



Illuminated Switches

Product Training Module

Purpose

- To “illuminate” the customer regarding illuminated switches and their functions, and to display the wide variety of illuminated switches that NKK offers

Objectives

- Introduce the various types of illumination
- Describe how isolated lamp terminals offer more flexibility to the customer
- Explain how resistors are used with illuminated switches
- Present the various types of illuminated actuations
- Discuss applications by product grouping
- Present the UB2 alternating legends
- Description of custom legend capabilities

Types of Illumination

Types of Illumination	Benefits	Disadvantages
LEDs	<ul style="list-style-type: none">• Long life• Low current & DC voltage levels• Not easily damaged by shock• Variety of colors• Bright & super bright options• Bicolor & RGB available in some lines	<ul style="list-style-type: none">• Higher initial costs• Ballast resistor required
Incandescent Lamps	<ul style="list-style-type: none">• Lower initial costs• Brightness	<ul style="list-style-type: none">• Short life• Sensitive to shock & vibration• High heat dissipation
Neon Lamps	<ul style="list-style-type: none">• Long life• Not easily damaged by shock or vibration	<ul style="list-style-type: none">• Low intensity• Series resistor required

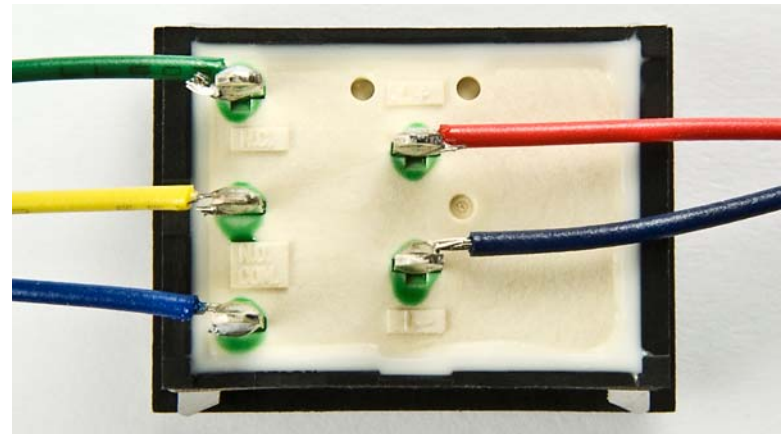
Isolated Circuits from External Source



All of NKK's illuminated switches come with isolated circuits for the lamps.

In this example, the red and dark blue wires are soldered to an external source. This source will send the current that illuminates the lamp.

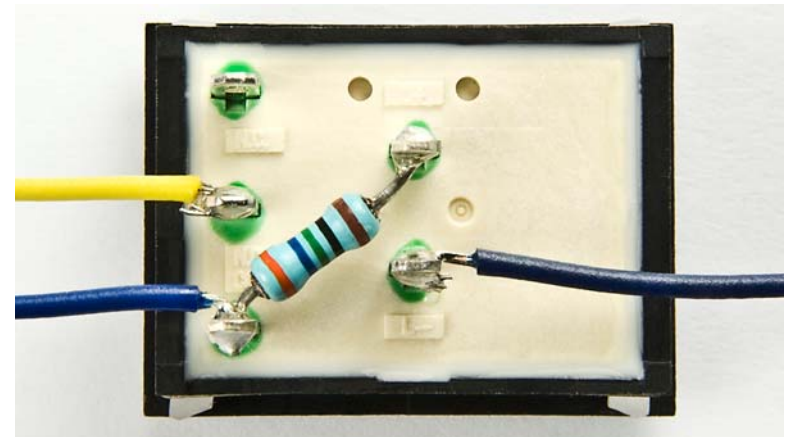
The source current will depend upon the lamp specifications.



Isolated Circuit Wired in Line with Switch Actuation

In this example, a resistor is wired to the positive lamp terminal from the “Normally Open” switch terminal. As a result, when the switch is actuated from the “Normally Closed” terminal to the “Normally Open” terminal, the lamp will illuminate.

The resistor is required to properly power the lamp.



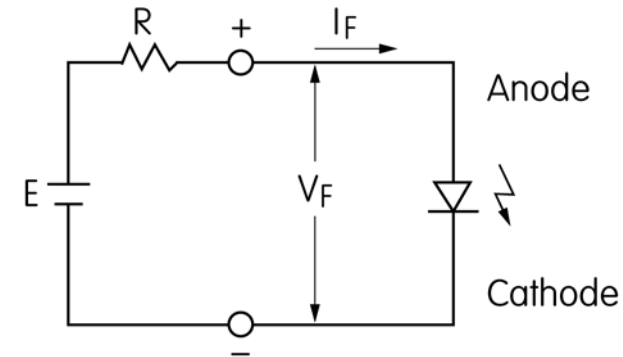
LED Circuit

The illumination is created by the LED which has the properties of a diode (Anode “+” and Cathode “-”). Once the Forward Voltage (V_F) and Current (I_F) is achieved, the LED will illuminate.

If the voltage is reversed and exceeds the Reversed Voltage (V_R) the LED can be damaged.

The ballast resistor (R) is used to create the proper voltage and current through the circuit. An alternative to the ballast resistor is a constant current source circuit.

The LED is generally used in DC applications. If an AC circuit is to be used, a rectifier circuit along the ballast resistor is required to generate the appropriate DC voltage.



Ballast Resistor Calculation



The ballast resistor value is calculated by the formula shown here.

As an example:

Source Voltage = 5.0V

Forward Voltage = 1.9V (set by LED)

Forward Current = 20mA (set by LED)

The resultant ballast resistor = 155Ω

Additionally, the power rating of this ballast resistor must be considered.

- With a forward current of 20mA and the voltage across the ballast resistor (5.0V – 1.9V) = 3.1V
- Power across is then calculated:
3.1V x 20mA = 0.062W
- For safety purposes, typical power rating of 2X the calculated value is selected
- The resulting power rating = 0.125W (1/4W resistor)

$$R = \frac{E - V_F}{I_F}$$

Where: R = Resistor Value (Ohms)
E = Source Voltage (V)
V_F = Forward Voltage (V)
I_F = Forward Current (A)

Ballast Resistor Calculation for LED

Forward voltages of the LED are different for each LED and color. In switches where bicolor or RGB LEDs are used, different ballast resistor values may be required for each LED.

The current profile of an LED is that it varies with temperature, so the value of the ballast resistors should be calculated at the appropriate operating temperature.

This can be calculated with the current reduction rate information supplied.

AT635 LED Specifications				
Colors		Red	Amber	Green
Forward Peak Current	I_{FM}	30mA	30mA	30mA
Continuous Forward Current	I_F	20mA	20mA	20mA
Forward Voltage	V_F	1.9V	2.0V	2.1V
Reverse Peak Voltage	V_{RM}	5V	5V	5V
Current Reduction Rate Above 25°C	ΔI_F	0.42mA/°C		
Ambient Temperature Range		-25° ~ +50°C		

NIKK
SWITCHES

- Single Color: Red, Green, Amber, Blue, White (see “White” note below)
- Bicolor: Red/Green (produces Amber when both are illuminated)
- RGB: Red/Green/Blue; theoretically, all colors can be created by combining these, except for Black
- White: Blue LED with Yellow fluorescent (analog White)
Generated by RGB (digital White)

Illuminated Pushbuttons



HB2 Series



FP01 Series



KP01 Series



GB Series

Illuminated Pushbuttons



HB Series



KB Series



LB Series



LB Series
Panel Seal

Illuminated Pushbuttons



LP Series



UB Series



UB2 Series



YB2 Series



YB Series

Illuminated Tactiles



JB Series



JF Series



JL Series

Illuminated Toggles

NKK
SWITCHES



M2100 Series



B Series



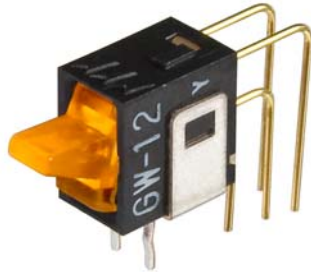
G Series



TL Series

Illuminated Rockers & Paddles

NKK
SWITCHES



GW Series



CWSB Series



CWSC Series



M2100 Series

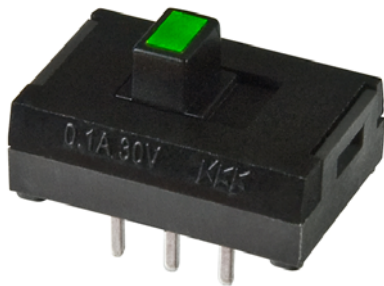


MLW Series

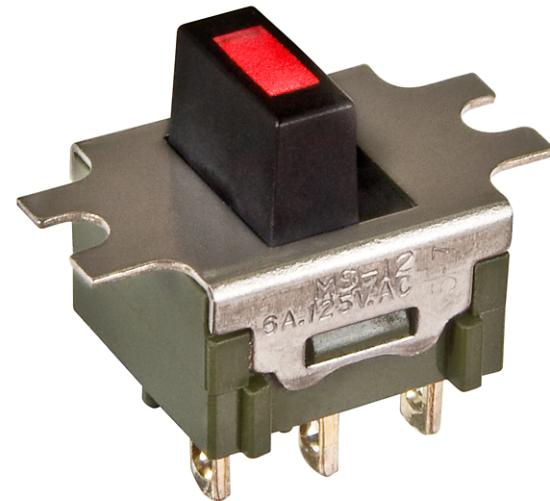


LW Series

Illuminated Slides



SS Series



MS Series

Ultra-Miniature & Subminiature



- GB Pushbuttons
- B & G Toggles
- GW Rockers



Applications: Preamplifiers, Recording Mixers,
Audio Converters, Microphones, Wireless Receivers

FP01 Pushbuttons

Features:

- **Photo Interrupter**
- **3 Million Operations Minimum**
- **Connector Plug & Wire**
- **Leads Available**

Applications:

Gaming

Vending Machines

Equipment Exposed to Corrosive Gases

Automotive Repair Equipment

X-Ray & MRI machines



HB2 & KP Pushbuttons



Applications:

Broadcast Equipment

Recording Mixers

Audio-Visual Control Consoles

Patient Monitors

Autoclaving Equipment

Basic Pushbuttons

HB, KB & LB Pushbuttons

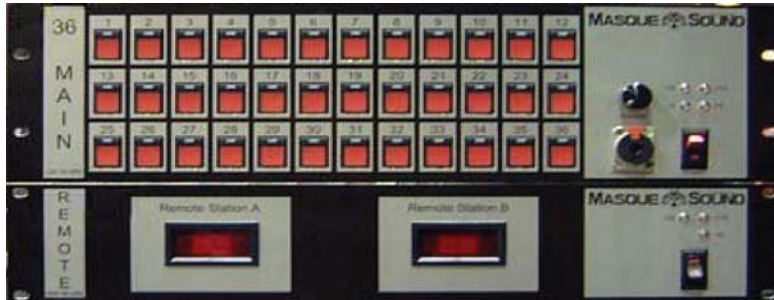


Applications:
Sheet Counters
Rinsing Systems
Control Panels
Weight Scales
X-Ray Meters

Illuminated Tactile Switches



JB, JF & JL Tactiles



Applications:

RF Monitors

Printing Presses

Score Boards

Portable Lighting Units

In-Store Demo

Displays



Low Profile Illuminated Pushbuttons



LP, UB & UB2 Pushbuttons



Applications:

Patient Analyzers

A/V Wall Mount Controls

Photo Equipment

Cable Modems

Robotics



LED Tipped Switches



M21 Paddles, Rockers & Toggles



Applications:

Emergency Vehicles

Textile Printers

Model Train Control Panels

Avionic Electrical Control Systems

Dashboard Controls

Illuminated Rockers



CWSB, CWSC, MLW & LW Rockers

Applications:

Telecom Cooling Modules

In-Car Video Recorders

Transilluminators

Operating Table Controls

CRT Monitors



Illuminated Slides

MS & SS Slides

Applications:

RC Controls

Theater Controls

Laser Trackers

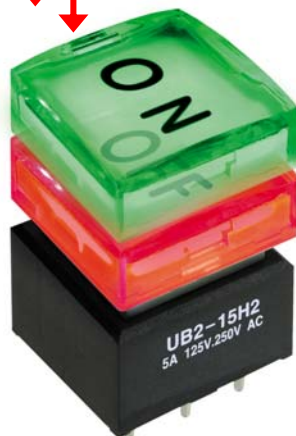
Diagnostic Equipment

Surveillance Equipment



Alternating Legends

UB2 Pushbuttons



Methods for All Applications

Laser Etching

For highest durability on many different cap designs and sizes; legend may be etched on inside or outside of cap

Pad Printing

For highest print quality and excellent durability on most surfaces

Screen Printing

For very competitive, high quality printing on flat surfaces

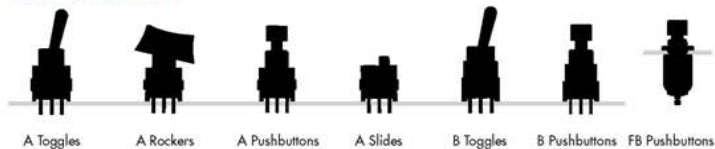
Product Overview

NIKK
SWITCHES

Product Overview

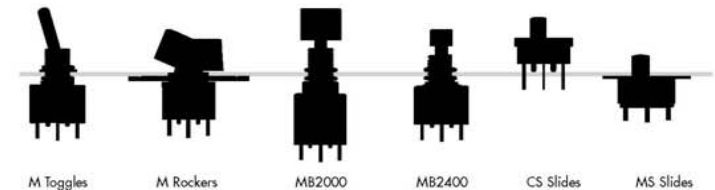
Ultra-Miniature & Subminiature

Toggles
Rockers
Pushbuttons
Slides



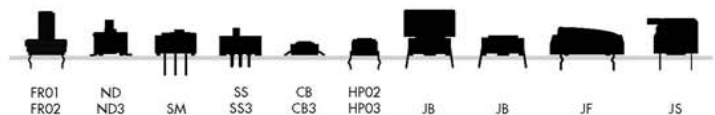
Miniature

Toggles
Rockers
Pushbuttons
Slides



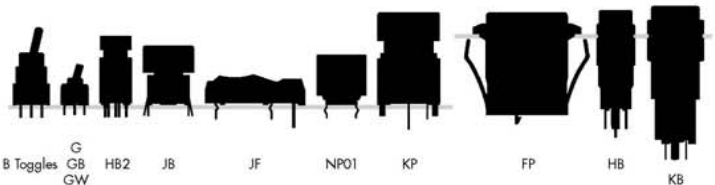
Specialty

Rotaries
DIP Rotaries
Tactiles
Slides
Keylocks
Tilt Switches



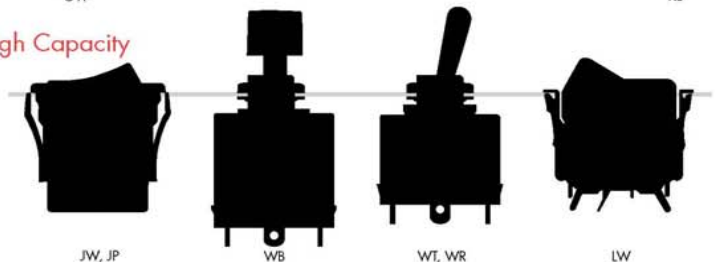
Illuminated

Toggles
Rockers
Pushbuttons
Tactiles
Slides



Standard & High Capacity

Toggles
Rockers
Pushbuttons
Rotaries



Product Overview

