

IEC 61850 Testing and Commissioning Advantages Using GOOSE Messaging

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Agenda

Introduction

Traditional Relay Testing Practices

IEC 61850 Testing Functionality

IEC 61850 Data Model Approach to Testing

IEC 61850 Test Plan Example

Introduction

- The use of IEC 61850 and associated standards paved the road to digital substations
- IEC 61850 digital substation can
 - Be engineered & designed faster
 - Reduce physical wiring
 - Reduce control house size
 - Build a substation faster
- IEC 61850 service protocols can reduce the testing time of an Intelligent Electronic Device (IED)
- Concept can be used even in conventional substation
 - e.g. hard wired analogs and discrete IO for normal service, but GOOSE or MMS can be communicated via an ethernet port for testing purposes only.

Traditional Relay Testing Practices

Requires testing of every element that is used in an IED. e.g. Line impedance zone pick ups & Operate, directional overcurrent pickups & Operates, fault detectors, etc.

Test switches and test devices are used to isolate the relay

Test sets are used to:

- Inject analog signals (currents & voltages)
- Monitor discrete inputs and outputs

Test Set Software is used to create relay-specific test plans

Relay settings are modified during testing to test each individual element

Time wasted to modify relay settings, configure test scenario per step, and repeat...

Line Protection test plan has 250+ steps



Regulatory Category		Inherit	Retest Interval		72 mo			
Last Compliant Test Run			Retest Due					
Test Steps								
Settings Group 1								
<input type="checkbox"/> Hide disabled tests								
#	Test Name	Test Enabled	Type	Auto Run	Comments	Compliance/Required	Last Run	Modified
40	PH1-2 RCH Z1	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH1-2 ZONE 1	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
41	PH1-2 MTA Z1	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
42	PH1-2 PLOT Z1	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
43	PH2-3 RCH Z1	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH2-3 ZONE 1	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
44	PH2-3 MTA Z1	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
45	PH2-3 PLOT Z1	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
46	PH3-1 RCH Z1	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH3-1 ZONE 1	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
47	PH3-1 MTA Z1	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
48	PH3-1 PLOT Z1	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
49	INSTRUCTIONS	<input checked="" type="checkbox"/>	Documen...	<input checked="" type="checkbox"/>	MASK H1 = PH DIST Z1 OP	<input checked="" type="checkbox"/>	*	2017-Jul-17
50	PH3-1 PU TIME Z1	<input checked="" type="checkbox"/>	TIME1	<input checked="" type="checkbox"/>	Z1 TIMING	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
51	PH3-1 BLOCK Z1	<input checked="" type="checkbox"/>	TIME1	<input checked="" type="checkbox"/>	BLOCK: W/FUSE FAIL	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
52	INSTRUCTIONS	<input checked="" type="checkbox"/>	Documen...	<input checked="" type="checkbox"/>	MASK H1 = PH DIST Z2 PKP	<input checked="" type="checkbox"/>	*	2017-Jul-17
53	PH1-2 RCH Z2	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH1-2 ZONE 2	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
54	PH1-2 MTA Z2	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
55	PH1-2 PLOT Z2	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
56	PH2-3 RCH Z2	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH2-3 ZONE 2	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
57	PH2-3 MTA Z2	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
58	PH2-3 PLOT Z2	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
59	PH3-1 RCH Z2	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH3-1 ZONE 2	<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
60	PH3-1 MTA Z2	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
61	PH3-1 PLOT Z2	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-17	2017-Jul-17
62	INSTRUCTIONS	<input checked="" type="checkbox"/>	Documen...	<input checked="" type="checkbox"/>	MASK H1 = PH DIST Z2 OP	<input checked="" type="checkbox"/>	*	2017-Jul-17
63	PH3-1 PU TIME Z2	<input checked="" type="checkbox"/>	TIME1	<input checked="" type="checkbox"/>	Z2 TIMING	<input type="checkbox"/>	2017-Jan-24	2017-Jul-17
64	PH3-1 BLOCK Z2	<input checked="" type="checkbox"/>	TIME1	<input checked="" type="checkbox"/>	BLOCK: W/FUSE FAIL	<input type="checkbox"/>	2017-Jan-18	2017-Jul-17
65	INSTRUCTIONS	<input checked="" type="checkbox"/>	Documen...	<input checked="" type="checkbox"/>	MASK H1 = PH DIST Z4 PKP	<input checked="" type="checkbox"/>	*	2017-Jul-17
66	PH1-2 RCH Z4	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH1-2 ZONE 4	<input type="checkbox"/>	2017-Jan-18	2017-Jul-17
67	PH1-2 MTA Z4	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-18	2017-Jul-17
68	PH1-2 PLOT Z4	<input checked="" type="checkbox"/>	ZPXBO1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-18	2017-Jul-17
69	PH2-3 RCH Z4	<input checked="" type="checkbox"/>	RCHLR1	<input checked="" type="checkbox"/>	PH2-3 ZONE 4	<input type="checkbox"/>	2017-Jan-18	2017-Jul-17
70	PH2-3 MTA Z4	<input checked="" type="checkbox"/>	MAXTA1	<input checked="" type="checkbox"/>		<input type="checkbox"/>	2017-Jan-18	2017-Jul-17

IEC 61850 Testing Functionality - Quality Attribute

Within the IEC 61850 standard (7-4)

- Every Logical node within a data set is accompanied by the quality attribute (q)
- The attribute is 13 bits long
- The data is good if all bits are false
- Each bit represents a quality issue.

Validity:

- **good:** The value shall be marked good if no abnormal condition of the acquisition function or the information source is detected.
- **invalid:** The value shall be marked invalid when an abnormal condition of the acquisition function or the information source (missing or non-operating updating devices) is detected.
- **questionable:** The value shall be marked questionable if a supervision function detects an abnormal behavior, however the value could still be valid. The user shall be responsible for determining whether or not values marked "questionable" should be used.

Bit(s)	IEC 61850-7-3		Bit-String	
	Attribute name	Attribute value	Value	Default
0-1	Validity	Good	0 0	0 0
		Invalid	0 1	
		Reserved	1 0	
		Questionable	1 1	
2	Overflow		TRUE	FALSE
3	OutOfRange		TRUE	FALSE
4	BadReference		TRUE	FALSE
5	Oscillatory		TRUE	FALSE
6	Failure		TRUE	FALSE
7	OldData		TRUE	FALSE
8	Inconsistent		TRUE	FALSE
9	Inaccurate		TRUE	FALSE
10	Source	Process	0	0
		Substituted	1	
11	Test		TRUE	FALSE
12	OperatorBlocked		TRUE	FALSE

Test bit shall be an additional identifier that may be used to classify a value being a test value and not to be used for operational purposes. The processing of the test quality in the client shall be as described in IEC 61850-7-4.

IEC 61850 Testing Functionality – Test Mode

Within the IEC 61850 standard

- If test bit is set to true, then any devices not in test mode won't interact with the message if it was configured to normally subscribe to the message.
- Any other device in test mode will respond to the message from another device in test mode if it was configured to normally subscribe to the message.
- The device in test mode will operate for messages from devices not in test mode.
- A logical node or a logical device can be put in test mode using the data object Mod of the logical node of LLNO.

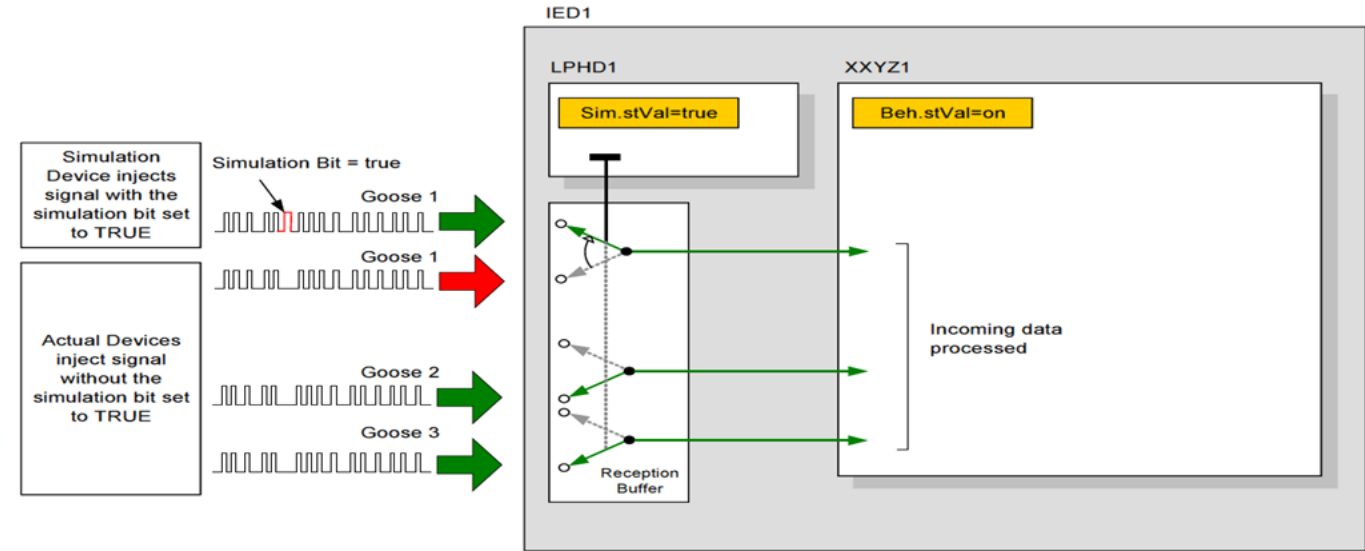
Test Mode Overview

- Verify system reliability and availability without interrupting the system process
- Modes are initiated with represented LN
- 5 Modes:
 - **ON** – Communication services work correctly
 - **ON-BLOCKED** – Control commands & output data will be rejected
 - **TEST** – “Quality test” control commands are accepted
 - **TEST/BLOCKED** – “Quality test” data is accepted, but output data is rejected
 - **OFF** – No process output or control commands are accepted

IEC 61850 Testing Functionality - Stimulation Mode

Within the IEC 61850 standard

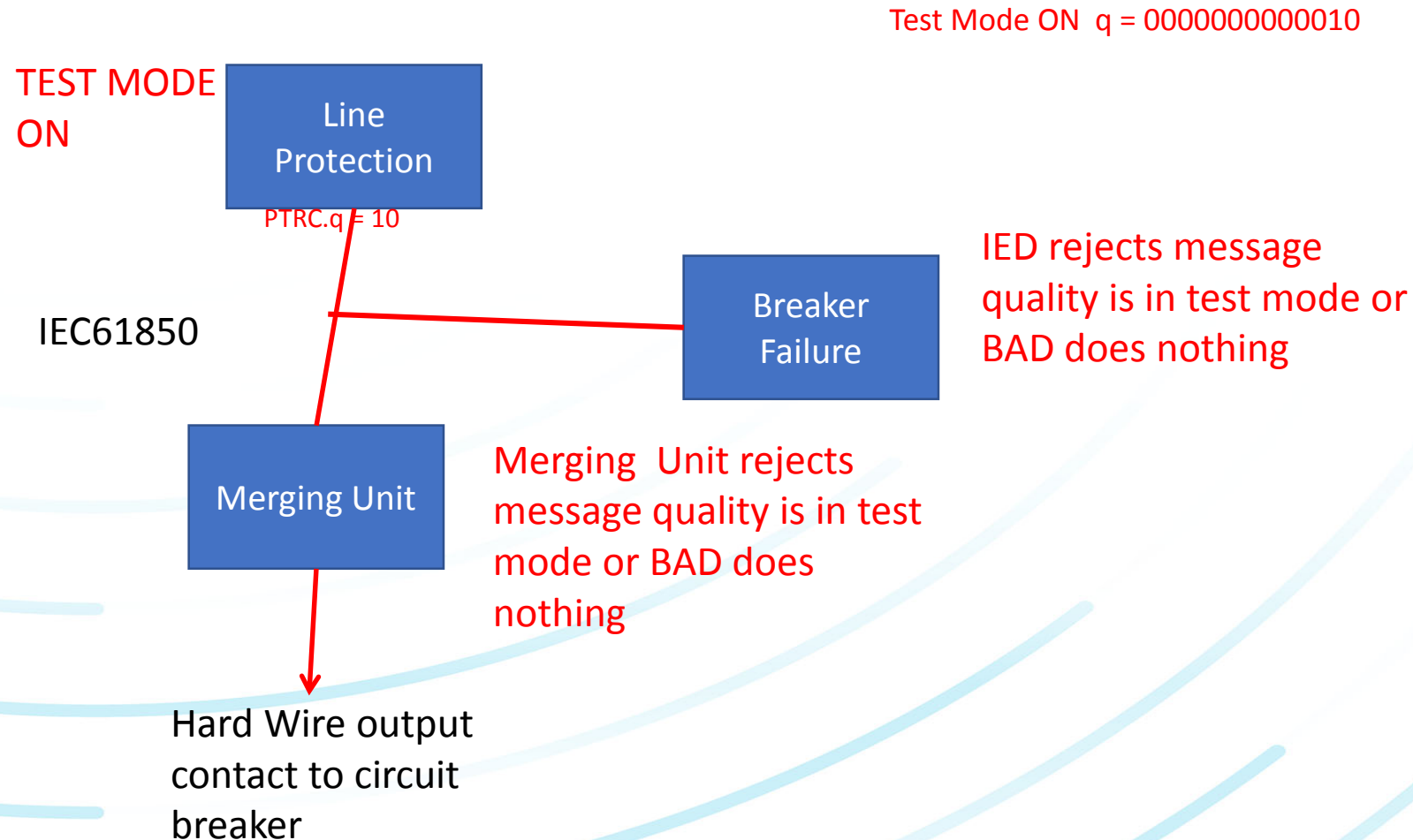
- Simulation mode can be enabled by using Logical Node LPHD and Data Object SIM. LPHD.SIM.stVal=TRUE
- To allow the IED to process the simulated message instead of actual message
- Not only applies to GOOSE, but Sampled Values as well



IEC 61850-7-1

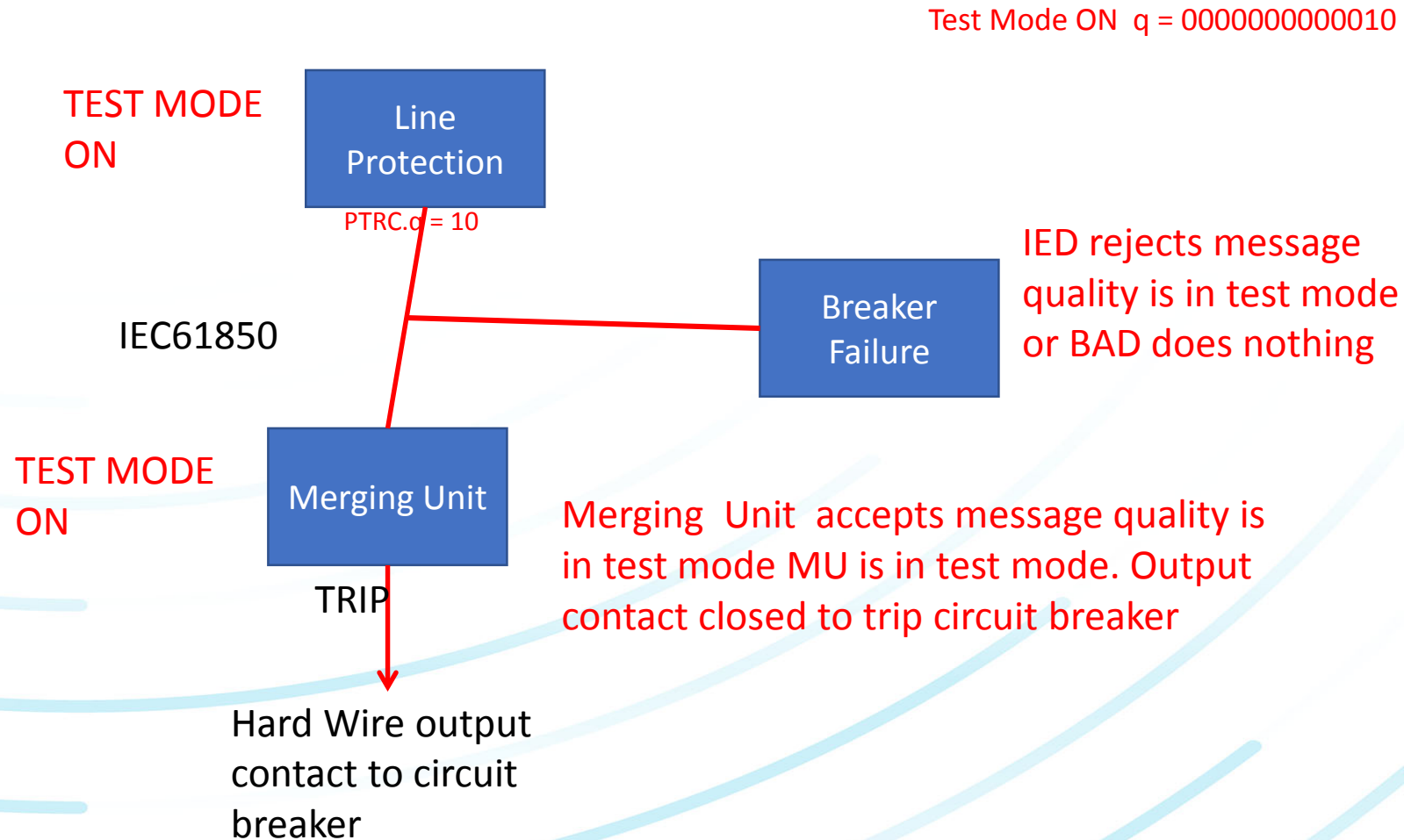
IEC 61850 Testing Functionality Example 1

Example 1: Test Mode in Single Device



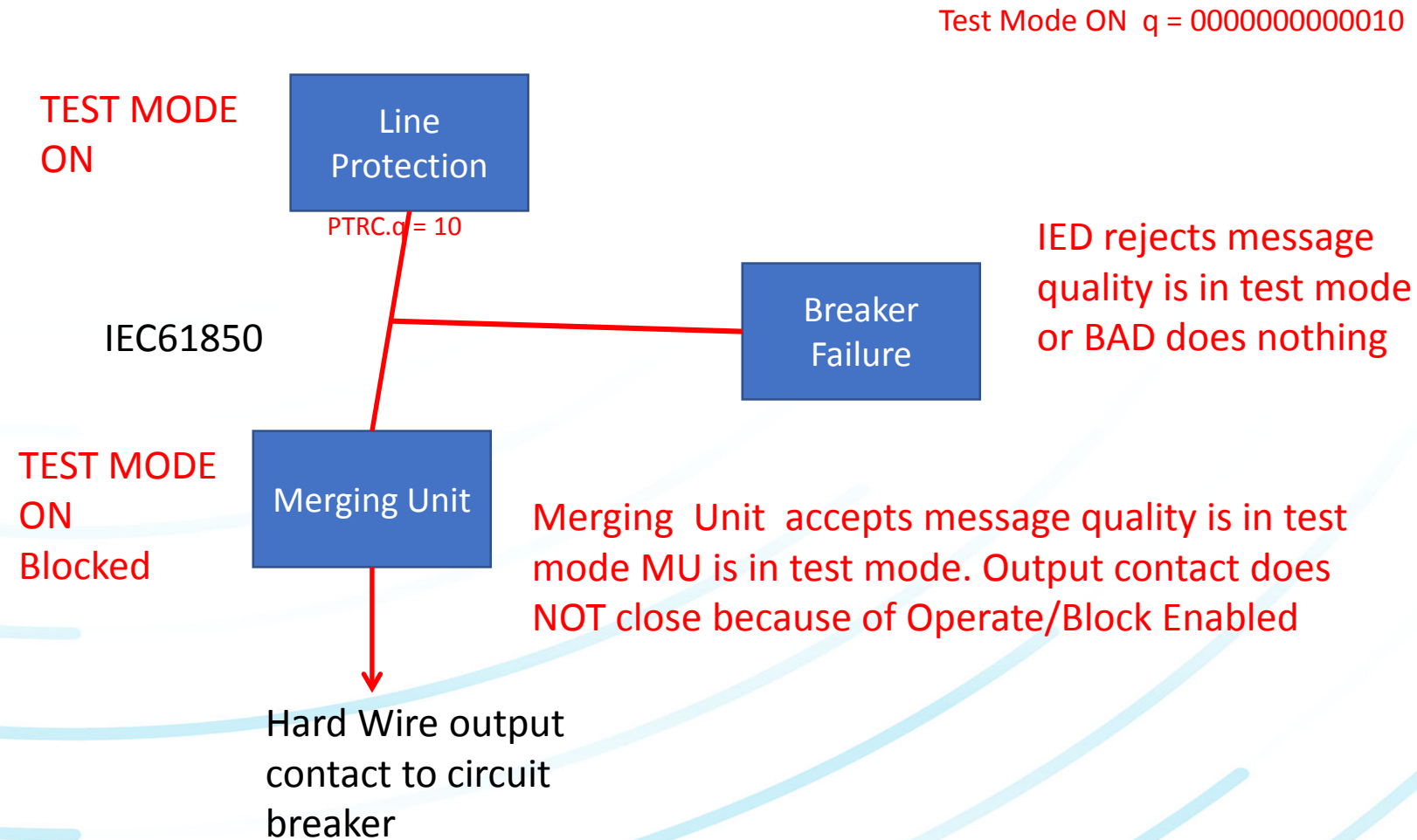
IEC 61850 Testing Functionality Example 2

Example 2: Test Mode in Two Devices



IEC 61850 Testing Functionality Example 3

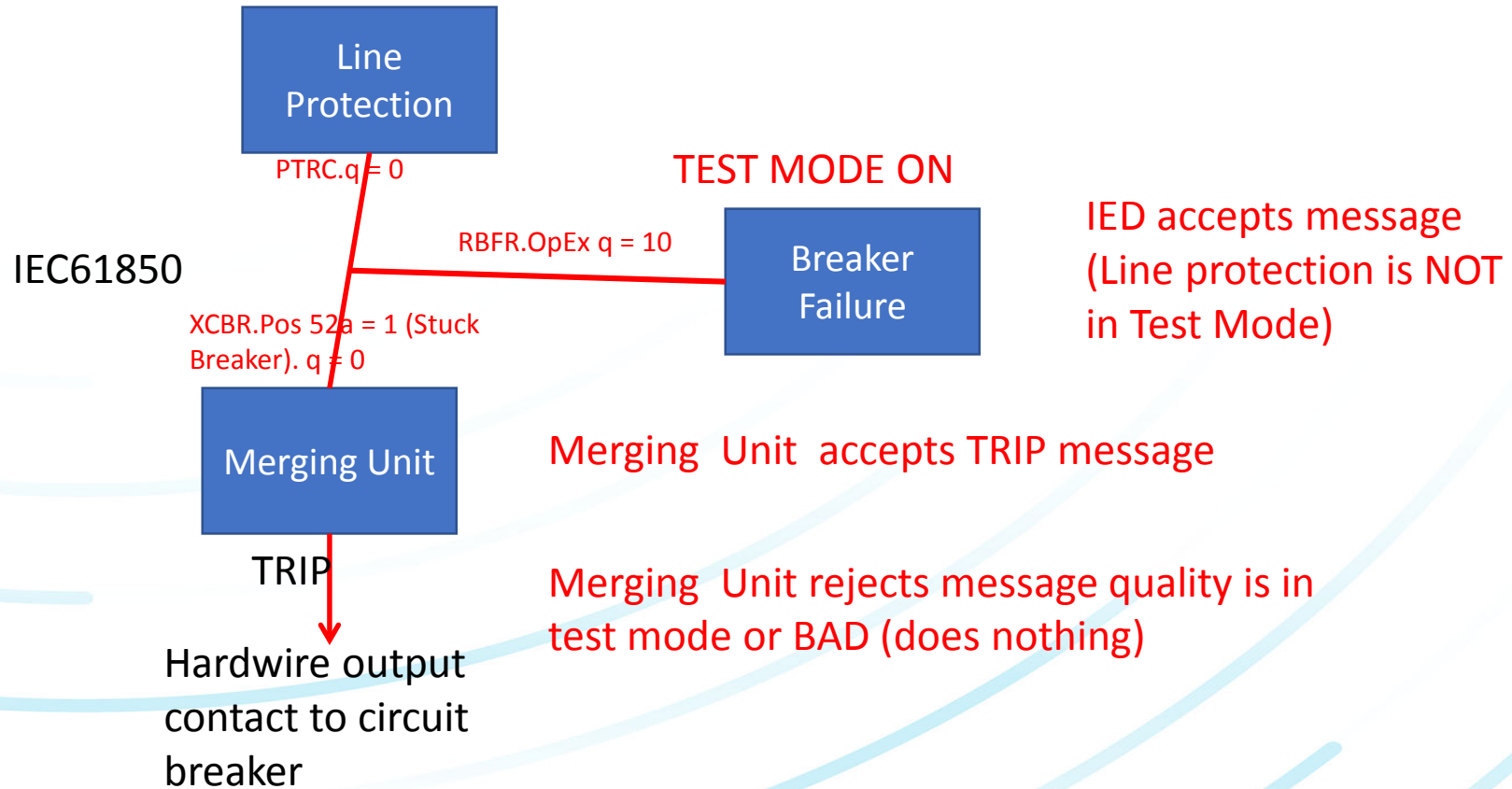
Example 3: Test Mode/Blocked



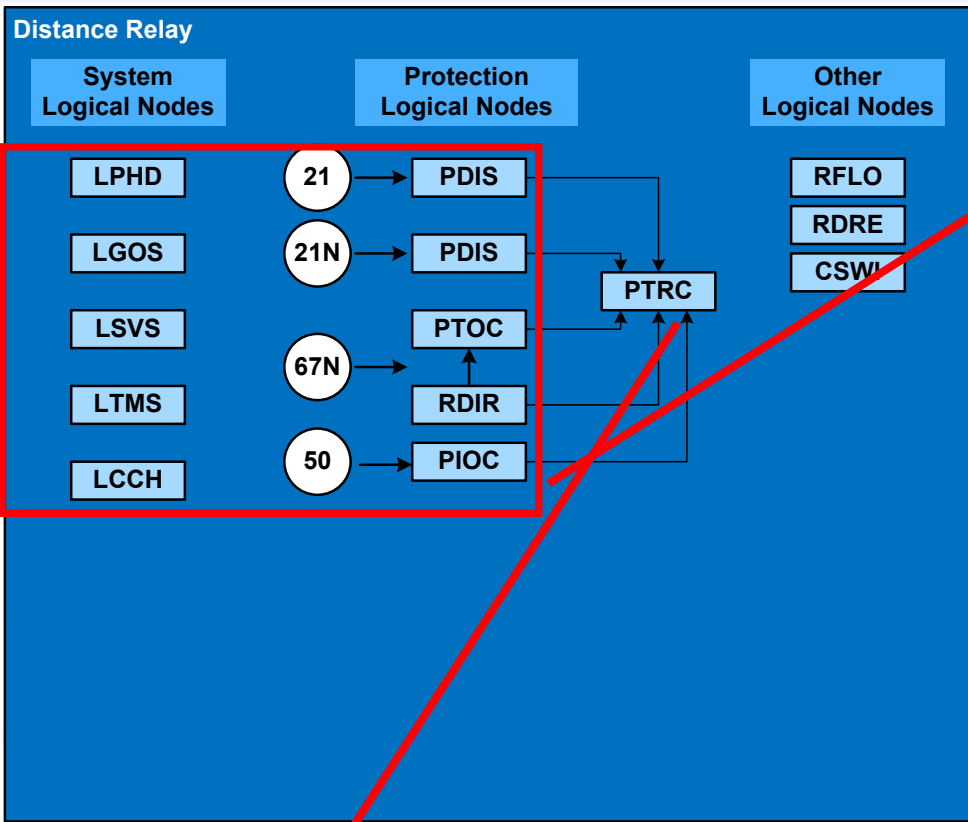
IEC 61850 Testing Functionality Example 4

Example 4: In Service Test Mode with Stuck Circuit Breaker

Test Mode ON q = 0000000000010



IEC 61850 Data Model Approach to Testing Line



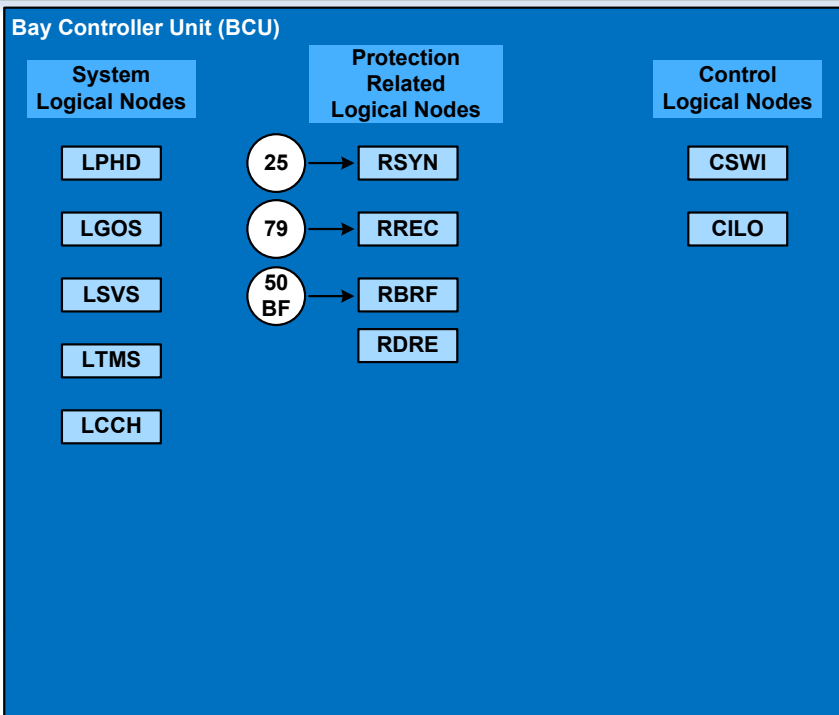
Testing GOOSE Message

IEC 61850-7-4 Logical Node/DO	IEEE C37.2	Comments
LLN0.Mod	-	Test Mode
LPHD.Sim	-	Simulation Mode
LCCH1.ChLiv	-	Channel/Port Status
EFPIOC1.Op	50	Directional Inst. Overcurrent
EFPTOC1.Str	67N	Directional Time Overcurrent pick up
EFPTOC1.Op	67N	Directional Time Overcurrent Trip
PHPDIS1.Op	21	Zone 1 Phase Line Imp. Distance Trip
GNDPDIS1.Op	21N	Zone 1 Ground Line Imp. Distance Trip
PHPDIS2.Op	21	Zone 2 Phase Line Imp. Distance Trip
GNDPDIS2.Str	21N	Zone 2 Ground Line Imp. Distance Pick Up
STBPTOC1.Op	51	Stub Bus Time Overcurrent Trip
STBPTOC1.Str	51	Stub Bus Time Overcurrent Pick Up

Normal Service GOOSE Message

IEC 61850-7-4 Logical Node/DO	IEEE C37.2	Comments
PTRC1.Op	94	Trip
PSCH1.Tx	85	Carrier/Pilot Scheme POTT

IEC 61850 Data Model Approach to Testing Bay Controller



Testing GOOSE Message

IEC 61850-7-4 Logical Node/DO	IEEE C37.2	Comments
LLN0.Mod	-	Test Mode
LPHD.Sim	-	Simulation Mode
LCCH1.ChLiv	-	Channel/Port Status
SYNRSYN1.REL	25	Synch Check
SYNRSYN1.FailSynch	25	Synch Check fail
SYNRSYN1.SynPrg	25	Synch Check in Progress
SYNRSYN1.VInd	25	Synch Check Voltage indication
RREC1.AutoRecSt	79	Auto Reclose Status
RREC1.PrgRec	79	Auto Reclose in Progress

Normal Service GOOSE Message

IEC 61850-7-4 Logical Node/DO	IEEE C37.2	Comments
RBRF1.OpEx	50BF	Breaker Failure External Trip
RBRF1.OpIn	50BF	Breaker failure Re-Trip
RREC1.OpCls	79	AutoReclose Close Command
CSWI.OpOpn	-	Control Open command
CSWI.OpCls	-	Control Close command

IEC 61850 Test Plan Example

File Home Insert Text View

Cut Copy Paste
 Start/Continue All Clear All Stop Pause Start/Continue Clear
 Test Execution

Set All Reports
 Report Settings Manual Assessment Comment
 Test Documentation

Open Test Options Verify
 Extras

PR1-LN1 TEST PLAN: Report V... x

- RED670
 - Hardware Configuration
 - Connection Diagram
 - GOOSE Configuration
 - Sampled Values Configuration
 - IEC 61850 Client/Server
 - Instructions
 - Single relay tests
 - Distance
 - Distance Characteristic
 - Distance direction test information
 - Z1 PU A-B
 - Z1 PU B-C
 - Z1 PU C-A
 - Z1 PU A-B-C
 - ZMF(C)PDIS Reach/Plot A-N
 - ZMF(C)PDIS Reach/Plot B-N
 - ZMF(C)PDIS Reach/Plot C-N
 - ZMF(C)PDIS Reach/Plot A-B
 - ZMF(C)PDIS Reach/Plot B-C
 - ZMF(C)PDIS Reach/Plot C-A
 - ZMF(C)PDIS Reach/Plot A-B-C
 - Z1 TIME -na
 - Z2 TIME -na
 - ZMF(C)PDIS Trip Times Z1 and Z2 @MTA all PH
 - ZMF(C)PDIS Directional (search)
 - ZMF(C)PDIS Blinder test (search)
 - Backup Overcurrent
 - EF4PTOCx and EFPIOC Pick-up
 - EF4PTOCx and EFPIOC Trip Times
 - Pulse Ramping
 - OC4PTOCx and PHPIOC Pick-up

GOOSE Configuration:

Test Module

Name: OMICRON GOOSE Configuration Version: 4.00
 Test Start: 12-Feb-2019 08:47:11 Test End: 12-Feb-2019 08:47:17
 User Name: Manager:
 Company:

Settings

General:

Ethernet Port: ETH1
 Simulation Flag: Inactive

GOOSE Subscriptions

Bin. Inp.	GOOSE Control Ref.	Attribute	Type	Value	Inverted
1 - Bin. In. 1	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1ZMF_1/ZMFDPIS1.Op.PR1_LN1ZMF_1/ZMFDPIS1.Op.general	Boolean		no
2 - Bin. In. 2	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1ZMF_1/ZMFDPIS2.Str.PR1_LN1ZMF_1/ZMFDPIS2.Str.general	Boolean		no
3 - Bin. In. 3	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1ZMF_1/ZMFDPIS2.Op.PR1_LN1ZMF_1/ZMFDPIS2.Op.general	Boolean		no
4 - Bin. In. 4	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1EF4_1/EF4PTRC1.Str.PR1_LN1EF4_1/EF4PTRC1.Str.general	Boolean		no
5 - Bin. In. 5	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1EF4_1/EF4PTRC1.Op.PR1_LN1EF4_1/EF4PTRC1.Op.general	Boolean		no
6 - Bin. In. 6	PR1_LN1LD0/LLN0\$GOSPR1_LN1_GCBTST1	PR1_LN1PROT/EFPIOC1.Op.PR1_LN1PROT/EFPIOC1.Op.general	Boolean		no

Test Results

IEC 61850 Test Plan Example GOOSE Configuration

Test View: GOOSE Configuration in PR1-LN1 TEST PLAN

Subscriptions Simulations

Inputs

- 1 - Bin. In. 1
Boolean - PR1_LN1ZMF_1/ZMFPDIS1.Op.general
- 2 - Bin. In. 2
Boolean - PR1_LN1ZMF_1/ZMFPDIS2.Str.general
- 3 - Bin. In. 3
Boolean - PR1_LN1ZMF_1/ZMFPDIS2.Op.general
- 4 - Bin. In. 4
Boolean - PR1_LN1EF4_1/EF4PTRC1.Str.general
- 5 - Bin. In. 5
Boolean - PR1_LN1EF4_1/EF4PTRC1.Op.general
- 6 - Bin. In. 6
Boolean - PR1_LN1PROT/EFPIOC1.Op.general
- 7 - Bin. In. 7



PR1_LN1ZMF_1/ZMFPDIS1.Op.general

Name	PR1_LN1ZMF_1/ZMFPDIS1.Op.general
Inverted	False

Name

GOOSEs

- PR1_LN1LD0/LLN0\$GO\$gcb_A
- PR1_LN1LD0/LLN0\$GO\$PR1_LN1_GCBTST1**
 - PR1_LN1LD0/LLN0\$PR_LN1GSETEST1
 - Structure - PR1_LN1PROT/EFPIOC1.Op
 - Boolean - PR1_LN1PROT/EFPIOC1.Op.general
 - BitString - PR1_LN1PROT/EFPIOC1.Op.q
 - TimeStamp - PR1_LN1PROT/EFPIOC1.Op.t
 - Structure - PR1_LN1PROT/ZCVPSOF1.Op
 - Structure - PR1_LN1L4C_1/L4CPSCH1.Op
 - Structure - PR1_LN1EF4_1/EF4PTRC1.Op
 - Structure - PR1_LN1EF4_1/EF4PTRC1.Str
 - Structure - PR1_LN1OC4_1/PH3PTOC1.Op
 - Structure - PR1_LN1OC4_1/PH3PTOC1.Str



PR1_LN1LD0/LLN0\$GO\$PR1_LN1_GCBTST1

GOOSE control reference	PR1_LN1LD0/LLN0\$GO\$PR1_LN1_GCBTST1
GOOSE ID	PR1_LN1LD0/LLN0.PR1_LN1_GCBTST1
Application ID	1 (0x0001)
MAC Address	01-0C-CD-01-00-00
Simulation Flag	Don't care
Enabled	True

GOOSE control reference

GOOSE control reference (GoCBRef, Object Reference)

IEC 61850 Test Plan Example Test Mode

Test Object Hardware Configuration Protocol Configuration
Start/Continue Stop Clear
Read Values Report Settings Manual Assessment
Comment Exit & Return to PR1-LN1 TEST PLAN

Test View: IEC 61850 Client/Server in PR1-...

Name
1 Set IED
2 Meter Check
3 Reset IED

Detail View: Set IED

Settings

Set Modes and Simulation Flag

Name	Set to
1 LD0.LLN0.Mod	4 [test/blocked]
2 LD0.LPHD1.Sim	True

Verify 'Beh'

Enable Reports

Report

Time Signal View: IEC 61850 Client/Server in PR1-LN1 TEST PLAN

	Time	Signal	Value
Cursor 1	0.000 s	<none>	n/a
Cursor 2	10.86 s	<none>	n/a
C2 - C1	10.86 s		n/a

Time Signal View | Phasor View | Report View

Assessment View: IEC 61850 Client/Server in PR1-LN1 TEST PLAN

Name	State	Parameter	Expected	Dev-	Dev+	Actual	Dev.	Timestamp	Assessment
1 AB Voltage	Meter Check	MON.VMMXU1.PPV.phsA...	230.0 kV	100.0 V	100.0 V	230.0 kV	16.61 V	2/12/2019 08:...	✓
2 BC Voltage	Meter Check	MON.VMMXU1.PPV.phsB...	230.0 kV	100.0 V	100.0 V	230.0 kV	16.81 V	2/12/2019 08:...	✓
3 CA Voltage	Meter Check	MON.VMMXU1.PPV.phsC...	230.0 kV	100.0 V	100.0 V	230.0 kV	16.58 V	2/12/2019 08:...	✓
4 A Ph Amps	Meter Check	MON.CMMXU1.A.phsA.cV...	2.000 kA	10.00 A	10.00 A	2.000 kA	-1.465 mA	2/12/2019 08:...	✓
5 B Ph Amps	Meter Check	MON.CMMXU1.A.phsB.cV...	2.000 kA	10.00 A	10.00 A	2.000 kA	-366.2 μA	2/12/2019 08:...	✓
6 C Ph Amps	Meter Check	MON.CMMXU1.A.phsC.cV...	2.000 kA	10.00 A	10.00 A	2.000 kA	4.028 mA	2/12/2019 08:...	✓

Status History

● Overload Monitor
✖ C/S Monitor

IEC 61850 Test Plan Example Zone 2 Operate

Table View: Z2 TIME -na in PR1-LN1 TEST PLAN

	1			2			3		
Name	PREFault			Z2 FAULT			POST FAULT		
V A-N	132.8 kV	0.00 °	60.000 Hz	160.9 kV	-15.87 °	60.000 Hz	0.000 V	0.00 °	60.000 Hz
V B-N	132.8 kV	-120.00 °	60.000 Hz	160.9 kV	-104.13 °	60.000 Hz	0.000 V	-120.00 °	60.000 Hz
V C-N	132.8 kV	120.00 °	60.000 Hz	230.9 kV	120.00 °	60.000 Hz	0.000 V	120.00 °	60.000 Hz
I A	0.000 A	0.00 °	60.000 Hz	2.000 kA	-52.20 °	60.000 Hz	0.000 A	0.00 °	60.000 Hz
I B	0.000 A	-120.00 °	60.000 Hz	2.000 kA	-232.20 °	60.000 Hz	0.000 A	-120.00 °	60.000 Hz
I C	0.000 A	120.00 °	60.000 Hz	0.000 A	0.00 °	60.000 Hz	0.000 A	120.00 °	60.000 Hz
CMC Rel	0 output(s) active			0 output(s) active			0 output(s) active		
Trigger		60.00 cy			60.00 cy			60.00 cy	

Detail View: Z2 TIME -na in PR1-LN1 TEST PLAN

Analog Out Binary Out Trigger General

PREFault			
Set Mode	Direct		
V A-N	132.8 kV	0.00 °	60.000 Hz
V B-N	132.8 kV	-120.00 °	60.000 Hz
V C-N	132.8 kV	120.00 °	60.000 Hz
I A	0.000 A	0.00 °	60.000 Hz
I B	0.000 A	-120.00 °	60.000 Hz
I C	0.000 A	120.00 °	60.000 Hz

Force absolute phases

Time Signal View: Z2 TIME -na in PR1-LN1 TEST PLAN

	Time	Signal	Value
Cursor 1	0.0000 cy	<none>	n/a
Cursor 2	145.4940 cy	<none>	n/a
C2 - C1	145.4940 cy		n/a

Export COMTRADE ...

Time Signal View Phasor View Impedance View Report View

Time Assessments: Z2 TIME -na in PR1-LN1 TEST PLAN

	Name	Ignore before	Start	Stop	Time Assessment					Assessment
					Tnom	Tdev-	Tdev+	Tact	Tdev	
1	Z2 TIME TEST	Z2 FAULT	Z2 FAULT	Z2 OP 0>1	24.00 cy	1.500 cy	1.500 cy	25.49 cy	1.494 cy	

Time Assessments State Assessments

Thank You

Questions?

