TECHNICAL GUIDE

TRANSFER

SWITCHING

THE GLOBAL SPECIALIST IN ELECTRICAL
AND DIGITAL BUILDING INFRASTRUCTURES

legrand®

This guide is meant to provide comprehensive and detailed information for proper use and selection of the most suitable TSE (Transfer Switching Equipment) solution for each possible application field.

It also highlights Legrand's transfer switching equipment product offer, illustrating the solutions to ensure a constant and reliable power supply:

- Overview of "transfer switching" topic and technical-economical advantages;
- Overview of certifications and regulations;
- Description and comparison of transition types, operating modes and applications;
- Understanding the product ranges, their features and use cases.

The present guide addresses utility managers, consultants, project engineers and designers who specify and manage power protection devices.

CONTENTS

SAFETY INSTRUCTIONS

General information

- Use only the products and accessories recommended by the Legrand Group in the catalogue, instructions, technical data sheets and all other documents provided by Legrand (hereinafter referred to as «the Documentation») in compliance with the installation rules.
- Improper installation and/or use may result in the risk of arcing in the enclosure, overheating or fire. The enclosures must be used under normal conditions, they must not be subjected to Voltage / Current / Temperature values other than those specified in the Documentation.
- Legrand declines all responsibility for any modification or repair of the equipment making up the enclosure that is not authorized by the Legrand Group, as well as any failure to comply with the rules and recommendations specified by Legrand in the Documentation. In addition, in the cases mentioned above, the warranty granted by Legrand will not be applicable.
- It is necessary to check that the characteristics of the products are appropriate for their environment and use during maintenance operations, and to refer to the Documentation. If you have any questions or require clarification, please contact Legrand Group.
- The installation, use and maintenance of the enclosures and their components must be carried out by qualified, trained and authorized personnel, in accordance with the regulations in force in each country.

RISK OF ELECTRIC SHOCK, BURNS AND EXPLOSION.

- People working on the installation must have the appropriate electrical authorizations for the work to be carried out.
- Wear the PPE (Personal Protective Equipment) necessary to work on live products.
- Respect the safety rules related to electrical work.
- Improper electrical and mechanical use of equipment can be dangerous and may result in personal injury or damage to property.
- Depending on the maintenance operations to be carried out, partial or total power cuts of the enclosure concerned should be planned before any work.
- When performing operations that involve access to the inside of the enclosure, be aware of the risk of burns before touching any products or metal parts.
- Before turning the power back on, make sure that there are no foreign bodies and that all physical protections have been put back in place (e.g.: screens, covers, shields).

Any failure to strictly apply the procedures and to respect these recommendations, could lead to serious risk of accident, endangering people and property (in particular, without limitation, risk of burns, electric shocks, etc.).

The rules and recommendations in this document are based on our knowledge of the typical conditions of use of our products in the fields of application usually encountered. However, it is always the customer's responsibility to verify and validate that Legrand products are suitable for its installation and use.

The customer must ensure proper installation, maintenance and operation of the equipment to avoid any risk of injury to personnel or damage to property in the event of product failure, especially for applications that require a very high level of safety (e.g., those in which the failure of a component may endanger human life or health).

The rules for storage, handling, installation and maintenance and the appropriate precautions and warnings must be strictly observed and applied.

OVERVIEW

Power Supply quality in low-voltage electrical installation is the starting point to make:

- efficient installations;
- safety for people;
- equipment protection.

The IEC 60364-1 norm: "Low-voltage electrical installations – Fundamental principles, assessment of general characteristics", impose specific means in case of supply damages: "Cl. 131.7 Protection against power supply interruption" states that where danger or damage is expected to arise due to an interruption of supply, suitable provisions shall be made in the installation or installed equipment.

As specific means, the referred product standard defines a transfer switching equipment (TSE) as a complete system to be used in power systems for transferring a load supply between a normal and an alternate source with a supply interruption during transfer (IEC 60947-6-1 Low-voltage switchgear and controlgear–Part 6-1: Multiple function equipment - Transfer switching equipment).

Besides, only in specific cases, there is also the possibility to have a transfer switch through a closed transition type, keeping power on loads when coming back from backup line to the one with higher priority without the need of external supplies.

It is therefore a system composed of circuit breakers, switch-disconnectors or contactors, that switches (fully or partly) and selects supply for a load between different sources to ensure supply energy to the installation when the normal source is unavailable or discontinuous (it can be a second source of energy by different other system as converter, electric generator, batteries, etc.).

Main power supply + Secondary/Emergency power supply

Continuity of service

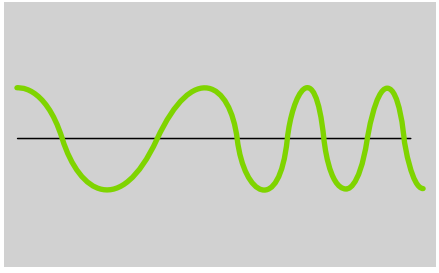
Safety and efficiency

TYPICAL NEEDS

Inside the terms “Power Supply quality”, different needs have to be taken into account and the use of TSE provide these needs to:

- Avoid the complete interruption of industrial processes or services;

- Solve the problem of a bad quality of power distribution (frequent blackouts, phase loss, voltage unbalances or overloads). A backup system is useful to reduce or to overcome the effects caused by network faults on parts of the installation;



Frequency variations

- Enhance security, avoiding dangerous situations for people, environment or equipment;

- Optimise energy supply, managing alternative and renewable power sources (green management);

- Optimise the costs of energy supply (energy efficiency), using the best prices and preventing penalties;

- Be able to repair and replace the main source without interruption of service on loads (maintenance plans);

- Meet legal requirements regulated by municipal, state, federal or other governmental agencies in regards of the supply conditions.

Traditionally used in hospitals, public buildings, industries with continuous manufacturing processes, airports, military applications and emergency lighting, a TSE becomes increasingly necessary for new applications such as data centers, telecommunications and computing treatment or in the already called “green” management of energy sources and energy efficiency.

CERTIFICATION & STANDARDS

CERTIFICATIONS

Any manufacturer is free to design and test his own electrical devices without mandatory specific standard, but in respect of:

- electrical rules of the "state of art";
- free World Trade Organization (WTO) www.wto.org;

- specific area's legal directives;
- market requirements.

Considering these different points, an electrical system, "de facto", shall have to be supported by a certification document declaring the full conformity to the installation requirements. The system of these "installation requirements" are grouped in specific documents named Standards and the verification of the conformity are submitted to relevant Third Part Authorities inside a recognized system of rules managed by the International Electrotechnical Commission (IEC).

STANDARDS

IEC, with the drafting and publication of the rules for all the electrical installation, gives the minimum technical requirements to the maximum safety realization.

TSE functions are covered in general by the **IEC 60364-1** «Fundamental principles, assessment of general characteristics, definitions» and into detail by the **IEC 60947-6-1** «Low-voltage switchgear and controlgear - Multiple function equipment - Transfer switching equipment".

IEC 60364-1 (Cl. 35.2) fix the types of service (supply) that characterize a low voltage electrical system:

- **safety services**

A power supply used to ensure power is supplied to equipment or parts of installations required for the safety of people and could be non automatic or automatic supply. In this second case, safety services are classified according to change-over time into 5 types of transfer switching:

- no-break: an automatic supply which can ensure a continuous supply within specified conditions during the period of transition;
- very short break: an automatic supply available within 0,15 s;
- short break: an automatic supply available within 0,5 s;
- medium break: an automatic supply available within 15 s;
- long break: an automatic supply available in more than 15 s.

- **continuity of service**

Each circuit with any need for continuity of service should consider the following characteristics:

- selection of the system earthing;
- selection of the protective device in order to achieve discrimination;
- number of circuits;
- multiple power supplies;
- use of monitoring devices.

The corresponding international product standard **IEC 60947-6-1** goes into detail about requirements and tests. Is a part of the IEC 60947 group of standards for low voltage switchgear and controlgear and applies to all open transition transfer switching equipment (TSE) for power system rated up to 1000 Vac. or 1500 Vdc.

Based on IEC 60947-6-1, TSE are classified according to:

- the **short-circuit capability**, considering the connected devices (circuit-breakers, switch-disconnectors and contactors);
- the **method of transfer controlling**, considering manual (MTSE), remotely (RTSE), automatic (ATSE) transition mode.

The standard takes into account and defines the "derived" TSE as a TSE in which the main part are device(s) fulfilling the requirements of other IEC 60947 product standards.

REFERENCE STANDARDS
www.iec.ch

- IEC 60364-1 "Low-voltage electrical installations – Fundamental principles, assessment of general characteristics";
- IEC 60947-6-1 "Low-voltage switchgear and controlgear – Part 6-1: Multiple function equipment - Transfer switching equipment";
- IEC 60947-2: 2006, Low-voltage switchgear and controlgear – Part 2: Circuit-breakers;
- IEC 60947-3: 2008, Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units;
- IEC 60947-4 -1: 2009, Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters.

TRANSITION TYPES

Transfer switches can manage transition loads between mains and backup sources in two basic ways: open or closed.

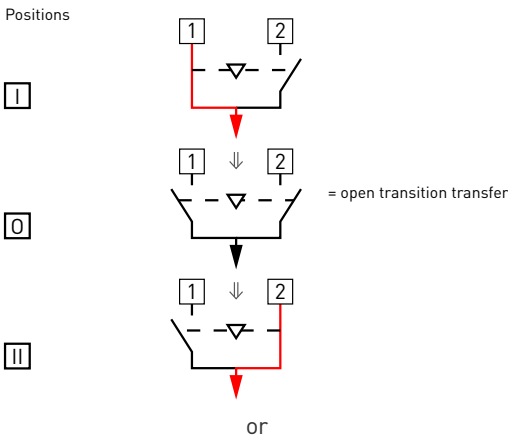
- **Open transition transfer switch**, also called a "break-before-make" transfer switch.

A "break-before-make" TSE is specifically designed to transfer power between main line and backup line. The supply inverter open the connected source before closing the second source causing, for a short period of time, a total power interruption (black-out) on loads during transition.

They neither require nor allow backup line paralleling with the main line and, for this reason, interlocks that positively prevent interconnection of the two power sources in automatic and non automatic (manual and remote) modes are commonly used in order to have simpler and safer management.

Open transition is the most commonly used type of transfer switch and can be used in all types of applications: This solution is generally intended for basic standby power systems for businesses, hotels, small manufacturing and commercial buildings or residential installation, without sensitive loads, that can tolerate short power interruptions and don't need continuity of service within short times.

International standard IEC 60947-6-1 focuses on supply interruption, but in "Cl. 8.2.1.2 f)" states that any time delay or off-time provided in the total operating transfer time, from the normal to the alternative or the alternative to the normal supply, shall not be less than 50 ms. For applications that require a faster transfer time it is recommended to include adequate measurement and protection in the installation.



TRANSITION TYPES

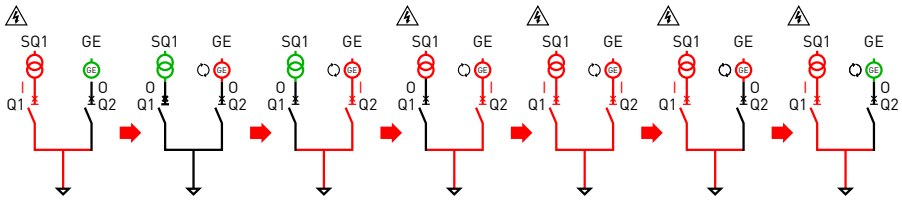
Closed transition transfer switch, also called a "make-before-break" transfer switch.

A "make-before-break" TSE is useful when there are operational conditions where, when conditions permit, it may be desirable to transfer loads with zero interruption of power and in a very quick way.

To take place the transfer, the two power sources must be synchronized and have the same voltage and frequency. Operate like an open-transition transfer switch when a source has failed, but will parallel the two sources to the load for a short time (depending on the local network regulations) and then disconnect/open the source from which the load is being transferred when both sources are available/closed, avoiding a total power interruption on loads.
Due to short timings, this kind of transition is possible in applications with fast switching means, accordingly to product ranges.

For this reason, a mechanical interlock or a manual operation cannot be compatible and closed transition must be executed by an ATS controller.

Closed transition is the best choice when frequent load transfers are executed between active sources: is used in critical power requirements, such as data centers, large businesses and hospitals, where the system can't withstand a momentary load interruption.



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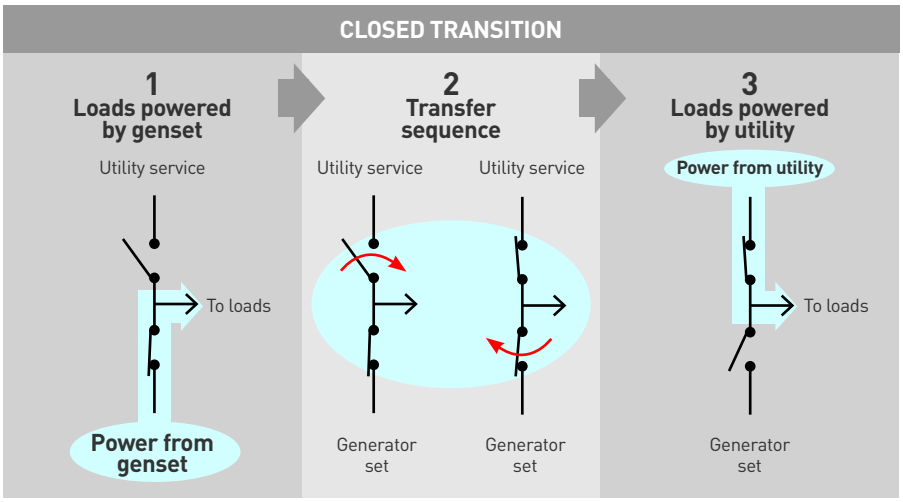


TABLE:

DEVICE TYPE	Transition type		
		OPEN	CLOSED
	Contactor based	X	X
	Modular circuit breakers based	X	
	Moulded case circuit breaker based	X	X
	Air circuit breaker based	X	X
	Switch disconnector based	X	X

UPS

The supply inversion control system must not be confused with an Uninterruptible Power Supply (UPS) that provide critical loads with a ready-to-use power source.

Moreover, in an open delayed transition, unless an UPS is located downstream, loads will have a short power interruption while a closed transition does not always substitute for an UPS where one is required by the load equipment.

UPS is an electrical device used to keep electrical devices constantly powered.

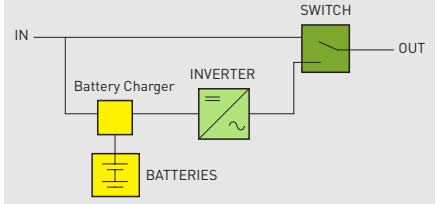
Provide near-instantaneous emergency power to a load when the main power source is lost by supplying energy stored in batteries.

Derives from the needs to store energy for mission-critical facilities (data centers, hospitals etc.) and to protect against voltage or frequency fluctuations. They also provide autonomy or temporary power to overcome any blackouts.

Different types of static UPS systems are on the market, but in general there are three systems:

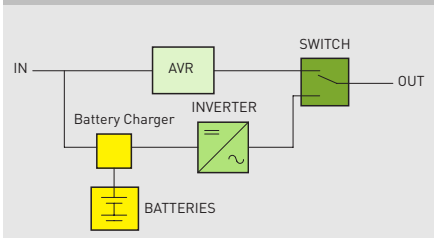
- **off-line:** When the mains supply is on, the output is identical to the input. The UPS attends only when there is no input voltage and powers the load using the inverter, which in turn is powered by the batteries.

Off-line (VD)



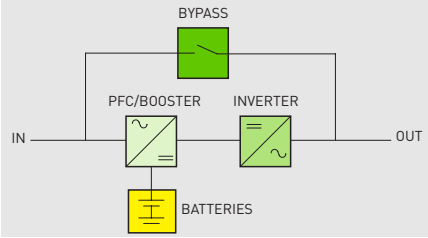
- **line-interactive:** When the mains supply is on, the input and output are separated by a filtering and stabilization circuit (AVR: Automatic Voltage Regulator), but some of the disturbances and waveform variations that may be at the input may be found at the output. As in Off-line systems, when there is a power failure, the output is connected to the inverter, which in turn is powered by the batteries.

Line-Interactive (VI)



- **on-line double conversion:** This is the most common type of UPS above 1 kVA. The input is first rectified and then re-converted into alternating current with an inverter. This way the output voltage waveform is totally independent from the input. All potential mains disturbances are eliminated and there is no transient time switching from the mains to the battery, as the output is always powered by the inverter. In the event of overloads or other eventual problems, this type of UPS has an automatic bypass that ensures the load is powered by switching it directly at the input.

On-line double conversion (VFI)



UPS RANGE:

- **consumer and SOHO UPS** up to 3 kVA.

Characteristics of the range:

- simple: compact, easy to install and configure;
- reliable: with an electronic voltage regulator, LEDs indicator and telephone protection, they provide total, reliable protection of the installation;
- cost-effective: they provide an excellent quality/price ratio and guarantee of a lasting investment.

Application fields: Shops, small office, home entertainment systems.

- **conventional UPS** from 0,8 up to 800 kVA.

Characteristics of the range:

- safety: on-line double conversion UPS with DSP microprocessors for precise, constant control of all measurements and of the power factor correction circuit (PFC);
- performance: professional solutions with power up to 800 kVA;
- technology: transformer-free technology for high quality energy output with up to 96% efficiency.

Application fields: Hospital and healthcare, office and working areas, transport.

- **modular UPS** from 1,25 up to 480 kW.

Characteristics of the range:

- expandability: modular UPS enable the power supply to be sized exactly to requirements, without precluding any future expansion;
- flexibility: they are made up of "standard" modules that can be added to existing configurations to increase their power or backup time;
- redundancy: their innovative three-phase system, made up of individual single phase modules, provides the highest possible level of redundancy.

Application fields: Data center, tertiary, industry.

OPERATING MODES

MANUAL, REMOTE AND AUTOMATIC TRANSFER SWITCH

The supply inversion device ensures continuity of operation by switching over to a standby supply if there is a main supply not into the limits of value and quality requested by the load.

There are two operational modes to transfer power and three type of control categories, depending on the degree of automation of the function: the choice of one or the other is one of the main decision to be carried out to have a transfer switch.

Power transfer involves two processes: initiation (what starts the transfer) and operation (what completes then transfer).

MANUAL AND REMOTE OPERATED

Manual and remote transition are intended for applications where operators are present.

They ensure the transition manually or by a remote operation (e.g. motor control).

Are commonly applied in systems where the need for continuity of service is significant but not a priority thus there is no need to be on line in very short time periods, a loss of power doesn't represent immediate safety risk and there is no need of continuous system monitoring.

This type of transition allows only open transition (device can close if the other one is open).

- **manual** transition is the simplest type and is done through a lever or keylocks (see "mechanical interlock" also). In manual mode, initiation and operation are performed manually, the operators are physically present where the TSE is located and have the competence to manage the transition in a safe way. In this situation, no monitoring capability for the power sources is required.
- **remote** transition has the same previous characteristics (manual transition) but is electrically operated (e.g. motor operator for circuit breakers) and the operation is also given by the suitable devices (operator pushbuttons) mounted on the TSE or located and managed remotely.

AUTOMATIC

Automatic transition incorporates electrical controls (an integrated controller/microprocessor) that continuously monitor the condition of power sources, comparing the quality of the sources (e.g. voltage, frequency, phases) and completely manages, according to external parameters, both initiation and operation of the transition through an actuator.

This is a type of control commonly used to have greater use flexibility and for critical loads, to ensure the fastest possible transfer (short or even no break of supply) with no dependence on a human operator, to guarantee optimum energy management and in general when the continuous monitoring of the voltage and frequency of sources is a primary need.

If the main source becomes unacceptable within the parameters set, the TSE will automatically and safely transfer the load to the alternate power supply source without operator presence. When the main source returns within the parameters set, the TSE will activate back-switching so as to return to the initial conditions (if forseen by control logic).

This type of TSE provides the most reliable power and is recommended for continuity of service and unattended operation.

Automatic switches allow both open and closed transition and usually include provisions for manual or remote transfer, to use in case of emergency situations.

TRANSITION USE

Different needs and different kind of installations impose the different "transition use":

- **manual and remote transition**: is a appropriate solution in small buildings and infrastructure (like hotels), small manufacturing and commercial buildings, small and medium-sized businesses, offices, residential installations or any other systems which provides a medium-long break of supply.

Building services

Commercial building

- **automatic transition**: is the right solution for commercial and service sector (critical power needs in hospital and healthcare buildings, financial and data center facilities, high rise buildings, shopping centers, safety systems for buildings like lighting, emergency lighting systems, fire protection system etc.), industry (assembly lines, manufacturing plants, chemical industry etc.) infrastructures (transportation like airport, railway and port facilities, runway lighting systems etc.) and telecommunication.

Data center

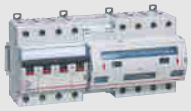
Industry

Hospital

Infrastructure

OPERATING MODES

INTERLOCKING COMPARATIVE TABLE

		DEVICE TYPE				
MECHANICAL INTERLOCK	OPERATING MODES	MCB	SWITCHING-DEVICE	MCCB	ACB	CONTACTOR
TOGGLE CONTROL	MANUAL					
KEYLOCK	MANUAL					
CABLES	MANUAL REMOTE OR AUTOMATIC					
BASE PLATE	MANUAL REMOTE OR AUTOMATIC					
CENTRAL MECHANISM	MANUAL REMOTE OR AUTOMATIC					

MECHANICAL INTERLOCKING

For all these transition methods listed above, the referred standards (IEC 60947-6-1 Clause 8.2.1.1 b), impose that the operating mechanism has to be interlocked to prevent simultaneous connection to both normal and alternative supplies under all conditions.

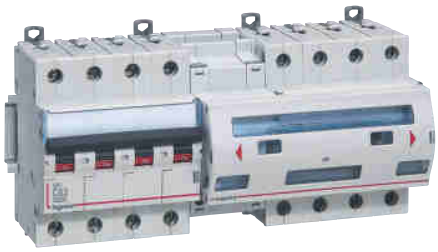
This mechanical interlock system allows transfer switch (for manual and remote operations), ensures "mechanical safety" redundancy in the event of supply inversion (for automatic operations) and may enable devices of different sizes and types to be interlocked.

To have a transfer switch, different types of interlocks can be used:

- toggle-controlled;
- keylocks;
- cables;
- base plate;
- central mechanism.

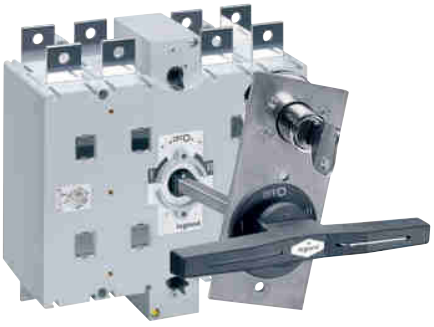
Various functions are defined for these different usages and below there are the characteristics of each of them.

- **Interlocking by toggle-controlled device**



- interlocking system that can interlock two devices;
- when one device is closed (ON position) the other shall be open (OFF position);
- this interlocking system model is available only for MCB range;
- it is incompatible with motor operator and available only for manual transition.

- **Interlocking by keylocks**



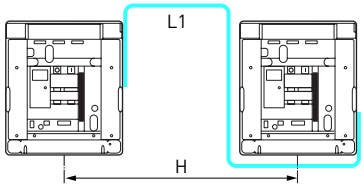
- it is the simplest interlocking system and enables interlocking between two or more devices that are physically distant or that have different characteristics. It is based on two or more identical keylocks with a single key (available for all devices) and a keylock adaptor (different for each device);
- one key may operate one or more locks, but it is necessary to first open (OFF position) the device with the key before the key can be removed and used to lock (ON position) another device;
- interlocking by keylocks makes possible a large number of combinations between many devices;
- all range of circuit breakers (MCCB and ACB) and switch-disconnectors can be interlocked between each other or with any other device equipped with the same type of keylock;
- it is incompatible with motor operator and available only for manual transition.

OPERATING MODES

Interlocking by cables

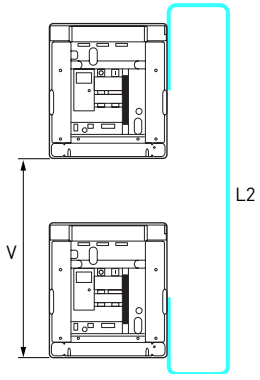
- interlocking system achieved using interlocking units mounted on the right-hand side of the device;
- this system provides flexibility to install and can interlock 2 or 3 ACB devices, which may be different frame, type (fixed or drawout), in a vertical (in the same enclosure) or a horizontal configuration;
- it is made up with a set of cables (different length) and an adaptation fixture;
- it is compatible with motor operator and available for manual, remote and automatic transition;
- to have a fully automatic transition this mechanical interlocking system should be supplemented by motorised operators and an electronic control unit.

2 DMX³ - HORIZONTAL CONFIGURATION



Calculation of cable length:
L1 = 1430 + H

2 DMX³ - VERTICAL CONFIGURATION



Calculation of cable length:
L2 = 1570 + V

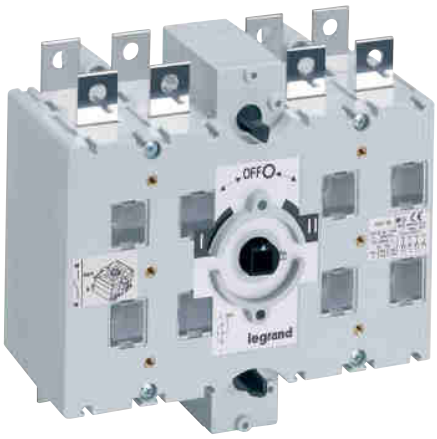
Interlocking by base plate

- interlocking system carried out on the base plate by a mechanism, not hindering the access to the device controls and trip units, located behind the devices that should be installed horizontally;
- it is designed for the mounting and interlocking of two Legrand protection devices, that must be either with the same configuration (fixed, draw-out or plug-in versions);
- it is compatible with manual, remote and automatic transition.
- to have a fully automatic transition this mechanical interlocking system should be supplemented by motorised operators and an electronic control unit.

Interlocking by central mechanism

- interlocking system carried out on the base plate by a mechanism, not hindering the access to the device controls and trip units, located behind the devices that should be installed horizontally on a mounting rail;
- it is compatible with manual, remote and automatic transition.
- to have a fully automatic transition this mechanical interlocking system should be supplemented by motorised operators and an electronic control unit

CHANGEOVER SWITCH



In addition to the mechanical methods listed above, there is another way to have a manual transfer.

DCX-M range of changeover switches, from 63 to 1600 A - 3P and 3P+N, offers a high level of security and reliability particularly adapted for the most demanding environments and guaranteed by its electrical and mechanical performance.

Has been designed according to IEC 60947-3 standard for its use in low voltage installations for commercial and industrial buildings:

- meets the requirements of manual supply invertors for transfers between the main supply and the alternative supply through a single 3-position rotary handle (source I ON, all OFF, source II ON);
- has a wide variety of accessories to customize the installation such as direct and external handles, auxiliary contacts and safety key lock devices that gives flexibility to plan your installation.

APPLICATION TYPES

Manual and remote transfer switches fully cover utility/utility, utility/gen set, gen set/gen set use cases. However, it is advisable to place a greater focus if a generator set is used as an emergency source since it will be activated separately and always by an operator.

On the other hand, **automatic** transfer switches are designed to be operated, as for manual and remote TSE, in three applications types requiring backup power.

These applications are:

UTILITY TO GENERATOR (U-G):

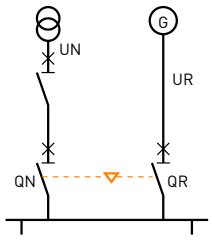
Transfer switches between a utility and a generator set for emergency and standby power systems is the most common application.

Under normal operating conditions, the network is powered by transformer and if a failure occurs the loads are supplied by the emergency line through a generator set.

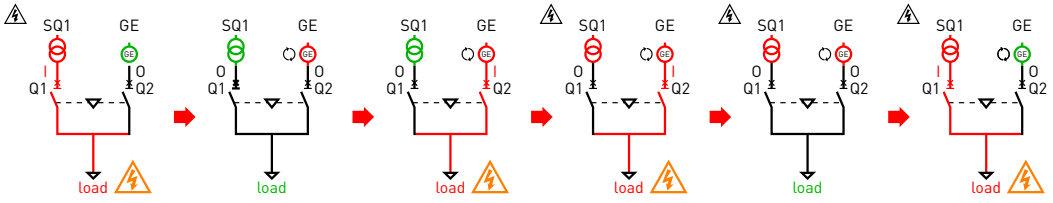
The basic functions of an automatic utility-to-generator set control are the following:

- the ATS continuously monitors the normal power source and, if the main line becomes unavailable or unacceptable (defined by the settings) for a predetermined time delay, transmits a command witch activates the generator set;
- when the emergency line becomes available, the ATS activates main line protection device opening and emergency line protection device closing (from that moment on the network is supplied by the generator set);
- when the main line returns within acceptable limits, the ATS starts the back-switching procedures by opening protection device on the emergency line and subsequently closing protection device on the primary line (from that moment on the network returns to be supplied by the transformer on the main line);
- the ATS removes the activation command from the generator that allows it to cool down while running at no load before being shut down.

1 normal source
1 replacement source



QN	QR
0	0
1	0
0	1



Back-switching:

Main supply returns acceptable → Opening of emergency line CB and closing of maine line CB → Supply from the main line → Generator stop (if present)

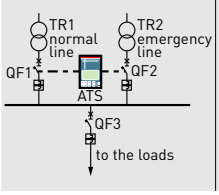
Valid TABLE for both U/G and U/U applications

UTILITY TO UTILITY (U-U):

In the utility to utility network, the load is normally connected to a priority network and transfer to secondary line takes place in case of fault on the primary line or following an external signal. The basic functions are similar to the other automatic controls, except there is no start/stop signalling circuit:

- under normal conditions, the ATS monitors the normal power supply and, if the main line becomes unavailable or unacceptable (defined by the settings) for a predetermined time delay, transmits an opening command to main protection device of the main supply.
- if an emergency power supply is available the ATS transmits a closing command to the protection device on the emergency line (from that moment on, the network is supplied by the secondary transformer).
- when the main line returns within acceptable limits, the ATS starts the back-switching procedures by opening protection device on the emergency line and subsequently closing protection device on the primary line (from that moment on the network returns to be supplied by the transformer on the main line).

Wiring diagram	Switching logic



	QF1	QF2
	0	0
Normal	I	
Emergency	0	I

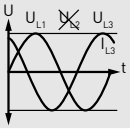
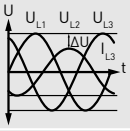
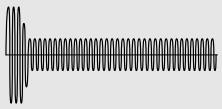
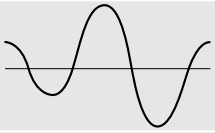
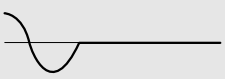
0 = circuit-breaker open
I = circuit-breaker closed

GENERATOR TO GENERATOR (G-G):

In generator set to generator set network, transfer switches are installed between two generator sets for prime power use and one generator is designed as the preferred source.

The ATS controller automatically sends a start signal and then transfers the load to the backup generator set if the preferred generator set becomes unavailable or unacceptable for a predetermined time delay.

TABLE: FAULTS EXAMPLES

DISTURBANCE CATEGORY	WAVE FORM	DESCRIPTION
PHASE LOSS		The maximum condition of voltage unbalance and occurs when one phase of a three-phase system is lost
FREQUENCY VARIATIONS		Any deviation of the fundamental frequency and generally occur in the energy produced by power-supply units
VOLTAGE UNBALANCE		The maximum deviation from the average phase/sequence voltage and is caused by unequal distribution of loads amongst the three phases
VOLTAGE FLUCTUATIONS		A series of small, random voltage changes due to any load exhibiting significant current variations or systematic variation of the voltage waveform
UNDERVOLTAGE		A drop in voltage levels reached when the AC voltage lags the nominal voltage by 10%-20% for more than a minute
OVERVOLTAGE		An increase in voltage levels reached when the voltage exceeds the nominal voltage by 10% - 20% for more than 1 minute
POWER SYSTEM FAILURE		Means that there is no power supply at all

SWITCHING MECHANISM FOR THE TRANSFER

To meet any change-over and transfer need, low voltage switching mechanism technology is available in three basic types, generally referred to as circuit breaker type, contactor type and switch-disconnectors type that are all power devices rated to transfer the load to/from the power sources.

CIRCUIT BREAKERS SWITCHING MECHANISM

A circuit breaker is both a circuit-breaking device that can make, withstand and break currents whose intensity is at most equal to its rated current (In), and a protection device that can automatically break overcurrents which generally occur following faults in installations.

It is a device in electrical systems that has the capability to simultaneously provide switching, protection and isolation.

Circuit breaker switching mechanism can be divided into three sub-types: air circuit breakers, moulded case circuit breakers and modular circuit breakers.

ACB:

DMX^3 have very high performance, technologically advanced electronic control and protection units.

Are available in four frame sizes, two device versions (fixed and draw-out) and the range covers several rated currents, from 630 up to 6300 A, with four breaking capacities (42 kA, 50 kA, 65 kA, 100 kA).

Their electrical and mechanical strength, breaking capacity, maintainability and optional accessories make them ideal for protection and control requirements at the supply end of low voltage installations up to 6300 A, providing easy installation, Optimised dimensions, easy mounting and simple connection.

Can be operated both mechanically and electrically.

All DMX^3 devices can be configured in open and also closed transitions.

MCCB:

DPX^3 circuit breakers are available in thermal magnetic and electronic versions with nominal currents from 16 to 1600 A and breaking capacities from 16 to 100 kA.

The wide range of characteristics and versions covers the requirements of all installations providing a full protection in every operative situation like commercial and industrial installations requirements, without the need for additional upstream protective devices.

The main characteristics of DPX^3 circuit breakers are their compact dimensions, their ease of installation, use and accessorisation, their undisputed reliability and self-protecting at high fault current.

DPX^3 can be installed in fixed plug-in or draw-out versions, may have an integrated metering function that provide access to the parameters and consumption of the installation with no need for any additional device or accessory and may be equipped by a motor operator (for more details on available configurations, please consult catalogue pages).

All DPX^3 devices are suitable for open transition; additionally DPX^3 630 and DPX^3 1600 devices allow also closed transition.

MCB:

Modular circuit breakers can provide protection, control and isolation for commercial and residential installations.

- DX^3: this range is comprehensive, versatile, flexible and suitable for all segments. This is the ideal universal solution for all commercial and residential installations. Available with ratings ranging from 0.5 to 125 A, with breaking capacities from 6 to 50 kA.
- TX^3: range suitable in standard and less complex installations. Available with ratings ranging from 2 to 63 A, with breaking capacity of 6 kA and 10 kA.
- RX^3: this range provides minimum functional characteristics for residential installations. The range includes ratings from 6 to 63 A, with breaking capacities from 3 to 6 kA.

CONTACTORS SWITCHING MECHANISM

CTX³ contactors is the most common switching mechanism type.

Support both open and closed transition types but don't include integral overcurrent protection, so the power contacts are not self-protecting and can't be used for isolation.

Their high performance levels, perfect complementarity, compact size, ease of mounting and wide range of auxiliaries make them suitable for installation in all distribution boards and control enclosures.

CTX³ power contactors provide an ideal solution for controlling circuits for the most demanding applications from 40 up to 900 A (AC-1).

ISOLATING SWITCHES

Isolating switches are used for load breaking and isolation of low voltage circuits.

Designed to electrically separate an installation or part of an installation, the purpose of isolation is to ensure the safety of people working on the installation, protecting the load against network interference through a handle with two stable positions, which are not affected by voltage drops or vibrations, that confirms the actual position of the contacts.

There are 3 categories of device, depending on their characteristics and where they are to be used:

- isolating switches with positive contact operation
- isolating switches with visible contact indication: Vistop (32 to 160 A) and DPX-IS (63 to 1600 A)
- trip-free isolating switches: DPX³-I (160 to 1600 A) and DMX³-I (1000 to 1600 A).

All DPX³-I and DMX³-I switch-disconnectors are suitable for open transition; additionally, DPX³-I 630 (with all motors), DPX³-I 1600 (only with fast motor) and all DMX³-I devices allow also closed transition.

TABLE

	DEVICE TYPE					
	CIRCUIT-BREAKERS					CONTACTORS
OPERATING MODES	DMX³/DMX SP	DPX³	DX³	TX³	RX³	CTX³
MTSE	✓	✓	✓	✗	✗	✗
RTSE	✓	✓	✗	✓	✓	✓
ATSE O.T.	✓	✓	✗	✓	✓	✓
ATSE C.T.*	✓	DPX³ 630 DPX³ 1600	✗	✗	✗	✗

	DEVICE TYPE				
	SWITCH DISCONNECTORS				
OPERATING MODES	DCX-M	DPX-IS	Vistop	DPX³-I	DMX³-I
MTSE	✓	✓	✓	✓	✓
RTSE	✗	✗	✗	✓	✓
ATSE O.T.	✗	✗	✗	✓	✓
ATSE C.T.*	✗	✗	✗	DPX³ 630 DPX³ 1600	✓

* For Closed Transition mode, please provide the correct safety measures

ATS CONTROL UNITS

Legrand offers a complete range of "ATS" control units, to manage two or three power supplies.

Legrand ATS devices can be identified as a real turnkey solution to simplify project design, installation and product configuration and permits the management of all customer's needs: provides flexibility, reliability and value in an all-in-one compact solution, easy to install, simple to configure and adaptable to all application needs.

The product range is complete, ensures high performances (like multi-function logic) and has an intuitive and easy to use interface through secure operations (with also the option of a manual emergency control).

All Legrand automatic transfer switches are certified systems to meet the requirements set by the international standards.

The transfer switch control unit is the core of the ATSE and handles all power sensing, timing functions and fault monitoring to check the supply characteristics of the main and backup lines and required for fully automatic operation. It manages the inversion and tells the switching device when to make quickly and safely transfer/retransfer to a right-parametered source: the switch-over to the standby/emergency supply is carried out automatically if there is a fault on the main supply and vice versa a retransfer after the restoration of this supply reducing the possibility of injury and property damage.

ATSE ADVANTAGES

- Space optimization; - Simple installation on LV switchboard; - High versatility; - User friendly interface; - Conformity to standards; - Diagnostic warning; - Safe and reliable operation; - Fully manages the inversion.

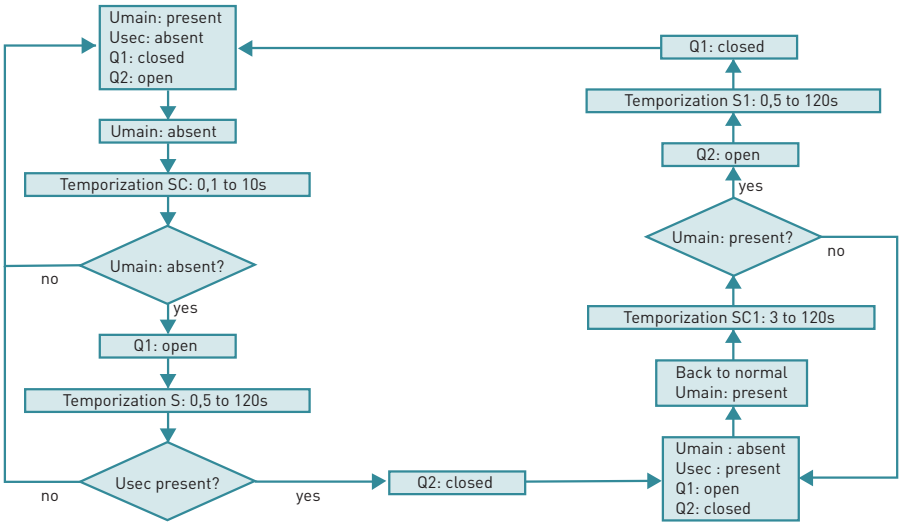


TABLE: Example of algorithm for the functioning of an ATS

Legrand ATSE/TSMS can manage several types of devices and gives the right answer to every project needs, from 2 to 5 devices to manage.

Can cover up all Legrand range of MCCB's, from DPX³ 125 HP up DPX³ 1600, all the range of ABC's, from DMX³ 1600 to DMX³ 6300, DMX-SP 2500/4000 and all contactors CTX³.

It's perfect integration with all Legrand devices ensures a fully co-working system.

In this guide we use the abbreviation ATSE (automatic transfer switch equipment) that has to be intended as a "derived" TSE (derived transfer switching equipment) in which the main part are device(s) fulfilling requirements of other IEC 60947 product standards.

ATS control units are particularly suited to use in all emergency power supply system where continuity of service is a priority. Main application of ATS are: Hospitals, data processing centers, commercial building, infrastructural buildings and industrial processes.

Data centers

Hospitals

SYSTEM CONFIGURATION FOR THE INSTALLATION OF AN ATSE:

An automatic transfer switch equipment is made up of several main components:

- 2 MCCBs, one on the emergency line and the other on the main line + 1 Mechanical interlock through base plate + 2 Motor operated controls + 1 ATSE control unit (Cat.Nos 4 226 81/82/83/84; see below).
- ATSE with DMX³ circuit breakers have the same basic characteristic of the Manual TSE, with in addition the possibility to remotely control and automatically manage the source changeover. They consist of: 2 or 3 ACBs circuit breakers + 1 Mechanical interlock (identical to the associated manual network: using cable) + 2 or 3 Motor operated controls + 1 ATSE control unit (Cat.Nos 4 226 80/82/83; see below).

- Contactor based ATSE:
  - the contactor switching device includes the main power assembly and the operating mechanism;
  - the power assembly is composed of the individual power poles;
  - the operating mechanism includes the mechanical interlock.

MOTOR-DRIVEN CONTROL

is one of the main applications of automatic supply inversion ATSE or RTSE and can be used both in automated processes and safety processes (priority of service, breaking for fire, etc.).

Motor-driven controls enable remote control of the operation of the remote devices (on, off, reset).

They are associated with appropriate electrical control layouts according to requirements.

Motor operators, connected to the circuit breakers devices controlled by the ATS control unit should be chosen very carefully since the action time must be reduced to capture the moment of synchronization between the controlled sources especially for a closed transition (when there is a generator set).

Motor-driven controls and coils for DMX³

Motor-driven controls for DPX³

CONTROL UNIT CAT.NO 4 226 81

MAIN FEATURES:

- power Supply 110 - 240 V AC
- 2 x 3 phases + N voltage input
- 100 – 480 V AC rated voltage
- graphic LCD display, 5 languages
- 6 digital inputs, 7 relay outputs
- "utility / utility", "utility / gen set" and "gen set/gen set" application;
- front interface to activate USB or WI-FI communication
- drive of circuit breakers, contactors.
- controls of minimum voltage, maximum voltage, phase loss, asymmetry, minimum frequency, maximum frequency, with independent enable and delay
- open transition management

ADVANTAGES/PLUS:

- standard transfer switch management;
- use cases fully covered;
- simple interaction ways;
- simple installation;
- different ways to interact with device (like Wi-Fi and USB);

THE SOLUTION FOR:

- healthcare buildings
- non critical process that don't require enhanced control
- high rise buildings
- basic projects not requiring communication

CONFORMITY TO STANDARDS:

Full compliance with IEC 60947-6-1 is achieved through usage of Legrand devices and solutions.

APPROVAL AND CERTIFICATIONS:

The Cat.No 4 226 81 ATS can manage different kind of devices as breakers and contactors and is used for standard management of 2 power supplies.

This central unit is used to create basic automatic source-changeover systems that switch from one source to another depending on the presence of voltage on the main source.

It is intended for use in low voltage power supply systems where a brief interruption of the load supply is acceptable during transfer (open transition).

Main idea behind this kind of need is the installation simplicity with an "ergonomic enhanced" device.

It is designed for 3 types of applications/ functions:

- utility/utility: provide all the functions necessary for these applications (operation with or without priority, preferred source selection) together with the monitoring of the voltage and frequency of both sources for single, two-phase and three-phase networks;
- utility/gen set: provide specific functions for these applications (genset startup, tests on load etc.) together with the monitoring of the voltage and frequency of both sources for single, two-phase and three-phase networks;
- gen set/gen set: with independent activation and activation delay.

It can:

- control single phase, two-phase and three-phase networks;
- control phase-phase and phase-neutral voltages;
- manage generator start/stop.

EQUIPMENT AND ACCESSORIES:

This central unit is designed for standard installation.

The customer can interact with the central unit in many different ways:

- locally with a local LCD navigation menu (available in five different languages), to view/modify actual configuration and system status or to run tests or switches on the lines;
- remotely with front side accessories that make it easy to configure the control unit via computer or tablet and smartphone (depending on the type chosen) and allow to communicate with device without any panel maintenance working and without having to cut off the power to the electrical cabinet:

- locally with a PC connected to the mini-USB dongle on the front cover of the central unit, to program the unit, launch diagnostics, download all the back-up parameters, and update the firmware, besides the actions done also right on front panel pushbuttons;

- locally with a PC/tablet/smartphone connected to the Wi-Fi dongle on the front cover of the central unit, to program the unit, launch diagnostics, download all the back-up parameters, or replicate all the data (parameters, counters, log) via a PC, tablet or smartphone, without using a cable. The replication function is useful for transferring all the data from one unit to another or for reverting to a previous configuration (on the same control unit).

Control functions on the lines are: minimum and maximum voltage, phase loss, voltage imbalance, minimum and maximum frequency.

AUXILIARY DUAL POWER SUPPLY:

Cat.No 4 226 81 has a new Auxiliary Dual Power supply to simplify wiring and increase supply quality:

- it allows the constant monitoring of the network status, reduces the number of components and improves installation safety;
- used to control and measure the voltages present at its input terminals by identifying and automatically selecting the most appropriate voltage for the output between two single-phase AC power supply lines;
- dedicated to the control of the supply voltages of ATS controllers, motorised circuit breakers and changeover switches;
- the two inputs of the power supply module are independent and isolated; each of them can supply the internal measuring circuit controlled by a microprocessor.

Dual power supply module

CONFIGURATION SOFTWARE AND MOBILE APP:

Programming software (Automatic Control Unit Configurator) available for download via E-catalogue; App (ACU Configurator) for smartphone & tablet available on Apple store and Google Play.

LEGRAND SOFTWARE

Available for downloading via the E-Catalogue and the Legrand app (available from Google Play and Apple Store in order to:

- display the values measured by the control unit;
- control certain control unit functions such as counter;
- reset, activation/deactivation of programmable outputs;
- configure the unit and make a copy in the form of a back-up file
- view current alarms;
- consult the event log and save a copy.

CONTROL UNIT CAT.NO 4 226 82

MAIN FEATURES:

- dual Power Supply 12 – 24V DC & 110 – 240V AC
- 2 x 3 phases + N voltage input
- 100 – 480 V AC rated voltage
- graphic LCD display, 5 languages
- 2 expansion slots to add accessories for communication or increase number of I/O
- 6 programmable digital inputs, 7 programmable relay outputs
- front interface to activate USB or Wi-Fi communication
- "utility / utility", "utility / gen set" and "gen set / gen set" applications
- drive of circuit breakers, contactors
- controls of minimum voltage, maximum voltage, phase loss, asymmetry, minimum frequency, maximum frequency, with independent enable and delay
- real time clock to store up to 100 events
- open transition management

ADVANTAGES/PLUS:

- different ways to interact with the device (like Wi-Fi and USB);
- real time clock calendar (RTC);
- expandable chance (2 slots).

THE SOLUTION FOR:

- healthcare buildings
- data centers
- mission critical industrial processes
- high rise buildings

CONFORMITY TO STANDARDS:

Full compliance with IEC 60947-6-1 is achieved through usage of Legrand devices and solutions.

APPROVAL AND CERTIFICATIONS:

The Cat.No 4 226 82 device can manage different kind of breakers and contactors and is used for advanced management of 2 power supplies.

Is intended for use in low voltage power supply systems where a brief interruption of the load supply is acceptable during transfer (open transition).

This central unit is an "ergonomic enhanced" device, that can control power supply inversion between two sources in each context where communication features are a plus:

- device configuration on the field
- data/alarm consulting
- critical and periodical maintenance

All the characteristics of Cat.No 4 226 81 basic 2 ways driver are maintained or enhanced, also this central unit:

- fully cover unit utility/utility, utility/gen set, gen set/gen set use cases, with 3 phases + neutral sources;
- can control single phase, two-phase and three-phase networks;
- control phase-phase and phase-neutral voltages;
- manage generator start/stop.

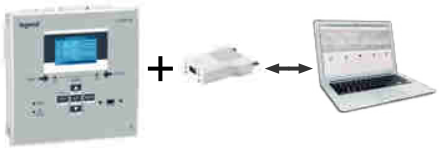
EQUIPMENT AND ACCESSORIES:

This advanced two ways drivers is intended for all the situations where simplicity and speed are mandatory.

Like the device Cat.No 4 226 81, the customer can interact with the central unit in many different ways:

- locally with a local LCD navigation menu (available in five different languages), to view/modify actual configuration and system status or to run tests or switches on the lines;
- remotely with front side accessories that make it easy to configure the control unit via computer or tablet and smartphone (depending on the type chosen) and allow to communicate with device without any panel maintenance working and without having to cut off the power to the electrical cabinet:

- locally with a PC connected to the mini-USB dongle on the front cover of the central unit, to program the unit, launch diagnostics, download all the back-up parameters, and update the firmware, besides the actions done also right on front panel pushbuttons;



- locally with a PC/tablet/smartphone connected to the Wi-Fi dongle on the front cover of the central unit, to program the unit, launch diagnostics, download all the back-up parameters, or replicate all the data (parameters, counters, log) via a PC, tablet or smartphone, without using a cable. The replication function is useful for transferring all the data from one unit

to another or for reverting to a previous configuration (on the same control unit).

Unlike device Cat.No 4 226 81, this device Cat.No 4 226 82 has 2 expansion slots, used to add a communication function or increase the number of inputs or outputs:

- to establish RS485 serial communication to interact from a remote room through a supervision system with protocol ModBus to configure, set up and manage device;
- to manage other I/Os (inputs and outputs) for remote controls besides the standard ones (6 programmable digital inputs and 7 programmable relay outputs) to have a complete interaction, manage more sophisticated plants and configurations and control of all the electrical parameters managed.

Control functions on the lines are: minimum and maximum voltage, phase loss, voltage imbalance, minimum and maximum frequency.

EXTENSION MODULES:

- opto-isolated RS485 interface;
- 4 opto-isolated static outputs;
- 2 relay outputs;
- 2 opto-isolated digital inputs and 2 relay outputs.

It has an onboard RTC (real time clock) calendar to enrich events stored, for a maximum of 100 events, with relative date and time.

DUAL POWER SUPPLY MODULE:

Like Cat.No 4 226 81.

Dual power supply module

CONFIGURATION SOFTWARE AND MOBILE APP:

Like Cat.No 4 226 81.

LEGRAND SOFTWARE

Available for downloading via the E-Catalogue and the Legrand app (available from Google Play and Apple Store in order to:

- display the values measured by the control unit;
- control certain functions such as the counter;
- reset, activation/deactivation of programmable outputs;
- configure the unit and make a copy in the form of a back-up file
- view current alarms;
- consult the event log and save a copy.

CONTROL UNIT CAT.NO 4 226 83

MAIN FEATURES: ADDITIONAL FEATURES COMPARED TO CAT.NO 4 226 82

- 3 controlled breakers
- 3 expansion slots to add accessories
- 8 programmable digital inputs, 7 programmable relay outputs
- on board RS485 communication port
- 8 languages
- up to 250 events stored
- many pre-built Legrand configurations and PLC mode
- open/close transition management for 2 circuit breakers or open transition management for 2 circuit breakers and 1 tie-breaker

ADVANTAGES/PLUS:

- can manage 2 or 3 devices;
- cover any installation need (like closed transition management);
- extension of pre-built functionalities with PLC logic;
- on board RS485 communication port;
- 3 expansions accessories.

THE SOLUTION FOR:

- healthcare buildings
- data centers
- mission critical industrial processes
- high rise buildings

CONFORMITY TO STANDARDS:

Full compliance with IEC 60947-6-1 is achieved through usage of Legrand devices and solutions.

APPROVAL AND CERTIFICATIONS:

All the characteristics of ATS Cat.No 4 226 82 advanced 2 ways driver are maintained or enhanced.

Also this central unit:

- fully cover unit utility/utility, utility/gen set, gen set/gen set use cases, with 3 phases + neutral sources;
- can control single phase, two-phase and three-phase networks;
- control phase-phase and phase-neutral voltages;
- manage generator start/stop.

The premium characteristic of Cat.No 4 226 83 central unit is the possibility to manage up to **three different devices** (breakers or contactors; for examples 3 breakers, or two breakers and a tie-breaker) at the same time, in order to build up sophisticated solutions covering any installation need.

Among installation needs, as added value, this driver can **manage closed transition transfers** (also called a "make-before-break" transfers) with control of status of feedbacks on synchronization of generator sets.

A further feature of this Cat.No 4 226 83 advanced controller is that it's possible to use Legrand Automatic Control Unit Configurator (see equipment and accessories) to create a **PLC internal logic** inside the device. In this way, user can create any function necessary to manage any kind of application.

In application program logic, all the variables managed internally by the controller can be entered, such as inputs, threshold limits, remote variables, controller states, etc.

With timers menu it's possible to add timings to application. The processing results of the different branches of the ladder logic are stored in internal variables, which may later be used to control the outputs, or as support memories to build a more complex logic or to control the alarms defined by the user.

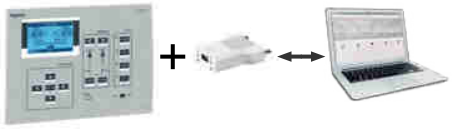
With Legrand Automatic Control Unit Configurator, the operation of the logic created with the ladder program may be real time checked and modified.

EQUIPMENT AND ACCESSORIES:

As for Cat.No 4 226 82, this device is intended for all the situations where simplicity and speed are mandatory. Like for device Cat.No 4 226 82, customer can interact with the central unit in many different ways:

- locally with an enhanced LCD navigation menu (available in eight different language packs onboard), to view/modify actual configuration and system status or to test line switching;
- remotely with front side accessories that make it easy to configure the control unit via computer or tablet and smartphone (depending on the type chosen) and allow to communicate with device without any panel maintenance working and without having to cut off the power to the electrical cabinet:

- locally with a PC connected to the mini-USB dongle on the front cover of the central unit;



- locally with a PC/tablet/smartphone connected to the Wi-Fi dongle on the front cover of the central unit;

- an integrated RS485 communication port.

Compared to device Cat.No 4 226 82, device Cat.No 4 226 83 has 3 expansion slots to increase the number of I/Os managed (by default, 8 programmable digital inputs and 7 programmable relay outputs onboard), besides an RS485 onboard communication port, to have a complete interaction and control of all the electrical parameters managed.

Control functions on the lines are: minimum and maximum voltage, phase loss, voltage imbalance, minimum and maximum frequency.

EXTENSION MODULES:

- 4 opto-isolated static outputs;
- 2 relay outputs;
- 2 opto-isolated digital inputs and 2 relay outputs.

AUXILIARY DUAL POWER SUPPLY

like Cat.No 4 226 81.

CONFIGURATION SOFTWARE AND MOBILE APP:

Like Cat.No 4 226 81 control unit.

Like device Cat.No 4 226 82, Cat.No 4 226 83 has an onboard **RTC** (real time clock) calendar to enrich events stored, for a maximum limit increased to 250, with relative date and time.

TSMS (Three Sources Management System)

CONTROL UNIT CAT.NO 4 226 84

MAIN FEATURES: ADDITIONAL FEATURES COMPARED TO CAT.NO 4 226 83

- 3 sources managed
- 5 controlled breakers
- 12 programmable digital inputs
- 11 programmable relay outputs
- open/close transition management for 2 circuit breakers or open transition management for 3 circuit breakers and 2 tie-breakers.

ADVANTAGES/PLUS:

- can manage complex projects with 3 sources
- can manage up to 5 devices
- cover any installation need (complex systems, management, ...)
- PLC logic to increase functionalities
- LG technical support to configure device on project needs

THE SOLUTION FOR:

- hospitals
- data centers
- mission critical industrial processes
- infrastructures
- complex systems and systemic installations

All the characteristics of Cat.No 4 226 83 are maintained or enhanced.

Also this unit:

- fully cover all the possible use cases (utility/utility/gen set, utility/gen set/gen set, ...)
- can control single phase, two-phase and three-phase networks;
- control phase-phase and phase-neutral voltages;
- manage generator start/stop

The distinctive premium characteristic of Cat. No 4 226 84 unit is the possibility to **manage 3 sources** (in any possible use cases) and control up to **five different devices** (breakers or contactors, in different configurations) at the same time, in order to face complex systems and build up advanced solutions to cover any installation need.

Also with Cat.No 4 226 84 it's possible to use Legrand Automatic Control Unit Configurator (see equipment and accessories) to create a **PLC internal logic**. In this way, user can create any function necessary to manage any kind of application.

In application program logic, all the variables managed internally by control unit can be entered, such as inputs, threshold limits, remote variables, controller states, etc.

With timer menu it's possible to add timings to application. The processing results of different branches of the ladder logic are stored in internal variables, which may later be used to control the outputs, or as support to build a more complex logic or to control the alarms defined by the user.

With Legrand Automatic Control Unit Configurator, the operation of the logic created with the ladder program may be real time checked and modified.

EQUIPMENT AND ACCESSORIES:

As for Cat.No 4 226 83, customer can interact with central unit in many different ways:

- locally with an enhanced LCD navigation menu (available in eight different language packs onboard), to view/modify actual configuration and system status or to test line switching;
- remotely with front side accessories that make it easy to configure the control unit via computer or tablet and smartphone (depending on the type chosen) and allow to communicate with device without any panel maintenance working and without having to cut off the power to the electrical cabinet:

- locally with a PC connected to the mini-USB dongle on the front cover of the central unit;

- locally with a PC/tablet/smartphone connected to the Wi-Fi dongle on the front cover of the central unit;

- an integrated RS485 communication port.

Also Cat.No 4 226 84 has 3 expansions slots to increase I/O (by default 12 programmable digital inputs and 11 programmable relay outputs), besides an RS485 onboard communication port, to have a complete interaction and control of all the electrical parameters managed.

Control functions on the lines are: minimum and maximum voltage, phase loss, voltage imbalance, minimum and maximum frequency.

EXTENSION MODULES:

- opto-isolated RS485 interface;
- 4 opto-isolated static outputs;
- 2 relay outputs;
- 2 opto-isolated digital inputs and 2 relay outputs.

Also device Cat.No 4 226 84 has an onboard **RTC** (real time clock) calendar to enrich events stored, for a maximum limit of 250 with relative date and time.

CONFIGURATION SOFTWARE AND MOBILE APP:

Like Cat.No 4 226 81 control unit.

DUAL POWER SUPPLY MODULE:

Like Cat.No 4 226 81 control unit.

AUTOMATIC CONTROL UNITS COMPARATIVE TABLE

HOW TO SELECT YOUR DEVICE?

1) Which type of transfer?
2) Which power supply?
3) Transition option?
4) Which application?
5) Supervision?

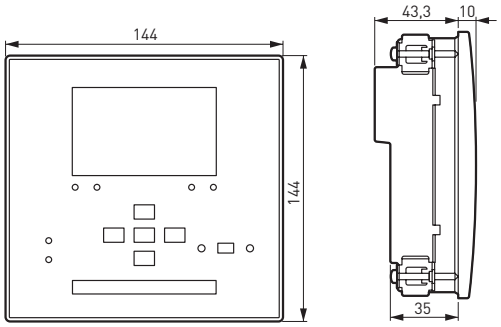
COMPARATIVE TABLE

	4 226 81	4 226 82	4 226 83	4 226 84 (TSMS)
POWER SUPPLY	110-240 V~ ; IP40 (on front panel)	12-24 V= ; 110-240 V~ ; IP40 (on front panel)	12-24-48 V= ; 110-240 V~ ; IP65 (on front panel»	12-24-48 V= ; 110-240 V~ ; IP65 (on front panel)
CONTROLLED VOLTAGE	(Line 1, Line 2) 2 x 3 phases + N 100 - 480 V~	(Line 1, Line 2) 2 x 3 phases + N 100 - 480 V~	(Line 1, Line 2) 2 x 3 phases + N 100 - 600 V~	(Line 1, Line 2, line 3) 3 x 3 phases + N 100 - 600 V~
DISPLAY	Backlit LCD display, 5 languages		Backlit LCD display, 8 languages	
INPUTS	6 porogrammable digital inputs		8 programmable digital inputs	12 programmable digital inputs
OUTPUTS	7 programmable relay outputs			11 programmable relay outputs
EXPANSION	-	2 expansions modules for additional I/O or communications functions	3 expansions modules for additional I/O or communications functions	
PORT	Optical port on front panel for USB or Wi-Fi connectors (for configuration from PC or tablet and smartphone)		- Integrated RS485 communication port - Optical port on front panel for USB or Wi-Fi connectors (for configuration from a PC or tablet and smartphone)	
FUNCTIONS	Line/Line, Line/Generator and Generator/Generator with indipendent activation and activation delay			All sources configuration available, with indipendent activation and activation delay
TRANSITION OPTION	Open		Open + Closed-transition load switching with spontaneous or controlled synchronisation of generator sets	Open
CONTROL FUNCTIONS ON THE LINES	Min. and Max. voltage - Phase cutting - Voltage imbalance - Min. and Max. frequency			
CLOCK	RTC with working service			
STORAGE	-	100 most recent events	250 most recent events	
PROGRAMMING	Direct on front panel or with USB or Wi-Fi communication modules and software or Legrand App			

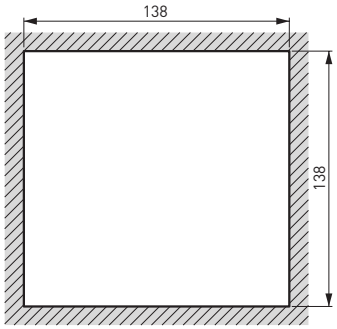
DIMENSIONS AND CONNECTION

CAT.NOS 4 226 81/82

Overall dimensions (mm)

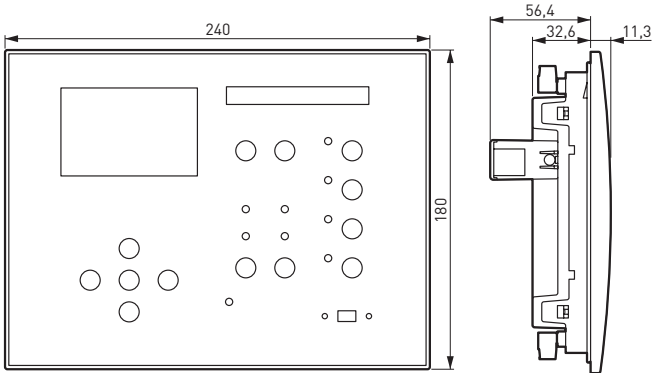


Panel cutout (mm)

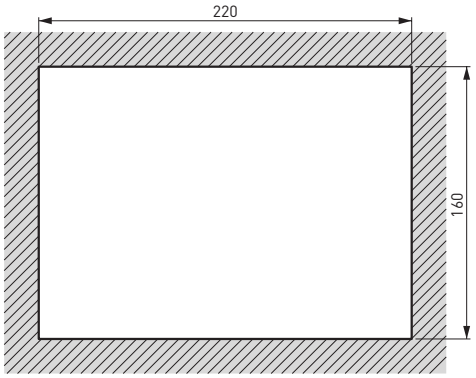


CAT.NOS 4 226 83/84

Overall dimensions (mm)



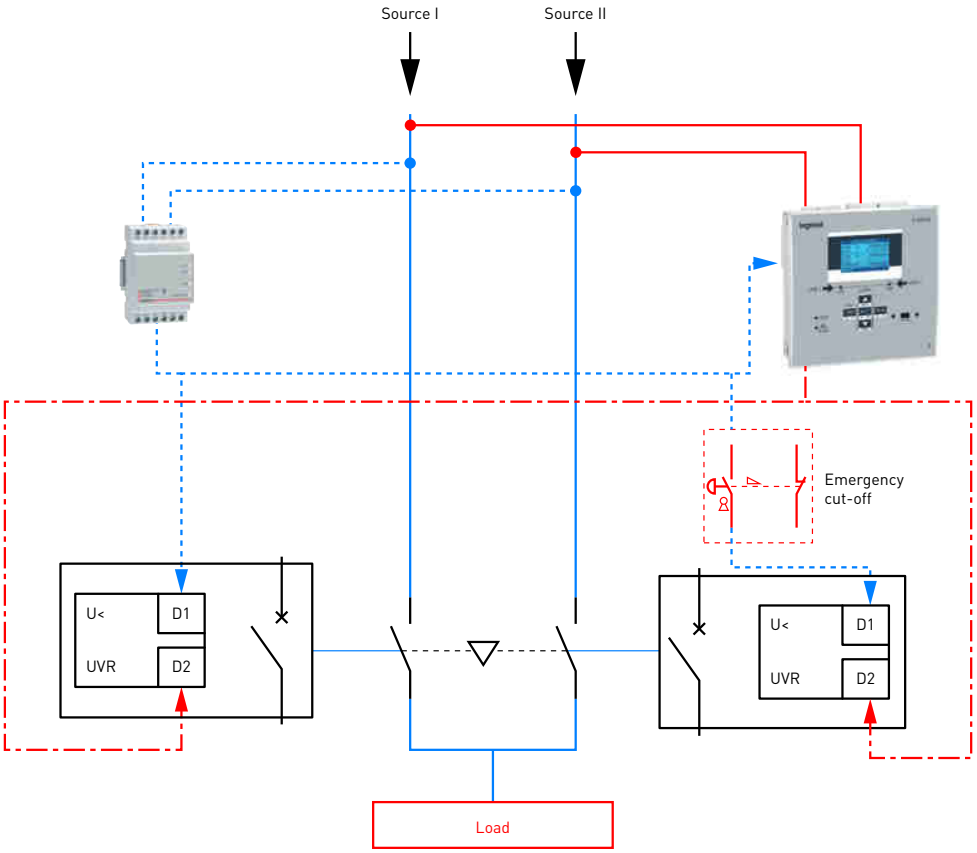
Panel cutout (mm)



ELECTRICAL DIAGRAMS
EXAMPLES

CAT.NOS 4 226 81/82

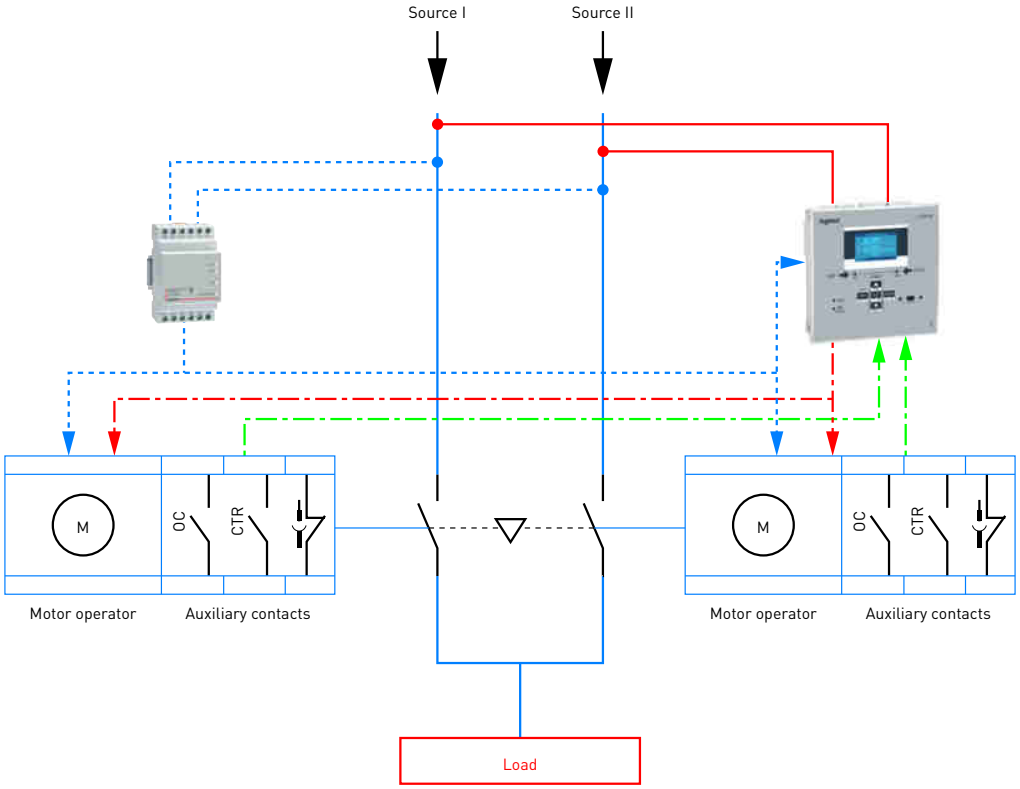
Undervoltage release manages



Source lines (main and backup)
Power supply for motor operators and ATS
Source line senses
Relay outputs to command motor operators

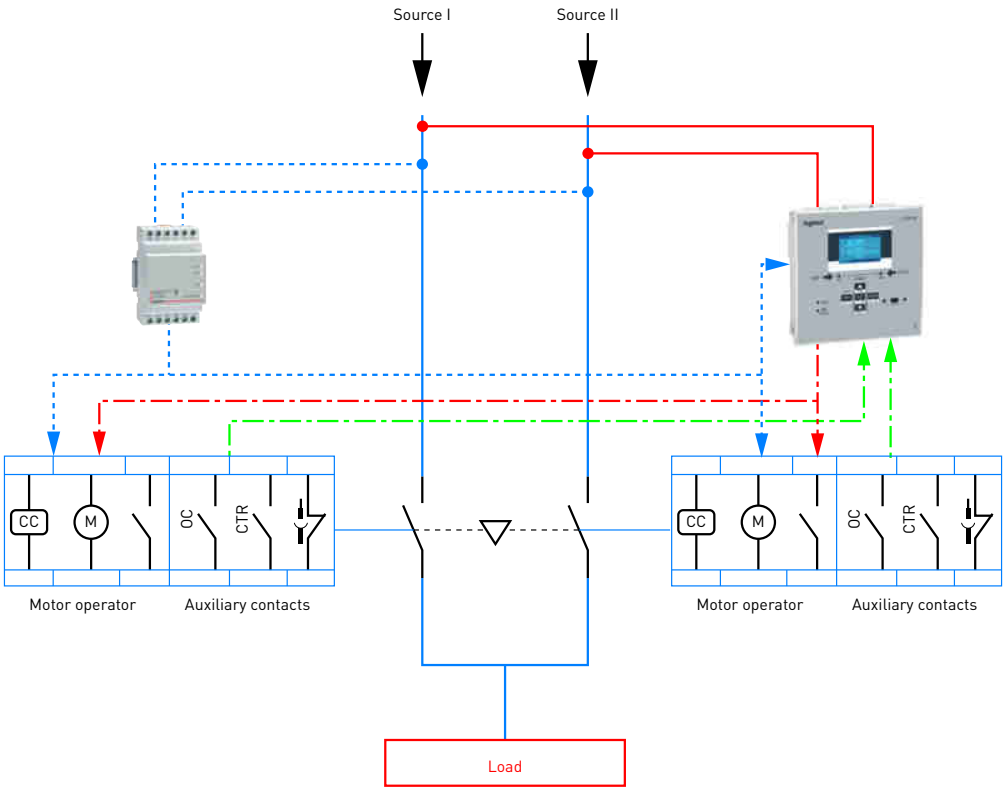
ELECTRICAL DIAGRAMS EXAMPLES

Fast closing operation command with feedback for DPX³ 1600 with Cat.Nos 4 226 81/82



Source lines (main and backup)
Power supply for motor operators and ATS
Source line senses
Auxiliary digital inputs for feedbacks on ATS
Relay outputs to command motor operators

DMX³ with feedback with Cat.Nos 4 226 81/82

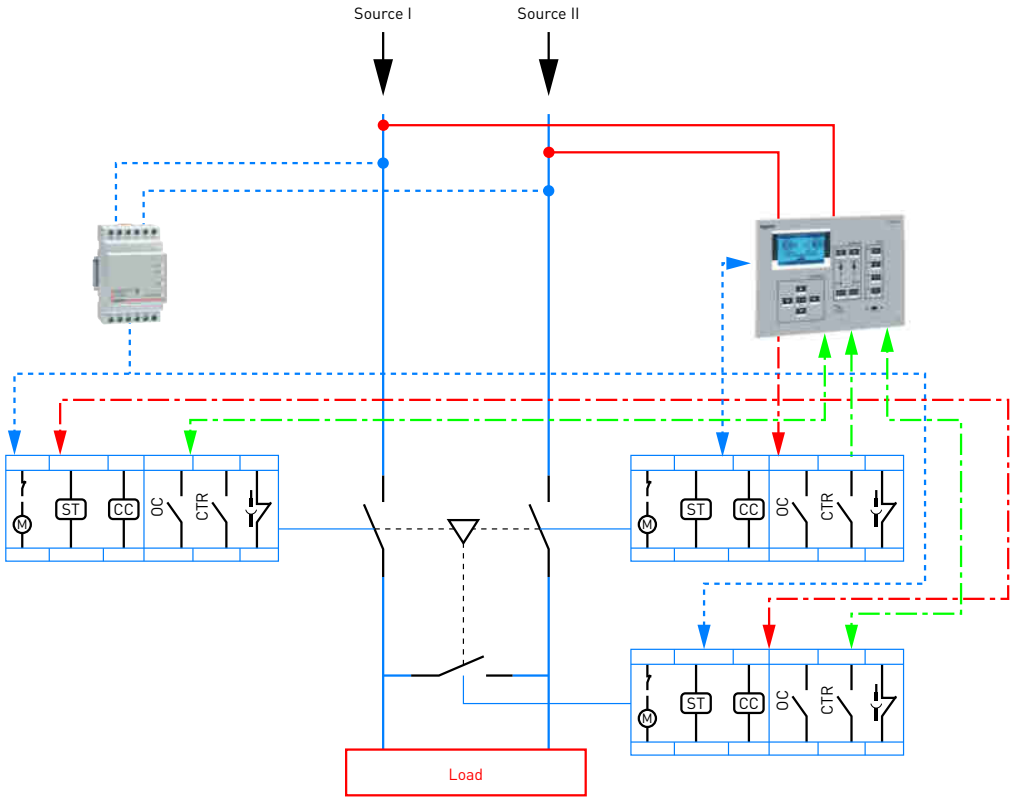


Source lines (main and backup)
Power supply for motor operators and ATS
Source line senses
Auxiliary digital inputs for feedbacks on ATS
Relay outputs to command motor operators

ELECTRICAL DIAGRAMS EXAMPLES

CAT.NO 4 226 83

Management with feedback for Cat.No 4 226 83



Source lines (main and backup)
Power supply for motor operators and ATS
Source line senses

CAT.NO 4 226 84 (TSMS)

For more details, please contact Legrand.

Notes

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