Industrial Automatic Transfer Switch Fundamentals

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INTRODUCTION

Automatic Transfer Switches (ATS) are critical components in industrial power systems, designed to ensure a continuous power supply during utility outages. They automatically switch the load from the primary power source to a backup generator, minimizing downtime and protecting sensitive equipment.

This white paper explores the functions, key components, operational modes, applications, and specification considerations of ATS systems, providing engineers with a comprehensive understanding of their role in power reliability.

Industrial Bypass Isolation Switch.

FUNCTION AND KEY COMPONENTS

The primary function of an ATS is to detect power loss from the utility source and initiate a transfer to an emergency power source, typically a generator. Once utility power is restored, the ATS switches the load back to the primary source. Key components include the transfer mechanism, controller, and enclosure.

The controller acts as the brain of the system, managing sensing, timing, and transfer logic. Rehlko's Decision-Maker MPAC 1200 and 1500 controllers offer programmable settings, communication interfaces, and load management capabilities.

OPERATIONAL MODES AND FUNCTIONALITIES

ATS units operate in various transition modes: standard/open (break-before-make), delayed/programmed, and closed (make-before-break). Open transition disconnects the load before switching sources, suitable for non-critical loads. Delayed transition introduces a customer programmable pause in a center 'off' position to allow electromagnetic fields to decay, ideal for large inductive loads. Closed transition maintains power during transfer by paralleling both sources for a brief period of time (less than 100msec), essential for mission-critical applications like hospitals and data centers. (See *Figures 1-3*)

ATS configurations include standard, bypass-isolation, and service-entrance types. Bypass-isolation combines automatic and manual switches to allow for ATS mechanism maintenance without power interruption, while service-entrance ATS integrates utility disconnect functionality, eliminating the need for additional upstream overcurrent protective devices.

Figure 1

Standard/ Open Transition

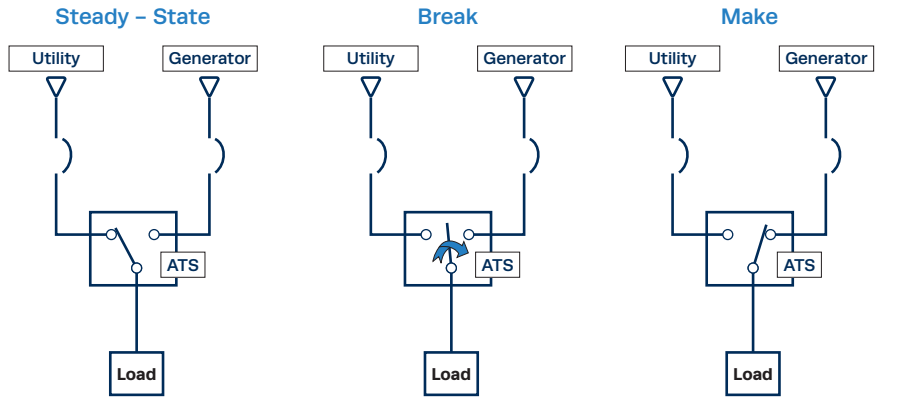


Figure 2

Programmed/ Delayed Transition

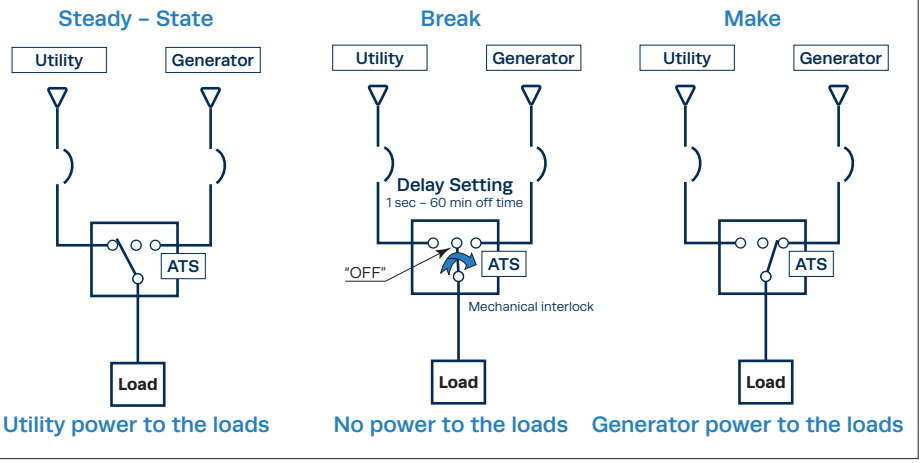
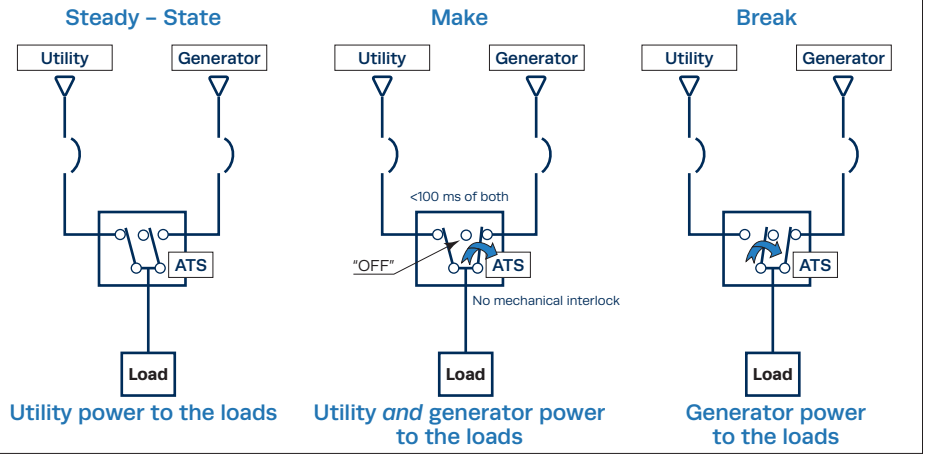


Figure 3

Closed Transition



APPLICATIONS

ATS systems are deployed across various industries where power continuity is vital. While there are countless ways to implement an ATS, three main application types stand out. (*See Figure 6*)

LIFE SAFETY

The first is the Life Safety segment. It encompasses installations such as hospitals, critical care units, and emergency response centers. As you can imagine, keeping operating rooms, ICUs, and emergency dispatch systems operating at all times is extremely important. Maintenance and testing these systems without compromising patient safety, along with operational readiness, is paramount. A typical ATS in this type of application would be a bypass isolation with closed transition (bypass for reduced downtime for maintenance and closed transition for seamless power during transfer). While all Rehlko ATS are designed to UL 1008 (Standard for Automatic Transfer Switches for Use in Emergency Standby Systems) and CSA C22.2 No. 178, Life Safety applications are also governed by NFPA 70 (National Electric Code) and NFPA 99 (Essential Systems for Health Care Facilities).

MISSION CRITICAL

The second main application is the Mission Critical segment. These include data centers, telecom hubs, and financial institutions. The need for redundant, continuous power guarantees 24/7 uptime for servers and communication/cloud infrastructure. Key needs would include load shedding and load prioritization during emergencies. This would also support Tier III and Tier IV data center standards for fault tolerance and concurrent maintainability. A typical ATS for this segment would be a closed transition, either as bypass isolation or standard, depending on customer specifications.

STANDARD

The last segment is the 'Standard' application. This includes the majority of typical uses for an ATS, such as office buildings, retail centers, and manufacturing facilities. A standard/open or programmed/delayed transition mechanism is the pick for this type of ATS. It provides a cost-effective solution to provide reliable backup power during outages, especially where a brief power interruption can be tolerated. While it is the simplest implementation, various accessories and options can tailor a switch to meet the exact job requirements.

Figure 6 **ATS APPLICATION SEGMENTS**

Description	Life Safety	Mission Critical	Standard Application
Typical Facility	Hospitals Emergency Response Centers	Data Centers Telecom Hubs Financial Services	Commercial Buildings Light Industrial Sites
ATS Type	Bypass Isolation ATS	Standard or Bypass Isolation ATS; 3 source capable	Standard ATS
Transition Mode	Closed Transition	Closed Transition	Standard/Open or Programmed/Delayed Transition
Key Features	Allows maintenance without power loss Seamless source switching	Supports multiple power sources Synchronizes loads for uninterrupted uptime	Disconnects before switching Simple and cost-effective
Primary Benefit	Zero downtime for critical life-support systems	High redundancy and continuous operation	Reliable backup with acceptable brief outage

SPECIFICATIONS CONSIDERATIONS

In specifying an ATS, engineers must evaluate not only amperage rating, voltage compatibility, and transition type, but also additional parameters including neutral switching, withstand and close-on ratings, and enclosure type.

Neutral switching options include solid, switched, and overlapping neutral, impacting ground-fault protection and compliance with National Electric Code (NEC) standards.

Withstand and close-on ratings (WCR) define the ATS's ability to handle fault currents, influencing overcurrent protective device (typically breaker) selection, coordination, and system reliability. Additional considerations include load management features, communication protocols (RS-485, Ethernet), seismic certification, and available accessories such as input/output modules, alarm modules, current sensing, surge protection, and digital meters.

Enclosure ratings (NEMA Type 1, 3R, 4, 4X, 12; *see Figures 7 and 8*) determine suitability for indoor, outdoor, or corrosive environments.

Figure 7 Comparison of Specific Applications of Enclosures for Indoor Nonhazardous Locations

Provides a Degree of Protection Against the Following Conditions	Type of Enclosure			
	1*	4	4X	12
Access to hazardous parts	X	X	X	X
Ingress of solid foreign objects (falling dirt)	X	X	X	X
Ingress of water (Dripping and light splashing)	–	X	X	X
Ingress of solid foreign objects (Circulating dust, lint, fibers, and flyings **)	–	X	X	X
Ingress of solid foreign objects (Settling airborne dust, lint, fibers, and flyings **)	–	X	X	X
Ingress of water (Hose down and splashing water)	–	X	X	–
Oil and coolant seepage	–	–	X	–
Oil or coolant spraying and splashing	–	–	–	–
Corrosive agents	–	–	X	–

* These enclosures may be ventilated.

** These fibers and flyings are nonhazardous materials and are not considered Class III type ignitable fibers or combustible flyings. For Class III type ignitable or combustible flyings see the National Electric Code, Article 500

Figure 8

Comparison of Specific Applications of Enclosures for Outdoor Nonhazardous Locations

Provides a Degree of Protection Against the Following Conditions	Type of Enclosure		
	3R*	4	4X
Access to hazardous parts	X	X	X
Ingress of water (Rain, snow, and sleet **)	X	X	X
Sleet ***	–	–	X
Ingress of solid foreign objects (Windblown dust, lint, fibers, and flyings)	–	X	X
Ingress of solid foreign objects (Settling airborne dust, lint, fibers, and flyings **)	X	X	X
Ingress of water (Hose down)	–	X	X
Corrosive agents	–	–	X
Ingress of water (Occasional temporary submersion)	–	–	–

* These enclosures may be ventilated.

** External operating mechanisms are not required to be operable when the enclosure is ice covered

*** External operating mechanisms are operable when the enclosure is ice covered.

SUMMARY

Automatic Transfer Switches are indispensable in maintaining power continuity and protecting industrial operations from outages. Their diverse configurations, transition modes, and advanced control features make them adaptable to a wide range of applications. Proper specification ensures compliance, safety, and optimal performance, making ATS systems a cornerstone of resilient power infrastructure.

CONCLUSION

ATS systems play a vital role in industrial power reliability. Engineers must understand their functionalities, components, and specification criteria to design effective power solutions. Rehlko's ATS offerings provide robust, customizable, and integrated solutions that meet the demands of modern industrial environments. By leveraging advanced controllers, flexible configurations, and global support, Rehlko ATS systems empower engineers to build resilient and efficient power systems.

ABOUT THE AUTHOR

Mike Little is a Principal Engineer with Rehlko. He holds a bachelor's degree in mechanical engineering from Marquette University and has been with Rehlko in the Automatic Transfer Switches and Controls engineering groups since 2005. He has 15 years prior experience designing and developing commercial and industrial controls (contactors, overload relays, soft-starters and switches).

ABOUT POWER SYSTEMS

Power Systems, Rehlko's largest division, delivers worldwide energy solutions designed to ensure resilience for mission-critical applications of all sizes. Building on more than a century of expertise and dedication, the company offers complete power systems, including industrial backup generators (HVO, diesel, gaseous), enclosures, hydrogen fuel cell systems, automatic transfer switches, switchgear, monitoring controls, genuine parts, and end-to-end services. As a global company with service partners in every country, Power Systems provides reliable, cutting-edge technology to keep industries and businesses running.
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ABOUT REHLKO

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