SKM Power*Tools®
Electrical Engineering Software

Power*Tools for Windows
Version 8.0 Enhancements

SKM
Systems Analysis, Inc.

SKM SYSTEMS ANALYSIS, INC.
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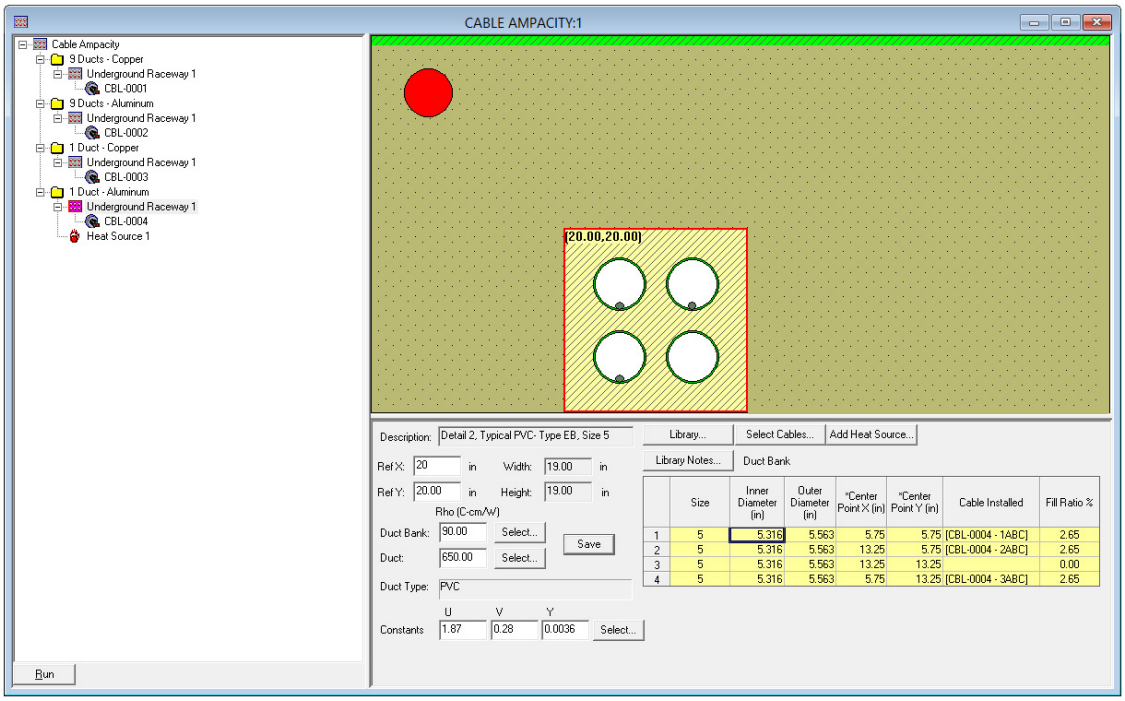
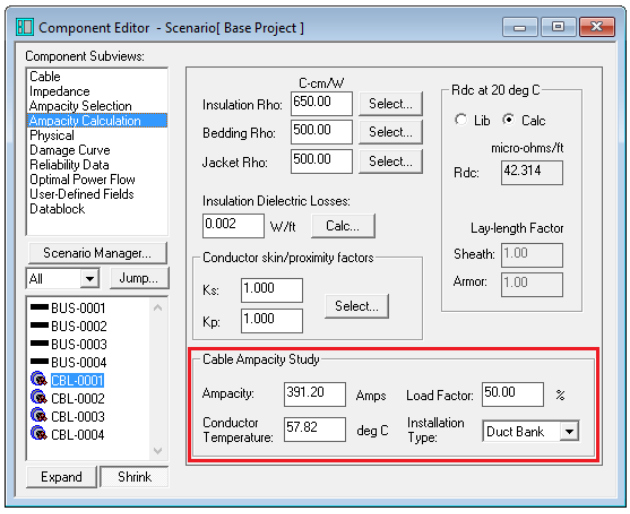
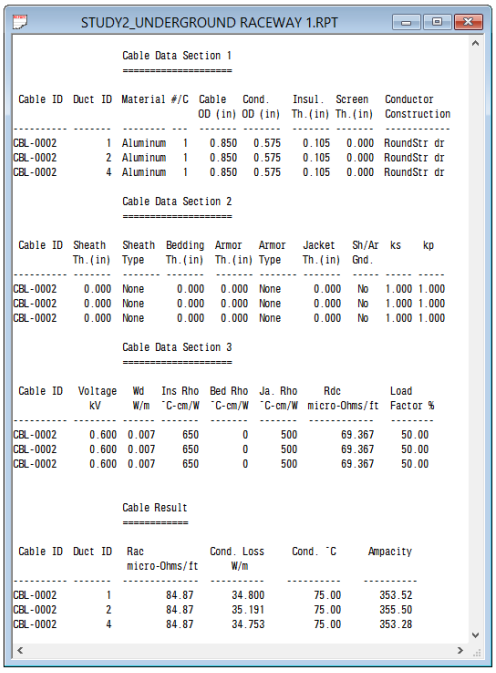
1972 ~ 2017

List of Enhancements and Changes in Power*Tools for Windows Version 8.0

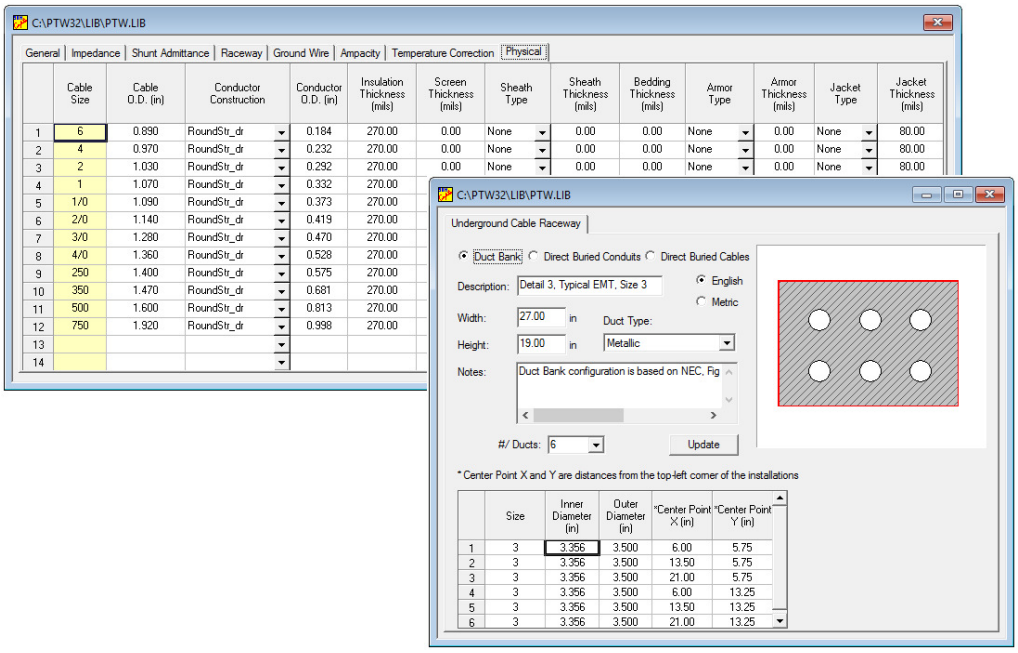
1. **New Study Module** – Underground & Aboveground Cable Ampacity/Ductbank calculations based on Neher-Mcgrath and IEC 60287. Calculates cable ampacity ratings and operating temperatures for user definable cable installations. See Reference manual for more details.







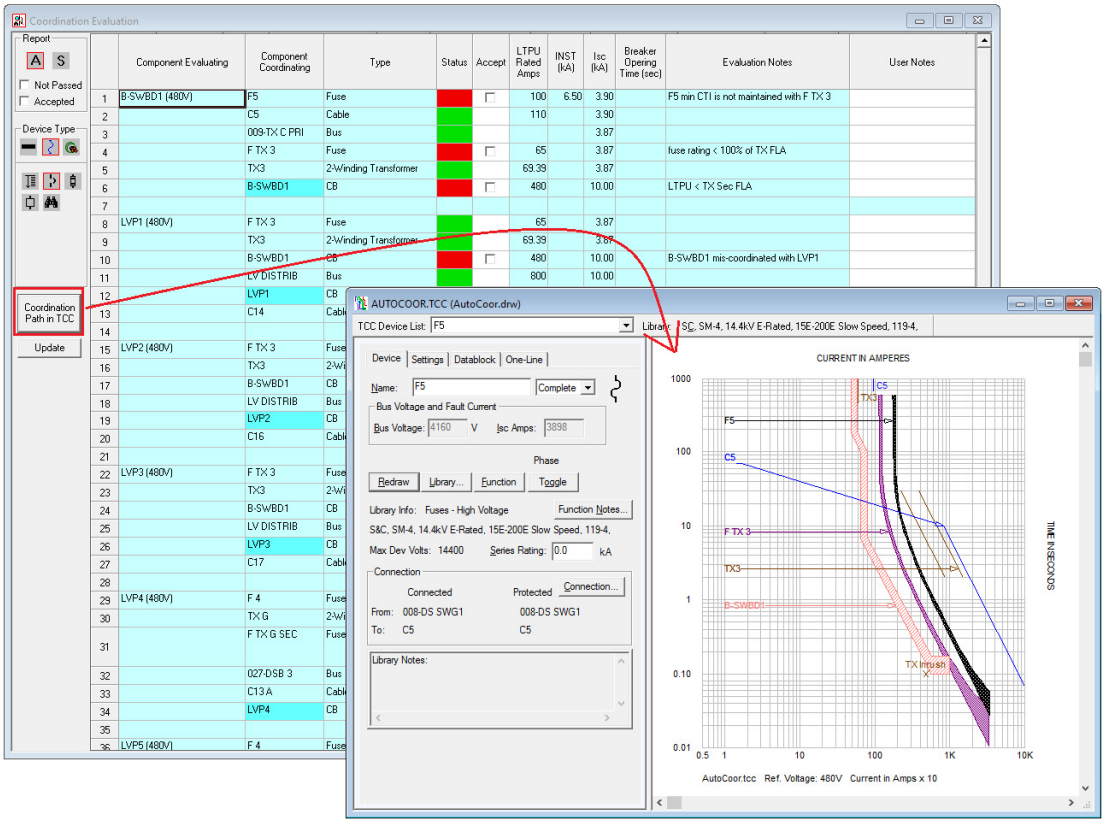
New Ampacity Calculation and Physical subviews in the Component Editor. These contain the data utilized for the Cable Ampacity Program. The data is either linked to the library or user defined.



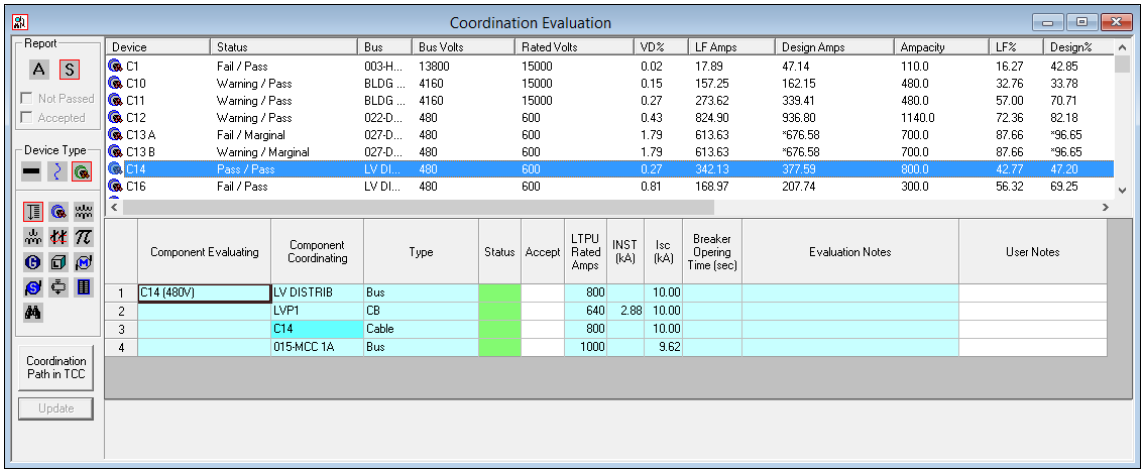
2. **New Study Module** – Auto Coordination Evaluation. Instantly evaluate system components and protective devices to address whether it follows the basic coordination and protection rules per National Electric Code (NEC) and industry recommended practices.

   Violation can then be resolved systematically at each location/zone either manually or automatically by creating TCC drawings of the affected area with a single click. The auto coordination feature will attempt to make the minimum amount of changes to the existing coordination and resolve the violations by changing protective equipment settings or frame sizes. New settings can be reviewed or reverted back to the original settings.

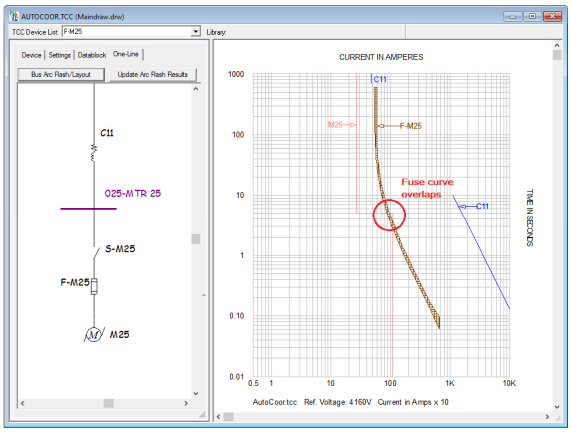
   The software is designed to evaluate the entire system and identify violating equipment. Quickly view TCC plots to determine the cause of the miscoordination with a single mouse click to efficiently make changes to improve coordination.

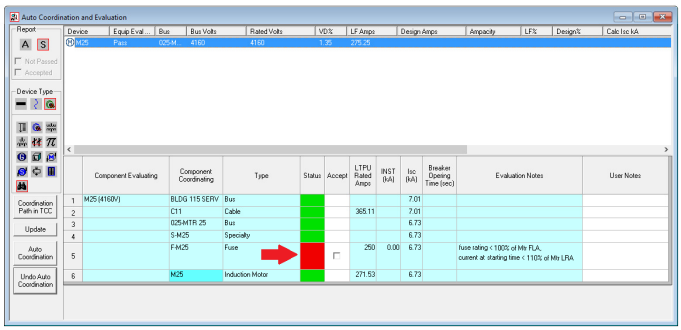


Plot all equipment curves with a single click to quickly evaluate coordination.

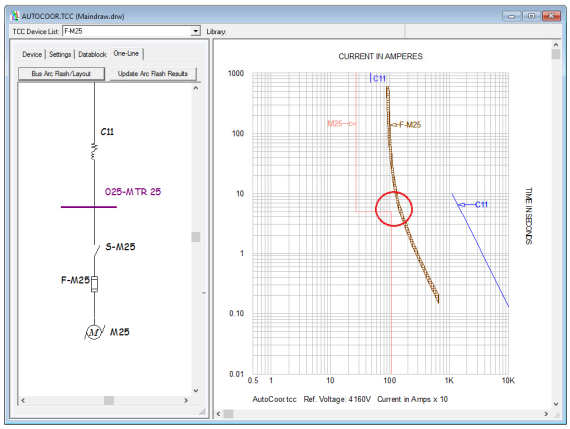


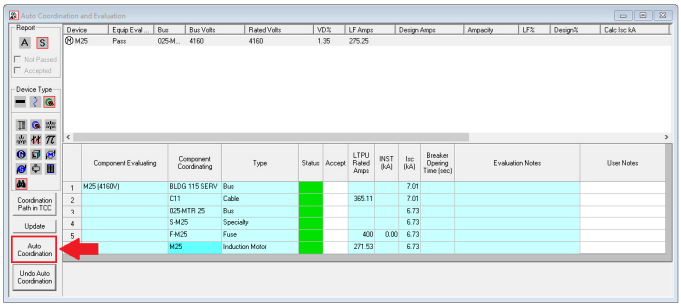
Selected mode to show individual equipment paths.





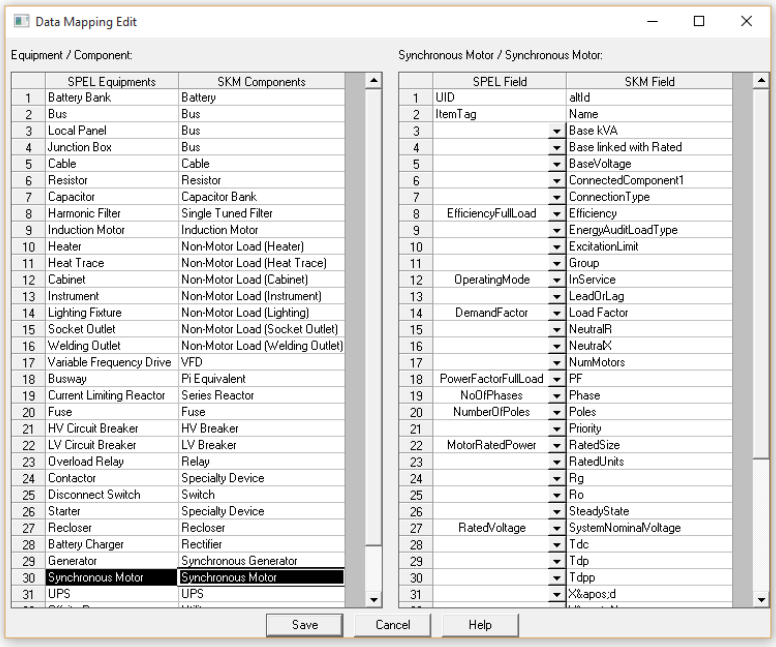
BEFORE: Miscoordinated Fuse and Motor starting curve.



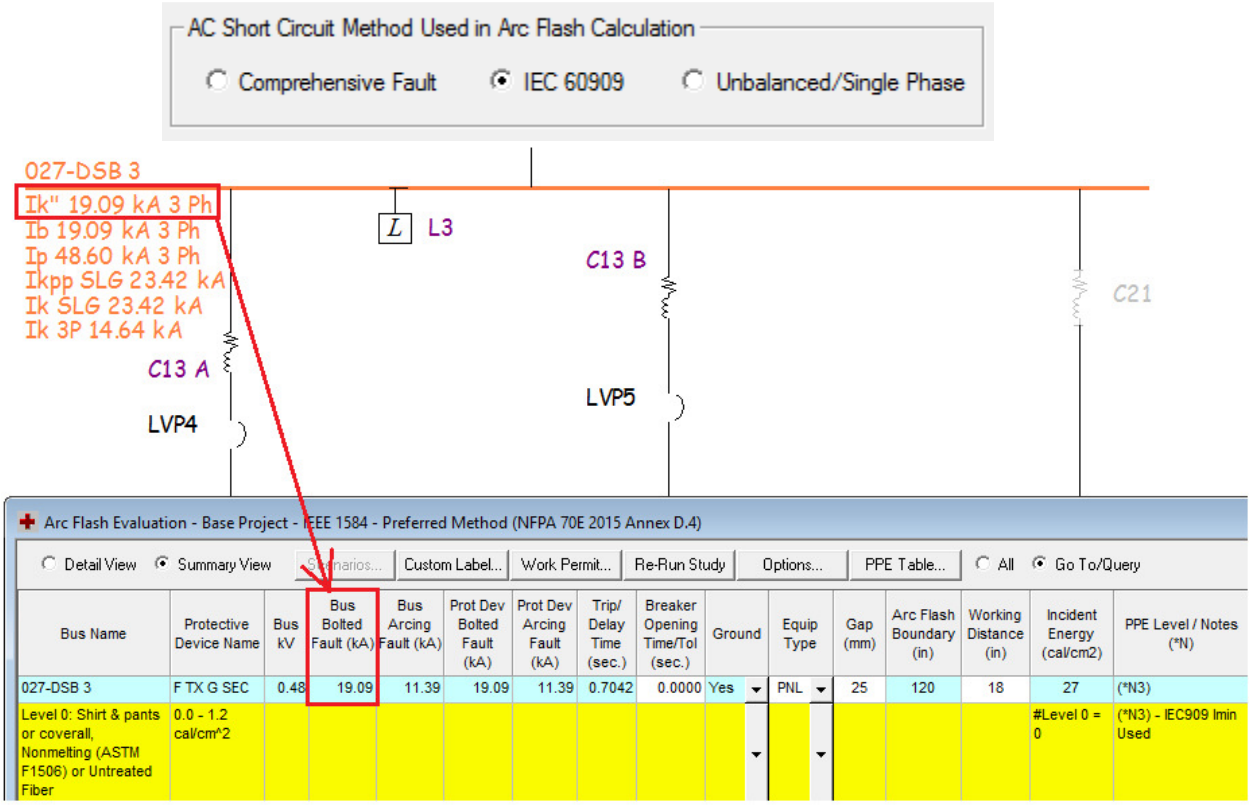


AFTER Auto Coordination: Fuse size changed automatically to not overlap with Motor starting curve.

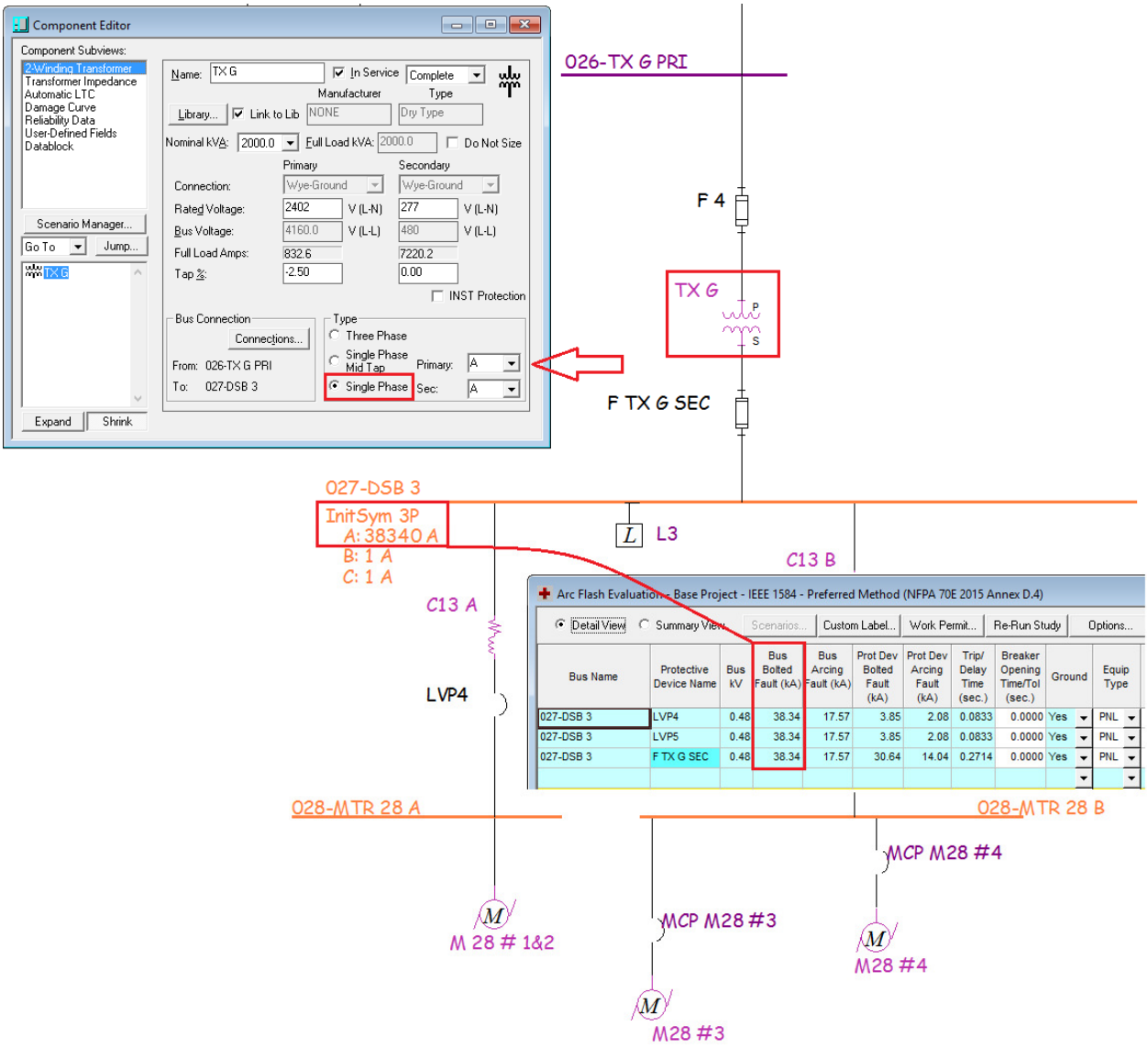
3. **New Study Module** – Intergraph SmartPlant Electrical Data Exchange. Interface to provide bidirectional data exchange between Power*Tools and SmartPlant Electrical software. Use Power*Tools for the design and analysis. Use SmartPlant Electrical for operation, maintenance, and construction. Both software packages work complimentary to each other by supporting each other's strengths. The block diagram shown below illustrates the data flow process. See Reference manual for more details.



4. Added new short circuit methods for Arc Flash Evaluation. IEC 60909 and Unbalanced/Single Phase fault are now available for use within Arc Flash Evaluation (provided that these fault studies are licensed).



IEC 909 short circuit results carried over to Arc Flash.

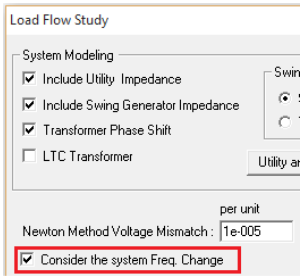


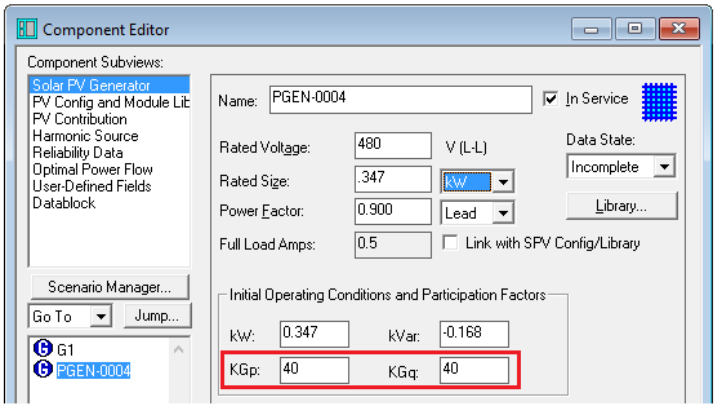
Unbalanced/Single Phase short circuit results carried over to Arc Flash.

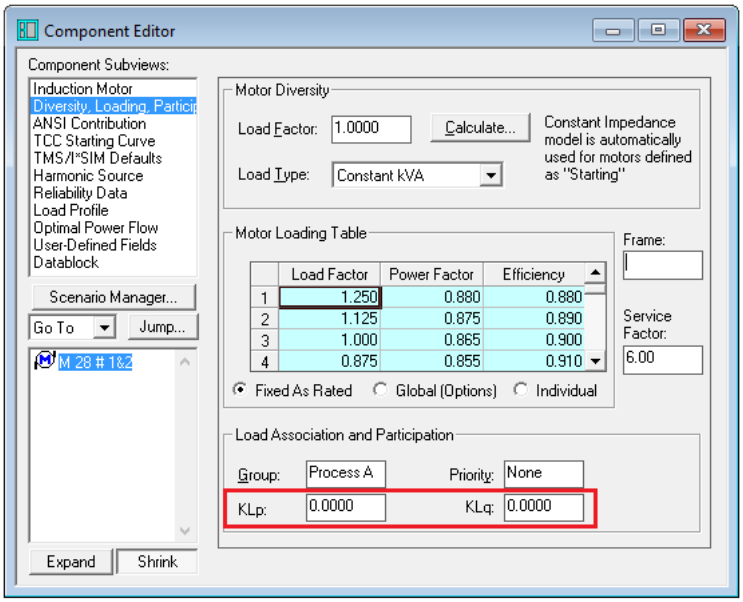
5. New Load Flow Calculation Method for Islanding Micro Grids (projects without a swing bus). Power flow calculation is normally based on a fixed system frequency and at least one swing bus must be defined to represent a large power source for balancing the power demand and maintaining the system frequency. New distributed generation resources (DGR) like wind and solar energies are being added into the power grid. In an island system due to local demand or failure of the grid, the DGR are often limited and there is no single DGR that can balance the demand. In other words, there is no swing bus and the system frequency will decline in such island micro grid systems. Also large-scale wind and solar power integration may cause significant impact on power system frequency, it is therefore necessary to take frequency regulation issues into account in power system steady-state operation analysis.

   The feature of "power flow considering frequency change" is designed for handling such situations. The active and reactive power of generators and loads are presented with their static power–frequency characteristics. All the generators with frequency regulation capability participate in generation-load power regulation. The power flow calculation results can reveal the impact to the system frequency from operational mode changes and load variation, and present the output adjustment of the generators.

   a. In load flow setup, check the option "Consider the system Freq Change".
   b. In Component Editor for Generators and Loads, enter the freq. adjustment factors. Need to be set to non-zero values for at least one generator.



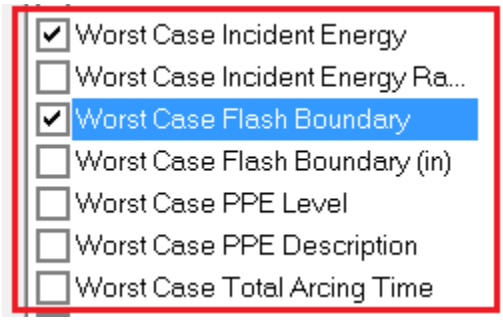




- KGp: equivalent regulation coefficient of active power of generator. PGi=Pgi0 – Kgpi*(f-1.0). Where f is the current island freq., f0 is the base freq. PGi , Pgi0, f are in pu.
- KGq: equivalent regulation coefficient of reactive power of generator. QGi=Qgi0 – Kgqi*(Vt-1.0). Where Vt is the generator terminal voltage. QGi , Qgi0, and Vt are in pu.
- KLp: equivalent regulation coefficient of active power of load. PLi=Pli0 – Klpi*(f-1.0). Where f is the current island freq., f0 is the base freq., PLi , Pli0, and f are in pu.
- KLq: equivalent regulation coefficient of reactive power of load. QLi=Qli0 – Klqi*(f-1.0). Where f is the current island freq., f0 is the base freq., QLi , Qli0, and f are in pu.
- New Datablock attributes: Bus freq. for each island. All buses in the same island have the same frequency. The generator and load P and Q are modified values, which is the sum of initial PQ and freq. related changes.
- kW - enter the real power of the Solar PV Generator in this field. This real power value is held constant at the machine's connected bus in the steady state load flow calculations. Note: If the "Link with SPV Config/Library" checkbox is checked, the software will calculate this value based on the rated size and power factor; and this field will be grayed out.
- kVar - enter the reactive power of the Solar PV Generator in this field. This reactive power value is held constant at the machine's connected bus in the steady state load flow calculations. Note: If the "Link with SPV Config/Library" checkbox is checked, the software will calculate this value based on the rated size and power factor; and this field will be grayed out.

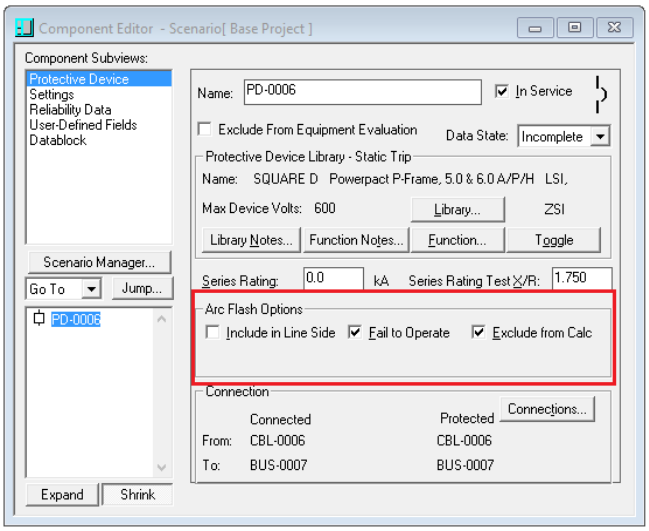
6. New Arc Flash Custom Label Designer Fields:
   - Arc Flash Standard
   - Schedule Fed From
   - Notes (User2)
   - Notes (User3)
   - Notes (User4)
   - Worst Case Incident Energy
   - Worst Case Incident Energy Range
   - Worst Case Flash Boundary
   - Worst Case Flash Boundary (in)
   - Worst Case Working Distance
   - Worst Case Working Distance (in)
   - Worst Case PPE Level
   - Worst Case PPE Description

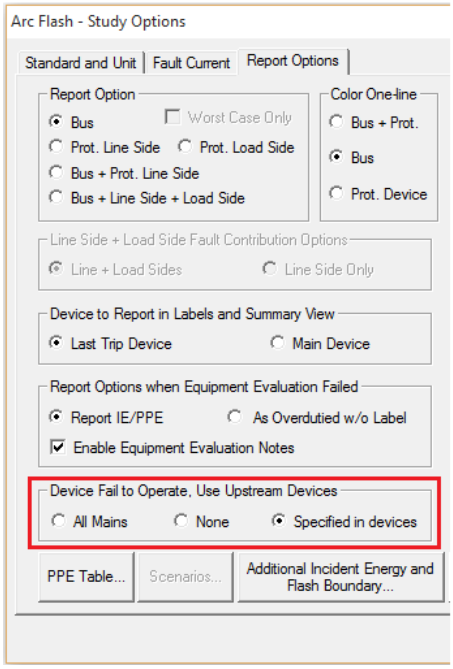
- Worst Case Arc Duration
- Worst Case Scenario Name



New Arc Flash label fields to show Worst Case results. Also includes ability to show both Worst Case and Current Scenario results on the same label.

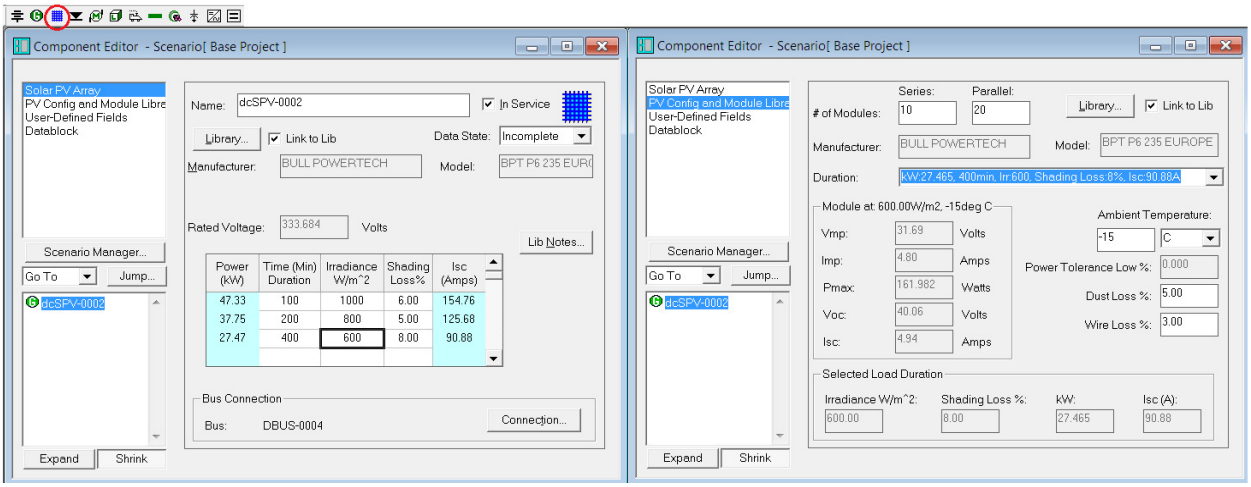
7. Expanded the "Device Fail to Operate" option which applies to all Mains or as specified in the devices. This is commonly used to simulate the operating failure of the main device. If this option is checked, the software will run Arc Flash based on the assumption that the Device connected to the bus did not operate. The software will then automatically use the upstream devices for the arc flash calculation instead.



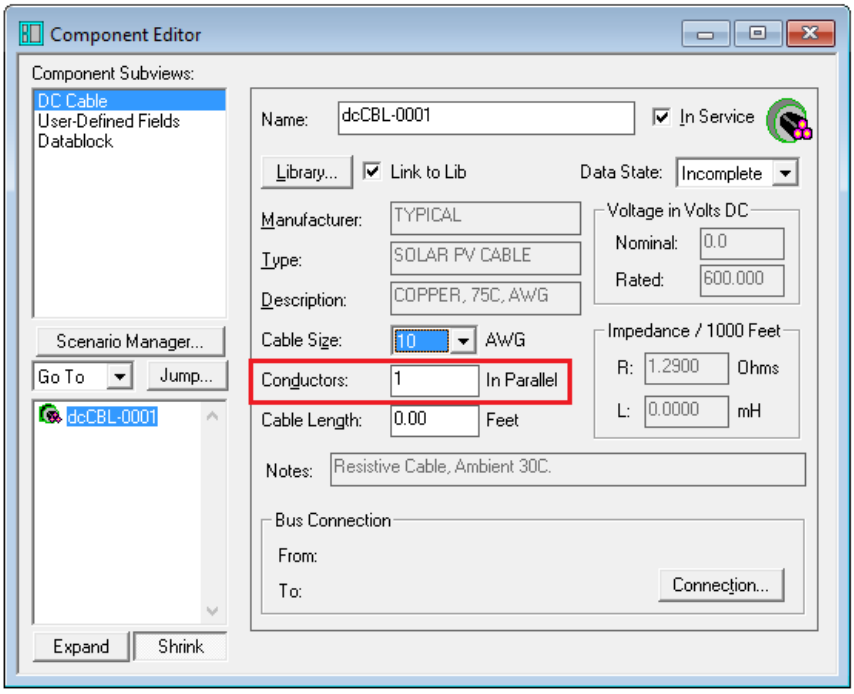


8. Added oneline component Arc Flash coloring based on the Arc Flash spreadsheet. This includes worst case results from multiple scenarios.

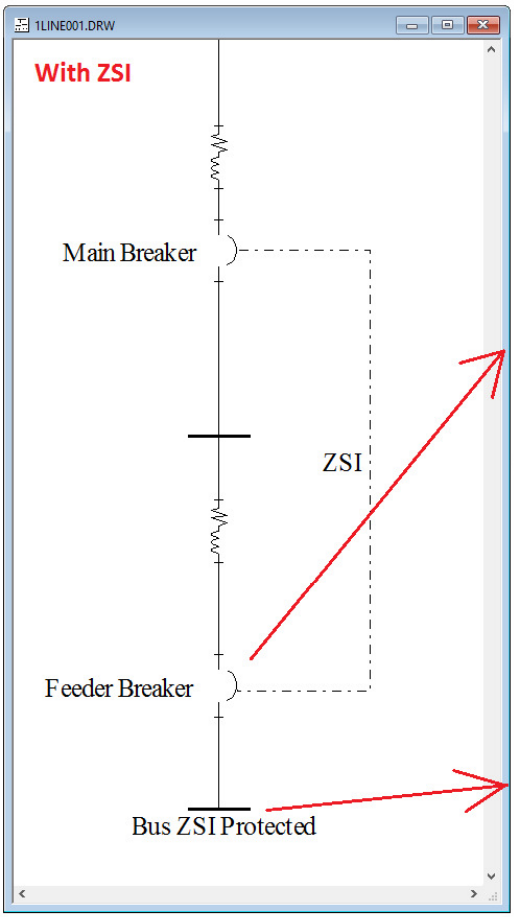
9. Added new DC solar Photovoltaic component.

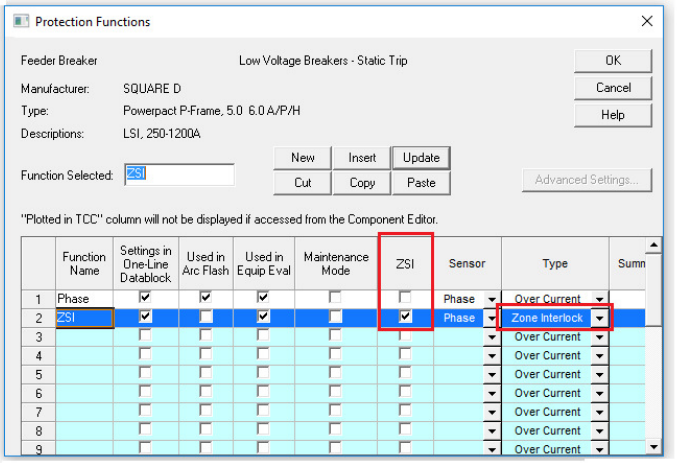


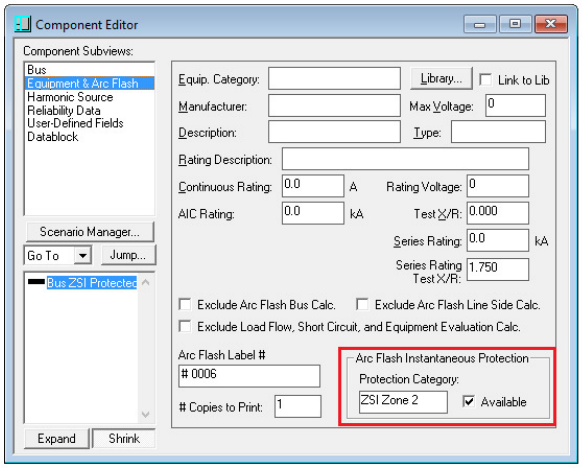
10. Added new fields for modeling parallel DC cables.

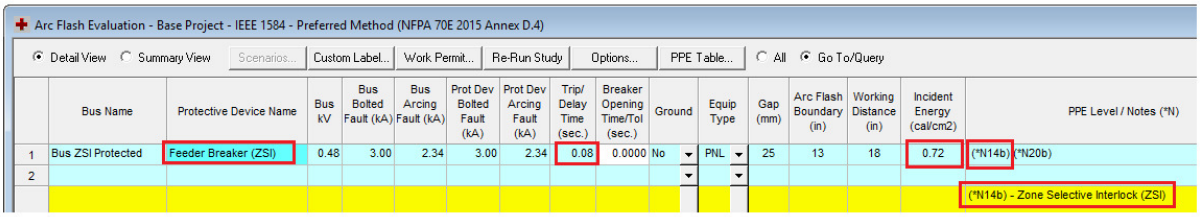


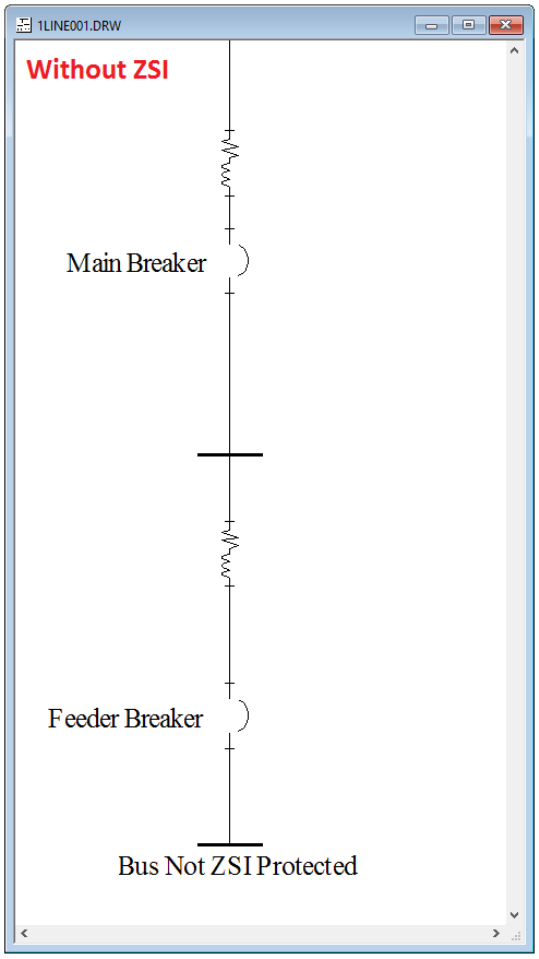
11. New Zone Selective Interlocking modeling. With ZSI, a short circuit will be isolated and cleared by the nearest upstream breaker with no intentional time delay. Without ZSI, an intentional delay is used to clear the fault. ZSI is particular useful in reducing Arc Flash incident energy as shown. With clearing time reduced from 0.32 seconds to 0.08 seconds, incident energy reduced from 2.79 cal/cm^2 to 0.72 cal/cm^2.









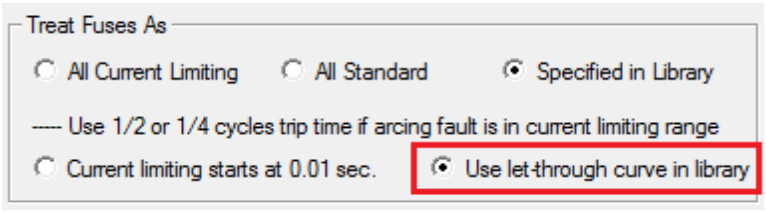


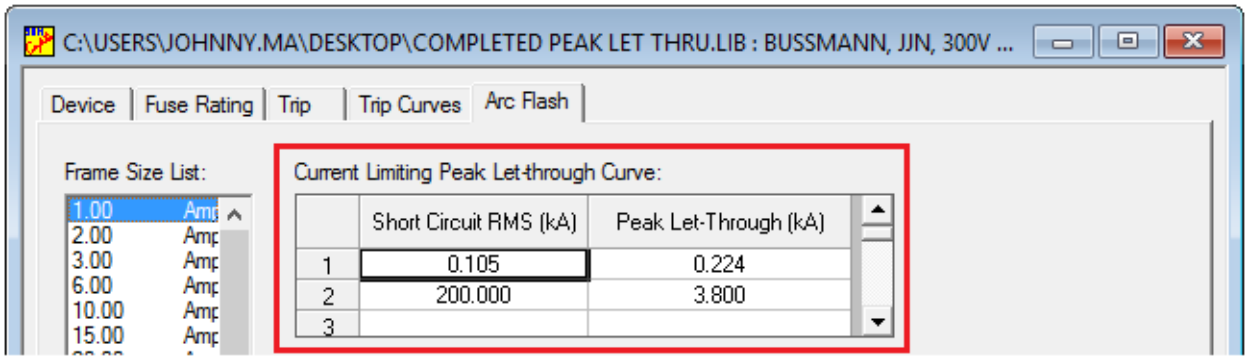
Arc Flash Evaluation - Base Project - IEEE 1584 - Preferred Method (NFPA 70E 2015 Annex D.4)

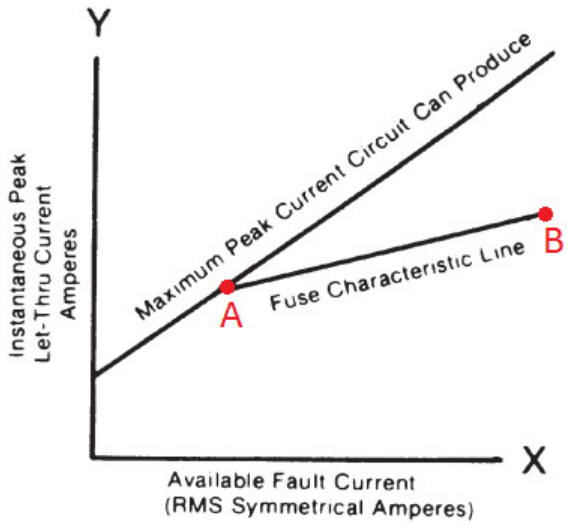
Detail View | Summary View | Scenarios... | Custom Label... | Work Permit... | Re-Run Study | Options... | PPE Table... | All | Go To/Query

	Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Ground	Equip Type	Gap (mm)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	PPE Level / Notes (*N)
1	Bus Not ZSI Protected	Feeder Breaker (Phase)	0.48	3.00	2.34	3.00	2.34	0.32	0.0000	No	PNL	25	31	18	2.9	(*N20b)
2																

12. New option for current limiting fuse to use the let-through curve to determine if ½ or ¼ cycle should be used as the clearing time in Arc Flash Evaluation. Peak Let-through curve data points are stored in the Fuse library.



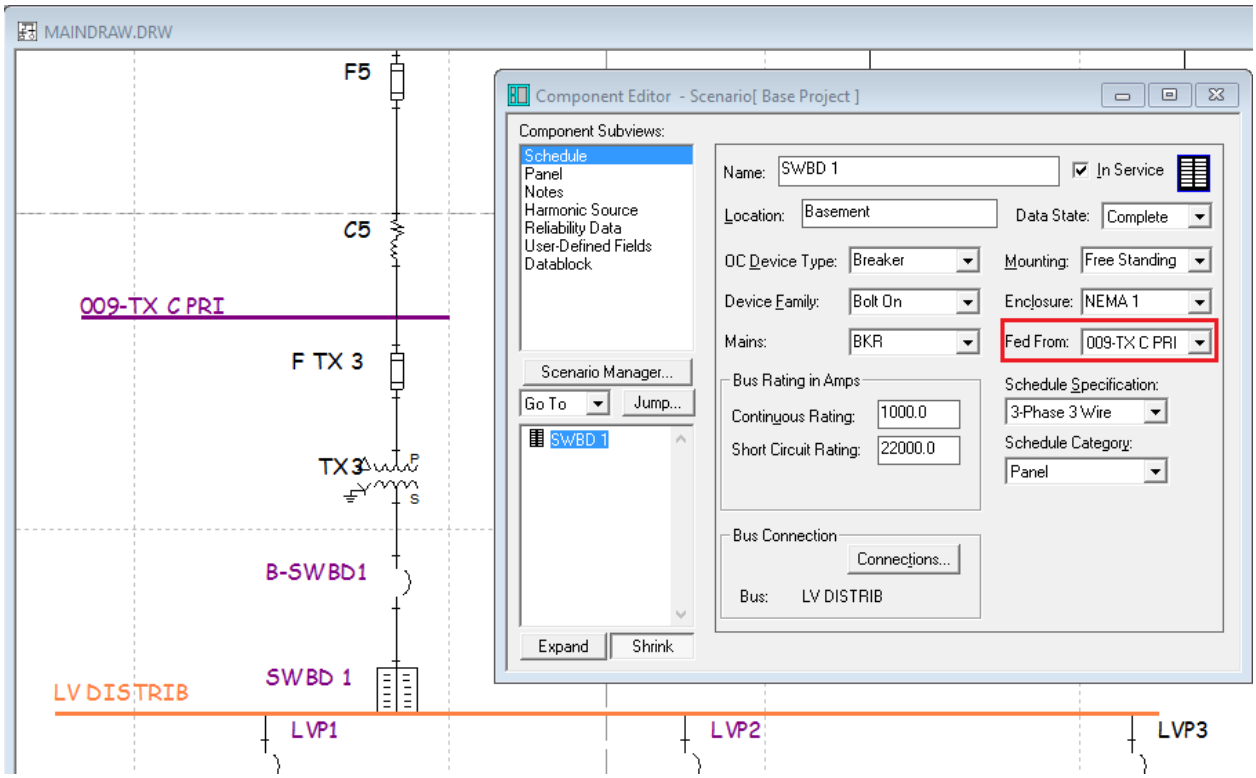


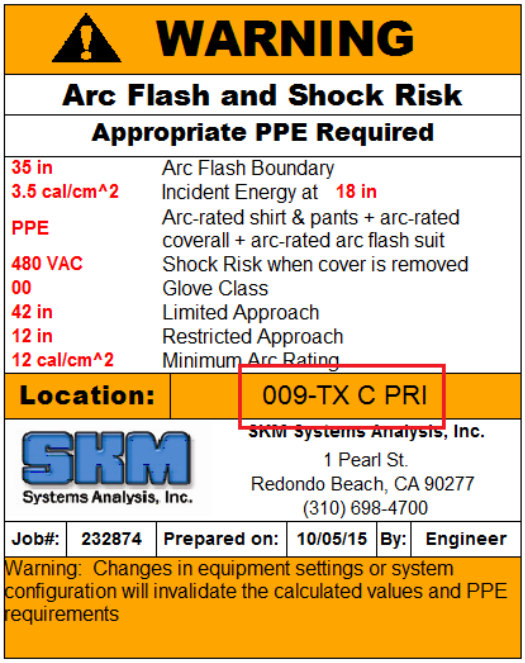


Line from A to B is where the fuse operates as a current limiting fuse.
I_{arc} is the arcing current flowing through the fuse.

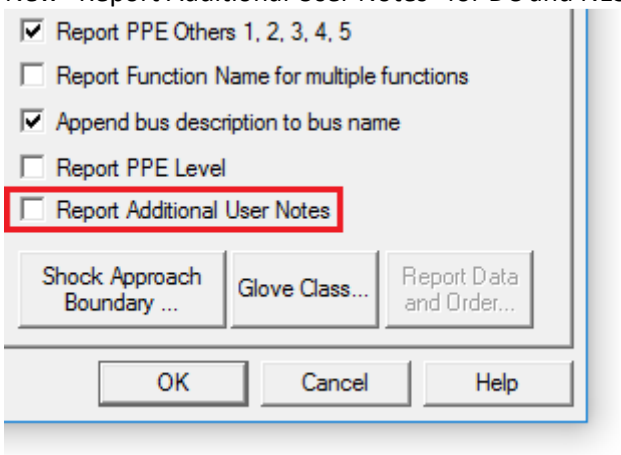
If $I_A \leq I_{arc} \leq 2 \times I_A$, then the fuse clearing time is set to ½ cycle in Arc Flash Evaluation.
If $I_{arc} > 2 \times I_A$, then the fuse clearing time is set to ¼ cycle in Arc Flash Evaluation.

13. Added “Schedule Fed From” custom Arc Flash label field. If there is a connected Schedule at the bus, the “Fed From” specified in the Schedule can now be reported. This aids in locating the panel so it can be shut off and work performed.



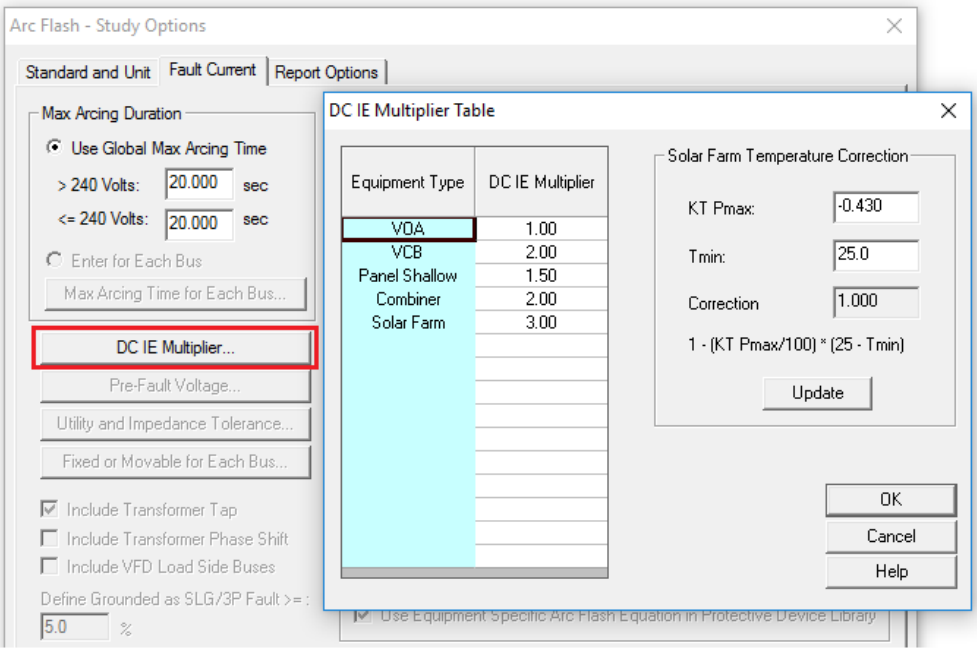


14. New “Report Additional User Notes” for DC and NESC Arc Flash methods.



15. Added 3 additional User Notes columns in Arc Flash Evaluation.

16. DC Arc Flash Multiplier Table and Solar Farm Temperature Correction. Based on IEEE paper DC Arc Flash Calculations for Solar Farms.

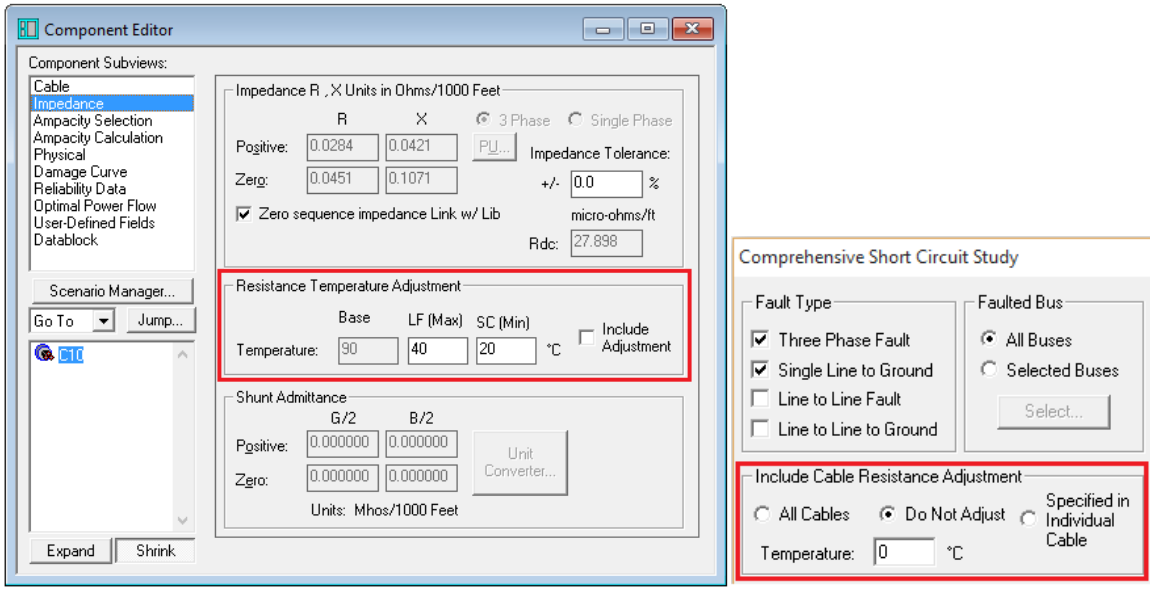


Arc Flash Evaluation - Base Project - DC Systems Arc Flash (NFPA 70E 2015 Annex D.5) (ANSI)

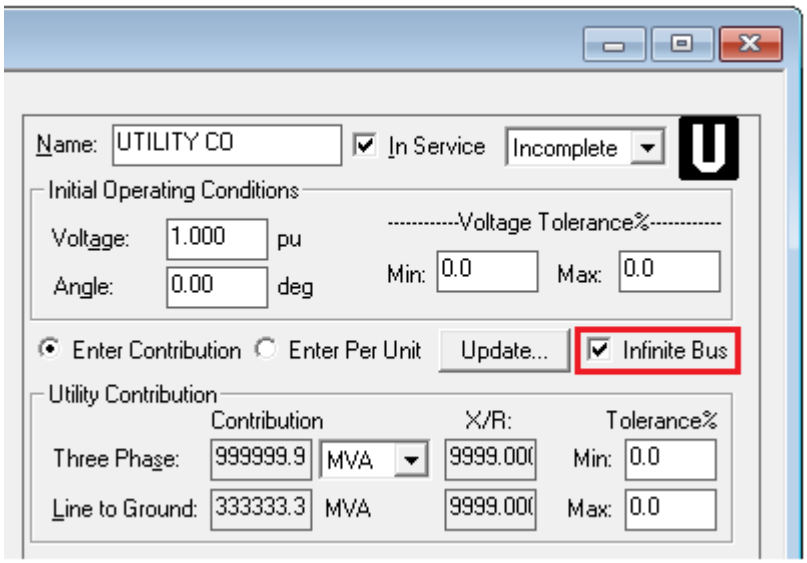
Detail View | Summary View | Scenarios... | Custom Label... | Work Permit... | Re-Run Study | Options... | PPE Table...

	Bus Name	Protective Device Name	Bus kV	DC Bolted Bus Fault (kA)	DC Arcing Bus Fault (kA)	Bus Equivalent Resistance (Ohms)	DC Bolted Prot Dev Fault (kA)	DC Arcing Prot Dev Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Duration of Arc (sec.)	Equip Type
1	DBUS-0001	CB1	0.25	7.063	3.531	0.0354	7.054	3.527	20.0000	0.0000	20.0000	VOA
2	DBUS-0002	CB2	0.25	18.931	9.465	0.0132	17.366	8.683	0.0167	0.0000	0.0167	VOA
3	DBUS-0003	F2	0.25	64.617	32.308	0.0039	64.540	32.270	0.0153	0.0000	0.0153	VOA
4	DBUS-0004	CB6	0.25	12.780	6.390	0.0196	10.835	5.418	0.0195	0.0000	0.0195	VOA
5	DBUS-0005	CB3	0.25	9.076	4.538	0.0275	2.324	1.162	20.0000	0.0000	20.0000	VOA
6	DBUS-0006	CB4	0.25	7.153	3.577	0.0350	3.619	1.810	20.0000	0.0000	20.0000	VOA
7	DBUS-0007	CB4	0.25	5.394	2.697	0.0463	2.730	1.365	20.0000	0.0000	20.0000	VOA
8	DBUS-0008	CB7	0.25	7.286	3.643	0.0343	3.049	1.524	20.0000	0.0000	20.0000	VOA
9	dcBUS-0010	F1	0.12	0.008	0.004	14.2971	0.008	0.004	10.9370	0.0000	10.9370	VOA

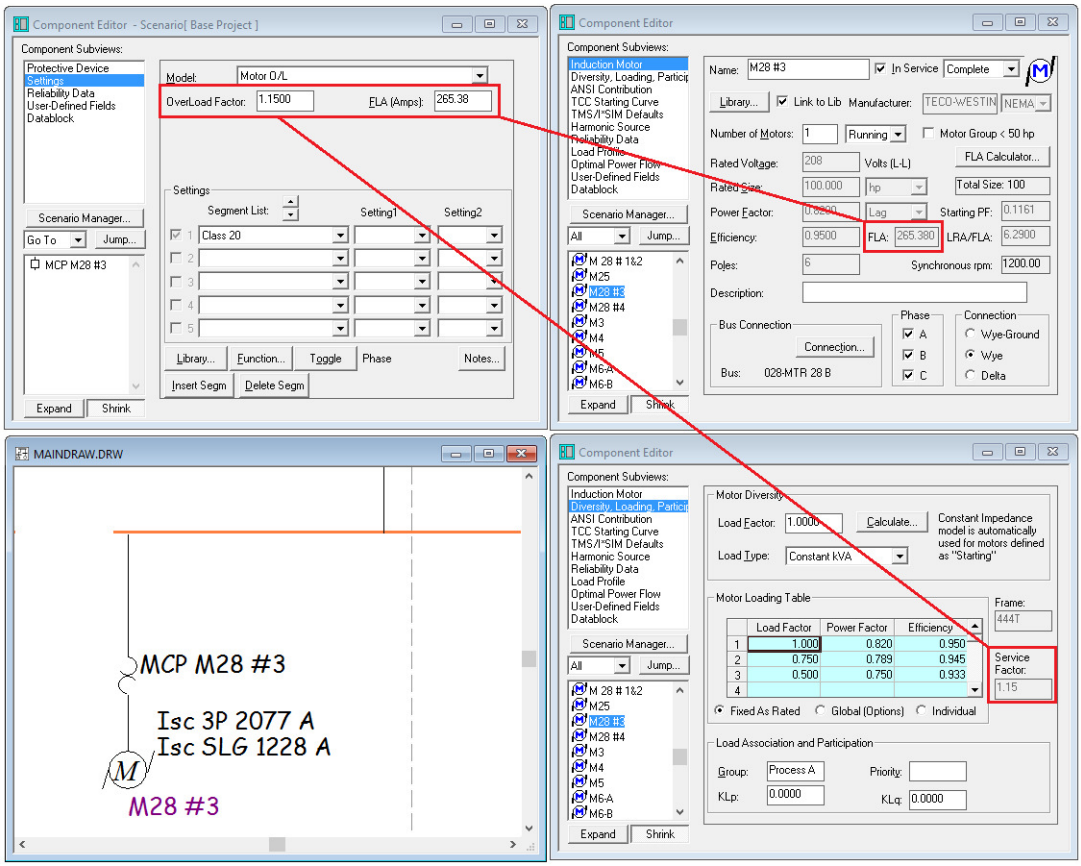
17. Added cable resistance temperature adjustment field for individual cables in the Component Editor. Enhanced study options for SC Comprehensive, Load Flow, ANSI, IEC 60909, IEC 61363, and UBSC to allow for this adjustment.



18. Added infinite bus option for utility component.



19. Added automatic copying of the OverLoad Factor and FLA from an induction motor to a connected motor over load device.



20. Added more Project Titles (up to 10 total).

21. Add additional Crystal Report templates to accomadate 30 characters component names.

22. Added auto renaming of associated onelines when a TCC drawing is renamed. Applies when the associated oneline is named the same as the TCC drawing.

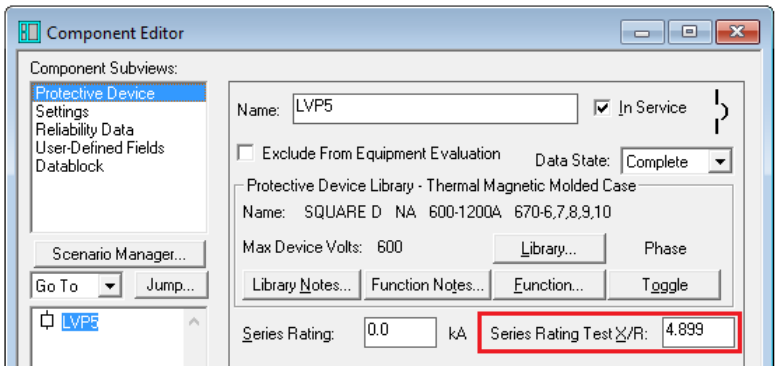
23. In Equipment Evaluation, if a component is missing evaluation information such as the device SC ratings, it will be reported as Unknown.

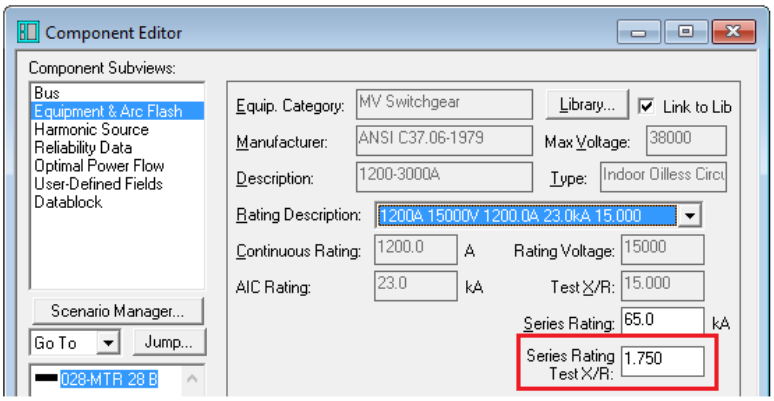
24. HI_WAVE – added “Generation Equipment” Component Editor checkbox for Transmission Line component types based on IEEE 519-2014.

25. HI_WAVE – Calculate Total Demand Distortion (TDD).

26. HI_WAVE – Calculate Harmonic Loss Factor (I_FHL).

27. Added new field for Series Rating Test X/R. This field is used for Low Voltage (<= 1kV) buses and protective devices and is considered in Equipment Evaluation when the entered Series Rating value is higher than the Interrupting Rating of the equipment from the Library.





28. New protective device library enhancements.
    a. Cable library model MCODE field now stores 15 characters.
    b. New library category Underground Cable Raceway. (Used for the Cable Ampacity module)
    c. Updated the Standard Cable to physical characteristics of a cable.

29. New Datablocks added:
    - AFWC_wcBusLineLoad_Boundary
    - AFWC_wcBusLineLoad_IncidentEnergy
    - AFWC_wcBusLineLoad_PPE Desc
    - AFWC_wcBusLineLoad_PPE Level
    - AFWC_ArcDuration
    - AFWC_Notes (N*)
    - AF_wcBusLineLoad_IncidentEnergy
    - AF_wcBusLineLoad_PPE Desc
    - AF_wcBusLineLoad_PPE Level
    - AF_wcBusLineLoad_Boundary
    - AF_wcBusLineLoad_IncidentEnergy
    - AF_wcBusLineLoad_PPE Desc
    - AF_wcBusLineLoad_PPE Level
    - AF_ArcDuration
    - AF_NESC_3PhaseMultiplier
    - AF_NESC_Altitudes
    - AF_NESC_LLorLG
    - AF_NESC_TypeOfWork
    - AF_Notes2 (User)
    - AF_Notes3 (User)
    - AF_Notes4 (User)
    - AF_BreakerTime_LineLoadSide (for Protective Devices)
    - AF_BusExclude (for Protective Devices)

- AF_FailedToOperate (for Protective Devices)
- AF_IncludeInLineSide (for Protective Devices)
- AF_ProtDev (for Protective Devices)
- AF_TripTime_LineLoadSide (for Protective Devices)
- AFWC_BreakerTime_LineLoadSide (for Protective Devices)
- AFWC_TripTime_LineLoadSide (for Protective Devices)
- FunctionName (for Protective Devices)
- FunctionNames (All) (for Protective Devices)
- CT Ratios (All) (for Protective Devices)
- DE_Notes (Equipment Evaluation)
- OnelineNames
- CoorEval_Notes (Coordination Evaluation)
- CoorEval_Status (Coordination Evaluation)
- #/Conductors (Cable Ampacity)
- Ampacity (NM) (Cable Ampacity)
- ArmorLayLengthFactor (Cable Ampacity)
- ArmorThickness (Cable Ampacity)
- ArmorType (Cable Ampacity)
- Bedding Rho (Cable Ampacity)
- BeddingThickness (Cable Ampacity)
- CableInstallationType (Cable Ampacity)
- CableOD (Cable Ampacity)
- CondConstructions (Cable Ampacity)
- ConductorKp (Cable Ampacity)
- ConductorKs (Cable Ampacity)
- ConductorOD (Cable Ampacity)
- DielectricLosses (Cable Ampacity)
- Insulation Rho (Cable Ampacity)
- InsulationThickness (Cable Ampacity)
- Jacket Rho (Cable Ampacity)
- JacketThickness (Cable Ampacity)
- JacketType (Cable Ampacity)
- NM Temperature (Cable Ampacity)
- Rdc (Cable Ampacity)
- RdcOption (Cable Ampacity)
- ScreenThickness (Cable Ampacity)
- SheathGroundingOption (Cable Ampacity)
- SheathLayLengthFactor (Cable Ampacity)
- SheathThickness (Cable Ampacity)
- SheathType (Cable Ampacity)
- TempAdj SC (for Cables)

- Temperature Ambient (for Cables)
- Temperature Continuous (for Cables)
- Temperature Damage (for Cables)
- Temperature LF (for Cables)
- Temperature ResistanceBase (for Cables)
- Temperature SC (for Cables)

30. New additions to the library. Refer to Readme V8.0 Lib Changes.pdf

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