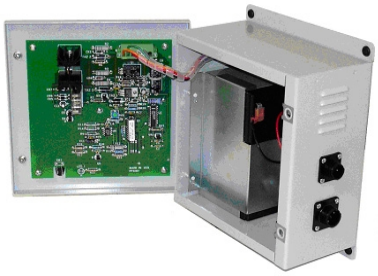
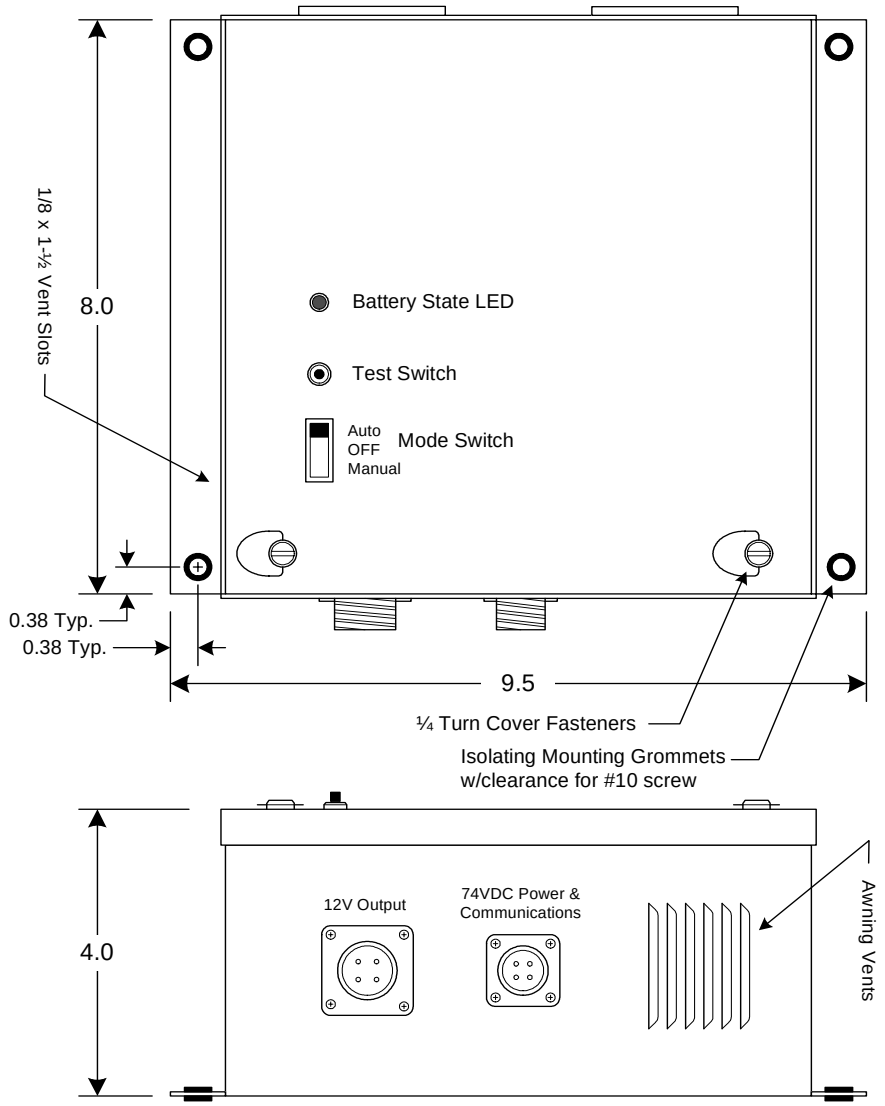
EPC-13858 Emergency Backup Lighting Controller



The EPC-13858 is a microcontroller based Emergency Backup Lighting Controller developed for use in 74V DC rail systems. The EPC-13858 energizes external LED lamps using an internal 12V sealed lead acid battery when the 74V supply fails. The 74V DC operating power must be re-established in order to turn the emergency lights off. The controller provides charging of the internal battery and automatically reports the battery status through the red Battery State LED mounted in the cover and to the external CDS. The unit incorporates an Echelon® LonWorks® twisted pair interface which broadcasts critical messages containing system and battery status to the CDS. This system is designed to meet or exceed the requirements of 49CFR238.115

Mechanical



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Operation

External Emergency Lights Operation:

Two conditions *must* be met for the system to energize the external LED lights:

1. The 74V supply must drop beow 50V DC.
2. The voltage must stay below 50V for 70 minutes (or as otherwise requested by the customer).

When these conditions have been met, the internal battery is switched to the LED lighting output *regardless of the voltage of the internal battery*. In this state the LonWorks® communications broadcasts this event for 60 seconds and then shuts down to conserve battery power.

The emergency light output will remain energized indefinitely until both of the following conditions are met:

1. The 74V supply is restored above 60V.
2. The 74V supply stays above 60V for 30 seconds.

The controller charges the internal lead acid battery when the 74V is available. If the internal battery voltage is below 10VDC, this indicates that the battery has been discharged past it's specified capacity and the controller will not attempt to recharge the battery. In this condition the red Battery Status LED will be illuminated for 1 second every 5 seconds indicating that the battery *must* be replaced for proper operation.

Optionally, the external lighting system can be controlled via the LonWorks® network connection.

Test Switch Operation:

Pressing and holding the Test Switch mounted on the cover performs the following:

1. The Emergency light output is energized for a maximum of 5 seconds regardless of how long it is held.
2. If the battery voltage is below the 10V threshold the red Battery Status LED will flash once per second indicating that the battery *must* be replaced.

   - or -
3. If the battery voltage is above the 10V threshold the red Battery Status LED is illuminated continuously.

Mode Switch Operation:

The Mode Switch mounted on the cover allows the user to select 1 of 3 operating modes:

1. Auto - Normal operation. Loss of input voltage energizes the external emergency lights and recovery of input voltage turns the emergency lights off, details in section above
2. OFF - The emergency light output is disabled *regardless* of the condition of the system thereby preserving battery charge when the rail car is taken offline for service. If the 74V power is lost in this mode the *emergency lighting output will not function. If the output is already energized it will be turned off.*
3. Manual - The emergency lighting output is energized regardless of the condition of the system. This serves as a manual override to the emergency lights. *The controller will remain in this state until the Mode Switch is changed to another setting*.

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LonWorks® Interface

The EPC-13858 incorporates a LonWorks® free topology twisted pair network connection. The controller will broadcast the system status value and supports additional network variables which can be used for system diagnostics and testing.

SYS_STATUS: This variable indicates the state of the controller and internal battery and can be the following values:

SYS_RDY: The battery voltage is above 10V and the mode switch is in the Auto state.
LIGHTS_ON: The system has detected the loss of power and has energized the emergency light output
BAT_LOW: The internal battery is below the 10V charging threshold and requires replacement
MODE_OFF: The Mode Switch is OFF and *must be returned to Auto for normal operation*.

In any state other than SYS_RDY, the controller will regulary broadcast its value every 60 seconds. If both the BAT_LOW and MODE_OFF conditions exist, the controller will alternate between the two values on each broadcast. The LIGHTS_ON value is transmitted for the first 60 seconds of the event, then communications is disabled.

Other network variables: 1) 74V DC input voltage, 2) DC voltage of the internal battery, 3) Charged state of the battery expressed in % of fully charged, and 4) Mode Switch state, either Auto, OFF, or Manual.

Battery Operation

Battery Charging:

The internal sealed lead acid battery is charged using a proprietary charging algorythm which maintains the battery at a maximum charge state while minimizing the charging time and extending its service life. The charging system monitors the battery charging voltage, charging current, and ambient temperature during all phases of the charging operation. The system utilizes a three state charging system: Constant Current charging, Constant Voltage charging, and Float Service charging.

Battery Discharging:

When the system detects a loss of the 74V power, the battery is switched to the lamp output and the charging system is disabled. **Table 1** below shows the expected battery discharge life down to the battery voltage recharging point of 10V at various average discharge currents. *The system will keep the emergency lights energized below this critical battery voltage if the 74V power remains disabled*. Exceeding the Discharge Time shown can drive the battery below its recharging point which will subsequently require replacement of the battery before the system can be returned to service. All sealed lead acid batteries experience diminished storage capacity as they are discharged to significant depths. **Table 2** below shows the expected number of discharge cycles the battery can experience before dropping to a maximum recharged capacity of 80% of the initial capacity. The depth of discharge is expressed in %, where 100% equates to discharging the battery down to the 10V recharge threshold.

Table 1
Discharge Life @ 25°C
100% initial charge

Lamp Current	Discharge Time
4.2A	50 min
2.8A	90 min
2.1A	150 min
1.4A	240 min

Table 2
Discharge Cycles @ 25°C
to 80% initial capacity

Discharge Depth	Number of Cycles
100%	200
50%	400
30%	1000

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Specifications

Operating Voltage:	60V - 80V DC
Power Consumption:	1.2 Amperes maximum during deep discharge recovery, 200mA nominal.
Battery Supply:	Rechargeable sealed lead acid type 12V DC, 7Ah capacity. See Battery Operation section for charging and discharging performance
Operating Temperature:	0°C to +50ºC.
LonWorks® Interface:	Free topology twisted pair connection. Transformer isolated with DC blocking capacitors, 78kbps data rate. Designed to comply with FCC and VDE Level B requirements.
Construction:	Painted and labeled metal enclosure with isolating mounting grommets, ventilation slots\vents, and 1/4 turn fasteners for cover.
Mounting Orientation:	Any orientation which allows convective airflow to the ventilation slots.
Shock Resistance:	8g longitudinal, 4g lateral, or 4g vertical accelerations
Revision Date and ©:	August 16, 2006

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