ADB Airfield Solutions
Runway Guard Light System Operation

1. Introduction
Following is a description of how the ADB Airfield Solutions (ADB) Runway Guard Light (RGL) system works. According to FAA specification AC 150/5340-30 and AC 120-57 (SMGCS), a RGL bar consists of either in-pavement lights or elevated lights. In some cases, both in-pavement and elevated lights are used in a single bar. RGLs provide a distinctive warning to anyone approaching the runway holding position that they are about to enter an active runway.

2. In-Pavement RGL Bar
An in-pavement RGL bar consists of a row of yellow, pulsing, wide-beam L-852G in-pavement fixtures installed across a taxiway, at the runway holding position marking. The entire row pulses such that even-numbered lights are on simultaneously. As they extinguish, the odd-numbered lights pulse simultaneously. Power is applied alternately to each set of fixtures for 50%, ± 0.5% of the total cycle. Each fixture pulses at a rate of 30-32 flashes per minute over all brightness settings.

3. Elevated RGL Bar
An elevated RGL bar consists of two yellow, pulsing, L-804 wide-beam elevated fixtures installed across a taxiway, at the runway holding position marking. Each elevated fixture pulses at a rate of 45-50 flashes per minute over all brightness settings (on a series circuit). Power is applied alternately to each lamp in an elevated fixture for 50%, ± 0.5% of the total cycle. An elevated L-804 fixture must use a high strength baseplate (P/N 1832 RGL) due to the 300mph wind speed requirement. The fixture includes a tether. The maximum height of the fixture is 26 inches.

4. RGL System Components
ADB's RGL system consists of the following components:
- BRITE® PC (electronically monitored systems only)
- BRITE® Master (electronically monitored systems only)
- BRITE® single channel Remote (one for each L-852G fixture)
- BRITE® dual channel Remote (one for each elevated L-804 fixture)
- L-852G In-pavement fixture with one 105W lamp
- L-804 Elevated fixture with two 100W lamps

Note: Ferroresonant CCRs should always be used with flashing loads- the type of load RGLs impose on CCRs. SCR type CCRs should not be used on RGL circuits.

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5. Monitoring Options

Runway Guard Lights can either be visually or electronically monitored. Many airports have elected to install ADB's unmonitored RGL system because of its reliability, ease of installation, ease of maintenance and low cost. Also, the system can be easily upgraded in the future to an electronically monitored version by simply adding a BRITE PC and BRITE Masters. *No hardware changes are needed in the BRITE Remotes installed in the airfield.*

6. Unmonitored RGL System Architectures

6.1 Unmonitored In-pavement RGL System

A block diagram of an unmonitored in-pavement RGL system is shown in Figure 1. No BRITE Master or computer interface is required. Simply install the Remotes and the system works automatically. At turn on, all remotes digitally sync to the power line and maintain operation in accordance with FAA requirements with no further commands from any other device. In order to achieve alternate pulsing, the Remotes are supplied in two versions- Initial Flash ON and Initial Flash Off. The version is indicated on the Remote label. During installation, the two versions are alternately installed in an in-pavement bar.

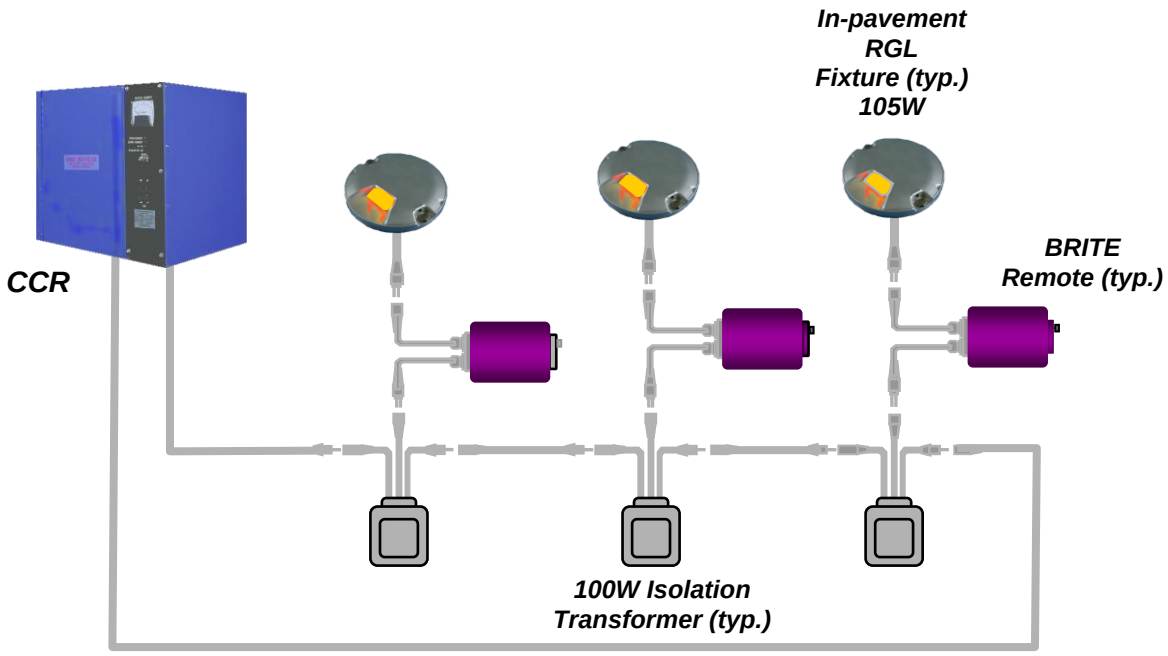

Figure 1: Un-monitored in-pavement RGL system.

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6.2 Unmonitored Elevated RGL System

A block diagram of an unmonitored elevated RGL system is shown in Figure 2. No BRITE Master or computer interface is required. Simply install the dual Remotes and the system works automatically. At turn on, all remotes digitally sync to the power line and maintain operation in accordance with FAA requirements with no further commands from any other device. Alternate pulsing of an elevated L-804 RGL fixture is automatically accomplished within the dual BRITE Remote. There are no electronic devices inside the L-804 other than the lamps.

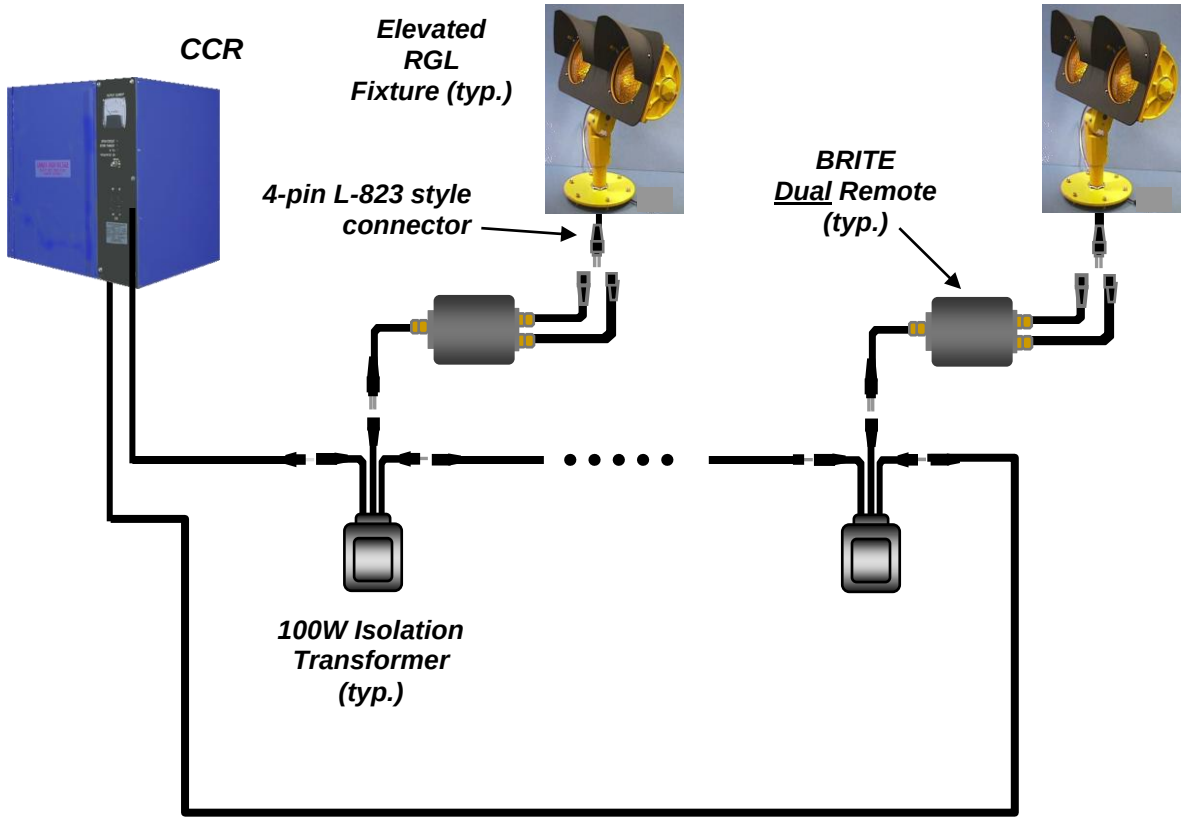

Figure 2: Un-monitored elevated RGL system.

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7. Monitored RGL System Architectures

For monitored RGL systems, ADB uses proven power line carrier technology to communicate on the airfield series circuit without the addition of any external wiring. ADB has the most experience in this technology (greater than 50,000 Remotes installed worldwide) and the most *operational* BRITE systems in the world.

Figure 3 shows a monitored in-pavement RGL system and Figure 4 shows an elevated system. The BRITE system operates by imposing a communication signal on top of the 60 Hz airfield series circuit. The BRITE Master essentially operates as a high voltage modem, sending the digital information from the BRITE PC to the BRITE Remotes using power line carrying signals. There is one BRITE Master per CCR. Each Remote can also respond to queries from the Master by generating response signals. Each Remote has a digital address which is stored in the BRITE PC. The BRITE Master sequentially polls each RGL Remote to check for proper status. The BRITE PC then displays the status of each physical light according each Remote's digital address.

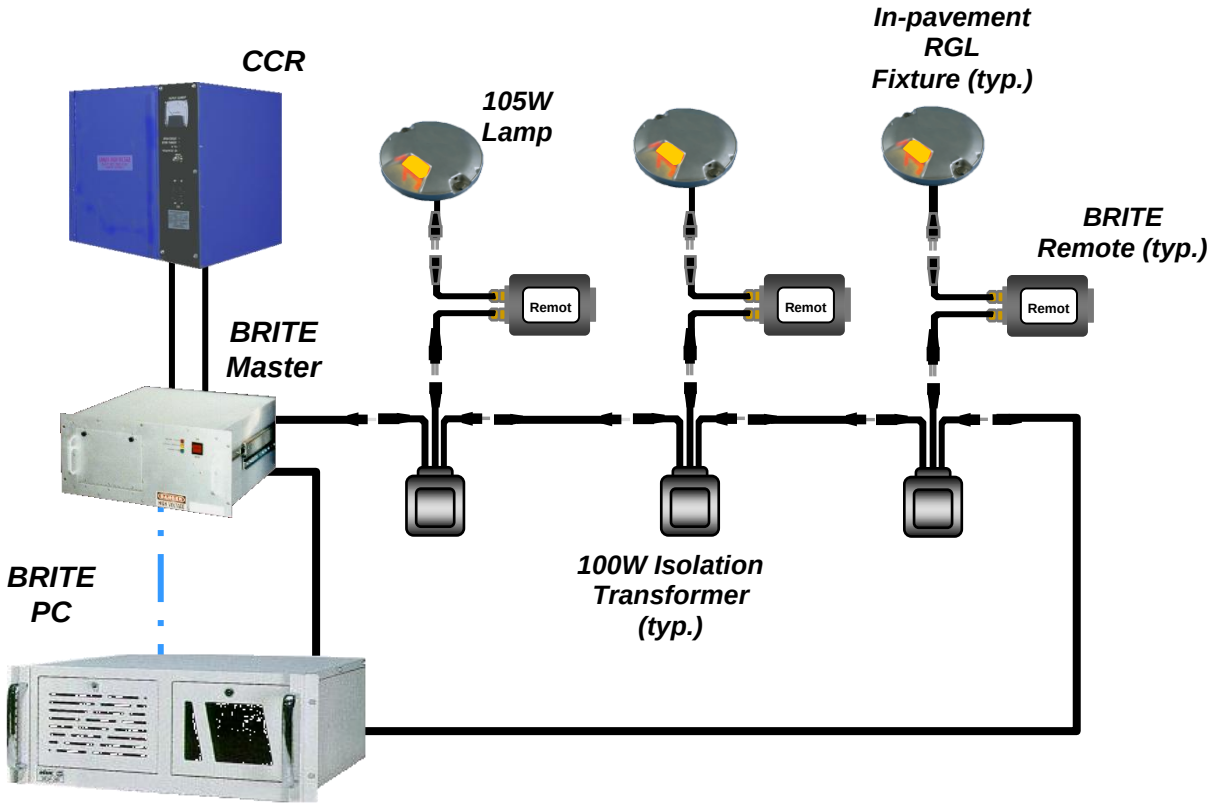

Figure 3: Monitored in-pavement RGL system.

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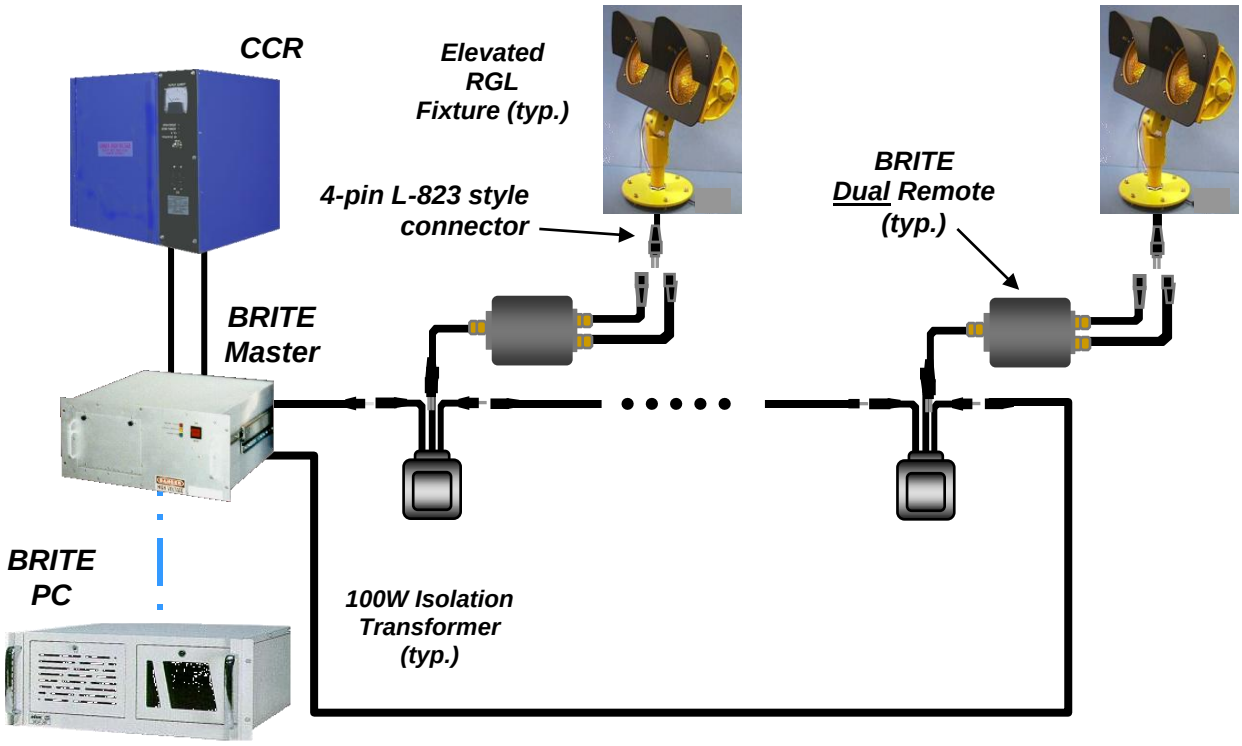

Figure 4: Monitored Elevated RGL system.

7.1 Monitored RGL System addressing

Each Remote on the airfield is assigned a unique address. As an example, consider a 10-light in-pavement RGL bar. All of the odd fixtures are assigned a sequential address. All of the even fixtures are assigned a separate sequential address. The Remotes for lights 1, 3, 5, 7 and 9 would be assigned (again, as an example) addresses 100, 101, 102, 103 and 104. The *initial* power-on state for these lights is ON-Flash. The Remotes for lights 2, 4, 6, 8 and 10 would be assigned addresses 200, 201, 202, 203 and 204. The *initial* power-on state for these lights is OFF. At turn on, all remotes digitally sync to the power line and maintain operation with no further commands from the Master. This minimizes communication traffic on the series circuit.

7.2 Monitored RGL System communication

Communication between the BRITE PC (typically one per vault) is accomplished via a separate Ethernet communication link with each BRITE Master. The BRITE PC issues commands to the Master(s). Each Master sends to the BRITE PC status information concerning the Remotes and the lamps connected to them. The BRITE PC then presents pertinent status information graphically on the local display in the vault and can also send details to the Tower/Maintenance Center. If the overall control system is supplied by ADB, this is typically accomplished via Ethernet using redundant fiber optic communication links. If the overall control system is supplied by another manufacturer, this is typically

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accomplished by connecting PLC I/O to the other manufacturers PLC I/O. Typically, the data that is communicated is Caution and Fault status for each individual bar of RGL lights. Specific lamp caution/fault location information is obtained on the display at the BRITE PC.

8. RGL Serviceability Requirements

The FAA has the following Serviceability Requirements for RGL bars:

- Caution: One or two non-adjacent in-pavement lights/Remotes or one light in an elevated fixture fails.
- Fault: No more than two adjacent (including one entire elevated RGL or Dual Remote) nor three total in-pavement RGL lights or Remotes fail.

Each Remote monitors the actual current through its lamp and reports status information (both lamp and Remote health status) to the Master. One Remote is needed per each in-pavement fixture in order to detect if two lamps are out in a row. Note that if the BRITE Master fails, there is no effect on RGL bar operation, since the power line is used as the clock for RGL fixture flashing. This is an important differentiator compared to other manufacturer's architectures that use a separate master device to send timing signals (sometimes via a separate wired connection) to all fixtures in a bar. If this master timing device or the separate timing wiring fails, the Remotes can quickly get out of synchronization or even worse, fail all ON or all OFF. According to the FAA requirements, none of these failsafe states are allowed.

9. RGL System Maintenance Issues

Maintenance on ADB BRITE Remotes is also an important differentiator. For unmonitored RGLs, the appropriate BRITE Remote is substituted and you are done! Other manufacturer's architectures require a separate programmer to program their Remote device in the vault. If the programmer fails, there is no way to replace failed units.

For monitored systems, replacement of ADB Remotes is also very easy. Each BRITE Remote has a unique electronic serial number that is printed on the label (and permanently embedded in the Remote firmware). When the failed Remote is replaced, the serial number is noted and later typed into the BRITE PC. A "Replace Remote" button is then activated. The system automatically searches for the electronic serial number and then updates the digital address in the system.

In addition, the BRITE Remote is re-enterable. Any failed units can be returned to ADB for repair, minimizing maintenance costs. Other manufacturers encapsulate their remote devices in resin. If this device fails, there is no choice but to throw it away, often an expensive exercise.

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10. Installation

Elevated and in-pavement fixtures have been installed in various ways. Some airports elect to put both elevated and in-pavement fixtures on the same series circuit. ADB recommends that elevated and in-pavement RGLs be on separate, dedicated series circuits. Use of separate dedicated circuits allows the intensity of elevated and in-pavement fixtures to be separately controlled.

11. RGL Bar Timing

There have been questions concerning overall timing of whole RGL bars. If both elevated and in-pavement RGLs are on a single bar, there are no FAA requirements to synchronize them. This would not be possible anyway since they flash at different rates. Likewise, there are no FAA requirements to synchronize adjacent RGL bars.

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