



Patnode Substation

Relay Settings Basis

For The

**MARBLE RIVER WIND FARM & PATNODE
INTERCONNECTION SUBSTATION PROJECT**

April 10, 2012

Prepared For

NYPA and MARBLE RIVER, LLC

Revision	Date	By	Approved By
A	3/20/12	JK	LAM
0	4/10/12	JK	RJ

1. INTRODUCTION

The Patnode Substation is being constructed for the interconnection of Horizon Wind Energy's Marble River Wind Farm which consists of 73 wind turbine generators (WTGs) each with a nominal rating of 3.0MW for a total generation capacity of 219MW. Patnode Substation will be operated by NYPA when complete. TRC is providing protective relay settings for all relays other than those for line protection at Patnode Substation. This document provides the criteria used by TRC to complete the relay settings. A separate document provides the relay setting criteria for the Marble River Wind Farm collector substation.

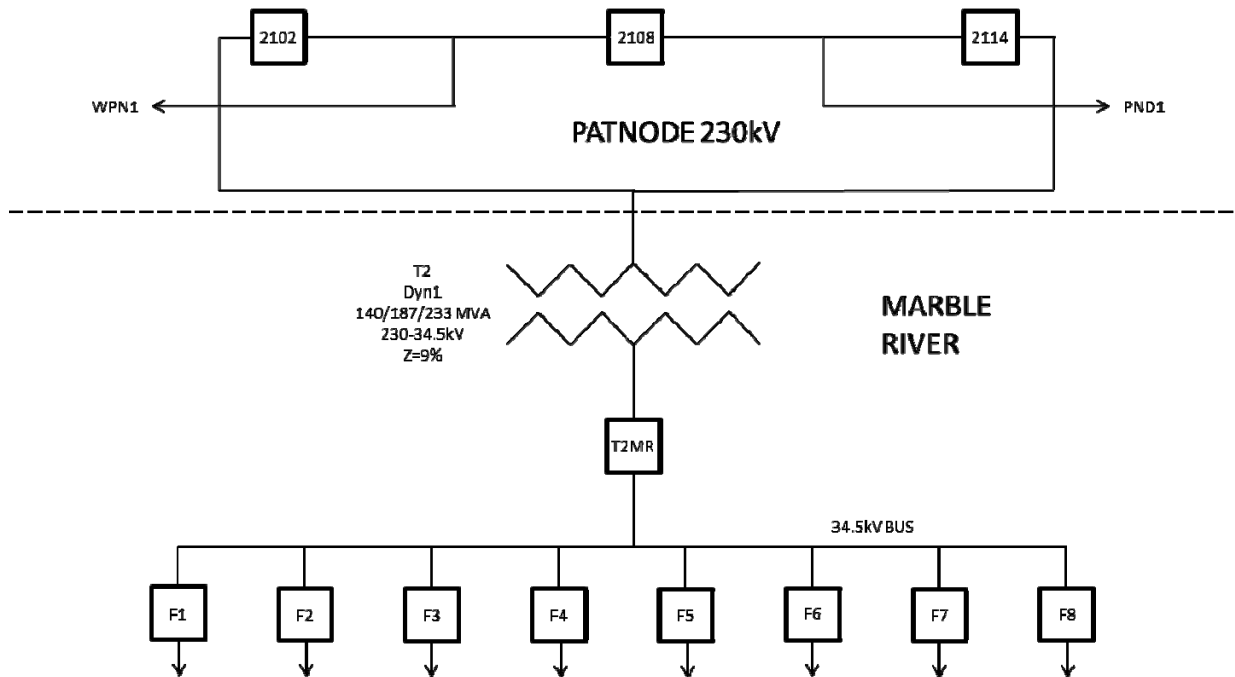


Figure 1: System Overview Diagram

2. **CRITICAL NOTES AND ASSUMPTIONS**

- 2.1 TRC is only responsible for protective relays settings in Patnode Substation for breaker failure, bus protection, and transformer protection. Relay settings for WPN1 or PND1 transmission line protection are provided by NYPA.
- 2.2 All impedance and short circuit contribution information in the supplied short circuit model used for calculating relay settings is based on Horizon/EDPR information supplied to the date of this document. Short circuit model information can be found in the Marble River Settings Basis document.
- 2.3 All protective equipment for T2 and the 230kV system is located in the Patnode Substation control house. All other protective equipment is located in the Marble River Wind Farm collector station control house and documented in the Marble River Settings Basis document.
- 2.4 NYPA has provided setting guidance and set points for the 230kV breaker reclosing and sync-check relays. TRC has completed documentation of these settings and included them in this document.

3. **PROTECTION OVERVIEW**

- 3.1 The following table lists the protective devices covered by this document. The name, model, brief description, and protective functions are provided. Refer to relay calculations section for more detailed information.

Relay	Relay Type	Relay Description	Protective Elements	Element Function
87TBP/T2	7UT613	230kV Bus 2BE and T2 Differential/Overcurrent Protection Relay	87T 50H 50HN 51H	Bus and transformer differential Phase IOC Gnd IOC Phase TOC

			51NH 59N	Gnd TOC Gnd OV
87TP/T2	SEL-587	T2 Differential/Overcurrent Protection Relay	87T 50H 50HN 51H 51HN 51L 51LN	Transformer differential Phase IOC Gnd IOC Phase TOC Gnd TOC 34.5kV Phase TOC 34.5kV Gnd TOC
87TS/T2	GE-T60	T2 Differential/Overcurrent Protection Relay	87T 50H 50HN 51H 51HN 51L 51N 59N	Transformer differential Phase IOC Gnd IOC Phase TOC Gnd TOC 34.5kV Phase TOC 34.5kV T2 Gnd TOC Gnd OV
87BS/2BE	SEL-587Z	230kV Bus 2BE Differential Relay	87B	High impedance bus differential
50/62BFP/2102	7SJ61	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer
50/62BFP/2108	7SJ61	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer
50/62BFP/2114	7SJ61	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer
50/62BFS/2102	GE-C60	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer
50/62BFS/2108	GE-C60	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer
50/62BFS/2114	GE-C60	Breaker Failure Relay	50FD 62BF	Phase and Gnd Fault Det. Timer

Table 1: Protective Device Overview

3.2 The following table lists the lock out relays covered by this document. The name and description of operation are provided.

Lockout Relay	Function	Tripped By	Trips	Blocks	Comments
86TBP/T2	87TBP/T2 Lockout	87TBP/T2	2102-TC1 2114-TC1 T2MR	2102 2114 T2MR	Gnd OV element trips T2MR directly. Initiates BF
86TP/T2	87TP/T2 Lockout	87TP/T2	2102-TC1 2114-TC1 T2MR	2102 2114 T2MR	Initiates BF
86TS/T2	87TS/T2 Lockout	87TS/T2	2102-TC2 2114-TC2 T2MR	2102 2114 T2MR	Gnd OV element trips T2MR directly. Initiates BF
86BS/T2	87BS/2BE Lockout	87BS/2B3	2102-TC2 2114-TC2 T2MR	2102 2114 T2MR	Initiates BF
86BFP/2102	50/62BFP/2102 Lockout	50/62BFP/2102	2108-TC1 2114-TC1 T2MR DTT-P/WPN1	2108 2114 T2MR	
86BFP/2108	50/62BFP/2108 Lockout	50/62BFP/2108	2102-TC1 2114-TC1 DTT-P/PND1 DTT-P/WPN1	2102 2114	
86BFP/2114	50/62BFP/2114 Lockout	50/62BFP/2114	2102-TC1 2108-TC1 T2MR DTT-P/PND1	2102 2108 T2MR	
86BFS/2102	50/62BFS/2102 Lockout	50/62BFS/2102	2108-TC2 2114-TC2 T2MR DTT-S/WPN1	2108 2114 T2MR	
86BFS/2108	50/62BFS/2108 Lockout	50/62BFS/2108	2102-TC2 2114-TC2 DTT-S/PND1	2102 2114	

			DTT-S/WPN1		
86BFS/2114	50/62BFS/2114 Lockout	50/62BFS/2114	2102-TC2 2108-TC2 T2MR DTT-S/PND1	2102 2108 T2MR	

Table 2: Lock Out Relay Overview

3.3 The following table summarizes sync-check and reclosing relays

Relay	Relay Type	Relay Description	Protective Elements	Element Function
79/2102	BE1-79M	Reclosing Relay	NA	Single Shot Reclosing
79/2108	BE1-79M	Reclosing Relay	NA	Single Shot Reclosing
79/2114	BE1-79M	Reclosing Relay	NA	Single Shot Reclosing
25/27/2102	MLJ	Syn-Check & Voltage Relay	NA	Sync Check (HB/DL for certain operational conditions)
25/27/2108	MLJ	Syn-Check & Voltage Relay	NA	Sync & LL/DB Checks
25/27/2114	MLJ	Syn-Check & Voltage Relay	NA	Sync Check (LL/DB for certain operational conditions)

Table 3: Control Relays Overview

4. Relay Calculations

- 4.1 Relay calculations documents only show utilized settings.
- 4.2 All fault current values used for the relay calculations are based on information available as of the date of this document.
- 4.3 Any changes shall be approved by the settings engineer before record document is issued.

PATNODE

87TBP/T2

STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
ENG: **JK/TRC**

RELAY USED FOR 2BE AND T2 DIFFERENTIAL AND OVERCURRENT PROTECTION

DEVICE CONFIGURATION

0103 Setting Group Change Option	Disabled	NOT USED
0105 Protection Object	3ph Trans.	
0112 87 Differential Protection	Enabled	
0117 Cold Load Pickup	Disabled	NOT USED
0120 50/51	TOC ANSI	Phase Overcurrent for 230kV Only
0130 50/51#2	Disabled	NOT USED
0132 50/51#3	Disabled	NOT USED
0122 50N/51N	TOC ANSI	Residual Ground OC for 230kV Only
0134 50/51N#2	Disabled	NOT USED
0136 50/51N#3	Disabled	NOT USED
0124 50G/51G	Disabled	NOT USED
0138 50/51G#2	Disabled	NOT USED
0142 49 Thermal Overload Protection	Disabled	NOT USED
0144 49#2 Thermal Overload Protection	Disabled	NOT USED
0143 24 Overexcitation	Disabled	NOT USED
0150 32R Reverse Power	Disabled	NOT USED
0151 32F Forward Power	Disabled	NOT USED
0152 27 Undervoltage	Disabled	NOT USED
0153 59 Overvoltage	Disabled	NOT USED
0156 81 O/U Frequency	Disabled	NOT USED
0180 Disconnect Meas. Location	Disabled	NOT USED
0181 Measured Values Supervision	Disabled	NOT USED
0186 External Trip Function 1	Disabled	NOT USED
0187 External Trip Function 2	Disabled	NOT USED
Flexible Functions	Enable #1	Used for Ground Fault Overvoltage (59N)

CONFIGURATION: BINARY INPUTS

BINARY INPUTS NOT USED

CONFIGURATION: BINARY OUTPUTS

STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
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Binary Output 1- 6	Type	SPARE	
	Conf.		
Binary Output 7	Type	87, 50-1, 51, 50N-1, 51N	Trip 86TBP/T2
	Conf.	OUT	All are outputs of 7UT613 Protection
		U	Not latched, output trips LOR
Binary Output 8	Type	59N	Trip T2MR
	Conf.	OUT	
		U	Not latched

CONFIGURATION: LEDS

LED 1	Type	RELAY PICKUP
	Conf.	OUT
		L
LED 2	Type	87 TRIP
	Conf.	OUT
		L
LED 3	Type	87 A PH TRIP
	Conf.	OUT
		L
LED 4	Type	87 B PH TRIP
	Conf.	OUT
		L
LED 5	Type	87 C PH TRIP
	Conf.	OUT
		L
LED 6	Type	50H TRIP
	Conf.	OUT
		L
LED 7	Type	50HN TRIP
	Conf.	OUT
		L
LED 8	Type	50BF LOGIC TRIP
	Conf.	OUT
		L
LED 9	Type	51H TRIP
	Conf.	OUT
		L
LED 10	Type	51HN TRIP
	Conf.	OUT
		L
LED 11	Type	59N TRIP
	Conf.	OUT
		L
LED 12	Type	Test Mode
	Conf.	IntSP
		U
LED 13	Type	Various Relay Alarms
		OUT

STATION:

DEVICE:

DATE:

LINE:

RELAY:

FID:

ENG:

	Conf.	U
LED 14		Protection Config. Error
	Type	OUT
	Conf.	U

CONFIGURATION: SYSTEM INTERFACE

LEAVE AT DEFAULT

INTERFACE: SERIAL INTERFACE ON PC

Address	
Frame	
Baud Rate	
COM Interface	
Apply Settings	

INTERFACE: VD ADDRESSES

VD Address	
SIPROTEC SYS VD Address	
Proxy VD Address	
SIPROTEC T103 VD Address	

INTERFACE: OPERATOR INTERFACE

DIGSI Link Address	
Frame	
Baud Rate	
Max gap	
IP Address	
Subnet Mask	
Link Layer	
Access Authorization	
Access Rights	

INTERFACE: SERVICE INTERFACE

DIGSI Link Address	
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STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
ENG: **JK/TRC**

Frame
Baud Rate
Max gap
IP Address
Subnet Mask
Link Layer
Access Authorization
Access Rights

INTERFACE: IEC 103 ON DEVICE

NOT USED - LEAVE AT DEFAULT

GENERAL DEVICE SETTINGS

0610 Fault Display **Disp. Tar. All PU**
0640 Start Image **Image 1**

POWER SYSTEM DATA

0211 Number of Connected Meas. Loc **3** CTs are connected at breakers 2102, 2114, and T2MR
0212 Number of Assigned Meas. Loc **3** All CTs are used
0213 Number of Sides **2** Choose two sides for two winding transformer
0201 Assignment of CT to Sides **S1:M1+M2 S2:M3** This assigns S1 to 230kV CTs and S2 to 34.5kV CT.
0251 Aux CT IX1 **Not Conn.**
0252 Aux CT IX2 **Not Conn.**
0253 Aux CT IX3 **Not Conn.**
0255 Type Aux CT **1A/5A** REQUIRED SETTING, NOT USED
0261 VT Va,Vb,Vc assigned **Side 1** 3ph connection to 230kV VT 2144
0262 VT V4 assigned **Not Conn** NOT USED
0263 VT V4 used as **Vdelta** REQUIRED SETTING, NOT USED
0270 Rated Frequency **60** Hz
0271 Phase Sequence **ABC**
0276 Unit of Temperature **F** Degrees
0311 Rated Primary Voltage S1 **230** kV
0312 Rated Apparent Power of S1 **233** MVA

STATION: **PATNODE**
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LINE: **BUS 2BE & T2**
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0313 Starpoint of S1	Isolated	High side winding is Delta connected
0314 Transf. Winding Connection S1	Delta	
0321 Rated Primary Voltage S2	34.5	kV
0322 Rated Apparent Power of S2	233	MVA
0323 Starpoint of S2	Grounded	Low side winding is Wye connected
0324 Transf. Winding Connection S2	Wye	
0325 Vector Group Numeral S2	1	Dyn1 Transformer
0420 50/51 assigned to	S1	50/51 for 230kV side only
0422 50N/51N assigned to	S1	50/51N for 230kV side only
0511 CT1 Starpoint in direction of object	Yes	M1, BKR 2102 CT
0512 CT1 Primary Current	2000	
0513 CT1 Secondary Current	5	
0521 CT2 Starpoint in direction of object	Yes	M2, BKR 2114 CT
0522 CT2 Primary Current	2000	
0523 CT3 Secondary Current	5	
0531 CT3 Starpoint in direction of object	Yes	M3, BKR T2MR CT
0532 CT3 Primary Current	4000	
0533 CT3 Secondary Current	5	
0801 Rated Pri. Voltage	230	kV Enter Phase-Phase voltage
0812 Rated Sec. Voltage	111	V Vsec must be >=80 and <=125
0817 Angle correction	0	Only required if power protection is used, not for OV/UV protection

SETTINGS GROUPS: POWER SYSTEM DATA 2

1111 Pole Open Threshold S1 **0.17** Required for relay to unblock protection functions

Set per Section 2.1, page 99 in 7UT613 manual

Ip	2000 CT primary rating
T2 MVA	233 T2 max rating
Ins	585 Current at 230kV
Ip/Ins	3.419499
Margin	120%
Set >=	0.164136

1112 Pole Open Threshold S2 **0.05** Required for relay to unblock protection functions

Set per Section 2.1, page 99 in 7UT613 manual

Ip	4000 CT primary rating
T2 MVA	233 T2 max rating
Ins	3899 Current at 34.5kV
Ip/Ins	1.02585
Margin	120%

STATION: **PATNODE**

DEVICE: **87TBP/T2**

DATE: **4/6/2012**

LINE: **BUS 2BE & T2**

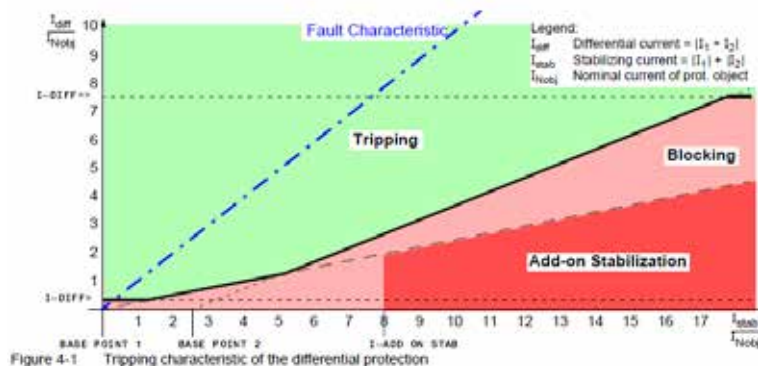
RELAY: **7UT61354DC111AC0**

FID: **V04.6 (FIELD TO VERIFY)**

ENG: **JK/TRC**

Set >= 0.049241

SETTINGS GROUPS: 87 DIFFERENTIAL PROTECTION



1201 87 Differential Protection	ON	
1205 87 Increase. Of Trip Char. During Start	OFF	
1206 87 Inrush w 2nd Harmonic Restraint	ON	
1207 87 n-th Harmonic Restraint	5th	Allow restraint for presence of 5th Harmonic
1221 87-1 Pickup Value	0.3	Restrained Differential Pickup
1226A 87-1 Time Delay	0	sec. No delay for differential trip
1231 87-2 Pickup of High Set Trip	8	Unrestrained Differential Pickup
1236 87-2 Time delay	0	sec. No delay for differential trip
1241A Slope 1	0.25	Corresponds to a 25% slope
1242A Slope 1 Base Point	0	Start slope at 0 (See diagram above)
1243A Slope 2	0.5	Corresponds to a 50% slope
1244A Slope 2 Base Point	1.5	Start slope at 1.5 (replicates IRS1=3 in SEL)
1251A I ₁ restraint Start Detection	0.1	REQUIRED SETTING, NOT USED
1252A Increase at Start Factor	1	REQUIRED SETTING, NOT USED
1253 Max. Permissible Starting Time	5	sec. Default Setting
1261A Pickup for stabilization	4	Default Setting
1262A Duration for Stabilization	15	cyc. Default Setting
1263A Duration for Stabilization Crossblock	0	cyc. Setting of zero prevents crossblocking
1271 2nd Harmonic Content	20%	
1272A Time for 2nd Harmonic Crossblock	0	cyc Setting of zero prevents crossblocking, 7UT613 manual, p.104
1276 nth Harmonic Content	35%	5th Harmonic Content
1277A Time for nth Harmonic Crossblock	0	cyc Setting of zero prevents crossblocking, 7UT613 manual, p.104

STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
ENG: **JK/TRC**

1278A Limit of nth Harm. Restr. **1.5** Default Setting, no 5th harmonic restraint above this level

SETTINGS GROUPS: 50/51 PHASE/GROUND OVERCURRENT

PHASE

2001 50, 51 Phase TOC

ON

2012 50-2 Pickup

oo

NOT USED

2013 50-2 Time Delay

oo

NOT USED

2015 50-1 Pickup

8.62

T2 50H

Set 87TBP/T2 pickup the same as 87TP/T2

50H= **21** A,sec 5040 A,pri

CTR= **240** 587 CTR

Ins= **584.88** 8.62 A,pu

SET **50-1** **8.62** A,pu
5042 A,pri

2016 50-1 Time Delay

0

sec.

2022 51 Pickup

1.6

T2 51H

Set 87TBP/T2 pickup the same as 87TP/T2

51H= **3.9** A,sec 936 A,pri

CTR= **240** 587 CTR

Ins= **584.88** 1.60 A,pu

SET **51** **1.6** A,pu
936 A,pri

2024 51 Time Dial

2.2

Test Point: 0.74s @ 500%

2025 51 Drop-Out

Instantaneous

2027 51 ANSI Curve

Mod. Inv.

2002 50/51 Inrush Restained

OFF

2008A 50/51 Manual Close Mode

Inactive

RESIDUAL GROUND

2201 50N, 51N Phase TOC

ON

2212 50N-2 Pickup

oo

NOT USED

2213 50N-2 Time Delay

oo

NOT USED

2215 50N-1 Pickup

1.23

T2 50NH

Set 87TBP/T2 pickup the same as 87TP/T2

50NH= **3** A,sec 720 A,pri

CTR= **240** 587 CTR

Ins= **584.88** 1.23 A,pu

STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
ENG: **JK/TRC**

		SET	50N-1	1.23	A _{pu}
				719	A _{pri}
2216 50N-1 Time Delay	0	sec.			
2222 51N Pickup	0.25	T2 51NH			
			Set 87TBP/T2 pickup the same as 87TP/T2		
		51NH=	0.6	A _{sec}	144 A _{pri}
		CTR=	240	587 CTR	
		Ins=	584.88	0.25 A _{pu}	
		SET	51N	0.25	A _{pu}
				146	A _{pri}
2224 51N Time Dial	1				Test Point: 0.26s @ 500%
2225 51N Drop-Out	Instantaneous				
2227 51N ANSI Curve	VERY INV.				
2202 50/51N Inrush Restained	OFF				
2208A 50/51N Manual Close Mode	Inactive				

SETTINGS GROUPS: MEASUREMENT

NOT USED - LEAVE AT DEFAULT

SETTINGS GROUPS: SUPERVISION

NOT USED - LEAVE AT DEFAULT

ADDITIONAL FUNCTIONS (01)

Used to create a 59N protection function using calculated 3V0

Measured Quantity	Voltage	Use 3ph voltage inputs from VT 2144
Function Utilizes Component	3V0	Calculate 3V0
Pickup With	Exceed Thresh.	Trip upon exceeding set 3V0 level

SETTINGS GROUPS: FLEXIBLE FUNCTION 01

Used to enable a 59N protection function using calculated 3V0

Flexible Function	ON	Enables Function
Pickup Threshold	166	

Set 59N pickup to 50% of 3V0

V _n =	111	Nominal VT connection
3V0=	333	3 times nominal
50%=	166.5	V _{pri}

STATION: **PATNODE**
DEVICE: **87TBP/T2**
DATE: **4/6/2012**

LINE: **BUS 2BE & T2**
RELAY: **7UT61354DC111AC0**
FID: **V04.6 (FIELD TO VERIFY)**
ENG: **JK/TRC**

SET **Pickup** 166 V_{pri}

Trip Delay **0** sec
Pickup Time Delay **5** sec 3V0 threshold must be present for 5.0s to issue trip
Dropout Time Delay **0.1** sec Set to clearing time of breaker plus margin (3cyc+3cyc)
Block w/loss of Voltage **YES**
Dropout Ratio **0.95** Default Value

TIME SYNCHRONIZATION

Source **IRIG B**
Fault Indication **10 Min**
Time Format **mm/dd/yy** USA Time Format
Offset to Signal **0**

Oscillographic Fault Records

0901 Waveform Capture **With Pickup**
0903 Max. Length of Capture **3** sec. Max Setting
0904 Capture Prior to Trigger **0.1** sec.
0905 Capture After Event **0.1** sec.
0906 Capture Time via Binary Input **0.5** sec. Default

CFC CHART (SEE LOGIC DIAGRAM)

NOT USED - LEAVE AT DEFAULT

PATNODE

87TP/T2

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

RELAY USED FOR T2 DIFFERENTIAL AND OVERCURRENT PROTECTION

RID= **87TP/T2**

TID= **PN T2**

MVA= **233.00** (MVA) Maximum Power Transformer Capability

VWDG1= **230.00** (kV) Winding 1 Line to Line Voltage

VWDG2= **34.50** (kV) Winding 2 Line to Line Voltage

Trans. 2 is an ANSI STD (DABY) connected delta (230 kV) high side with a solidly grounded wye (34.5 kV) low side. (140/187/233 MVA)

The high side CT's are 1200/5 connected in wye.
The low side CT's are 4000/5 connected in wye.

TRCON= **DABY** Refer to Appendix F in SEL-587 Instruction Bk.

CTCON= **YY** Refer to Appendix F in SEL-587 Instruction Bk.

RZS= **N** Remove I0 from Wye Conn. Compensation (587-1 ONLY)

CTR1= **240** (Wye) Winding 1 CT ratio, 1200:5 MR CT

CTR2= **800** (Wye) Winding 2 CT ratio, 4000:5 MR CT

DATC= **OFF** (Min) Demand Ammeter Time Constant - Not Used

PDEM= **N/A** Phase Demand Ammeter Threshold (A) - Not Used

QDEM= **N/A** Neg-Seq Demand Ammeter Threshold (A) - Not Used

NDEM= **N/A** Residual Demand Ammeter Threshold (A) - Not Used

TAP1 and TAP2 values are automatically calculated by relay if a value for MVA has been entered.

Manual calculation of TAP1 and TAP2 can be done as follows:
(Refer to Table 3.2 in SEL-587 Instruction Book for C1 and C2 values.)

$$TAP1 = (MVA \times 1000 \times C1) / ((\sqrt{3}) \times VWDG1 \times CTR1)$$

C1= **1.00** For this case

$$TAP2 = (MVA \times 1000 \times C2) / ((\sqrt{3}) \times VWDG2 \times CTR2)$$

C2= **1.00** For this case

TAP1= **2.44** Winding 1 Current Tap

TAP2= **4.87** Winding 2 Current Tap

We are using a 5.0 Amp. Relay (In = 5) so the TAP range must be between
(0.1 x In and 32 x In) = (0.5 to 160) Checks out OK

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

(TAPmax/TAPmin) must be less than or equal to 4.5

TAPmax= **4.87**
TAPmin= **2.44**
TAPmax/TAPmin= **2.00** TAP ratio is acceptable
IN1= **N/A** Not Used
IN2= **N/A** Not Used

Fault values from Aspen Oneliner Case: Marble River WFr1.

RESTRAINED ELEMENT OPERATING PU Used SEL-587 Instruction Bk. Section 3 Settings

O87P range must be between (0.1 and 1.0)

O87P must also be greater than or equal to (0.1 x 5.0)/TAPmin (5.0 amp relay)

O87P>= **0.21**
SET O87P= **0.30** Operating Current Pick Up - PU of TAP

Minimum fault is with weak utility source (Willis - Patnode Out of Service). A T2 lowside fault is 10,664A with corresponding current on the highside of 1600A.
Min. T2 3Ph fault = 1600A,pri / (1200/5 CT) = 6.67A,sec
O87P times TAPmin = (0.30 x 2.437) = 0.731A,sec. Relay Operates

RESTRAINT SLOPE SETTINGS Used typical settings from SEL-587 Instruction Bk. Section 3

SLP1= **25.00** (%) Restraint Slope 1
SLP2= **50.00** (%) Restraint Slope 2
IRS1= **3.00** (pu) Restraint Current Slope 1 Limit

INST. UNRESTAINED CURRENT PU Used typical settings from SEL-587 Instruction Bk. Section 3

The Maximum U87P setting is (32 x 5.0)/TAPmax (5 amp relay)

U87P (Max)= **32.83**
SET U87P= **8.00**

TB1 MVA **140** TIMES **12** EQUALS 1680.00 MVA
INRUSH= 17.57 AMP SEC 4217.17 AMP PRI
U87P= **8** pu, TAP EQUALS 4679.05 AMP PRI

Unrestrained differential will not operate for expected inrush

HARMONIC BLOCKING % SETTINGS Used typical settings from SEL-587 Instruction Bk. Section 3

STATION:
DEVICE:
DATE:

LINE:
RELAY:
FID:
ENG:

PCT2= (%) 2nd Harmonic Block Setting

PCT4= (%) 4th Harmonic Block Setting (587-1 ONLY)

The fifth harmonic is a reliable quantity for detecting transformer overexcitation. Because it is difficult, with differential protection, to control the amount of overexcitation that a transformer can tolerate, differential tripping for overexcitation is NOT desirable. Therefore, use the fifth harmonic to restrain differential tripping. A recommended setting for the fifth harmonic restraint is 35%.

Reference SEL Technical Paper "Considerations for Using Harmonic Blocking and Harmonic Restraint Techniques on Transformer Differential Relays", Section III, B.

PCT5= (%) 5th Harmonic Block Setting

TH5= 5th Harmonic Alarm Threshold

TH5D= (cyc) 5th Harmonic Alarm TDPD

DCRB= DC Ratio Blocking (587-1 ONLY)

The SEL-587 relay allows use of even-harmonic restraint for added security during inrush conditions. Setting HRSTR=Y allows the 2nd and 4th harmonic compensated currents to be added to the restraint quantity.

HRSTR= Harmonic Restraint Allowed (587-1 ONLY)

Independent harmonic blocking blocks the percentage differential element for a particular phase if the 2nd or 5th harmonic in that phase is above the block threshold % setting. The other phase elements are not blocked.

Common harmonic blocking blocks all of the percentage differential elements if any one phase has a harmonic magnitude above the blocking threshold.

Common harmonic blocking is more secure, but it will delay percentage differential element operation for internal faults.

With HRSTR=Y, the relay automatically enables independent harmonic blocking logic. This logic will make the relay operate faster for internal faults at the risk of slightly reduced security against false trips on inrush.

IHBL= Independent Harmonic Blocking (Set by relay, 587-1 only)

WINDING 1 OVERCURRENT ELEMENTS

WINDING 1 PHASE DEFINITE TIME OC

50P1P= Definite Time OC PU - Not Used

50P1D= Definite Time OC Time Delay - Not Used

50P1TC= External Torque Control - Not Used

WINDING 1 PHASE INSTANTANEOUS SETTINGS

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

50P1H= **21.00**

Set PU to 140% of maximum 34.5kV fault & Check Inrush.
Maximum expected inrush is above 140% of 34.5kV fault.
50H pick up will be set to 120% of expected inrush current.

MAX FLT (MVA) **1057** TIMES **1.4** EQUALS 1479.80 MVA
15.48 AMP SEC 3714.62 AMP PRI

TB1 MVA **140** TIMES **12** EQUALS 1680.00 MVA
INRUSH= 17.57 AMP SEC 4217.17 AMP PRI

17.57 TIMES **1.2** EQUALS 21.09 AMP SEC

SET **50P1PH** **21.00** amps sec
5040.00 amps pri

50P1HC= External Torque Control - Not Used

WINDING 1 PHASE TOC ELEMENT SETTINGS:

51P1P= **3.90** **PHASE TOC**

Set to carry load and reach 34.5kV faults. Set TOC PU to approximately 150% of T2 maximum rating and less than 40% of LS minimum 3ph SC (WPN1 Out of Service).
40% of minimum fault is below margin for max load. Set pickup at minimum margin for max load which is approx. 55% of minimum lowside fault.
Set TD to coordinate with downstream protection, transformer should clear in approximately 1 sec for a low side fault.
Verify inrush will not cause any issues.

TB1 MAX (MVA) **233.00** TIMES **1.50** EQUALS 349.50 MVA
3.66 AMP SEC 877.32 AMP PRI

MAX FLT (MVA) **637.00** TIMES **0.40** EQUALS 254.80 MVA
2.67 AMP SEC 639.60 AMP PRI

SET **51P1P** **3.90** amps sec
936.00 amps pri

SET 51P1C = **U1** US MODERATELY INVERSE

SET 51P1TD TIME DIAL = **2.2** set in flt study

SET 51P1RS RESET DELAY = **N**

SET 51P1TC = **N/A** Torque Control - Not Used

Test value: 500% @ 0.75 sec

WINDING 1 NEG. SEQ. DEFINITE TIME OC

50Q1P= **OFF** Definite Time OC PU - Not Used

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

50Q1D= Definite Time OC Time Delay - Not Used

50Q1TC= External Torque Control - Not Used

WINDING 1 NEG. SEQ. TOC ELEMENT SETTINGS:

51Q1P= Inv Time OC - Not Used

WINDING 1 RESIDUAL DEFINITE TIME OC

50N1P= Definite Time OC PU - Not Used

50N1D= Definite Time OC Time Delay - Not Used

50N1TC= External Torque Control - Not Used

WINDING 1 RESIDUAL INST. SETTINGS

50N1H=

Typically set 5 times TOC pickup and a maximum of 50% of minimum 230kV phase to ground fault (WPN1 Out of Service).

Set at 5 times TOC pickup

Check coordination with line NYPA line protection.

310	2340.00	TIMES	0.50	EQUALS	1170.00	AMP PRI
EQUALS	4.88	AMPS SEC				
TOC pickup=	0.60	TIMES	5	EQUALS	3.00	AMP SEC
		SET	50N1H	3.00	amps sec	
				720.00	amps pri	

50N1HC= External Torque Control - Not Used

WINDING 1 RESIDUAL TOC ELEMENT SETTINGS:

51N1P=

RESIDUAL GND TOC

Typically set at 60% of full load current to cover unbalance.

NYPA 67N TOC pickup is set at 176A primary. Set TOC pickup to coordinate with NYPA relay and have a 20% margin.

Check coordination with NYPA line protection.

T2 FLA=	585.00	TIMES	0.60	EQUALS	351.00	AMP PRI
	1.46	AMPS SEC				
NYPA pu =	176.00	DIVIDED	1.2	EQUALS	146.67	AMP PRI

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

0.61 AMPS SEC

SET	51N1P	0.60	amps sec
		144.00	amps Pri

SET 51N1C =	U3	US VERY INVERSE
SET 51N1TD TIME DIAL =	1.0	set in flt study
SET 51N1RS RESET DELAY =	N	
SET 51N1TC =	N/A	Torque Control - Not Used
Test value: 500% @ 0.26 sec		

WINDING 2 OVERCURRENT ELEMENTS

Winding 2 overcurrent elements will activate transformer LOR 86TS/T2. Faults external to T2 may cause a lock out condition for transformer T2.

WINDING 2 PHASE DEFINITE TIME OC

50P2P=	OFF	<u>Definite Time OC PU - Not Used</u>
50P2D=		<u>Definite Time OC Time Delay - Not Used</u>
50P2TC=		<u>External Torque Control - Not Used</u>

WINDING 2 PHASE INSTANTANEOUS SETTINGS

50P2H=	OFF	<u>Not Used</u>
50P2HC=		<u>External Torque Control - Not Used</u>

WINDING 2 PHASE TOC ELEMENT SETTINGS:

51P2P=	7.50	PHASE TOC
--------	-------------	------------------

Set TOC pick up to 150% TB2 maximum MVA to carry load.
Set TD to coordinate with downstream protection.

TB1 MAX (MVA)	233.00	TIMES	1.50	EQUALS	349.50	MVA
	7.31	AMP SEC			5848.81	AMP PRI

SET	51P2P	7.50	amps sec
		6000.00	amps Pri

SET 51P2C =	U1	US MODERATELY INVERSE
SET 51P2TD TIME DIAL =	1.2	set in flt study

STATION:
DEVICE:
DATE:

LINE:
RELAY:
FID:
ENG:

SET 51P2RS RESET DELAY =
SET 51P2TC = Torque Control - Not Used
Test value: 500% @ 0.41 sec

WINDING 2 NEG. SEQ. DEFINITE TIME OC

50Q2P= Definite Time OC PU - Not Used
50Q2D= Definite Time OC Time Delay - Not Used
50Q2TC= External Torque Control - Not Used

WINDING 2 NEG. SEQ. TOC ELEMENT SETTINGS:

51Q2P= NOT USED

WINDING 2 RESIDUAL DEFINITE TIME OC

50N2P= Definite Time OC PU - Not Used
50N2D= Definite Time OC Time Delay - Not Used
50N2TC= External Torque Control - Not Used

WINDING 2 RESIDUAL INST. SETTINGS

50N2H= NOT USED
50N1HC= External Torque Control - Not Used

WINDING 2 RESIDUAL TOC ELEMENT SETTINGS:

51N2P= NOT USED

Set TOC PU at 50% of bank full load rating. 233MVA = 3900A @ 34.5kV.
Set TD to coordinate with downstream protection.

3900.00 2.44	TIMES	0.50 AMPS SEC	EQUALS	1950.00 AMP PRI
SET		51N2P	2.50 amps sec	
			2000.00	amps Pri

SET 51N2C = US MODERATELY INVERSE

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

SET 51N2TD TIME DIAL = **4.0** set in flt study
SET 51N2RS RESET DELAY = **N**
SET 51N2TC = **N/A** Torque Control - Not Used
Test value: 500% @ 1.36 sec

LTRP= **N** Latch Trip Setting
Set LTRP = N, Resets when current is below threshold - Using an ext. LOR

MINIMUM TRIP DURATION TIME DELAY:

Minimum time that the output trip contacts remain closed. Set to coordinate with bkr trip times plus a 3 cycle margin. (3 cyc breaker + 3 cyc = 6 cyc)

SET TDURD EQUAL **6.00** cycles

LOGIC VARIABLE TIMERS

TXPU= **0.00** (cyc) Timer X Pick Up Delay - Not Used
TXDO= **0.00** (cyc) Timer X Drop Out Delay - Not Used
TYPU= **0.00** (cyc) Timer Y Pick Up Delay - Not Used
TYDO= **0.00** (cyc) Timer Y Drop Out Delay - Not Used

GLOBAL VARIABLES

NFREQ= **60.00** (cyc) Power System Frequency
PHROT= **ABC** Power System Phase Rotation

LOGIC VARIABLE SETTINGS

X= **NA** Logic Variable X Setting - Not Used
Y= **NA** Logic Variable Y Setting - Not Used

TRIP LOGIC SETTINGS

Logic Variable MTU1 setting determines Logic Variable TRP1 assertion
Set MTU1 to assert for Differentiation element operation.

SET MTU1= **50P1T+51P1T+** Wind. 1 Phase Inst and TOC Oper

STATION: **PATNODE**
DEVICE: **87TP/T2**
DATE: **4/06/2012**

LINE: **T2**
RELAY: **SEL 058710325X1**
FID: **R703-Z001**
ENG: **JK/TRC**

50N1T+51N1T	Wind. 1 Res Gnd Inst and TOC Oper

Logic Variable MTU2 setting determines Logic Variable TRP2 assertion
Set MTU2 to assert for Winding 1 or Winding 2 Overcurrent element operation

SET MTU2=

51P2T + 51N2T	Wind. 2 Phase and Res. Gnd TOC Oper.

Logic Variable MTU3 setting determines Logic Variable TRP3 assertion
Set MTU3 to NA - Not Used

SET MTU3=

87R + 87U	Restrained or Unrestrained Diff. Oper.

EVENT REPORT TRIGGER CONDITIONS:

Determines which events will trigger an event report:
Assertion of TRP1 or TRP2 or TRP3 will automatically trigger an event report

SET MER=

51P1P + 51N1P + 51P2P + 51N2P

OUTPUT SETTINGS:

OUTPUTS:	SET	OUT1=	<table border="1"><tr><td>TRP1 + TRP2 + TRP3</td></tr></table>	TRP1 + TRP2 + TRP3	Operate 86TP/T2 Lockout Relay
TRP1 + TRP2 + TRP3					
	SET	OUT2=	<table border="1"><tr><td>NA</td></tr></table>	NA	Not used
NA					
	SET	OUT3=	<table border="1"><tr><td>NA</td></tr></table>	NA	Not used
NA					
	SET	OUT4=	<table border="1"><tr><td>NA</td></tr></table>	NA	Not Used
NA					

PORT 1

PROTO=

MOD

SPEED=

9600

PARITY=

N

STOP=

1

SLAVEID=

1

T2 high and low side CT ratio selection.

The CT ratios should be selected such that for full load transformer current, the secondary amperes should be between (0.5 and 5.0) amperes for our 5 Ampere relay.

STATION:	PATNODE	LINE:	T2
DEVICE:	87TP/T2	RELAY:	SEL 058710325X1
DATE:	4/06/2012	FID:	R703-Z001
		ENG:	JK/TRC

At 233MVA full load, the T2 high side current = 585 Amp.
 For the chosen high side CT ratio of (1200/5) (Wye), the CT secondary current at full load is (2.4) Amp.

At 233MVA full load, the T2 low side current = 3916 Amp.
 For the chosen low side CT ratio of (4000/5) (Wye), the CT secondary current at full load is (4.9) Amp.

Check the required CT performance for external faults to minimize CT saturation.

The maximum external fault currents for a 3ph fault at 230 kV Bus are as follows:
 The high side (1200/5) (Wye) CT sees 945 amperes of fault current = 3.9 amperes secondary.
 The low side (4000/5) (Wye) CT sees 6301 amperes of fault current = 7.9 amperes secondary.

The maximum external fault currents for a 3ph fault at 34.5 kV Bus are as follows:
 The high side (1200/5) (Wye) CT sees 2650 amperes of fault current = 11 amperes secondary.
 The low side (4000/5) (Wye) CT sees 17700 amperes of fault current = 22 amperes secondary.

After determining the total CT burden to the relay, calculate the CT secondary voltage for the above external fault currents. Chose an ANSI STD C class voltage rating that is twice the calculated voltage.

Assuming a total CT burden to the relay of (1.5) ohms:

The high side (1200/5) (Wye) CT sees a maximum secondary external fault current of (11) amperes times the (1.5) ohm burden = 17 volts secondary.

The low side (4000/5) (Wye) CT sees a maximum secondary external fault current of (22.1) amperes times the (1.5) ohm burden = 33 volts secondary.

Therefore, the T2 high & low side ANSI C800 CT should be sufficient to minimize CT saturation for external faults.

PATNODE

87TS/T2

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

RELAY USED FOR TRANSFORMER 2 DIFFERENTIAL, OVERCURRENT, AND NEUTR. GRND. PROTECTION

PRODUCT SETUP: SECURITY

Command Password	0
Setting Password	0
Command Password Access Timeout	5 min
Setting Password Access Timeout	30 min
Invalid Password Attempts	3
Password Lockout Duration	5 min
Password Access Events	Enabled

PRODUCT SETUP: DISPLAY PROPERTIES

Flash Message Time	1.0 s
Default Message Timeout	300 s
Default Message Intensity (VFD Only)	25%
Screen Saver Feature (LCD Only)	Enabled
Screen Saver Wait Time (LCD Only)	30 min
Current Cutoff Level	0.020 pu
Voltage Cutoff Level	1.0 V

PRODUCT SETUP: CLEAR RELAY RECORDS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SERIAL PORTS

RS485 Com2 Baud Rate	19200
RS485 Com2 Parity	None
RS485 Com2 Response Min Time	0 ms

PRODUCT SETUP: COMMUNICATIONS: NETWORK

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: MODBUS PROTOCOL

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PRODUCT SETUP: COMMUNICATIONS: DNP PROTOCOL

DNP Channel 1 Port **COM2 - RS485**

DNP Channel 2 Port **NONE**

DNP Address **25**

PRODUCT SETUP: COMMUNICATIONS: DNP - IEC104 POINTS LIST

Points List Required From NYPA, If Used

PRODUCT SETUP: COMMUNICATIONS: IEC 61850

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: HTTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: TFTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 60870-5-104

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SNTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: MODBUS USER MAP

NOT USED - LEAVE AT DEFAULT

REAL TIME CLOCK

IRIG-B Signal Type **DC Shift**

Real Time Clock Events **Enabled**

Time Zone Offset **0.0 hr**

DST Function **Disabled**

PRODUCT SETUP: USER-PROGRAMMABLE FAULT REPORT

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: OSCILLOGRAPHY

THE FOLLOWING ARE INCLUDED IN OSCILLOGRAPHY FILE. CT/VT SOURCES ARE AUTOMATICALLY INCLUDED.

Number Of Records	5
Trigger Mode	Automatic Overwrite
Trigger Position	30%
Trigger Source	Osc Trigger On (VO64)
AC Input Waveforms	64 samples/cycle
Digital Channel 2	SRC1 50DD OP
Digital Channel 3	XFMR INST DIFF OP
Digital Channel 4	XFMR PCNT DIFF OP
Digital Channel 5	XFMR INST DIFF OP A
Digital Channel 6	XFMR INST DIFF OP B
Digital Channel 7	XFMR INST DIFF OP C
Digital Channel 8	XFMR PCNT DIFF 2ND A
Digital Channel 9	XFMR PCNT DIFF 2ND B
Digital Channel 10	XFMR PCNT DIFF 2ND C
Digital Channel 11	XFMR PCNT DIFF OP A
Digital Channel 12	XFMR PCNT DIFF OP B
Digital Channel 13	XFMR PCNT DIFF OP C
Digital Channel 14	PHASE TOC1 OP
Digital Channel 15	PHASE IOC1 OP
Digital Channel 16	NEUTRAL TOC1 OP
Digital Channel 17	NEUTRAL IOC1 OP
Digital Channel 18	PHASE TOC2 OP
Digital Channel 19	NEUTRAL TOC2 OP
Digital Channel 20	GROUND TOC3 OP
Digital Channel 21-63	SPARE
Analog Channel 1	Xfmr Iad Mag
Analog Channel 2	Xfmr Iar Mag

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Analog Channel 3	Xfmr Harm2 lsd Mag
Analog Channel 4	Xfmr lbd Mag
Analog Channel 5	Xfmr lbr Mag
Analog Channel 6	Xfmr Harm2 lbd Mag
Analog Channel 7	Xfmr lsd Mag
Analog Channel 8	Xfmr lcr Mag
Analog Channel 9	Xfmr Harm2 lsd Mag
Analog Channel 10	SRC1 I_1 Mag
Analog Channel 11	SRC1 I_2 Mag
Analog Channel 12	SRC1 I_0 Mag
Analog Channel 13	SRC2 I_1 Mag
Analog Channel 14	SRC2 I_2 Mag
Analog Channel 15	SRC2 I_0 Mag
Analog Channel 16	Tracking Frequency

PRODUCT SETUP: DATA LOGGER

Data Logger Mode	Continuous
Data Logger Trigger	OFF
Rate	60000 msec

PRODUCT SETUP: DEMAND

Current Method	Thermal Exponential
Power Method	Thermal Exponential
Interval	15 MIN
Trigger	OFF

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: LED TEST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: TRIP AND ALARMS LEDS

Trip LED Input	TRIPBUS 1 OP
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PRODUCT SETUP: USER-PROGRAMMABLE LEDS: USER PROGRAMMABLE LEDS

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PRODUCT SETUP: USER-PROGRAMMABLE SELF TESTS

Direct Ring Break Function	Enabled
Direct Device Off Function	Enabled
Remote Device Off Function	Enabled
Pri Ethernet Fail Function	Disabled
Battery Fail Function	Enabled
SNTP Fail Function	Enabled
IRIG B Fail Function	Enabled

PRODUCT SETUP: CONTROL PUSHBUTTONS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: FLEX STATES

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-DEFINEABLE DISPLAYS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: DIRECT I/O

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: INSTALLATION

Relay Name	87TS/T2
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SYSTEM SETUP: AC INPUTS: CURRENT

CT F1: Phase CT Primary	4000 A	T2 34.5KV SIDE, 4000:4 MR CT
CT F1: Phase CT Secondary	5 A	
CT F1: Ground CT Primary	600 A	T2 NEUTRAL GROUND, 600:5 MR CT
CT F1: Ground CT Secondary	5 A	

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

CT M1: Phase CT Primary	1200 A	T2 230KV SIDE, 1200:5 MR CT
CT M1: Phase CT Secondary	5 A	
CT M1: Ground CT Primary	1 A	REQUIRED ENTRY, NOT USED
CT M1: Ground CT Secondary	1 A	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: AC INPUTS: VOLTAGE

VT M5: VT Connection	Wye	M5 VOLTAGE IS CONNECTED TO 2144 VT X WINDING
VT M5: VT Secondary Voltage	66.4	V CONNECTED AT 66.4V
VT M5: VT Ratio	2000	PT RATIO FOR 66.4V TAP IS 2000:1

SYSTEM SETUP: POWER SYSTEM

Nominal Frequency	60 Hz	
Phase Rotation	ABC	
Frequency And Phase Reference	SRC 1 (SRC 1)	T2 230KV
Frequency Tracking Function	Enabled	

SYSTEM SETUP: SIGNAL SOURCES

SOURCE 1: Name	SRC 1	DEFAULT VALUE
SOURCE 1: Phase CT	M1	ASSIGN 230KV AS SOURCE 1
SOURCE 1: Ground CT	None	
SOURCE 1: Phase VT	M5	ASSIGN 230KV VT 2144 3PH. X WINDING TO SOURCE 1
SOURCE 1: Auxiliary VT	None	
SOURCE 2: Name	SRC 2	DEFAULT VALUE
SOURCE 2: Phase CT	F1	ASSIGN 34.5KV AS SOURCE 2
SOURCE 2: Ground CT	F1	ASSIGN T2 NEUTR. GRND TO SOURCE 2
SOURCE 2: Phase VT	None	
SOURCE 2: Auxiliary VT	None	

SYSTEM SETUP: TRANSFORMER: GENERAL

T2 is an ANSI STD (DABY) connected delta (230kV) high side with a solidly grounded wye (34.5kV) low side. T2 is rated 140/187/233MVA.

Number Of Windings	2	PER T2 NAMEPLATE
Reference Winding Selection	Automatic Selection	
Phase Compensation	Internal (software)	

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Load Loss At Rated Load	100 kW	REQUIRED ENTRY, NOT USED
Rated Winding Temperature Rise	65°C (oil)	REQUIRED ENTRY, NOT USED
No Load Loss	10 kW	REQUIRED ENTRY, NOT USED
Type Of Cooling	OA	REQUIRED ENTRY, NOT USED
Top-oil Rise Over Ambient	35 °C	REQUIRED ENTRY, NOT USED
Thermal Capacity	100.00 kWh/°C	REQUIRED ENTRY, NOT USED
Winding Thermal Time Constant	2.00 min	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: TRANSFORMER: WINDINGS

WINDING 1: Source	SRC 1 (SRC 1)	ASSOCIATE 230KV WINDING WITH WINDING 1
WINDING 1: Rated MVA	140.000 MVA	USE SELF COOLED RATING, T60 Manual page 5-74
WINDING 1: Nominal Phs-phs Voltage	230.000 kV	
WINDING 1: Connection	Delta	
WINDING 1: Grounding	Not within zone	
WINDING 1: Angle Wrt Winding 1	0.0 deg	
WINDING 1: Resistance	10.0000 ohms	REQUIRED ENTRY, NOT USED
WINDING 2: Source	SRC 2 (SRC 2)	ASSOCIATE 34.5KV WINDING WITH WITH WINDING 2
WINDING 2: Rated MVA	140.000 MVA	USE SELF COOLED RATING, T60 Manual page 5-74
WINDING 2: Nominal Phs-phs Voltage	34.500 kV	
WINDING 2: Connection	Wye	
WINDING 2: Grounding	Within zone	T2 34.5KV WINDING IS GROUNDED WYE
WINDING 2: Angle Wrt Winding 1	-30.0 deg	
WINDING 2: Resistance	10.0000 ohms	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: TRANSFORMER: THERMAL INPUTS

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: BREAKERS

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: SWITCHES

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: FLEXCURVES

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

FLEXLOGIC: FLEXLOGIC EQUATION EDITOR

THE FOLLOWING FLEXLOGIC EQUATION IS USED TO TRIGGER AN OSCILLOGRAPHY RECORD.

FlexLogic Entry 1	XFMR INST DIFF OP
FlexLogic Entry 2	POSITIVE ONE SHOT
FlexLogic Entry 3	XFMR PCNT DIFF OP A
FlexLogic Entry 4	POSITIVE ONE SHOT
FlexLogic Entry 5	XFMR PCNT DIFF OP B
FlexLogic Entry 6	POSITIVE ONE SHOT
FlexLogic Entry 7	XFMR PCNT DIFF OP C
FlexLogic Entry 8	POSITIVE ONE SHOT
FlexLogic Entry 9	XFMR PCNT DIFF OP
FlexLogic Entry 10	POSITIVE ONE SHOT
FlexLogic Entry 11	PHASE TOC1 OP
FlexLogic Entry 12	POSITIVE ONE SHOT
FlexLogic Entry 13	NEUTRAL TOC1 OP
FlexLogic Entry 14	POSITIVE ONE SHOT
FlexLogic Entry 15	PHASE TOC2 OP
FlexLogic Entry 16	POSITIVE ONE SHOT
FlexLogic Entry 17	NEUTRAL TOC2 OP
FlexLogic Entry 18	POSITIVE ONE SHOT
FlexLogic Entry 19	GROUND TOC3 OP
FlexLogic Entry 20	POSITIVE ONE SHOT
FlexLogic Entry 21	SRC1 50DD OP
FlexLogic Entry 22	POSITIVE ONE SHOT
FlexLogic Entry 23	SRC2 50DD OP
FlexLogic Entry 24	POSITIVE ONE SHOT
FlexLogic Entry 25	NEUTRAL OV1 OP
FlexLogic Entry 26	POSITIVE ONE SHOT
FlexLogic Entry 27	TRIPBUS 1 OP
FlexLogic Entry 28	POSITIVE ONE SHOT
FlexLogic Entry 29	TRIPBUS 2 OP
FlexLogic Entry 30	POSITIVE ONE SHOT

STATION: **PATNODE**
DEVICE: **87TS/T2**
DATE: **4/6/2012**

LINE: **T2**
RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**
FID: **5.5x**
ENG: **JK/TRC**

FlexLogic Entry 31 **OR (15)**
FlexLogic Entry 32 **OSC TRIGGER (V064)**
FlexLogic Entry 33 **END**

GROUPED ELEMENTS: GROUP 1: DISTANCE

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: POWER SWING DETECT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: LOAD ENCROACHMENT

NOT USED - LEAVE AT DEFAULT

LOAD AND FAULT CURRENTS:

ALL CALCULATIONS ARE BASED ON ASPEN ONELINER CASE MARBLE RIVER WFR1.
THE GE RELAY USES PICKUP SETTINGS IN PER UNIT VALUES, 5A BASE

T2 RATINGS:

BASE= **140** MVA
MAX= **233** MVA

T2 HIGH SIDE (M1, SOURCE 1):

CTR= **240**
VII= **230** KV

I,base= 351.43 A,pri 1.46 A,sec 0.29 A,pu
I,max= 584.88 A,pri 2.44 A,sec 0.49 A,pu

T2 LOW SIDE (F1, SOURCE 2):

CTR= **800**
VII= **34.5** KV

I,base= 2342.87 A,pri 2.93 A,sec 0.59 A,pu
I,max= 3899.21 A,pri 4.87 A,sec 0.97 A,pu

T2 NEUTRAL GROUND (F1, SOURCE 2):

CTR= **120.00**
VII= **34.50** KV

I,base= 2342.87 A,pri 19.52 A,sec 3.90 A,pu
I,max= 3899.21 A,pri 32.49 A,sec 6.50 A,pu

T2 INRUSH:

I. FACTOR= **12.00**

I, INRUSH = 4217.17 A,pri 17.57 A,sec 3.51 A,pu

INTERNAL FAULT VALUES:

FAULT VALUES ARE FOR A FAULT ON T2 HIGH SIDE BUSHINGS.

3 phase

1 phase

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

	A,pri	A,sec	A,pu	A,pri	A,sec	A,pu
SRC 1	8782.00	36.59	7.32	7983.00	33.26	6.65
SRC 2	6114.00	7.64	1.53	0.00	0.00	0.00

I_{int},pu= 7.32

EXTERNAL FAULT VALUES:

Fault values are taken for close in faults external to the zone of protection.

Maximum External Through Fault on Transformer HV Side

	3 phase			1 phase		
	A,pri	A,sec	A,pu	A,pri	A,sec	A,pu
SRC 1	917.00	3.82	0.76	0.00	0.00	0.00
SRC 2	6114.00	7.64	1.53	0.00	0.00	0.00

I_{int},pu= 1.53

Maximum External Through Fault on Transformer LV Side

	3 phase			1 phase		
	A,pri	A,sec	A,pu	A,pri	A,sec	A,pu
SRC 1	2654.00	11.06	2.21	0.00	0.00	0.00
SRC 2	17693.00	22.12	4.42	28730.00	35.91	7.18

I_{int},pu= 7.18

Maximum current relay will see for through fault= 7.18

GROUPED ELEMENTS: GROUP 1: TRANSFORMER: PERCENT DIFFERENTIAL

Function	Enabled	
Pickup	0.300 pu	TYPICAL SETTING, ABOVE CT AND T2 MAGNETIZING ERROR
Slope 1	25%	TYPICAL SLOPE SETTING TO COVER CT, RELAY, T2 ERRORS
Break 1	1.500 pu	SET ABOVE T2 FULL LOAD CURRENT
Break 2	8.000 pu	
Slope 2	98%	RECOMMENDED SETTING, GET-8425
Inrush Inhibit Function	Adapt. 2nd	USE ADAPTIVE TO DETECT LOW LEVEL INRUSH HARMONICS
Inrush Inhibit Mode	2-Out-Of-3	
Inrush Inhibit Level	20.0 % fo	RECOMMENDED SETTING, GET-8429
Overexcitation Inhibit Function	Disabled	
Overexcitation Inhibit Level	10.0 % fo	
Block	OFF	
Target	Self-reset	
Events	Enabled	

GROUPED ELEMENTS: GROUP 1: TRANSFORMER: INSTANTANEOUS DIFFERENTIAL

Function	Enabled
----------	----------------

STATION: **PATNODE**
DEVICE: **87TS/T2**
DATE: **4/6/2012**

LINE: **T2**
RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Pickup

8.000 pu

RECOMMENDED SETTING

Set Inst. Differential to recommended setting and verify pickup is greater than inrush and through faults.

I, unrst= **8**
I, inr.= 3.51 228%
I, trhflt= 7.18 111%

Inst. Differential pickup is greater than both max. inrush and throughfault.

Block

OFF

Target

Self-reset

Events

Enabled

GROUPED ELEMENTS: GROUP 1: TRANSFORMER: HOTTEST SPOT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: TRANSFORMER: AGING FACTOR

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: TRANSFORMER: LOSS OF LIFE

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT: PHASE TOC

PHASE TOC1: Function

Enabled

PHASE TOC1: Signal Source

SRC 1 (SRC 1) T2 51H

PHASE TOC1: Input

Phasor

PHASE TOC1: Pickup

0.78 pu

Set 87TS/T2 pickup the same as 87TP/T2

51H= **3.9** A,sec 936 A,pri

CTR= **240**

CTP= **1200** 0.78 A,pu

SET **PTOC1** **0.78** A,pu
936 A,pri

PHASE TOC1: Curve

IEEE Mod Inv

PHASE TOC1: TD Multiplier

0.45

Test Point: 0.76s @ 500%

PHASE TOC1: Reset

Instantaneous

PHASE TOC1: Voltage Restraint

Disabled

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PHASE TOC1: Block A **OFF**

PHASE TOC1: Block B **OFF**

PHASE TOC1: Block C **OFF**

PHASE TOC1: Target **Self-reset**

PHASE TOC1: Events **Enabled**

PHASE TOC2: Function **Enabled**

PHASE TOC2: Signal Source **SRC 2 (SRC 2)** T2 51L

PHASE TOC2: Input **Phasor**

PHASE TOC2: Pickup **1.5 pu**

Set 87TS/T2 pickup the same as 87TP/T2

51L= **7.5** A,sec 6000 A,pri

CTR= **800**

CTP= **4000** 1.5 A,pu

SET **PTOC2** **1.5** A,pu 6000 A,pri

PHASE TOC2: Curve **IEEE Mod Inv**

PHASE TOC2: TD Multiplier **0.24** Test Point: 0.40s @ 500%

PHASE TOC2: Reset **Instantaneous**

PHASE TOC2: Voltage Restraint **Disabled**

PHASE TOC2: Block A **OFF**

PHASE TOC2: Block B **OFF**

PHASE TOC2: Block C **OFF**

PHASE TOC2: Target **Self-reset**

PHASE TOC2: Events **Enabled**

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT: PHASE IOC

PHASE IOC1: Function **Enabled**

PHASE IOC1: Source **SRC 1 (SRC 1)** T2 50H

PHASE IOC1: Pickup **4.2 pu**

Set 87TS/T2 pickup the same as 87TP/T2

50H= **21** A,sec 5040 A,pri

CTR= **240**

CTP= **1200** 4.2 A,pu

SET **PIOC1** **4.2** A,pu 5040 A,pri

PHASE IOC1: Delay **0.00 s**

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PHASE IOC1: Reset Delay **0.00 s**

PHASE IOC1: Block A **OFF**

PHASE IOC1: Block B **OFF**

PHASE IOC1: Block C **OFF**

PHASE IOC1: Target **Self-reset**

PHASE IOC1: Events **Enabled**

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT: PHASE DIRECTIONAL

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT: NEUTRAL TOC

NEUTRAL TOC1: Function **Enabled**

NEUTRAL TOC1: Source **SRC 1 (SRC 1)** T2 51HN

NEUTRAL TOC1: Input **Phasor**

NEUTRAL TOC1: Pickup **0.12 pu**

Set 87TS/T2 pickup the same as 87TP/T2

51HN= **0.6** A,sec 144 A,pri

CTR= **240**

CTP= **1200** 0.12 A,pu

SET **NTOC1** **0.12** A,pu
144 A,pri

NEUTRAL TOC1: Curve **IEEE Very Inv**

NEUTRAL TOC1: TD Multiplier **0.2**

NEUTRAL TOC1: Reset **Instantaneous**

NEUTRAL TOC1: Block **OFF**

NEUTRAL TOC1: Target **Self-reset**

NEUTRAL TOC1: Events **Enabled**

NEUTRAL TOC2: Function **Enabled**

NEUTRAL TOC2: Source **SRC 2 (SRC 2)** T2 51LN

NEUTRAL TOC2: Input **Phasor**

NEUTRAL TOC2: Pickup **0.5 pu**

Test Point: 0.26s @ 500%

Set 87TS/T2 pickup the same as 87TP/T2

51LN= **2.5** A,sec 2000 A,pri

CTR= **800**

CTP= **4000** 0.5 A,pu

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

SET **NTOC2** **0.5** A,pu
2000 A,pri

NEUTRAL TOC2: Curve **IEEE Mod Inv**

NEUTRAL TOC2: TD Multiplier **0.8**

NEUTRAL TOC2: Reset **Instantaneous**

NEUTRAL TOC2: Block **OFF**

NEUTRAL TOC2: Target **Self-reset**

NEUTRAL TOC2: Events **Enabled**

Test Point: 1.35s @ 500%

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT: NEUTRAL IOC

NEUTRAL IOC1: Function **Enabled**

NEUTRAL IOC1: Source **SRC 1 (SRC 1)** T2 50HN

NEUTRAL IOC1: Pickup **0.6 pu**

Set 87TS/T2 pickup the same as 87TP/T2

50HN= **3** A,sec 720 A,pri
CTR= **240**

CTP= **1200** 0.6 A,pu

SET **NIOC1** **0.6** A,pu
720 A,pri

NEUTRAL IOC1: Delay **0.00 s**

NEUTRAL IOC1: Reset Delay **0.00 s**

NEUTRAL IOC1: Block **OFF**

NEUTRAL IOC1: Target **Self-reset**

NEUTRAL IOC1: Events **Enabled**

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT: NEUTRAL DIRECTIONAL OC

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT: GROUND TOC

GROUND TOC3: Function **Enabled**

GROUND TOC3: Source **SRC 2 (SRC 2)** T2 51N

GROUND TOC3: Input **Phasor**

GROUND TOC3: Pickup **3.33 pu**

Set 87TS/T2 pickup the same as 87TP/T2

51N= **2.5** A,sec 2000 A,pri

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

CTR= **800**

CTP= **600** 3.33 A,pu

SET	NTOC2	3.33	A,pu
		1998	A,pri

GROUND TOC3: Curve **IEEE Mod Inv**

GROUND TOC3: TD Multiplier **0.8** Test Point: 1.35s @ 500%

GROUND TOC3: Reset **Instantaneous**

GROUND TOC3: Block **OFF**

GROUND TOC3: Target **Self-reset**

GROUND TOC3: Events **Enabled**

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT: GROUND IOC

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT: RESTRICTED GROUND FAULT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: VOLTAGE ELEMENTS: NEUTRAL OV

NEUTRAL OV1: Function **Enabled** 59N FUNCTION ENABLED, REFER TO MANUAL SECTION 5.5

NEUTRAL OV1: Source **SRC 1** ASSIGNED TO M5, 230KV VT 2144

NEUTRAL OV1: Pickup **1.5** pu

Set 59N pickup to 50% of 3V0

V,n= **66.4** Nominal VT connection

3V0= **199.2** 3 times nominal

3V0,pu= **3** pu, value of 3V0. 66.4V is V,base

50%= **1.5** pu

SET	NOV1	1.5	V,pu
		99.6	V,pri

NEUTRAL OV1: Curve **Def. Time**

NEUTRAL OV1: Pickup Delay **5.0** s

NEUTRAL OV1: Reset Delay **0** s

NEUTRAL OV1: Block **OFF**

NEUTRAL OV1: Target **Self-reset**

NEUTRAL OV1: Events **Enabled**

GROUPED ELEMENTS: GROUP 2

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 3

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 4

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 5

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 6

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: TRIP BUS

USE TRIP BUS 1 FOR ALL PROTECTIVE ELEMENTS THAT WILL TRIP 86TS/T2.

Trip Bus 1 Function	Enabled	
Trip Bus 1 Block	OFF	NO BLOCK TRIP
Trip Bus 1 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 1 Reset Delay	0.1 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 1 Input 1	XFMR INST DIFF OP	T2 87
Trip Bus 1 Input 2	XFMR PCNT DIFF OP	T2 87
Trip Bus 1 Input 3	NEUTRAL IOC1 OP	T2 50HN
Trip Bus 1 Input 4	NEUTRAL TOC1 OP	T2 51HN
Trip Bus 1 Input 5	PHASE IOC1 OP	T2 50H
Trip Bus 1 Input 6	PHASE TOC1 OP	T2 51H
Trip Bus 1 Input 7	PHASE TOC2 OP	T2 51L
Trip Bus 1 Input 8	NEUTRAL TOC2 OP	T2 51LN
Trip Bus 1 Input 9	GROUND TOC3 OP	T2 51N
Trip Bus 1 Input 10	OFF	
Trip Bus 1 Input 11	OFF	
Trip Bus 1 Input 12	OFF	
Trip Bus 1 Input 13	OFF	

STATION: **PATNODE**

DEVICE: **87TS/T2**

DATE: **4/6/2012**

LINE: **T2**

RELAY: **T60-N03-VFH-F8F-H6P-M8F-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Trip Bus 1 Input 14	OFF
Trip Bus 1 Input 15	OFF
Trip Bus 1 Input 16	OFF
Trip Bus 1 Latching	Disabled
Trip Bus 1 Reset	OFF
Trip Bus 1 Target	Self-reset
Trip Bus 1 Events	Enabled

USE TRIP BUS 2 FOR 59N PROTECTION

Trip Bus 2 Function	Enabled	
Trip Bus 2 Block	OFF	NO BLOCK TRIP
Trip Bus 2 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 2 Reset Delay	0.1 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 2 Input 1	NEUTRAL OV1 OP	59N Protection
Trip Bus 2 Input 2-16	SPARE	
Trip Bus 2 Latching	Disabled	
Trip Bus 2 Reset	OFF	
Trip Bus 2 Target	Self-reset	
Trip Bus 2 Events	Enabled	

CONTROL ELEMENTS: SETTING GROUPS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SELECTOR SWITCHES

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: UNDERFREQUENCY

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: OVERFREQUENCY

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SYNCHROCHECK

NOT USED - LEAVE AT DEFAULT

STATION:

DEVICE:

DATE:

LINE:

RELAY:

FID:

ENG:

CONTROL ELEMENTS: DIGITAL ELEMENTS

CONTROL ELEMENTS: DIGITAL COUNTERS

CONTROL ELEMENTS: MONITORING ELEMENTS

CONTROL ELEMENTS: PILOT SCHEMES

INPUTS/OUTPUTS: CONTACT INPUTS

INPUTS/OUTPUTS: CONTACT INPUT THRESHOLDS

Cont 1p 1 - Cont 1p 4 Suggested setting for 125Vdc control system

INPUTS/OUTPUTS: VIRTUAL INPUTS

INPUTS/OUTPUTS: CONTACT OUTPUTS

[H1] Contact Output 1 ID	Cont Op 1	
[H1] Contact Output 1 Operate	TRIPBUS 1 OP	TRIP LOR 86TS/T2
[H1] Contact Output 1 Seal-In	OFF	LOR TRIP, NO SEAL IN
[H1] Contact Output 1 Events	Enabled	
[H2] Contact Output 2 ID	Cont Op 2	
[H2] Contact Output 2 Operate	TRIPBUS 2 OP	TRIP T2MR (59N)
[H2] Contact Output 2 Seal-In	OFF	
[H2] Contact Output 2 Events	Enabled	

INPUTS/OUTPUTS: VIRTUAL OUTPUTS

STATION:

PATNODE

DEVICE:

87TS/T2

DATE:

4/6/2012

LINE:

T2

RELAY:

T60-N03-VFH-F8F-H6P-M8F-R7A

FID:

5.5x

ENG:

JK/TRC

INPUTS/OUTPUTS: REMOTE DEVICES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS DNA BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS USERST BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: RESETTING

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT OUTPUTS

NOT USED - LEAVE AT DEFAULT

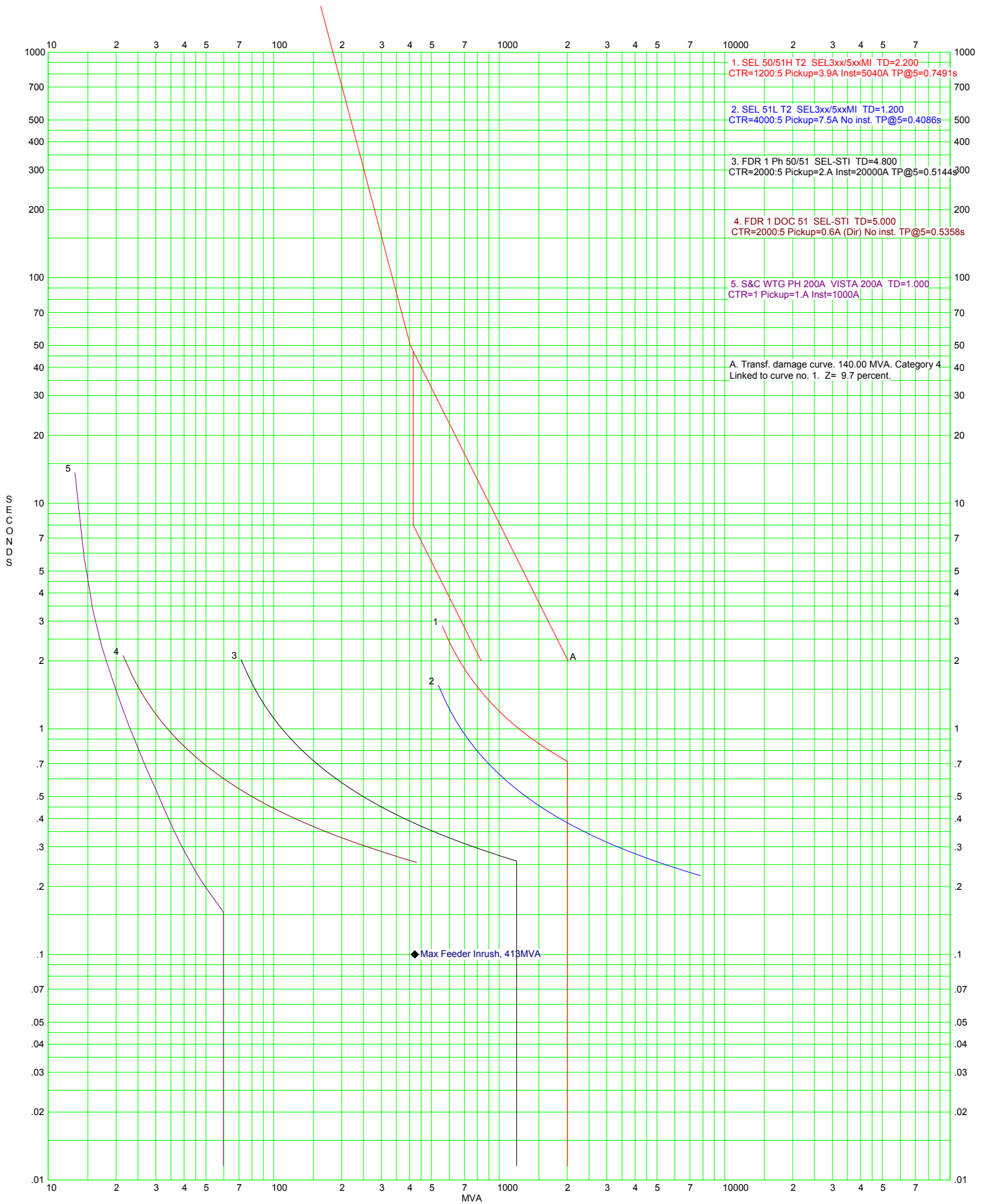
INPUTS/OUTPUTS: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

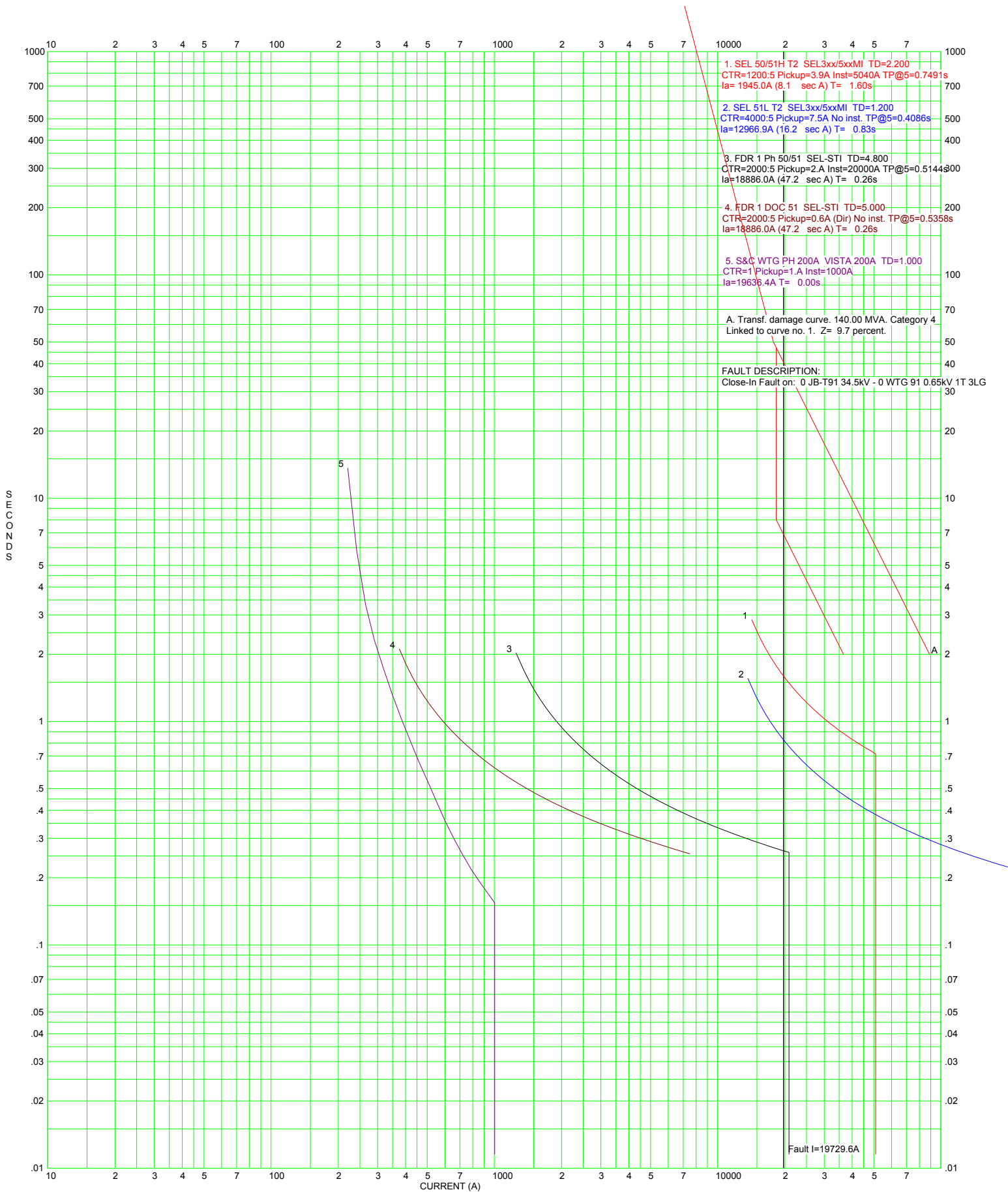
INPUTS/OUTPUTS: IEC 61850 GOOSE ANALOGS INPUTS

NOT USED - LEAVE AT DEFAULT

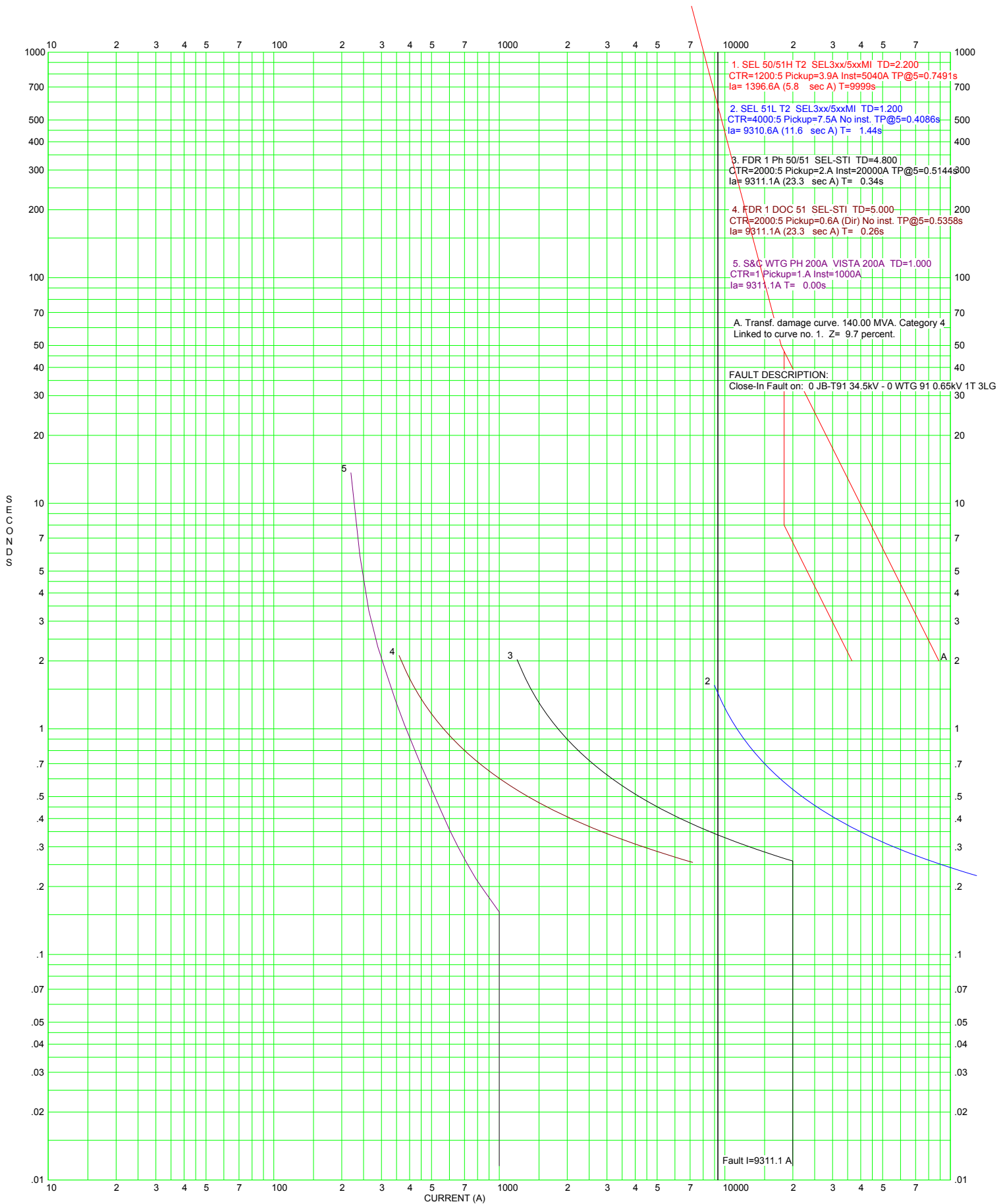
PATNODE COORDINATION CURVES



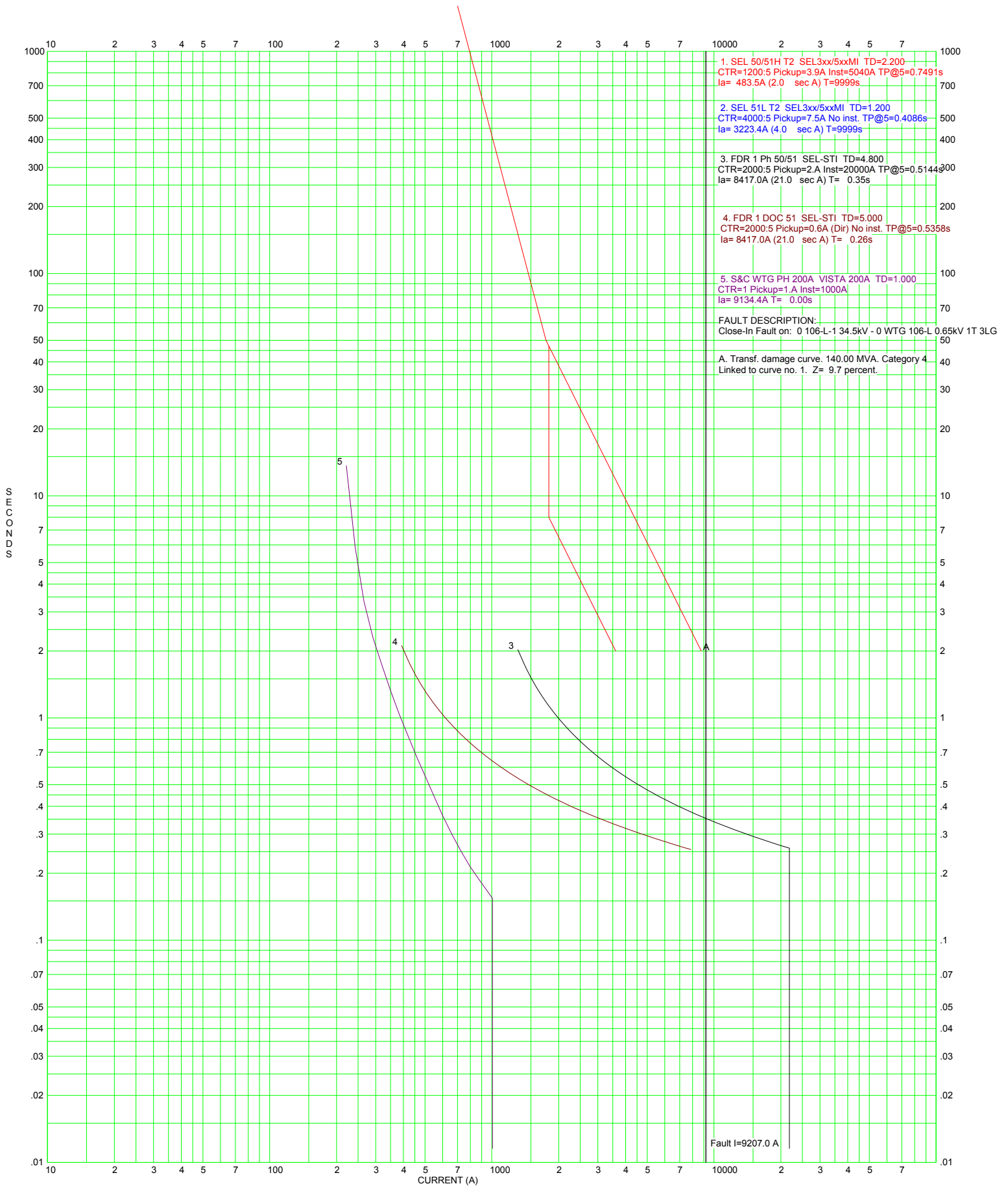
Feeder Phase Coordin	TIME-CURRENT CURVES @ Voltage 34.5-230kV	By JK/TRC
For Marble River Feeder Phase Coordination		No.
Comment Applicable to Feeders 1 through 8 (var. feeder instantaneous per settings basis)		Date 03/20/12



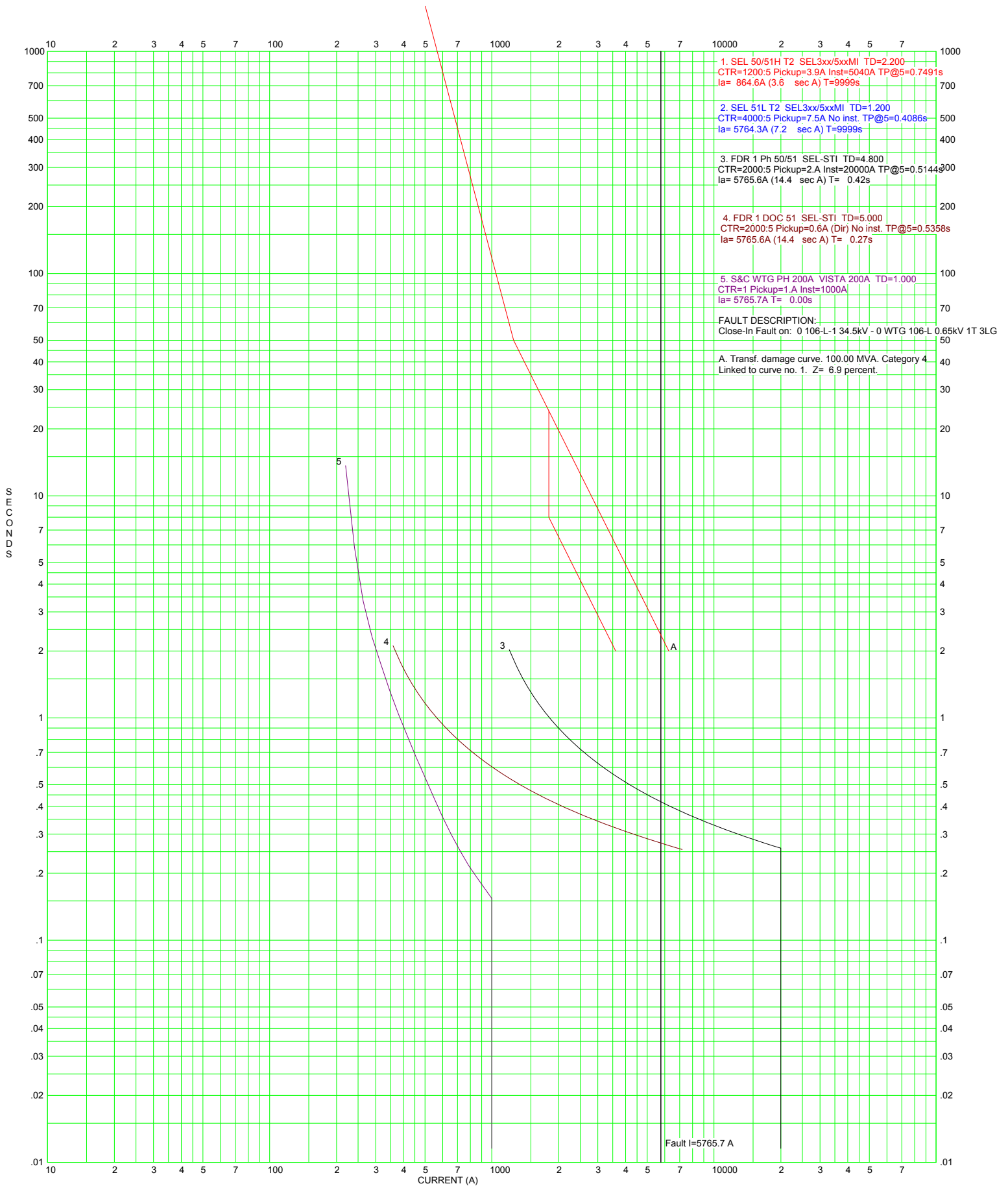
TIME-CURRENT CURVES @ Voltage 34.5-230kV		By	JK/TRC
For Marble River Feeder Phase Coordination, First WTG, System Max		No.	
Comment Applicable to Feeders 1 through 8 (var. feeder instantaneous per settings basis)		Date	03/20/12



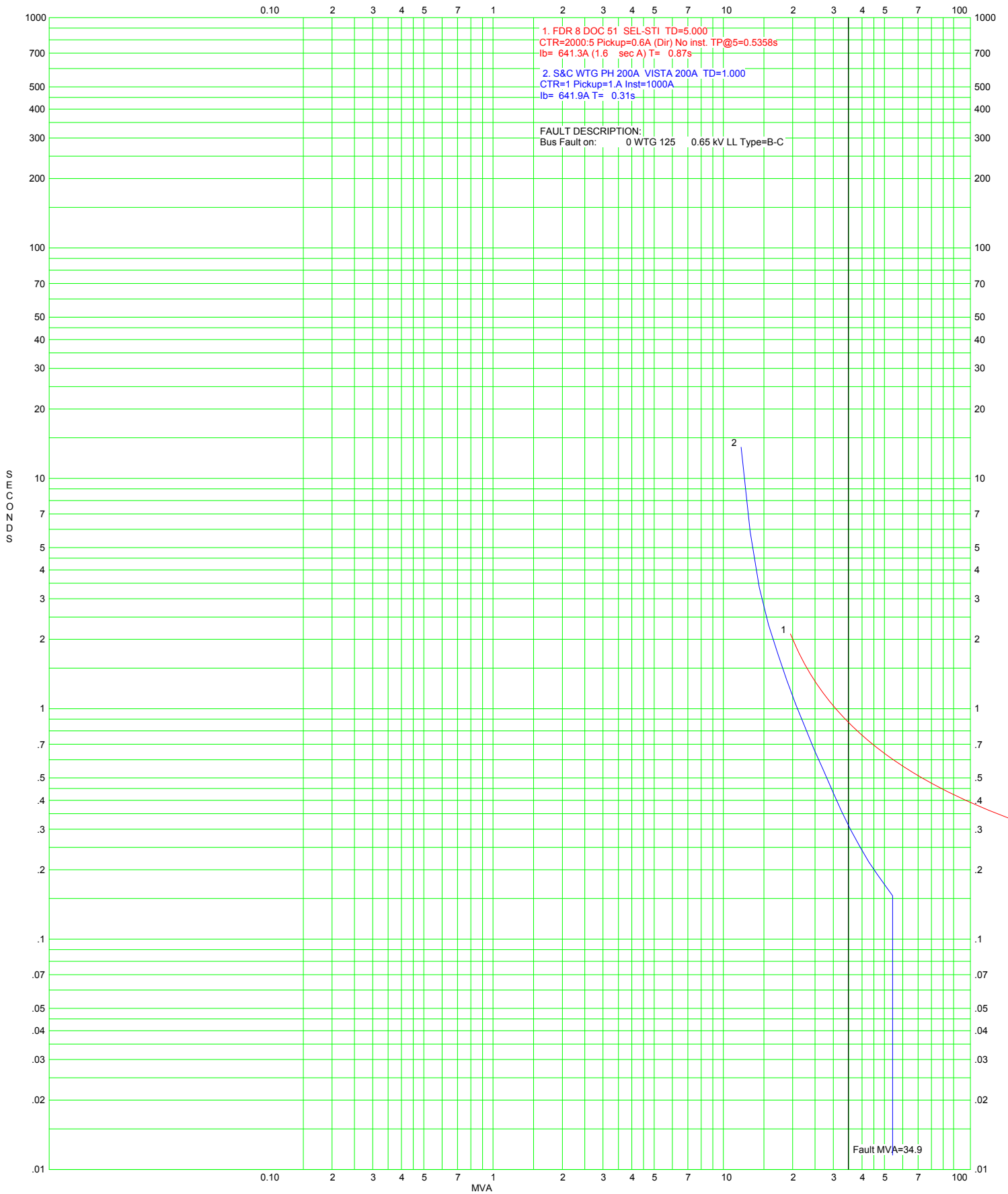
TIME-CURRENT CURVES @ Voltage 34.5-230kV		By	JK/TRC
For Marble River Feeder Phase Coordination, First WTG, System Min		No.	
Comment Applicable to Feeders 1 through 8 (var. feeder instantaneous per settings basis)		Date	03/20/12



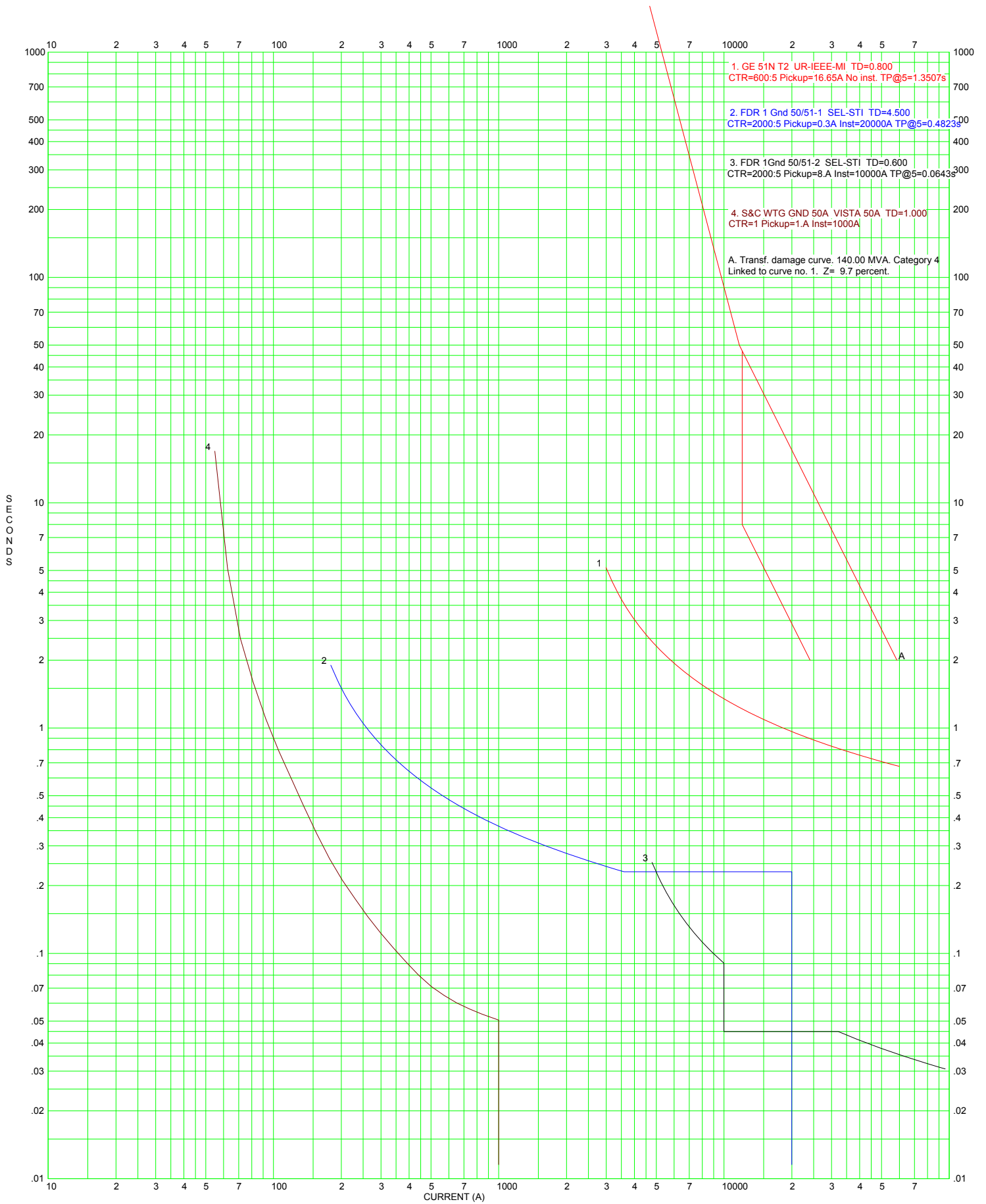
Feeder Phase Coordin	TIME-CURRENT CURVES @ Voltage 34.5-230kV	By JK/TRC
For Marble River Feeder Phase Coordination, End of feeder, System Max		No.
Comment Applicable to Feeders 1 through 8 (var. feeder instantaneous per settings basis)		Date 03/20/12



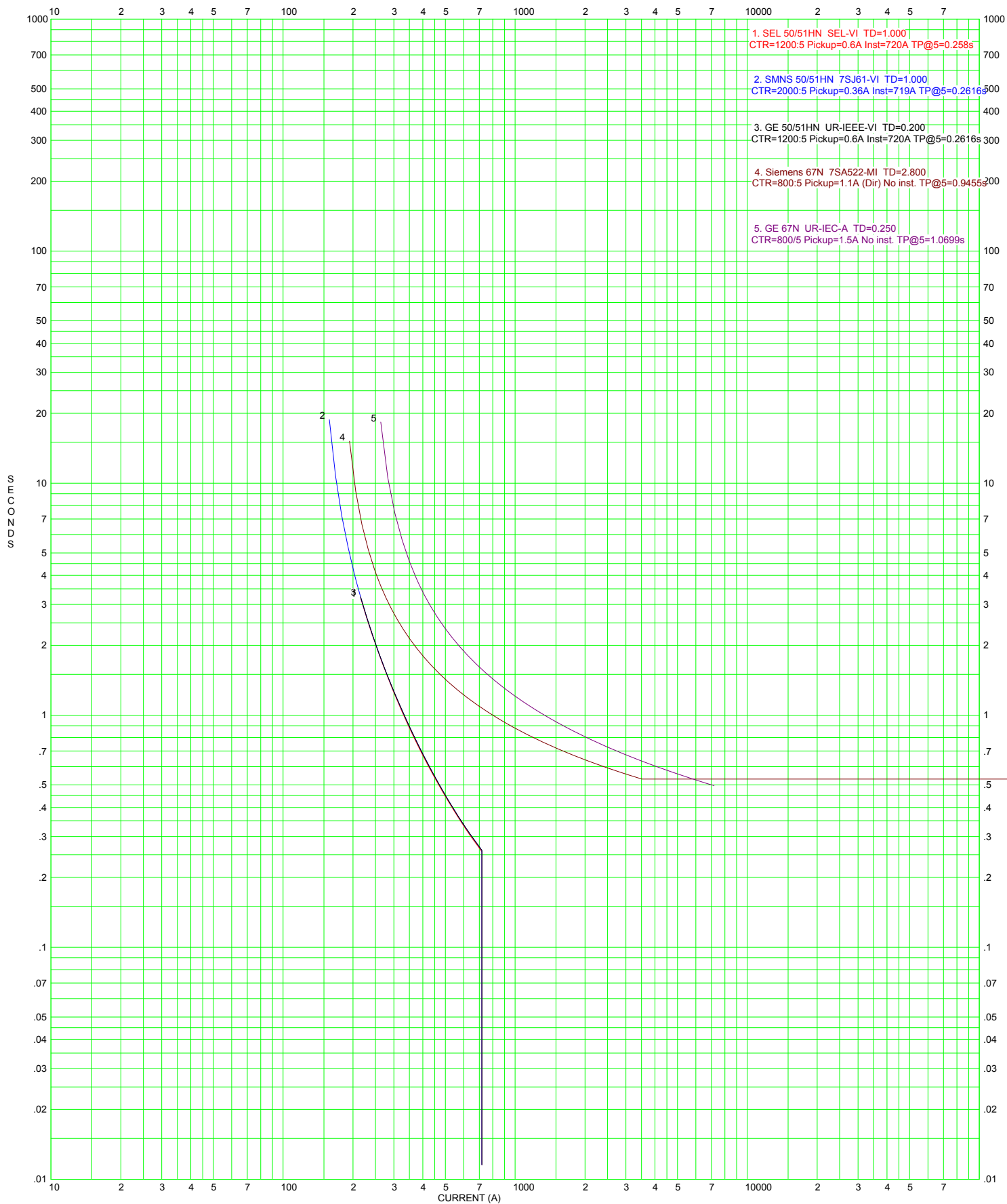
Feeder Phase Coordin	TIME-CURRENT CURVES @ Voltage 34.5-230kV	By JK/TRC
For Marble River Feeder Phase Coordination, End of feeder, System Min		No.
Comment Applicable to Feeders 1 through 8 (var. feeder instantaneous per settings basis)		Date 03/20/12



TIME-CURRENT CURVES @ Voltage .65-34.5kV		By	JK/TRC
For Marble River Feeder DOC, Sys. Minimum, End of longest feeder (8)		No.	
Comment LL fault on WTG 125 Transformer Secondary (650V)		Date	03/20/12



TIME-CURRENT CURVES @ Voltage 34.5kV		By JK/TRC
For Marble River Ground Coordination		No.
Comment Typical for Feeders 1 through 7, Feeder 8 per settings basis		Date 03/20/12



TIME-CURRENT CURVES @ Voltage 230kV		By	JK/TRC
For Marble River T2 230kV Ground OC		No.	
Comment Line settings provided by NYPA		Date	04/06/12

PATNODE

87BS/2BE

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

RELAY USED FOR BUS 2BE DIFFERENTIAL PROTECTION

CT RATIO= **400**

RID= **87BS/2BE**

TID= **PN BUS 2BE**

NUM OF CT'S= **3**

CT DATA:	2102	2114	T2 HIGH SIDE	
CT OHMS/TURN:	0.00219	0.00219	0.00242	
Rct:	0.8760	0.8760	0.9660	CT RESISTANCE IN OHMS
Es:	600	600	600	CT VOLTS AT KNEE

CABLE DATA:	2102	2114	T2 HIGH SIDE	
CABLE LENGTH:	220	245	340	CT TO REL PANEL IN FT
CABLE SIZE:	#10 CU	#10 CU	#10 CU	
CABLE RES:	1.02	1.02	1.02	OHMS PER 1000 FT
Rlead:	0.2244	0.2499	0.3468	LEAD RESISTANCE OHMS

Fault values from Aspen Oneliner Case: Marble River WFr1 and NYISO CY11

THRU FAULT DATA:

Individual current values seen by breaker are assuming breaker 2108 is open. A worst case through fault is for a T2 bushing fault.

	2102	2114	T2 HIGH SIDE	
3PH THRU FLT:	6620	2170	8780	PRI AMP
PH-GND THRU FLT:	5220	1930	7150	PRI AMP

BUS FAULT DATA:

Maximum and minimum fault conditions examined. A situation where the only source is Marble River will leave an ungrounded 230kV bus. Additional protection will be required to detect a phase to ground fault

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

in this scenario.

	ALL IN	WILLIS OUT	DULEY OUT	230kV OUT (M.R. ONLY)	
3PH BUS FLT:	9700	X	X	970	PRI AMP
PH-GND BUS FLT:	7980	X	X	0	PRI AMP

DIFF. ELEMENT SETTINGS:

HIGH VALUE SETTING FOR THRU FAULTS. FROM SEL INST BOOK, USE EQUATION: $V_r = (R_{ct} + (P * R_{lead})) * (I_F/N)$ Calculate V_r for each CT Use

CT SATURATION - 3PH THRU FLT:

	2102	2114	T2 HIGH SIDE	
Rct=	0.8760	0.8760	0.9660	OHMS
P=	1	1	1	
Rlead=	0.2244	0.2499	0.3468	OHMS
IF=	6620	2170	8780	PRI AMP
N=	400	400	400	CT RATIO
Vr=	18	6	29	VOLTS

CHECK AGAINST CT VOLTS AT KNEE OF EXCITATION CURVE:

Es=	600	600	600	VOLTS
-----	-----	-----	-----	-------

CT SATURATION - PH-GND THRU FLT:

	2102	2114	T2 HIGH SIDE	
Rct=	0.8760	0.8760	0.9660	OHMS
P=	2	2	2	
Rlead=	0.2244	0.2499	0.3468	OHMS
IF=	5220	1930	7150	PRI AMP
N=	400	400	400	CT RATIO
Vr=	17	7	30	VOLTS

CHECK AGAINST CT VOLTS AT KNEE OF EXCITATION CURVE:

Es=	600	600	600	VOLTS
-----	-----	-----	-----	-------

USE HIGHEST V_r CALCULATED PLUS MARGIN TO GET FINAL V_s SETTING:

HIGHEST Vr=	30	volts	T2 HIGH SIDE CT FOR 3PH THRU FAULT
MARGIN=	1.50		
Vs=	45	volts	

STATION: **PATNODE**
DEVICE: **87BS/2BE**
DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**
RELAY: **SEL 0587Z0X325H12XX**
FID: **R102-Z001**
ENG: **JK/TRC**

CHECK FOR MIN PRIMARY CURRENT REQUIRED TO OPERATE RELAY FOR INTERNAL FAULT FOR CHOSEN Vs.

FROM SEL INST BOOK USE EQUATION: $I_{min} = (n \cdot I_e + I_r + I_m) \cdot N$

Vs=	45	volts	
N=	400	ct ratio	
n=	3	num of ct's	
Ie=	0.0060	amp	T2 HIGH SIDE CT EXCITATION CURRENT AT SETTING VOLTAGE Vs
Ir=	0.0225	amp	CURRENT THRU RELAY = Vs/2000
Im=	0.0000	amp	CURRENT THRU MOV AT VOLTAGE Vs - USE FIGURE 3.7 IN SEL INST BOOK
Imin=	16.20	amps pri	

Relay will operate with a primary differential current of 16.20A,pri. Minimum expected fault for a normal operating condition is 970A,pri. Additional protection will be required to detect a ground fault on the 230kV bus if Marble River could become only source.

CHECK TO INSURE MOV SIZE IS ADEQUATE. USE FIG 3.10 IN SEL INST BOOK. USE MAX SECONDARY FAULT CURRENT AND MAX CT KNEE VOLTS

3PH BUS FLT:	9700	amps pri
CT RATIO:	400	
3PH BUS FLT:	24	amps sec
Es=	600	volts

FROM FIG 3.10 IN SEL INST BOOK, SEC FLT CURRENT = 24 AMPS AND CT VOLTS Es = 600 LIES JUST BELOW 1 MOV. THIS RELAY HAS TWO MOV'S

MINIMUM TRIP DURATION TIME DELAY:

Minimum time that the output trip contacts remain closed. Set to coordinate with bkr trip times plus a 3 cyc margin. (3cyc breaker +3cyc = 6cyc)

SET	TDURD	EQUAL	6.00	cycles
-----	--------------	-------	------	--------

DIFFERENTIAL ELEMENTS 87A1P-87C2P:

SET	87A1P	EQUAL	45	volts
SET	87A2P	EQUAL	OFF	
SET	87B1P	EQUAL	45	volts

STATION: **PATNODE**
DEVICE: **87BS/2BE**
DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**
RELAY: **SEL 0587Z0X325H12XX**
FID: **R102-Z001**
ENG: **JK/TRC**

SET	87B2P	EQUAL	OFF	
SET	87C1P	EQUAL	45	volts
SET	87C2P	EQUAL	OFF	

SINGLE PHASE INST. ELEMENT SETTINGS:

50A1P=	OFF	NOT USED
50A2P=	OFF	NOT USED
50B1P=	OFF	NOT USED
50B2P=	OFF	NOT USED
50C1P=	OFF	NOT USED
50C2P=	OFF	NOT USED

PHASE TOC ELEMENT SETTINGS:

51PP=	OFF	NOT USED
51AP=	OFF	NOT USED
51BP=	OFF	NOT USED
51CP=	OFF	NOT USED

RESIDUAL INST. ELEMENT SETTINGS:

51G1P=	OFF	NOT USED
51G2P=	OFF	NOT USED

RESIDUAL TOC ELEMENT SETTINGS:

51GP=	OFF	NOT USED
-------	------------	----------

NEGATIVE SEQ. INST. ELEMENT SETTINGS:

50Q1P=	OFF	NOT USED
50Q2P=	OFF	NOT USED

NEGATIVE SEQ. TOC ELEMENT SETTINGS:

51QP=	OFF	NOT USED
-------	------------	----------

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

CLOSE FAILURE TIME DELAY:

SET **CFD** EQUAL **60.00** cycles

DEMAND METERING

DMTC= **15**

PDEMP= **OFF**

GDEMP= **OFF**

QDEMP= **OFF**

SEL LOGIC VARIABLE TIMERS: Not Used

NFREQ= **60** cyc

PHROT= **ABC**

DATE_F= **MDY**

TR LOGIC:

TR logic determines which variables will trip unconditionally:

SET	TR1	EQUAL	87A1 + 87B1 + 87C1
SET	TR2	EQUAL	0
SET	TR3	EQUAL	0
SET	ULTR1	EQUAL	1
SET	ULTR2	EQUAL	1
SET	ULTR3	EQUAL	1

TORQUE CONTROL FOR TOC ELEM: Not Used

CLOSE LOGIC:

Sets close logic equations.

SET **52A** EQUAL **0**

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

SET **CL** EQUAL **0**

SET **ULCL** EQUAL **1**

EVENT REPORT TRIGGER CONDITIONS:

Determines which events will trigger an event report:

SET **ER1** EQUAL **87A1 +87B1 +87C1**

SET **ER2** EQUAL **0**

SEL LOGIC VARIABLE TIMERS: Not Used

OUTPUT SETTINGS:

OUTPUTS: SET **OUT1** EQUAL **TRIP1** Trip 86BS/2BE

SET **OUT2** EQUAL **0**

SET **OUT3** EQUAL **0**

SET **OUT4** EQUAL **0**

DISPLAY POINT EQUATIONS:

DP1= **87A1**

DP2= **87B1**

DP3= **87C1**

DP4=

DP5=

DP6=

DP7=

DP8=

DP1_1= **PH 1 ELEM**

DP1_0= **NA**

DP2_1= **PH 2 ELEM**

DP2_0= **NA**

DP3_1= **PH 3 ELEM**

DP3_0= **NA**

DP4_1=

DP4_0=

DP5_1=

DP5_0=

DP6_1=

DP6_0=

DP7_1=

DP7_0=

DP8_1=

DP8_0=

DISPLAY POINT LABELS

PORT 1

PROTO= **MOD**

STATION:
DEVICE:
DATE:

LINE:
RELAY:
FID:
ENG:

SPEED=
PARITY=
STOP=
SLAVEID=

SEQUENCE OF EVENTS TRIGGER CONDITIONS:

Determines which events will appear in the sequence of events report

SET	SER1	EQUAL	87A1,87B1,87C1
SET	SER2	EQUAL	N/A
SET	SER3	EQUAL	N/A

LOGIC EQUATIONS: Not Used

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

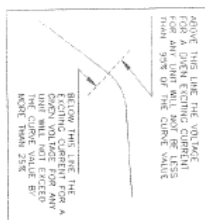
FID: **R102-Z001**

ENG: **JK/TRC**

APPENDIX:

CT, Breakers 2102 and 2114

Current Ratio	Turns Ratio	Sec. Res. *
2000:5	400:1	.876
1500:5	300:1	.657
1200:5	240:1	.526
1100:5	220:1	.482
800:5	160:1	.35
500:5	100:1	.219
400:5	80:1	.175
300:5	60:1	.131



This test report is in accordance with IEEE C57.13 1993



Instrument Transformers, Inc.
1907 Calumet St.
Clearwater, FL 33765

Date: 7/10/2008

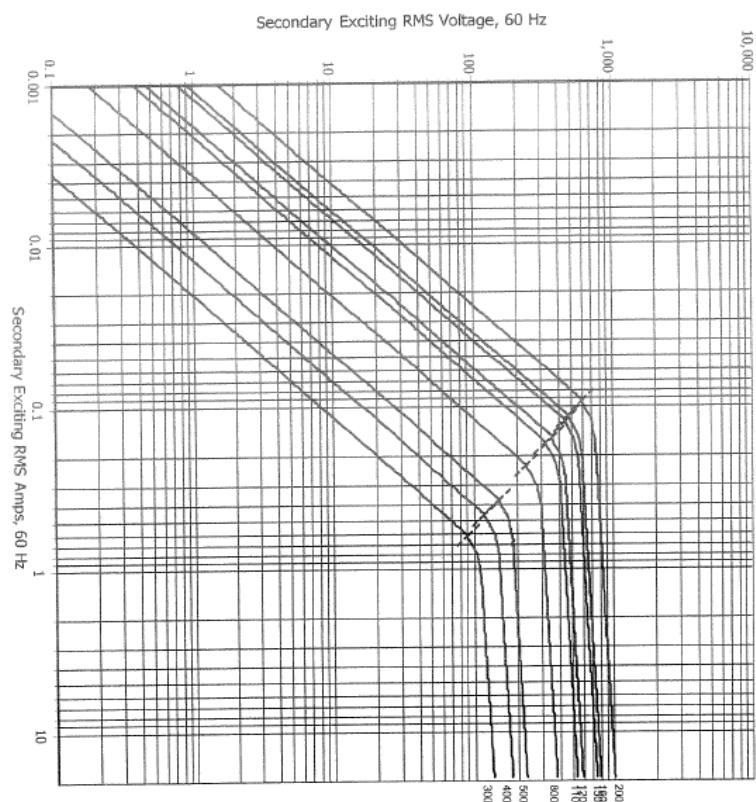
Entered

JS

Checked

Excitation Curve
Part Number: 17-4200-21

REVISION



STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

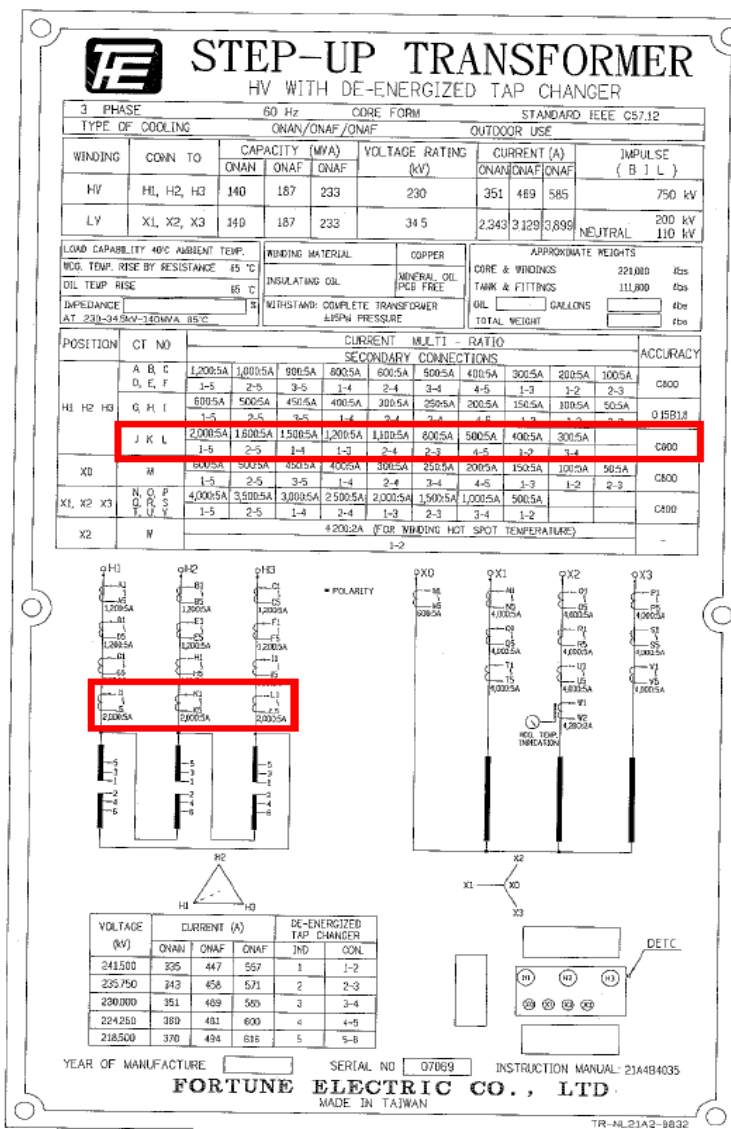
LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

CT, Transformer



STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

设备: 电流互感器

0821026

APPARATUS : Bushing Current Transformer

标准 Standard : ANSI/IEEE C57.13

频率 Frequency : 60 Hz

测试环境温度 Ambient air temperature: 20°C

编号 Serial No.	0821026
订单号 Order number	BB208100049
图号 Construction No.	H81041-3 (TR96069) (21T4B4906)
电流比 Ratio	2000/1600-1500-1200-1100-800-500-400-300/5
准确级 Accuracy class	C800-C800-C400-C400-C400-C400-C200-C200-C100

1. 极性检查 Verification of terminal marking

减极性 Subtractive

结果——合格 Result --- Satisfactory

2. 直流电阻测量 Winding resistance measurement

折算到 Corrected to 75°C 单位 unit in : Ω

J1 ~ J5(2000/5)	J2 ~ J5(1600/5)	J1 ~ J4(1500/5)
0.963	0.782	0.727
J1 ~ J3(1200/5)	J2 ~ J4(1100/5)	J2 ~ J3(800/5)
0.582	0.546	0.402
J4 ~ J5(500/5)	J1 ~ J2(400/5)	J3 ~ J4(300/5)
0.278	0.222	0.184

结果——合格 Result --- Satisfactory

3. 二次绕组工频耐压测试 Power-frequency withstand test on secondary winding

测试电压 Test voltage : 3 kV

频率 Frequency : 60 Hz

持续时间 Duration : 1 minute

结果——合格 Result --- Withstood

4. 匝间过电压测试 Inter-turn over voltage test

二次绕组开路 Secondary winding open circuited

感应电压 Induced voltage (J1~J5) : 4.5 kV peak

频率 Frequency : 60 Hz

持续时间 Duration : 1 minute

结果——合格 Result --- Withstood

5. 励磁特性测试 Excitation measurement

频率 Frequency : 60 Hz

B : 感应电压 Excitation voltage (V) I : 励磁电流 Exciting current (A)

J1 ~ J5(2000/5)		J2 ~ J5(1600/5)		J1 ~ J4(1500/5)	
E	I	E	I	E	I
1467	10	1124	10	1050	10
1415	5	1103	5	1031	5
1367	2.5	1076	2.5	1008	2.5
946	0.1	653	0.1	582	0.1
815	0.08	536	0.08	466	0.08
620	0.06	373	0.06	314	0.06
355	0.04	206	0.04	175	0.04
124	0.02	80	0.02	66	0.02
ε C = 0.084%		ε C = 0.17%		ε C = 0.077%	

(48) —1—

STATION: **PATNODE**

DEVICE: **87BS/2BE**

DATE: **3/20/2012**

LINE: **230KV BUS 2BE DIFFERENTIAL**

RELAY: **SEL 0587Z0X325H12XX**

FID: **R102-Z001**

ENG: **JK/TRC**

K1 ~ K3(1200/5)		K2 ~ K4(1100/5)		K2 ~ K3(800/5)	
E	I	E	I	E	I
840	10	768	10	557	10
821	5	750	5	544	5
797	2.5	730	2.5	522	2.5
325	0.1	274	0.1	127	0.1
244	0.08	193	0.08	88	0.08
161	0.06	125	0.06	60	0.06
89	0.04	71	0.04	30	0.04
35	0.02	26	0.02	11	0.02
$\varepsilon C=0.13\%$		$\varepsilon C=0.16\%$		$\varepsilon C=0.44\%$	
K4 ~ K5(500/5)		K1 ~ K2(400/5)		K3 ~ K4(300/5)	
E	I	E	I	E	I
342	10	272	10	202	10
331	5	264	5	193	5
319	2.5	248	2.5	184	2.5
40.8	0.1	15.6	0.1	12	0.1
27.6	0.08	12	0.08	8.4	0.08
19.2	0.06	7.2	0.06	5.6	0.06
10.8	0.04	4.4	0.04	3	0.04
3.7	0.02	1.9	0.02	1.08	0.02
$\varepsilon C=0.43\%$		$\varepsilon C=0.94\%$		$\varepsilon C=0.61\%$	

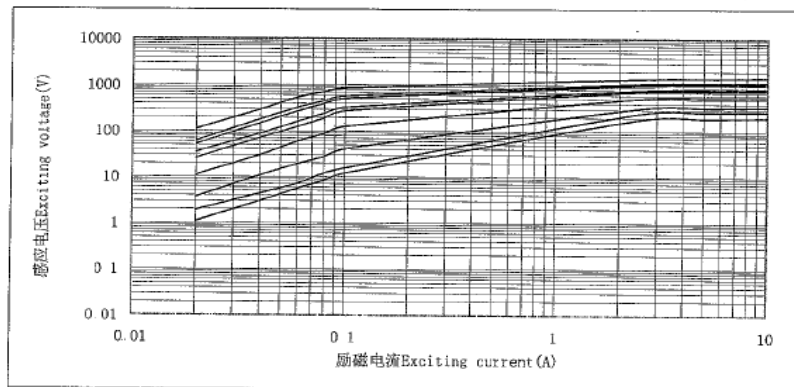
0821027

结果—合格 Result --- Satisfactory

6 绝缘电阻测量 Insulation resistance measurement

用1000V兆欧表测量，绝缘电阻不小于1000欧姆 Above 1000M Ω with 1000V megger

励磁曲线 Plot of magnetization



K1 ~ K5
K2 ~ K5
K1 ~ K4
K1 ~ K3
K2 ~ K4
K2 ~ K3
K4 ~ K5
K1 ~ K2
K3 ~ K4

检验员 TESTED BY: **102**

审核员 CHECKED BY: **103**

南京智达电气有限公司
Nanjing Zhida Electric Co.Ltd



日期 Date: 2008.11

(51)-2-

PATNODE

50/62BFP/2102

STATION: **PATNODE**

DEVICE: **50/62BFP/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2102 BREAKER FAILURE

DEVICE CONFIGURATION

0103 Setting Group Change Option	Disabled	NOT USED
0104 Oscillographic Fault Records	Enabled	
0112 50/51	Def. Time Only	USED FOR FAULT DETECTOR
0113 50N/51N	Def. Time Only	USED FOR FAULT DETECTOR
0127 50 1Ph	Disabled	NOT USED
0117 Cold Load Pickup	Disabled	NOT USED
0122 2nd Harmonic Inrush Restraint	Disabled	NOT USED
0131 (Sensitive) Ground Fault	Disabled	NOT USED
0140 46 Negative Sequence Protection	Disabled	NOT USED
0142 49 Thermal Overload Protection	Disabled	NOT USED
0170 50BF Breaker Failure Protection	Disabled	NOT USED
0172 52 Breaker Wear Monitoring	Disabled	NOT USED
0182 74TC Trip Circuit Supervision	Disabled	NOT USED

CONFIGURATION: BINARY INPUTS

Binary Input 1	Type	BFI	BF initiation
	Conf.	SP	
		H	
Binary Input 2	Type	SPARE	
	Conf.		
Binary Input 3	Type	BFI + 52a	No current BF initiation
	Conf.	SP	
		H	
Binary Input 4	Type	Low Gas Detection	Input from bkr low gas relay
	Conf.	SP	
		H	
Binary Input 5	Type	SPARE	
	Conf.		
Binary Input 6	Type	SPARE	
	Conf.		
Binary Input 7	Type	SPARE	
	Conf.		
Binary Input 8	Type	SPARE	

STATION: **PATNODE**
DEVICE: **50/62BFP/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Conf.

CONFIGURATION: BINARY OUTPUTS

Binary Output 1	Type	50BF LOGIC TRIP	BF trip of bkr.
	Conf.	OUT	
		U	
Binary Output 2	Type	RETRIP	Retrip of bkr.
	Conf.	OUT	
		U	
Binary Output 3	Type	BF BYPASS	Bypass BF timer to trip bkr.
	Conf.	OUT	
		U	
Binary Output 4	Type	SPARE	
	Conf.		
Binary Output 5	Type	SPARE	
	Conf.		
Binary Output 6	Type	SPARE	
	Conf.		
Binary Output 7	Type	SPARE	
	Conf.		
Binary Output 8	Type	SPARE	
	Conf.		

CONFIGURATION: LEDS

LED 1	Type	50BF LOGIC TRIP & BF BYPASS
	Conf.	OUT
		L
LED 2	Type	BFI + 52a
	Conf.	SP
		L
LED 3	Type	A ph BFT LED
	Conf.	OUT
		L
LED 4	Type	B ph BFT LED
	Conf.	OUT
		L
LED 5	Type	C ph BFT LED
	Conf.	OUT
		L
LED 6	Type	Various Relay Alarms
	Conf.	OUT
		U

STATION:

DEVICE:

DATE:

LINE:

RELAY:

FID:

ENG:

LED 7

Type
Conf.

GND BFT LED

OUT

L

CONFIGURATION: SYSTEM INTERFACE

LEAVE AT DEFAULT

INTERFACE: SERIAL INTERFACE ON PC

Address	
Frame	
Baud Rate	
COM Interface	
Apply Settings	

INTERFACE: VD ADDRESSES

VD Address	
SIPROTEC SYS VD Address	
Proxy VD Address	
SIPROTEC T103 VD Address	

SYSTEM INTERFACE: OPERATOR INTERFACE

DIGSI Link Address	
Frame	
Baud Rate	
Max gap	
IP Address	
Subnet Mask	
Link Layer	
Access Authorization	
Access Rights	

SYSTEM INTERFACE: SERVICE INTERFACE

DIGSI Link Address	
Frame	

STATION: **PATNODE**
DEVICE: **50/62BFP/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Baud Rate
Max gap
IP Address
Subnet Mask
Link Layer
Access Authorization
Access Rights

GENERAL DEVICE SETTINGS

0610 Fault Display **Disp. Tar. All PU**
0640 Start Image **Image 1**

POWER SYSTEM DATA

0214 Rated Frequency **60hz**
0209 Phase Sequence **ABC**
0276 Temperature Unit **Degr. F**
0201 CT Starpoint **Towards Bus**
0235A Storage **NO**
0250A 50, 51 TOC with 2ph. Prot. **OFF**
0613A 50N/51N/67N GOC **Ignd(meas.)**
0204 CT Rated Primary Current **800**
0205 CT Rated Secondary Current **5**
0217 Ignd-CT Rated Primary Current **800**
0218 Ignd-CT Rated Secondary Current **5**
0210A Min. TRIP Commonad Duration **0.10s**
0211A Max. Close Command Duration **1.00s**
0212 Min. Current Threshold **0.50A**

SETTINGS GROUPS: POWER SYSTEM DATA 2

1102 Meas. Full Scale Current **800A**

Fault Values:

CTR= **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

STATION: **PATNODE**
DEVICE: **50/62BFP/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

WPN1 Line Rating= **996** A,pri 6.23 A,sec
PND1 Line Rating= **996** A,pri 6.23 A,sec

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground= **2023** A,pri (3I0) 12.64 A,sec
Phase to Phase= **2492** A,pri 15.58 A,sec
Three Phase= **2889** A,pri 18.06 A,sec

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground= **1102** A,pri (3I0) 6.89 A,sec
Phase to Phase= **894** A,pri 5.59 A,sec
Three Phase= **1034** A,pri 6.46 A,sec

SETTINGS GROUPS: 50/51 PHASE/GROUND OVERCURRENT

PHASE

1201 50, 51 Phase TOC **ON**
1217 50-3 Pickup **oo** NOT USED
1218 50-3 Time Delay **oo** NOT USED
1202 50-2 Pickup **2.75** NOT USED

Set the phase fault detector at 50% of the lowest phase fault value.
Phase fault detector will be set below the current rating of the line.
Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)= **894** TIMES **0.5** EQUALS 447 A,pri
EQUALS 2.79 A,sec
Set pickup at: **2.75** A,sec
440 A,pri

1203 50-2 Time Delay **oo** Allows signal only, CFC timer used
1204 50-1 Pickup **oo** NOT USED
1205 50-1 Time Delay **oo** NOT USED

RESIDUAL GROUND

STATION: **PATNODE**
DEVICE: **50/62BFP/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

1301 50N, 51N Phase TOC **ON**
1317 50N-3 Pickup **oo** NOT USED
1318 50N-3 Time Delay **oo** NOT USED
1302 50N-2 Pickup **1.25** NOT USED

Set the ground fault detector at 20% of the line rating and check that it is lower than expected ground fault.

Gnd fault detector setting of 40A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
Set pickup at: **1.25** A,sec
200 A,pri

1303 50N-2 Time Delay **oo** Allows signal only, CFC timer used
1304 50N-1 Pickup **oo** NOT USED
1305 50N-1 Time Delay **oo** NOT USED

SETTINGS GROUPS: MEASUREMENT SUPERVISION

NOT USED - LEAVE AT DEFAULT

TIME SYNCHRONIZATION

Source **IRIG B**
Fault Indication **10 Min**
Time Format **mm/dd/yy** USA Time Format
Offset to Signal **0**

CFC CHART

See CFC Chart in Appendix for Breaker Failure Logic

STATION: **PATNODE**

DEVICE: **50/62BFP/2102**

DATE: **3/20/2012**

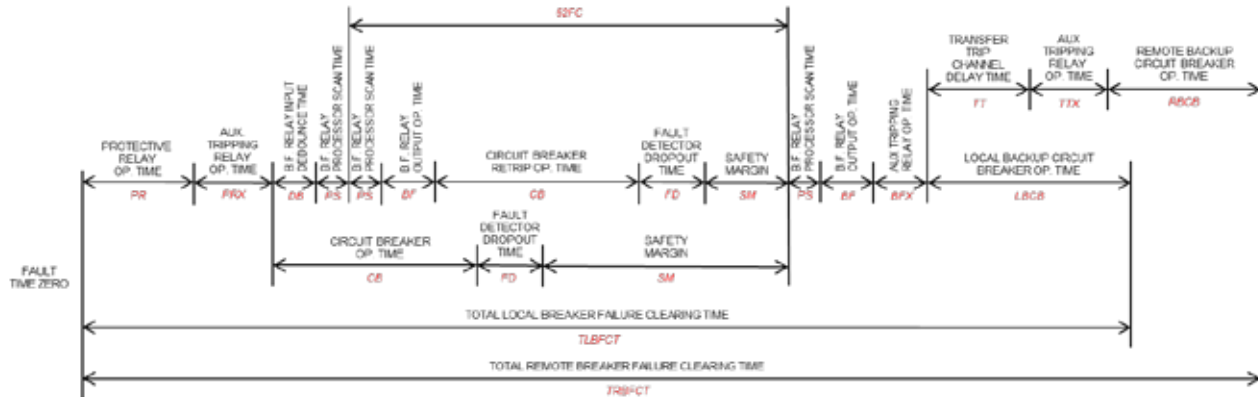
LINE: **BKR 2102**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

BREAKER FAILURE TIMING (CFC TIMER)



62FC= **7.700** cyc

PR = 2.040 cyc

PRX = 0.900 cyc

DB = 0.240 cyc

PS = 0.030 cyc

CB = 3.000 cyc

FD = 2.400 cyc

BF = 0.240 cyc

BFX = 0.900 cyc

LBCB = 3.000 cyc

TT = 0.000 cyc

TTX = 0.000 cyc

RBCB = 0.000 cyc

Used for CFC Timer setting (Adjusted to achieve ~2 cyc safety margin)

T2 relay time to operate for a differential fault

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

76J6115 Input Pickup Time = 4ms (76J6115 Manual, page 299)

76J6115 Processor Scan Time = 0.5ms (Not published, typical used)

Local circuit breaker operate time (Per bkr. nameplate)

Fault Detector MAX dropout = 40ms (7SJ6115 Manual, Page 309)

76J6115 Published operate time = 4ms (Not published, typical used)

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

Local backup circuit breaker operate time

Transfer trip channel time - By NYPA

Transfer trip aux relay operate time - By NYPA

Assumed remote backup circuit breaker operate time - By NYPA

(ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB

NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB

RCT = 6.480 cyc

Time for breaker retrip to occur

BF TIMER SETTING (62FC)>=PS+BF+CB+FD

62FC >= 5.670 cyc

62FC must provide enough time for breaker to trip normally or retrip

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB

TLBFCT = 15.080 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD

SMNT = 2.570 cyc

Try to maintain a 2 cycle margin to cover timing errors

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD

SMRT = 2.030 cyc

Try to maintain a 2 cycle margin to cover timing errors

SET BF TIMER PU DELAY= 7.700 cyc

SET BF TIMER DO DELAY= **6.000** cyc

EQUALS 128.33 msec (round to 129msec for Siemens)

EQUALS 100.00 msec

LINE:	BKR 2102	
RELAY:	7SJ6115-4DC11-1FA1	
FID:	V04.71.04	
ENG:	JK/TRC	

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PATNODE\50_62_WFP_2102\DIGEST Program\Plane\WYPA BF LOGIC

Parit.: A Sh.: 1

Author: JK/TRC
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Last change: 3/12/2012 13:16
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03/12/2012 01:20:10 PM

PATNODE

50/62BFS/2102

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2102 BREAKER FAILURE

PRODUCT SETUP: SECURITY

Command Password	0
Setting Password	0
Command Password Access Timeout	5 min
Setting Password Access Timeout	30 min
Invalid Password Attempts	3
Password Lockout Duration	5 min
Password Access Events	Enabled

PRODUCT SETUP: DISPLAY PROPERTIES

Flash Message Time	1.0 s
Default Message Timeout	300 s
Default Message Intensity (VFD Only)	25%
Screen Saver Feature (LCD Only)	Enabled
Screen Saver Wait Time (LCD Only)	30 min
Current Cutoff Level	0.020 pu
Voltage Cutoff Level	1.0 V

PRODUCT SETUP: CLEAR RELAY RECORDS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SERIAL PORTS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: NETWORK

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: MODBUS PROTOCOL

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP PROTOCOL

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP - IEC104 POINTS LIST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 61850

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: HTTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: TFTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 60870-5-104

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SNTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: MODBUS USER MAP

NOT USED - LEAVE AT DEFAULT

REAL TIME CLOCK

IRIG-B Signal Type

DC Shift

Real Time Clock Events

Enabled

Time Zone Offset

0.0 hr

DST Function

Disabled

PRODUCT SETUP: USER-PROGRAMMABLE FAULT REPORT

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: OSCILLOGRAPHY

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Number Of Records	5
Trigger Mode	Automatic Overwrite
Trigger Position	30%
Trigger Source	Osc Trigger On (VO64)
AC Input Waveforms	32 samples/cycle
Digital Channel 1	BFI On(H7A)
Digital Channel 2	BFI LOW CURR On(H7C)
Digital Channel 3	52a On(H8A)
Digital Channel 4	LOW GAS Off(H8C)
Digital Channel 5	BKR FAIL 1 RETRIP
Digital Channel 6	BKR FAIL 1 T1 OP
Digital Channel 7	BKR FAIL 2 T3 OP
Digital Channel 8	BFI/BFI/ LC On (VO1)
Digital Channel 9	BF RETRIP On (VO2)
Digital Channel 10	BF TRIP On (VO3)
Digital Channel 11	BF BYPASS On (VO4)
Digital Channel 12	LC RETRIP On (VO5)
Digital Channel 13	TRIPBUS 1 OP
Digital Channel 14	TRIPBUS 2 OP
Digital Channel 15	TRIPBUS 3 OP
Digital Channel 16 - 63	OFF
Analog Channel 1	SRC1 Ia RMS
Analog Channel 2	SRC1 Ib RMS
Analog Channel 3	SRC1 Ic RMS
Analog Channel 4 - 16	OFF

PRODUCT SETUP: DATA LOGGER

Data Logger Mode	Continuous
Data Logger Trigger	OFF
Rate	60000 msec

PRODUCT SETUP: DEMAND

Current Method	Thermal Exponential
----------------	---------------------

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Power Method **Thermal Exponential**
Interval **15 MIN**
Trigger **OFF**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: LED TEST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: TRIP AND ALARMS LEDS

Trip LED Input **Osc Trigger (VO64)**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: USER PROGRAMMABLE LEDS

LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE SELF TESTS

Direct Ring Break Function **Enabled**
Direct Device Off Function **Enabled**
Remote Device Off Function **Enabled**
Pri Ethernet Fail Function **Disabled**
Battery Fail Function **Enabled**
SNTP Fail Function **Enabled**
IRIG B Fail Function **Enabled**

PRODUCT SETUP: CONTROL PUSHBUTTONS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: FLEX STATES

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-DEFINEABLE DISPLAYS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: DIRECT I/O

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PRODUCT SETUP: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: INSTALLATION

Relay Name **50/62BFS/2102**

SYSTEM SETUP: AC INPUTS: CURRENT

CT F1: Phase CT Primary	800 A	2000/ 800 :5 CT
CT F1: Phase CT Secondary	5 A	
CT F1: Ground CT Primary	1 A	REQUIRED ENTRY, NOT USED
CT F1: Ground CT Secondary	1 A	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: AC INPUTS: VOLTAGE

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: POWER SYSTEM

Nominal Frequency	60 Hz
Phase Rotation	ABC
Frequency And Phase Reference	SRC 1 (SRC 1) CURRENT ONLY
Frequency Tracking Function	Enabled

SYSTEM SETUP: SIGNAL SOURCES

SOURCE 1: Name	SRC 1	DEFAULT VALUE
SOURCE 1: Phase CT	F1	ASSIGN BKR CT AS SOURCE 1
SOURCE 1: Ground CT	None	
SOURCE 1: Phase VT	None	
SOURCE 1: Auxiliary VT	None	
SOURCE 2: Name	SRC 2	REQUIRED ENTRY, NOT USED
SOURCE 2: Phase CT	None	
SOURCE 2: Ground CT	None	
SOURCE 2: Phase VT	None	
SOURCE 2: Auxiliary VT	None	

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

SYSTEM SETUP: BREAKERS

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: SWITCHES

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: FLEXCURVES

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXLOGIC EQUATION EDITOR

FlexLogic Entry 1	BFI On(H7A)
FlexLogic Entry 2	BFI LOW CURR On(H7C)
FlexLogic Entry 3	OR(2)
FlexLogic Entry 4	BFI/BFI LC (VO1)
FlexLogic Entry 5	BKR FAIL 1 RETRIP
FlexLogic Entry 6	LC RETRIP On (VO5)
FlexLogic Entry 7	AND(2)
FlexLogic Entry 8	BF RETRIP (VO2)
FlexLogic Entry 9	BKR FAIL 1 T1 OP
FlexLogic Entry 10	BKR FAIL 2 T3 OP
FlexLogic Entry 11	OR(2)
FlexLogic Entry 12	BF TRIP (VO3)
FlexLogic Entry 13	LOW GAS On(H8C)
FlexLogic Entry 14	BF RETRIP (VO2)
FlexLogic Entry 15	AND(2)
FlexLogic Entry 16	BF BYPASS (VO4)
FlexLogic Entry 17	TRIPBUS 1 OP
FlexLogic Entry 18	POSITIVE ONE SHOT
FlexLogic Entry 19	TRIPBUS 2 OP
FlexLogic Entry 20	POSITIVE ONE SHOT
FlexLogic Entry 21	TRIPBUS 3 OP
FlexLogic Entry 22	POSITIVE ONE SHOT
FlexLogic Entry 23	OR(3)
FlexLogic Entry 24	Osc Trigger (VO64)

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

FlexLogic Entry 25	BFI LOW CURR ON(H7C)
FlexLogic Entry 26	52a ON(H8A)
FlexLogic Entry 27	AND(2)
FlexLogic Entry 28	LC RETRIP (V05)
FlexLogic Entry 29 - 512	SPARE

FLEXLOGIC: FLEXLOGIC TIMERS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXELEMENTS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: NON-VOLATILE LATCHES

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

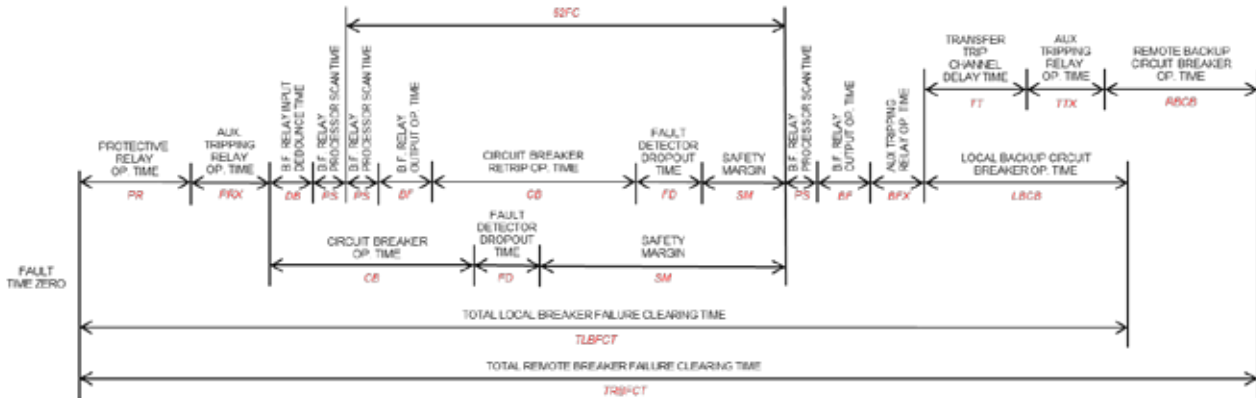
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BREAKER FAILURE INFORMATION

TIMER:



62FC = **7.700** cyc
 PR = 2.040 cyc
 PRX = 0.900 cyc
 DB = 0.000 cyc
 PS = 0.030 cyc
 CB = 3.000 cyc
 FD = 2.400 cyc
 BF = 0.240 cyc
 BFX = 0.900 cyc
 LBCB = 3.000 cyc
 TT = 0.000 cyc
 TTX = 0.000 cyc
 RBCB = 0.000 cyc

Used for Flexlogic setting (Adjusted to achieve ~2 cyc safety margin)
 T2 relay time to operate for a differential fault
 Electroschwitch standard speed LOR, 15mSec operate time (Per catalog)
 C60 Debounce Time for this input
 C60 Processor Scan Time = 0.5ms (GE C60 Manual, Page 5-178)
 Local circuit breaker operate time (Per bkr. nameplate)
 Fault Detector MAX dropout (Not published, use typical of 40ms)
 C60 Published operate time = 4ms (GE C60 Manual, Page 2-11)
 Electroschwitch standard speed LOR, 15mSec operate time (Per catalog)
 Local backup circuit breaker operate time
 Transfer trip channel time - By NYPA
 Transfer trip aux relay operate time - By NYPA
 Assumed remote backup circuit breaker operate time - By NYPA
 (ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB
 NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB
 RCT = 6.240 cyc

BF TIMER SETTING (62FC) >= PS+BF+CB+FD
 62FC >= 5.670 cyc

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB
 TLBFCT = 14.840 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD
 SMNT = 2.330 cyc

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD
 SMRT = 2.030 cyc

FAULT VALUES:

CTR = **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

WPN1 Line Rating = **996** A, pri 6.23 A, sec 1.25 A, pu

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

PND1 Line Rating= **996** A,pri 6.23 A,sec 1.25 A,pu

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground=	2023	A,pri (3I0)	12.64 A,sec	2.53 A,pu
Phase to Phase=	2492	A,pri	15.58 A,sec	3.12 A,pu
Three Phase=	2889	A,pri	18.06 A,sec	3.61 A,pu

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground=	1102	A,pri (3I0)	6.89 A,sec	1.38 A,pu
Phase to Phase=	894	A,pri	5.59 A,sec	1.12 A,pu
Three Phase=	1034	A,pri	6.46 A,sec	1.29 A,pu

GROUPED ELEMENTS: GROUP 1: BREAKER FAILURE

BF1: Function	Enabled	Enable function for current supervised BFI
BF1: Mode	3-Pole	Three pole tripping only
BF1: Source	SRC 1 (SRC 1)	Current from breaker
BF1: Current Supervision	Yes	Enable current supervision of BFI
BF1: Use Seal-In	No	No seal in
BF1: Three Pole Initiate	BFI/BFI LC On (VO1)	BFI from line relay or low current BFI inputs
BF1: Block	OFF	No blocking of BFI
BF1: Phase Current Supv Pickup	0.55 pu	

Set the phase fault detector at 50% of the lowest phase fault value.

Phase fault detector will be set below the current rating of the line.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)=	894	TIMES	0.5	EQUALS	447 A,pri
EQUALS	2.79	A,sec			
EQUALS	0.56	A,pu			
Set pickup at:	0.55	A,pu			
	440	A,pri			

BF1: Neutral Current Supv Pickup

0.05 pu

Set the ground fault detector at 20% of the line rating and check that it is

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

lower than expected ground fault.

Gnd fault detector setting of 200A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
EQUALS 0.25 A,pu

Set pickup at: **0.25** A,pu
200 A,pri

BF1: Use Timer 1 **Yes** 62BF, Current supervised trip

BF1: Timer 1 Pickup Delay **0.128 s** See time calculations above

62FC= **7.700 cyc**
EQUALS 0.128333 sec

BF1: Use Timer 2 **No** NOT USED

BF1: Timer 2 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Use Timer 3 **No** NOT USED

BF1: Timer 3 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Breaker Pos1 Phase A/3P **ON** Set to logic 1 to enable BFI timer (No 52a supervision)

BF1: Breaker Pos2 Phase A/3P **OFF** NOT USED

BF1: Breaker Test On **OFF** NOT USED

BF1: Phase Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Phase Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: LoSet Time Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Trip Dropout Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Target **Self-reset**

BF1: Events **Enabled**

BF1: Phase A Initiate **OFF** NOT USED

BF1: Phase B Initiate **OFF** NOT USED

BF1: Phase C Initiate **OFF** NOT USED

BF1: Breaker Pos1 Phase B **OFF** NOT USED

BF1: Breaker Pos1 Phase C **OFF** NOT USED

BF1: Breaker Pos2 Phase B **OFF** NOT USED

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BF1: Breaker Pos2 Phase C	OFF	NOT USED
BF2: Function	Enabled	Enable function for low current BFI
BF2: Mode	3-Pole	Three pole tripping only
BF2: Source	SRC 1 (SRC 1)	Current from breaker
BF2: Current Supervision	No	No current supervision for low current scheme
BF2: Use Seal-In	No	No seal in
BF2: Three Pole Initiate	BFI LOW CURR On(H7C)	BFI from low current inputs only
BF2: Block	OFF	No blocking of BFI
BF2: Phase Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Neutral Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Use Timer 1	No	NOT USED
BF2: Timer 1 Pickup Delay	0.000 s	REQUIRED SETTING, NOT USED
BF2: Use Timer 2	No	NOT USED
BF2: Timer 2 Pickup Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Use Timer 3	Yes	62BF, Low/NO current trip
BF2: Timer 3 Pickup Delay	0.128 s	Set same as BF1 T1
BF2: Breaker Pos1 Phase A/3P	OFF	Not used
BF2: Breaker Pos2 Phase A/3P	52a On(H8a)	Used for breaker position supervision of low current BFI
BF2: Breaker Test On	OFF	NOT USED
BF2: Phase Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Phase Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: LoSet Time Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Trip Dropout Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Target	Self-reset	
BF2: Events	Enabled	
BF2: Phase A Initiate	OFF	NOT USED
BF2: Phase B Initiate	OFF	NOT USED
BF2: Phase C Initiate	OFF	NOT USED
BF2: Breaker Pos1 Phase B	OFF	NOT USED
BF2: Breaker Pos1 Phase C	OFF	NOT USED
BF2: Breaker Pos2 Phase B	OFF	NOT USED

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

BF2: Breaker Pos2 Phase C

OFF

NOT USED

GROUPED ELEMENTS: GROUP 1: VOLTAGE ELEMENTS

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: POWER

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 2

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 3

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 4

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 5

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 6

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: TRIP BUS

Trip Bus 1 Function

Enabled

Trip Bus 1 Block

OFF

NO BLOCK TRIP

Trip Bus 1 Pickup Delay

0.00 s

NO PICK-UP DELAY

Trip Bus 1 Reset Delay

0.10 s

SET EQUAL TO SEL TDURD (6cyc)

Trip Bus 1 Input 1

BF TRIP On (VO3)

Current or breaker supervised trip

Trip Bus 1 Input 2 - 16

SPARE

Trip Bus 1 Latching

Disabled

Trip Bus 1 Reset

OFF

Trip Bus 1 Target

Self-reset

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Trip Bus 1 Events	Enabled	
Trip Bus 2 Function	Enabled	
Trip Bus 2 Block	OFF	NO BLOCK TRIP
Trip Bus 2 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 2 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 2 Input 1	BF RETRIP ON (VO2)	Immediate re-trip of secondary breaker trip coil
Trip Bus 2 Input 2 -16	SPARE	
Trip Bus 2 Latching	Disabled	
Trip Bus 2 Reset	OFF	
Trip Bus 2 Target	Self-reset	
Trip Bus 2 Events	Enabled	
Trip Bus 3 Function	Enabled	
Trip Bus 3 Block	OFF	NO BLOCK TRIP
Trip Bus 3 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 3 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 3 Input 1	BF BYPASS On (VO4)	Bypass breaker failure timer for low gas and BFI
Trip Bus 3 Input 2 - 16	SPARE	
Trip Bus 3 Latching	Disabled	
Trip Bus 3 Reset	OFF	
Trip Bus 3 Target	Self-reset	
Trip Bus 3 Events	Enabled	
Trip Bus 4-6	SPARE	

CONTROL ELEMENTS: SETTING GROUPS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SELECTOR SWITCHES

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: UNDERFREQUENCY

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: OVERFREQUENCY

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SYNCHROCHECK

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL COUNTERS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: MONITORING ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: PILOT SCHEMES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT INPUTS

[H7A] Contact Input 1 ID	BFI	BFI INITIATE
[H7A] Contact Input 1 Debounce Time	0 ms	Debounce set to 0ms
[H7A] Contact Input 1 Events	Enabled	
[H7C] Contact Input 2 ID	BFI LOW CURR	BF OC BY-PASS
[H7C] Contact Input 2 Debounce Time	0 ms	Debounce set to 0ms
[H7C] Contact Input 2 Events	Enabled	
[H8A] Contact Input 3 ID	52a	52a
[H8A] Contact Input 3 Debounce Time	0 ms	Debounce set to 0ms
[H8A] Contact Input 3 Events	Enabled	
[H8C] Contact Input 4 ID	LOW GAS	BF LOW GAS
[H8C] Contact Input 4 Debounce Time	0 ms	Debounce set to 0ms
[H8C] Contact Input 4 Events	Enabled	
[M7A] - [M8C]	SPARE	

INPUTS/OUTPUTS: CONTACT INPUT THRESHOLDS

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Cont 1p 1 - Cont Ip 4 **84 Vdc** Suggested setting for 125Vdc control system

Cont 1p 5 - Cont Ip 8 **84 Vdc** Suggested setting for 125Vdc control system

INPUTS/OUTPUTS: VIRTUAL INPUTS: VIRTUAL INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT OUTPUTS

[H1] Contact Output 1 ID	Cont Op 1	BF TIME TRIP 86BFS
[H1] Contact Output 1 Operate	TRIPBUS 1 OP	
[H1] Contact Output 1 Seal-In	OFF	
[H1] Contact Output 1 Events	Enabled	
[H2] Contact Output 2 ID	Cont Op 2	62ZP RETRIP BKR. SECONDARY COIL
[H2] Contact Output 2 Operate	TRIPBUS 2 OP	
[H2] Contact Output 2 Seal-In	OFF	
[H2] Contact Output 2 Events	Enabled	
[H3] Contact Output 3 ID	Cont Op 3	BF TIMER BY-PASS TRIP 86BFS
[H3] Contact Output 3 Operate	TRIPBUS 3 OP	
[H3] Contact Output 3 Seal-In	OFF	
[H3] Contact Output 3 Events	Enabled	
[H4] - [H6]	SPARE	
[M1] - [M6]	SPARE	

INPUTS/OUTPUTS: VIRTUAL OUTPUTS

Virtual Output 1 ID	BFI/BFI LC
Virtual Output 1 Events	Enabled
Virtual Output 2 ID	BF RETRIP
Virtual Output 2 Events	Enabled
Virtual Output 3 ID	BF TRIP
Virtual Output 3 Events	Enabled
Virtual Output 4 ID	BF BYPASS
Virtual Output 4 Events	Enabled
Virtual Output 5	LC RETRIP
Virtual Output 5 Events	Enabled

STATION: **PATNODE**
DEVICE: **50/62BFS/2102**
DATE: **3/20/2012**

LINE: **BKR 2102**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Virtual Output 6-63	SPARE
Virtual Output 64 ID	Osc Trigger
Virtual Output 64 Events	Enabled
Virtual Output 65 - 96	SPARE

INPUTS/OUTPUTS: REMOTE DEVICES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS DNA BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS USERST BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: RESETTING

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT OUTPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: IEC 61850 GOOSE ANALOGS INPUTS

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2102**

DATE: **3/20/2012**

LINE: **BKR 2102**

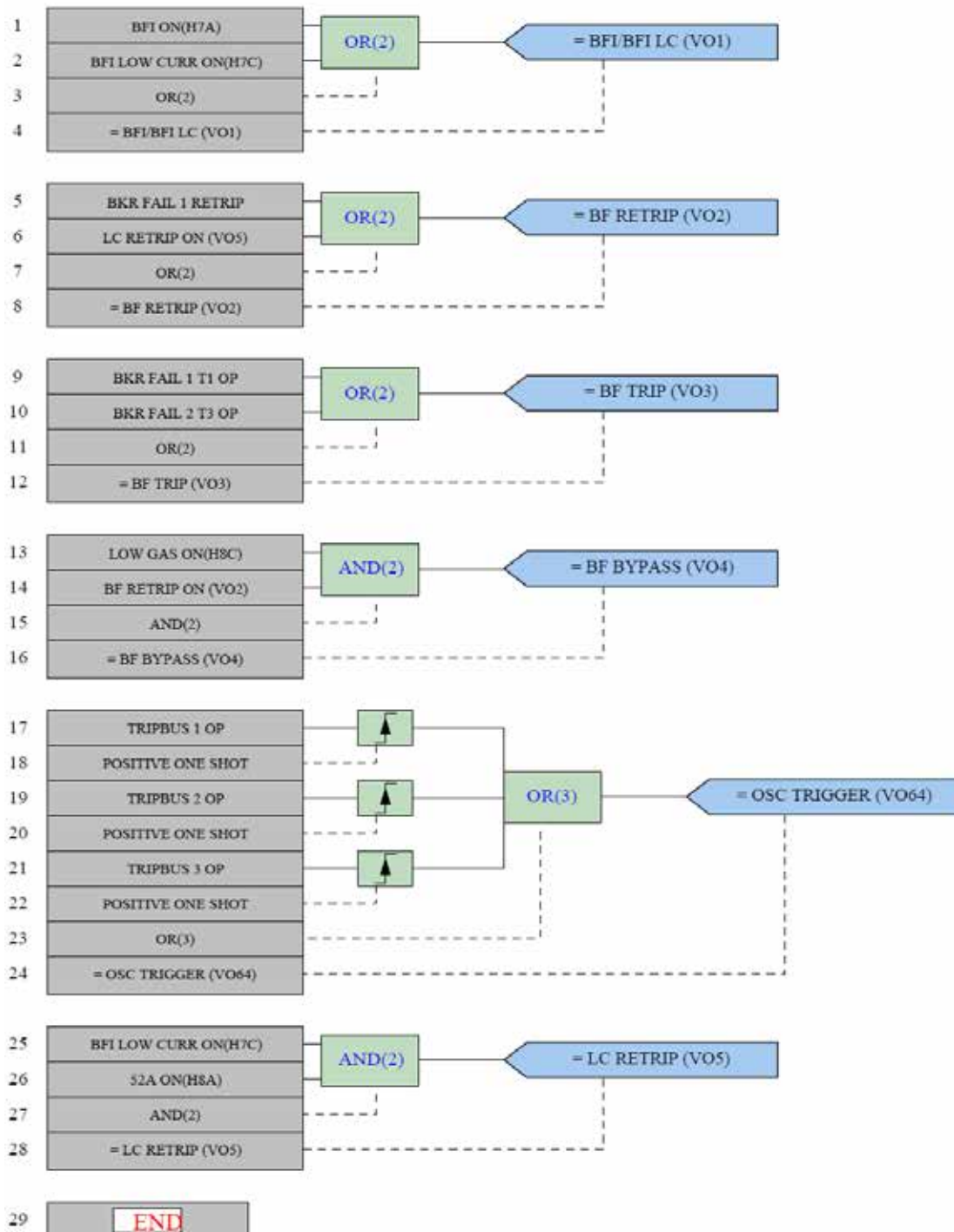
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

APPENDIX:

Flex Logic Diagram for C60



PATNODE

50/62BFP/2108

STATION: **PATNODE**

DEVICE: **50/62BFP/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2108 BREAKER FAILURE

DEVICE CONFIGURATION

0103 Setting Group Change Option	Disabled	NOT USED
0104 Oscillographic Fault Records	Enabled	
0112 50/51	Def. Time Only	USED FOR FAULT DETECTOR
0113 50N/51N	Def. Time Only	USED FOR FAULT DETECTOR
0127 50 1Ph	Disabled	NOT USED
0117 Cold Load Pickup	Disabled	NOT USED
0122 2nd Harmonic Inrush Restraint	Disabled	NOT USED
0131 (Sensitive) Ground Fault	Disabled	NOT USED
0140 46 Negative Sequence Protection	Disabled	NOT USED
0142 49 Thermal Overload Protection	Disabled	NOT USED
0170 50BF Breaker Failure Protection	Disabled	NOT USED
0172 52 Breaker Wear Monitoring	Disabled	NOT USED
0182 74TC Trip Circuit Supervision	Disabled	NOT USED

CONFIGURATION: BINARY INPUTS

Binary Input 1	Type	BFI	BF initiation
	Conf.	SP	
		H	
Binary Input 2	Type	SPARE	
	Conf.		
Binary Input 3	Type	BFI + 52a	No current BF initiation
	Conf.	SP	
		H	
Binary Input 4	Type	Low Gas Detection	Input from bkr low gas relay
	Conf.	SP	
		H	
Binary Input 5	Type	SPARE	
	Conf.		
Binary Input 6	Type	SPARE	
	Conf.		
Binary Input 7	Type	SPARE	
	Conf.		
Binary Input 8	Type	SPARE	

STATION: **PATNODE**
DEVICE: **50/62BFP/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Conf.

CONFIGURATION: BINARY OUTPUTS

Binary Output 1	Type	50BF LOGIC TRIP	BF trip of bkr.
	Conf.	OUT	
		U	
Binary Output 2	Type	RETRIP	Retrip of bkr.
	Conf.	OUT	
		U	
Binary Output 3	Type	BF BYPASS	Bypass BF timer to trip bkr.
	Conf.	OUT	
		U	
Binary Output 4	Type	SPARE	
	Conf.		
Binary Output 5	Type	SPARE	
	Conf.		
Binary Output 6	Type	SPARE	
	Conf.		
Binary Output 7	Type	SPARE	
	Conf.		
Binary Output 8	Type	SPARE	
	Conf.		

CONFIGURATION: LEDS

LED 1	Type	50BF LOGIC TRIP & BF BYPASS
	Conf.	OUT
		L
LED 2	Type	BFI + 52a
	Conf.	SP
		L
LED 3	Type	A ph BFT LED
	Conf.	OUT
		L
LED 4	Type	B ph BFT LED
	Conf.	OUT
		L
LED 5	Type	C ph BFT LED
	Conf.	OUT
		L
LED 6	Type	Various Relay Alarms
	Conf.	OUT
		U

STATION:

DEVICE:

DATE:

LINE:

RELAY:

FID:

ENG:

LED 7

Type
Conf.

GND BFT LED
OUT
L

CONFIGURATION: SYSTEM INTERFACE

LEAVE AT DEFAULT

INTERFACE: SERIAL INTERFACE ON PC

Address	
Frame	
Baud Rate	
COM Interface	
Apply Settings	

INTERFACE: VD ADDRESSES

VD Address	
SIPROTEC SYS VD Address	
Proxy VD Address	
SIPROTEC T103 VD Address	

SYSTEM INTERFACE: OPERATOR INTERFACE

DIGSI Link Address	
Frame	
Baud Rate	
Max gap	
IP Address	
Subnet Mask	
Link Layer	
Access Authorization	
Access Rights	

SYSTEM INTERFACE: SERVICE INTERFACE

DIGSI Link Address	
Frame	

STATION: **PATNODE**
DEVICE: **50/62BFP/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Baud Rate	
Max gap	
IP Address	
Subnet Mask	
Link Layer	
Access Authorization	
Access Rights	

GENERAL DEVICE SETTINGS

0610 Fault Display	Disp. Tar. All PU
0640 Start Image	Image 1

POWER SYSTEM DATA

0214 Rated Frequency	60hz
0209 Phase Sequence	ABC
0276 Temperature Unit	Degr. F
0201 CT Starpoint	Towards Bus
0235A Storage	NO
0250A 50, 51 TOC with 2ph. Prot.	OFF
0613A 50N/51N/67N GOC	Ignd(meas.)
0204 CT Rated Primary Current	800
0205 CT Rated Secondary Current	5
0217 Ignd-CT Rated Primary Current	800
0218 Ignd-CT Rated Secondary Current	5
0210A Min. TRIP Commonad Duration	0.10s
0211A Max. Close Command Duration	1.00s
0212 Min. Current Threshold	0.50A

SETTINGS GROUPS: POWER SYSTEM DATA 2

1102 Meas. Full Scale Current	800A
-------------------------------	-------------

Fault Values:

CTR= **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

STATION:	PATNODE	LINE:	BKR 2108
DEVICE:	50/62BFP/2108	RELAY:	7SJ6115-4DC11-1FA1
		FID:	V04.71.04
DATE:	3/20/2012	ENG:	JK/TRC

WPN1 Line Rating= **996** A,pri 6.23 A,sec
PND1 Line Rating= **996** A,pri 6.23 A,sec

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground= **2023** A,pri (3I0) 12.64 A,sec
Phase to Phase= **2492** A,pri 15.58 A,sec
Three Phase= **2889** A,pri 18.06 A,sec

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground= **1102** A,pri (3I0) 6.89 A,sec
Phase to Phase= **894** A,pri 5.59 A,sec
Three Phase= **1034** A,pri 6.46 A,sec

SETTINGS GROUPS: 50/51 PHASE/GROUND OVERCURRENT

PHASE

1201 50, 51 Phase TOC	ON	
1217 50-3 Pickup	oo	NOT USED
1218 50-3 Time Delay	oo	NOT USED
1202 50-2 Pickup	2.75	NOT USED

Set the phase fault detector at 50% of the lowest phase fault value.

Phase fault detector will be set below the current rating of the line.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)= **894** TIMES **0.5** EQUALS 447 A,pri
EQUALS 2.79 A,sec

Set pickup at: **2.75** A,sec
440 A,pri

1203 50-2 Time Delay	oo	Allows signal only, CFC timer used
1204 50-1 Pickup	oo	NOT USED
1205 50-1 Time Delay	oo	NOT USED

RESIDUAL GROUND

STATION: **PATNODE**
DEVICE: **50/62BFP/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

1301 50N, 51N Phase TOC **ON**
1317 50N-3 Pickup **oo** NOT USED
1318 50N-3 Time Delay **oo** NOT USED
1302 50N-2 Pickup **1.25** NOT USED

Set the ground fault detector at 20% of the line rating and check that it is lower than expected ground fault.

Gnd fault detector setting of 40A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
Set pickup at: **1.25** A,sec
200 A,pri

1303 50N-2 Time Delay **oo** Allows signal only, CFC timer used
1304 50N-1 Pickup **oo** NOT USED
1305 50N-1 Time Delay **oo** NOT USED

SETTINGS GROUPS: MEASUREMENT SUPERVISION

NOT USED - LEAVE AT DEFAULT

TIME SYNCHRONIZATION

Source **IRIG B**
Fault Indication **10 Min**
Time Format **mm/dd/yy** USA Time Format
Offset to Signal **0**

CFC CHART

See CFC Chart in Appendix for Breaker Failure Logic

STATION: **PATNODE**

DEVICE: **50/62BFP/2108**

DATE: **3/20/2012**

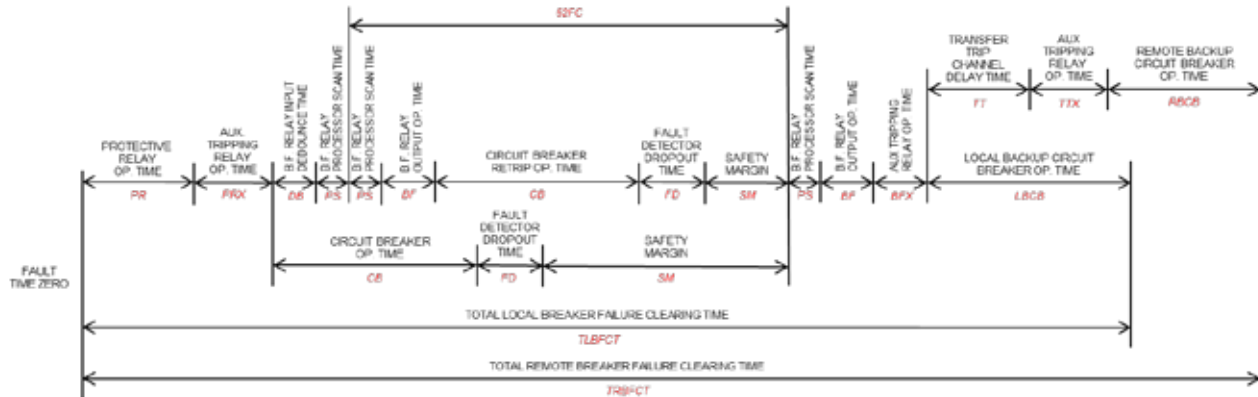
LINE: **BKR 2108**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

BREAKER FAILURE TIMING (CFC TIMER)



62FC= **7.700** cyc

PR = 2.040 cyc

PRX = 0.900 cyc

DB = 0.240 cyc

PS = 0.030 cyc

CB = 3.000 cyc

FD = 2.400 cyc

BF = 0.240 cyc

BFX = 0.900 cyc

LBCB = 3.000 cyc

TT = 0.000 cyc

TTX = 0.000 cyc

RBCB = 0.000 cyc

Used for CFC Timer setting (Adjusted to achieve ~2 cyc safety margin)

T2 relay time to operate for a differential fault

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

76J6115 Input Pickup Time = 4ms (76J6115 Manual, page 299)

76J6115 Processor Scan Time = 0.5ms (Not published, typical used)

Local circuit breaker operate time (Per bkr. nameplate)

Fault Detector MAX dropout = 40ms (7SJ6115 Manual, Page 309)

76J6115 Published operate time = 4ms (Not published, typical used)

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

Local backup circuit breaker operate time

Transfer trip channel time - By NYPA

Transfer trip aux relay operate time - By NYPA

Assumed remote backup circuit breaker operate time - By NYPA

(ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB

NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB

RCT = 6.480 cyc

Time for breaker retrip to occur

BF TIMER SETTING (62FC)>=PS+BF+CB+FD

62FC >= 5.670 cyc

62FC must provide enough time for breaker to trip normally or retrip

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB

TLBFCT = 15.080 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD

SMNT = 2.570 cyc

Try to maintain a 2 cycle margin to cover timing errors

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD

SMRT = 2.030 cyc

Try to maintain a 2 cycle margin to cover timing errors

SET BF TIMER PU DELAY= 7.700 cyc

SET BF TIMER DO DELAY= **6.000** cyc

EQUALS 128.33 msec (round to 129msec for Siemens)

EQUALS 100.00 msec

STATION: **PATNODE**

DEVICE: **50/62BFP/2108**

DATE: **3/20/2012**

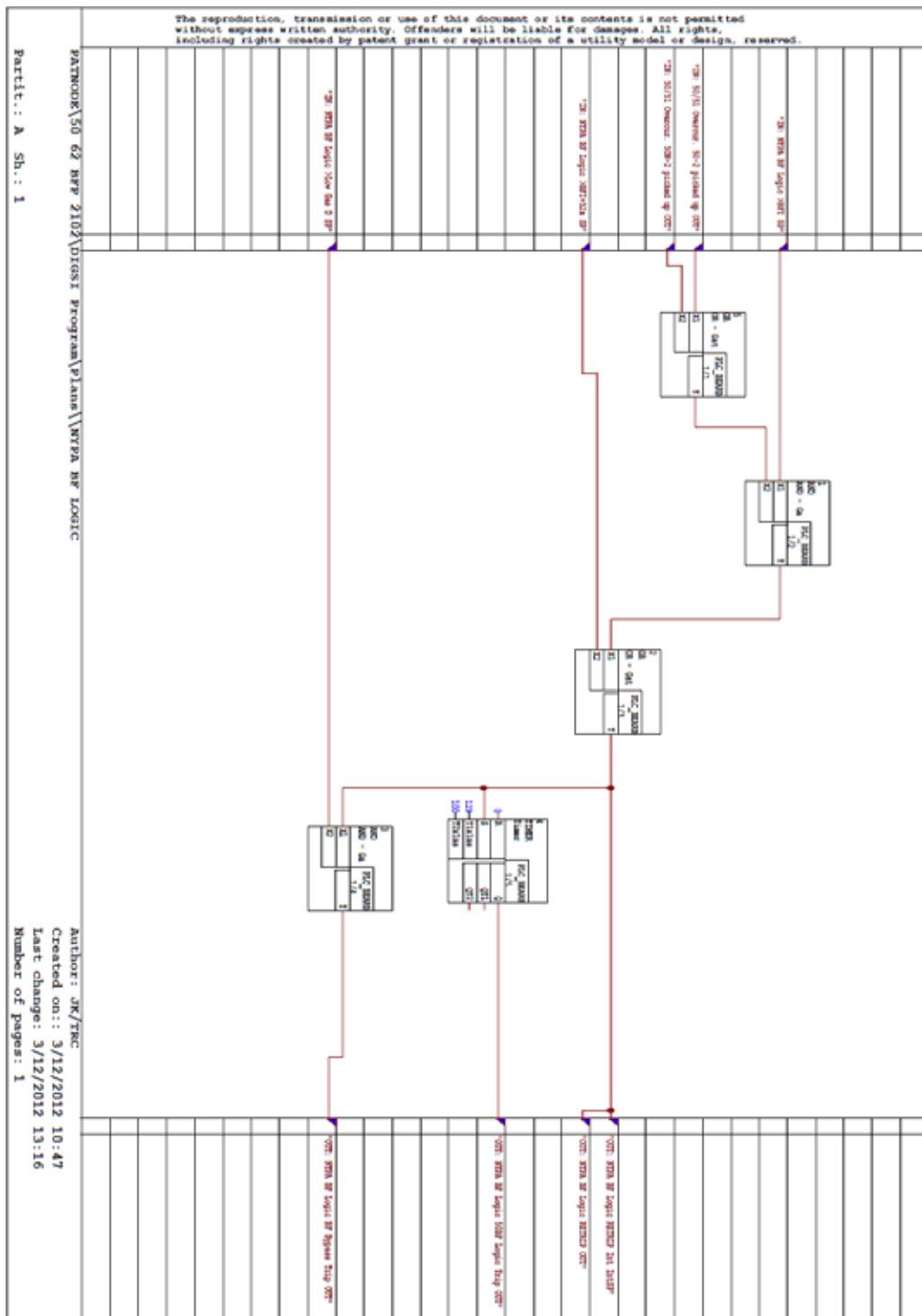
LINE: **BKR 2108**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

APPENDIX:



STATIC

PATNODE\50 62 BFP 2102\...\WYPA BF LOGIC

03/12/2012 01:20:10 PM

STATION: **PATNODE**

DEVICE: **50/62BFP/2108**

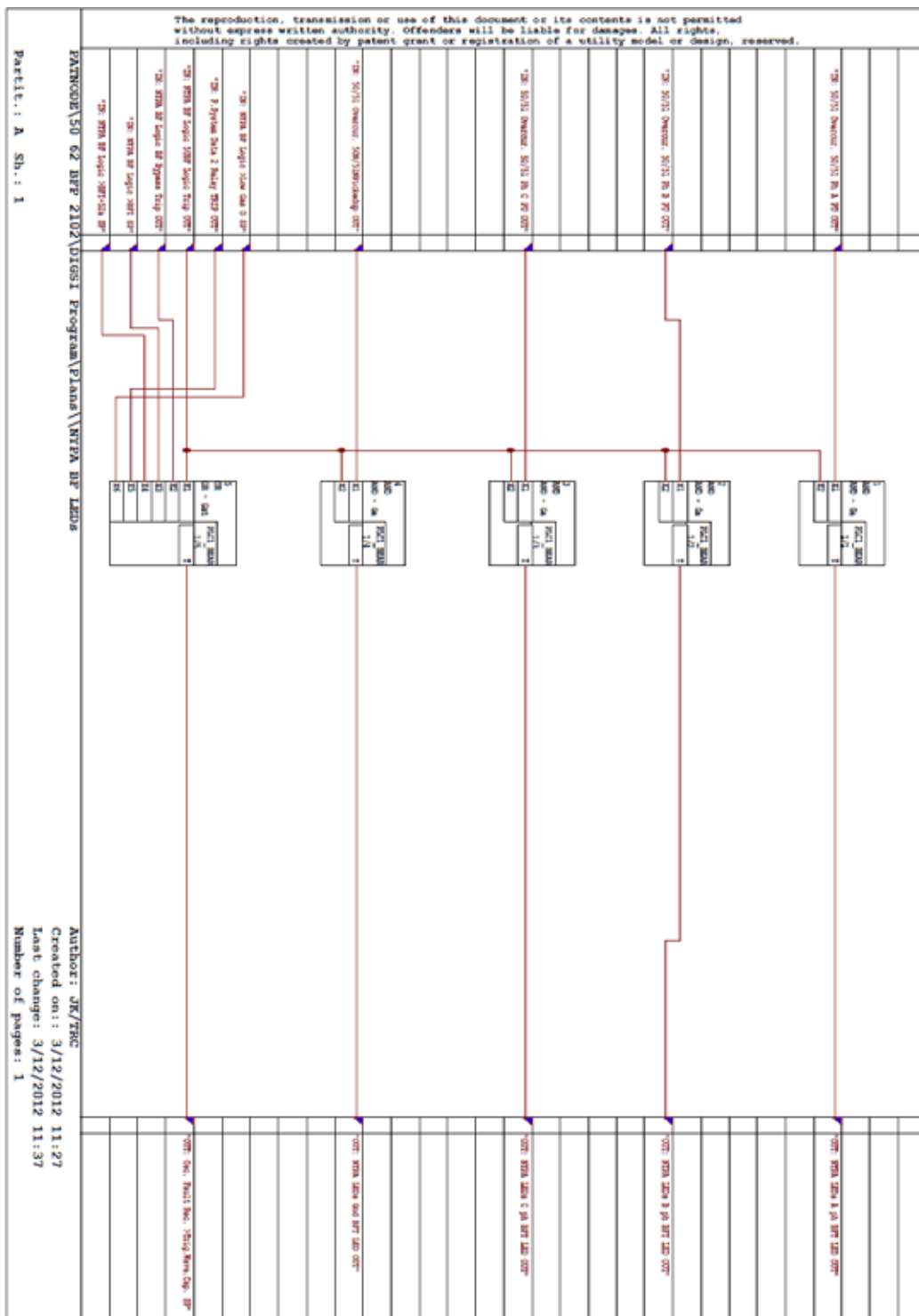
DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**



SIMATIC PATNODE\50 62 BFP 2102\...\WYPA BF LEDS 03/12/2012 01:24:07 PM

PATNODE

50/62BFS/2108

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2108 BREAKER FAILURE

PRODUCT SETUP: SECURITY

Command Password	0
Setting Password	0
Command Password Access Timeout	5 min
Setting Password Access Timeout	30 min
Invalid Password Attempts	3
Password Lockout Duration	5 min
Password Access Events	Enabled

PRODUCT SETUP: DISPLAY PROPERTIES

Flash Message Time	1.0 s
Default Message Timeout	300 s
Default Message Intensity (VFD Only)	25%
Screen Saver Feature (LCD Only)	Enabled
Screen Saver Wait Time (LCD Only)	30 min
Current Cutoff Level	0.020 pu
Voltage Cutoff Level	1.0 V

PRODUCT SETUP: CLEAR RELAY RECORDS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SERIAL PORTS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: NETWORK

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: MODBUS PROTOCOL

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP PROTOCOL

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP - IEC104 POINTS LIST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 61850

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: HTTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: TFTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 60870-5-104

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SNTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: MODBUS USER MAP

NOT USED - LEAVE AT DEFAULT

REAL TIME CLOCK

IRIG-B Signal Type

DC Shift

Real Time Clock Events

Enabled

Time Zone Offset

0.0 hr

DST Function

Disabled

PRODUCT SETUP: USER-PROGRAMMABLE FAULT REPORT

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: OSCILLOGRAPHY

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Number Of Records	5
Trigger Mode	Automatic Overwrite
Trigger Position	30%
Trigger Source	Osc Trigger On (VO64)
AC Input Waveforms	32 samples/cycle
Digital Channel 1	BFI On(H7A)
Digital Channel 2	BFI LOW CURR On(H7C)
Digital Channel 3	52a On(H8A)
Digital Channel 4	LOW GAS Off(H8C)
Digital Channel 5	BKR FAIL 1 RETRIP
Digital Channel 6	BKR FAIL 1 T1 OP
Digital Channel 7	BKR FAIL 2 T3 OP
Digital Channel 8	BFI/BFI/ LC On (VO1)
Digital Channel 9	BF RETRIP On (VO2)
Digital Channel 10	BF TRIP On (VO3)
Digital Channel 11	BF BYPASS On (VO4)
Digital Channel 12	LC RETRIP On (VO5)
Digital Channel 13	TRIPBUS 1 OP
Digital Channel 14	TRIPBUS 2 OP
Digital Channel 15	TRIPBUS 3 OP
Digital Channel 16 - 63	OFF
Analog Channel 1	SRC1 Ia RMS
Analog Channel 2	SRC1 Ib RMS
Analog Channel 3	SRC1 Ic RMS
Analog Channel 4 - 16	OFF

PRODUCT SETUP: DATA LOGGER

Data Logger Mode	Continuous
Data Logger Trigger	OFF
Rate	60000 msec

PRODUCT SETUP: DEMAND

Current Method	Thermal Exponential
----------------	---------------------

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Power Method **Thermal Exponential**
Interval **15 MIN**
Trigger **OFF**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: LED TEST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: TRIP AND ALARMS LEDS

Trip LED Input **Osc Trigger (VO64)**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: USER PROGRAMMABLE LEDS

LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE SELF TESTS

Direct Ring Break Function **Enabled**
Direct Device Off Function **Enabled**
Remote Device Off Function **Enabled**
Pri Ethernet Fail Function **Disabled**
Battery Fail Function **Enabled**
SNTP Fail Function **Enabled**
IRIG B Fail Function **Enabled**

PRODUCT SETUP: CONTROL PUSHBUTTONS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: FLEX STATES

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-DEFINEABLE DISPLAYS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: DIRECT I/O

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PRODUCT SETUP: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: INSTALLATION

Relay Name **50/62BFS/2108**

SYSTEM SETUP: AC INPUTS: CURRENT

CT F1: Phase CT Primary	800 A	2000/ 800 :5 CT
CT F1: Phase CT Secondary	5 A	
CT F1: Ground CT Primary	1 A	REQUIRED ENTRY, NOT USED
CT F1: Ground CT Secondary	1 A	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: AC INPUTS: VOLTAGE

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: POWER SYSTEM

Nominal Frequency	60 Hz
Phase Rotation	ABC
Frequency And Phase Reference	SRC 1 (SRC 1) CURRENT ONLY
Frequency Tracking Function	Enabled

SYSTEM SETUP: SIGNAL SOURCES

SOURCE 1: Name	SRC 1	DEFAULT VALUE
SOURCE 1: Phase CT	F1	ASSIGN BKR CT AS SOURCE 1
SOURCE 1: Ground CT	None	
SOURCE 1: Phase VT	None	
SOURCE 1: Auxiliary VT	None	
SOURCE 2: Name	SRC 2	REQUIRED ENTRY, NOT USED
SOURCE 2: Phase CT	None	
SOURCE 2: Ground CT	None	
SOURCE 2: Phase VT	None	
SOURCE 2: Auxiliary VT	None	

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

SYSTEM SETUP: BREAKERS

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: SWITCHES

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: FLEXCURVES

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXLOGIC EQUATION EDITOR

FlexLogic Entry 1	BFI On(H7A)
FlexLogic Entry 2	BFI LOW CURR On(H7C)
FlexLogic Entry 3	OR(2)
FlexLogic Entry 4	BFI/BFI LC (VO1)
FlexLogic Entry 5	BKR FAIL 1 RETRIP
FlexLogic Entry 6	LC RETRIP On (VO5)
FlexLogic Entry 7	AND(2)
FlexLogic Entry 8	BF RETRIP (VO2)
FlexLogic Entry 9	BKR FAIL 1 T1 OP
FlexLogic Entry 10	BKR FAIL 2 T3 OP
FlexLogic Entry 11	OR(2)
FlexLogic Entry 12	BF TRIP (VO3)
FlexLogic Entry 13	LOW GAS On(H8C)
FlexLogic Entry 14	BF RETRIP (VO2)
FlexLogic Entry 15	AND(2)
FlexLogic Entry 16	BF BYPASS (VO4)
FlexLogic Entry 17	TRIPBUS 1 OP
FlexLogic Entry 18	POSITIVE ONE SHOT
FlexLogic Entry 19	TRIPBUS 2 OP
FlexLogic Entry 20	POSITIVE ONE SHOT
FlexLogic Entry 21	TRIPBUS 3 OP
FlexLogic Entry 22	POSITIVE ONE SHOT
FlexLogic Entry 23	OR(3)
FlexLogic Entry 24	Osc Trigger (VO64)

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

FlexLogic Entry 25	BFI LOW CURR ON(H7C)
FlexLogic Entry 26	52a ON(H8A)
FlexLogic Entry 27	AND(2)
FlexLogic Entry 28	LC RETRIP (V05)
FlexLogic Entry 29 - 512	SPARE

FLEXLOGIC: FLEXLOGIC TIMERS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXELEMENTS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: NON-VOLATILE LATCHES

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

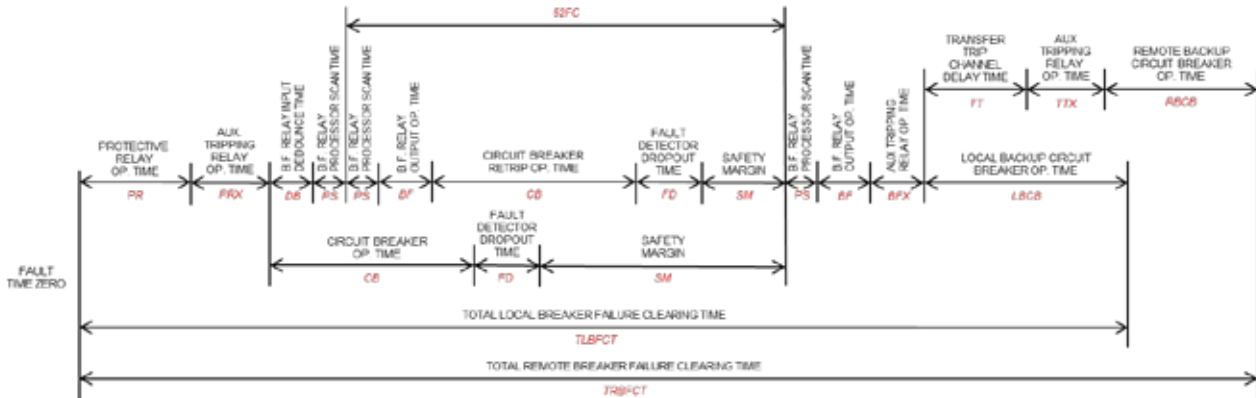
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BREAKER FAILURE INFORMATION

TIMER:



62FC = **7.700** cyc

PR = 2.040 cyc

PRX = 0.900 cyc

DB = 0.000 cyc

PS = 0.030 cyc

CB = 3.000 cyc

FD = 2.400 cyc

BF = 0.240 cyc

BFX = 0.900 cyc

LBCB = 3.000 cyc

TT = 0.000 cyc

TTX = 0.000 cyc

RBCB = 0.000 cyc

Used for Flexlogic setting (Adjusted to achieve ~2 cyc safety margin)

T2 relay time to operate for a differential fault

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

C60 Debounce Time for this input

C60 Processor Scan Time = 0.5ms (GE C60 Manual, Page 5-178)

Local circuit breaker operate time (Per bkr. nameplate)

Fault Detector MAX dropout (Not published, use typical of 40ms)

C60 Published operate time = 4ms (GE C60 Manual, Page 2-11)

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

Local backup circuit breaker operate time

Transfer trip channel time - By NYPA

Transfer trip aux relay operate time - By NYPA

Assumed remote backup circuit breaker operate time - By NYPA

(ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB

NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB

RCT = 6.240 cyc

Time for breaker retrip to occur

BF TIMER SETTING (62FC) >= PS+BF+CB+FD

62FC >= 5.670 cyc

62FC must provide enough time for breaker to trip normally or retrip

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB

TLBFCT = 14.840 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD

SMNT = 2.330 cyc

Try to maintain a 2 cycle margin to cover timing errors

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD

SMRT = 2.030 cyc

Try to maintain a 2 cycle margin to cover timing errors

FAULT VALUES:

CTR = **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

WPN1 Line Rating = **996** A, pri 6.23 A, sec 1.25 A, pu

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

PND1 Line Rating= **996** A,pri 6.23 A,sec 1.25 A,pu

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground=	2023	A,pri (3I0)	12.64 A,sec	2.53 A,pu
Phase to Phase=	2492	A,pri	15.58 A,sec	3.12 A,pu
Three Phase=	2889	A,pri	18.06 A,sec	3.61 A,pu

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground=	1102	A,pri (3I0)	6.89 A,sec	1.38 A,pu
Phase to Phase=	894	A,pri	5.59 A,sec	1.12 A,pu
Three Phase=	1034	A,pri	6.46 A,sec	1.29 A,pu

GROUPED ELEMENTS: GROUP 1: BREAKER FAILURE

BF1: Function	Enabled	Enable function for current supervised BFI
BF1: Mode	3-Pole	Three pole tripping only
BF1: Source	SRC 1 (SRC 1)	Current from breaker
BF1: Current Supervision	Yes	Enable current supervision of BFI
BF1: Use Seal-In	No	No seal in
BF1: Three Pole Initiate	BFI/BFI LC On (VO1)	BFI from line relay or low current BFI inputs
BF1: Block	OFF	No blocking of BFI
BF1: Phase Current Supv Pickup	0.55 pu	

Set the phase fault detector at 50% of the lowest phase fault value.

Phase fault detector will be set below the current rating of the line.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)=	894	TIMES	0.5	EQUALS	447 A,pri
EQUALS	2.79	A,sec			
EQUALS	0.56	A,pu			
Set pickup at:	0.55	A,pu			
	440	A,pri			

BF1: Neutral Current Supv Pickup

0.25pu

Set the ground fault detector at 20% of the line rating and check that it is

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

lower than expected ground fault.

Gnd fault detector setting of 200A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
EQUALS 0.25 A,pu

Set pickup at: **0.25** A,pu
200 A,pri

BF1: Use Timer 1 **Yes** 62BF, Current supervised trip

BF1: Timer 1 Pickup Delay **0.128 s** See time calculations above

62FC= **7.700 cyc**
EQUALS 0.128333 sec

BF1: Use Timer 2 **No** NOT USED

BF1: Timer 2 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Use Timer 3 **No** NOT USED

BF1: Timer 3 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Breaker Pos1 Phase A/3P **ON** Set to logic 1 to enable BFI timer (No 52a supervision)

BF1: Breaker Pos2 Phase A/3P **OFF** NOT USED

BF1: Breaker Test On **OFF** NOT USED

BF1: Phase Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Phase Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: LoSet Time Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Trip Dropout Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Target **Self-reset**

BF1: Events **Enabled**

BF1: Phase A Initiate **OFF** NOT USED

BF1: Phase B Initiate **OFF** NOT USED

BF1: Phase C Initiate **OFF** NOT USED

BF1: Breaker Pos1 Phase B **OFF** NOT USED

BF1: Breaker Pos1 Phase C **OFF** NOT USED

BF1: Breaker Pos2 Phase B **OFF** NOT USED

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BF1: Breaker Pos2 Phase C	OFF	NOT USED
BF2: Function	Enabled	Enable function for low current BFI
BF2: Mode	3-Pole	Three pole tripping only
BF2: Source	SRC 1 (SRC 1)	Current from breaker
BF2: Current Supervision	No	No current supervision for low current scheme
BF2: Use Seal-In	No	No seal in
BF2: Three Pole Initiate	BFI LOW CURR On(H7C)	BFI from low current inputs only
BF2: Block	OFF	No blocking of BFI
BF2: Phase Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Neutral Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Use Timer 1	No	NOT USED
BF2: Timer 1 Pickup Delay	0.000 s	REQUIRED SETTING, NOT USED
BF2: Use Timer 2	No	NOT USED
BF2: Timer 2 Pickup Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Use Timer 3	Yes	62BF, Low/NO current trip
BF2: Timer 3 Pickup Delay	0.128 s	Set same as BF1 T1
BF2: Breaker Pos1 Phase A/3P	OFF	Not used
BF2: Breaker Pos2 Phase A/3P	52a On(H8a)	Used for breaker position supervision of low current BFI
BF2: Breaker Test On	OFF	NOT USED
BF2: Phase Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Phase Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: LoSet Time Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Trip Dropout Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Target	Self-reset	
BF2: Events	Enabled	
BF2: Phase A Initiate	OFF	NOT USED
BF2: Phase B Initiate	OFF	NOT USED
BF2: Phase C Initiate	OFF	NOT USED
BF2: Breaker Pos1 Phase B	OFF	NOT USED
BF2: Breaker Pos1 Phase C	OFF	NOT USED
BF2: Breaker Pos2 Phase B	OFF	NOT USED

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

BF2: Breaker Pos2 Phase C

OFF

NOT USED

GROUPED ELEMENTS: GROUP 1: VOLTAGE ELEMENTS

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: POWER

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 2

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 3

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 4

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 5

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 6

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: TRIP BUS

Trip Bus 1 Function

Enabled

Trip Bus 1 Block

OFF

NO BLOCK TRIP

Trip Bus 1 Pickup Delay

0.00 s

NO PICK-UP DELAY

Trip Bus 1 Reset Delay

0.10 s

SET EQUAL TO SEL TDURD (6cyc)

Trip Bus 1 Input 1

BF TRIP On (VO3)

Current or breaker supervised trip

Trip Bus 1 Input 2 - 16

SPARE

Trip Bus 1 Latching

Disabled

Trip Bus 1 Reset

OFF

Trip Bus 1 Target

Self-reset

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Trip Bus 1 Events	Enabled	
Trip Bus 2 Function	Enabled	
Trip Bus 2 Block	OFF	NO BLOCK TRIP
Trip Bus 2 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 2 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 2 Input 1	BF RETRIP ON (VO2)	Immediate re-trip of secondary breaker trip coil
Trip Bus 2 Input 2 -16	SPARE	
Trip Bus 2 Latching	Disabled	
Trip Bus 2 Reset	OFF	
Trip Bus 2 Target	Self-reset	
Trip Bus 2 Events	Enabled	
Trip Bus 3 Function	Enabled	
Trip Bus 3 Block	OFF	NO BLOCK TRIP
Trip Bus 3 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 3 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 3 Input 1	BF BYPASS On (VO4)	Bypass breaker failure timer for low gas and BFI
Trip Bus 3 Input 2 - 16	SPARE	
Trip Bus 3 Latching	Disabled	
Trip Bus 3 Reset	OFF	
Trip Bus 3 Target	Self-reset	
Trip Bus 3 Events	Enabled	
Trip Bus 4-6	SPARE	

CONTROL ELEMENTS: SETTING GROUPS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SELECTOR SWITCHES

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: UNDERFREQUENCY

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: OVERFREQUENCY

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SYNCHROCHECK

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL COUNTERS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: MONITORING ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: PILOT SCHEMES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT INPUTS

[H7A] Contact Input 1 ID	BFI	BFI INITIATE
[H7A] Contact Input 1 Debounce Time	0 ms	Debounce set to 0ms
[H7A] Contact Input 1 Events	Enabled	
[H7C] Contact Input 2 ID	BFI LOW CURR	BF OC BY-PASS
[H7C] Contact Input 2 Debounce Time	0 ms	Debounce set to 0ms
[H7C] Contact Input 2 Events	Enabled	
[H8A] Contact Input 3 ID	52a	52a
[H8A] Contact Input 3 Debounce Time	0 ms	Debounce set to 0ms
[H8A] Contact Input 3 Events	Enabled	
[H8C] Contact Input 4 ID	LOW GAS	BF LOW GAS
[H8C] Contact Input 4 Debounce Time	0 ms	Debounce set to 0ms
[H8C] Contact Input 4 Events	Enabled	
[M7A] - [M8C]	SPARE	

INPUTS/OUTPUTS: CONTACT INPUT THRESHOLDS

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Cont 1p 1 - Cont Ip 4 **84 Vdc** Suggested setting for 125Vdc control system

Cont 1p 5 - Cont Ip 8 **84 Vdc** Suggested setting for 125Vdc control system

INPUTS/OUTPUTS: VIRTUAL INPUTS: VIRTUAL INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT OUTPUTS

[H1] Contact Output 1 ID	Cont Op 1	BF TIME TRIP 86BFS
[H1] Contact Output 1 Operate	TRIPBUS 1 OP	
[H1] Contact Output 1 Seal-In	OFF	
[H1] Contact Output 1 Events	Enabled	
[H2] Contact Output 2 ID	Cont Op 2	62ZP RETRIP BKR. SECONDARY COIL
[H2] Contact Output 2 Operate	TRIPBUS 2 OP	
[H2] Contact Output 2 Seal-In	OFF	
[H2] Contact Output 2 Events	Enabled	
[H3] Contact Output 3 ID	Cont Op 3	BF TIMER BY-PASS TRIP 86BFS
[H3] Contact Output 3 Operate	TRIPBUS 3 OP	
[H3] Contact Output 3 Seal-In	OFF	
[H3] Contact Output 3 Events	Enabled	
[H4] - [H6]	SPARE	
[M1] - [M6]	SPARE	

INPUTS/OUTPUTS: VIRTUAL OUTPUTS

Virtual Output 1 ID	BFI/BFI LC
Virtual Output 1 Events	Enabled
Virtual Output 2 ID	BF RETRIP
Virtual Output 2 Events	Enabled
Virtual Output 3 ID	BF TRIP
Virtual Output 3 Events	Enabled
Virtual Output 4 ID	BF BYPASS
Virtual Output 4 Events	Enabled
Virtual Output 5	LC RETRIP
Virtual Output 5 Events	Enabled

STATION: **PATNODE**
DEVICE: **50/62BFS/2108**
DATE: **3/20/2012**

LINE: **BKR 2108**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Virtual Output 6-63	SPARE
Virtual Output 64 ID	Osc Trigger
Virtual Output 64 Events	Enabled
Virtual Output 65 - 96	SPARE

INPUTS/OUTPUTS: REMOTE DEVICES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS DNA BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS USERST BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: RESETTNG

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT OUTPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: IEC 61850 GOOSE ANALOGS INPUTS

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2108**

DATE: **3/20/2012**

LINE: **BKR 2108**

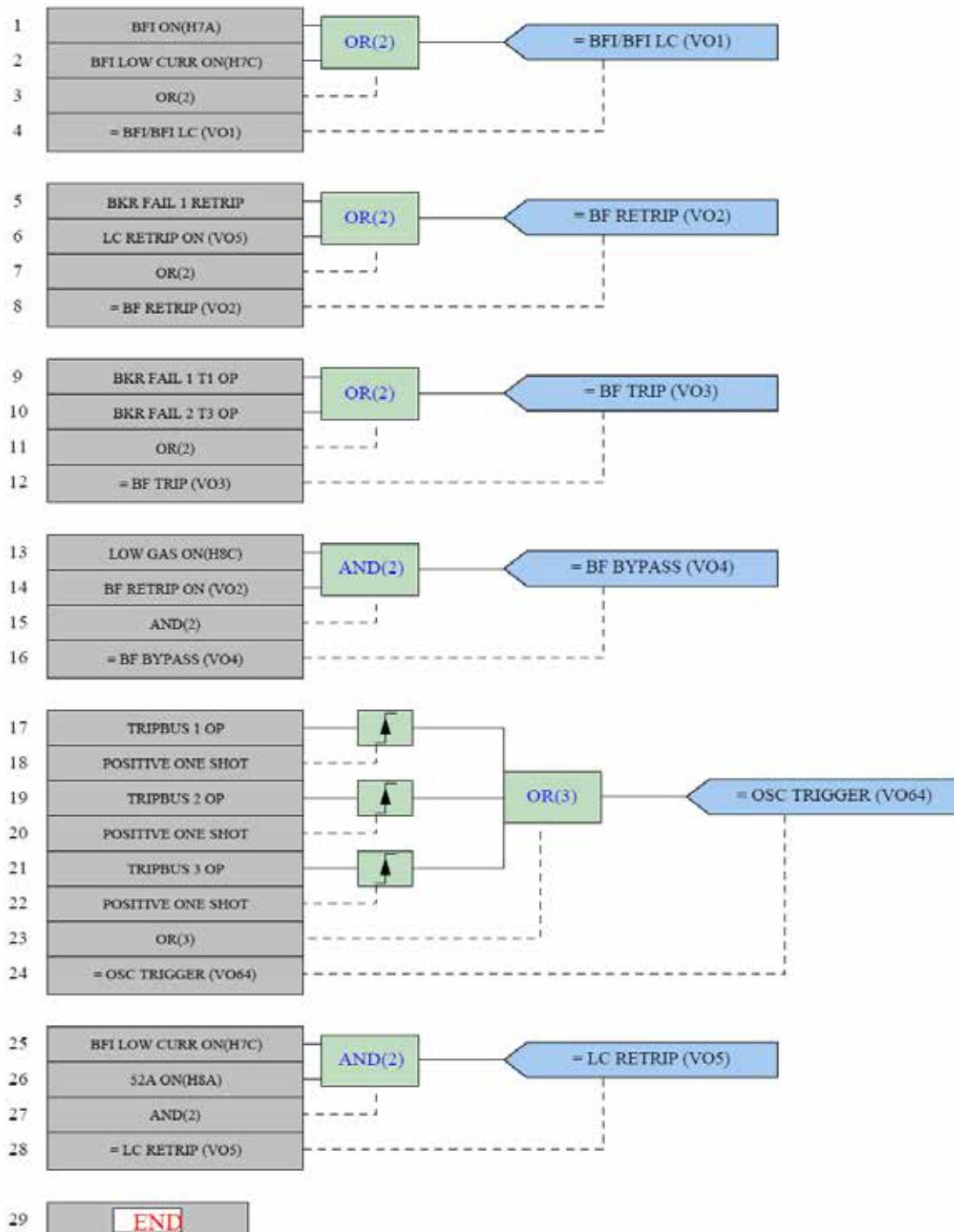
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

APPENDIX:

Flex Logic Diagram for C60



PATNODE

50/62BFP/2114

STATION: **PATNODE**

DEVICE: **50/62BFP/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2114 BREAKER FAILURE

DEVICE CONFIGURATION

0103 Setting Group Change Option	Disabled	NOT USED
0104 Oscillographic Fault Records	Enabled	
0112 50/51	Def. Time Only	USED FOR FAULT DETECTOR
0113 50N/51N	Def. Time Only	USED FOR FAULT DETECTOR
0127 50 1Ph	Disabled	NOT USED
0117 Cold Load Pickup	Disabled	NOT USED
0122 2nd Harmonic Inrush Restraint	Disabled	NOT USED
0131 (Sensitive) Ground Fault	Disabled	NOT USED
0140 46 Negative Sequence Protection	Disabled	NOT USED
0142 49 Thermal Overload Protection	Disabled	NOT USED
0170 50BF Breaker Failure Protection	Disabled	NOT USED
0172 52 Breaker Wear Monitoring	Disabled	NOT USED
0182 74TC Trip Circuit Supervision	Disabled	NOT USED

CONFIGURATION: BINARY INPUTS

Binary Input 1	Type	BFI	BF initiation
	Conf.	SP	
		H	
Binary Input 2	Type	SPARE	
	Conf.		
Binary Input 3	Type	BFI + 52a	No current BF initiation
	Conf.	SP	
		H	
Binary Input 4	Type	Low Gas Detection	Input from bkr low gas relay
	Conf.	SP	
		H	
Binary Input 5	Type	SPARE	
	Conf.		
Binary Input 6	Type	SPARE	
	Conf.		
Binary Input 7	Type	SPARE	
	Conf.		
Binary Input 8	Type	SPARE	

STATION: **PATNODE**
DEVICE: **50/62BFP/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Conf.

CONFIGURATION: BINARY OUTPUTS

Binary Output 1	Type	50BF LOGIC TRIP	BF trip of bkr.
	Conf.	OUT	
		U	
Binary Output 2	Type	RETRIP	Retrip of bkr.
	Conf.	OUT	
		U	
Binary Output 3	Type	BF BYPASS	Bypass BF timer to trip bkr.
	Conf.	OUT	
		U	
Binary Output 4	Type	SPARE	
	Conf.		
Binary Output 5	Type	SPARE	
	Conf.		
Binary Output 6	Type	SPARE	
	Conf.		
Binary Output 7	Type	SPARE	
	Conf.		
Binary Output 8	Type	SPARE	
	Conf.		

CONFIGURATION: LEDS

LED 1	Type	50BF LOGIC TRIP & BF BYPASS
	Conf.	OUT
		L
LED 2	Type	BFI + 52a
	Conf.	SP
		L
LED 3	Type	A ph BFT LED
	Conf.	OUT
		L
LED 4	Type	B ph BFT LED
	Conf.	OUT
		L
LED 5	Type	C ph BFT LED
	Conf.	OUT
		L
LED 6	Type	Various Relay Alarms
	Conf.	OUT
		U

STATION:

DEVICE:

DATE:

LINE:

RELAY:

FID:

ENG:

LED 7

Type
Conf.

GND BFT LED

OUT

L

CONFIGURATION: SYSTEM INTERFACE

LEAVE AT DEFAULT

INTERFACE: SERIAL INTERFACE ON PC

Address	
Frame	
Baud Rate	
COM Interface	
Apply Settings	

INTERFACE: VD ADDRESSES

VD Address	
SIPROTEC SYS VD Address	
Proxy VD Address	
SIPROTEC T103 VD Address	

SYSTEM INTERFACE: OPERATOR INTERFACE

DIGSI Link Address	
Frame	
Baud Rate	
Max gap	
IP Address	
Subnet Mask	
Link Layer	
Access Authorization	
Access Rights	

SYSTEM INTERFACE: SERVICE INTERFACE

DIGSI Link Address	
Frame	

STATION: **PATNODE**
DEVICE: **50/62BFP/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

Baud Rate
Max gap
IP Address
Subnet Mask
Link Layer
Access Authorization
Access Rights

GENERAL DEVICE SETTINGS

0610 Fault Display **Disp. Tar. All PU**
0640 Start Image **Image 1**

POWER SYSTEM DATA

0214 Rated Frequency **60hz**
0209 Phase Sequence **ABC**
0276 Temperature Unit **Degr. F**
0201 CT Starpoint **Towards Bus**
0235A Storage **NO**
0250A 50, 51 TOC with 2ph. Prot. **OFF**
0613A 50N/51N/67N GOC **Ignd(meas.)**
0204 CT Rated Primary Current **800**
0205 CT Rated Secondary Current **5**
0217 Ignd-CT Rated Primary Current **800**
0218 Ignd-CT Rated Secondary Current **5**
0210A Min. TRIP Commonad Duration **0.10s**
0211A Max. Close Command Duration **1.00s**
0212 Min. Current Threshold **0.50A**

SETTINGS GROUPS: POWER SYSTEM DATA 2

1102 Meas. Full Scale Current **800A**

Fault Values:

CTR= **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

STATION: **PATNODE**
DEVICE: **50/62BFP/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

WPN1 Line Rating= **996** A,pri 6.23 A,sec
PND1 Line Rating= **996** A,pri 6.23 A,sec

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground= **2023** A,pri (3I0) 12.64 A,sec
Phase to Phase= **2492** A,pri 15.58 A,sec
Three Phase= **2889** A,pri 18.06 A,sec

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground= **1102** A,pri (3I0) 6.89 A,sec
Phase to Phase= **894** A,pri 5.59 A,sec
Three Phase= **1034** A,pri 6.46 A,sec

SETTINGS GROUPS: 50/51 PHASE/GROUND OVERCURRENT

PHASE

1201 50, 51 Phase TOC **ON**
1217 50-3 Pickup **oo** NOT USED
1218 50-3 Time Delay **oo** NOT USED
1202 50-2 Pickup **2.75** NOT USED

Set the phase fault detector at 50% of the lowest phase fault value.
Phase fault detector will be set below the current rating of the line.
Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)= **894** TIMES **0.5** EQUALS 447 A,pri
EQUALS 2.79 A,sec
Set pickup at: **2.75** A,sec
440 A,pri

1203 50-2 Time Delay **oo** Allows signal only, CFC timer used
1204 50-1 Pickup **oo** NOT USED
1205 50-1 Time Delay **oo** NOT USED

RESIDUAL GROUND

STATION: **PATNODE**
DEVICE: **50/62BFP/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **7SJ6115-4DC11-1FA1**
FID: **V04.71.04**
ENG: **JK/TRC**

1301 50N, 51N Phase TOC **ON**
1317 50N-3 Pickup **oo** NOT USED
1318 50N-3 Time Delay **oo** NOT USED
1302 50N-2 Pickup **1.25** NOT USED

Set the ground fault detector at 20% of the line rating and check that it is lower than expected ground fault.

Gnd fault detector setting of 40A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
Set pickup at: **1.25** A,sec
200 A,pri

1303 50N-2 Time Delay **oo** Allows signal only, CFC timer used
1304 50N-1 Pickup **oo** NOT USED
1305 50N-1 Time Delay **oo** NOT USED

SETTINGS GROUPS: MEASUREMENT SUPERVISION

NOT USED - LEAVE AT DEFAULT

TIME SYNCHRONIZATION

Source **IRIG B**
Fault Indication **10 Min**
Time Format **mm/dd/yy** USA Time Format
Offset to Signal **0**

CFC CHART

See CFC Chart in Appendix for Breaker Failure Logic

STATION: **PATNODE**

DEVICE: **50/62BFP/2114**

DATE: **3/20/2012**

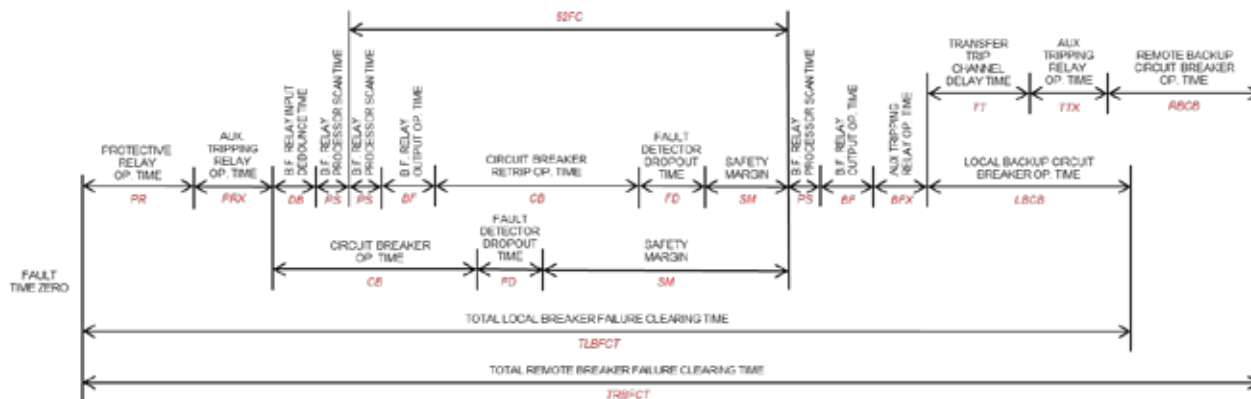
LINE: **BKR 2114**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**

BREAKER FAILURE TIMING (CFC TIMER)



62FC= **7.700** cyc

PR = 2.040 cyc

PRX = 0.900 cyc

DB = 0.240 cyc

PS = 0.030 cyc

CB = 3.000 cyc

FD = 2.400 cyc

BF = 0.240 cyc

BFX = 0.900 cyc

LBCB = 3.000 cyc

TT = 0.000 cyc

TTX = 0.000 cyc

RBCB = 0.000 cyc

Used for CFC Timer setting (Adjusted to achieve ~2 cyc safety margin)

T2 relay time to operate for a differential fault

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

76J6115 Input Pickup Time = 4ms (76J6115 Manual, page 299)

76J6115 Processor Scan Time = 0.5ms (Not published, typical used)

Local circuit breaker operate time (Per bkr. nameplate)

Fault Detector MAX dropout = 40ms (7SJ6115 Manual, Page 309)

76J6115 Published operate time = 4ms (Not published, typical used)

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

Local backup circuit breaker operate time

Transfer trip channel time - By NYPA

Transfer trip aux relay operate time - By NYPA

Assumed remote backup circuit breaker operate time - By NYPA

(ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB

NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB

RCT = 6.480 cyc

Time for breaker retrip to occur

BF TIMER SETTING (62FC)>=PS+BF+CB+FD

62FC >= 5.670 cyc

62FC must provide enough time for breaker to trip normally or retrip

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB

TLBFCT = 15.080 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD

SMNT = 2.570 cyc

Try to maintain a 2 cycle margin to cover timing errors

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD

SMRT = 2.030 cyc

Try to maintain a 2 cycle margin to cover timing errors

SET BF TIMER PU DELAY= 7.700 cyc

SET BF TIMER DO DELAY= **6.000** cyc

EQUALS 128.33 msec (round to 129msec for Siemens)

EQUALS 100.00 msec

LINE:	BKR 2114	
RELAY:	7SJ6115-4DC11-1FA1	
FID:	V04.71.04	
ENG:	JK/TRC	

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PATNODE\50 62 WPP 2102\Digest Program\Plane\WYPA BF LOGIC

Partit.: A Sh.: 1

Author: JK/TRC
Created on:: 3/12/2012 10:47
Last change: 3/12/2012 13:16
Number of pages: 1

03/12/2012 01:20:10 PM

STATION: **PATNODE**

DEVICE: **50/62BFP/2114**

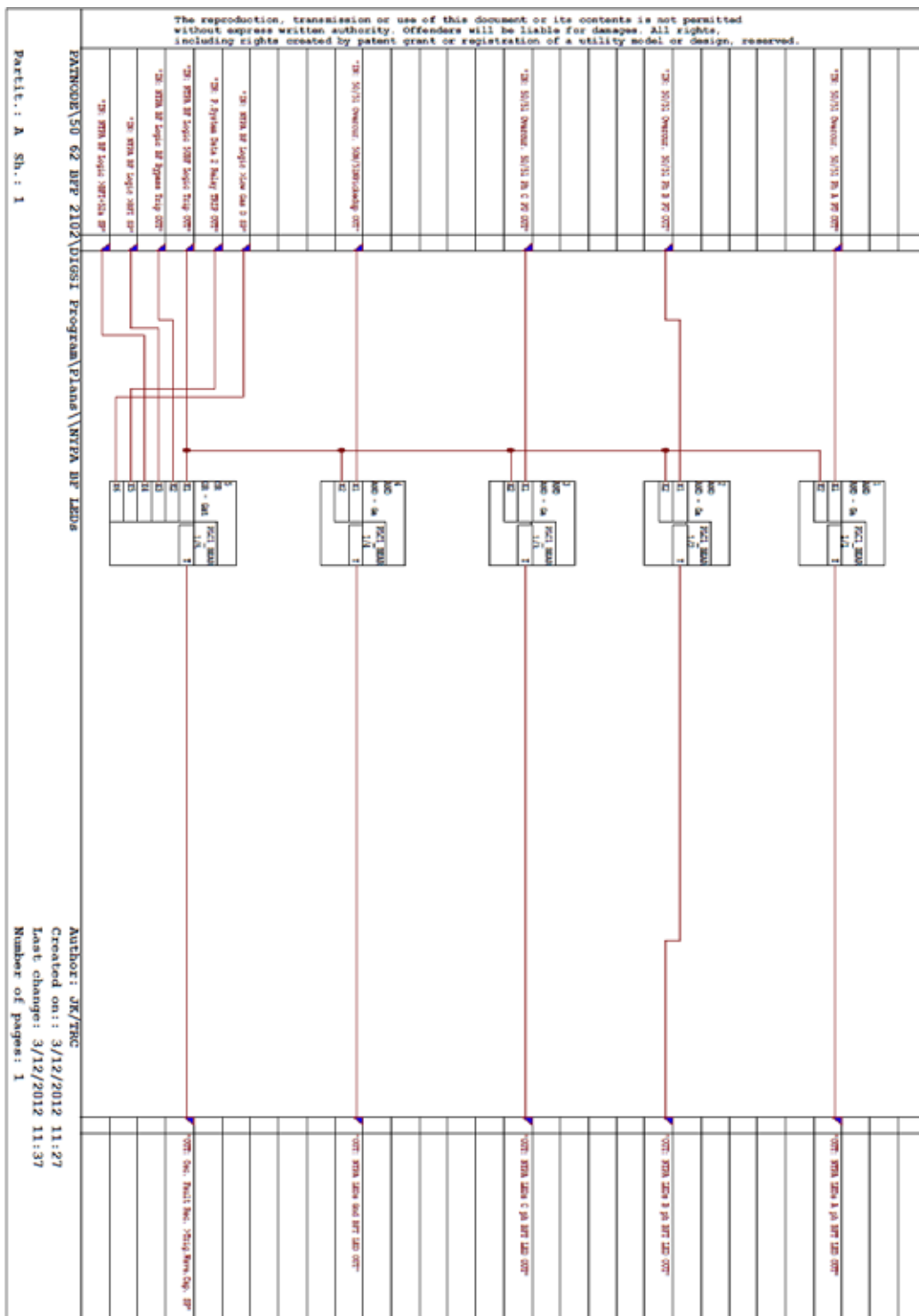
DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **7SJ6115-4DC11-1FA1**

FID: **V04.71.04**

ENG: **JK/TRC**



SIMATIC PATNODE\50 62 BFP 2102\...\WYPA BF LEDS 03/12/2012 01:24:07 PM

PATNODE

50/62BFS/2114

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

RELAY ONLY USED FOR BREAKER 2114 BREAKER FAILURE

PRODUCT SETUP: SECURITY

Command Password	0
Setting Password	0
Command Password Access Timeout	5 min
Setting Password Access Timeout	30 min
Invalid Password Attempts	3
Password Lockout Duration	5 min
Password Access Events	Enabled

PRODUCT SETUP: DISPLAY PROPERTIES

Flash Message Time	1.0 s
Default Message Timeout	300 s
Default Message Intensity (VFD Only)	25%
Screen Saver Feature (LCD Only)	Enabled
Screen Saver Wait Time (LCD Only)	30 min
Current Cutoff Level	0.020 pu
Voltage Cutoff Level	1.0 V

PRODUCT SETUP: CLEAR RELAY RECORDS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SERIAL PORTS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: NETWORK

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: MODBUS PROTOCOL

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP PROTOCOL

STATION:
DEVICE:
DATE:

LINE:
RELAY:
FID:
ENG:

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: DNP - IEC104 POINTS LIST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 61850

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: HTTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: TFTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: IEC 60870-5-104

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: COMMUNICATIONS: SNTP

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: MODBUS USER MAP

NOT USED - LEAVE AT DEFAULT

REAL TIME CLOCK

IRIG-B Signal Type

Real Time Clock Events

Time Zone Offset

DST Function

PRODUCT SETUP: USER-PROGRAMMABLE FAULT REPORT

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: OSCILLOGRAPHY

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Number Of Records	5
Trigger Mode	Automatic Overwrite
Trigger Position	30%
Trigger Source	Osc Trigger On (VO64)
AC Input Waveforms	32 samples/cycle
Digital Channel 1	BFI On(H7A)
Digital Channel 2	BFI LOW CURR On(H7C)
Digital Channel 3	52a On(H8A)
Digital Channel 4	LOW GAS Off(H8C)
Digital Channel 5	BKR FAIL 1 RETRIP
Digital Channel 6	BKR FAIL 1 T1 OP
Digital Channel 7	BKR FAIL 2 T3 OP
Digital Channel 8	BFI/BFI/ LC On (VO1)
Digital Channel 9	BF RETRIP On (VO2)
Digital Channel 10	BF TRIP On (VO3)
Digital Channel 11	BF BYPASS On (VO4)
Digital Channel 12	LC RETRIP On (VO5)
Digital Channel 13	TRIPBUS 1 OP
Digital Channel 14	TRIPBUS 2 OP
Digital Channel 15	TRIPBUS 3 OP
Digital Channel 16 - 63	OFF
Analog Channel 1	SRC1 Ia RMS
Analog Channel 2	SRC1 Ib RMS
Analog Channel 3	SRC1 Ic RMS
Analog Channel 4 - 16	OFF

PRODUCT SETUP: DATA LOGGER

Data Logger Mode	Continuous
Data Logger Trigger	OFF
Rate	60000 msec

PRODUCT SETUP: DEMAND

Current Method	Thermal Exponential
----------------	----------------------------

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Power Method **Thermal Exponential**
Interval **15 MIN**
Trigger **OFF**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: LED TEST

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: TRIP AND ALARMS LEDS

Trip LED Input **Osc Trigger (VO64)**

PRODUCT SETUP: USER-PROGRAMMABLE LEDS: USER PROGRAMMABLE LEDS

LEAVE AT DEFAULT

PRODUCT SETUP: USER-PROGRAMMABLE SELF TESTS

Direct Ring Break Function **Enabled**
Direct Device Off Function **Enabled**
Remote Device Off Function **Enabled**
Pri Ethernet Fail Function **Disabled**
Battery Fail Function **Enabled**
SNTP Fail Function **Enabled**
IRIG B Fail Function **Enabled**

PRODUCT SETUP: CONTROL PUSHBUTTONS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: FLEX STATES

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: USER-DEFINEABLE DISPLAYS

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: DIRECT I/O

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

PRODUCT SETUP: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

PRODUCT SETUP: INSTALLATION

Relay Name **50/62BFS/2114**

SYSTEM SETUP: AC INPUTS: CURRENT

CT F1: Phase CT Primary	800 A	2000/ 800 :5 CT
CT F1: Phase CT Secondary	5 A	
CT F1: Ground CT Primary	1 A	REQUIRED ENTRY, NOT USED
CT F1: Ground CT Secondary	1 A	REQUIRED ENTRY, NOT USED

SYSTEM SETUP: AC INPUTS: VOLTAGE

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: POWER SYSTEM

Nominal Frequency	60 Hz
Phase Rotation	ABC
Frequency And Phase Reference	SRC 1 (SRC 1) CURRENT ONLY
Frequency Tracking Function	Enabled

SYSTEM SETUP: SIGNAL SOURCES

SOURCE 1: Name	SRC 1	DEFAULT VALUE
SOURCE 1: Phase CT	F1	ASSIGN BKR CT AS SOURCE 1
SOURCE 1: Ground CT	None	
SOURCE 1: Phase VT	None	
SOURCE 1: Auxiliary VT	None	
SOURCE 2: Name	SRC 2	REQUIRED ENTRY, NOT USED
SOURCE 2: Phase CT	None	
SOURCE 2: Ground CT	None	
SOURCE 2: Phase VT	None	
SOURCE 2: Auxiliary VT	None	

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

SYSTEM SETUP: BREAKERS

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: SWITCHES

NOT USED - LEAVE AT DEFAULT

SYSTEM SETUP: FLEXCURVES

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXLOGIC EQUATION EDITOR

FlexLogic Entry 1	BFI On(H7A)
FlexLogic Entry 2	BFI LOW CURR On(H7C)
FlexLogic Entry 3	OR(2)
FlexLogic Entry 4	BFI/BFI LC (VO1)
FlexLogic Entry 5	BKR FAIL 1 RETRIP
FlexLogic Entry 6	LC RETRIP On (VO5)
FlexLogic Entry 7	AND(2)
FlexLogic Entry 8	BF RETRIP (VO2)
FlexLogic Entry 9	BKR FAIL 1 T1 OP
FlexLogic Entry 10	BKR FAIL 2 T3 OP
FlexLogic Entry 11	OR(2)
FlexLogic Entry 12	BF TRIP (VO3)
FlexLogic Entry 13	LOW GAS On(H8C)
FlexLogic Entry 14	BF RETRIP (VO2)
FlexLogic Entry 15	AND(2)
FlexLogic Entry 16	BF BYPASS (VO4)
FlexLogic Entry 17	TRIPBUS 1 OP
FlexLogic Entry 18	POSITIVE ONE SHOT
FlexLogic Entry 19	TRIPBUS 2 OP
FlexLogic Entry 20	POSITIVE ONE SHOT
FlexLogic Entry 21	TRIPBUS 3 OP
FlexLogic Entry 22	POSITIVE ONE SHOT
FlexLogic Entry 23	OR(3)
FlexLogic Entry 24	Osc Trigger (VO64)

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

FlexLogic Entry 25	BFI LOW CURR ON(H7C)
FlexLogic Entry 26	52a ON(H8A)
FlexLogic Entry 27	AND(2)
FlexLogic Entry 28	LC RETRIP (V05)
FlexLogic Entry 29 - 512	SPARE

FLEXLOGIC: FLEXLOGIC TIMERS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: FLEXELEMENTS

NOT USED - LEAVE AT DEFAULT

FLEXLOGIC: NON-VOLATILE LATCHES

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: PHASE CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: NEUTRAL CURRENT

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: GROUND CURRENT

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

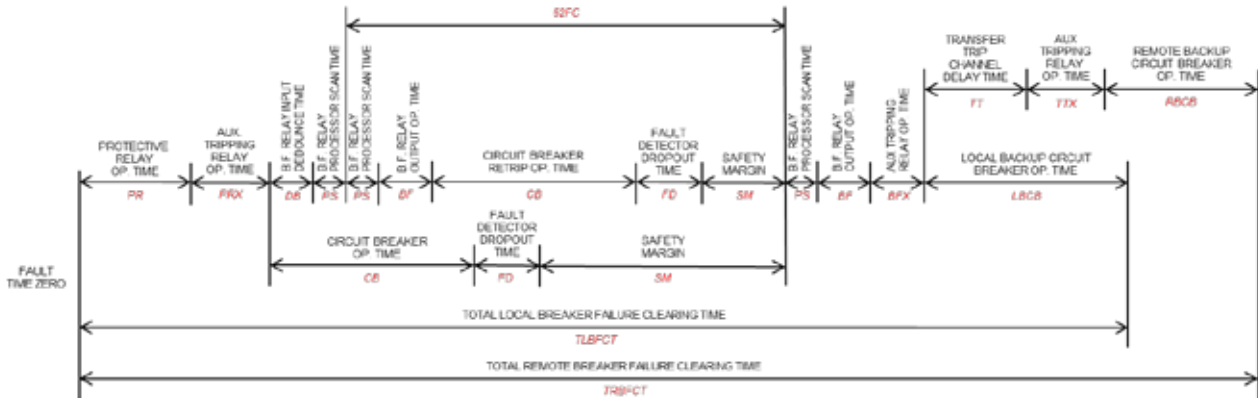
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BREAKER FAILURE INFORMATION

TIMER:



62FC = **7.700** cyc

PR = 2.040 cyc

PRX = 0.900 cyc

DB = 0.000 cyc

PS = 0.030 cyc

CB = 3.000 cyc

FD = 2.400 cyc

BF = 0.240 cyc

BFX = 0.900 cyc

LBCB = 3.000 cyc

TT = 0.000 cyc

TTX = 0.000 cyc

RBCB = 0.000 cyc

Used for Flexlogic setting (Adjusted to achieve ~2 cyc safety margin)

T2 relay time to operate for a differential fault

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

C60 Debounce Time for this input

C60 Processor Scan Time = 0.5ms (GE C60 Manual, Page 5-178)

Local circuit breaker operate time (Per bkr. nameplate)

Fault Detector MAX dropout (Not published, use typical of 40ms)

C60 Published operate time = 4ms (GE C60 Manual, Page 2-11)

Electroswitch standard speed LOR, 15mSec operate time (Per catalog)

Local backup circuit breaker operate time

Transfer trip channel time - By NYPA

Transfer trip aux relay operate time - By NYPA

Assumed remote backup circuit breaker operate time - By NYPA

(ENTER '0' FOR 'RBCB' IF NO REMOTE BACKUP BREAKER (OR TT))

NORMAL CLEARING TIME (NCT) = PR+PRX+CB

NCT = 5.940 cyc

RETRIP CLEARING TIME (RCT) = PR+PRX+DB+PS+PS+BF+CB

RCT = 6.240 cyc

Time for breaker retrip to occur

BF TIMER SETTING (62FC) >= PS+BF+CB+FD

62FC >= 5.670 cyc

62FC must provide enough time for breaker to trip normally or retrip

TOTAL LOCAL BREAKER FAILURE CLEARING TIME (TLBFCT) = PR+PRX+DB+PS+62FC+PS+BF+BFX+LBCB

TLBFCT = 14.840 cyc

SAFETY MARGIN, NORMAL TRIP (SMNT) = 62FC - CB + DB + PS - FD

SMNT = 2.330 cyc

Try to maintain a 2 cycle margin to cover timing errors

SAFETY MARGIN, RETRIP (SMRT) = 62FC - PS - BF - CB - FD

SMRT = 2.030 cyc

Try to maintain a 2 cycle margin to cover timing errors

FAULT VALUES:

CTR = **160** 2000/800:5 CT

230kV Line Ratings (R102-11 Analysis to Confirm Non-Material Change for Marble River Wind Farm, Table 3-1)

WPN1 Line Rating = **996** A, pri 6.23 A, sec 1.25 A, pu

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

PND1 Line Rating= **996** A,pri 6.23 A,sec 1.25 A,pu

Fault Information

All fault information is based on Aspen Oneliner Case: NYISO CY11. To model a weak system the following were taken out of service: Noble Clinton W.F., Chateaugay W.F., Noble Ellenburg W.F., Noble Altona W.F., Marble River W.F. Additionally, The strongest source opposite the faulted station was removed (ie, for a Duley the strongest source at Willis was removed. The removed element is specified next to the fault table below.

Fault at Duley 230kV Bus (MW1 OS at Willis)

Phase to Ground=	2023	A,pri (3I0)	12.64 A,sec	2.53 A,pu
Phase to Phase=	2492	A,pri	15.58 A,sec	3.12 A,pu
Three Phase=	2889	A,pri	18.06 A,sec	3.61 A,pu

Fault at Willis 230kV Bus (LN701 OS at Plattsburgh)

Phase to Ground=	1102	A,pri (3I0)	6.89 A,sec	1.38 A,pu
Phase to Phase=	894	A,pri	5.59 A,sec	1.12 A,pu
Three Phase=	1034	A,pri	6.46 A,sec	1.29 A,pu

GROUPED ELEMENTS: GROUP 1: BREAKER FAILURE

BF1: Function	Enabled	Enable function for current supervised BFI
BF1: Mode	3-Pole	Three pole tripping only
BF1: Source	SRC 1 (SRC 1)	Current from breaker
BF1: Current Supervision	Yes	Enable current supervision of BFI
BF1: Use Seal-In	No	No seal in
BF1: Three Pole Initiate	BFI/BFI LC On (VO1)	BFI from line relay or low current BFI inputs
BF1: Block	OFF	No blocking of BFI
BF1: Phase Current Supv Pickup	0.55 pu	

Set the phase fault detector at 50% of the lowest phase fault value.

Phase fault detector will be set below the current rating of the line.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Fault contribution from Marble River Windfarm may fall below this level and protection will rely on the low current scheme for proper operation.

Fault I (A,pri)=	894	TIMES	0.5	EQUALS	447 A,pri
EQUALS	2.79	A,sec			
EQUALS	0.56	A,pu			
Set pickup at:	0.55	A,pu			
	440	A,pri			

BF1: Neutral Current Supv Pickup

0.05 pu

Set the ground fault detector at 20% of the line rating and check that it is

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

lower than expected ground fault.

Gnd fault detector setting of 200A primary is below expected Ph-gnd fault of 1034A 3I0.

Remote end protection transfer trip as well as Patnode Transformer and 230kV bus protection will initiate the low current breaker failure scheme at Patnode. Marble River Windfarm is not a ground current source and the protection will rely on the low current scheme for proper breaker failure operation.

Line Rating (A,pri)= **996** TIMES **0.2** EQUALS 199.2 A,pri
EQUALS 1.25 A,sec
EQUALS 0.25 A,pu

Set pickup at: **0.25** A,pu
200 A,pri

BF1: Use Timer 1 **Yes** 62BF, Current supervised trip

BF1: Timer 1 Pickup Delay **0.128 s** See time calculations above

62FC= **7.700 cyc**
EQUALS 0.128333 sec

BF1: Use Timer 2 **No** NOT USED

BF1: Timer 2 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Use Timer 3 **No** NOT USED

BF1: Timer 3 Pickup Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Breaker Pos1 Phase A/3P **ON** Set to logic 1 to enable BFI timer (No 52a supervision)

BF1: Breaker Pos2 Phase A/3P **OFF** NOT USED

BF1: Breaker Test On **OFF** NOT USED

BF1: Phase Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current HiSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Phase Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: Neutral Current LoSet Pickup **1.050 pu** REQUIRED ENTRY, NOT USED

BF1: LoSet Time Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Trip Dropout Delay **0.000 s** REQUIRED ENTRY, NOT USED

BF1: Target **Self-reset**

BF1: Events **Enabled**

BF1: Phase A Initiate **OFF** NOT USED

BF1: Phase B Initiate **OFF** NOT USED

BF1: Phase C Initiate **OFF** NOT USED

BF1: Breaker Pos1 Phase B **OFF** NOT USED

BF1: Breaker Pos1 Phase C **OFF** NOT USED

BF1: Breaker Pos2 Phase B **OFF** NOT USED

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

BF1: Breaker Pos2 Phase C	OFF	NOT USED
BF2: Function	Enabled	Enable function for low current BFI
BF2: Mode	3-Pole	Three pole tripping only
BF2: Source	SRC 1 (SRC 1)	Current from breaker
BF2: Current Supervision	No	No current supervision for low current scheme
BF2: Use Seal-In	No	No seal in
BF2: Three Pole Initiate	BFI LOW CURR On(H7C)	BFI from low current inputs only
BF2: Block	OFF	No blocking of BFI
BF2: Phase Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Neutral Current Supv Pickup	1.050 pu	REQUIRED SETTING, NOT USED
BF2: Use Timer 1	No	NOT USED
BF2: Timer 1 Pickup Delay	0.000 s	REQUIRED SETTING, NOT USED
BF2: Use Timer 2	No	NOT USED
BF2: Timer 2 Pickup Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Use Timer 3	Yes	62BF, Low/NO current trip
BF2: Timer 3 Pickup Delay	0.128 s	Set same as BF1 T1
BF2: Breaker Pos1 Phase A/3P	OFF	Not used
BF2: Breaker Pos2 Phase A/3P	52a On(H8a)	Used for breaker position supervision of low current BFI
BF2: Breaker Test On	OFF	NOT USED
BF2: Phase Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current HiSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Phase Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: Neutral Current LoSet Pickup	1.050 pu	REQUIRED ENTRY, NOT USED
BF2: LoSet Time Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Trip Dropout Delay	0.000 s	REQUIRED ENTRY, NOT USED
BF2: Target	Self-reset	
BF2: Events	Enabled	
BF2: Phase A Initiate	OFF	NOT USED
BF2: Phase B Initiate	OFF	NOT USED
BF2: Phase C Initiate	OFF	NOT USED
BF2: Breaker Pos1 Phase B	OFF	NOT USED
BF2: Breaker Pos1 Phase C	OFF	NOT USED
BF2: Breaker Pos2 Phase B	OFF	NOT USED

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

BF2: Breaker Pos2 Phase C

OFF

NOT USED

GROUPED ELEMENTS: GROUP 1: VOLTAGE ELEMENTS

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 1: POWER

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 2

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 3

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 4

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 5

NOT USED - LEAVE AT DEFAULT

GROUPED ELEMENTS: GROUP 6

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: TRIP BUS

Trip Bus 1 Function

Enabled

Trip Bus 1 Block

OFF

NO BLOCK TRIP

Trip Bus 1 Pickup Delay

0.00 s

NO PICK-UP DELAY

Trip Bus 1 Reset Delay

0.10 s

SET EQUAL TO SEL TDURD (6cyc)

Trip Bus 1 Input 1

BF TRIP On (VO3)

Current or breaker supervised trip

Trip Bus 1 Input 2 - 16

SPARE

Trip Bus 1 Latching

Disabled

Trip Bus 1 Reset

OFF

Trip Bus 1 Target

Self-reset

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Trip Bus 1 Events	Enabled	
Trip Bus 2 Function	Enabled	
Trip Bus 2 Block	OFF	NO BLOCK TRIP
Trip Bus 2 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 2 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 2 Input 1	BF RETRIP ON (VO2)	Immediate re-trip of secondary breaker trip coil
Trip Bus 2 Input 2 -16	SPARE	
Trip Bus 2 Latching	Disabled	
Trip Bus 2 Reset	OFF	
Trip Bus 2 Target	Self-reset	
Trip Bus 2 Events	Enabled	
Trip Bus 3 Function	Enabled	
Trip Bus 3 Block	OFF	NO BLOCK TRIP
Trip Bus 3 Pickup Delay	0.00 s	NO PICK-UP DELAY
Trip Bus 3 Reset Delay	0.10 s	SET EQUAL TO SEL TDURD (6cyc)
Trip Bus 3 Input 1	BF BYPASS On (VO4)	Bypass breaker failure timer for low gas and BFI
Trip Bus 3 Input 2 - 16	SPARE	
Trip Bus 3 Latching	Disabled	
Trip Bus 3 Reset	OFF	
Trip Bus 3 Target	Self-reset	
Trip Bus 3 Events	Enabled	
Trip Bus 4-6	SPARE	

CONTROL ELEMENTS: SETTING GROUPS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SELECTOR SWITCHES

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: UNDERFREQUENCY

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: OVERFREQUENCY

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: SYNCHROCHECK

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: DIGITAL COUNTERS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: MONITORING ELEMENTS

NOT USED - LEAVE AT DEFAULT

CONTROL ELEMENTS: PILOT SCHEMES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT INPUTS

[H7A] Contact Input 1 ID	BFI	BFI INITIATE
[H7A] Contact Input 1 Debounce Time	0 ms	Debounce set to 0ms
[H7A] Contact Input 1 Events	Enabled	
[H7C] Contact Input 2 ID	BFI LOW CURR	BF OC BY-PASS
[H7C] Contact Input 2 Debounce Time	0 ms	Debounce set to 0ms
[H7C] Contact Input 2 Events	Enabled	
[H8A] Contact Input 3 ID	52a	52a
[H8A] Contact Input 3 Debounce Time	0 ms	Debounce set to 0ms
[H8A] Contact Input 3 Events	Enabled	
[H8C] Contact Input 4 ID	LOW GAS	BF LOW GAS
[H8C] Contact Input 4 Debounce Time	0 ms	Debounce set to 0ms
[H8C] Contact Input 4 Events	Enabled	
[M7A] - [M8C]	SPARE	

INPUTS/OUTPUTS: CONTACT INPUT THRESHOLDS

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

ENG: **JK/TRC**

Cont 1p 1 - Cont Ip 4 **84 Vdc** Suggested setting for 125Vdc control system

Cont 1p 5 - Cont Ip 8 **84 Vdc** Suggested setting for 125Vdc control system

INPUTS/OUTPUTS: VIRTUAL INPUTS: VIRTUAL INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: CONTACT OUTPUTS

[H1] Contact Output 1 ID	Cont Op 1	BF TIME TRIP 86BFS
[H1] Contact Output 1 Operate	TRIPBUS 1 OP	
[H1] Contact Output 1 Seal-In	OFF	
[H1] Contact Output 1 Events	Enabled	
[H2] Contact Output 2 ID	Cont Op 2	62ZP RETRIP BKR. SECONDARY COIL
[H2] Contact Output 2 Operate	TRIPBUS 2 OP	
[H2] Contact Output 2 Seal-In	OFF	
[H2] Contact Output 2 Events	Enabled	
[H3] Contact Output 3 ID	Cont Op 3	BF TIMER BY-PASS TRIP 86BFS
[H3] Contact Output 3 Operate	TRIPBUS 3 OP	
[H3] Contact Output 3 Seal-In	OFF	
[H3] Contact Output 3 Events	Enabled	
[H4] - [H6]	SPARE	
[M1] - [M6]	SPARE	

INPUTS/OUTPUTS: VIRTUAL OUTPUTS

Virtual Output 1 ID	BFI/BFI LC
Virtual Output 1 Events	Enabled
Virtual Output 2 ID	BF RETRIP
Virtual Output 2 Events	Enabled
Virtual Output 3 ID	BF TRIP
Virtual Output 3 Events	Enabled
Virtual Output 4 ID	BF BYPASS
Virtual Output 4 Events	Enabled
Virtual Output 5	LC RETRIP
Virtual Output 5 Events	Enabled

STATION: **PATNODE**
DEVICE: **50/62BFS/2114**
DATE: **3/20/2012**

LINE: **BKR 2114**
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**
FID: **5.5x**
ENG: **JK/TRC**

Virtual Output 6-63	SPARE
Virtual Output 64 ID	Osc Trigger
Virtual Output 64 Events	Enabled
Virtual Output 65 - 96	SPARE

INPUTS/OUTPUTS: REMOTE DEVICES

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS DNA BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: REMOTE OUTPUTS USERST BIT PAIRS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: RESETTNG

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT INPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: DIRECT OUTPUTS

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: TELEPROTECTION

NOT USED - LEAVE AT DEFAULT

INPUTS/OUTPUTS: IEC 61850 GOOSE ANALOGS INPUTS

NOT USED - LEAVE AT DEFAULT

STATION: **PATNODE**

DEVICE: **50/62BFS/2114**

DATE: **3/20/2012**

LINE: **BKR 2114**

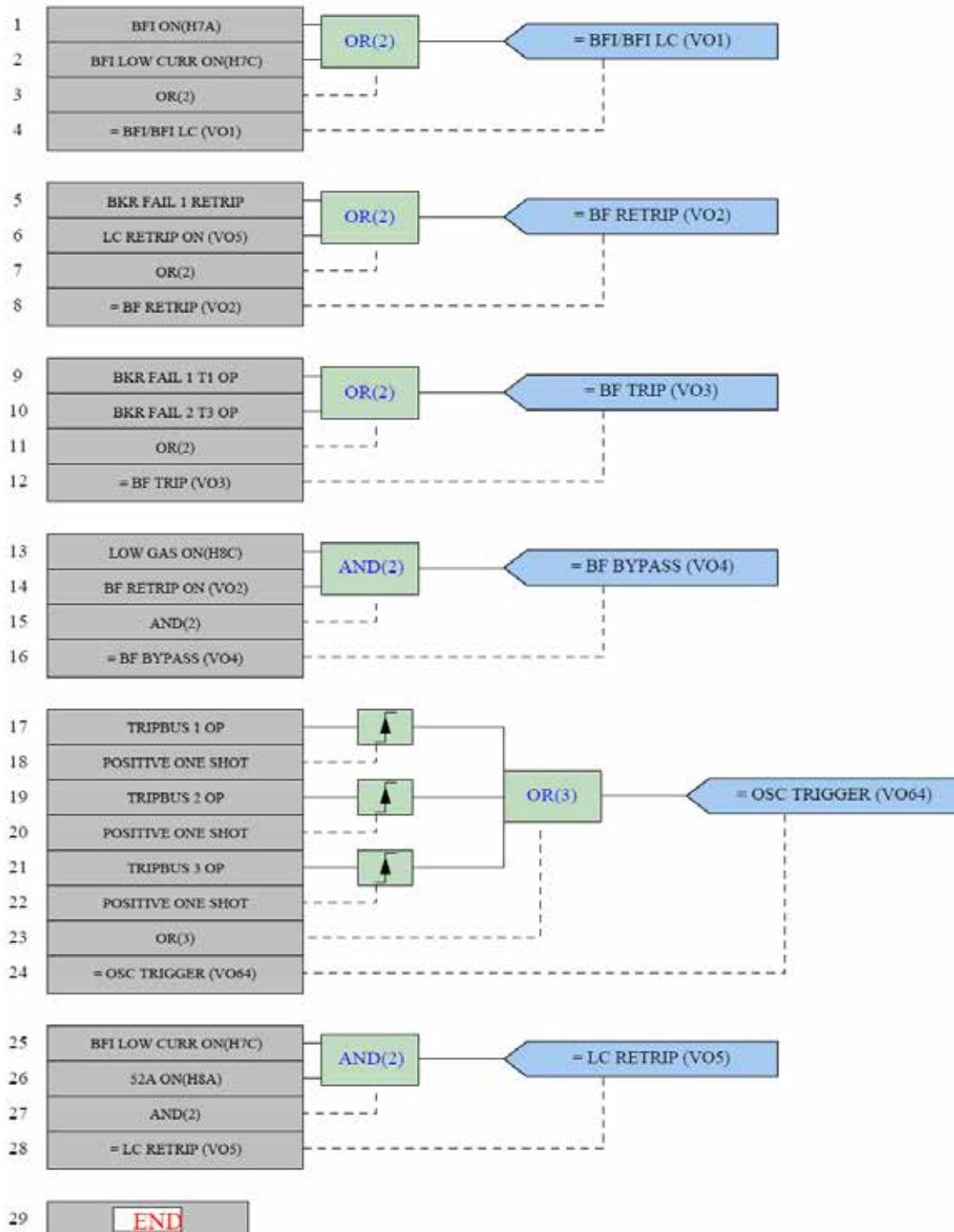
RELAY: **C60-N03-VFH-F8F-H6P-M6M-R7A**

FID: **5.5x**

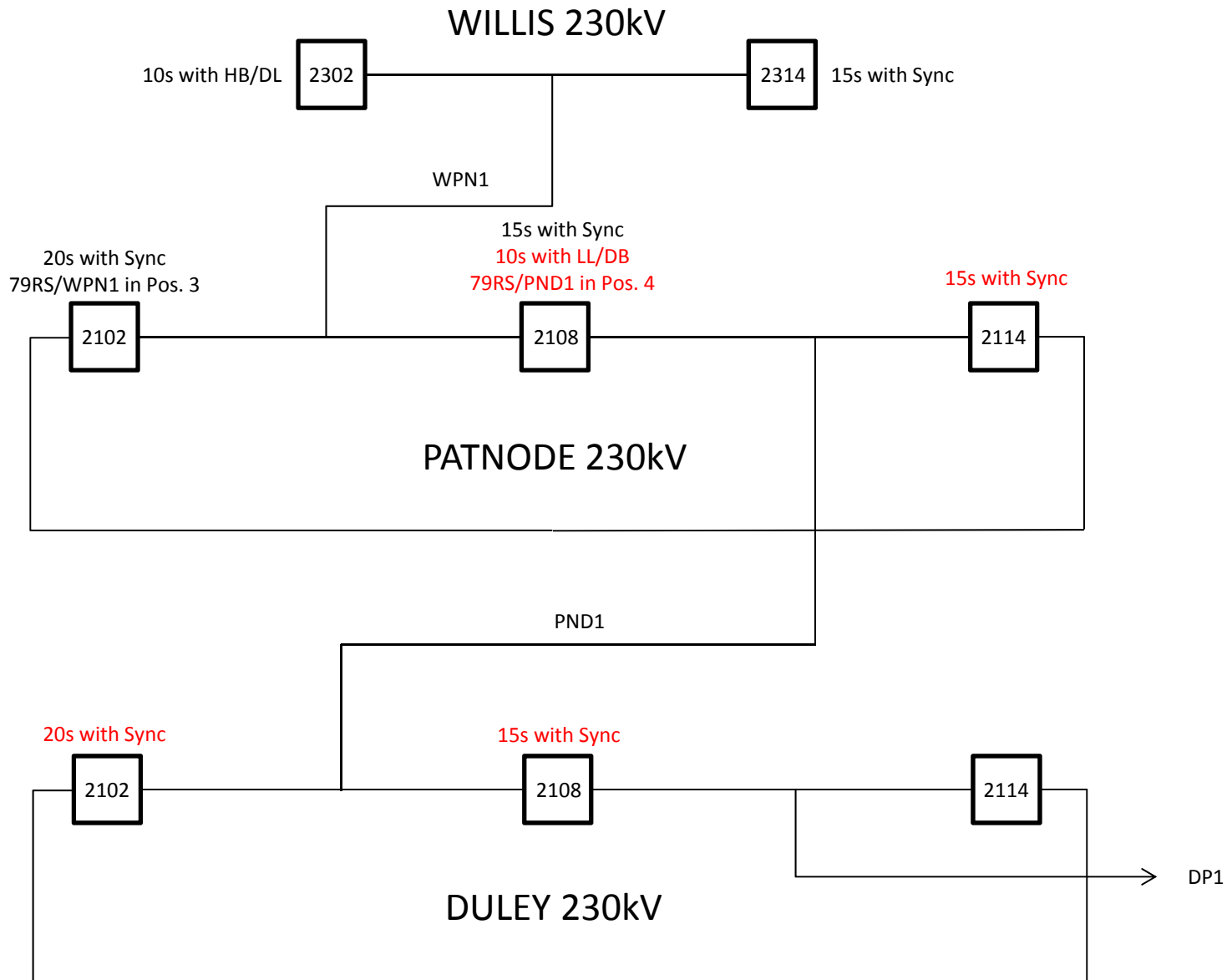
ENG: **JK/TRC**

APPENDIX:

Flex Logic Diagram for C60



RECLOSING AND SYNC- CHECK



Notes:

Reclosing at Willis and Duley are outside of TRC scope of work

Sequence and times provided by NYPA

Normal system operation is to reclose from West to East (Willis to Patnode to Duley)

79RS switches can be operated to change reclosing sequence

STATION: **PATNODE**

DEVICE: **25/27/2102**

DATE: **4/5/2012**

LINE: **2102**

RELAY: **MLJ100-5-B010-G-00-C**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2102 SYNC-CHECK & RECLOSING PERMISSION

NOTES:

Normal operation is for breaker 2102 to only reclose with sync check
Under certain operational conditions 79RS/WPN1 can be placed in Position 2 for DL/LB reclosing
Breaker 2102 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions

AC INPUTS:

POINT	FUNCTION
LINE	WPN1, 2104 VT's
BUS	BUS 2BE, 2144 VT's

SETTINGS

0-1 Frequency **60** Hz

1-1 Voltage Diff. **15** Volts

1-2 Angle **30** Degrees

1-3 Freq. Slip **30** mHZ

1-4 Cont. Timing **10** s

1-5 Man. Timing **10.1** s Factory Default

2-1 Volt. Sup. En. **ON**

2-2 Volt. Sup. Thr. **40** Volts

3-1 Line OV Thr. **98** Volts

3-2 Line UV Thr. **10** Volts

3-3 Bus OV Thr. **98** Volts

3-4 Bus UV Thr. **10** Volts

4-1 Sync. Enable **ON**

4-2 DLDB Enable **OFF**

4-3 DLLB Enable **ON**

4-4 LLDB Enable **ON**

5-1 Conf. Aux 1 **25**

5-2 Conf. Aux 2 **dL**

6-1 Unit Number **1** Factory Default

6-2 Port Baud **9.6** Factory Default

STATION: PATNODE
DEVICE: 25/27/2102
DATE: 4/5/2012

LINE: 2102
RELAY: MLJ100-5-B010-G-00-C
FID: NA
ENG: JK/TRC

JUMPER SETTINGS

JUMPERS ON MAIN BOARD

-ALL JUMPERS AT FACTORY DEFAULT

STATION: **PATNODE**

DEVICE: **25/27/2108**

DATE: **4/5/2012**

LINE: **2108**

RELAY: **MLJ100-5-B010-G-00-C**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2108 SYNC-CHECK & RECLOSING PERMISSION

NOTES:

Normal operation is for Breaker 2108 to only reclose with sync check
Under certain operational conditions 79RS/PND1 can be placed in Position 4 for LL/DB reclosing
Breaker 2108 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions

AC INPUTS:

POINT	FUNCTION
LINE	WPN1, 2104 VT's
BUS	PND1, 2124 VT's

SETTINGS

0-1 Frequency **60** Hz

1-1 Voltage Diff. **15** Volts

1-2 Angle **30** Degrees

1-3 Freq. Slip **30** mHZ

1-4 Cont. Timing **5** s

1-5 Man. Timing **10.1** s Factory Default

2-1 Volt. Sup. En. **ON**

2-2 Volt. Sup. Thr. **40** Volts

3-1 Line OV Thr. **98** Volts

3-2 Line UV Thr. **10** Volts

3-3 Bus OV Thr. **98** Volts

3-4 Bus UV Thr. **10** Volts

4-1 Sync. Enable **ON**

4-2 DLDB Enable **OFF**

4-3 DLLB Enable **ON**

4-4 LLDB Enable **ON**

5-1 Conf. Aux 1 **25**

5-2 Conf. Aux 2 **dB**

6-1 Unit Number **1** Factory Default

6-2 Port Baud **9.6** Factory Default

STATION: **PATNODE**

DEVICE: **25/27/2108**

DATE: **4/5/2012**

LINE: **2108**

RELAY: **MLJ100-5-B010-G-00-C**

FID: **NA**

ENG: **JK/TRC**

JUMPER SETTINGS

JUMPERS ON MAIN BOARD

-ALL JUMPERS AT FACTORY DEFAULT

STATION: **PATNODE**

DEVICE: **25/27/2114**

DATE: **4/5/2012**

LINE: **2114**

RELAY: **MLJ100-5-B010-G-00-C**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2114 SYNC-CHECK & RECLOSING PERMISSION

NOTES:

Normal operation is for breaker 2114 to only reclose with sync check
Under certain operational conditions 79RS/PND1 can be placed in Position 2 for DL/LB reclosing
Breaker 2114 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions

AC INPUTS:

POINT	FUNCTION
LINE	PND1, 2124 VT's
BUS	BUS 2BE, 2144 VT's

SETTINGS

0-1 Frequency **60** Hz

1-1 Voltage Diff. **15** Volts

1-2 Angle **30** Degrees

1-3 Freq. Slip **30** mHZ

1-4 Cont. Timing **5** s

1-5 Man. Timing **10.1** s Factory Default

2-1 Volt. Sup. En. **ON**

2-2 Volt. Sup. Thr. **40** Volts

3-1 Line OV Thr. **98** Volts

3-2 Line UV Thr. **10** Volts

3-3 Bus OV Thr. **98** Volts

3-4 Bus UV Thr. **10** Volts

4-1 Sync. Enable **ON**

4-2 DLDB Enable **OFF**

4-3 DLLB Enable **ON**

4-4 LLDB Enable **ON**

5-1 Conf. Aux 1 **25**

5-2 Conf. Aux 2 **dL**

6-1 Unit Number **1** Factory Default

6-2 Port Baud **9.6** Factory Default

STATION: **PATNODE**

DEVICE: **25/27/2114**

DATE: **4/5/2012**

LINE: **2114**

RELAY: **MLJ100-5-B010-G-00-C**

FID: **NA**

ENG: **JK/TRC**

JUMPER SETTINGS

JUMPERS ON MAIN BOARD

-ALL JUMPERS AT FACTORY DEFAULT

STATION: **PATNODE**

DEVICE: **79/2102**

DATE: **4/5/2012**

LINE: **2102**

RELAY: **BE1-79M-B8C-A6J-C0L0F**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2102 RECLOSING

NOTES:

Only single shot reclosing is used
Reclosing relay is supervised by 25/27/2102 relay
Breaker 2102 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions
Manual operation of the breaker with 52CS will drive the reclosing relay to lock out

SETTINGS

Reclose 1	15.0	s	
Reclose 2	0	s	NOT USED
Reclose 3	0	s	NOT USED
Reset	20	s	
Reclose Fail	0	s	Reclose is continuous until breaker closes
Max Cycle	180	s	
Inst Trip 1	BLOCK		
Inst Trip 2	BLOCK		
Inst Trip 3	BLOCK		
Inst Trip 4	BLOCK		
Inst Trip 5	BLOCK		

STATION: **PATNODE**

DEVICE: **79/2108**

DATE: **4/5/2012**

LINE: **2108**

RELAY: **BE1-79M-B8C-A6J-C0L0F**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2108 RECLOSING

NOTES:

Only single shot reclosing is used
Reclosing relay is supervised by 25/27/2108 relay
Breaker 2108 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions
Manual operation of the breaker with 52CS will drive the reclosing relay to lock out

SETTINGS

Reclose 1	10.0	s	
Reclose 2	0	s	NOT USED
Reclose 3	0	s	NOT USED
Reset	20	s	
Reclose Fail	0	s	Reclose is continuous until breaker closes
Max Cycle	180	s	
Inst Trip 1	BLOCK		
Inst Trip 2	BLOCK		
Inst Trip 3	BLOCK		
Inst Trip 4	BLOCK		
Inst Trip 5	BLOCK		

STATION: **PATNODE**

DEVICE: **79/2114**

DATE: **4/5/2012**

LINE: **2114**

RELAY: **BE1-79M-B8C-A6J-C0L0F**

FID: **NA**

ENG: **JK/TRC**

RELAY USED FOR 2114 RECLOSING

NOTES:

Only single shot reclosing is used
Reclosing relay is supervised by 25/27/2114 relay
Breaker 2114 can be manually reclosed with DL/LB, LL/DB, and Sync-Check permissions
Manual operation of the breaker with 52CS will drive the reclosing relay to lock out

SETTINGS

Reclose 1	15.0	s	
Reclose 2	0	s	NOT USED
Reclose 3	0	s	NOT USED
Reset	20	s	
Reclose Fail	0	s	Reclose is continuous until breaker closes
Max Cycle	180	s	
Inst Trip 1	BLOCK		
Inst Trip 2	BLOCK		
Inst Trip 3	BLOCK		
Inst Trip 4	BLOCK		
Inst Trip 5	BLOCK		

APPENDIX 1: BREAKER FAILURE LOGIC DIAGRAM

