नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्तांक
Marks Awarded :

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुदेशक के आद्यक्षर
Instructor Initial :

LED SIGNALS

INTRODUCTION TO LED SIGNAL: LED **(**Light Emitting Diode) light sources are solid-state p-n semiconductor devices. By doping a substrate material with different materials, a p-n junction is formed within the semiconductor crystal. The material used at the junction determines the wavelength of the emitted light. A clear or diffuse epoxy lens covers the semiconductor chip and seals the LED. It also provides some optical control to the emitted light.

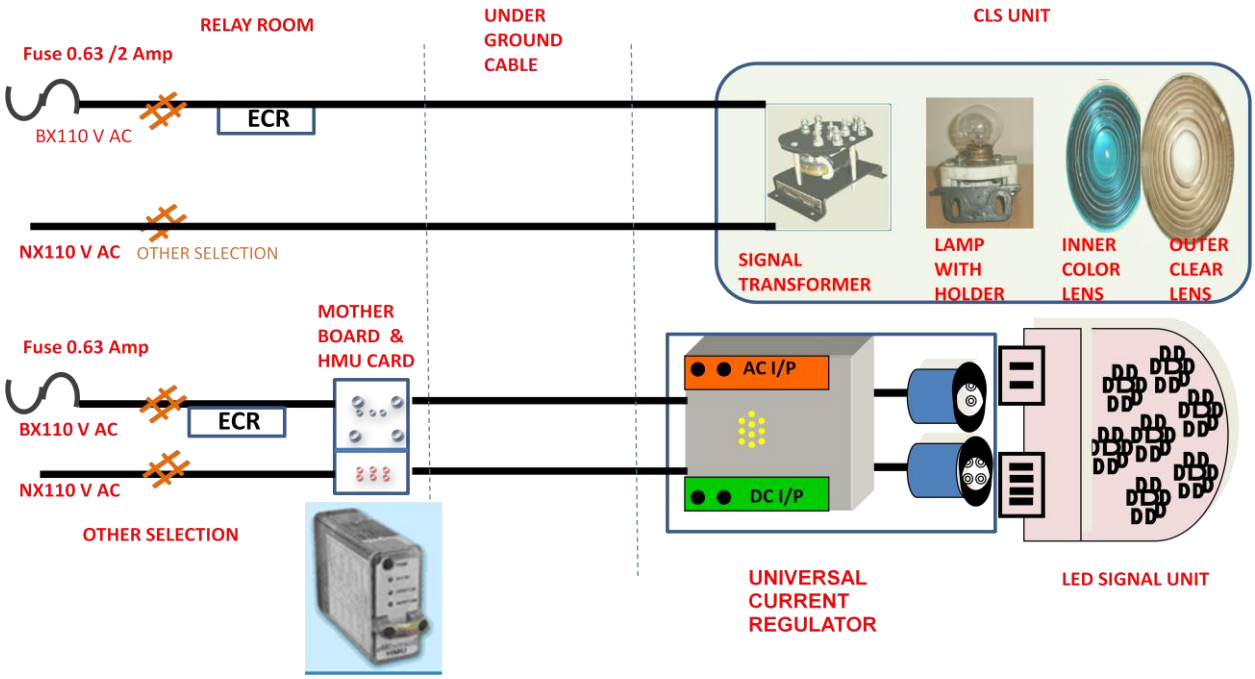
Colour	**Wavelength**	**Voltage**	**Semiconductor Material**
RED	$610 < \lambda < 760$	$1.63 < \Delta V < 2.03$	Aluminium gallium arsenide (AlGaAs) Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphate (AlGaInP) Gallium(III) phosphide (GaP)
Yellow	$570 < \lambda < 590$	$2.10 < \Delta V < 2.18$	Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium(III) phosphide (GaP)
Green	$500 < \lambda < 570$	$1.9 < \Delta V < 4.0$	(AlGaP) Indium gallium nitride (InGaN) / Gallium(III) nitride (GaN) Gallium(III) phosphide (GaP) Aluminium gallium indium phosphide (AlGaInP) Aluminium gallium phosphide

The LED signal has certain advantages over conventional filament lamp

- There is no Phantom effect.
- LED lamps are pre-focussed and do not need external lenses or periodic focusing.
- LED lamps are physically compatible with existing signal housings, hence can be retrofitted.
- Long life and no periodic replacements hence traffic hazards while changing bulbs by maintenance staff is eliminated.

- DC power feeding of signals possible, thus alternate mode is available if AC power fails.
- Wide voltage variation in power feed is tolerated.
- AC immunity (DC version) is up to 300 volt.
- One design (same type, AC lit LED ECR / DC lit LED ECR) of ECR for all LED signal lamp application including shunt signal and route indicator
- Maintenance costs reduced, as they don't need frequent replacement. Only occasional cleaning of transparent cover needed in dusty areas.

Aspect control circuit arrangement with filament lamp & LED signal



SCOPE:

1. RDSO/SPN/153/2002 Specification covers the general and technical requirements of LED signal lighting units suitable for fitment in adjusting colour light signal units available in RE & NON-RE areas of Indian Railways.
2. The LED Signal lighting Units covered in the above specification Include Main Signal Unit, Route indicator Units, Calling ON signal units and shunt signal units
3. The Above Specification supersede specification numbers RDSO/SPN – 153/98 RDSO/SPN – 153/99 and RDSO/SPN – 164/99.
4. The latest Specification covers both AC and DC fed LED signal lighting units.
5. The latest specification shall be read with the specifications RDSO/SPN/144/94 for safety
6. LED Signal lighting Units shall generally be used with ECRS as per RDSO specification STS/E/Relays/DC lit LED Signal /03 – 2000 or STS/E/Relays/AC lit LED Signal /03 – 2000 as applicable. However it shall be possible to use LED Signal lighting Units with existing metal to metal OR carbon to metal ECRs and called as conventional ECR for this purpose.
7. Whenever in this specification, any of the above mentioned specification is referred to by number only, without mentioning the year of issue, the latest issue of the specification is implied, otherwise the particular issue is referred.

CONSTRUCTION OF LED LAMP:

LED Signal Unit comprises of the following units.

1. **LED Signal Aspect lighting Unit**
2. **Current Regulator Unit**
3. **Failure indication Unit (Health Monitoring Unit)**

LED signal units are available for,

- Main signal aspect
- Shunt signal
- Calling on signal
- Direction route indicator

These signal units can be easily fixed in CLS unit by removing all the parts of signal lighting unit that is clamp, holder, lamp, both inner & outer lenses

LED Signal Aspect Unit:

It comprises of a cluster of LEDs and are arranged in more than one array. These arrays are wired in series and parallel combinations. This arrangement prevents blanking of signal in event of failure of any one array. Number of LEDs changes as per LED signal unit for a particular aspect of a signal to maintain stipulated Lux output. LEDs in the array are interleaved so that effect of failure of any array is spread out equally to maintain uniform visibility. All aspects (except route and shunt) use two arrays for higher noise immunity and also provide the redundancy. Generally the optical sensors are provided for each aspect to check the lumens output of group of LEDs and output from optical sensors is given to the current regulator unit for corrective action that is reduction of current feed to LED signal unit.

IN PUT , OUT PUT AND FUNCTION OF LED SIGNAL UNIT

Sr No	LED Signal unit		Function		IN PUT to LED SIGNAL UNIT	Out put of LED SIGNAL UNIT in Lux as per Spec RDSO/SPN/153 /		Mini Visibility Mts	AC immunity Of	
			Gives out light beam of	Optical output feed back to current regulator		2000	2004		AC in put lit LED	DC in put lit LED
						-15% +25%	-10% +40%			
1	Main running signal	RED	RED LIGHT	Yes if optical sensors provided by manufacturer	Always DC appro. 135 Volts DC, which is 125% of I/P to CR	120	150	600	AC noise imm-unity Is 60 Volts	300 Volts
2		YELLOW	YELLOW LIGHT			110	175			
3		GREEN	GREEN LIGHT			150	150			
4	Directional rout indicator		Gives out lunar white light			50	50	400		
5	Calling ON signal					50	50	200		
6	Shunt signal					30	30			

A few LEDs in the signal unit are so arranged as to ensure near visibility of 5 meters so that the signal is clearly visible to a driver stopping at the foot of the signal. LED signal unit housing is made of industrial grade plastic like ABS or fiberglass. The front cover (Dome) is made of UV stabilized polycarbonate dome. LED signal unit is hermetically sealed in order to ensure that it is able to withstand the environment severity. The all LED signal unit are compatible to existing CLS unit.

Universal Current Regulator Unit (UCR):

It is called universal as it works on either 110 volts AC & 110 volts DC . It is a separate unit for main aspect LED signal unit and fixed in CLS unit, for other LED signal unit that is Shunt signal, calling ON signal & route indicator, it is inbuilt. LED is current driven device, therefore current to LED cluster must be constant hence current regulator feed constant current irrespective of fluctuations in the input supply voltage. It consists of solid – State variable resistance controlled current regulating arrangement. UCR can adjust current of circuit to match pick up current of ECR. The current of circuit can be changed by shorting pins provided on UCR. There is scope for adjustment for, cascaded OR non cascaded aspect control circuit. Blanking option for cascaded and Non-blanking option for non- cascaded aspect control circuit shall be taken. UCR also regulates the current supplied to LED signal unit as per feedback from sensors of LED signal unit. Number of optical sensors are provided for each array which gives feed back to UCR about optical output of array and in turn current regulator regulates current accordingly (in case of fusing of LEDs). When lumens output further reduces then whether supply to LED array should cut OFF OR remains is depends upon which pin shorting option is opted that is Blanking for cascaded and Non-blanking for Non-cascaded aspect control circuit .

In put, output and functions of universal current regulator

Sr No	Universal current regulator for		In put per unit as per Spec RDSO/SPN/153/		Out put	Function
			2000	2004		
			Voltage Current	Voltage Current		
1	Main running signal	Separate & fixed in side CLS unit	110V AC/DC±20% 125 ma AC±5% 105 ma DC ±5%	110V AC/DC ±25% 140ma AC +10%-20 125 ma DC +10%-20	Always DC appro. 135 Volts DC, which is 125% of I/P to current regulator	1) Supply constant regulated current to LED signal unit. 2) Scope for adjustment of current of aspect control circuit to suite pick up current of ECR 3) Scope for adjustment to suite cascaded OR non cascaded aspect control circuit. 4) Regulates the current as per feed by LED signal unit
2	Rout indicator	In build	110 volt AC/DC ±20% 25 ma AC ±5% 23 ma DC ±5%			
3	Calling ON signal		110VAC/DC±20% 125 ma AC ±5% 125 ma DC ±5%	110 V AC/DC±25% 150ma AC +10%-20 125 ma DC +10%-20		
4	Shunt signal		110 volt AC/DC ±20% 55 ma AC ±5% 50 ma DC ±5%			

Failure indication Unit or health monitoring unit (HMU):

LED Signal unit works in association with Failure indication unit located at the cabin/relay room/SM Room. It is available in two type, relay type and box type and for each aspect one relay/ HMU card is require. It requires separate 110 Volts AC power supply for mother board. Both out going Bx & Nx 110 AC wires of aspect control circuit are terminated as IN PUT on HMU card / Relay and OUT PUT is extended to site. There is facility to by-pass the card from the circuit. The failure indication unit monitors the performance (light output / current) of the LED Signal Aspect. It actuate the buzzer circuit to alert about the variation of current in the aspect control circuit for particular aspect and also controls, the Aspect O.K visual indication which, If lit indicates that LED Signal unit is in lit condition at site.

Lamp checking relay (ECR):

RDSO issues guide line time to time about ECR that can be used along with LED signal. The LED signal lighting unit shall generally be used with ECR as per RDSO specification STS/E/Relay /DC lit signal /03-2000 OR STS/E/Relay /AC lit signal /03-2000.The LED signals are compatible to all type of conventional ECR also. All the Q series ON ECR (metal to Carbone) and Siemnes OFF &ABB ON ECR (metal to metal) for main aspects may called as AC conventional ECR. The pins/jumpers are available on current regulator and selection shall be done as per the ECR to be used. This jumper selection changes current of circuit to suit pick up current of ECR, as the current of LED signal is 125 mA which may be less than pick up current ECR.

Selection Details for Universal Current & Jumper & pins selection details on the Universal Current Regulator (for power technologies Ltd make):

Terminals fixed on Red band are for AC input connection and Green band is for DC input connection. The jumper selection on UCR shall be done as per the ECR to be used that is conventional OR AC LED ECR OR DC LED ECR and whether aspect control circuit has cascading arrangement OR not. Blanking option is used for cascaded and Non-blanking is used for no cascaded aspect control circuit.

(Note: - jumper selection on Universal Current Regulator changes with manufacturer)

Jumper selections on universal regulator of Power technology Ltd				
Sr No	Type of ECR	jumper Pins to be shorted for		Approximate Current of circuit after jumper pins shorting
		Ten pin current regulator	Fourteen pin current regulator	
1	AC LED ECR	2,3 & 6,7	2,3 & 6,7 & 10,11	125 mA AC
2.	AC Conventional ECR	2,3 & 5,6	3,4,& 7,8 & 10,11	165 to 180 mA AC
3.	DC LED ECR	1,2 & 4,5	1,2 & 5,6 & 9,10	105ma DC
4	Blanking	8,9	13,14	Cascading
5	Non-blanking	9,10	12,13	Non-cascading

Review questions:

1) What are the functions of Current regulator?

2) What changes are to be done on current regulator, for using conventional ECR's?

3) What will happen if aspect control circuit have cascading and non-blanking option is chosen?

4) Remove the feedback lead from LED signal unit and check the change in current with blanking and non-blanking option

Date: **Signature of the Trainee**