ReadMe – Lights SubSystem

# LRUs (Line Replaceable Units)

1. White Curved Front (turns up side down for left or right). In MOT, Spare carried.
   * Side Light
   * Dipped Beam headlight
   * Full Beam headlight
     1. Soft Switchable headlight between shine to the left / shine to the right for countries that drive on the left or right.
     2. Soft Switchable headlight level, step up and step down with 16 positions overall.
     3. Tell Tale inside vehicle.
   * Running Lights
   * Fog Light
     1. Tell Tale inside vehicle.
2. Red Curved (turns up side down for left or right). In MOT, Spare carried.
   * Brake Light
   * Rear Light
   * Fog Light
   * Reflector
3. Amber Curved (turns up side down for left or right, front or back). In MOT, Spare carried.
   * Indicator
     1. Tell Tale inside vehicle.
4. White Curved Back (turns up side down for left or right). Not in MOT, no spare carried.
   * Reversing Light
5. White Straight Interior. Not in MOT, no spare carried.
   * Interior Light (interior, one of them, above drivers face)
6. White Straight Exterior. In MOT, Spare carried.
   * Number plate lights (one for front, one for back)
7. Red Straight. In MOT, Spare carried.
   * Exterior Brake Light on High – flashes upon emergency brake

# Spares Carried

One of each of the following five LRUs are carried onboard:

1. White Curved Front
2. Red Curved (for rear brake lights)
3. Amber Curved (for indicators)
4. White Straight Exterior (for number plates)
5. Red Straight.

But not

* 1. White Curved Back (reversing)
  2. White Straight Interior

Each LRU is held in place by magnetic bolts, of standard Klima design.

# Arduino Pin Outs

1. Digital Out: **Side Lights** on or off [Digital Pin 1]. These are front low wattage ones. The rear sidelights are the same as the normal rear red lights.
   1. Digital In: Monitor Left [Digital Pin 2]
   2. Digital In: Monitor Right [Digital Pin 3]
2. Digital Out: **Dipped Headlights** on or off [Digital Pin 4]. This is essentially a metal shutter that is positioned over the upper half of the path of shining. This action raises or lowers the pairs of shutters.
   1. Digital In: Monitor Left [Digital Pin 5]
   2. Digital In: Monitor Right [Digital Pin 6]
3. Digital Out: **Full Beam Headlights** on or off. Also controls a tell tale indicator. [Digital Pin 7]
   1. Digital In: Monitor Left [Digital Pin 8]
   2. Digital In: Monitor Right [Digital Pin 9]
4. Digital Out: **Running Lights** on or off. Although they are almost always on, this active control allows the option better standby power performance. [Digital Pin 10]. The monitor involves more than one sensor to cover the length, but the electronics is such that if any one sensor in the set sees less light than it should the monitor is triggered.
   1. Digital In: Monitor Left [Digital Pin 11]
   2. Digital In: Monitor Right [Digital Pin 12]
5. Digital Out: **Fog light** on or off, controls all four fog lights. Also controls a tell tale indicator. Front fog light is not mandatory, but is included for safety score [Digital Pin 13]
   1. Digital In: Monitor Front Left [Digital Pin 14]
   2. Digital In: Monitor Front Right [Digital Pin 15]
   3. Digital In: Monitor Rear Left [Digital Pin 16]
   4. Digital In: Monitor Rear Right [Digital Pin 17]
6. Digital Out: **Headlight beam direction** Left or Right. For driving on the continent and then crossing to the UK, or vice versa. No stickers are needed, rather it is under software control. Controls Dipped beam [Digital Pin 18]
   1. Properly to Left [Digital Pin 19]
   2. Properly to Right [Digital Pin 20]
7. Digital Out: **Lowering of headlights** (requires further investigation) [Digital Pin 21-24]
8. Digital Out: **Rising of headlights** (requires further investigation) – assume that details are in electronics outside of Arduino. [Digital Pin 21-24, 4 pins, 16 positions]
9. Digital Out: **Reverse Lights** – on or off [Digital Pin 25]
   1. Digital In: Monitor Left [Digital Pin 26]
   2. Digital In: Monitor Right [Digital Pin 27]
10. Digital Out: **Left turn indicator** – on or off (same pins cover hazard) [Digital Pin 28]
    1. Digital In: Monitor Front Left [Digital Pin 29]
    2. Digital In: Monitor Rear Left [Digital Pin 30]
11. Digital Out: **Right turn indicator** – on or off [Digital Pin 31]
    1. Digital In: Monitor Front Right [Digital Pin 32]
    2. Digital In: Monitor Rear Right [Digital Pin 33]
12. Digital Out: **Brake Light** – on or off (same pin covers flashing of brake lights during an emergency stop) [Digital Pin 34]
    1. Digital In: Monitor Rear Left [Digital Pin 35]
    2. Digital In: Monitor Rear Right [Digital Pin 36]
13. LRU Release from central control. These pins are not monitored. If LRU sticks to release do the following: Ask software to retract bolt. Then use a rod through a hole to push it out.
    1. White Curved Front Left [Digital Pin 37]
    2. White Curved Front Right [Digital Pin 38]
    3. Red Curved Rear Left [Digital Pin 39]
    4. Red Curved Rear Right [Digital Pin 40]
    5. Amber Curved Front Left [Digital Pin 41]
    6. Amber Curved Front Right [Digital Pin 42]
    7. Amber Curved Rear Left [Digital Pin 43]
    8. Amber Curved Rear Right [Digital Pin 44]
    9. White Curved Rear Left [Digital Pin 45]
    10. White Curved Rear Right [Digital Pin 46]
    11. White Straight Interior [Digital Pin 47]
    12. White Straight Exterior Front [Digital Pin 48]
    13. White Straight Exterior Rear [Digital Pin 49]
    14. Red Straight [Digital Pin 50]
14. LRU Spares Release
    1. White Curved Front [Digital Pin 51]
    2. Red Curved (for rear brake lights) [Digital Pin 52]
    3. Amber Curved (for indicators) [Digital Pin 53]
    4. White Straight Exterior (for number plates) [Digital Pin 54]
    5. Red Straight. [Digital Pin 55]

# Functions

1. Hazard lights – delivered from software
2. System tells you which LRU is faulty, releases it and releases the right spare for you.

# MOT Tests on lights

Front, rear, brake, fog, indicator and registration plate lights and rear reflectors must:

* Be correctly positioned and secure
* Not be obscured
* Be in good condition
* Show the correct colour (a bluish tinge to front headlights is acceptable as long as the predominant colour is white)
* Not be adversely affected by the operation of any other light
* Illuminate with a single operation of the switch

Pairs of lights must emit light of the same colour, size and shape.

Headlight aim (both dip beam and main beam) should be below the horizontal, so as not to dazzle other drivers.

MOT Test of Lights

The headlamps are checked for alignment with a Beam Setter. The headlamp beam image will be a fail if it is clearly incorrect. After first aligning the equipment with the vehicle, the left and right headlamp beams are checked to ensure they are correctly set so as not to dazzle other road users.

All required lights are checked for:

Operation

Condition

Security

With the exception of headlamps, all lamps must have at least 50% of the light source illuminating.

All lamps must be visible from a reasonable distance (not obscured by products on the light lens or source.

Side lights and headlamps

are the correct type and colour

dip and aim

LED and HiD headlamps: automatic levelling or cleaning device inoperative or obviously defective

'tell-tale' device does not iluminate when main beam is selected

Stop lights, indicators and hazard lights\*

are the correct type and colour

do not interfere with each other in operation

driver's tell-tale works with respect to indicators, or there is an audible warning system

hazard lights fitted and operative

Rear Fog lamps\*\*

must be fitted to the centre or offside of the vehicle

tell-tale must work

must not be affected by other lamps and not be obscured

must be red.

Registration Plate lamps (Class (v): incl. end outline marker lamps)

All lamps fitted must be working

must illuminate with a single operation of the switch

Rear reflectors

There must be two red reflectors fitted reasonably symmetrically, securely attached and not obscured.

\* Must be fitted to all vehicles first used on or after 1st April 1986, but if fitted, must be Tested.

\*\* Must be fitted to all vehicles first used on or after 1st April 1980.