

**CLiP® APPLICATION
TYPICAL QUESTIONS AND ANSWERS**

1. How many CLiP and PAF installations are there, and how often do they trigger?

G&W has shipped approximately 1500 CLiP and PAF units to 26 countries on 6 continents. Shipments of interrupters are well over 2000. Since the CLiP operates only on the higher magnitude faults, a typical incidence level is one operation every 5-10 years. Some sites have over 20 years service without triggering.

2. What are the most common uses of the CLiP?

The CLiP is often used to *protect line-ups of underrated switchgear*. It can also be used for *ARCFLASH or ARCBLAST MITIGATION* by direct energy reduction, can enhance *personnel protection* (reduce arc exposure or keep tanks of oil filled transformers from rupturing due to an internal fault) or to *limit damage to critical systems* such as the metropolitan underground grids, or *equipment* such as generators or large motors.

Since the CLiP is so fast, the I²t let-thru is typically 0.5% of a 5-cycle breaker's. It is critical in planning for personnel protection. Instead of trying to cope with the fault energy by traditional techniques, it is far more effective to use the CLiP to simply cut off the fault energy.

Typical applications also include the *bypassing of reactors* to eliminate reactor power losses and regulation problems (especially those related to starting large motors). Upon sensing an overcurrent condition, the CLiP inserts the reactor back into the circuit in a current limiting fashion.

The CLiP is commonly applied in a *bus tie position*, which enables closure of the tie breaker to better balance system sources and loads. It often bypasses a tie position reactor. Bus tie applications account for over 60% of CLiP applications.

Cogeneration is an area of substantial usage. The CLiP is used to eliminate the additional contribution of a cogenerator to a system; thereby maintaining fault currents within the equipment ratings. This also applies to wind turbine usage. Conversely, it can be used to protect the cogenerator itself.

3. How is the CLiP used in bypassing current limiting reactors?

A major portion of the CLiP applications involves the paralleling of reactors. There are 2 primary reasons for bypassing reactors. First, the *elimination of the real power losses* in large reactors can be a major \$ savings to the user. Second, the *elimination of voltage regulation problems* can improve system operations.

While operational savings are a major factor in applying the CLiP for bypass, elimination of the voltage drop across a reactor is the predominant factor in this application. In high demand conditions, such as the start-up of large motors, the voltage drop across the reactor may simply be unacceptable. It may impede or even prevent the start-up of large motors.

The CLiP provides a parallel, very low impedance circuit path around the reactor. Upon sensing of an overcurrent condition, the CLiP triggers and inserts the reactor back into the system. The downstream switchgear can now interrupt within its ratings and the system remains energized. To prevent single-phasing a number of techniques can be applied. We suggest contacting G & W for further discussion.

4. Does the CLiP vent or issue a flame when it operates?

No, the CLiP does not vent or issue a flame during interruption. It is not an expulsion device. It does allow a very gradual pressure relief through the stranding of its triggering wire so that personnel replacing the interrupter are not working with a highly pressurized device.

5. Can the CLiP be used outside?

Yes, it is designed for indoor or outdoor use. It is rated for temperature ranges from -55 to +40C and with derating to 65C. Consult the factory for applications outside of these ranges.

6. Does the CLiP need to be mounted in a specific orientation?

No, it can be configured to mount in any orientation. If an underhung mount from the crossarm of a pole or other structure is anticipated, simply notify the factory when placing the order so that the sheds on the porcelain supports can be inverted.

7. Can I get a signal to tell that a CLiP has operated?

Yes, via the CLiP's Remote Indication feature. Remote Indication is a feedback function that provides a relay contact transfer in the control box indicating that an interrupter has been tripped. There is one relay per phase with 2 sets of "dry" 10A form C (SPDT) contacts for the user's control circuits. These can be used to trip a series breaker if only 1 or 2 phases are faulted (prevent single-phasing), sound an alarm, or energize a light. Relay transfer occurs within 3 cycles after CLiP operation.

8. Are there fuse curves to use for coordinating the CLiP with other protective devices?

No, the CLiP actually clears before fuse coordination curves even start (at the 0.01-second mark). This results in a straight line on the coordination curve related to the trigger level of the CLiP. If it has exceeded the trigger level, it is already clear. If it has not reached the trigger level, it will not trip.

This makes coordination easier. Generally, customers keep all existing coordination settings of their switchgear. It allows the other protective devices in the system do their job as designed. The CLiP is activated only on the catastrophic faults. This is also a less costly approach.

9. Can I turn the CLiP off if I don't need it?

Yes, the CLiP is configured for connection of a customer's enable/disable control contact to the terminal strip within the control box. This enables the CLiP's triggering circuit to be disabled remotely if the user has switching conditions where the CLiP's protective capabilities are not required. One does not need to remove the fuse and install a shorting bus.

10. How does the Field Tester work?

The Field Tester is an optional piece of equipment used to verify that the Sensing and Firing Logic (SFL) is fully operational and capable of delivering a firing pulse. The unit is clamped on the CLiP support bus above the isolation transformer, with the Sensing and Firing Logic(s) between the test conductors. A set of internal capacitors is charged when the "charge" button is pressed. The capacitors are discharged with a

peak current of up to 20kA (or 60kA) when the test button is pressed. The SFL senses this and emits a triggering pulse to the field test unit, indicating that a current of sufficient magnitude to trigger the CLiP has occurred. The CLiP user has verified that the system is operational. For further information refer to the Field Tester operating instructions.

11. What is a CLiP Simulator?

The Simulator is an optional device purchased with the CLiP. It has 2 wires (shorted when received) which connect to the Sensing and Firing Logic (SFL) in place of the trigger leads of the interrupter. These leads are connected in lieu of the interrupter leads during initial energization of the medium voltage system. The purpose of the Simulator is to determine whether unprojected inrush or transient conditions exist which exceed the trigger level of the unit and will cause an undesired firing.

The CLiP interrupter is not functional during the time that its trigger leads are not connected. It is therefore advised that the user's system be configured such that the fault current does not exceed the ratings of the protected gear during the test. This is obviously a compromise since the reconfigured or limited system may not generate the same inrush/transient conditions as that under full available power. It is an approximation of the inrush conditions without jeopardizing system protection or risking the operation of the more costly interrupter.

12. How often is maintenance required?

We recommend a maintenance check on the CLiP on a 1-2 year basis or during normal maintenance periods for other equipment on the system.

13. What does maintenance entail?

Suggested maintenance procedures include use of the Field Tester to verify the proper operation of the electronic sensing system, removal of contaminants from dielectric surfaces and touch-up of painted surfaces as required.

14. Are there any special storage or disposal requirements?

As with any piece of electrical equipment, the CLiP should be stored in a cool, dry location. Disposal of the CLiP is dependent upon its condition. For untriggered interrupters contact the factory. Triggered interrupters do not contain any live pyrotechnics and require no special handling. Consult factory for further information.

15. What is the service life of the CLiP?

The CLiP is designed to provide an indefinite service life of pyrotechnics and components. As a practical limitation, we recommend replacement of the interrupters and certain other components after 20 years.

16. Will the CLiP trigger on transformer or motor inrushes?

Peak inrushes to large motors and transformers should be determined during the early stages of application analysis. The trigger level must be set above the peak inrush level to avoid a possible nuisance trip. We can almost always work around excessive inrushes without compromising the CLiP's protective capabilities.

17. How do I select trigger levels to properly protect my equipment?

G & W's team of application specialists will assist you in selecting the proper trigger level for your CLiP.

18. Will the CLiP respond to harmonics or transients?

The CLiP is designed to trigger in response to an actual current level rather than a rate-of-rise of current. Since power systems typically have a wide variety of harmonic and transient conditions present, it is advantageous to avoid triggering in response to these, as rate-of-rise sensing may.

The CLiP Sensing and Firing Logic (SFL) system has undergone extensive redesign to reduce susceptibility of triggering under any conditions other than those specifically required. It also utilizes discrete logic components rather than microprocessor/memory chips having low tolerance for the temperature extremes regularly encountered.

19. What standards are used in testing the CLiP?

The CLiP has been tested according to applicable portions of ANSI/IEEE and NEMA standards for current limiting fuses. Many have also been tested per applicable IEC standards.

20. Can the CLiP be applied at 50hz?

Yes, no difficulty. The CLiP has been applied in a wide range of 50hz installations around the world.

21. How high of a fault current can the CLiP interrupt?

The standard units are rated 40kA rms, sym. Many units are rated to 120kA rms,. We have also succeeded in interrupting 311kA, at 15.7kV on test devices. We welcome inquiries on special interrupt duties.

22. What information do I need in order to apply the CLiP.

There are a few basic pieces of information needed to apply the CLiP:

- a. What am I trying to protect?
- b. What are the limitations of this gear (interrupt, momentary)?
- c. What is the total available fault current to this equipment (for momentary protection, determine the motor/generator contributions based upon subtransient reactance)?
- d. How much of this available fault current is flowing through the CLiP?
- e. A simple 1-line showing the sources of fault current and the equipment being protected should be provided.

Aside from this, some other application information is listed on the CLiP Inquiry Data Sheet found within the CLiP information package.

23. Is the CLiP field adjustable?

Yes, the trigger level can be field adjusted by the customer by changing a jumper in the SFL. This generally does not necessitate a visit from G&W Field Service personnel.

24. What type of power source is required for the controls?

The CLiP requires a reliable 250 Volt-Ampere source of control power. We can adapt to virtually any AC or DC voltage. Often an optional inverter is required for a DC source. Normal control power load is approximately 60 Volt-Amperes, but increases during initial energization and immediately after triggering.

25. Is the CLiP ready to trigger any time the control power is energized?

The CLiP requires a 4 second delay (after control power energization) for charging of its triggering circuit, before becoming fully operational. The CLiP remains operational for 2 cycles after removal of control power.

26. What is the purpose of the Isolation Transformer?

The Isolation Transformer serves a number of functions. First, it is the control power link to the CLiP. This is the means by which the Sensing and Firing Logic (SFL) is energized. Second, this is therefore the means by which the CLiP can be deactivated by a remote means. In other words, if you don't need the CLiP for a certain system operating condition, you can turn it off. This is done by a customer's relay contact (or other switching device) connected to the enable/disable circuit in the control box. Third, the Isolation Transformer serves as a feedback path to the customer's controls via the Fault Sensing Relays in the control box. This allows the customer to detect an interrupter operation and respond accordingly. The customer may utilize this to light a lamp, sound an annunciator or trip a series breaker (in the case of a single-phase operation).

27. Are there restrictions on the distance from the control box to the interrupters?

The CLiP is supplied with a 30-foot (9 meter) control cable. Longer lengths may affect certain functions, such as remote indication. Please consult the factory if lengths beyond 30 feet (9 meters) are required.

28. What is the resistance across a single phase of the CLiP?

The resistance of the CLiP bus varies with the voltage and current ratings of the unit. In all cases it is essentially negligible. For example, the 15.5kV, 3000A continuous rated CLiP has a bus resistance of approximately 16 micro-ohms. A typical voltage drop across the unit, regardless of rating, is approximately 50 millivolts at rated current. (This neglects contact resistance from joints at the customer terminations and at the interrupter to bus interface).