Automatic Transfer Switch Working Principle

An automatic transfer switch maintains power continuity in your building in case of power outages. Typically it is a part of a backup system based on a power generator. In a few words is an electrical cabinet that connect your building to a GENERATOR or to UTILITY POWER. We can say ‘automatic’ only when the transfer switch is supported by an automatic transfer switch controller.

The BEK3 Automatic Transfer Switch Controller

It will automatically govern all functions by automatically managing the connection assignment of the LOAD to UTILITY POWER or GENERATOR. The transfer switch and its controller are the core of an AUTOMATIC TRANSFER SWITCH panel. There are two basic ways to connect the LOAD to UTILITY POWER or GENERATOR via contactors

or via MOTORIZED TRANSFER SWITCH:

All topics are covered in the following videos.

Contactors versus motorized switches

The contactors, usually four-pole, are coil-operated switches that close a circuit when the excitation coil is supplied with alternating 230V. To keep the contactor in its closed position, it is therefore always necessary to supply the coil. The average consumption is 10 Watts per small contactor but reaches 20 watts for large contactors The life of the coils is expected to be several years. When a coil fails, you must replace the coil. The price of these contactors is reasonable up to a power of 80KVA. The great advantage of automatic transfer switch panels with contactors, often called AMF PANELS, is the ability to protect the load very well. They can therefore intervene in switching from UTILITY POWER to GENERATOR following complex settings of timers and priority thresholds. Over 80KVA, it is better to use a transfer switch. The transfer switch is really complex on mechanical point of view but it can offer switching currents over 2000 AMPS. Big systems feature a combination of contactors and transfer switches: one master panel capable of switching 2000 AMPS and several panels with relatively small contactor-basded transfer switches.

Automatic transfer switch controller features

All parameters, alarms, and additional functions are indicated using a display capable of operating in a wide range of temperatures. The AUTOMATIC TRANSFER SWITCH controller measures all electrical parameters of the utility power and generator. In particular, an AUTOMATIC TRANSFER SWITCH controller made by Bernini Design complies with all international standards providing at the same time all electrical protections for the load and the generator via current transformers of suitable size..

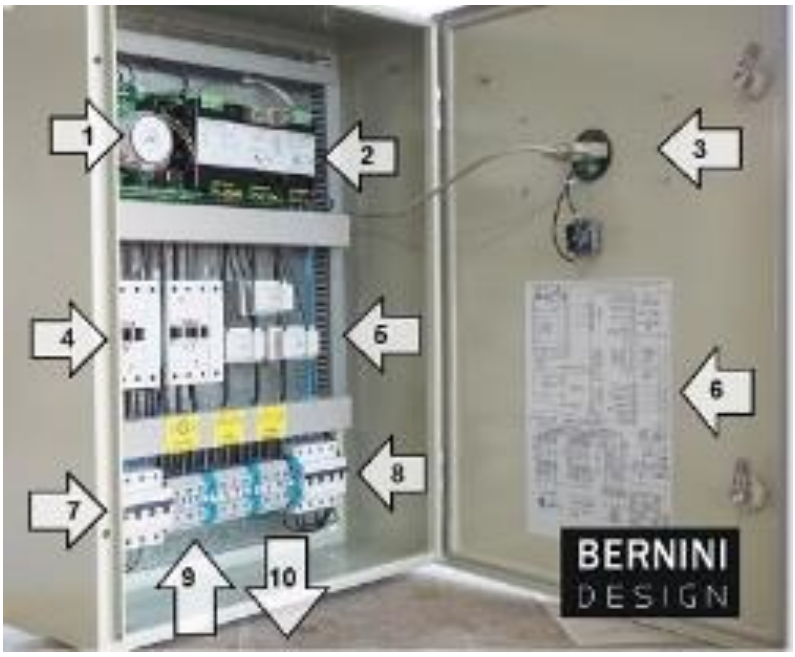
Automatic transfer switch controller monitoring

The AUTOMATIC TRANSFER SWITCH controller features the RS485 serial interface. This is the best way to drive as many as 24 nodes over a long distance. It supports the MODBUS-RTU protocol. In this you can connect compatible GSM and TCP-IP equipment.

Automatic transfer switch controller in electrical noise environment

It is essential to shield the AUTOMATIC TRANSFER SWITCH controller from all kinds of electrical noise. For this reason, the enclosure of the AUTOMATIC TRANSFER SWITCH controller must be made of metallic material. The best solution is a ferrous-based metal like steel. The 32-bit processor, the core of the AUTOMATIC TRANSFER SWITCH controller, runs into a very well protected Faraday shelter. The rear cover made of metal is the best solution for shock-proof equipment as well. This gives an extraordinary advantage over competitors' plastic-based enclosures.

INSIDE AN AUTOMATIC TRANSFER SWITCH PANEL OVERVIEW

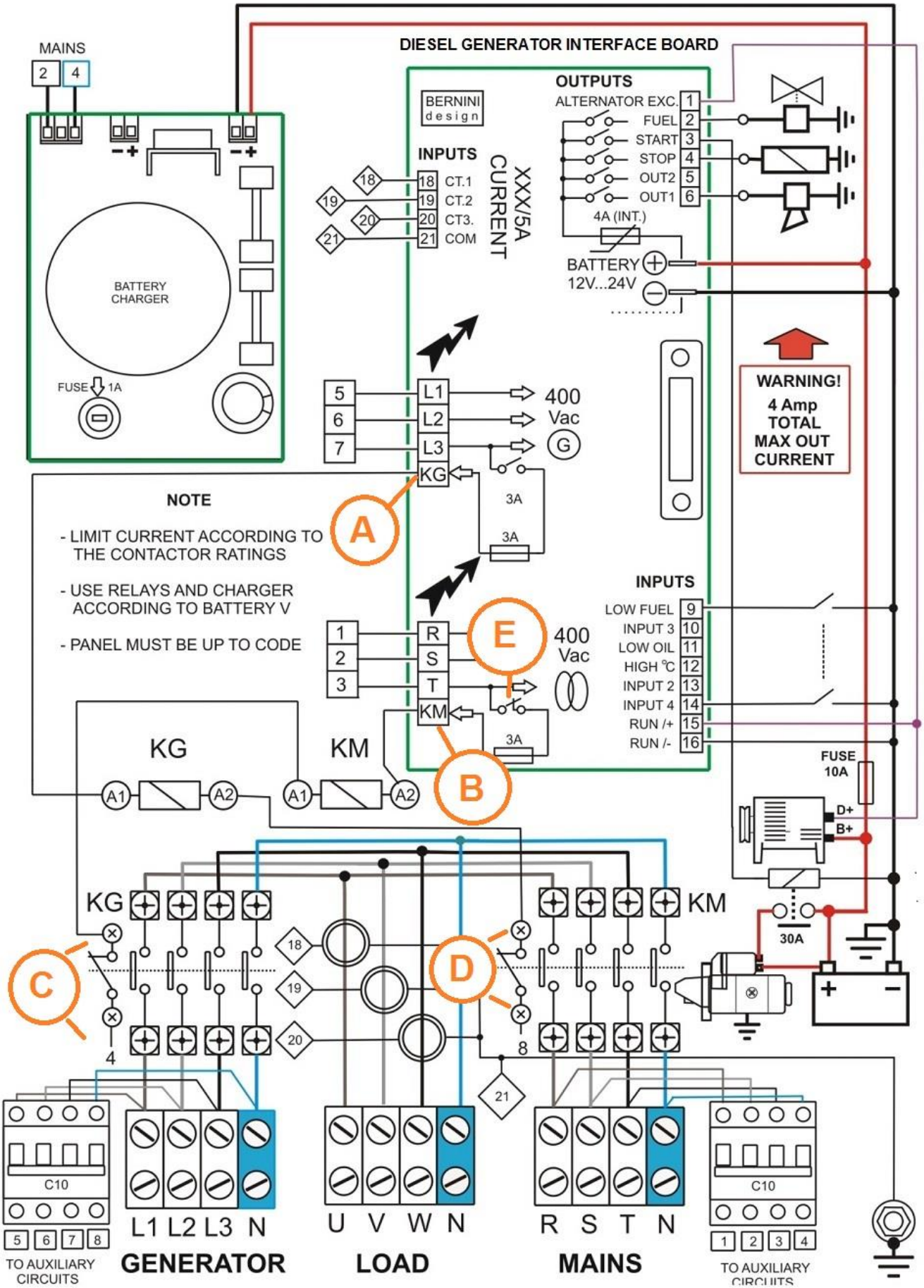


[1] BATTERY CHARGER [2] INTERFACE BOARD [3] AUTOMATIC TRANSFER SWITCH CONTROLLER [4] CONTACTORS [5] CURRENT TRANSFORMERS [6] CABINET DOOR [7] [8] CIRCUIT BREAKERS [9] [10] TERMINAL BLOCKS

The automatic transfer switch wiring diagram

The AUTOMATIC TRANSFER SWITCH controller governs the system and transfers the load to the generator or UTILITY POWER smoothly and with short downtime. The AUTOMATIC TRANSFER SWITCH panel wiring diagram illustrates the internal connections. It monitors the parameters of the UTILITY POWER and automatically starts the engine via relays or interface boards. Once the generator provides the correct frequency and voltage, the controller transfers the load from the UTILITY POWER to the generator and vice versa.

This happens after a UTILITY POWER failure programmed delay (seconds, minutes or hours). When the engine is cold, the AUTOMATIC TRANSFER SWITCH controller provides a warm-up time to run the engine offload. Once the UTILITY POWER has been restored, the AUTOMATIC TRANSFER SWITCH controller will connect the load to the UTILITY POWER automatically. After a time delay, the engine is then stopped.


DIESEL GENERATOR INTERFACE BOARD
MAINS
2
4
BERNINI design
INPUTS
18 CT.1
19 CT.2
20 CT3.
21 COM
XXX/5A CURRENT
OUTPUTS
ALTERNATOR EXC. 1
FUEL 2
START 3
STOP 4
OUT2 5
OUT1 6
4A (INT.)
BATTERY 12V...24V
BATTERY CHARGER
FUSE 1A
WARNING!
4 Amp TOTAL MAX OUT CURRENT
5 6 7
L1 L2 L3
KG
400 Vac
G
3A
3A
NOTE
- LIMIT CURRENT ACCORDING TO THE CONTACTOR RATINGS
- USE RELAYS AND CHARGER ACCORDING TO BATTERY V
- PANEL MUST BE UP TO CODE
A
1 2 3
R S T
KM
E
400 Vac
3A
B
INPUTS
LOW FUEL 9
INPUT 3 10
LOW OIL 11
HIGH °C 12
INPUT 2 13
INPUT 4 14
RUN /+ 15
RUN /- 16
KG
KM
A1
A2
A1
A2
FUSE 10A
D+
B+
30A
KG
KM
C
D
18
19
20
21
4
8
C10
C10
5 6 7 8
1 2 3 4
TO AUXILIARY CIRCUITS
TO AUXILIARY CIRCUITS
L1 L2 L3 N
GENERATOR
U V W N
LOAD
R S T N
MAINS

The engine connections

The AUTOMATIC TRANSFER SWITCH controller features a universal multi-functional interface board. This will allow you to connect all kinds of engines. It is possible to connect a simple engine that features a key start. You can also connect engines that include their own auto-start module. An overview of the connection follows,

you can find details about the diagram in this link

How does it work in details the automatic transfer switch panel

We describe the main condition of the AUTOMATIC TRANSFER SWITCH panel: when the LOAD is connected to the UTILITY POWER and when the LOAD is connected to the GENERATOR. In this example, we illustrate a CONTACTOR-BASED changeover, the MOTORIZED TRANSFER WITCH shares the same logic.

Automatic transfer switch: utility power-load

The four-pole KM contactor directly connects the LOAD to the UTILITY POWER. The coil of the KM energizes via the KM output **(B)** and KG auxiliary contacts **(C)**. The KG auxiliary contacts **(C)** have a mechanical connection with the KG body. The COIL of the KM is then supplied via the Neutral and phase T of the UTILITY POWER. The KM output features an internal normally closed relay **(E)**. In other words, we prioritize to the UTILITY POWER in case the AUTOMATIC TRANSFER SWITCH controller is damaged or without supply. When the AUTOMATIC TRANSFER SWITCH controller detects a UTILITY POWER failure, the AUTOMATIC TRANSFER SWITCH controller energizes the relay **(E)**. The KM output **(B)** will open. to cut the current to the KM coil. This caused the KM to open. Once the KM is open, the auxiliary contacts **(D)** will close.

Automatic transfer switch: generator-load

When the AUTOMATIC TRANSFER SWITCH controller activates the output KG **(A)**, the coil of the KG will energize, In this way, the LOAD is connected to the generator. The KG coil is energized via the normally closed contact **(D)** on the body of the KM contactor. In other words, the KG can energize only when the KM is in its open status. The Neutral and phase L3 wires of the generator supply the coil of the KG. When switching the generator to UTILITY POWER, the user observes a short ‘power outage’. This is normally 2 seconds. This is the typical behaviour of the automatic transfer switch based on contactors: BREAK-BEFORE-MAKE.

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