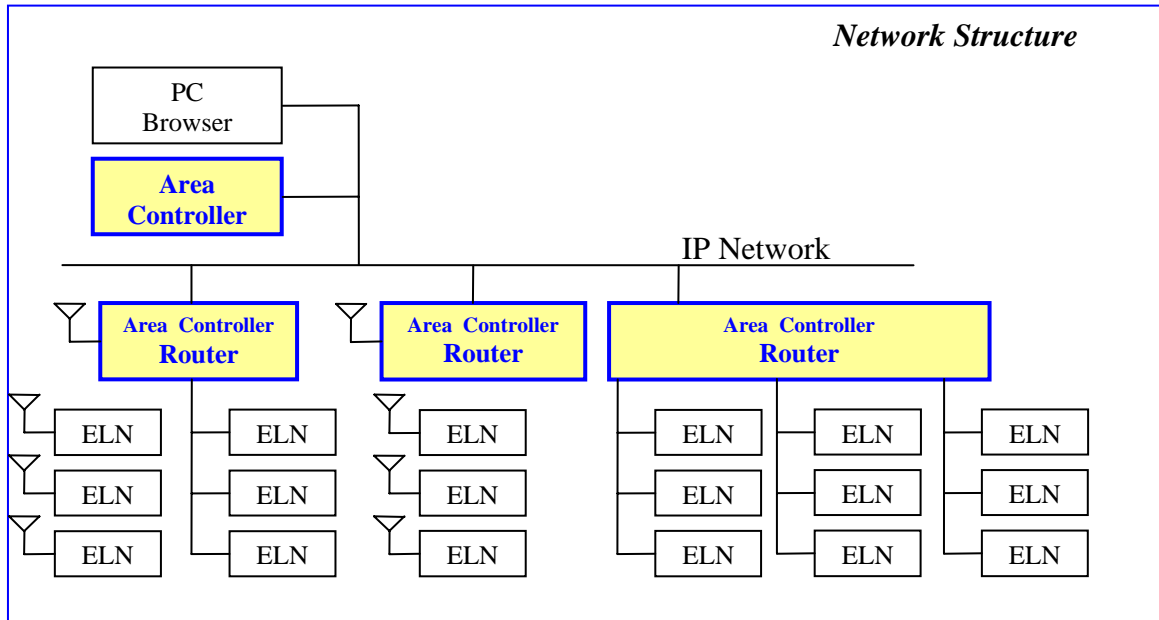# Thomas & Betts

Operational Description of the Nexus AC and ACR

Overview

This document describes the components and functions of the Wireless Nexus System. The primary purpose of the system is to facilitate the testing, monitoring and control of diverse networks of emergency lights. The system consist of an Area Controller (AC) device connected via a trunk network to a collection of AC or ACRouter (ACR) devices – each of which is connected via a branch network to a collection of Emergency Lighting Nodes (ELNs). It may also include a range of ancillary devices such as PCs, printers, and keyboards used to interface with the system.

Nexus RF Area Controller (AC)

The Area Controller is the system head end controller. The system does not require a PC to run the Nexus utilities as has been the case in the past and still is with competing products. The Area Controller stores the master database, operates as a user interface, coordinates nodes both through the Routers and in its own cluster. See Figure 1 (Diagram Block Nexus AC)
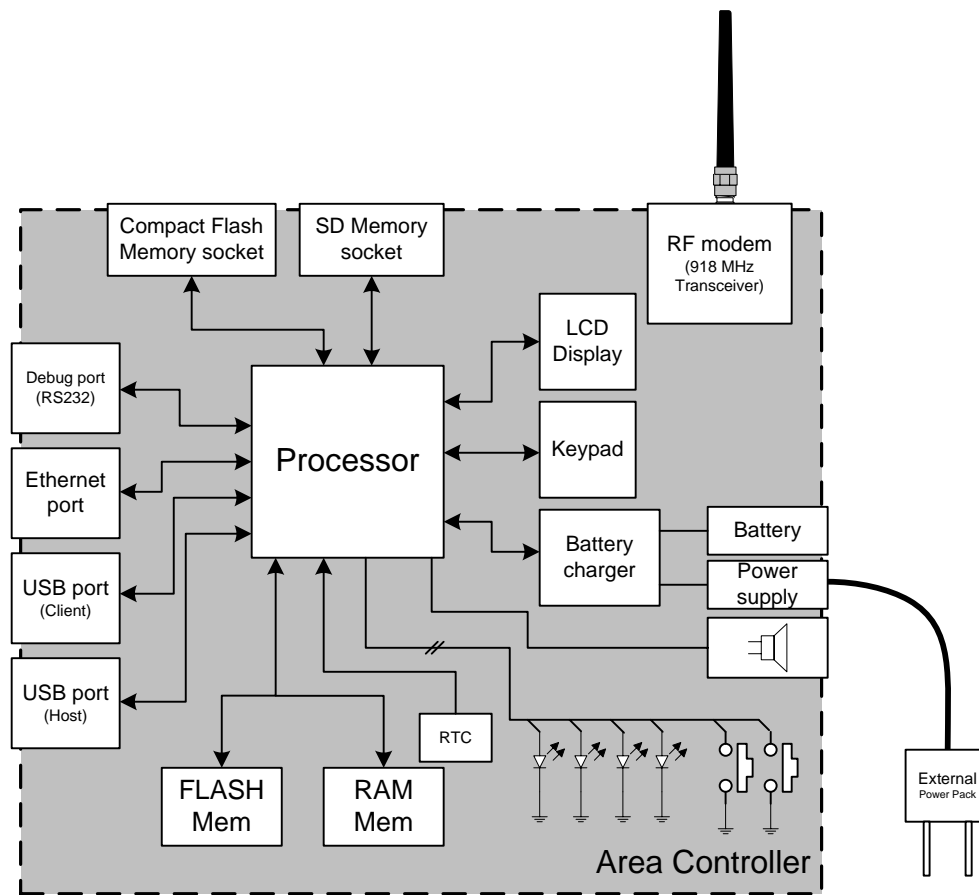
Figure 1 (Diagram Block Nexus AC)

Area Controller Hardware

The AC is essentially a single board computer. It has:
- a LCD display
- a touch screen keypad
- a Real Time Clock (RTC)
- a battery backed power supply
- a battery charger
- 4 LEDs indicators
- 2x push button switch
- Flash Memory
- RAM Memory
- Audio Output Piezo
- Some external connection options:
    - Ethernet port for connection to a LAN or host PC
    - Compact Flash memory socket
    - Secure Digital memory socket
    - USB Host port (hub, keyboard, mouse, flash memory, …)
    - USB Client port (for connection to a host PC)
    - A communication interface module socket for connection to custom interface modules such as a Wireless RF modem
    - a serial debug port

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Area Controller Software

Operating System
The AC and ACRs run Linux version 2.6.19.2

AC Software Functions
Nexus is a real-time emergency lighting monitoring system which offers building owners control over their public safety helps manage installation and directs the maintenance of an emergency lighting system. A Nexus network enables the user to:

- Manage the installation and removal of components
- Cost effectively test and monitor the system
- Assign units to groups
- Manage maintenance activities
- Ensure tests are performed properly
- Prepare reports
- Log test results and print them as required

Wireless Network

The nodes in the system will communicate with the area controller utilising a proprietary wireless MESH network.

The wireless network operates in the 915MHz ISM band, using a 38kbit/s GFSK modulation scheme. The system is divided into subnets, each AC maintains one sub-net. There can be up to 254 subnets in a system and up to 253 nodes in a sub-net. ACs try to use different RF channels for their subnets in order to keep the interference from adjacent subnets as low as possible. Node association with subnets is dynamic and automatic, there is no need to pre-configure the nodes or the ACs. If a node loses communication with its AC for a prolonged time, it will attempt to join an other subnet within its radio range, thus re-appearing within the system.

RF Modem:

The Nexus Area Controller RF modem operates in the 915MHz ISM band. In the Nexus system the physical layer operates in two distinct modes (modulation type and channel). One setting is used for a mesh network, that is, normal mode. The other setting is used in the backdoor mode. These two operating modes have distinct RF radio settings. The following table (next page) describes the two radio operations modes basic characteristics.

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Normal Mode Parameters		
Parameter Value	**Value**	
Lowest channel frequency (Carrier center freq.)	918,6	MHz
Highest channel frequency	925,8	MHz
Channel separation	600	kHz
Modulation Mode	GFSK	
Modulation frequency deviation	19	kHz
Preamble length	64	bits
Data Rate	38	Kbit/s
Transmit Output Power with Whip 1/4 wave antenna	-6,7	dBm
Packet Size	2-255	Bytes
Packet Protection (CRC)	32	bits
Backdoor Mode Parameters		
Parameter Value	**Value**	
Frequency (Carrier center freq.)	918	MHz
Modulation Mode	MSK	
Preamble length	128	bits
Data Rate	125	Kbit/s
Transmit Output Power with Whip 1/4 wave antenna	-14,4	dBm

Table 1

The differences between the normal and backdoor channel mode parameters indicate the difference in their functionality. In normal mode the aim is to have the largest possible radio distance while still having a reasonable data rate. Thus 38 Kbit/s is chosen, using GFSK modulation. The lower baud rate and the GFSK modulation's relative immunity to phase errors help to increase the radio range. Multiple channels make it possible that several networks can operate in the same area without disturbing each other. The backdoor channel, on the other hand, transmits at an output power level -14.4 dBm, uses 125 Kbit/s data rate that requires MSK modulation, which is more sensitive of multi-path distortions than GFSK. This is because the backdoor channel is intended to be used in close range only. Furthermore, while a node is on the backdoor channel, it can not simultaneously be on its normal channel as well.

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Nexus RF Area Controller Router (ACR)

The ACR is used to enhance system performance on large sites. Each ACR can co-ordinate a cluster of up to 100 nodes. The ACR maintains the database and monitors each cluster independent to the AC. Should the AC go off line, the ACR would continue to operate as normal and feedback information once the AC was available again.
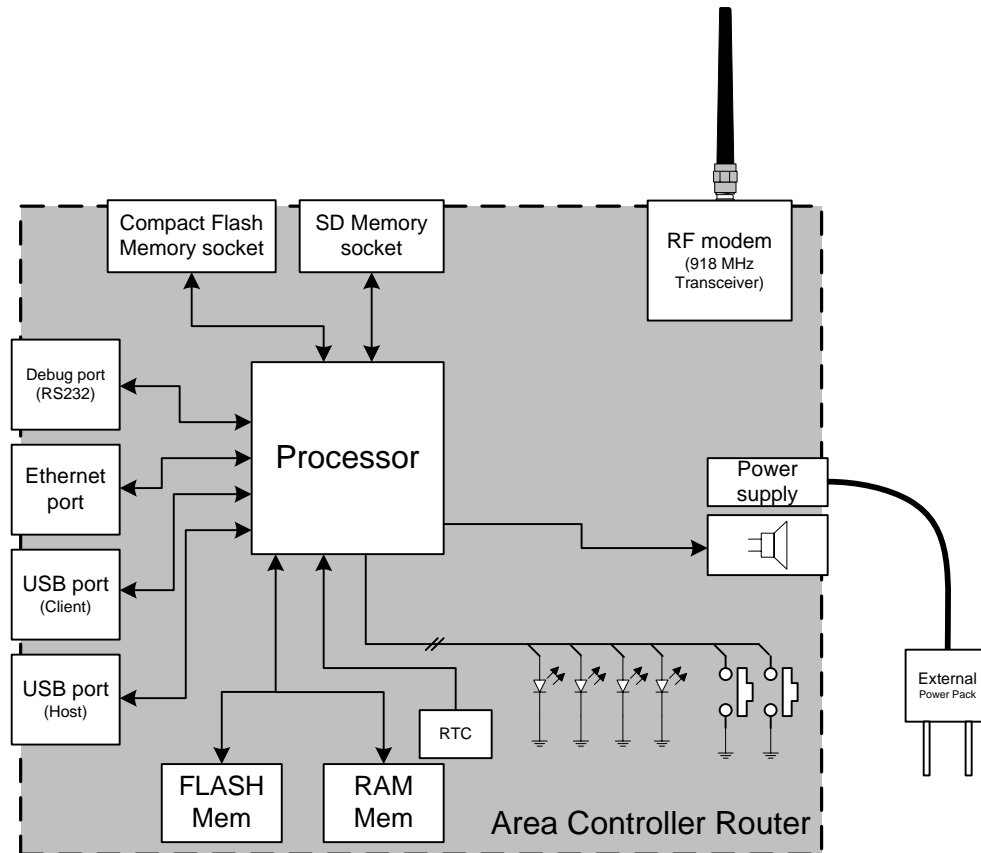

Figure 2 (Diagram Block Nexus ACR)

Area Controller Router Hardware

The ACR is essentially the same device as the AC but will be supplied without display, keypad and batteries. It may have less installed flash memory or RAM. It has:
- a Real Time Clock (RTC)
- 4 LEDs indicators
- 2x push button switch
- Flash Memory
- RAM Memory
- Some external connection options:
    - Ethernet port for connection to a LAN or host PC
    - Compact Flash memory socket
    - Secure Digital memory socket
    - USB Host port (hub, keyboard, mouse, flash memory, …)
    - USB Client port (for connection to a host PC)
    - A communication interface module socket for connection to custom interface modules such as a Wireless RF modem
    - a serial debug port