and current regulator. This may cause falls operation.

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- Don’t leave loose wires on input terminals of LED signal lighting unit and current regulator. This may cause false operation.
- Don’t connect wires at wrong input terminals for AC/DC power supply.
- Don’t try to interchange connections of LED Signal lighting unit, Current regulator and HMU.
- Don’t over tight the LED lead connector to the LED signal lighting unit.
- Do not try to give direct supply to the LED signal lighting unit of Main signal, Route Signals, Shunt signals and Calling-on Signals.
- Don’t try to open the cover for replacement of LEDs.
- Don’t use fuse more than 600mA rating in signaling circuit.
- Don’t try to drill the hole on the base of LED signal lighting unit for fixing on the existing signal unit.
- Don’t carry Current Regulator by its cable.
- Don’t carry hanging LED Signal Lighting Unit connected with Current Regulator.

M/s Efftronics Systems Pvt. Ltd. Vijayawada:
As per RDSO Specification no. RDSO/ SPN/ 153/ 2011/Rev 4.1

1. System Check for Fuse Terminal Block & Correspondence of ECR

1.1. System Performance with no optical out put

S. No.	Parameter	Requirements
1.	After taking OFF an aspect disconnect 3 pin round cell interconnecting cable between CR & LED/Signal lighting unit from LED/Signal lighting unit	i. Aspect extinguishes.
		ii. ECR of the aspect drops.
2.	Reconnect the disconnected 3 pin round cell	i. Aspect lights normal
		ii. ECR of the

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	connector and take off aspect again	aspect picks up.

1.2. System Check in Non-Blanking mode.

S. No.	Parameter	Requirements
	Configure the CR in Non-Blanking mode and take off the aspect. Disconnect the 2 pin Round Cell connector (optical feed back) from LED/Signal Lighting Unit.	i. Aspect lights up with deteriorated illumination with input current of CR restricted to < 40 mA rms.
		ii. ECR of the aspect drops.
2.	Reconnect the disconnected 2 pin round cell connector and take off aspect again.	i. Aspect lights up normal
		ii. ECR of the aspect picks up.

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1.3. System Check in Blanking mode.

S. No.	Parameter	Requirements
	Configure the CR in Blanking mode and take off the aspect. Disconnect the 2 pin Round Cell connector (optical feed back) from LED/Signal Lighting Unit.	i. Aspect blanks with input current of CR restricted to < 30 mA rms
		ii. ECR of the aspect drops.
2.	Reconnect the disconnected 2 pin round cell connector and take off aspect again	i. Aspect lights up normal
		ii. ECR of the aspect picks up.

2. General Precautions

- True RMS meter must be used for measurement of current in the input AC supply.
- LED Signal lighting unit should be kept in Burn in test for 48 hours before putting in to use.
- Individual ECR shall be provided for every Main Signal Aspect.
- Ensure that all connections are properly tight.
- Every aspect has individual return path.
- Ensure MOV is connected to MOV/input terminals of CR.

3. Trouble Shooting

Sr.	Symptom	Check Points	Solution
1.	ECR drop, Lamp OFF	Check 110 V input supply at I/P terminals of fuse terminal Block.	If supply not present rectify the supply problem
		Check	In proper

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Sr.	Symptom	Check Points	Solution
		glowing of the fuse blown indication conditions.	locking of fuse terminal block, lock it properly.
		Check 110 V output supply at out put terminals of Fuse terminal Block.	Fuse OK, Output 110 V of fuse terminal block not present, replace defective Terminal block.
		Check for 630 mA fuse in terminal block.	If fuse blown replace the fuse.
2.	All the connection s of CR and Lighting	Check 110 V input at I/P terminals of fuse terminal	Rectify the input connections between ECR

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Sr.	Symptom	Check Points	Solution
	unit proper but lamp does not glow.	block.	and fuse terminal block.
		Check glow of the fuse blown indication and 630 ma fuse in fuse terminal block.	Replace the defective fuse
		If not present, Check for 110V output at O/P terminals of fuse terminal block.	Replace defective terminal block.
		Check 110 V input at CR.	If input not present check the cables

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Sr.	Symptom	Check Points	Solution
			between CR and fuse terminal block and rectify.
		Check for the out put DC voltage between pins A&B, C&B of 3 pin round cell connector.	If output not present replace defective CR.
		Check for Non-Blanking, Blanking jumper selection 1-2, 2-3, If jumper is configured in Blanking mode	Check for open circuiting of 2 pin round cell connector.

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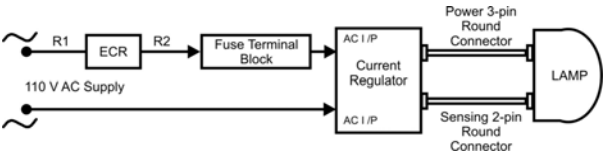
Sr.	Symptom	Check Points	Solution
		change to non- blanking mode and take off the aspect again, lamp glows with deteriorated intensity.	
		Lamp does not glow.	Defective lighting unit replace.
3.	Input voltage proper, lamp glows with deteriorated intensity in Non-Blanking mode and off (not	Disconnect the 2 pin round cell connector and short pins 1 & 2 of the connector and take off the aspect aga**in.**	Lamp glows with normal intensity. Defective sensing circuit. Check for connectivity of optical connector and replace

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Sr.	Symptom	Check Points	Solution
	glow) in Blanking mode.		the lighting unit.
		Disconnect the 3 pin round cell connector and measure the DC voltage between A-B, C-B with 2 pin optical sensor open circuited.	Voltage of about 12 V is observed in Non–Blanking mode and 8V in case of Blanking mode. Defective optical feed back connector replace
		No output DC voltage is observe in the CR	Defective CR replace.
4.	110V input to fuse terminal	Check the 110V out put of the ECR	110V present then check for the

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Sr.	Symptom	Check Points	Solution
	not present after taking off the aspect	after taking off the aspect.	connecting cable between fuse terminal block and ECR.
		Check for disconnection of the ECR coil	Replace the defective ECR.



Block Diagram of LED signal

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4. **Pre Installation Check list for Main Signal**

S. No.	**Check Points**	**Requirement**
1.	**General Requirement**	
i.	LED/Signal are procured from RDSO approved sources with RDSO inspection.	yes
ii.	Meter used for measurement in case of AC supply	True RMS
iii.	LED/Signal lighting unit have undergone burn in test for 48 hours before use	yes
iv.	Rating of fuse used in signal lighting circuit.	630 mA
V.	Current regulator (CR) of Main Signal have been configured in Blanking mode for OFF aspects and Non-Blanking mode for ON	yes

	aspects.	
2.	**ECR used in the circuit**	
i.	LED ECR is used for all signal aspects.	Yes
ii.	Individual ECR is used for every signal aspect	yes
3.	**Circuit requirement for Main LED/Signals**	
i.	Signalling circuit is such that in case of failure of an aspect, more restrictive aspect starts lighting i.e. cutting- in arrangement is provided.	yes
ii.	Red lamp Protection provided	Yes
iii.	Every aspect has individual return path.	yes
	Check Points	**Requirement**
4.	**Input Voltage available to Signal Aspect on load at site**	>82.5V to < 137.5 V AC
5.	**Jumper Selection and wiring Termination**	

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i.	Proper jumper Selection and wiring termination on CR is done as per manufacturer's manual as applicable.	Jumper Selection i. Blanking/Non-blanking (Blanking mode for OFF aspects and Non-blanking mode for ON aspects ii. ECR type: ACLED ECR III. Power Supply: AC
II.	Termination on CR and fuse terminal block are proper and properly tight	yes
iii.	Interconnecting cable between CR and LED/Signal lighting Unit is properly connected and tight.	yes
iv.	Mounting screws of LED Signal Lighting Unit, CR	yes

	and fuse terminal block are properly fixed.	
v.	Protective Caps are placed on the supply terminals of CR	Yes
6.	**Check for Lamp, CR and correspondence of ECR**	
i(a)	After taking OFF an aspect disconnect interconnecting cable between CR and LED Signal Lighting Unit from LED Signal lighting Unit (In case there are two Inter connecting cables between CR and LED Signal Lighting Unit– Disconnect the Cable other than optical sensing cable. The cable with 2 pin connector is optical sensing cable.)	(i) Aspect at the site extinguishes and more restrictive aspect lights(In case of Red aspect, signal in rear goes to danger.) ii. ECR of aspect drops.
i(b)	Reconnect	(i) Aspect at site

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	disconnected cable and take off the aspect again	lights normal
		(ii) ECR of the aspect Picks up
ii(a)	Disconnect the optical sensing cable (i.e. 2 pin round cell connector) from LED signal lighting unit.	(i) In case CR is configured for Non-blanking mode. Aspect at site lights with deteriorated illumination with input current of CR restricted to < 40 mA. In blanking mode Aspect at site extinguishes with input current restricted to < 30 mA
		(ii) More restrictive

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		aspect lights(In case of Red aspect, signal in rear goes to danger.
		(iii) ECR of the aspect drops
ii(b)	Reconnect disconnected cable	(i) Aspect at site lights normal
		(ii) ECR of the aspect picks up.
7.	**Check for lamp, CR, Correspondence of ECR & Fuse terminal block.**	
i(a)	After taking off an signal remove the fuse in the Fuse terminal block.	(i) Aspect at site extinguishes and more restrictive aspect lights (In case of RED aspect signal in rear goes to danger)
		(ii) Fuse blown

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		indication appears on terminal block.
		(iii) ECR of the aspect drops
i(b)	Restore the fuse in fuse terminal block.	(i) Aspect at site lights normal
		(ii) ECR of the aspect picks up

5. For Route Shunt and Calling- On Signal

S. No.	Check Points	Done Yes/No
1.	110V AC connected to Signal through ECR	yes
2.	i. Four Routes minimum are in Parallel ii. Two Shunts Minimum are in parallel iii. Calling-ON is stand alone	yes

S. No.	Check Points	Done Yes/No
	signal	
3.	MOV is available at input	yes
4.	Fuse holder on body is tight	yes
5.	Energize the Signal the ECR picks up	yes

Signature of Firm's representative

Signature of Inspecting official

DISCLAIMER

The information given in this pocket book does not supersede any existing provisions laid down in S.E.M., Rly. Board and RDSO publications. This document is not statutory and instructions given in it are for the purpose of guidance only. If at any point contradiction is observed, then S.E.M., Rly. Board/RDSO guidelines or Zonal Rly. instructions may be followed.

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