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grid2

ETAP

19.0.1C

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1

06-25-2025

Base

Normal

Electrical Transient Analyzer Program

Short-Circuit Analysis

ANSI Standard

3-Phase, LG, LL, & LLG Fault Currents

1/2 Cycle Network

	Swing	V-Control	Load	Total			
Number of Buses:	1	2	6	9			
	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	3	0	0	6	0	0	9
	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Total	
Number of Machines:	3	0	0	0	6	9	

System Frequency:

Unit System:

Project Filename:

Output Filename:

60.00

English

grid2

C:\Users\owner's\Desktop\PSA PBL\grid2\grid2\Untitled.SQ1S

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Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

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Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	SWNG	11.300	11.300	1	100.00	0.00
Bus2	Load	20.000	20.000	1	100.00	30.00
Bus3	Load	20.000	20.000	1	105.00	30.00
Bus4	Load	20.000	20.000	1	106.00	30.00
Bus5	Gen.	11.000	11.000	1	100.00	0.00
Bus6	Load	20.000	20.000	1	100.00	30.00
Bus7	Load	20.000	20.000	1	100.00	30.00
Bus8	Load	20.000	20.000	1	100.00	30.00
Bus9	Gen.	55.000	55.000	1	100.00	60.00
9 Buses Total						

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

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Line/Cable/Busway Input Data

ohms or siemens per 1000 ft per Conductor (Cable) or per Phase (Line/Busway)												
Line/Cable/Busway			Length		#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
ID	Library	Size	Adj. (ft)	% Tol.								
Cable2-6	25MCUS1	750	8000.0	0.0	12	75	0.0247982	0.093		0.2861325	0.248	
Cable4-7	15MALS1	750	8000.0	0.0	12	75	0.03657	0.0497		0.11519	0.12226	
Cable_7-8	25MCUS1	750	8000.0	0.0	12	75	0.0247982	0.093		0.2861325	0.248	
Line2-3		203.	5280.0	0.0	1	75	0.1308732	0.1667548	0.000001	0.1812249	0.4952841	0.0000005
Line_3-4		203.	5280.0	0.0	1	75	0.1308732	0.1667548	0.000001	0.1812249	0.4952841	0.0000005
Line6-8		203.	5280.0	0.0	1	75	0.1308732	0.1667548	0.000001	0.1812249	0.4952841	0.0000005

Line / Cable / Busway resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift		
	ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
TR_1		100.000	11.300	20.000	6.50	34.10	0	0	0	0	0	6.50	YNd	30.00
TR_2		100.000	20.000	11.000	6.50	34.10	0	0	0	0	0	6.50	Dyn	30.00
TR_3		100.000	20.000	55.000	8.00	34.10	0	0	0	0	0	8.00	YNd	30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding									
	ID	MVA	Prim. kV	Sec. kV	Conn.	Primary				Secondary			
					Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
TR_1		100.000	11.300	20.000	D/Y					Solid			
TR_2		100.000	20.000	11.000	D/Y					Solid			
TR_3		100.000	20.000	55.000	D/Y					Solid			

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Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
TR_1	2W XFMR	Bus1	Bus2	0.19	6.50	6.50	
TR_2	2W XFMR	Bus4	Bus5	0.19	6.50	6.50	
TR_3	2W XFMR	Bus8	Bus9	0.23	8.00	8.00	
Cable2-6	Cable	Bus2	Bus6	0.41	1.55	1.60	
Cable4-7	Cable	Bus4	Bus7	0.61	0.83	1.03	
Cable_7-8	Cable	Bus7	Bus8	0.41	1.55	1.60	
Line2-3	Line	Bus2	Bus3	17.28	22.01	27.98	0.0020147
Line_3-4	Line	Bus3	Bus4	17.28	22.01	27.98	0.0020147
Line6-8	Line	Bus8	Bus6	17.28	22.01	27.98	0.0020147

Synchronous Generator Input Data

Synchronous Generator					Positive Seq. Impedance					Grounding			Zero Seq. Impedance		
					Rating										
ID	Type	MVA	kV	RPM	X''/R	% R	Adj.	Tol.	% Xd'	Conn.	Type	Amp	X/R	% R0	% X0
Gen1	Steam Turbo	192.000	11.300	1800	4.00	5.000	20.00	0.0	10.00	Wye	Solid		3.00	5.000	15.00
Gen5	Steam Turbo	128.000	11.000	1800	0.50	20.000	10.00	0.0	20.00	Wye	Solid		0.50	20.000	10.00
Gen9	Steam Turbo	141.177	55.000	1800	0.50	20.000	10.00	0.0	20.00	Wye	Solid		0.50	20.000	10.00

Total Connected Synchronous Generators (= 3): 461.177 MVA

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Lumped Load					Motor Loads										
					Impedance										
Lumped Load		Rating		% Load		Loading		X/R Ratio		(Machine Base)			Grounding		
ID		kVA	kV	MTR	STAT	kW	kvar	X"/R	X'/R	% R	% X"	% X'	Conn.	Type	Amp.
Data Center		15000.0	19.800	80	20	10200.0	6321.4	10.00	10.00	1.538	15.38	23.08	Delta		
Great Lakes Tech_Park		10000.0	19.800	80	20	6800.0	4214.3	10.00	10.00	1.538	15.38	23.08	Delta		
HOSPITAL		17000.0	19.800	80	20	11560.0	7164.2	10.00	10.00	1.538	15.38	23.08	Delta		
Sewage Treatment		15000.0	19.800	80	20	10200.0	6321.4	10.00	10.00	1.538	15.38	23.08	Delta		
Solar Farm		10000.0	19.700	80	20	6800.0	4214.3	10.00	10.00	1.538	15.38	23.08	Delta		
Water Treatment Plant		16000.0	20.000	80	20	10880.0	6742.8	10.00	10.00	1.538	15.38	23.08	Delta		
Total Connected Lumped Loads (= 6): 83000.0 kVA															

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SHORT- CIRCUIT REPORT

Fault at bus: Bus7

Prefault voltage = 20.000 kV
= 100.00 % of nominal bus kV (20.000 kV)
= 100.00 % of base kV (20.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus			kA Symm. rms		% Impedance on 100 MVA base			
				Va	Vb	Vc	Ia	3I0	R1	X1	R0	X0
Bus7	Total	0.00	39.986	0.00	144.53	150.07	11.779	11.779	3.90E+000	6.07E+000	2.03E+001	5.39E+001
Bus4	Bus7	6.08	17.067	2.54	144.25	149.32	4.701	4.281	1.09E+001	1.30E+001	4.95E+001	1.51E+002
Bus8	Bus7	11.70	21.049	7.50	143.29	145.48	6.604	7.505	6.79E+000	1.19E+001	3.40E+001	8.38E+001
Sewage Treatment	Bus7	101.01	2.286	101.01	101.01	101.01	0.494	0.000	1.26E+001	1.26E+002		
Bus3	Bus4	38.86	3.404	42.98	122.80	123.45	2.050	4.281	3.38E+001	7.21E+001	4.76E+001	1.49E+002
Bus5	Bus4	33.37	12.714	90.47	88.03	102.35	2.352	0.000	1.58E+001	1.43E+001		
Great Lakes Tech_Park	Bus4	101.01	1.432	101.01	101.01	101.01	0.312	0.000	1.88E+001	1.88E+002		
Bus6	Bus8	60.64	5.189	76.31	105.73	106.00	3.412	7.505	2.00E+001	4.51E+001	2.92E+001	7.97E+001
Bus9	Bus8	44.90	12.285	89.95	102.44	91.82	2.292	0.000	1.44E+001	1.51E+001		
Data Center	Bus8	101.01	2.029	101.01	101.01	101.01	0.442	0.000	1.26E+001	1.26E+002		
HOSPITAL	Bus8	101.01	2.299	101.01	101.01	101.01	0.501	0.000	1.11E+001	1.11E+002		
Bus2	Bus3	62.86	2.478	81.60	105.61	101.30	1.835	4.281	2.85E+001	6.67E+001	2.37E+001	8.33E+001
Solar Farm	Bus3	101.52	0.958	101.52	101.52	101.52	0.221	0.000	1.87E+001	1.87E+002		
Gen5	Bus5	100.00	23.116	100.00	100.00	100.00	4.143	0.000	1.56E+001	7.81E+000	1.56E+001	7.81E+000
Bus2	Bus6	62.86	4.190	81.60	105.61	101.30	3.170	7.505	3.55E+000	2.86E+001	5.32E+000	1.43E+001
Water Treatment Plant	Bus6	100.00	1.000	100.00	100.00	100.00	0.251	0.000	1.20E+001	1.20E+002		
Gen9	Bus9	100.00	4.467	100.00	100.00	100.00	0.655	0.000	1.42E+001	7.08E+000	1.42E+001	7.08E+000

Indicates fault current contribution is from three-winding transformers
* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Short-Circuit Summary Report

1/2 Cycle - 3-Phase, LG, LL, & LLG Fault Currents

Prefault Voltage = 100 % of the Bus Nominal Voltage

Bus		3-Phase Fault			Line-to-Ground Fault			Line-to-Line Fault			*Line-to-Line-to-Ground		
ID	kV	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.
Bus7	20.000	21.604	-33.648	39.986	4.163	-11.019	11.779	29.434	11.173	31.483	-31.435	-8.263	32.503

All fault currents are symmetrical (1/2 Cycle network) values in rms kA.
* LLG fault current is the larger of the two faulted line currents.

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Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus7	20.000	0.15602	0.24300	0.28877	0.06943	0.35091	0.35772	0.81379	2.15715	2.30555	0.00000	0.00000	0.00000

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Sequence-of-Operation Event Summary Report

Symmetrical 3-Phase Fault at Bus7.

Time (ms)	ID	If (kA)	T1 (ms)	T2 (ms)	Condition
2.1	Relay3	12.714	2.1		Phase - OC1 - 50
2.1	Relay4	17.067	2.1		Phase - OC1 - 50
2.1	Relay6	12.285	2.1		Phase - OC1 - 50
20.0	Relay1		20.0		Phase - 87
20.0	Relay4		20.0		Phase - 87
20.0	Relay5		20.0		Phase - 87
52.1	CB_4		50.0		Tripped by Relay3 Phase - OC1 - 50
85.4	CB_3		83.3		Tripped by Relay3 Phase - OC1 - 50
85.4	CB_5		83.3		Tripped by Relay4 Phase - OC1 - 50
85.4	CB_12		83.3		Tripped by Relay6 Phase - OC1 - 50
85.4	CB_13		83.3		Tripped by Relay6 Phase - OC1 - 50
99.4	Relay1	6.655	99.4		Phase - OC1 - 51
99.4	Relay3	12.714	99.4		Phase - OC1 - 51
99.4	Relay4	17.067	99.4		Phase - OC1 - 51
99.4	Relay6	12.285	99.4		Phase - OC1 - 51
103	CB_1		83.3		Tripped by Relay1 Phase - 87
103	CB_2		83.3		Tripped by Relay1 Phase - 87
103	CB_5		83.3		Tripped by Relay4 Phase - 87
103	CB_10		83.3		Tripped by Relay5 Phase - 87
149	CB_4		50.0		Tripped by Relay3 Phase - OC1 - 51
183	CB_1		83.3		Tripped by Relay1 Phase - OC1 - 51
183	CB_2		83.3		Tripped by Relay1 Phase - OC1 - 51
183	CB_3		83.3		Tripped by Relay3 Phase - OC1 - 51
183	CB_5		83.3		Tripped by Relay4 Phase - OC1 - 51
183	CB_12		83.3		Tripped by Relay6 Phase - OC1 - 51
183	CB_13		83.3		Tripped by Relay6 Phase - OC1 - 51