



Transport
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Reference material

LED Signals Controlled by Relay Circuits

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LED SIGNALS CONTROLLED BY RELAY CIRCUITS

DESIGN GUIDELINES

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1. Introduction

LED signals have a number of advantages, over traditional incandescent signal lights. LED signals also have some issues that need to be managed. This guideline addresses:

- Circuit length limitations due to capacitive coupling in cables.
- Lamp proving by measurement of the current drawn by the light.
- Surge protection requirements.

2. Strategy

Existing installations that are converted to LED may retain QSR3 lamp proving with modifications as noted in this guideline.

No new QECX1 lamp proving relays are to be installed. Existing signals with QECX1 lamp proving are to be changed to either QSR3 or LPM lamp proving when they are changed to LED type.

New installations are to use the Lamp Proving Module (LPM) as the preferred method of lamp proving.

Lamp proving is not required on double light signals, except for the first 5 double light signals on entry to double light signalled areas from single light signalled areas.

3. Cables

Multi-conductor signalling cable in accordance with RIC standard *Cables for Railway Signalling Applications – Multi-conductor Signalling Cables* SC 11 11 07 00 SP is acceptable for use.

New installations using signalling cables should use two wires per light rather than the traditional use of a common neutral. The two wires for each light should be adjacent cable core numbers. It is preferred that the cable cores are in the same layer of cores in the cable and alternate, active, neutral, active, neutral, etc to minimise coupling within the cable.

Multi-pair Olex Dekoron Instrumentation cable with a nylon jacket and a sacrificial PVC sheath added to the standard cable may be used. The Dekoron instrumentation cable has twisted pairs. Individual signal lights are to use a pair. Circuits should not be split across pairs.

Although the Olex Dekoron instrumentation cable Australian data sheet indicates it is rated for 110VAC, it is actually rated for 300VAC. The Olex Dekoron cable may be used for 15VDC or 120VAC signal light circuits.

4. Aldridge RL400 series 120VAC Mainline outdoor signals 212mm.

Turn on voltage:	55VAC
Main aspect current:	Typically 160 to 250 mA AC.
Distance to signal:	Less than 750m for single cut circuits. Between 750m and 1500m for single cut circuits with two 6K8 6W bleed resistors fitted in the signal head. Less than 2000m for double cut circuits.
Surge protection:	Fit a 130 VAC, 20mm varistor across each led unit in the signal head. Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.
Pulsating aspect:	Tested ok, using QSR3 and a 2,000 Ohm resistor set at about 900 Ohms.
Lamp proving:	Aspect will work with QSR3 fitted with a 150 Ohm resistor. A 30V, 20mm varistor is to be fitted across the QSR3 to protect the diode bridge. Aspect will not work with QECX1. Aspect will work with Lamp Proving module (LPM).

5. Aldridge RL400 Series outdoor signals 120VAC 127mm

Turn on voltage:	40VAC.
Main aspect current:	Typically 100 to 130mA.
Distance to signal:	Less than 750m for single cut circuits. Between 750m and 1500m for single cut circuits with two 6K8 6W bleed resistors fitted in the signal head. Less than 2000m for double cut circuits.
Surge protection:	Fit a 130 VAC, 20mm varistor across each led unit in the signal head. Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.
Pulsating aspect:	Not yet tested.

Lamp proving: Aspect will not work with QSR3.
Aspect will not work with QECX1.
Aspect will work with Lamp Proving module (LPM).

6. Aldridge Tunnel signals 120VAC 127mm

Turn on voltage: >30VAC
Main aspect current: Typically 40mA to 100mA AC.
Distance to signal: Less than 1200m for single cut circuits.
Less than 2000m for double cut circuits.
Surge protection: No varistors are required across the LED units in the signal head.
Pulsating aspect: Not yet tested.
Lamp proving: Not tested.

7. Alstom Mark 2 120VAC Mainline outdoor signals 212mm

Turn on voltage: >40VAC
Main aspect current: Typically 167mA to 224mA AC.
Distance to signal: Less than 750m for single cut circuits.
Between 750m and 1500m for single cut circuits with two 4K7 6W bleed resistors fitted in the signal head.
Less than 2000m for double cut circuits.
Surge protection: No varistors are required across the LED units in the signal head.
Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.
Pulsating aspect: Tested ok, using QSR3 and a 2,000 Ohm resistor set at about 1,100 Ohms.
Lamp proving: Aspect will work with QSR3. A 30V, 20mm varistor is to be fitted across the QSR3 to protect the diode bridge.
Aspect will not work reliably with QECX1.
Aspect will work with Lamp Proving module (LPM).

8. Alstom Mark 2 Mainline outdoor signals 120VAC 127mm

Turn on voltage:	>40VAC
Main aspect current:	Typically 56mA to 90mA AC.
Distance to signal:	Less than 750m for single cut circuits. Between 750m and 1500m for single cut circuits with two 4K7 6W bleed resistors fitted in the signal head. Less than 2000m for double cut circuits.
Surge protection:	No varistors are required across the LED units in the signal head. Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.
Pulsating aspect:	Not yet tested.
Lamp proving:	Aspect will not work with QSR3. Aspect will not work with QECX1. Aspect will work with Lamp Proving module (LPM).

9. Alstom Mark 2 Tunnel signals 120VAC 127mm

Turn on voltage:	70VAC
Main aspect current:	Typically 30mA AC.
Distance to signal:	Less than 1500m for single cut circuits. Less than 2000m for double cut circuits.
Surge protection:	No varistors are required across the LED units in the signal head.
Pulsating aspect:	Not yet tested.
Lamp proving:	Not tested.

10. Westinghouse RM4 Mainline outdoor signals 120VAC 212mm

Turn on voltage:	44VAC
Main aspect current:	Typically 68mA to 107mA AC.
Distance to signal:	Less than 2000m for single cut circuits.
Surge protection:	No varistors are required across the LED units in the signal head. Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.

Pulsating aspect: Tested ok, using QSR3 and no resistor.

Lamp proving: Aspects will work with QSR3 however full compression may not be achieved for the QSR3. The green light is to be fitted with a 3K3, 10W shunt resistor in the signal head to even out the current drawn by the different colours. A 30V, 20mm varistor is to be fitted across the QSR3 to protect the diode bridge.

Aspect will not work with QECX1.

Aspect will work with the wire twice through a Lamp Proving module (LPM) if the shunt resistor is fitted on the green light.

11. Westinghouse TR3 501 series tunnel or outdoor signals 120VAC 127mm

Turn on voltage: 44VAC

Main aspect current: Typically 60mA to 80mA AC.

Distance to signal: Less than 2000m for single cut circuits.

Surge protection: No varistors are required across the LED units in the signal head.

Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.

Pulsating aspect: Not yet tested.

Lamp proving: Aspect will not work with QSR3.

Aspect will not work with QECX1.

Aspect will not work with Lamp Proving module (LPM).

12. Westinghouse RM4 Mainline outdoor signals 12VAC/DC with Signal light transformer 212mm

Turn on voltage: 40VAC

Main aspect current: Typically 35mA to 180mA AC.

Distance to signal: Less than 2000m for single cut circuits.

Surge protection: No varistors are required across the LED units in the signal head.

Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.

Pulsating aspect: Not yet tested.

Lamp proving: Not yet tested.

13. Alstom Turnout Repeater

Turn on voltage: 80VAC

Main aspect current: Typically 115mA to 127mA AC.

Distance to signal: Currently less than 500m for single cut circuits.

Technical confirmation required before use at distances longer than 500m.

Surge protection: No varistors are required across the LED units in the signal head.

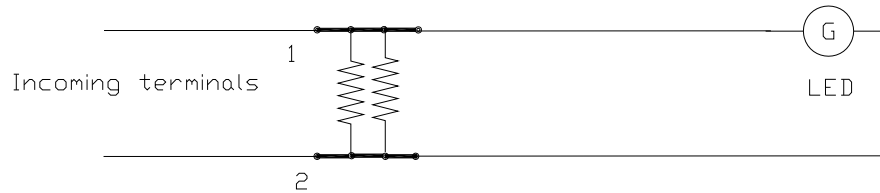
Must have some surge protection to earth on each leg of the 120VAC supply at power supply locations.

Pulsating aspect: Not applicable

Lamp proving: Aspect will work with Lamp Proving module (LPM).

14. Bleed resistor arrangement

The typical arrangement of the bleed resistors fitted in the signal head is as shown in the following drawing.



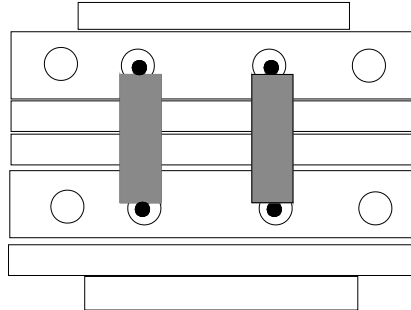
ZDU 2.5/4 AN Terminals

For Aldridge LEDs use: 6K8 6W Resistors
Welwyn W22 RS159-540

For Alstom LEDs use: 4K7 6W Resistors
Welwyn W22 RS159-534

The resistors are normally terminated on terminals installed on a mounting rail as shown:

End Bracket EW35
ZDU 2.5/4 AN
End Plate ZAP/TW3
End Plate ZAP/TW3
ZDU 2.5/4 AN
End Plate ZAP/TW3
End Bracket EW35



15. Relay Lamp proving currently in-place**15.1. QSR3**

Maximum continuous current:	350mA
Minimum release current:	30mA
Maximum on current:	105mA

15.2. QECX1

Maximum continuous current:	400mA
Minimum release current:	110mA
Maximum on current:	180mA

15.3. Lamp Proving Module (LPM) with single wire through current transformer

Maximum continuous current:	Not Applicable
Adjustable pick up current:	140mA to 500mA

15.4. Lamp Proving Module (LPM) with wire twice through the current transformer

Maximum continuous current:	Not Applicable
Adjustable pick up current:	70mA to 250mA