

# SIPROTEC DigitalTwin

Edson Ricardo Lacerda Videira

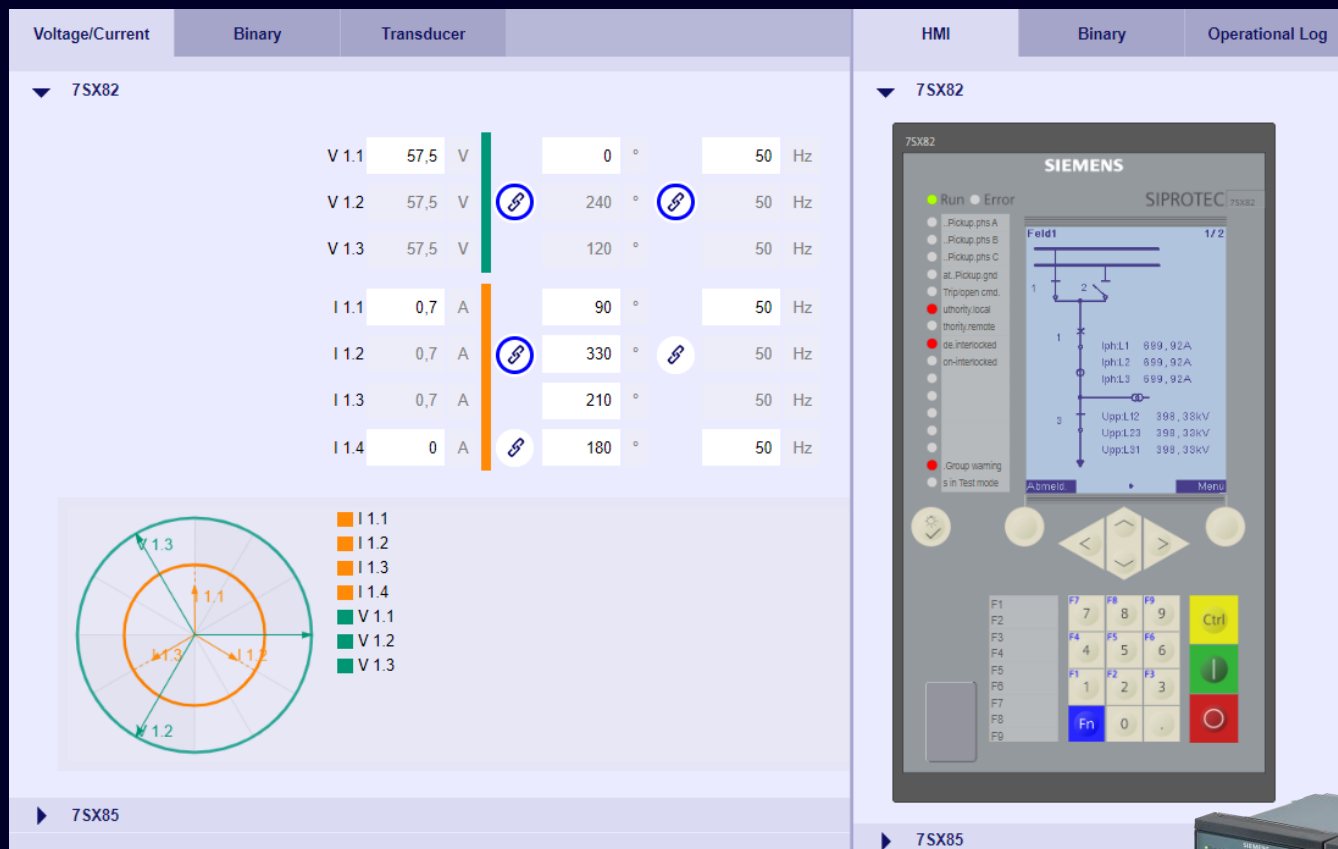
Siemens

Your Support Team of SI EA QM & GCC PA

Customer Support Center – Brazil

# SIPROTEC DigitalTwin

Nossa replica digital de um relé de proteção

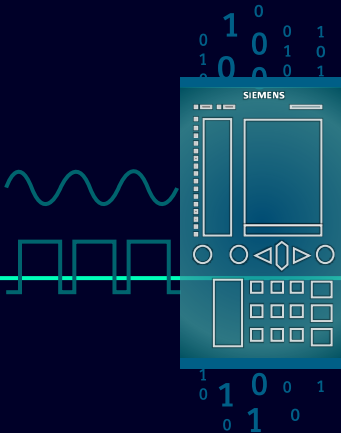


## Benefícios

- Testes realizados independente da existencia do hardware e compátiveis com todos os firmwares e modelos do SIPROTEC 5
- Em tempos onde tempo e recursos são escassos – uma replica digital de seus equipamentos de proteção pode ser um ganho em produtividade.
- Integração com outros equipamentos através de uma conexão de VPN.

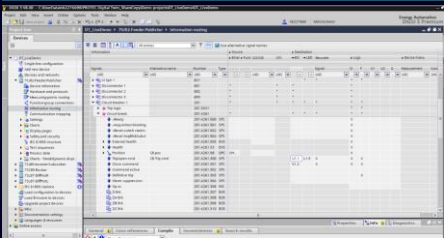


# Como acessar SIPROTEC DigitalTwin em 5 Passos.



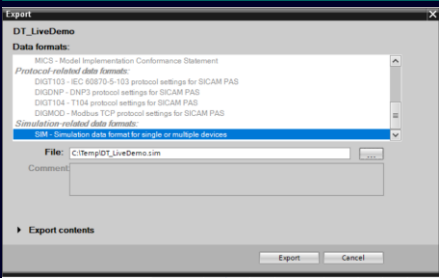
1

Abrir o projeto DIGSI 5



2

Exportar arquivo SIM



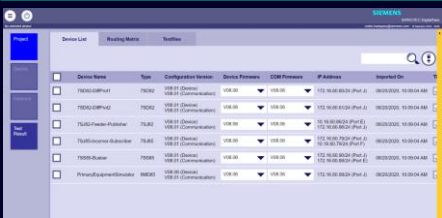
3

Conectar à Cloud do DT



4

Importar arquivo SIM



5

SIPROTEC DigitalTwin



# Maiores desafios em nosso mercado de Infraestrutura Critica

## Como manter alta disponibilidade e alta confiabilidade?



### Tempo e Dinheiro

- Complexidade dos Sistemas atuais.
- Implementação consome muito tempo.
- Consideravel esforço em testes e comissionamento.



### Agilidade e Flexibilidade

- Validação e homologação de novos produtos/ FW.
- Implementação de novos esquemas de proteção.
- Análise de faltas complexas com testes reais.



### Gerenciamento de Análise de Faltas

- Cobrança para energização mais rápida para Subestações novas
- Tempo de recomposição em manutenções planejadas
- Retrofit e Expansões de subestações existentes



### Treinamento e Manutenção de ativos

- Alto custo de treinamento de equipes
- Disponibilidade de um Laboratório de Testes
- Eficiência na manutenção

# Como a solução de Réplica Digital pode auxiliar em Sistemas com Subestações Digitais?

## Manutenção

- Impacto de alterações no sistema real.
- COMTRADE um estudo de caso
- Planejamento para futuras expansões.

## Treinamento contínuo

- Disponibilidade do próprio sistema para reproduzir casos reais
- Licença pode ser utilizada para vários departamentos
- Flexível para uso em qualquer lugar.

## Operação

- Treinamento para Operadores em ambiente controlado (VPN)
- COMTRADE (reprodução de faltas reais)

## Pre-vendas e Projeto

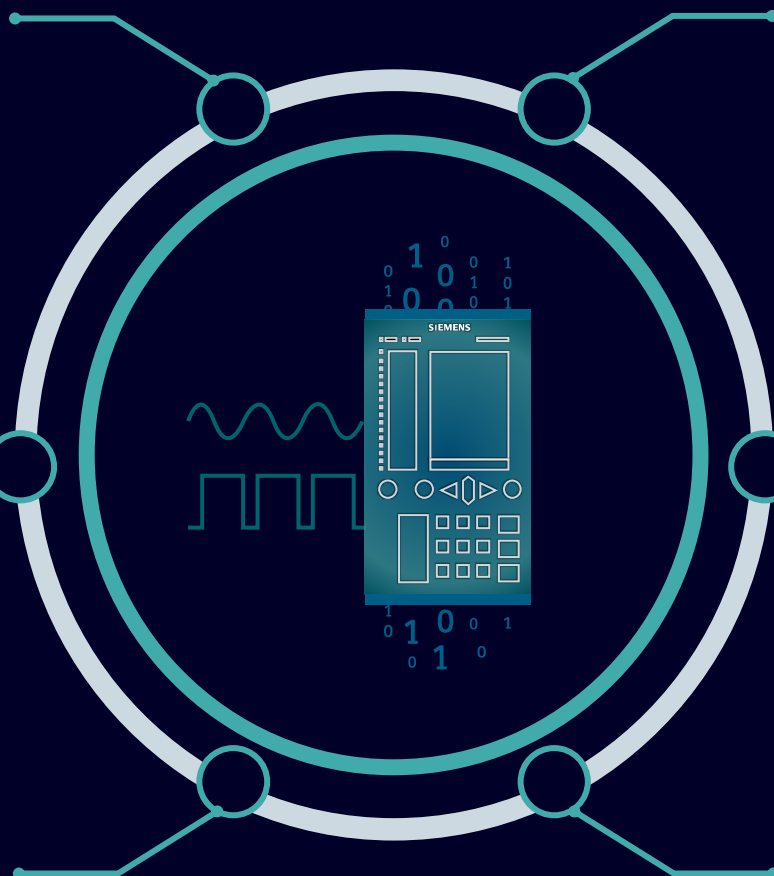
- Informações e apresentações
- Duvidas em aplicações e testes
- Elaboração de Requisitos (User Functional Requirement)
- Validação de Requisitos

## Implementação

- Planejamento de atividades
  - Testes do algoritmo
  - Estudo de proteção e Configuração
  - Pre-teste em ambiente seguro
- Documentação extraída do DT

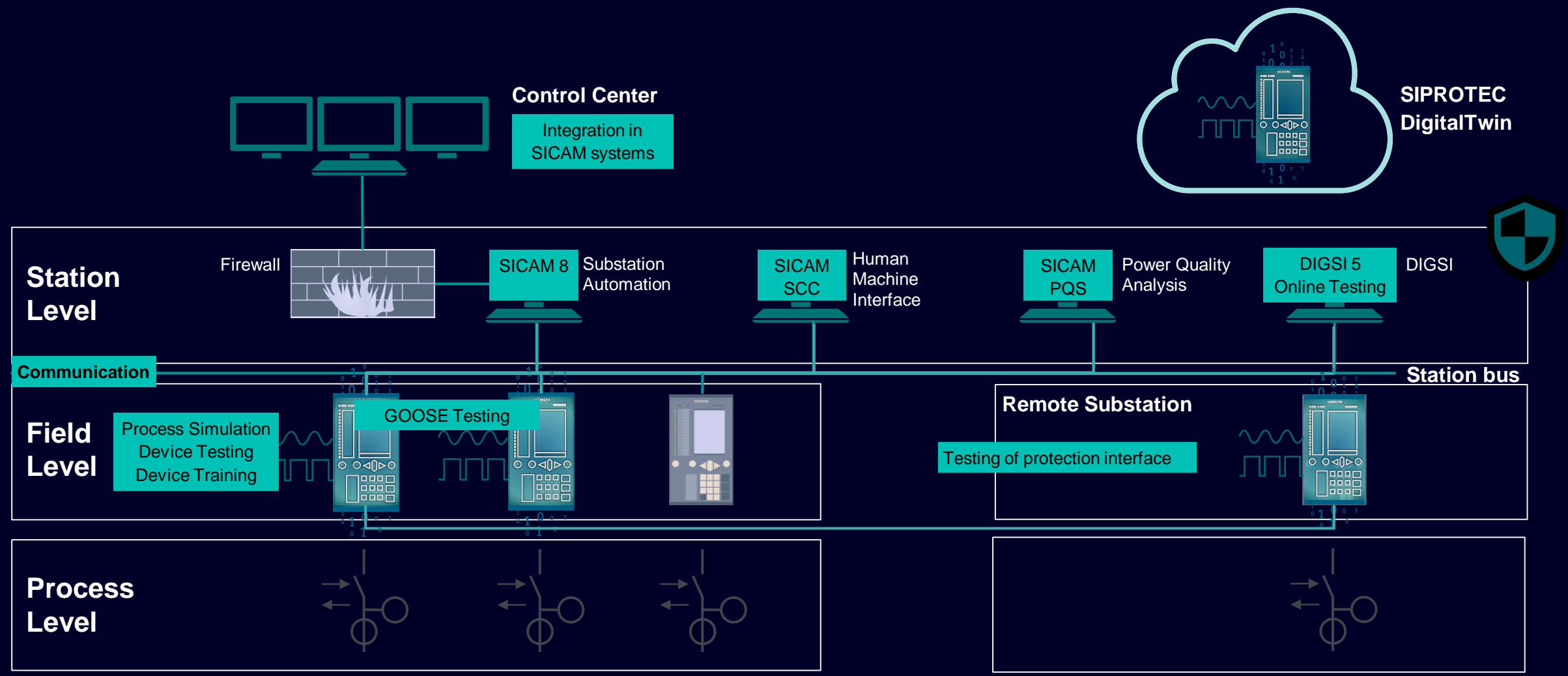
## Commissionamento

- FAT
- SAT, Field test
- Análise de Falta
- Teste de simulação.



# SIPROTEC DigitalTwin

Cenários onde é possível usar o DT.



# SIPROTEC DigitalTwin – O que testar? O que está disponível?

## Visualizar e interagir com relé Virtual

- P&D; Universidades
- Injeção de valores Analógicos
- Simulação de Binárias de Entrada e Saída
- Sistema de Monitoramento IEC61850 Supervisor
- Comportamentos entre equipamentos com diferentes Edições (1, 2 e 2.1)

## Documentação

- Test reports
- Logs

## Analises de Falta

- COMTRADE replay
- Relatório para ONS
- Contratação de serviço de consultoria

## DIGSI 5 Online Testing e Web Browser

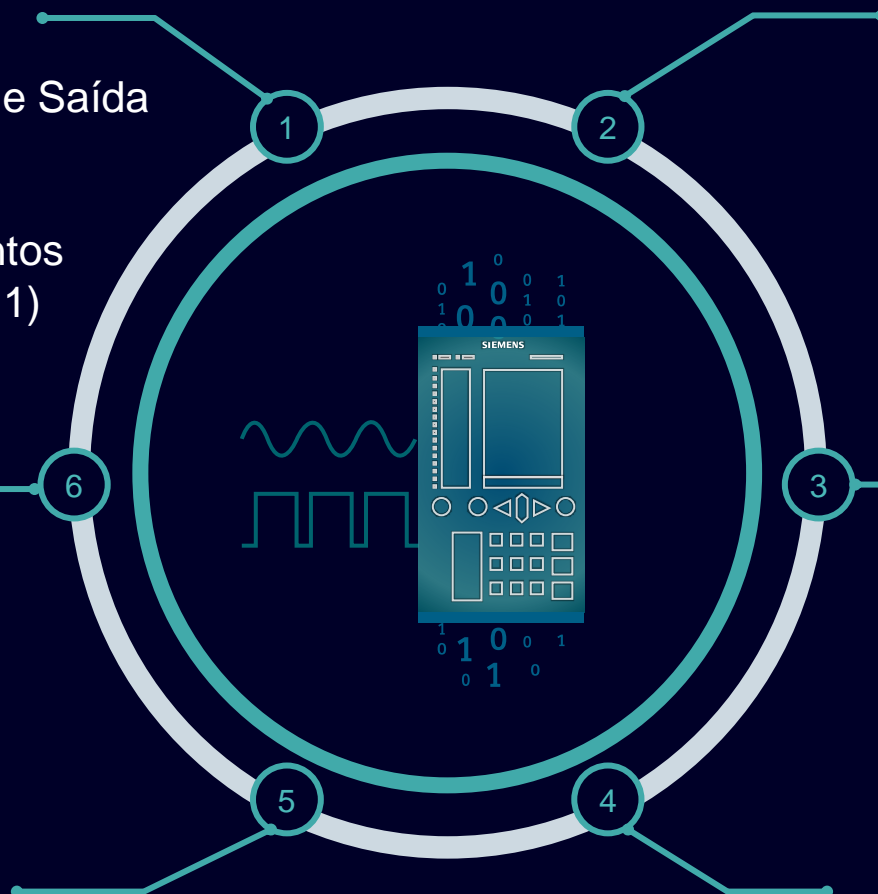
- Online CFC Debugging
- Download Logs e Fault records
- Test sequence
- Plug & Play
- Role-based access control (RBAC)

## Interface de Comunicação

- IEC 61850
- IEC 60870-5-104
- DNP3 TCP, Modbus TCP
- Protection Data Interface
- Cyber Security (RBAC, Syslog)

## Integração de Sistemas de Supervisão e Controle

- SICAM A8000 / S8000
- SICAM PAS, SCC and PQS
- 3<sup>rd</sup> party systems (SAGE)
- Interlockings via GOOSE





# COMTRADE replay

The first screenshot shows the 'Upload COMTRADE / State Sequence' dialog box. It lists three files: '1\_492019204451889\_FRA00001' (COMTRADE), 'SequencerDemo' (State Sequence), and 'Teleprotection\_SS\_ABC' (Routing Matrix Preset). The dialog has a 'CFG + DAT or XML' field and a '...' button to select a file.

The second screenshot shows the 'Routing Matrix' configuration screen. It displays a table for 'Output (Source) \ Input (Destination)' with columns for 1.1, 1.2, and 1.3. The table shows the following values:

Output (Source) \ Input (Destination)	1.1	1.2	1.3
MPV3p1:V A	✓		
MPV3p1:V B		✓	
MPV3p1:V C			✓

Below the table is a 'Routing Overview (Type: Voltage)' table with columns for 1, 2, 3, 4, 5, 6, 8, 9, and 10. It lists two rows: '11 - COMTRADE - 1\_492019204451...' and '12 - State Sequence - SequencerDemo'.

The third screenshot shows the 'Test Result' screen. It displays a table for 'Voltage/Current' with columns for 'Binary' and 'Operational Log'. The table shows the following values:

Voltage/Current	Binary	Operational Log
V 1.1 57.74 V	0	50 Hz
V 1.2 57.74 V	240	50 Hz
V 1.3 57.74 V	120	50 Hz
I 1.1 1 A	0	50 Hz

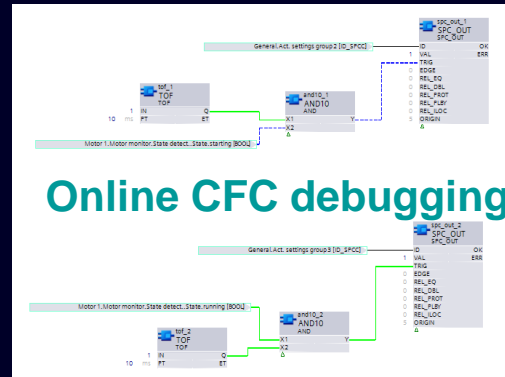
- Standard COMTRADE files (1999, 2013) :
  - Upload,
  - Mapeamento de binarias, tensão e corrente em um ou várias replicas digitais.
  - Reproduzir o comportamento
- XML state sequences é suportado:
  - Qualquer quantidade de estágios.
  - Triggers usando condições de OR/AND



# SIPROTEC DigitalTwin

## Support of DIGSI 5 Online Testing

- Download logs
- Test and diagnostic functions
- Online CFC debugging
- Test sequence
- Plug & Play



Project tree: Online access > Hyper-V Virtual Ethernet Adapter > Type E Bay 5 (Assigned) > Test suite > Wiring (Process)

Devices: Online access, COM, Hyper-V Virtual Ethernet Adapter, Type E Bay 5 (Assigned), Device information, Refresh device data, Logs, Records, Indications, Measurements, Test suite, Wiring, Communication module, Analog inputs, Control functions, Circuit-breaker test, Protection functions, 87 Line diff. prot., 50/51 OC-3ph-A1, 50N/51N OC-gnd-A1, Protection topology, Communication protocols.

Monitoring of binary I/O and LED can be performed.

Activate commissioning mode in order to perform the wiring test. [Activate commissioning mode](#) [Show device mode](#)

Binary output cannot be tested. To test binary output set "Oper. bin.outp under test" under "Device settings" as checked.

Change the state of binary inputs, outputs, and LEDs

Binary inputs/outputs and I mapped to signal(s)	Terminal	Current value	New value
Binary inputs			
Binary outputs			
LEDs			
LED 1.1	Line 1:Group indicat.:Pickup	off	on
LED 1.2	Line 1:Group indicat.:Pickup	off	on
LED 1.3	Line 1:Group indicat.:Pickup	off	on
LED 1.4	Line 1:Group indicat.:Pickup	off	on
LED 1.5	VS:Circuit break.:Spring Charged	on	off
LED 1.6		off	on
LED 1.7		off	on
LED 1.8		off	on
LED 1.9	Line 1:87 Line diff. prot.:General:Inactive	on	off
LED 1.10	2 device prot. com.:Prot. interf.1:Pi synchro...	off	on
LED 1.11		off	on
LED 1.12		off	on
LED 1.13		off	on
LED 1.14		off	on
LED 1.15		off	on
LED 1.16	Device:Process mode inactive	off	on

**Wiring Tests**

Project tree: Online access > Hyper-V Virtual Ethernet Adapter > Type E Bay 5 (Assigned) > Test suite > Protection functions > Line 1 > 87 Line diff. prot. (Process)

Devices: Online access, COM, Hyper-V Virtual Ethernet Adapter, Type E Bay 5 (Assigned), Device information, Refresh device data, Logs, Records, Indications, Measurements, Test suite, Wiring, Communication module, Analog inputs, Control functions, Circuit-breaker test, Protection functions, 87 Line diff. prot., 50/51 OC-3ph-A1, 50N/51N OC-gnd-A1, Protection topology, Communication protocols.

To start control-function test, Siemens recommends: [Switch device to test mode \(and send telegrams with test flags\)](#)

Or: [Operate switching devices directly](#)

Key switch of device is set to "Local"

Interlocking conditions are considered. [Ignore interlocking conditions](#) [Show device mode](#)

Control operations

Switching devices	Current value	New value	Select	Operate	Cancel	Interlocking condition	Quality
VS	intermediate	open	Select	Operate	Cancel	Fulfilled	good (process)
RS 1	intermediate	open	Select	Operate	Cancel	Not fulfilled	good (process)
RS 2	intermediate	open	Select	Operate	Cancel	Not fulfilled	good (process)
VA	intermediate	open	Select	Operate	Cancel	Fulfilled	good (process)

Spontaneous indication responses

Time stamp	Indication	Value	Additional information	Quality
(All)	(All)	(All)	(All)	(All)

Diagram shows all secondary values

Diagram: Idiff [p.u.] vs Time [s]. Legend: 1-0IFF, 1-0IFF fast 2, 1diff.A, 1diff.B, 1diff.C.

Protection-function test can be performed (measured values are calculated from analog signals connected to the terminals). Use external test eq... necessary. This may take up to 90 seconds. [Activate simulation mode](#) [Show device mode](#)

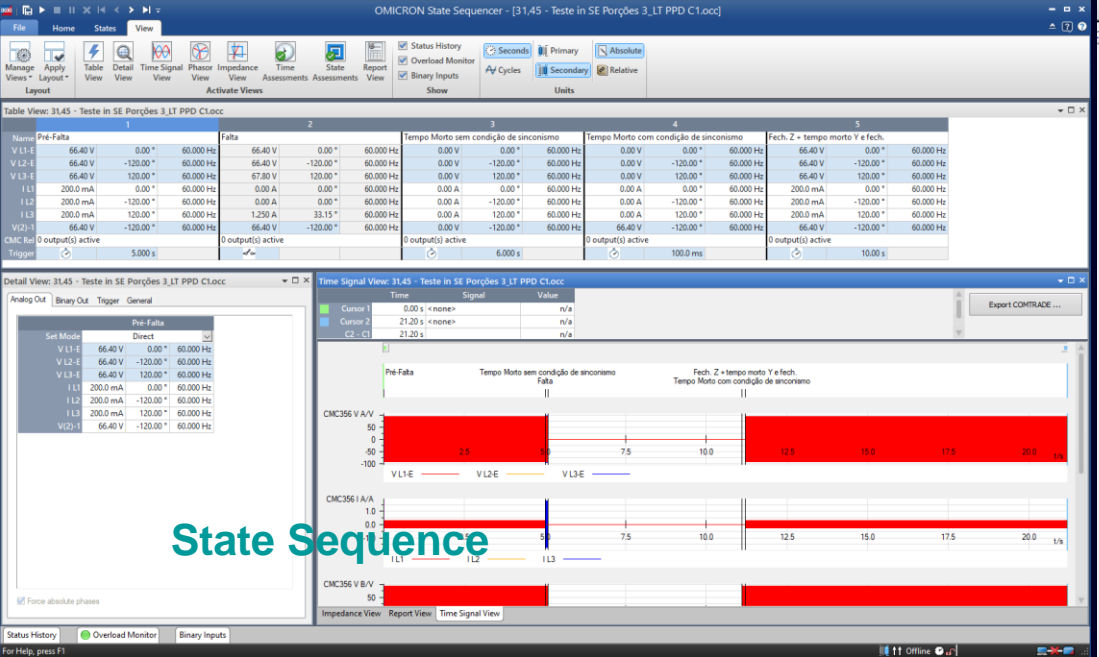
Spontaneous indications

Time stamp	Relative time	Indication	Value	Quality	Additional information
(All)	(All)	(All)	(All)	(All)	(All)
31.01.2019 16:00:27.117	00:00:00:00...	Security:Security Logging:Sec. Ev. Logg.:User logged on	on	good (process)	Data change
31.01.2019 16:00:27.117	00:00:00:00...	Security:Security Logging:Sec. Ev. Logg.:User logged off	off	good (process)	Data change

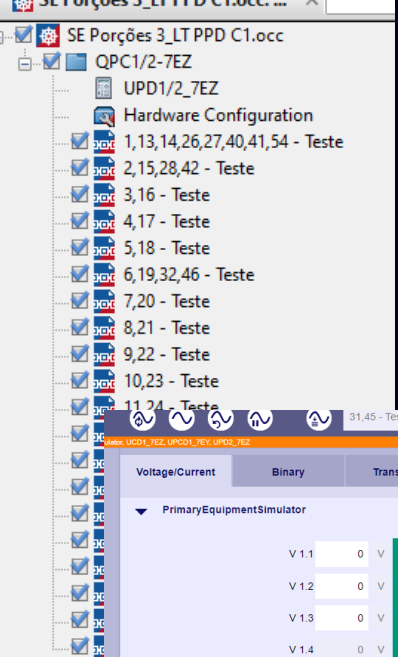
**Protection Functions**

# SIPROTEC DigitalTwin

## Support of DIGSI 5 Online Testing



State Sequence



Reprodução da sequencia na Réplica Digital

Device List

Routing Matrix

Test Files

Files for Apps

Type:

Current

Source:

35,49 - Teste

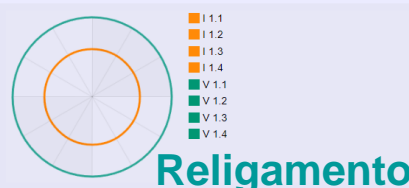
Destination:

UPD2\_7EZ

Output (Source) \ Input (Destination)	1.1	1.2	1.3	3.1	3.2	3.3
I L1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I L2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I L3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

States no DT

States no DT



Religamento

# SIPROTEC DigitalTwin – Licences overview & onboarding

License Option  Functionality	Freemium		Subscription Packages <sup>1)</sup>			
	DemoUI	DemoUI Advanced <sup>1)</sup>	Free Trial (3 weeks)	Small (S)	Medium (M)	Large (L)
Max. # devices	1	1	2	2	5	20
Upload of own project (SIM File)	X	✓	✓	✓	✓	✓
Device simulation	●	●	✓	✓	✓	✓
Connection from DigitalTwin device to local PC and local network (VPN)	X	X	✓	✓	✓	✓
COMTRADE and State Sequence replay	X	X	X	X	✓	✓
SIPROTEC Migration Tool	X	✓	✓	✓	✓	✓
Applications in the Cloud (DIGSI 5, ...)	X	X	✓	✓	✓	✓
Onboarding	Self-service	DemoUI.Forms	Registration <sup>2)</sup> (for new users)  Manage <sup>3)</sup> (for existing users)			

✓ Yes    ● Max 10 minutes per day

1) See list of released countries. DemoUI available worldwide  
2) Registration can be done online or via Siemens Regional Companies. Purchase order required for S/M/L licenses  
3) Upgrades, Floating licenses. Currently only for some countries available

# OBRIGADO

EDSON RICARDO LACERDA VIDEIRA

Siemens

Smart Infrastructure

Electrification & Automation

Customer Support Center – Brazil

[Suporte.br@siemens.com](mailto:Suporte.br@siemens.com)

Tel.: +55 0800 011 9484