GC Control Panel (GCCP) Arc Flash Energy Reducing Maintenance Mode

ABSTRACT
How to use the Maintenance Mode feature within the GCCP to help a generator set's installation meet the 2017 edition of the National Fire Protection Association - NFPA 70, Section 240.87 (Arc Energy Reduction).

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INTRODUCTION

Since 2014, National Fire Protection Association (NFPA) 70, Section 240.87 (Arc Energy Reduction), has required a method to reduce clearing time of arc flash energy. This applies when the highest continuous-current trip setting for which the actual overcurrent device installed in a circuit breaker is rated, or can be adjusted, to 1200 A or higher.

The basic intent is to protect personnel working near energized equipment through a reduction of the arc flash hazard by limiting the duration of fault current. This can be accomplished with a lowered instantaneous trip setting in the overcurrent device.

As per NFPA 70, Section 240.87, “An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.”

The Maintenance Mode feature within the GC Control Panel (GCCP) 1.2 is intended to help a generator set’s installation meet the 2017 edition of NFPA 70, Section 240.87 (Arc Energy Reduction). This feature applies to GCCP 1.2 with the Cat Unlock Code applied with the programming done via the GCCP screen or Configuration Suite.

To minimize the arc flash energy, the instantaneous trip setting of the overcurrent device should be set below the expected arc fault value. Keep in mind that the arc fault value is just a portion of the available fault current and will depend on voltage. In addition, the sensing equipment must be able to measure up to the expected arc fault current. This may require a change to the existing sensing equipment.

To fulfill the requirements of NFPA 70, an alternate instantaneous overcurrent set point can be applied. This alternate set point comes with a couple of considerations. Firstly, the expected value of the arcing current must be determined. NFPA 70, Section 240.87 references the Institute of Electrical and Electronics Engineers - IEEE 1584™, 2002 - IEEE Guide for Performing Arc Flash Hazard Calculations, as an available method to provide guidance in determining arcing current. More complex systems may require a more detailed study to determine the anticipated arc fault current. Secondly, the lower instantaneous overcurrent setting must always be below the anticipated arc fault level. This may be an acceptable solution unless a coordination study requires the instantaneous setting to be higher than the expected arc fault value.

A few notes on coordination studies:
• In order to properly determine the instantaneous trip setting for Maintenance Mode, both a coordination study and an arc flash hazard study must be performed. The arc flash study will provide the information needed to determine the new instantaneous trip setting while the coordination study will determine the effect on other downstream devices with the new setting. An evaluation must be done to both maximize the system safety and minimize the impact on the system coordination.
• Where the National Electric Code® (NEC) requires selective coordination, be aware that the coordination study and the new set point as determined by the arc flash study may conflict. This is because it is common for the selective coordination to set up devices where the instantaneous settings are greater than the available fault current, which is also above the potential arc fault current. In those cases, other methods cited in 240.87 may be needed to satisfy the code. In other words, a coordination study may recommend trip settings be raised on a breaker, but the higher setting may

allow larger fault current if there is a fault on the system, thus being in direct conflict with the intent of lowering arc fault current.

• A full coordination and arc flash study should consider both the prospective arc fault current as well as the inrush and transient load surges to ensure that nuisance tripping will not occur. This could be due to large motor starting or energizing transformers, for example.

SYSTEM INTEGRATION

GCCP 1.2

The GCCP 1.2 Maintenance Mode feature provides a method to reduce clearing time via two functions that work together.

1. A means to accept an energy-reducing maintenance switch and provide means to connect a local status indicator.
2. An instantaneous overcurrent setting that can be set below the available arcing current.

Function 1 is accomplished by activating Digital Input and Digital Outputs. Digital Inputs can be programmed for Function “Maintenance Mode” with polarity set as “Close to Activate” or “Open to Activate.” See Figure 1. When active, this feature activates an instantaneous overcurrent trip (removes intentional delay in the trip time for the circuit breaker trip.) This reduces the clearing time when a worker is within the arc flash boundary defined in NFPA 70E. When deactivated, the breaker trip setting reverts to the previous values.

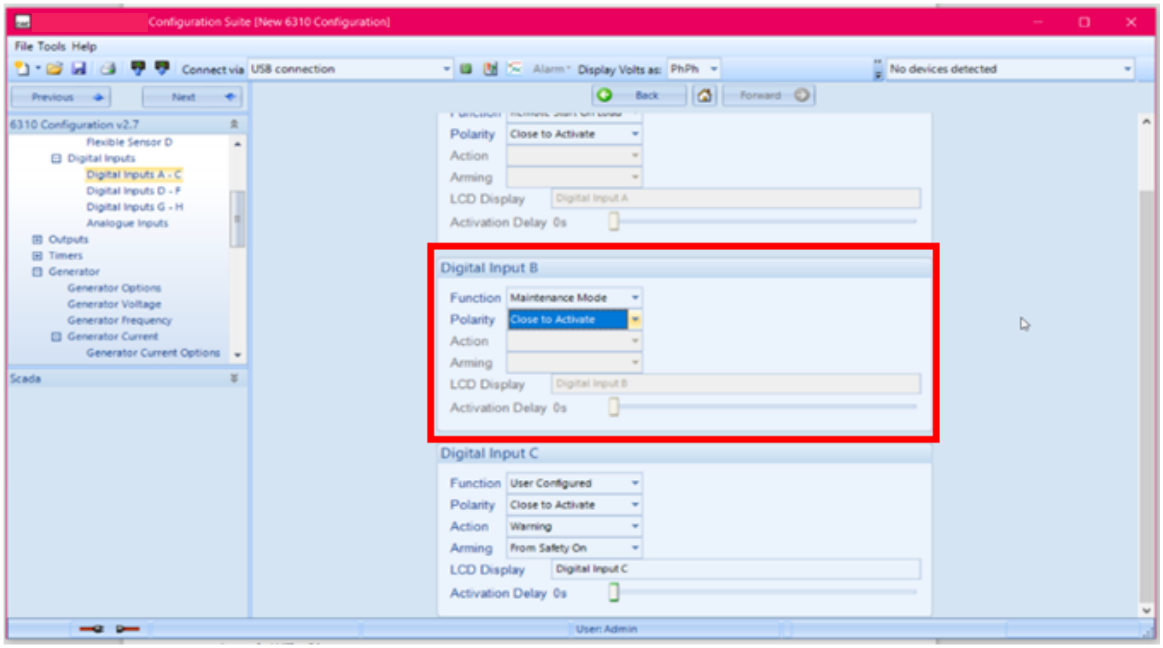

Figure 1: Maintenance Mode Digital Input

Digital Outputs can be programmed as “Maintenance Mode Active” to allow for wiring of an external status indicator (e.g., light). When the Maintenance Mode is activated from a programmed input, this output will become active. The local Authority Having Jurisdiction (AHJ) will have final word on the details of the external indicator installation. A ship loose option to fulfill the indication requirement is available from the price list. The display will also provide visual indication in the form of a warning alarm. An additional digital output is required, programmed as “Common Trip”, which is activated by

common shutdown, common electrical trip, short circuit current, instantaneous current trip, or maintenance mode current trip. See Figure 2.

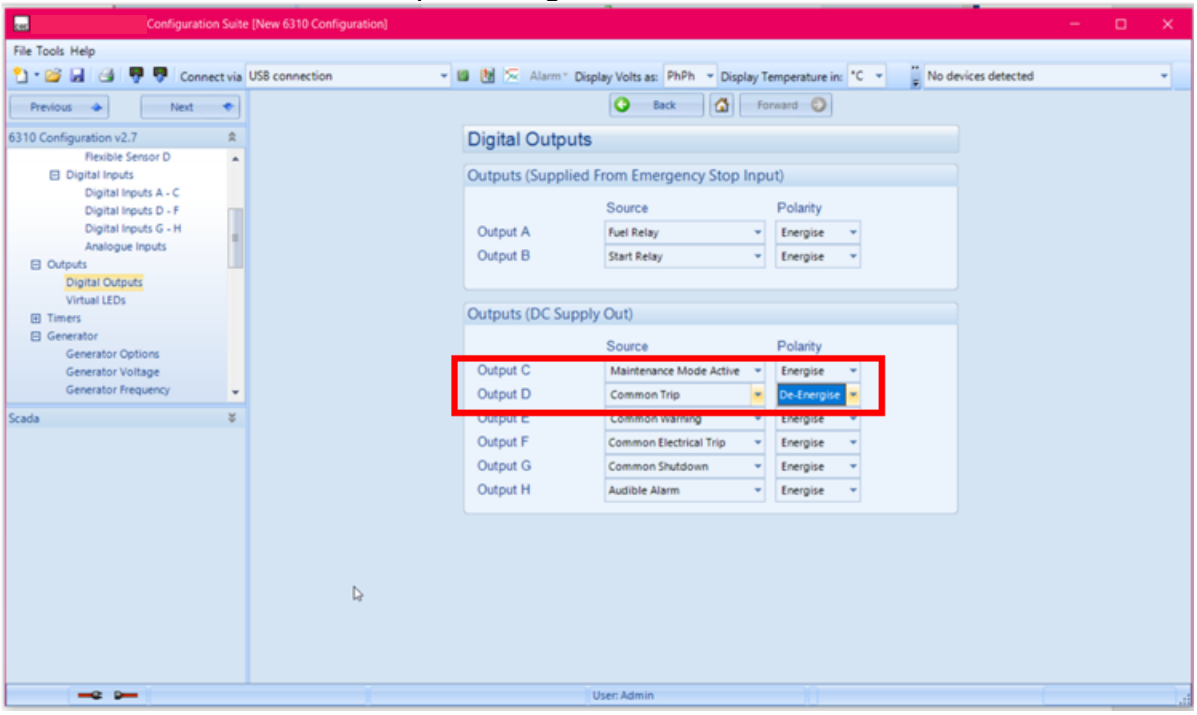

Figure 2: Digital Outputs

Function 2 is accomplished through the Maintenance Mode Overcurrent Alarm settings. In the Configuration Editor, navigate to Generator->Generator Current->Generator Current Alarms. There, “Maintenance Mode Overcurrent Alarm” should have the action set as “Electrical Trip” or “Shutdown”, with electrical trip as the default. An overcurrent setting range will be available to set between 0 and 300%, with 200% as the default. Note: There shall be no adjustable time multiplier or delay timer as it should be an instantaneous trip. See Figure 4.

When the maintenance mode trip is active it interacts with the existing overcurrent and short circuit trips. Current (A) readings below the maintenance mode trip level will follow the overcurrent and short circuit trip settings. See Figure 3. The maintenance mode trip is per phase (following existing protections), so any phase exceeding the maintenance mode trip level will cause a trip.

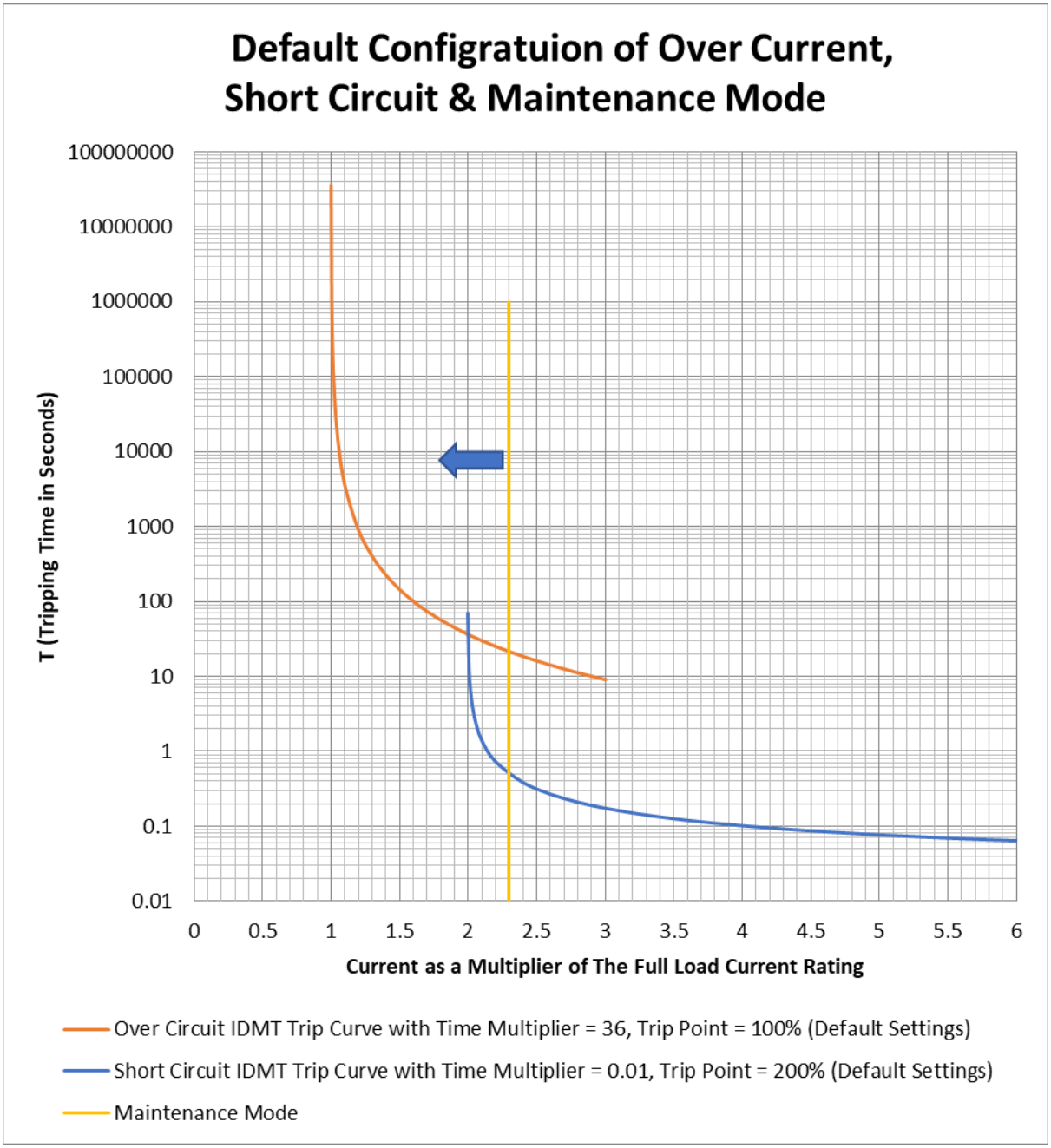

Figure 3: Graph of Overcurrent, Short Circuit, and Maintenance Mode Defaults

Instantaneous Overcurrent Alarm

When maintenance mode is not active, the instantaneous overcurrent alarm setting will be active. In the Configuration Editor, navigate to Generator->Generator Current->Generator Current Alarms and enable Instantaneous Overcurrent Alarm setting. Set the Action as “Electrical Trip” or “Shutdown”, the default will be set as electrical trip. Set trip percentage of rated current between 0 and 400%. This parameter has a default value of 300% but should be set based on the results of the coordination study. Time delay will be set to 0 seconds by default so that it will activate as soon as the output current reaches the programmed percentage but may be set between 0 seconds and 1 hour. See Figure 4. The instantaneous current trip is per phase, so any phase exceeding the instantaneous current trip will cause a trip.

Note: When the GCCP Maintenance Mode feature is active, this setting works in parallel with all overcurrent settings in the GCCP. This means that the most conservative settings will take precedence.

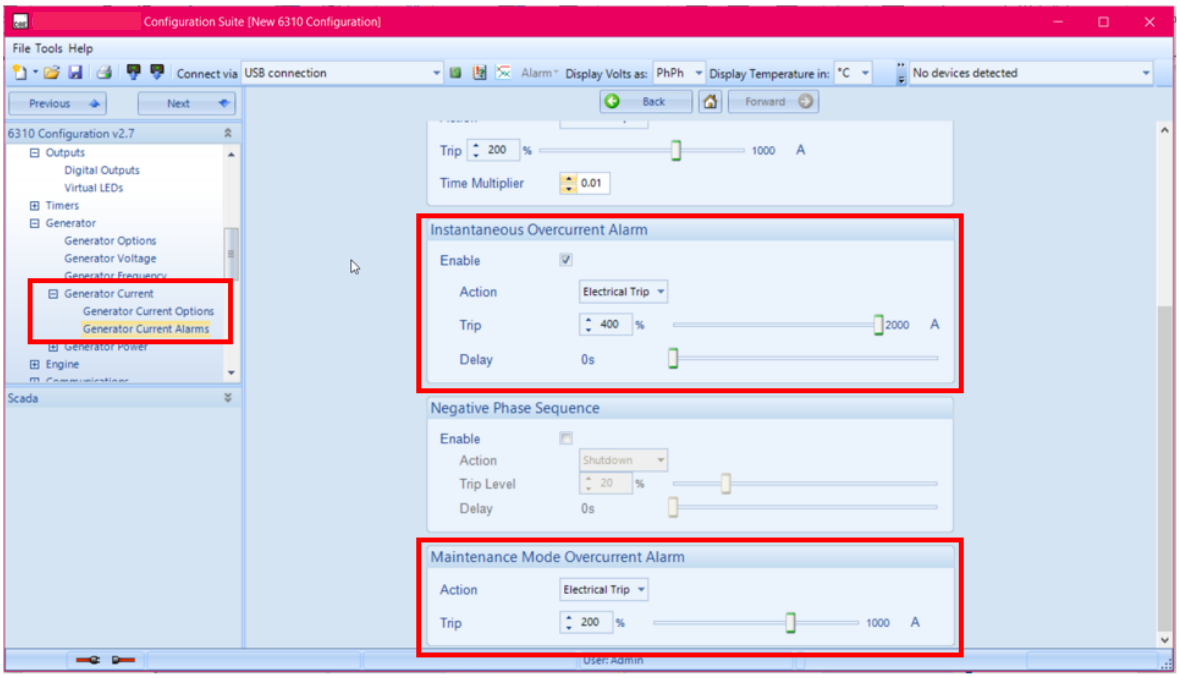

Figure 4: Generator Current Alarms Settings

GCCP 1.5

The GCCP 1.5 does not offer maintenance mode. To satisfy an arc energy reduction requirement, a means independent of the GCCP control should be used.

CONCLUSION

The Arc Flash Energy Reducing Maintenance Mode feature within the GCCP 1.2 provides a method to reduce clearing time of arc flash energy. This feature is flexible enough to take into account complex coordination studies but can easily accommodate simple systems.

ACKNOWLEGEMENTS

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