

AC 1201

**It's only a matter
of milliseconds...**

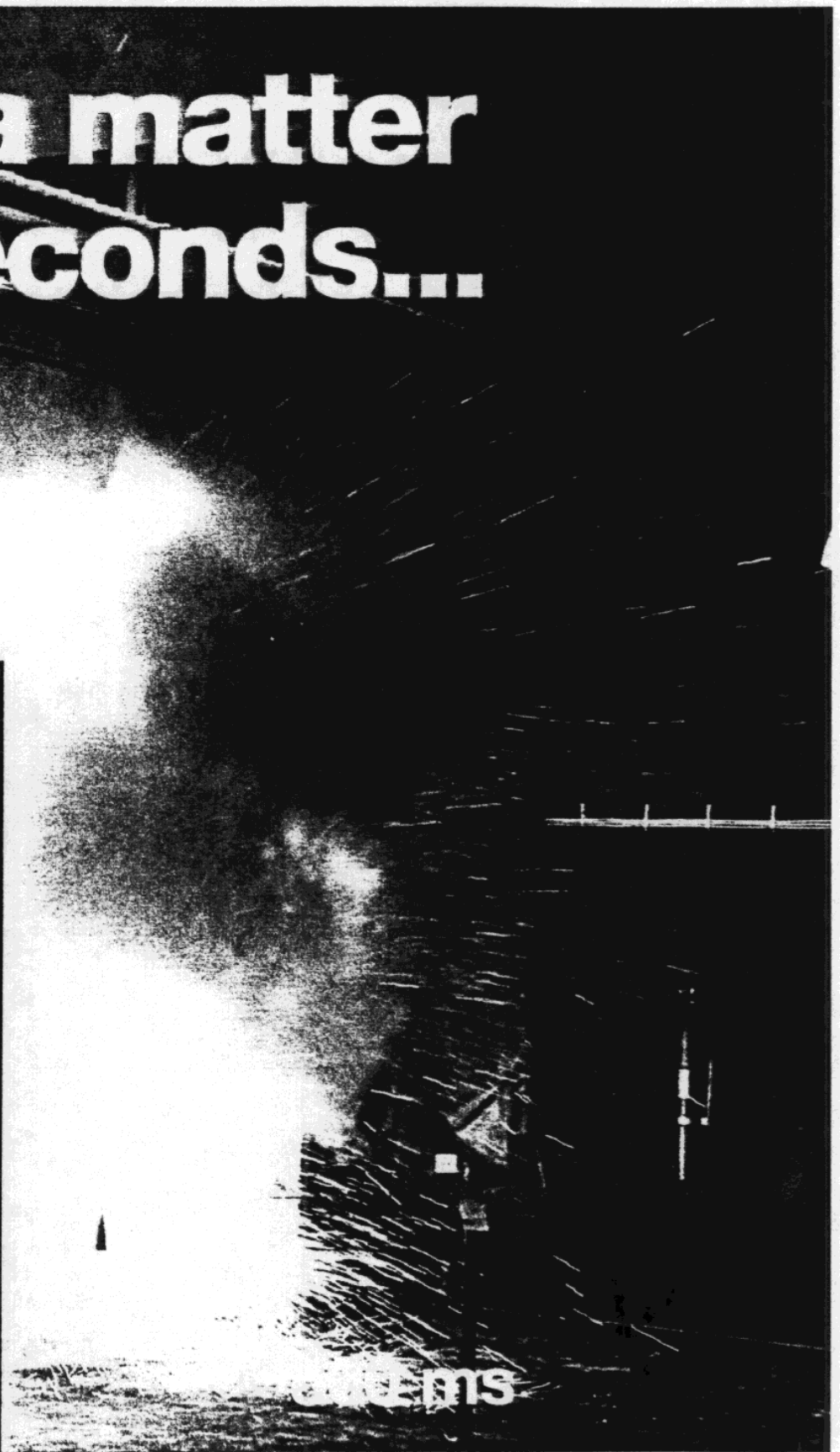
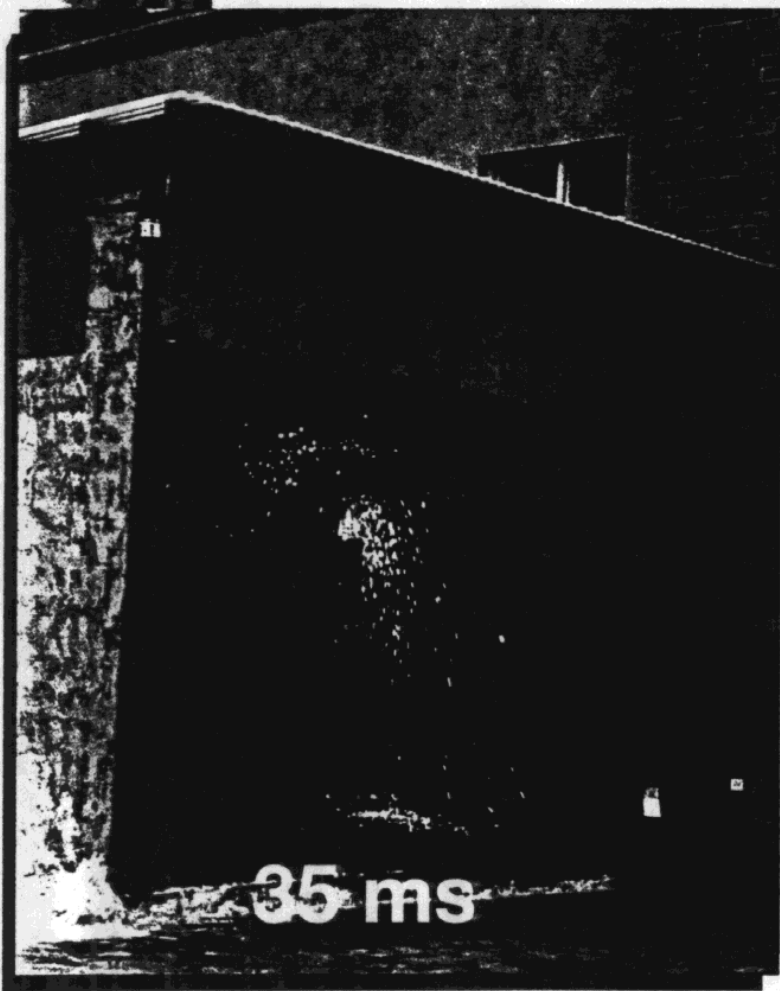


ABB Control Inc.

ABB

Introduction...

The menace of an arcing fault.

When an electrical arc occurs as a result of a fault in an electrical installation, a delay of just 100 ms is enough to put human life and equipment at risk!

The operating reliability of switch-gear is not just a question of making sure that it meets specifications, standards, and is properly installed. Eliminating or minimizing the risks and consequences of an accident is equally important.

Arcs are involved in most accidents occurring in the low and medium voltage distribution systems of utility and industrial power plants. An arcing fault often occurs in connection with an incorrect instrument setting, tools or material forgotten in the equipment, bad connections

causing overheating, improper or insufficient maintenance and adjustment procedures, or something as unpredictable as an animal damaging the insulation on power cables. The amount of damage depends on the amount of short circuit current and the arcing time of the short circuit event (*See Fig. 1*). The only way to limit equipment damage, down time and personnel injuries caused by arcing is to rapidly disconnect the source of power supply.

A short circuit arc contains enormous force with extreme heat and

light intensity. The heat at the core approaches 20,000°C which means steel and copper not only melt but vaporize. The consequences of an arc can be disastrous if the arc cannot be extinguished as quickly as possible, and quickly means within 35 milliseconds; after that the results can become catastrophic!

Arc Durations & Resulting Damage

35 ms arcing duration

Both personnel and equipment may sustain little or no damage.

100 ms arcing duration

Both personnel and equipment sustain damage and some burning will occur.

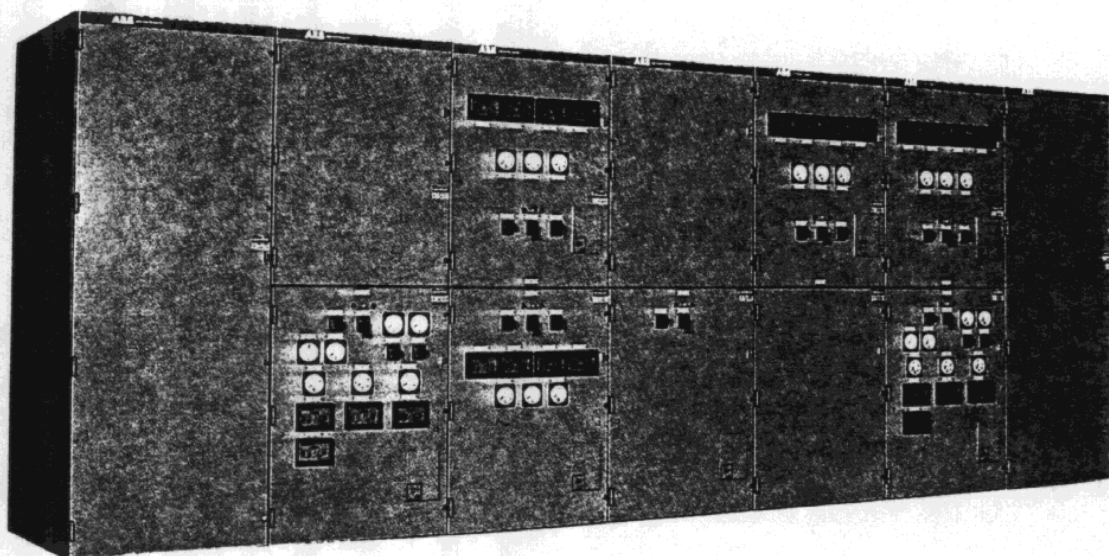
500 ms arcing duration

Both personnel and equipment will sustain extreme burning and damage.

Fig. 1

The Problem...

How to extinguish an arc before major damage occurs.



A circuit breaker is designed to interrupt a short circuit of any type. The problem in cases involving most arcing faults is that the short circuit current can be lower than the trip setting of the breaker and the signal to the upstream circuit breaker comes too late to prevent major damage.

With most standard protective relaying schemes, it may take up to 500 milliseconds for the circuit

breaker to react to a fault. In most cases, 500 milliseconds of arcing in a switch-gear unit will result in extreme damage to personnel and equipment; the breaker has to react as fast as 35 ms to avoid this! The solution for decreasing reaction time is to bypass the selectivity delay of the relaying system using the Arc Guard System.

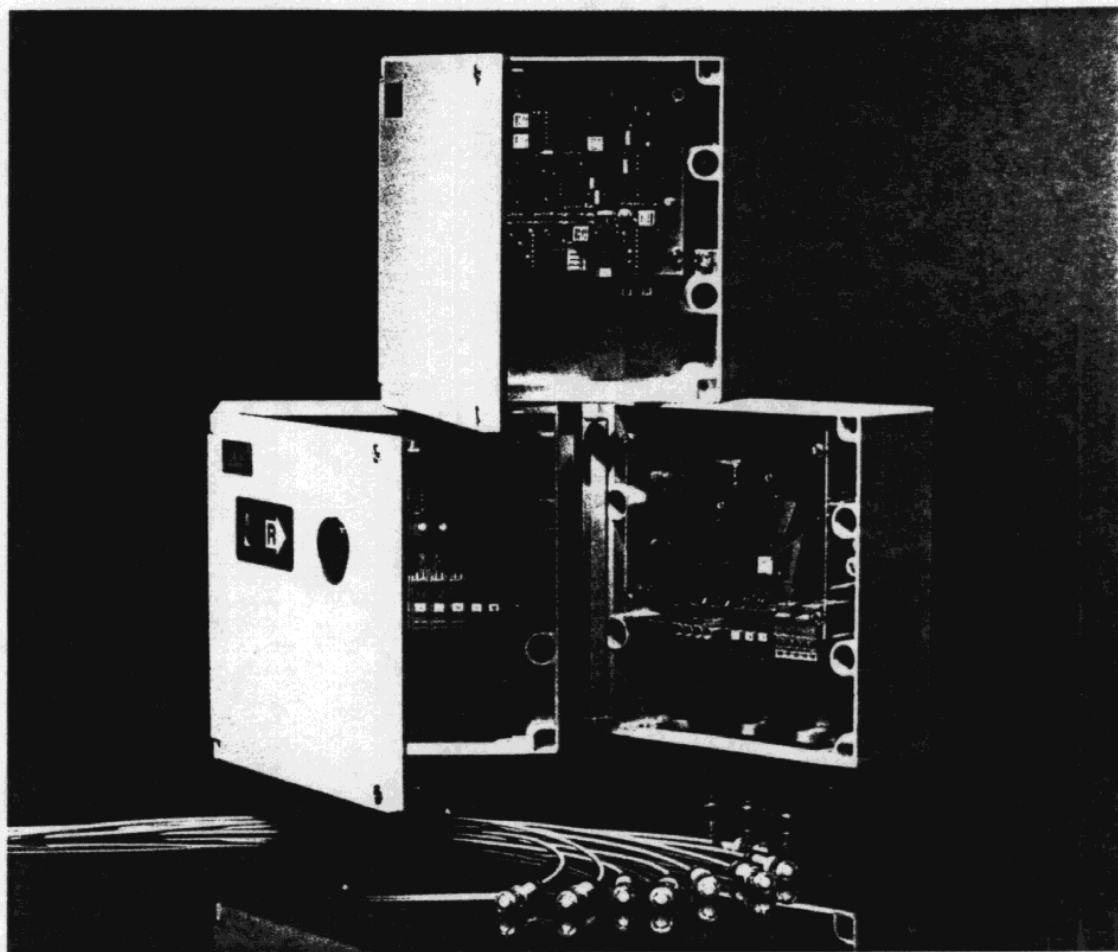


The Solution...

The Arc Guard System from ABB.

Companies within ABB have long been pioneers in the development of safer and more reliable electrical distribution equipment with emphasis on human safety. It is hardly a coincidence that a completely new integrated safety system with an Arc Monitor, Current Sensing Unit, and a Breaker Fault Unit including its own built in safety system, has been developed to help insure system integrity.

The purpose of the Arc Guard System is to quickly disconnect the switchgear if an arcing fault should occur. The watchful eye of the Arc Monitor detects any large increase in light intensity. The detector transfers light from the arc through a state of the art solid state electronics package. Within an interval of one to two milliseconds, the detector sends a trip signal to the disconnecting upstream circuit breaker located in the switchgear, bypassing delays caused by the selective



features of relaying schemes. This protects your equipment and personnel.

Working at the Speed of Light...



Up to nine detectors can be connected to each Arc Monitor to detect arcs in various switchgear compartments.

A number of insurance companies have approved ABB's Arc Guard System as a basis to reduce premiums for equipment utilizing the system.



The Arc Guard System works with the speed of light by utilizing a series of light sensitive detectors connected through fiber optic cable to a monitoring unit called an Arc Monitor.

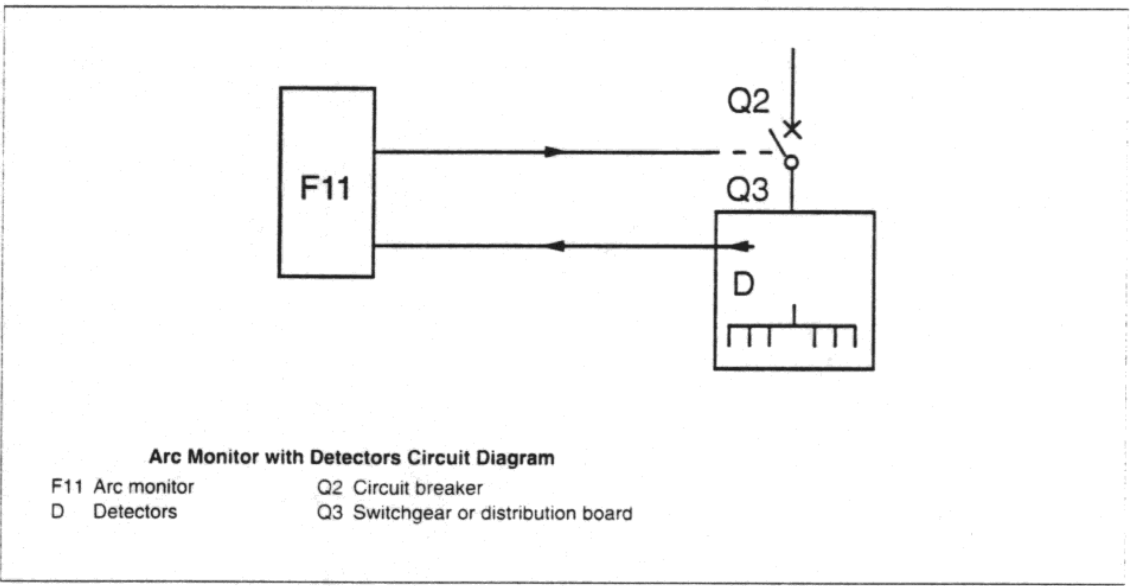
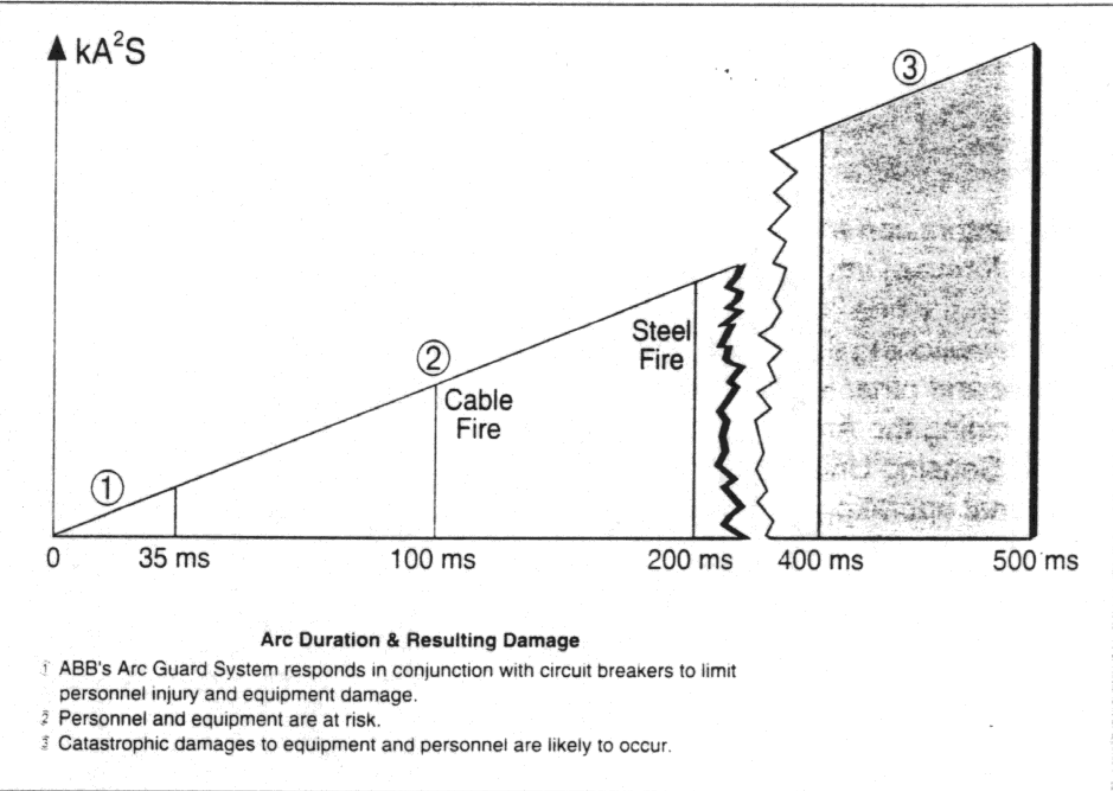
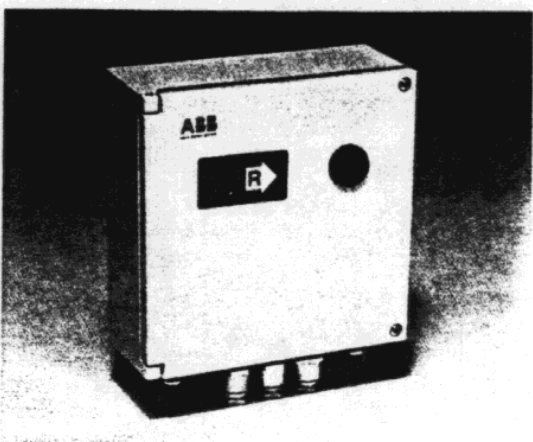
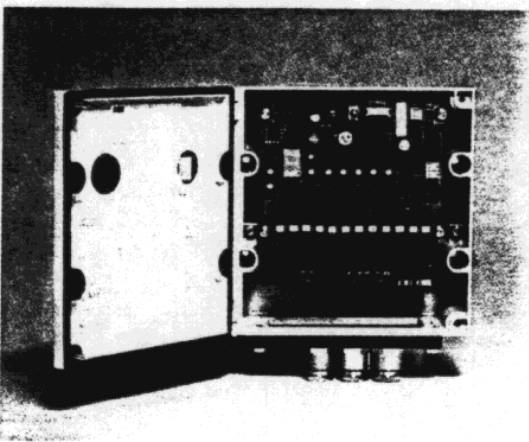
A switchgear environment is often subjected to extreme electromagnetic interference, especially during an arcing type fault. High currents in the busbars and cables, switching arcs in contactors and circuit breakers generate fields that interfere with communication between relays and meters. Fiber optic cables eliminate the risk of electromagnetic interference. All communication between the detectors, Arc Monitor, Current Measuring Unit and the Breaker Fault Unit are through fiber optics. Fiber optic signal transmission makes the systems immune to interference.

The Fast Acting Arc Guard System

Very short disconnection times are the best solution to limiting the risk of personnel injury and equipment damage due to arcing faults. A combination of the Arc Guard System and high speed circuit breakers provide the best means of insuring minimal damage. Cleaning and repair times are shorter, operating reliability and equipment availability increases, and down time is dramatically decreased. What this means in terms of cost savings for potential breakdowns and production losses speaks for itself.

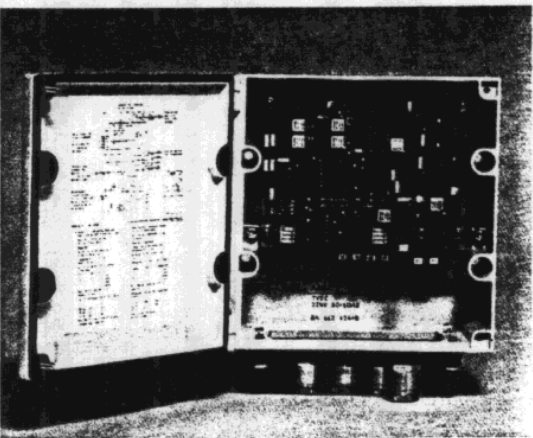
Operational Features

The Arc Monitor delivers the trip signal in approximately 1.5 milliseconds. The actual disconnection time depends on the type of circuit breaker used, but the entire process is over in as little as 35 milliseconds if the ABB switchgear has been provided with the Arc Guard System.

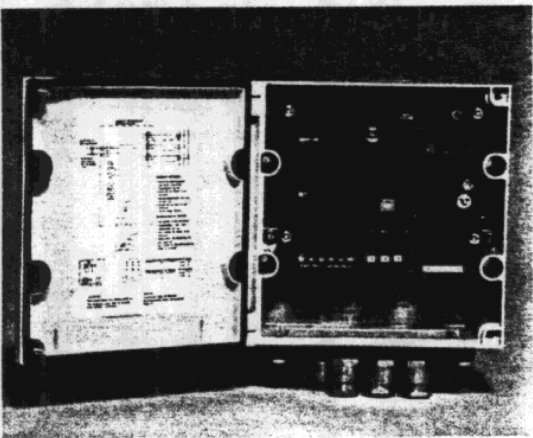


Additional Protection Options

Current Sensing Unit

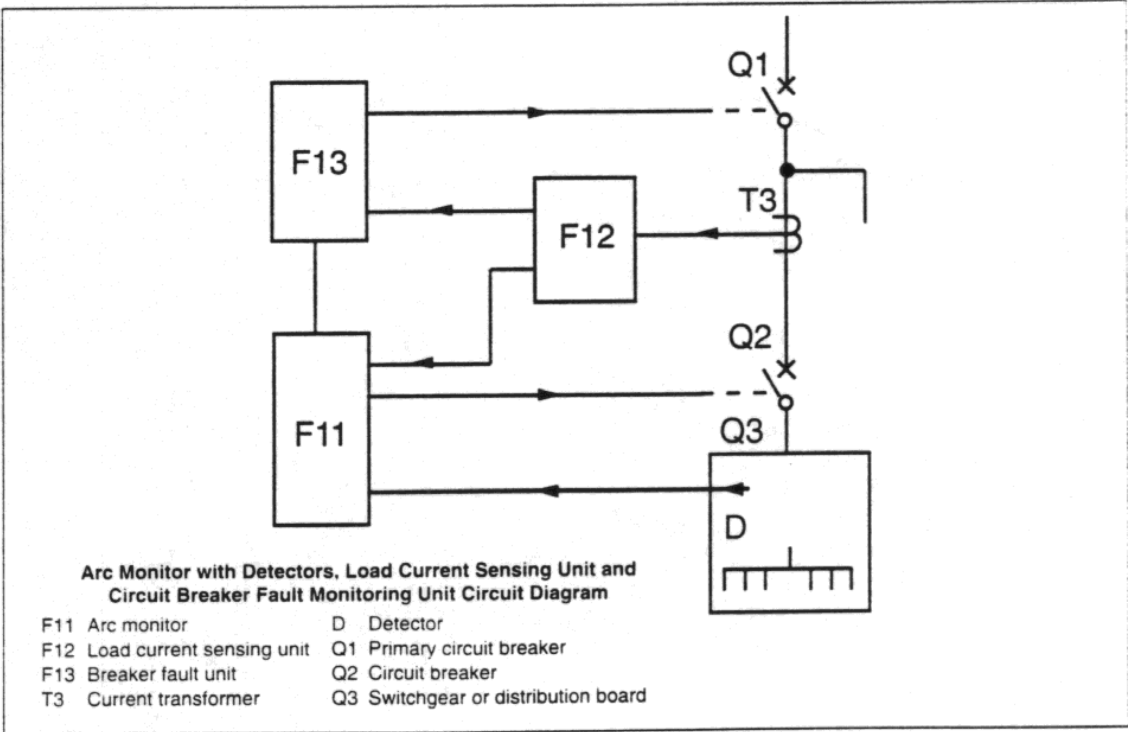
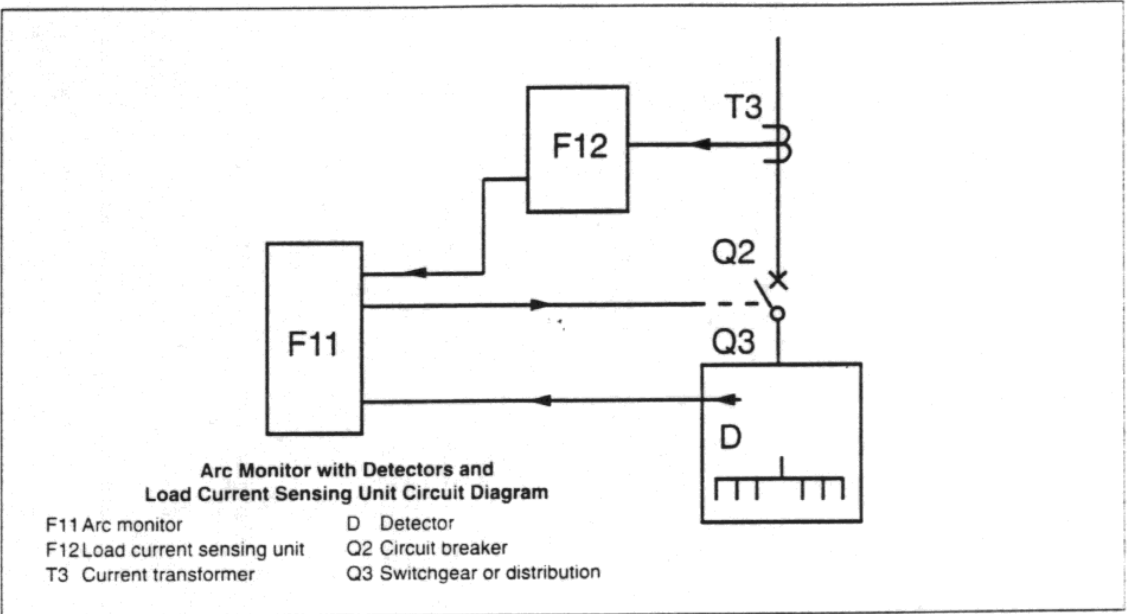


The detectors can also be sensitive to other forms of intense light, such as camera flashes, lightning, direct sunlight, switching arcs in circuit breakers and other large apparatus. By combining the Arc Monitor with a Current Sensing Unit set just over the normal operating level, a current dependent condition is introduced which prevents triggering from irrelevant light sources. This prevents nuisance tripping the switchgear and causing an unintentional power outage.



Breaker Fault Unit

The Breaker Fault Unit provides a safeguard from failures in downstream circuit breakers. In installations with access to the main upstream circuit breakers, the addition of a Breaker Fault Unit can be utilized. This ensures protection if the downstream branch circuit breaker does not function. If the downstream breaker fails to disconnect the supply within the set time, the Breaker Fault Unit will override and trip the main upstream breaker.



Guideline Specifications

Switchgear Protection

A switchgear protection system shall be included based on the ABB Arc Guard System, or equivalent, operating in conjunction with an Arc Monitor. At least one detector shall be included for each compartment of metal clad or metal enclosed switchgear.

In the metal clad switchgear optical detectors will be located in each vertical section, including detectors in the main horizontal bus compartments, in each circuit breaker compartment, and in the rear compartments where bus connections to outgoing cable and lightning arrestors are to be monitored. In low voltage switchgear, detectors will be located to monitor the main bus, breakers, and connections to outgoing cables. All detectors shall

be arranged to give maximum coverage to the compartment in which it is located. Additional detectors shall be added as required to obtain complete coverage. Tripping shall be arranged so that all circuits connected to a faulty section of a main bus are tripped.

To cover the condition when feeder circuits are acting as incoming or outgoing circuits, the current measuring input for each section of main bus shall be operated from current transformers on all feeder circuits via interposing current transformers.

The Arc Guard System protection scheme offered shall include all necessary interconnections within the basic switchgear lineup.

Application Opportunities

- Suitable for installation in new or existing high, medium & low voltage switchgear systems
- Installs in non-segregated phase busduct
- Equipped with auxiliary circuit for external indication
- Backup to protective relays in arcing faults
- Metal enclosed capacitor banks
- Transformer load tap changer panels
- Wherever unwanted arcs are a problem



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