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:	1	0	0	9	0	0	10

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Total
Number of Machines:	3	0	0	0	9	12

System Frequency:	60.00
Unit System:	English
Project Filename:	grid1
Output Filename:	C:\Users\owner's\Desktop\PSA PBL\grid1\grid1\Untitled.SQ1S

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	

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	SWNG	11.330	11.330	1	100.00	0.00
Bus_2	Load	11.330	11.330	1	97.56	0.00
Bus_3	Gen.	11.300	11.330	1	100.00	0.00
Bus_4	Load	11.330	11.330	1	98.09	4.73
Bus_5	Load	11.220	11.330	1	98.19	0.00
Bus_6	Load	11.300	11.330	1	100.30	0.00
Bus_7	Load	11.132	11.330	1	98.76	9.68
Bus_8	Load	11.176	11.330	1	98.53	0.00
Bus_9	Gen.	10.000	10.027	1	100.00	-30.00

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.

Line/Cable/Busway Input Data

ohms or siemens per 1000 ft per Conductor (Cable) or per Phase (Line/Busway)

Line/Cable/Busway			Length									
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
Cable3	15MALS1	750	2000.0	0.0	12	75	0.03657	0.0497		0.11519	0.12226	
Line1		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line4		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line6		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line8		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line10		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line12		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line14		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	0.0000005
Line16		319.	5280.0	0.0	1	75	0.0495098	0.161438	0.0000009	0.1005576	0.4890753	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
T1	100.000	11.300	10.000	10.00	20.10	0	0	0	0	0	10.00	Dyn	30.00

2-Winding Transformer Grounding Input Data

Transformer	Rating			Conn.	Grounding							
					Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	ohm	Type	kV	Amp	ohm
T1	100.000	11.300	10.000	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
T1	2W XFMR	Bus_6	Bus_9	0.49	9.93	9.95	
Cable3	Cable	Bus_5	Bus_8	0.47	0.65	0.80	
Line1	Line	Bus_2	Bus_3	20.36	66.40	69.45	0.0006382
Line4	Line	Bus1	Bus_2	20.36	66.40	69.45	0.0006382
Line6	Line	Bus1	Bus_4	20.36	66.40	69.45	0.0006382
Line8	Line	Bus_4	Bus_7	20.36	66.40	69.45	0.0006382
Line10	Line	Bus_7	Bus_8	20.36	66.40	69.45	0.0006382
Line12	Line	Bus_2	Bus_5	20.36	66.40	69.45	0.0006382
Line14	Line	Bus_3	Bus_5	20.36	66.40	69.45	0.0006382
Line16	Line	Bus_3	Bus_6	20.36	66.40	69.45	0.0006382

Synchronous Generator Input Data

Synchronous Generator		Rating			Positive Seq. Impedance					Grounding			Zero Seq. Impedance		
							% Xd"								
ID	Type	MVA	kV	RPM	X"/R	% R	Adj.	Tol.	% Xd'	Conn.	Type	Amp	X/R	% R0	% X0
Gen1	Steam Turbo	117.647	11.330	1800	1.00	10.000	10.00	0.0	9.00	Wye	Solid		34.10	0.293	10.00
Gen2	Steam Turbo	94.118	11.300	1800	20.10	0.498	10.00	0.0	8.00	Wye	Solid		30.00	0.333	10.00
Gen4	Steam Turbo	141.177	10.000	1800	20.10	0.498	10.00	0.0	7.00	Wye	Solid		20.00	0.500	10.00

Total Connected Synchronous Generators (= 3): 352.941 MVA

Lumped Load Input Data

Lumped Load	Lumped Load				Motor Loads									
	Rating		% Load		Loading		X/R Ratio		Impedance (Machine Base)			Grounding		
ID	kVA	kV	MTR	STAT	kW	kvar	X"/R	X'/R	% R	% X"	% X'	Conn.	Type	Amp.
Airport	1206.0	10.600	80	20	820.1	508.2	6.67	6.67	2.307	15.38	23.08	Delta		
Bank	300.0	10.870	80	20	204.0	126.4	6.67	6.67	2.307	15.38	23.08	Delta		
Biscuit Factory	1400.0	10.000	80	20	952.0	590.0	6.67	6.67	2.307	15.38	23.08	Delta		
EV_CHARGING Station	500.0	10.500	80	20	340.0	210.7	6.67	6.67	2.307	15.38	23.08	Delta		
Global Tech Park	300.0	10.500	80	20	204.0	126.4	6.67	6.67	2.307	15.38	23.08	Delta		
Power plant	300.0	10.000	80	20	204.0	126.4	6.67	6.67	2.307	15.38	23.08	Delta		
R_HOUSE1	980.0	10.500	80	20	666.4	413.0	6.67	6.67	2.307	15.38	23.08	Delta		
R_HOUSE2	800.0	10.800	80	20	544.0	337.1	6.67	6.67	2.307	15.38	23.08	Delta		
Wind Farm	1500.0	10.000	80	20	1020.0	632.1	10.00	10.00	1.538	15.38	23.08	Delta		

Total Connected Lumped Loads (= 9): 7286.0 kVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus_5**

Prefault voltage = 11.220 kV = 100.00 % of nominal bus kV (11.220 kV)
= 99.03 % of base kV (11.330 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 Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus_5	Total	0.00	13.381	0.00	125.76	121.89	8.308	8.308	1.06E+001	3.62E+001	2.09E+001	1.06E+002
Bus_8	Bus_5	0.41	2.583	0.38	126.23	122.25	1.565	1.416	6.02E+001	1.86E+002	1.26E+002	6.22E+002
Bus_2	Bus_5	58.09	4.262	61.66	106.63	104.80	2.709	2.788	3.56E+001	1.13E+002	6.25E+001	3.16E+002
Bus_3	Bus_5	84.53	6.186	89.62	99.77	99.24	3.889	4.103	2.15E+001	7.87E+001	4.18E+001	2.15E+002
Airport	Bus_5	105.85	0.358	105.85	105.85	105.85	0.145	0.000	2.09E+002	1.40E+003		
Bus_7	Bus_8	32.19	2.292	33.21	117.23	114.31	1.447	1.416	7.16E+001	2.07E+002	1.25E+002	6.21E+002
R_HOUSE1	Bus_8	106.86	0.295	106.86	106.86	106.86	0.120	0.000	2.53E+002	1.69E+003		
Bus_3	Bus_2	84.53	1.934	89.62	99.77	99.24	1.183	1.315	2.06E+001	1.06E+002	4.26E+001	2.45E+002
Bus1	Bus_2	89.52	2.315	95.41	98.30	97.60	1.515	1.473	3.71E+001	8.22E+001	4.19E+001	2.18E+002
Power plant	Bus_2	112.20	0.041	112.20	112.20	112.20	0.016	0.000	7.49E+002	4.99E+003		
Bus_6	Bus_3	96.55	0.889	94.48	101.31	100.42	0.358	0.000	2.12E+001	8.33E+001		
Gen2	Bus_3	99.29	7.218	99.29	99.29	99.29	4.710	5.419	5.26E-001	1.06E+001	3.52E-001	1.06E+001
EV_CHARGING Station	Bus_3	106.86	0.023	106.86	106.86	106.86	0.009	0.000	4.95E+002	3.30E+003		
Bus_4	Bus_7	60.79	2.140	64.10	106.30	104.48	1.386	1.416	5.71E+001	1.50E+002	8.32E+001	4.20E+002
R_HOUSE2	Bus_7	103.89	0.156	103.89	103.89	103.89	0.062	0.000	3.27E+002	2.18E+003		
Bus_4	Bus1	60.79	2.108	64.10	106.30	104.48	1.374	1.416	1.73E+001	1.84E+001	4.77E-001	1.73E+001
Gen1	Bus1	99.03	4.421	99.03	99.03	99.03	2.888	2.889	8.50E+000	8.50E+000	2.49E-001	8.50E+000
Bus_9	Bus_6	98.16	0.886	99.01	98.87	99.28	0.357	0.000	8.47E-001	1.69E+001		
Global Tech Park	Bus_6	106.86	0.003	106.86	106.86	106.86	0.001	0.000	8.25E+002	5.51E+003		

\# 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.
Bus_5	11.220	3.761	-12.842	13.381	1.883	-8.091	8.308	11.334	3.243	11.789	10.683	6.116	12.309

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.

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
Bus_5	11.220	0.13605	0.46459	0.48410	0.12577	0.45041	0.46764	0.26849	1.36338	1.38956	0.00000	0.00000	0.00000

Sequence-of-Operation Event Summary Report

Symmetrical 3-Phase Fault at Bus_5.

Time (ms)	ID	If (kA)	T1 (ms)	T2 (ms)	Condition
20.0	Relay2		20.0		Phase - 87
103	T1_HS2		83.3		Tripped by Relay2 Phase - 87
103	T1_LS2		83.3		Tripped by Relay2 Phase - 87