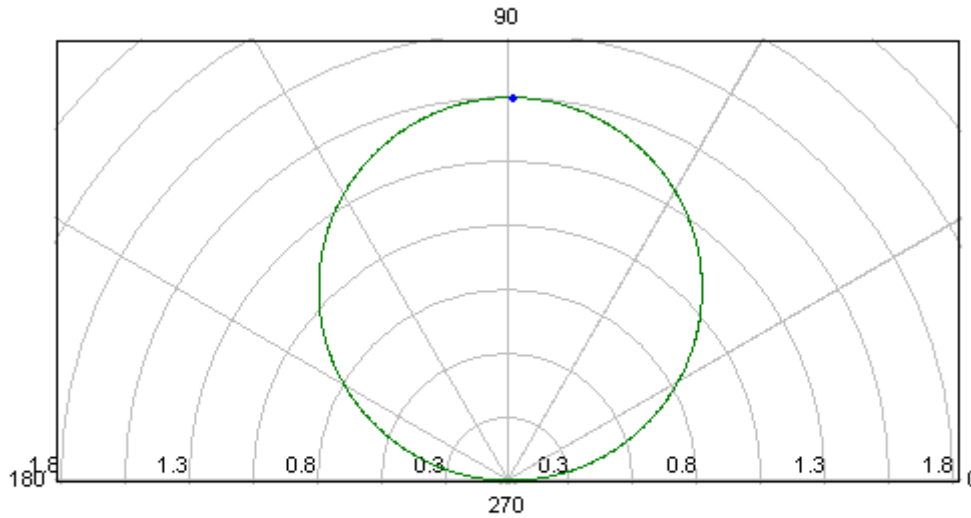


Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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21 Element Tests .21P1P Pickup Test

21P1P Pickup Test



■ 21P1P Theoretical Character
 ■ 21P1P Pickup Point

Impedance (Ohms)	CalcZ (Ohms)	Error (%)	MinRange (Ohms)	MaxRange (Ohms)	Pass/Fail
1.492	1.500	-0.52	1.325	1.675	Pass

21 Element Tests .21P1P Timing Test

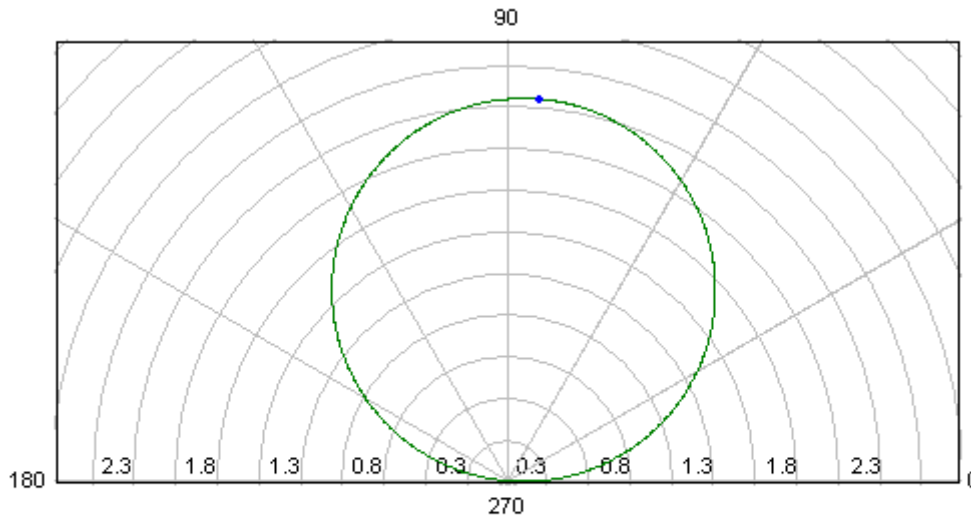
Time (Seconds)	ExpectedTime	MinRange (Seconds)	MaxRange (Seconds)	Error (%)	Pass/Fail
0.2818	0.250	0.246	0.287	19.40	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010	
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21 Element Tests .21P2P Pickup Test

21P2P Pickup Test



■ 21P2P Theoretical Character
 ■ 21P2P Pickup Point

Impedance (Ohms)	CalcZ (Ohms)	Error (%)	MinRange (Ohms)	MaxRange (Ohms)	Pass/Fail
2.292	2.300	-0.37	2.085	2.515	Pass

21 Element Tests .21P2P Timing Test

Time (Seconds)	ExpectedTime	MinRange (Seconds)	MaxRange (Seconds)	Error (%)	Pass/Fail
1.0340	1.000	0.995	1.038	5.07	Pass

24 Element Tests.Timing Tests (24CCS = DD).24D2D1 Timing Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail	TestVolts
60.0356	60.0000	0.09	59.9358	61.2892	Pass	73.35

Relay Results Report

Region: EXCEL Substation: FT ST VRRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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24 Element Tests.Timing Tests (24CCS = DD).24D2D2 Timing Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail	TestVolts
5.9948	6.0000	0.19	5.9898	6.0352	Pass	86.18

32 Element Tests.32P1P Pickup Test

Pickup	Expected_PU	Error	MinRange	MaxRange	Pass/Fail
0.016	0.016	0.01	0.016	0.024	Pass

32 Element Tests.32P1D Timing Test

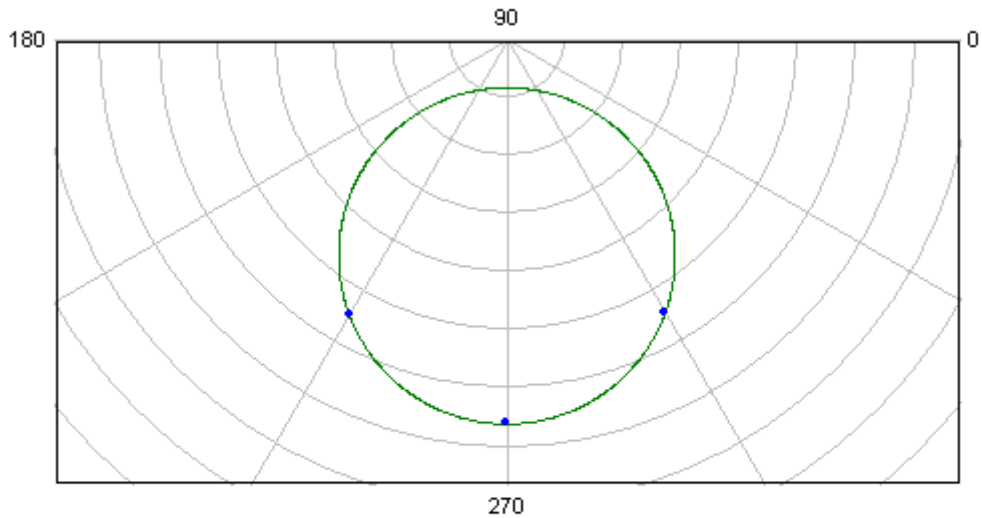
Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
5.0557	5.0000	1.11	4.9908	5.1342	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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40 Element Tests.40Z1P Charac Test

40Z1P Characteristic Test



■ 40Z1P Theoretical Character
 ■ Z1 Characteristic Plot Points

Impedance (Ohms)	CalcZ (Ohms)	Error (%)	MinRange (Ohms)	MaxRange (Ohms)	Pass/Fail
13.464	13.51	-0.32	12.83	14.18	Pass
16.289	16.40	-0.68	15.58	17.22	Pass
13.435	13.51	-0.53	12.83	14.18	Pass

40 Element Tests.40Z1P Delay Test

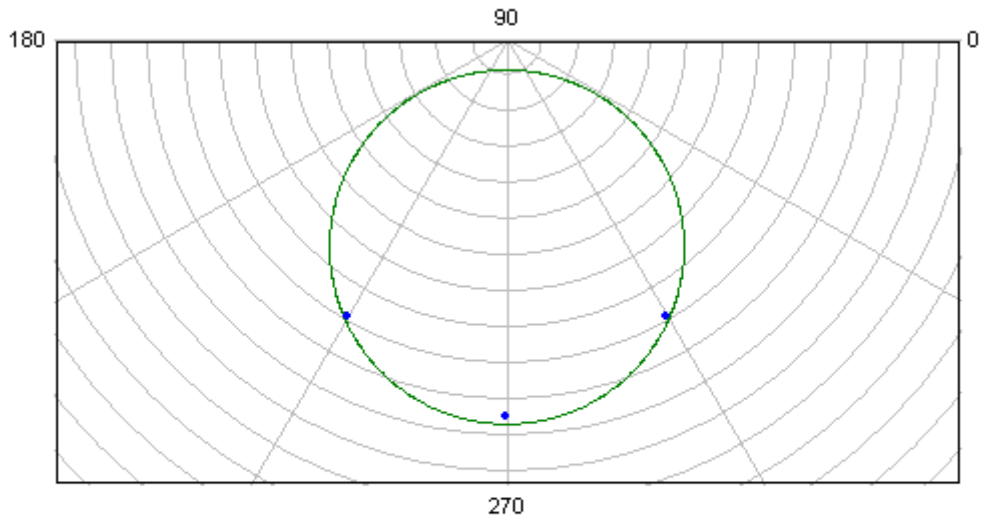
Time (Seconds)	Expected_Time (Seconds)	MinRange (Seconds)	MaxRange (Seconds)	Error (%)	Pass/Fail
0.087	0.050	0.046	0.104	74.00	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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40 Element Tests.40Z2P Charac Test

40Z2P Characteristic Test



■ 40Z2P Theoretical Character
 ■ Z2 Characteristic Plot Points

Impedance (Ohms)	CalcZ (Ohms)	Error (%)	MinRange (Ohms)	MaxRange (Ohms)	Pass/Fail
21.939	22.31	-1.65	21.19	23.42	Pass
25.957	26.50	-2.05	25.17	27.83	Pass
21.939	22.31	-1.65	21.19	23.42	Pass

40 Element Tests.40Z2P Delay Test

Time (Seconds)	Expected_Time (Seconds)	MinRange (Seconds)	MaxRange (Seconds)	Error (%)	Pass/Fail
0.538	0.500	0.495	0.555	7.66	Pass

46 Element Tests.46Q2 Pickup Test

PickupCurrent (Amps)	CalcPickup (Amps)	MinRange (Amps)	MaxRange (Amps)	Error (%)	Pass/Fail
0.347	0.35	0.34	0.36	-1.51	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010	
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46 Element Tests.46 Inv Timing Test

%_Neg_Seq (%)	PulsarTimeA (Seconds)	Expected_Time (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
100.00	4.7171	4.7000	0.36	4.51	4.94	Pass

27/59 Element Tests.27P1 Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
28.56	28.60	-0.14	27.07	30.13	Pass

27/59 Element Tests.27P2 Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
41.17	41.30	-0.33	39.13	43.47	Pass

27/59 Element Tests.27PP1 Pickup Test (Phase-Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
79.87	82.50	-3.19	78.38	86.63	Pass

27/59 Element Tests.27PP2 Pickup Test (Phase-Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
98.58	99.00	-0.42	93.95	104.05	Pass

27/59 Element Tests.59P1P Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
76.21	76.20	0.01	72.29	80.11	Pass

27/59 Element Tests.59P2P Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
74.63	74.60	0.05	70.87	78.33	Pass

27/59 Element Tests.59PP1 Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
126.59	126.50	0.07	120.18	132.83	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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27/59 Element Tests.59PP2 Pickup Test (Single Phase)

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
121.17	121.00	0.14	114.95	127.05	Pass

64 Element Tests.64G1 Pickup Test

Pickup (Volts)	ExpectedPU (Volts)	Error (%)	MinRange (Volts)	MaxRange (Volts)	Pass/Fail
9.99	10.00	-0.10	9.50	10.50	Pass

64 Element Tests.64G1T Timing Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail	TestVolts
0.776	0.750	3.47	0.720	0.787	Pass	12.00

81 Element Tests.81D1P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
59.404	59.400	0.00	59.390	59.410	Pass

81 Element Tests.81D1DTiming Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
180.0372	180.0000	0.02	179.7838	181.8362	Pass

81 Element Tests.81D2P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
58.403	58.400	0.00	58.390	58.410	Pass

81 Element Tests.81D2DTiming Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
30.1082	30.0000	0.36	29.9338	30.3362	Pass

81 Element Tests.81D3P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
57.801	57.800	0.00	57.790	57.810	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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81 Element Tests.81D3DTiming Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
7.5888	7.5000	1.18	7.4563	7.6112	Pass

81 Element Tests.81D4P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
57.293	57.300	-0.00	57.290	57.310	Pass

81 Element Tests.81D4DTiming Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
0.8424	0.7500	12.32	0.7130	1.1195	Pass

81 Element Tests.81D5P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
60.599	60.600	-0.00	60.590	60.610	Pass

81 Element Tests.81D5DTiming Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
180.0825	180.0000	0.05	179.7838	181.8362	Pass

81 Element Tests.81D6P Pickup Test

Pickup (Hz)	Expected_Pickup (Hz)	Error (%)	MinRange (Hz)	MaxRange (Hz)	Pass/Fail
61.598	61.600	-0.00	61.590	61.610	Pass

81 Element Tests.81D6D Timing Test

Time (Seconds)	ExpectedTime (Seconds)	Error (%)	MinRange (Seconds)	MaxRange (Seconds)	Pass/Fail
30.0527	30.0000	0.18	29.9338	30.0662	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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87_W1 Diff. Min Pickup PH a

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.330	1.220	1.420	Pass

87_W1 Diff. Min Pickup PH b

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.330	1.220	1.420	Pass

87_W1 Diff. Min Pickup PH c

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.325	1.220	1.420	Pass

87_W1 Diff. Time Delay PH a

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.980	1.00	2.31	0.00	3.00	Pass

87_W1 Diff. Time Delay PH b

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.980	1.00	2.65	0.00	3.00	Pass

87_W1 Diff. Time Delay PH c

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.980	1.00	2.36	0.00	3.00	Pass

87_W2 Diff. Min Pickup PH A

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.325	1.220	1.420	Pass

87_W2 Diff. Min Pickup PH B

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.325	1.220	1.420	Pass

Relay Results Report

Region: EXCEL Substation: FT ST VRAIN Line: STG PROTECTION	GENERATOR	Relay: STG SEL-300G Device: SEL-300G Tested By: Josh Date Tested: 04/22/2010
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87_W2 Diff. Min Pickup PH C

Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
1.320	1.320	1.220	1.420	Pass

87_W2 Diff. Time Delay PH A

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.980	1.00	2.61	0.00	3.00	Pass

87_W2 Diff. Time Delay PH B

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.452	1.00	2.80	0.00	3.00	Pass

87_W2 Diff. Time Delay PH C

Ic (Amps)	Expected (Cycles)	Test_Time (Cycles)	Min_Time (Cycles)	Max_Time (Cycles)	Pass/Fail
1.452	1.00	2.78	0.00	3.00	Pass

87 Slope PH A 300G

Ia (Amps)	Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
4.00	7.50	7.51	7.35	7.65	Pass

87 Slope PH B 300G

Ia (Amps)	Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
4.00	7.50	7.50	7.35	7.65	Pass

87 Slope PH C 300G

Ia (Amps)	Expected (Amps)	Pickup (Amps)	Min_Range (Amps)	Max_Range (Amps)	Pass/Fail
4.00	7.50	7.50	7.35	7.65	Pass