



Electro Standards Laboratories
ADVANCED SYSTEMS DESIGN & SERVICES

The Not-So-Simple A/B Copper Network Switch

Raymond B. Sepe, Sr.
Electro Standards Laboratories
36 Western Industrial Drive
Cranston, RI 02921

Telephone: 1-401-943-1164
Fax: 1-401-946-5790
E-mail: eslab@electrostandards.com
Web: www.ElectroStandards.com

Abstract: Backup switches allow the users the capability of sharing devices or networks connected to the COMMON port/s among devices or networks connected to the (A, B, C, etc.) lettered or (1, 2, 3, etc.) numbered ports. The number of switch positions required will be related to how many devices or networks to which you want to send your data. This paper will evaluate the elements required to design an A/B copper network backup switch.

Introduction:

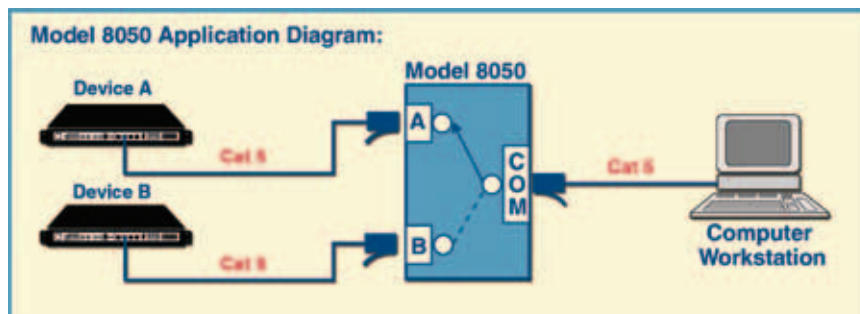
Electro Standards Laboratories, Cranston, RI, USA, has been designing network products since 1976. Communication network requirements have changed dramatically in the period of time since the company's inception.

Electro Standards developed a market for high-quality innovative standard and custom network switches. The company's forte is the design and manufacture of custom switches. The data networks of today are almost as diverse as snowflakes. Managers have a huge task trying to backup data, secure the network, deal with fiber to copper conversions and so much more. Electro Standards has developed the technology to solve today's and tomorrow's network requirements.

However simple this may sound, A/B switches are not necessarily simple. Following is a thought process with examples that can assist any network manager with the development of the exact switch to meet his or her requirements.

1. Location - Where are you going to put the switch?

A) Desktop – The Model 8050 is an example of a desktop switch. The Model 8050 RJ45 A/B Switch is CAT5 compliant. This manual switch enables access to two 10/100 Base-T networks (up to 100 Mbps). OK, it looks like a black box with a knob. But that's not the total story. This switch incorporates a high-quality sealed switch with self-wiping low-impedance contacts and is transparent to data speed and format. The anodized enclosure provides EMI/RFI shielding which enables this switch to perform well in noisy environments.

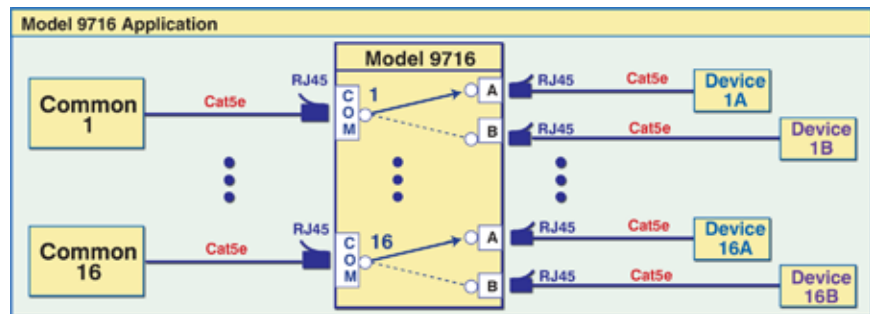


B) Computer Room Rack – Following are two examples of rackmount A/B switch systems.

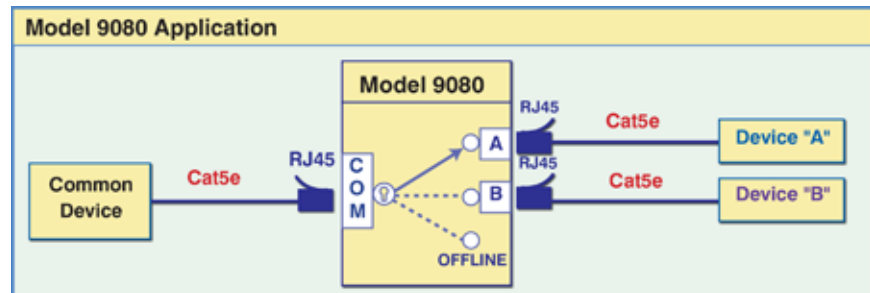
- i. Switch Modules - The manual Model 9740 100Base-T, CAT5 Switch System adds quick and easy backup switch capability to any data network by utilizing a high density switch system. The switch modules and rack can accommodate up to 40 channels in only 8.75 inches of panel height. The A, B and COMMON connectors are on the rear panel. The 2-position rotary switches are neatly lined up on the front panel. All 8 pins are switched which allows compatibility with all RJ45 interfaces. The Model 9741 1000Base-T, Cat5e System is available for systems requiring higher speeds.



- ii. Switch Box - The Model 9716 16-Channel RJ45 CAT5e Compliant A/B Switch, with manual operation, fits into a standard 19" rack (2U high). Sixteen front-panel knobs provide individual control of each channel. This switch is rated for 10/100/1000 networks (up to CAT5e).

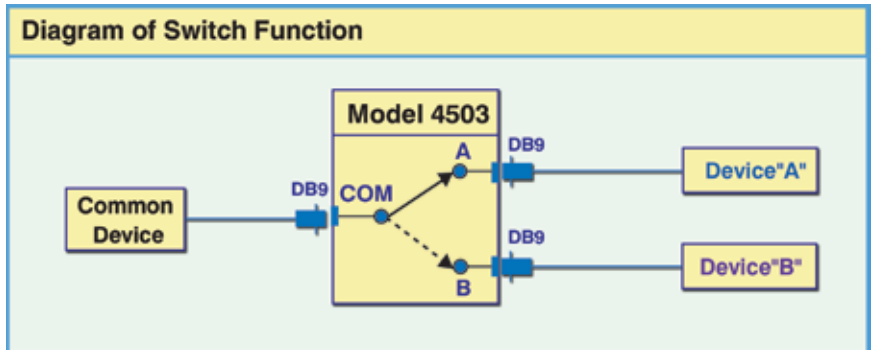
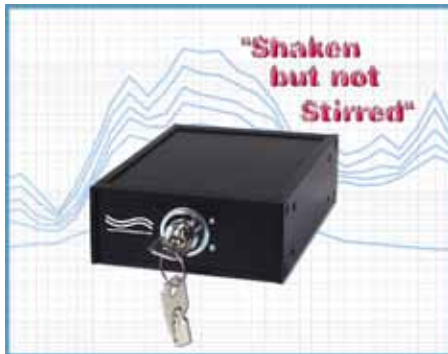


- C) Process Control System** - DIN rail mounting is an ideal method of mounting switches for use in process control systems. The Model 9080 RJ45 A/B/Offline Switch allows the user to access two RJ45 devices connected to its A and B ports with one RJ45 device connected to its COMMON port, or to isolate all ports by switching to the OFFLINE position. This unit is a manually operated keylock switch requiring no power. The Model 9080 switch is easily integrated as a system component by utilizing its rear panel DIN rail mounting bracket. A grounding screw is mounted on the front panel.

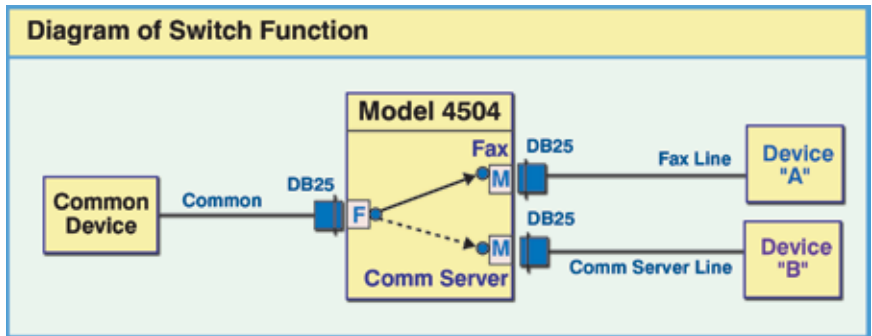




D) Nuclear Power Plant or other Rough Environments - The Model 4503 is a “Seismic-Proof” DB9 A/B switch. This manual switch has been ruggedized to withstand vibrations. The switch and its feed-through connector have successfully passed the rigorous seismic testing of the Electric Power Research Institute (EPRI) Seismic Qualification Reporting and Testing Standardization “SQRSTS” Program, qualifying it for use in nuclear power plants. The Model 4503 is available with mounting ears that allow firm attachment to surfaces. This “Shaken but not Stirred” switch is ideal for factory floors, energy facilities, and any other harsh environment applications.

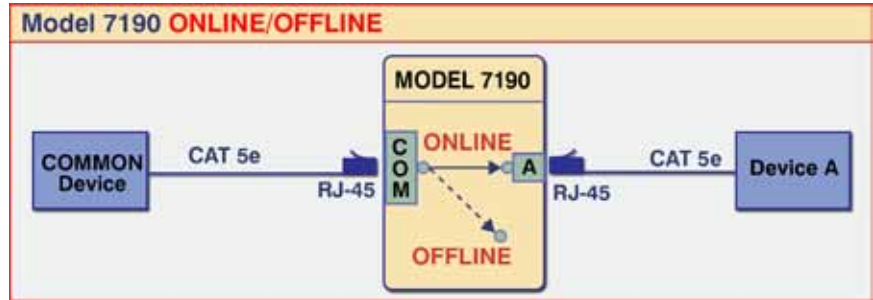


E) Ship or other Mobile/Motion Application – The manual Model 4504 ruggedized DB25 A/B switch is designed to withstand vibrations encountered in mobile/motion applications. This switch has passed rigorous seismic testing and features a rugged all-aluminum enclosure that provides EMI/RFI resistance in noisy environments. The optional mounting ears allow firm attachment to surfaces. All summed up, this switch can be placed in a vibrating noisy environment and still operate perfectly. The Lifetime guarantee against manufacturing defects accompanies this “Hit me with your best shot!” switch.





F) In the Wall – The Model 7190 is a manually operated double gang wall box Online/Offline switch. When in the ONLINE position, the switch connects the COMMON device to Device A. When in the OFFLINE position, the switch disconnects the COMMON device from Device A. There are two RJ45 CAT5e ports on the bracket inside the wall box. The RJ45 network cables must be run into the box and bracket before installing in the wall.



2. Connectors - Types of connectors/ports

Connector Types				
DB9	DB15	DB25	DB37	HD15
				
BNC	RJ45	RJ11/12	MINI DIN	USB
				

3. RJ45 - If the switch has RJ45 ports, is CAT5, CAT5e, or CAT6 required?

A) What is CAT 5?

CAT 5 is a type of twisted pair cabling. Twisted pair cabling is categorized according to its transmission capability. Category 5 (CAT 5) cabling transmits data at speeds up to 100 Mbps. Many new networks use CAT 5 UTP cabling because the faster network technologies require it.

B) What is CAT 5e?

CAT 5e is a CAT 5 variation that supports short-run Gigabit Ethernet (1000 Mbps) networking by utilizing all four wire pairs in a CAT5 cable. CAT 5e is backward-compatible with CAT 5.

C) What is CAT 6?

CAT 6 is a cable standard for Gigabit Ethernet and incorporates more stringent specifications for crosstalk and system noise than CAT 5 and 5e. The CAT 6 cable standard provides performance of up to 250 MHz and is suitable for 10BASE-T, 100BASE-TX (Fast Ethernet), 1000BASE-T/1000BASE-TX (Gigabit Ethernet) and 10GBASE-T (10-Gigabit Ethernet). Most high quality CAT 6 cables will exceed the standard and actually provide performance of up to 550 Mhz.

4. Controls - How do you want to control the switch?

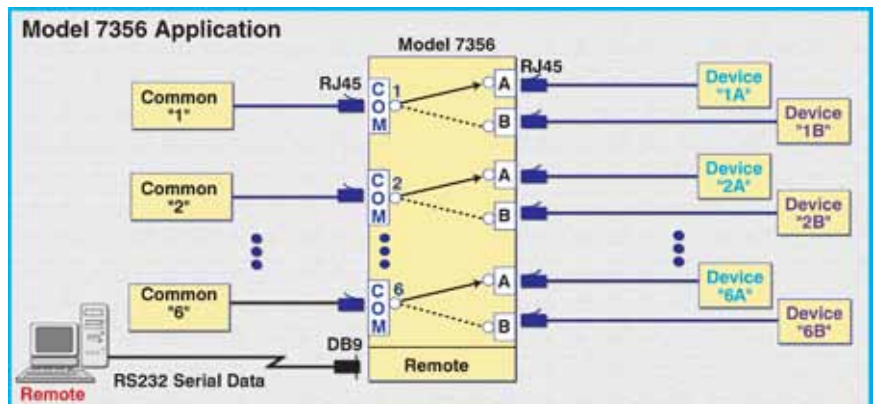
Electro Standards' control methodologies include: Local Manual Switching, Remotely Controllable Switching, Automatic Switching, and any combination.

A) Local Manual - Manual switches feature pushbuttons or rotary knobs and require no power.

B) Remotely Controllable Network Switches

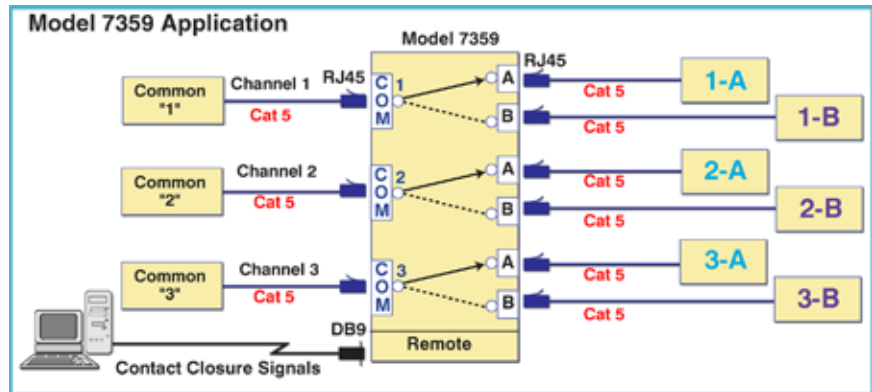
i. **RS232 Serial Control** - The REMOTE connector accepts RS232 serial data ASCII commands.

The Model 7356 6-Channel RJ45 CAT5 A/B Switch features local and remote individual channel control. Each channel maintains its current position in the event of a power loss and continues to pass data. The unit fits into a standard 19" rack and is 1U high. The Supervisory Remote Port consists of a DB9 female connector that accepts RS232 serial data. Switch positions can be selected locally via front panel controls or remotely via RS232 ASCII commands via the Remote port.



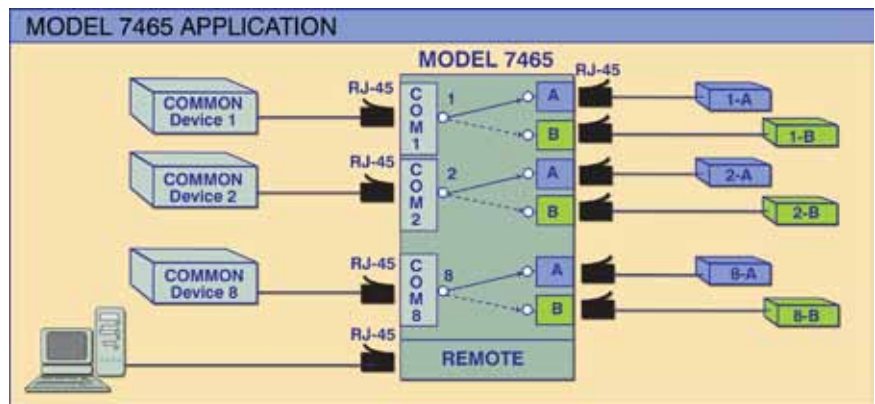
ii. Contact Closure - The REMOTE connector accepts Contact Closure signaling for remote control operation.

The Model 7359 Tri-Channel RJ45 CAT5 A/B Switch features remote control via contact closure. The switch is controlled manually via pushbuttons or remotely via the DB9 female connector on the rear panel that accepts contact closure signal switch commands.



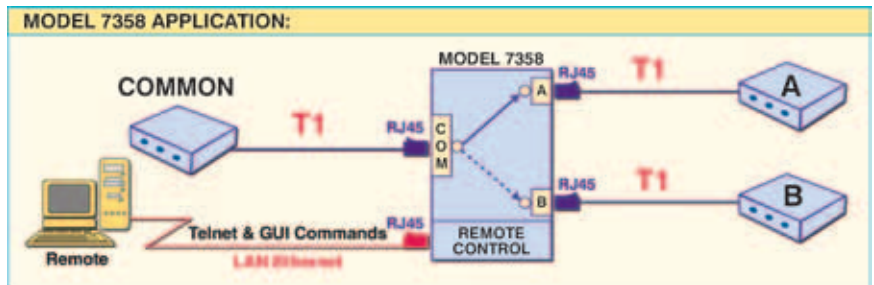
iii. IP Addressable - Remote control of the switch position is from a 10 Base-T/100 Base-TX LAN Ethernet environment. Users communicate with the switch via a TELNET session. The user setup allows assignment of an IP address for the switch unit.

The Model 7465 8-Channel RJ45 A/B Switch supports 10/100 Base-T LAN TELNET access. The 8 channels on this switch can be independently controlled via pushbuttons. Remote access can be accomplished via the RJ45 female connector that accepts 10/100 Base-T LAN Access Ethernet for remote control operation. Remotely select switch position, query switch position, and lockout the front-panel pushbuttons. During power loss, the Model 7465 continues to pass data in the last position.



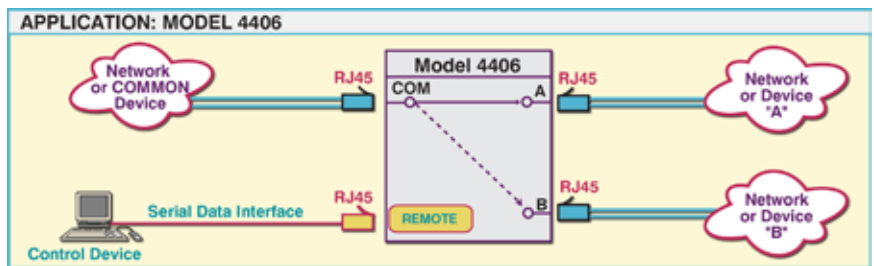
iv. Graphical User Interface (GUI) - The remote GUI interface allows the user to control the switch remotely with simple point and click operation.

The Model 7358 RJ45/48 T1 Interface A/B Switch features both Telnet and GUI remote control. This switch allows quick connection to any one of two RJ45/48 T1 interface devices from one COMMON device. Local control is via a front-panel pushbutton. The remote control RJ45 port is an IP addressable, 10/100 Base-T port. Remote control Telnet command interface or the Graphical User Interface allow the user to control the switch position, lockout the front panel operations and obtain switch status. The software features allow the user to access the switch via any standard Web browser. With simple point and click operation the user can control and monitor the Model 7358. The user can also change the switch's IP address. LAN access gives users across the LAN or over the Internet access to control the switch.



v. Code Operated - The switch position and lockout status can be changed through the data stream on the COMMON port.

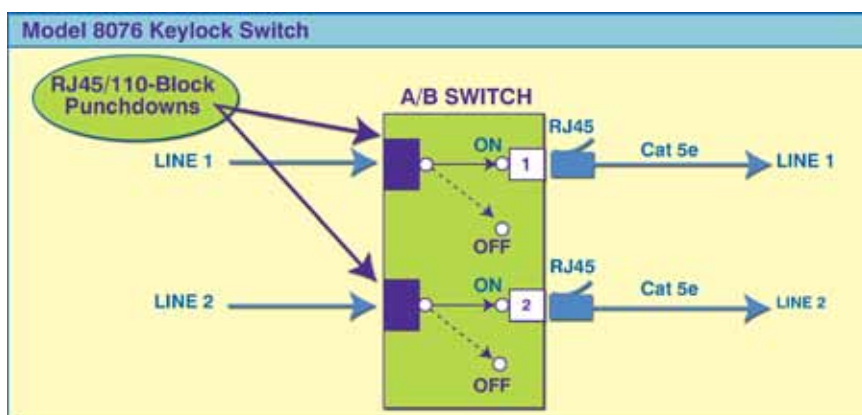
The Model 4406 RJ45 Code-Operated A/B Switch shares one RJ45 interface device between two other devices. The switch may be controlled via a front-panel pushbutton or remotely by sending a trigger character sequence to the unit via the Remote port. Switch position status is displayed by front-panel LEDs or can be queried by the PC connected to the Remote RS-232 serial port.



5. Security Concerns - Keylock, Lockout, and Offline Positions

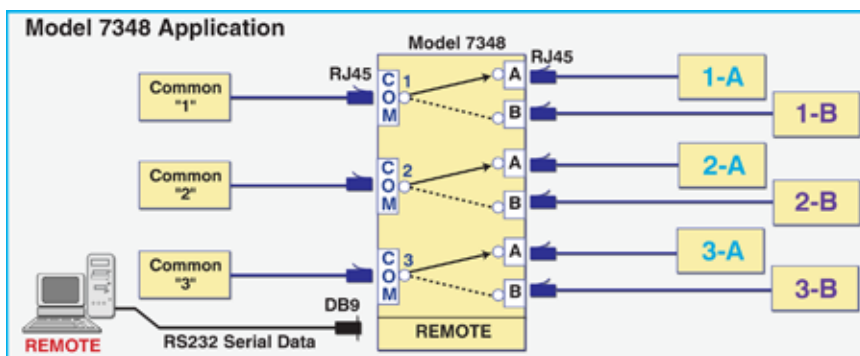
A) Keylock – The advantage of a keylock is the security of knowing that only the person with the key can change the switch position.

The Model 8076 Dual-Channel RJ45/110-Block, CAT5e 100 Base-T Network Access Keylock Switch accepts two 8-conductor CAT5e cables INPUT via two RJ45/110-Block punch-down connectors. This switch allows the user to switch-through or break-from two OUTPUT RJ45 exit ports. The user can remove the top cover of the switch and punch down the connections inside the unit.



B) Lockout – The advantage of the lockout feature is that the user can lockout the switch position remotely and be assured that the switch is operating as prescribed.

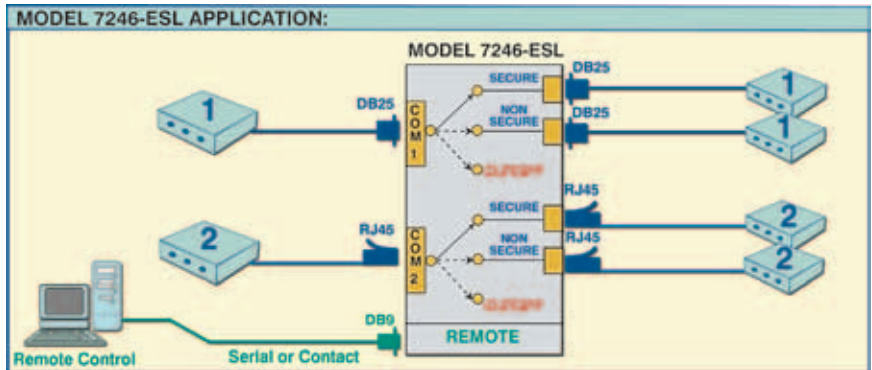
The Model 7348 Tri-Channel RJ45 CAT 5 A/B Switch may be controlled manually via pushbuttons or remotely from an RS232 serial port. Each channel is an individual switch that is independently controlled. Remote commands can switch each channel individually or all channels simultaneously as well as lockout the front panel control. Remote commands allow monitoring of channel switch position and lockout status.





C) Offline and Cutoff Positions – With remote and automatic switches, the switch can automatically switch to an offline position before switching between ports A and B. Manual and remotely controllable switches are also available with a physical offline position that can be selected to stop the switch from passing data.

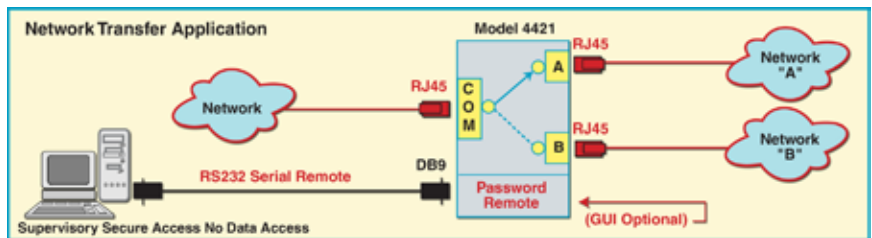
The Model 7246-ESL Dual Channel RS530 Switch and RJ45 Secure/Non-Secure Switch with Cutoff position provides two-channel switching in a low profile, 19-inch 1U rack unit. Channel one shares a single DB25(M) interface device connected to the COMMON port among two other DB25(F) devices connected to the SECURE and NON-SECURE DB25 ports. Channel two shares an RJ45 device connected to the COMMON port among two other RJ45 devices connected to the SECURE and NON-SECURE RJ45 ports. Both channels allow the user to set the switches to the CUTOFF position which stops any and all data throughput for the switch. If power to the Model 7246-ESL is removed, both switches will automatically move to the CUTOFF position. When power is restored, each switch will move to the programmed default position.



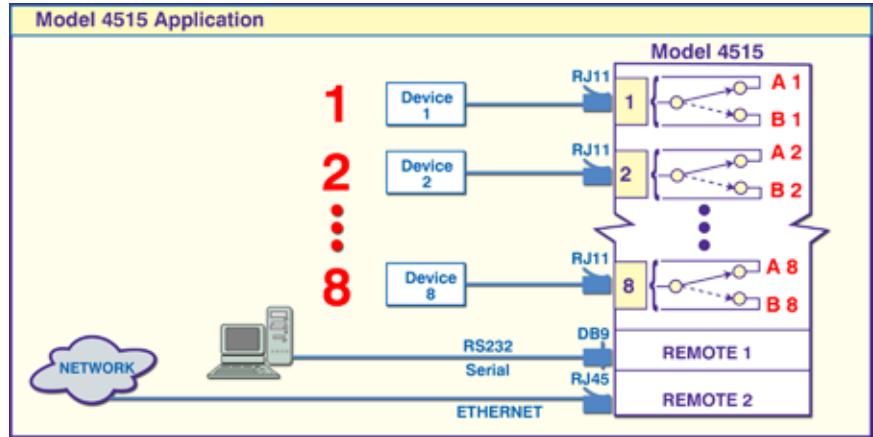
6. Power Loss - How do you want to handle a power loss?

Which position should the switch be in? Should the switch continue to pass data?

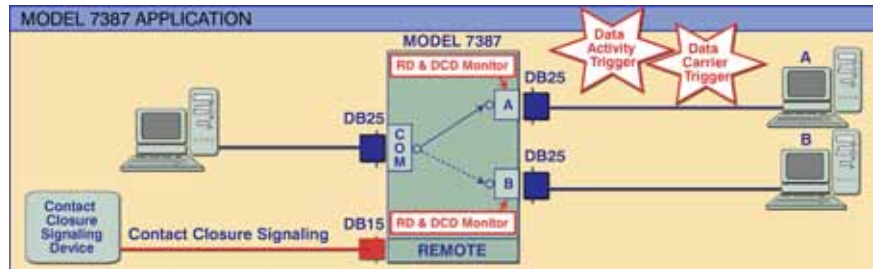
A) Last Position, Pass Data – The Model 4421 CAT5 RJ45 A/B Switch with Password Serial Remote Port includes an RS232 serial security enhanced Supervisory Remote Port requiring a password login to access. Upon proper authentication, a terminal or computer in terminal mode connected to this port can communicate with the unit, determine its status, change the switch position as desired, and/or lockout the front panel switching capability. The Model 4421 retains the last switch position in the event of a power loss and continues to pass data.



B) Default Position – The Model 4515 8-Channel A/B Single Contact Relay Port Switch, RJ11 Interface with 10/100 BASE-T LAN Access and Serial Remote Access shares a device connected to a single pin of each RJ11 interface port between two other devices connected to the A and B pins for each port. Remote access can be via a Web-based GUI interface through 10/100 BASE-T Ethernet connection or using ASCII commands sent to the unit via an RS232 connection. Each port has (4) active contacts: Normally OPEN, Normally CLOSED, the WIPER contact of the relay, and a pin for SG (signal ground referenced to the switch unit). The Model 4515 defaults to the Normally CLOSED position in the event of a power loss to the unit.



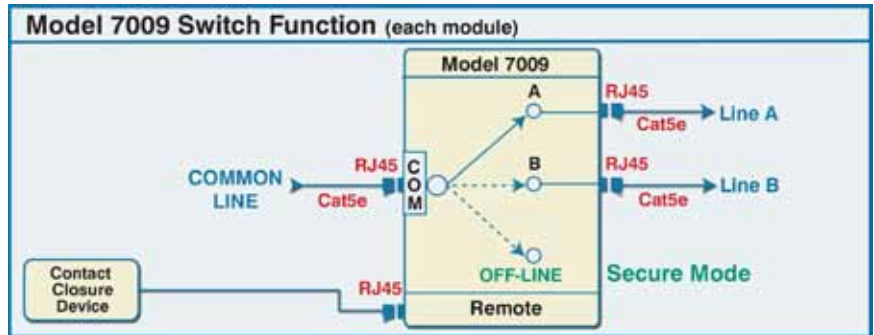
C) Switch Evaluates and Determines Power Up Position – The Model 7387 RS232 DB25 A/B Switch with Fallback and Remote Port shares a single port interface device connected to the COMMON port among two other devices connected to the A and B ports. This switch can sense RD activity or DCD presence on the ports and switch accordingly. The switch can also be controlled manually via pushbutton or remotely via contact closure. All switched signals are passed via latching copper contact relays that maintain their position and continuity in the event of a power loss. When power is restored, the Model 7387 loads the previous position and mode of operation and checks DIP switch settings and the remote port to determine the correct startup configuration.



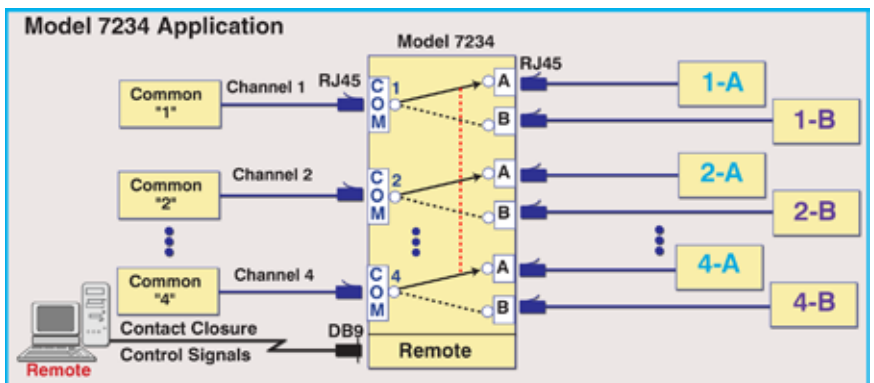
7. Number of Channels per Chassis

From single channel A/B switches to multiple channel switches, the technology exists to handle specific requirements.

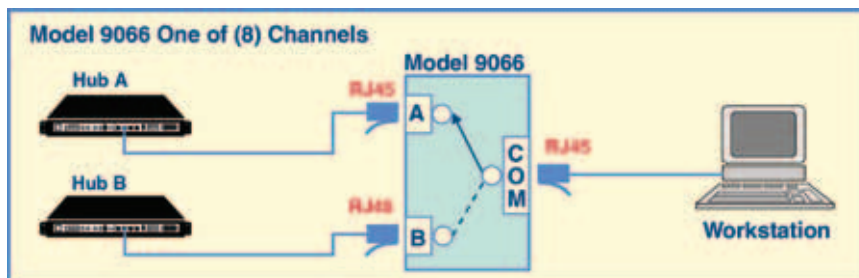
- A) Combining Single Channel Switch Modules** – Up to eight single-channel Model 7009 RJ45 CAT5e A/B/Off-Line Remotely Controllable Switch Modules compactly fit into a Model 9030 Rack. This modular expandable system allows the user to add switching capacity as required. Channels are switched individually.



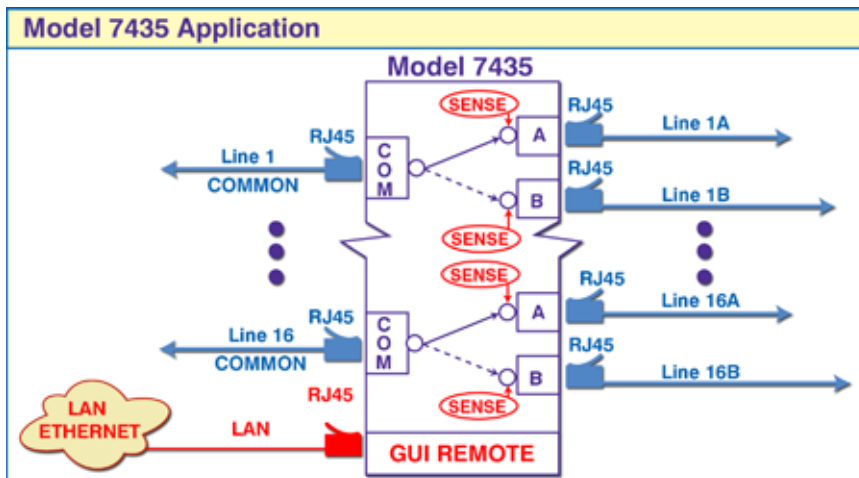
- B) 4-Channels in Slim Rackmount Configuration** – The Model 7234 Quad-Channel RJ45 A/B Switch with Remote Control Port is slim, only 1U high, and fits into a standard 19" rack. All four channels are switched simultaneously. This switch allows local switching via pushbutton. Remote switching is accomplished via the transition from open to closed or closed to open via a single set of contacts connected across pins 1 & 2 of the DB9/Female REMOTE connector port. Upon initial power to the unit, the unit will read the REMOTE port to determine the power up position state. If there are no connections to the REMOTE port connector, pins 1 & 2 are open, thus the unit will default to all four channels in the A position. All four channels are switched simultaneously.



C) 8 Channels in Rackmount Configuration – Model 9066 8-channel RJ45 (2 Pair) 10BASE-T manual A/B Switch enables access to two 10 Base-T networks. The operator can reroute data between two networks with a simple push of a button. Switch each channel individually.



D) 16 Channels of Auto-Controlled Switching in Rackmount Configuration – The Model 7435 Auto-Controlled 16-Channel RJ45 A/B Switch system allows sharing a single port RJ45 interface device connected to the COMMON port among two other devices connected to the A and B ports for each of the switch's 16 channels. The port position, A or B, of individual channels in the Model 7435 is user-configurable to be determined either manually, via the GUI, or automatically per the programming. In the Automatic mode, the position of the individual channels is controlled by sensing incoming data on ports A and B. All switched signals are passed via gold clad silver relays that maintain their position and continuity even in the event of a power loss. All channels can be switched simultaneously or independently.



E) Up to 40 Channels of A/B Switching – Model 9741 handles up to 40 channels of A/B switching in a high-density switch system that takes up only 8.75 inches of panel height. The A, B and COMMON connectors are on the rear panel. The 2-position rotary switches are on the front panel. All 8 pins are switched allowing compatibility with all RJ45 interfaces. This reliable switch system is manually operated and requires no power. Each channel is switched individually.



8. Channel Control

How do you want to switch your channels?

The examples above provide a variety of control systems:

Model 7009: Individual switching

Model 7234: Simultaneous switching

Model 9066: Individual switching

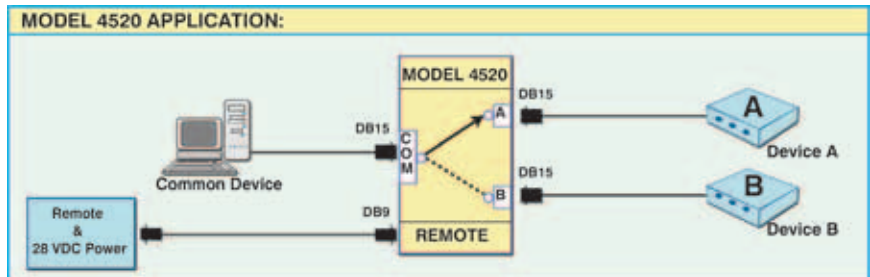
Model 7435: Individual or simultaneous switching

Model 9741: Individual switching

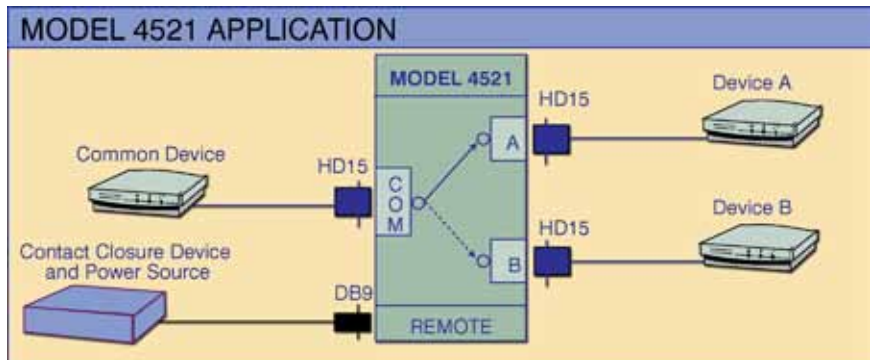
9. Power Requirements

Most remotely controllable and automatic switches require an external power supply.

- A) **UL approved** 120VAC, 60Hz wall mount power module that supplies 12 VDC, 500mA to the unit.
- B) **CE and UL listed** wall mount wide range power module, 100VAC, 240VAC, 50Hz/60Hz supplies 12 VDC, 1.5A to the unit.
- C) **Exceptions:** Some switches require customer supplied voltage to the power input connectors.
 - i. The Model 4520 DB15 A/B Switch with Remote Control via Contact Closure operates on 28 VDC supplied to the unit. The 28VDC power is to be supplied across pins 7 and 8 of the DB9 connector.



- ii. The Model 4521 Single Channel HD15 A/B Switch with Contact Control Remote Port requires 24 volts DC power supplied to pins 7 and 8 of the DB9 REMOTE connector.





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10. Summary

The A/B switch may or may not be so simple. There are tools to assist in determining the exact switch to meet your requirements. The Electro Standards' Website offers a custom network switch form that can be used as a guide to formulate the parameters of any requirement. This Website also allows comparisons of switches in their particular categories. Perhaps the most efficient way to find the exact switch is to talk to the switch experts at Electro Standards Laboratories.

What's coming? Just visit the Electro Standards' Website to see! New application requirements will be met with new switch solutions utilizing the latest technology.

Author's Background:

Raymond B. Sepe, Sr., is the President of Electro Standards Laboratories, Cranston, Rhode Island, USA. Mr. Sepe holds electrical engineering degrees from the University of Rhode Island. As the President of Electro Standards Laboratories, he has been involved with the design and manufacture of innovative network products for over 30 years, developing state-of-the-art copper and fiber optic network backup switches, interface converters, interface analyzers and cable assemblies.