

If You Cannot Test It, You Cannot Use It – IEC 61850 GOOSE System Designed With Testing in Mind

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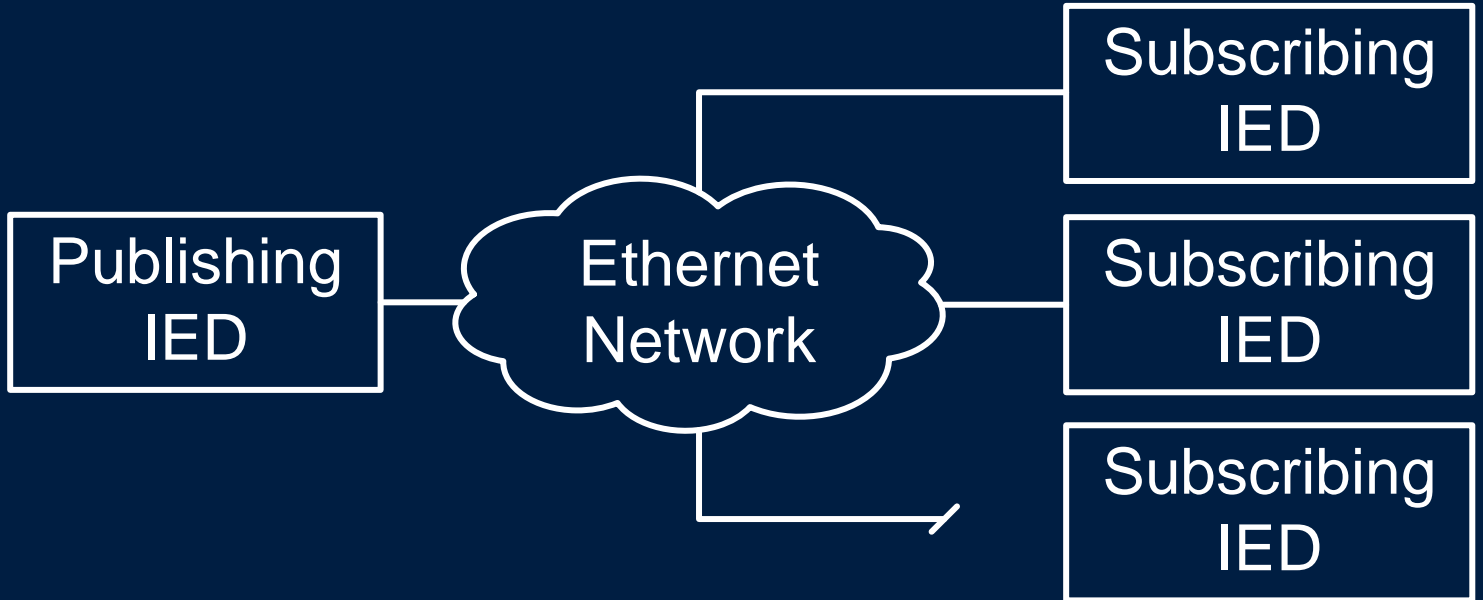
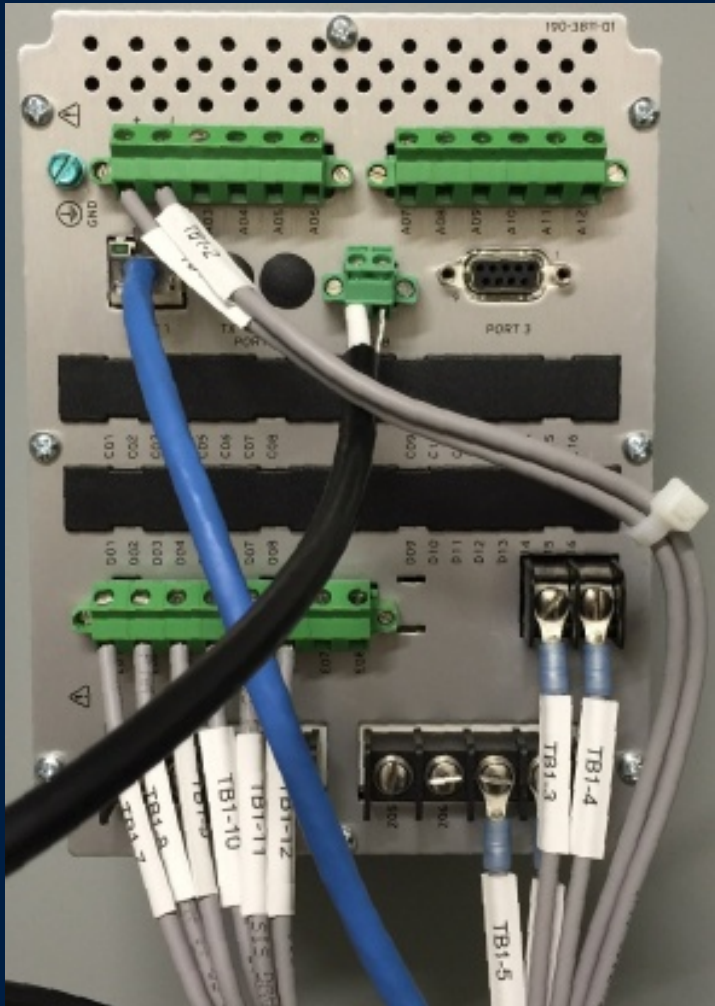
Keys to a Successful GOOSE System

Where to Plan?

- Testing
- Test plans / sets
- Drawings
- System expansion
- System updates

Hardwired vs. Ethernet

How Is Virtual Wiring Different?

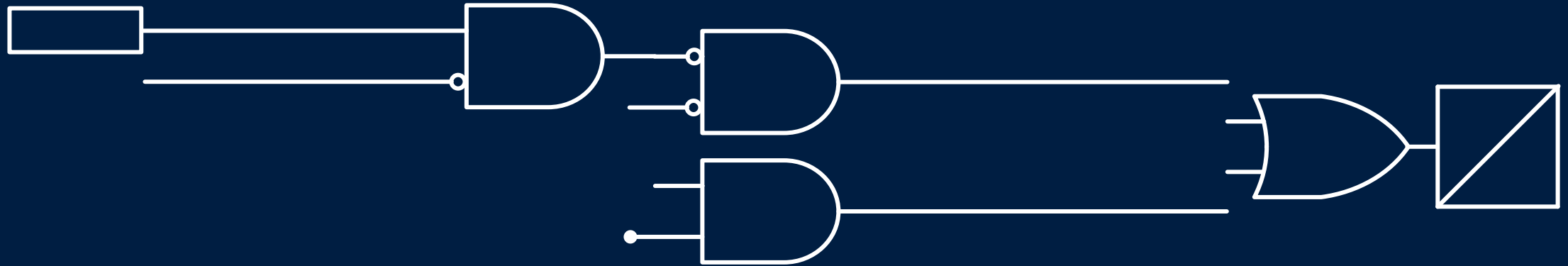


GOOSE Word Bit	From Device	IED Word Bit	Description
VB001	Tie 1-2	n/a	Communications failure
VB002	Tie 1-2	LT10	Test mode enabled
VB003	Tie 1-2	SV02T	AF pickup
VB004	Tie 1-2	SV11T	FB block
VB005	Tie 1-2	LT18	AF lockout trip
VB006	Tie 1-2	LT20	FB lockout trip
VB007	Tie 1-2	(unused)	Breaker closed
VB008		Spare	
VB009		Spare	
VB010		Spare	
VB011	Source 2	n/a	Communications failure
VB012	Source 2	LT10	Test mode enabled
VB013	Source 2	(unused)	AF pickup
VB014	Source 2	(unused)	FB block
VB015	Source 2	LT17	AF lockout trip
VB016	Source 2	LT19	FB lockout trip
VB017	Source 2	SV28T	Breaker closed
VB018		Spare	
VB019		Spare	
VB020		Spare	
		●	
		●	
		●	
VB051	Feeder E (future)		Communications failure
VB052	Feeder E (future)		Test mode enabled
VB053	Feeder E (future)		AF pickup
VB054	Feeder E (future)		FB block
VB055	Feeder E (future)		AF lockout trip
VB056	Feeder E (future)		FB lockout trip
VB057	Feeder E (future)		Breaker closed
VB058		Spare	
VB059		Spare	
VB060		Spare	

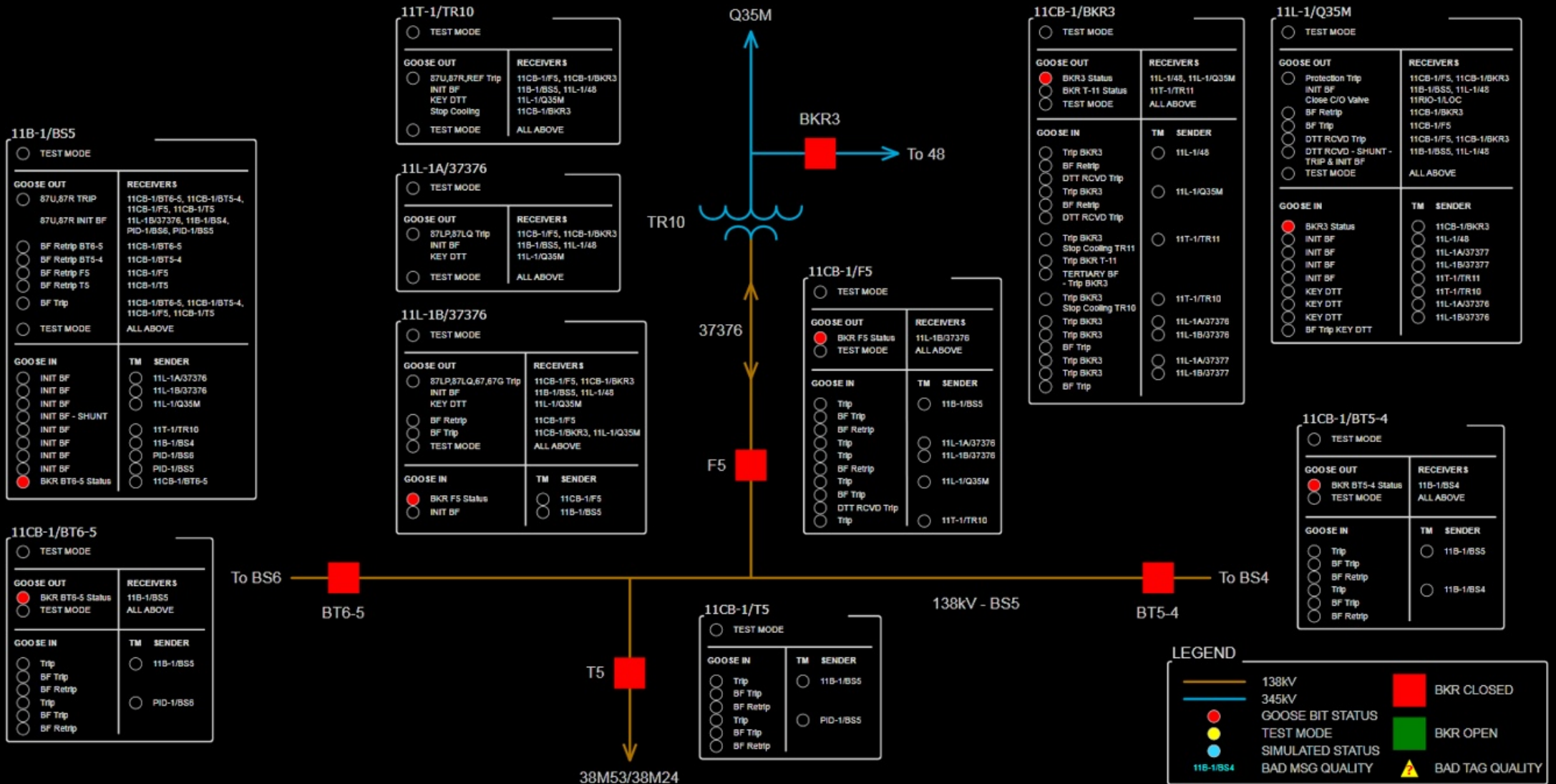
How Can GOOSE Systems Be Designed to Support Testing?

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How Can GOOSE Systems Be Designed to Support Testing?

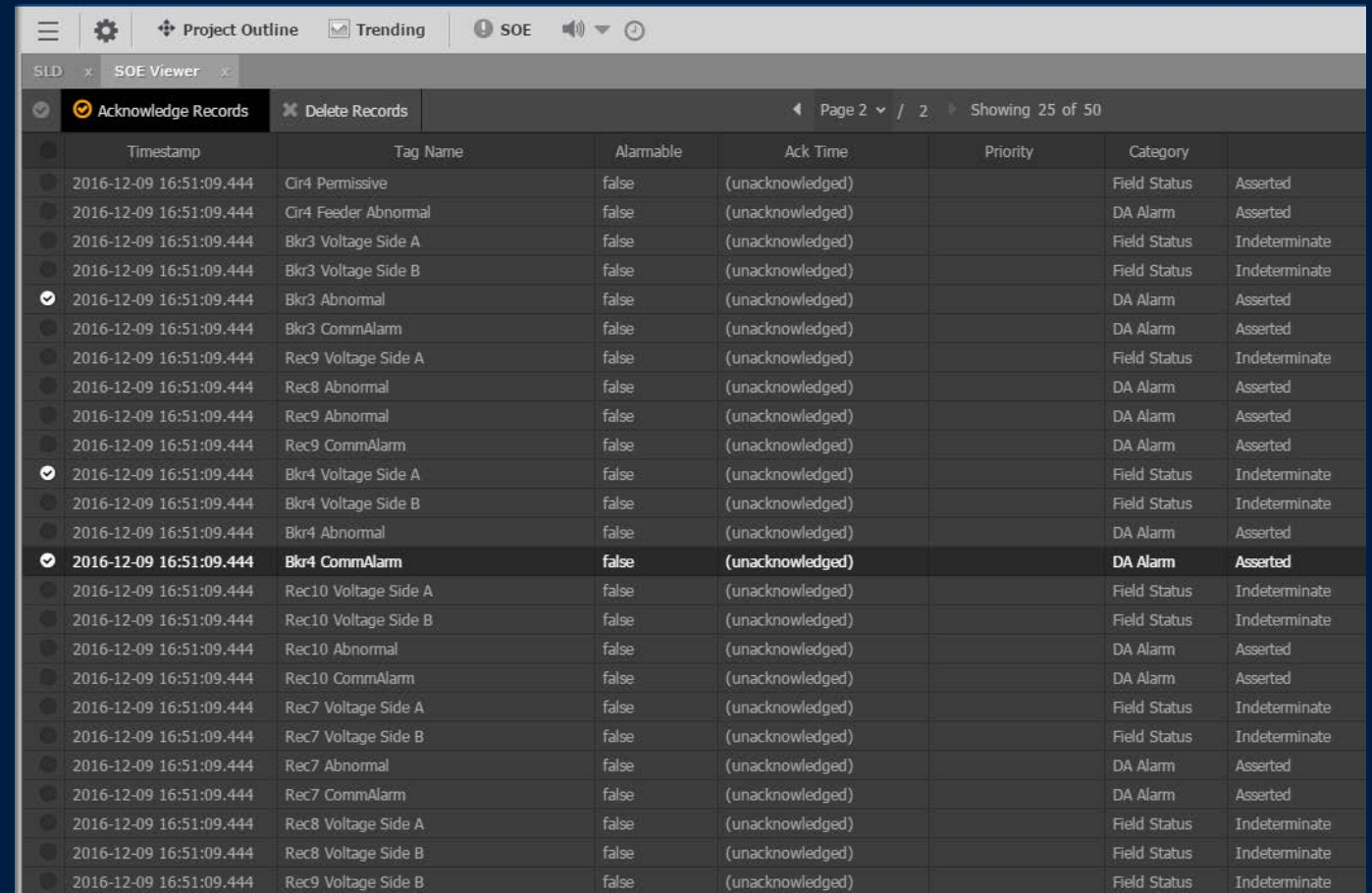


How Can GOOSE Systems Be Designed to Support Testing?



How Can GOOSE Systems Be Designed to Support Testing?

- Global SER visibility
- Consistent logging
- Positive and negative receipt verifications



The screenshot displays a software interface for monitoring SOE (Sequence of Events) records. The interface includes a navigation bar with 'Project Outline', 'Trending', and 'SOE' tabs. Below the navigation bar, there are two tabs: 'Acknowledge Records' (selected) and 'Delete Records'. The main area shows a table of records with the following columns: Timestamp, Tag Name, Alarmable, Ack Time, Priority, and Category. The table contains 25 records, with the 14th record highlighted in bold.

Timestamp	Tag Name	Alarmable	Ack Time	Priority	Category
2016-12-09 16:51:09.444	Cir4 Permissive	false	(unacknowledged)		Field Status Asserted
2016-12-09 16:51:09.444	Cir4 Feeder Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Bkr3 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Bkr3 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Bkr3 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Bkr3 CommAlarm	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec9 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec8 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec9 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec9 CommAlarm	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Bkr4 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Bkr4 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Bkr4 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Bkr4 CommAlarm	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec10 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec10 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec10 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec10 CommAlarm	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec7 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec7 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec7 Abnormal	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec7 CommAlarm	false	(unacknowledged)		DA Alarm Asserted
2016-12-09 16:51:09.444	Rec8 Voltage Side A	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec8 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate
2016-12-09 16:51:09.444	Rec9 Voltage Side B	false	(unacknowledged)		Field Status Indeterminate

How Can Relay Technicians Incorporate GOOSE System Verifications Into Relay Test Plans?

The screenshot shows a software interface for configuring a relay. On the left, there is a tree view showing the hierarchy: IEDs > IED1 > GOOSE > IED1.GCB. The main area displays the configuration for IED1.GCB, including fields for 'Enabled' (true), 'Control block reference' (350_#P227NCS/LLN0G0B6G), and 'Destination MAC address' (0200C0000000). Below this, there are several 'DM' (Data Monitor) windows showing values like 'false' and '5'. At the bottom, a table lists various data points with their descriptions and values.

Name	Description	Value
ICB1.Poc.stVal	Status value of the data	intermediate-state
ICB1.Poc.q	Quality of the attribute(s) representing the value of the d...	good
ICB2.Poc.stVal	Status value of the data	off
ICB2.Poc.q	Quality of the attribute(s) representing the value of the d...	good
ICB3.Poc.stVal	Status value of the data	on
ICB3.Poc.q	Quality of the attribute(s) representing the value of the d...	good
ICB4.Poc.stVal	Status value of the data	intermediate-state
ICB4.Poc.q	Quality of the attribute(s) representing the value of the d...	good

The screenshot shows a software interface with two main sections. The top section is 'Timers Setup', which contains a table with columns for '#', 'Label', 'Mode', 'Time', 'Tolerance', 'Type', 'Severity', 'Start State', and 'Stop Event'. The bottom section is 'Power States Summary', which includes a table with columns for 'Name', 'Label', 'Color', 'DC', 'Frequency', and three columns for 'Pre Fault', 'Fault', and 'Post Fault' states, each with 'Amplitude' and 'Phase' sub-columns.

Timers Setup Table:

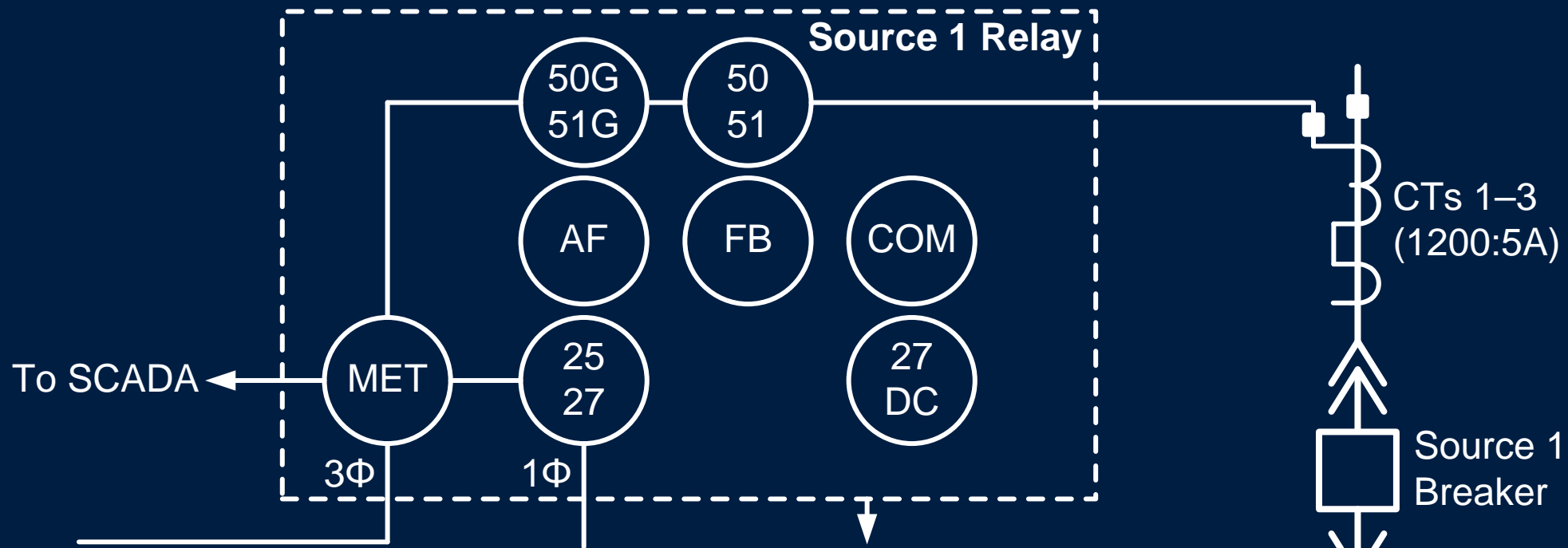
#	Label	Mode	Time	Minus	Plus	Type	Severity	Start State	Stop Event
1	Trip	Value	50.0 ms	100.00 %	0.00 %	Percent	Error	Fault	GN1

Power States Summary Table:

Name	Label	Color	DC	Frequency	Pre Fault		Fault		Post Fault	
					Amplitude	Phase	Amplitude	Phase	Amplitude	Phase
IA	IA	Green	<input type="checkbox"/>	50.000 Hz	0.660 A	0.0°	1.820 A	0.0°	0.000 A	0.0°
IB	IB	Brown	<input type="checkbox"/>	50.000 Hz	0.660 A	-120.0°	0.660 A	-120.0°	0.000 A	0.0°
IC	IC	Yellow	<input type="checkbox"/>	50.000 Hz	0.660 A	120.0°	0.660 A	120.0°	0.000 A	0.0°
I1	I1	Light Green	<input type="checkbox"/>	50.000 Hz	1.030 A	180.0°	1.820 A	0.0°	0.000 A	0.0°
I2	I2	Orange	<input type="checkbox"/>	50.000 Hz	1.030 A	60.0°	1.030 A	60.0°	0.000 A	0.0°
I3	I3	Cyan	<input type="checkbox"/>	50.000 Hz	1.030 A	-60.0°	1.030 A	-60.0°	0.000 A	0.0°

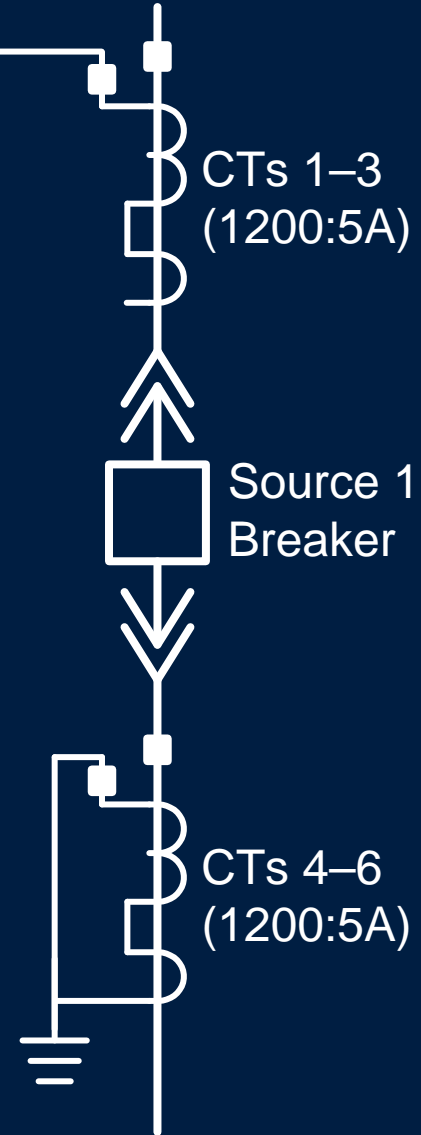
Drawings

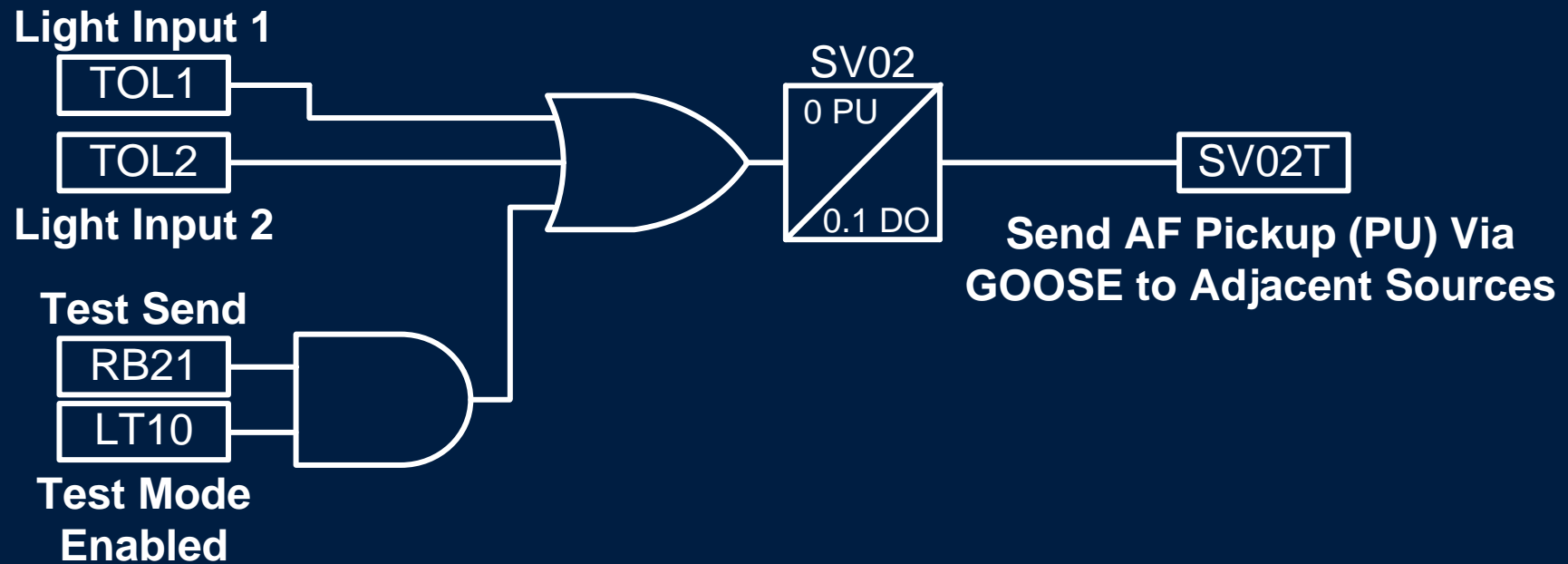
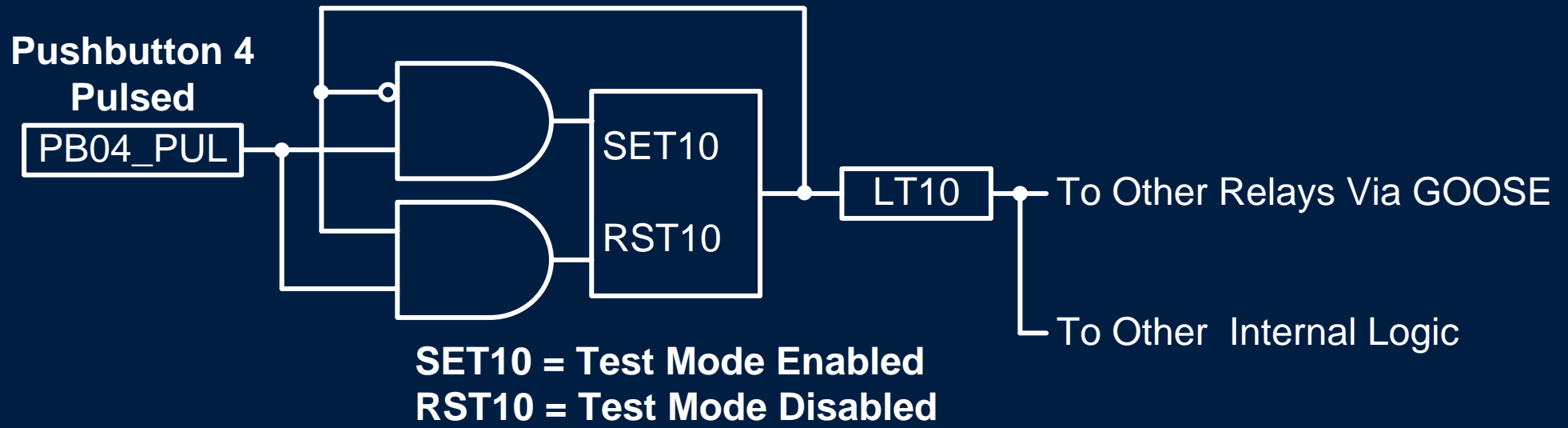
How Should GOOSE Signals Be Incorporated
Into Drawing Packages?



- | | |
|-----|--|
| 25 | Synchronism Check |
| 27 | Undervoltage |
| 50 | Instantaneous Overcurrent |
| 50G | Ground Instantaneous Overcurrent |
| 51 | Time Overcurrent |
| 51G | Ground Time Overcurrent |
| AF | Arc-Flash Tripping |
| COM | Communications-Based Tripping Scheme Enabled |
| FB | Fast-Bus Tripping |
| MET | Metering |

Trips Source 1
Breaker





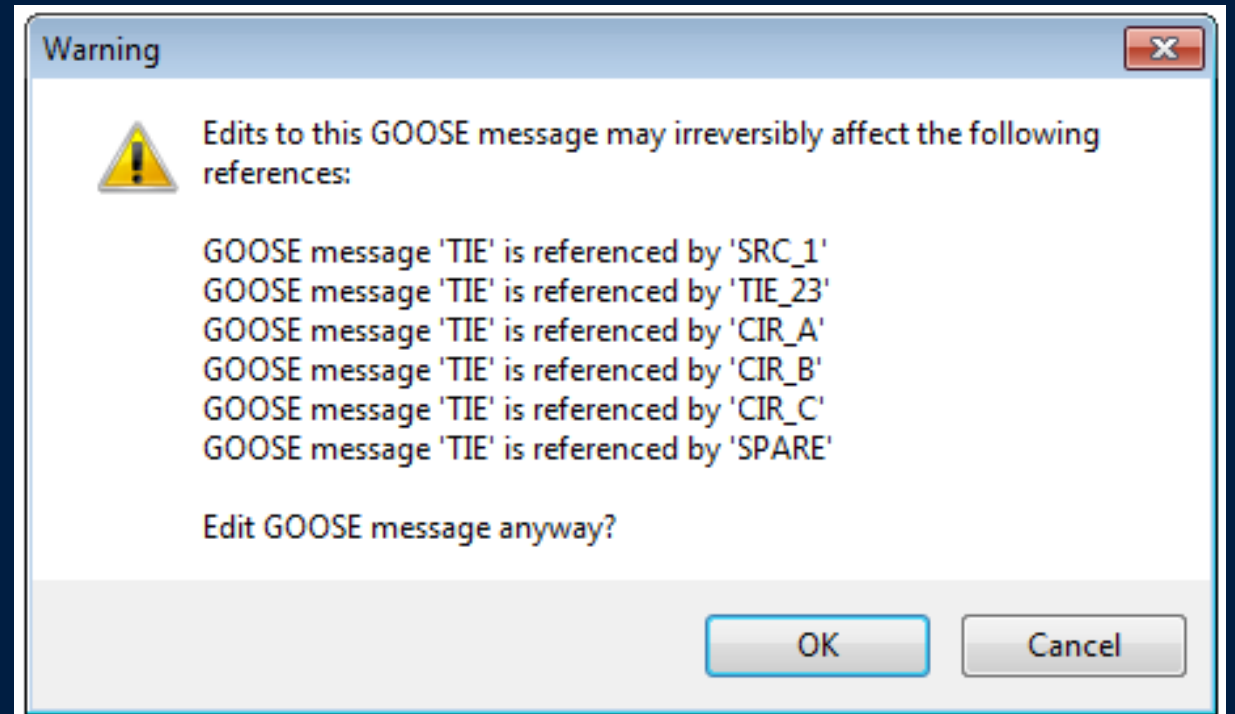
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		•	
		•	
		•	
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How Can GOOSE Systems Be Designed With Expansion in Mind?

- Subscription mapping pattern
- Reserved blocks for expansion
- Convenient logic

What Impact Do Settings Modifications Have on Test Validation?

- Transmit message modifications
- New transmit messages
- Relay logic updates



Summary

- Logical subscription mapping patterns prevent and identify virtual wiring errors
- GOOSE signal isolation is critical to in-service testing
- System visualization aids in testing

Summary

- GOOSE system verifications should be documented in test plans
- GOOSE signals should be documented in drawing packages
- Design should allow expansion and minimize retesting

Questions?

