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

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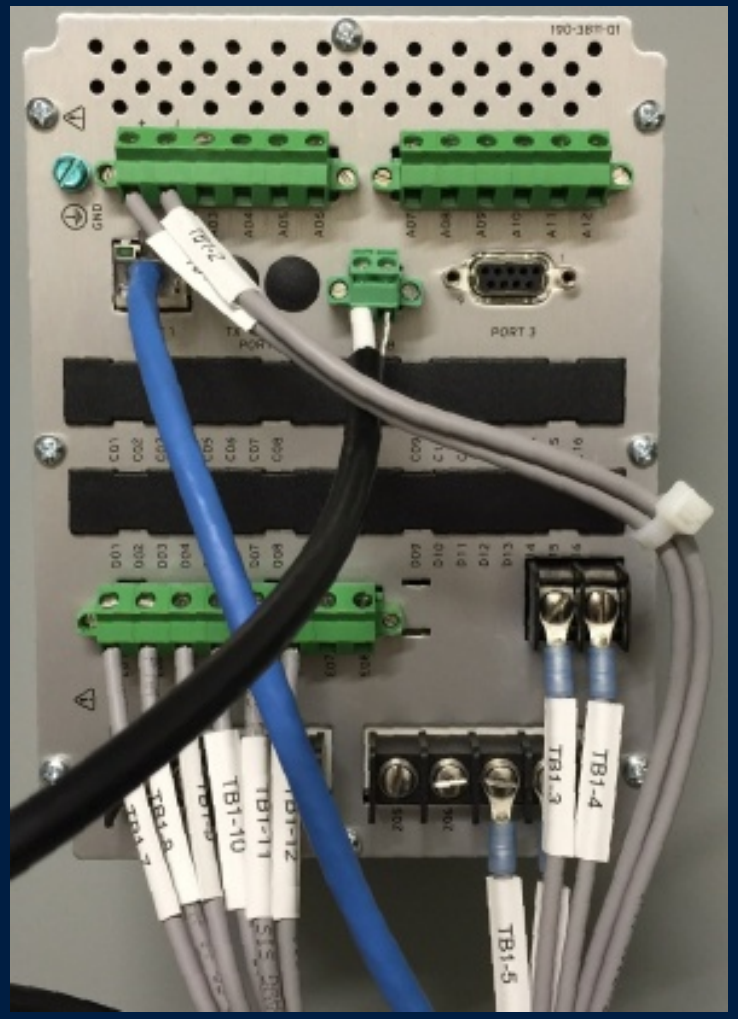
Keys to a Successful GOOSE System

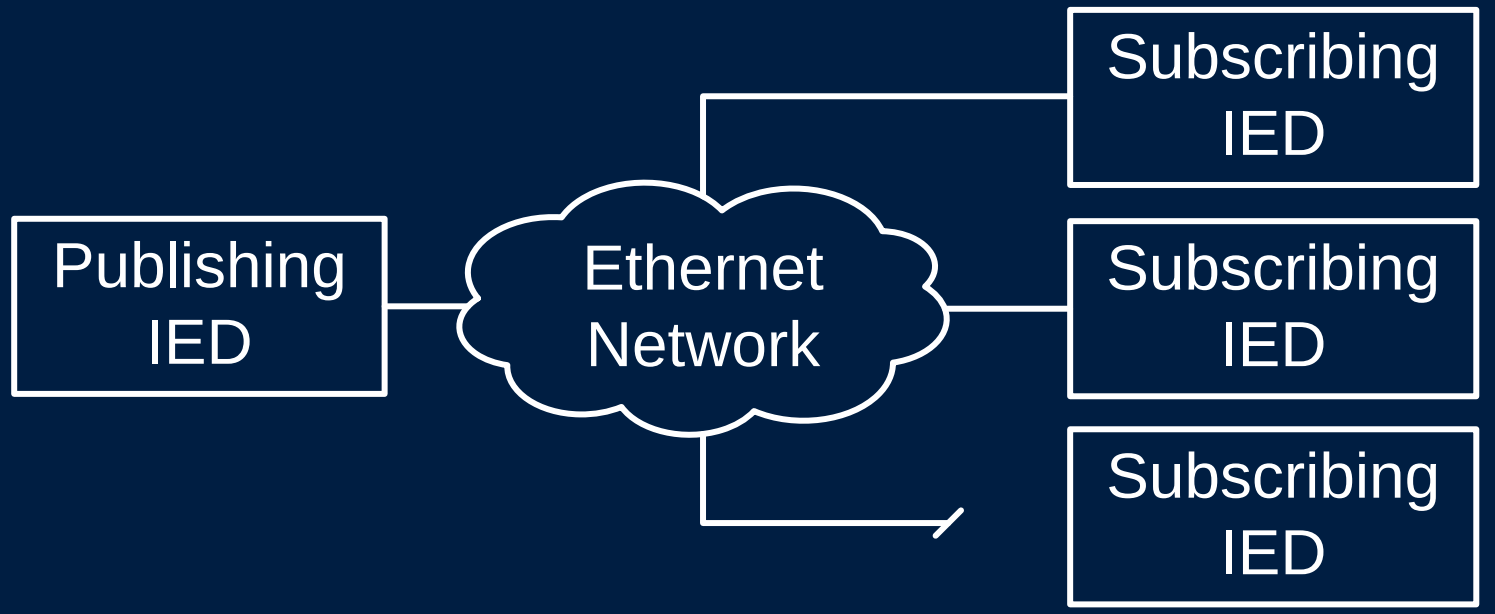
Where to Plan?

- 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?

GOOSE Word Bit	From Device	IED Word Bit	Description
VB001	Tie 1-2	n/a	Communications failure
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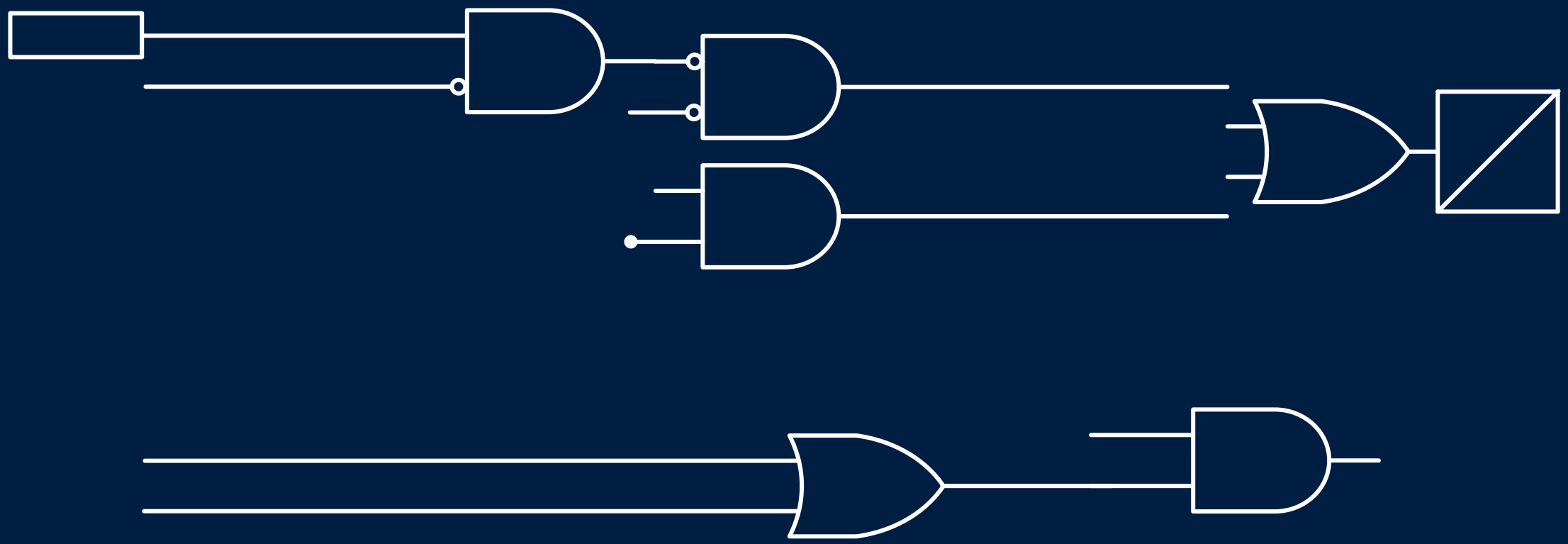

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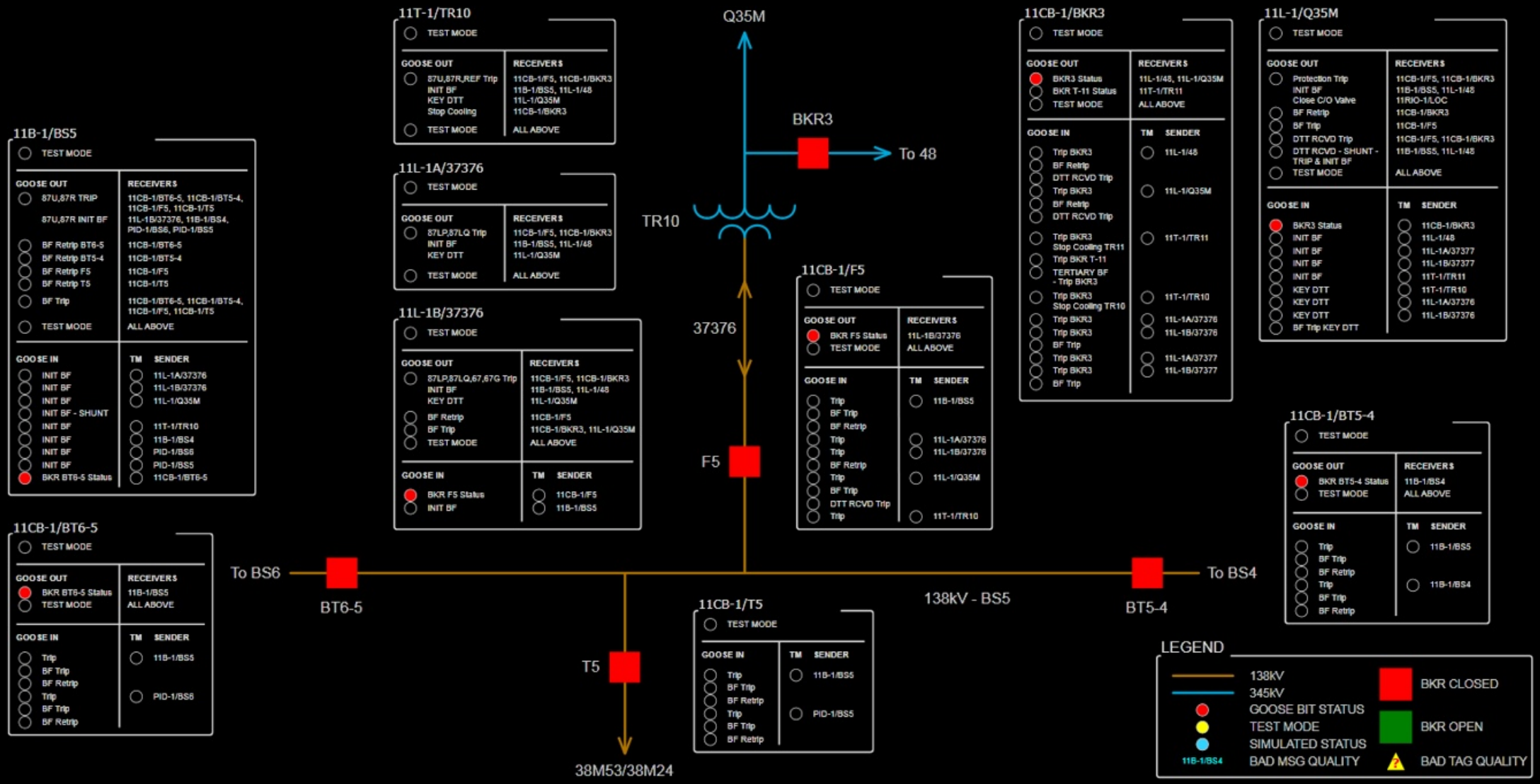
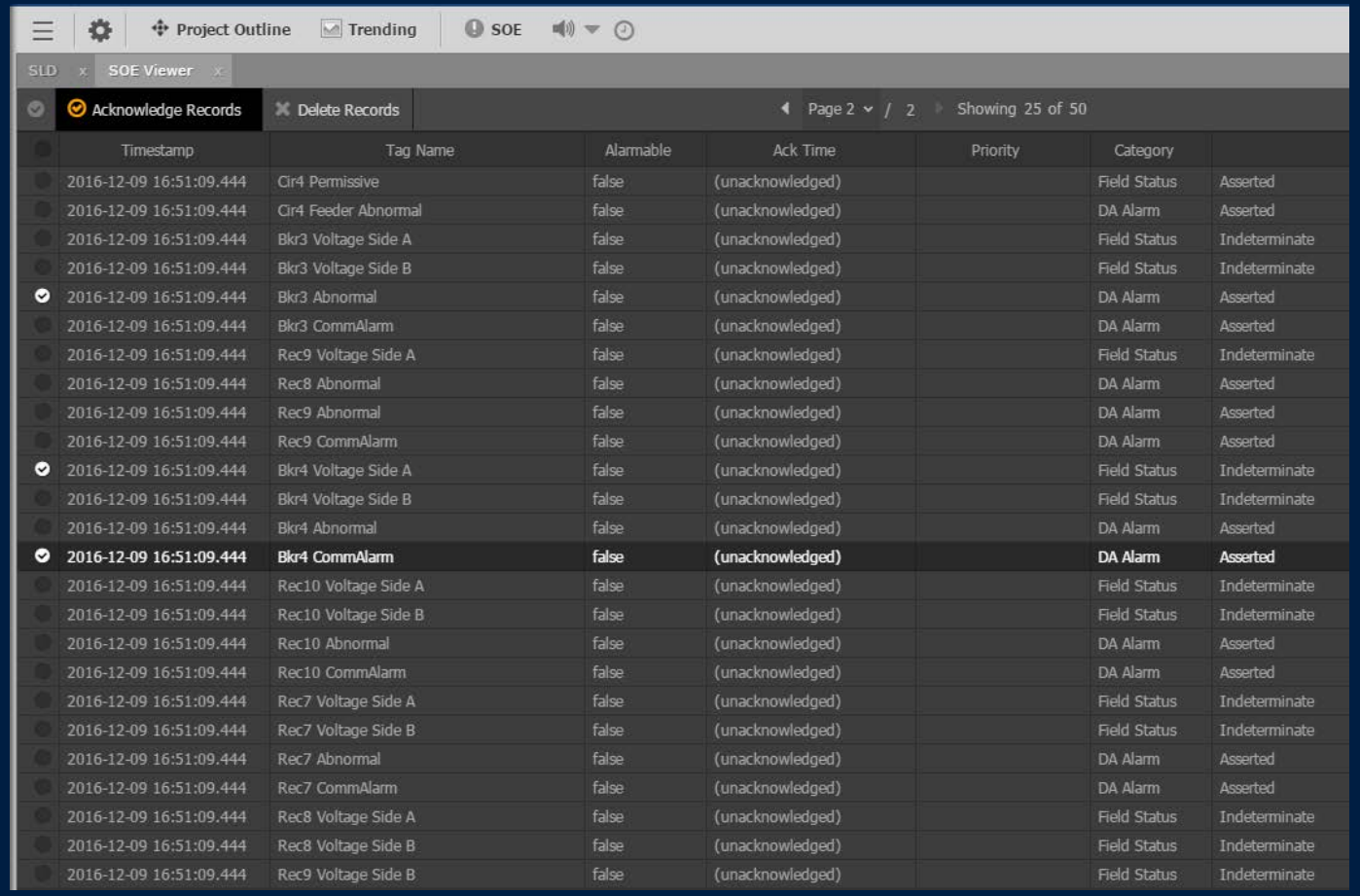


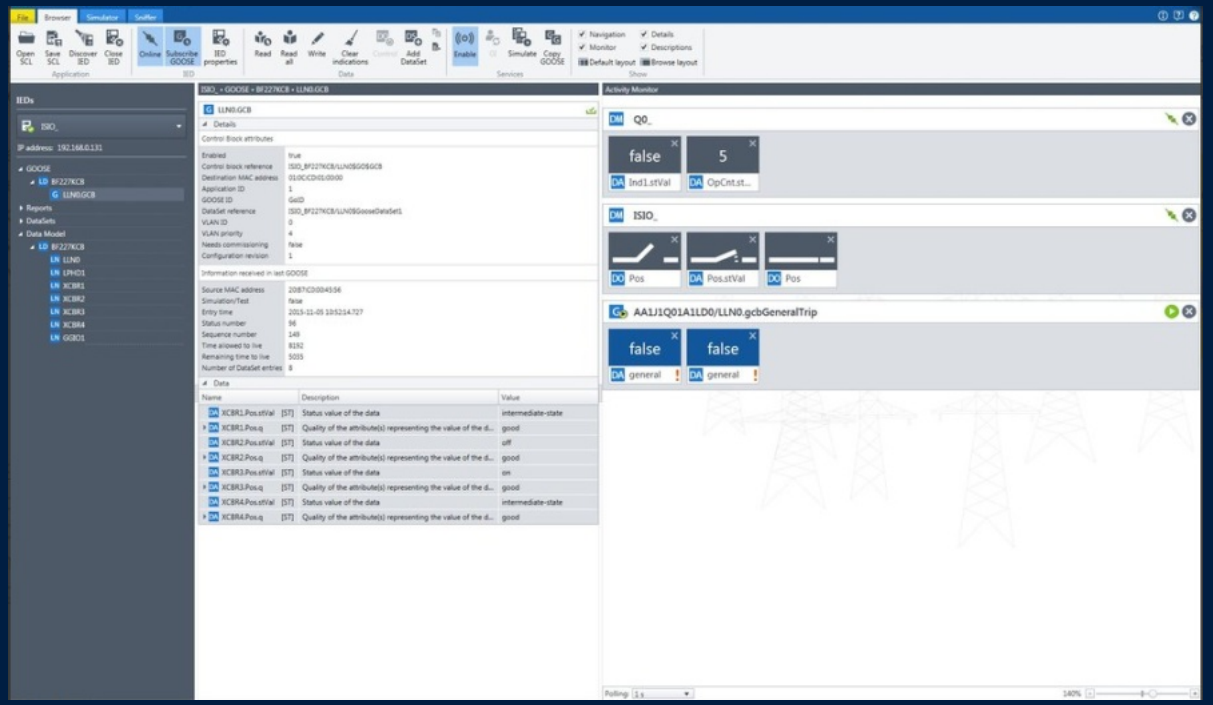
How Can GOOSE Systems Be Designed to Support Testing?

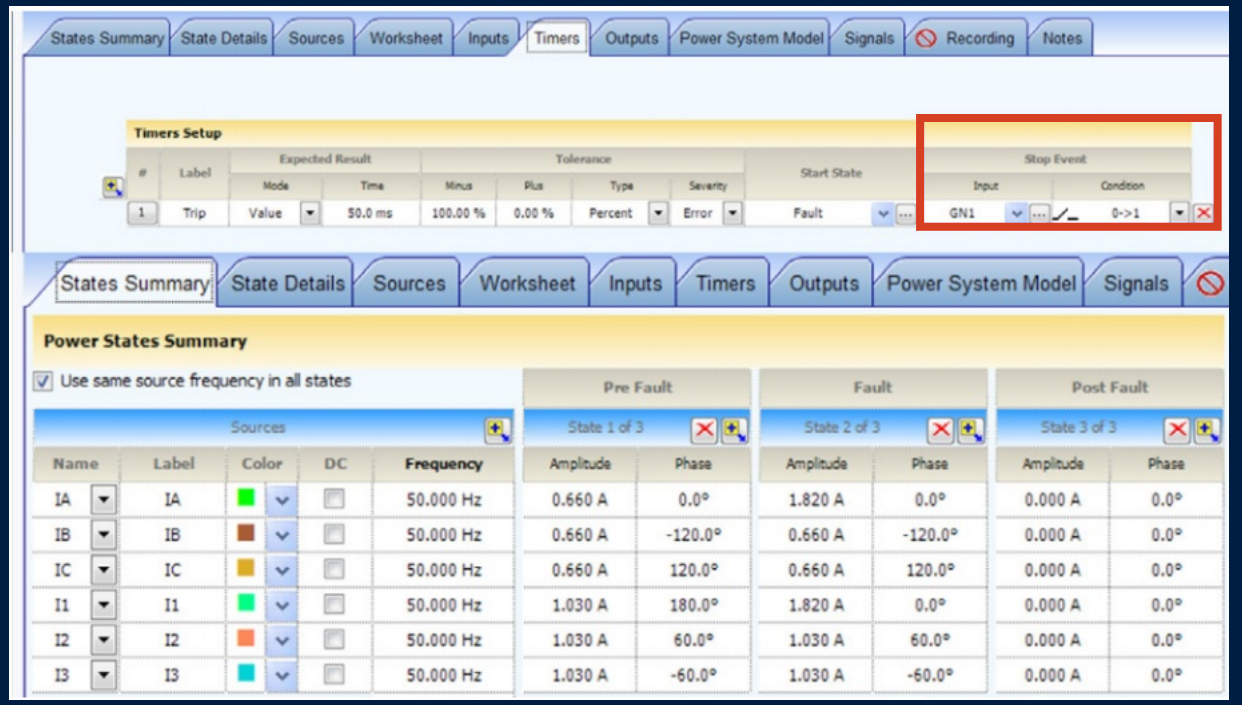
- Global SER visibility
- Consistent logging
- Positive and negative receipt verifications



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

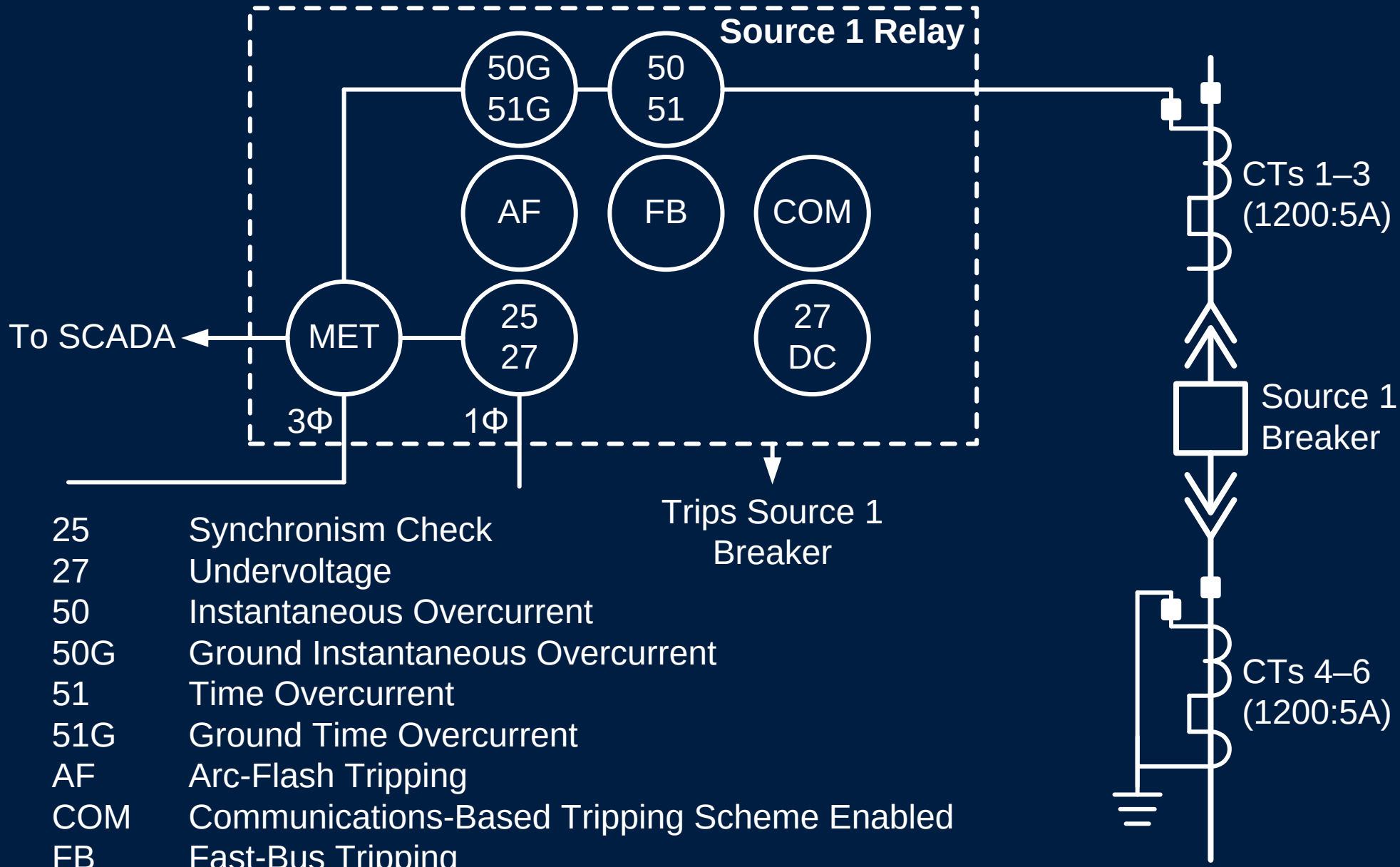
How Can Relay Technicians Incorporate GOOSE System Verifications Into Relay Test Plans?



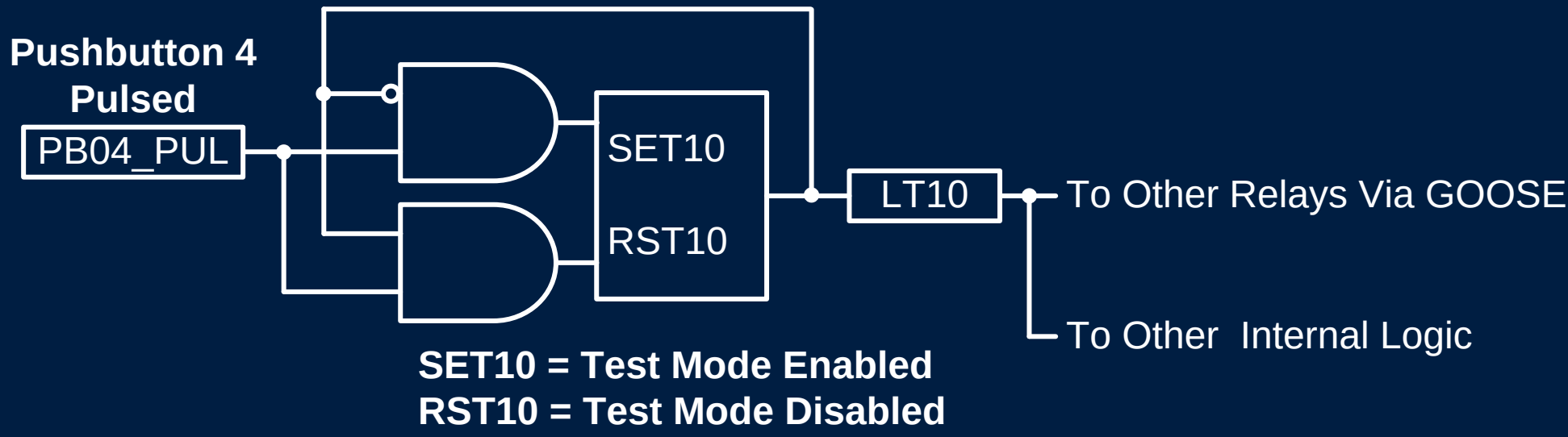


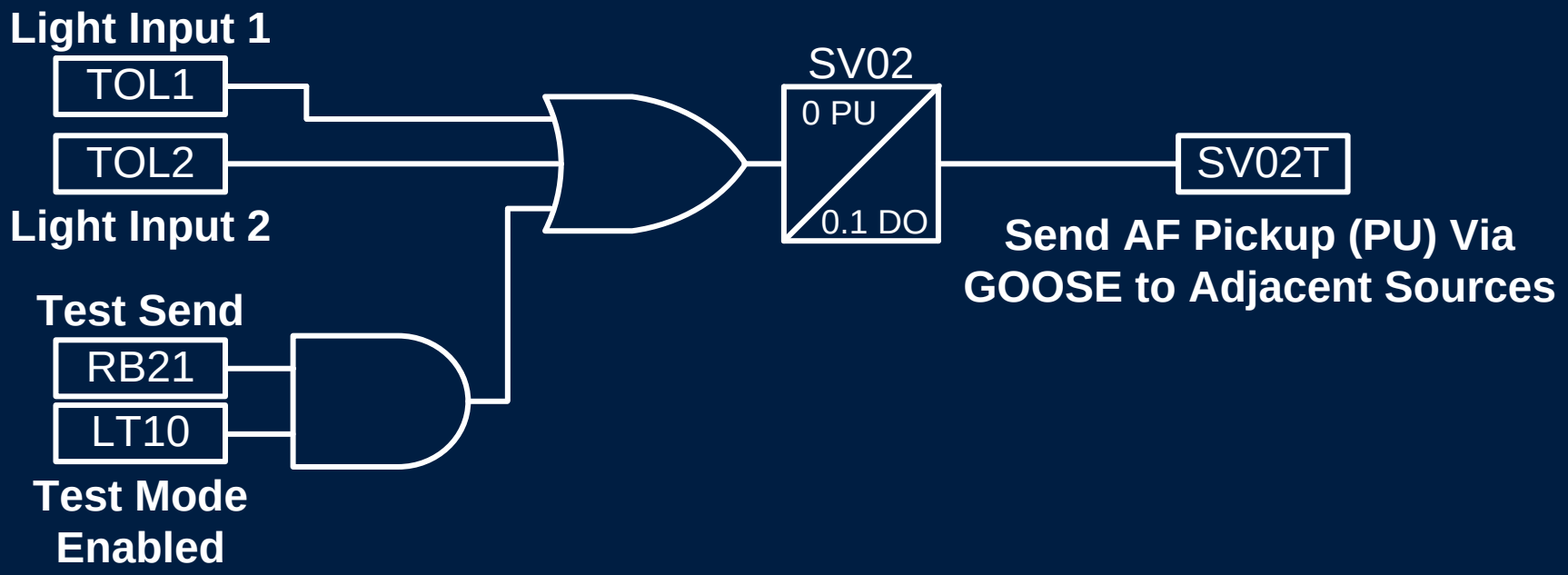
Drawings

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


Pushbutton 4
Pulsed
PB04_PUL
SET10
RST10
LT10
To Other Relays Via GOOSE
To Other Internal Logic
SET10 = Test Mode Enabled
RST10 = Test Mode Disabled


Light Input 1
TOL1
TOL2
Light Input 2
SV02
0 PU
0.1 DO
SV02T
Send AF Pickup (PU) Via
GOOSE to Adjacent Sources
Test Send
RB21
LT10
Test Mode
Enabled

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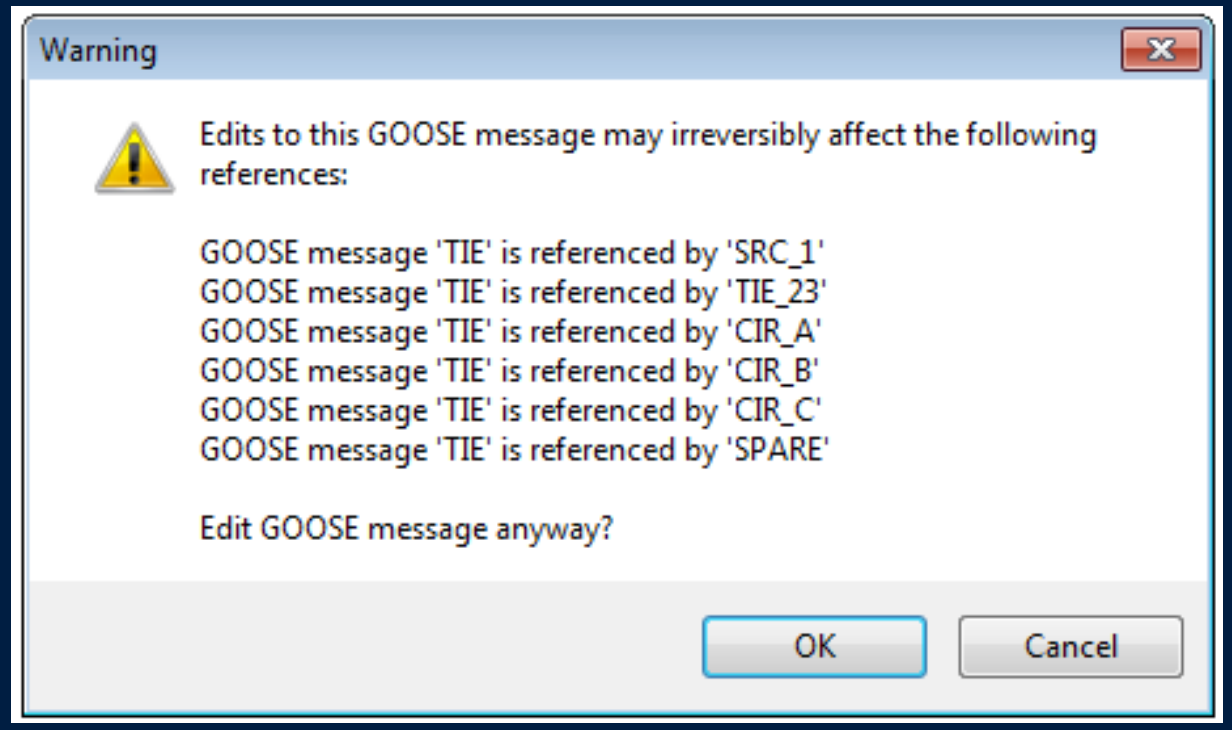
How Can GOOSE Systems Be Designed With Expansion in Mind?

- 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?