POWER AUTOMATION TECHNOLOGIES

DIGSI 5 QUICK NOTES
DIGSI-5-QN0020: Device Modes & Test Suite

SIPROTEC 5 relays operate in one of four defined modes. Process Mode is the normal operating mode, with Commissioning Mode and Simulation Mode enabling special testing features.

Test Sequences and Test Suite offer powerful testing features.

'Test Sequences' are different to 'Test Suite' features.

- Test Sequences can be used offline for CFC chart testing
- Test Sequences can be used online (in Simulation Mode) with some Test Suite features
- **Test Suite** provides a wide range of testing features that can be used with an **online** relay

Test Suite features	Process Mode	Simulation Mode	Commissioning Mode
Wiring test			**Y**
Analog input	**Y**	**Y**	**Y**
Communication Protocol			**Y**
Control functions	**Y**	**Y**	
Circuit-breaker check	**Y**		
Protection Function	**Y**	**Y**	
Protection topology	**Y**	**Y**	**Y**

Table 1. Test Suite features and relay Modes in which they are available.

QUICK GUIDE TO: Device Modes

Mode	Description	Device Indications [2][3]
Process Mode	• Normal operation (all protection operative) • Assuming there are no errors, the relay will always start up in Process Mode [1]	• Green **RUN** LED only
Commissioning Mode	Depends upon Test Suite: • Protection functions may be inactive to allow wiring and other tests to be performed, *such as binary input/outputs and SCADA points/values to be monitored and forced etc* • *Binary signals, CFCs etc may still be active* • *SCADA control may not be responded to*	• Green **RUN** LED & RED **ERROR** LED • LCD displays COMMISSIONING
Simulation Mode	• Similar to Process mode, but allows test sequences to be run, replacing actual measured inputs with simulated values	• Green **RUN** LED & RED **ERROR** LED • LCD displays SIMULATION
Fallback Mode	• A hardware error or inconsistency in the application/parameter setting has occurred • NO PROTECTION functions are operative	• Red **ERROR** LED only • LCD displays FALLBACK MODE

[1] Unless the device is being restarted to switch into Commissioning or Simulation Mode
[2] When red ERROR LED is illuminated, the life status contact also opens
[3] Device modes are displayed within DIGSI 5, and can be reported to SCADA. Reporting of "Process Mode" is highly recommended

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Several methods are available to change device modes:

1. Use the front panel menu to change the device mode
2. Within the online Test Suite, a button is normally provided to change to/from different modes
3. If online, use a dropdown box in the online 'Device Information' screen to change modes
4. Simply restart relay to return to the Process mode

Changing the Mode will cause the relay to restart, so USB/network communications will need to be re-established. (With firmware V6.0 onwards, a change from Process to Commissioning Mode does not require a restart).

QUICK GUIDE TO: Test Suite

Test Suite	Description	Applicable Relay Modes
Wiring	Read or set state of binary inputs, binary outputs and LEDs	Commissioning
Analog Inputs	Show phasors diagrams of measuring inputs (current and voltages) (Simulated values if in simulation mode)	Process Simulation Commissioning
Communication Protocols	Simulate SCADA output (digital and analogue) values. Note test bit is activated	Commissioning
Control Functions	Switch a breaker or other controlled device, with or without interlocking	Process Simulation
Circuit Breaker Check	Circuit breaker is automatically opened then closed with spontaneous indications logged. **NOTE CB is operated without consideration of any interlocking**	Process
Protection Functions	Displays a graph of a protection element operating curve, with a live or simulated operating value	Process Simulation
Protection Topology	For relays interconnected via protection data interfaces, this Test Suite function allows predefined measurements from remote relays to be inspected	Process Simulation Commissioning

Table 2. Summary of Test Suite features

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How the relay behaves when using Test Suite features.

To provide more detail to that of Table 2, the behaviour of the relay is described for each of following scenarios with each Test Suite feature [Protection Topology functions were not tested at the time this document was written].

Scenario	Tested example
1 – Normal Protection function	A normal protection function, such as over-current protection function where CB is tripped via relay output when input current exceeds definite current/time threshold
2 – External trip function	DIGSI 5 External Trip protection function. For example such as would be used for a buchholz relay connecting to binary input to trip HV and LV CBs via protection relay.
3 – User created signal	In this example a binary input is routed via a user defined signal to operate a relay output (similar to above, but not using the predefined external trip function).
4 – CFC function	In this example a binary input is routed via a CFC chart to operate a relay output.
5 – SCADA output	Does a CB open event or other point indicate to SCADA?
6 – SCADA control	Does the relay respond to SCADA control (e.g. open/close CB, or other SCADA controlled point)?

Test Suite – WIRING behaviour:

Scenario	Commissioning
1 – Normal Protection function	Not active
2 – External trip function	Not active
3 – User created signal	Forcing of binary input, results in that signal being processed
4 – CFC function	Forcing of binary input, results in that signal being processed
5 – SCADA output	Not active
6 – SCADA control	Not active

Test Suite – ANALOG INPUT behaviour:

Scenario	Process	Simulation	Commissioning
1 – Normal Protection function	Active	Not active	Not active
2 – External trip function	Active	Active	Not active
3 – User created signal	Active	Active	Active
4 – CFC function	Active	Active	Active
5 – SCADA output	Active	Active	Active
6 – SCADA control	Active	Not active	Not active

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Test Suite – COMMUNICATION PROTOCOLS behaviour:

Scenario	Commissioning
1 – Normal Protection function	Active
2 – External trip function	Active
3 – User created signal	Active
4 – CFC function	Active
5 – SCADA output	Active
6 – SCADA control	Active

Test Suite – CONTROL FUNCTIONS behaviour:

The following conditions were used during the **CONTROL FUNCTIONS** test:

1. Operate switching directly
2. Ignore interlocking conditions

Scenario	Process	Simulation
1 – Normal Protection function	Active [1]	Not active
2 – External trip function	Active [1]	Active [1]
3 – User created signal	Active	Not active [2]
4 – CFC function	Active	Not active [2]
5 – SCADA output	Active	Active
6 – SCADA control	Active	Not Active

[1] If protection function operates, then breaker cannot be opened/closed via control test till that fault is reset
[2] Signal is visible in simulation mode, but cannot open/close the breaker from DIGSI or SCADA simulation software

Test Suite – CIRCUILT BREAKER TEST behaviour:

The following conditions were used during the **CIRCUIT BREAKER** test:

1. Operate switching directly
2. Ignore interlocking conditions

Scenario	Process
1 – Normal Protection function	Active [1]
2 – External trip function	Active [1]
3 – User created signal	Active
4 – CFC function	Active
5 – SCADA output	Active
6 – SCADA control	Active

[1] If protection function operates, then breaker cannot be opened/closed via control test till that fault is reset

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Test Suite – PROTECTION FUNCTIONS behaviour:

Scenario	Process	Simulation
1 – Normal Protection function	Active [1]	Not active
2 – External trip function	Active [1]	Active
3 – User created signal	Active	Active
4 – CFC function	Active	Active
5 – SCADA output	Active	Active
6 – SCADA control	Active	Not Active

[1] If protection function operates, then breaker cannot be opened/closed via control test till that fault is reset

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