DIGSI-5-QN0014:	DIGSI 5 QUICK NOTES Test Sequence example

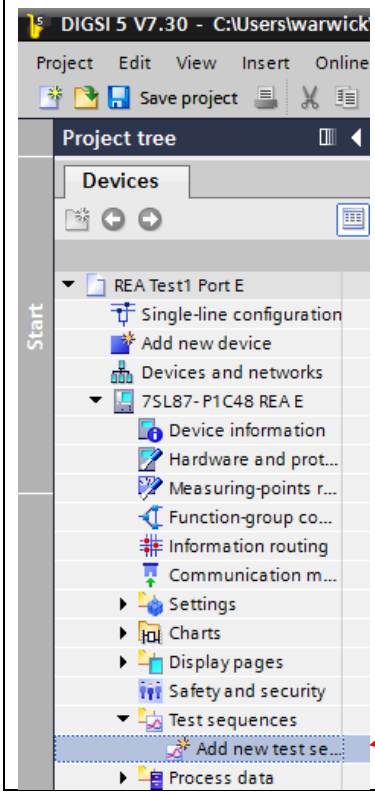
Test Sequences allow simulated values to be applied internally to the 'input' of the relay, allowing testing of protection functions, display and SCADA outputs with the need for external test equipment.

Test Sequences are detailed in the 'SIPROTEC 5 Operation Manual'. Siemens "SIPROTEC 5 Application Note SIP5-APN-011 Power commissioning with SIPROTEC 5" also introduces Test Sequences and other useful commissioning/testing tools.

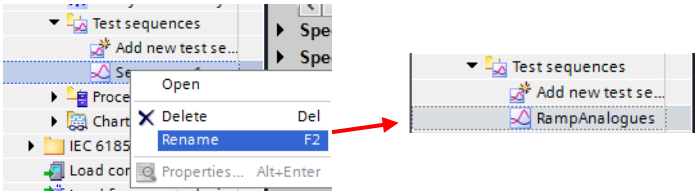
QUICK GUIDE TO: Creating a Test Sequence

In this example using DIGSI 5 Version 7.50, we create a test sequence using two steps. The first step ramps input current from 0-1 A over 5 seconds, then the second 5 second step ramps current and voltage down by 10 %.

1: Create and rename



1. Add a new test sequence in the offline project for the relay

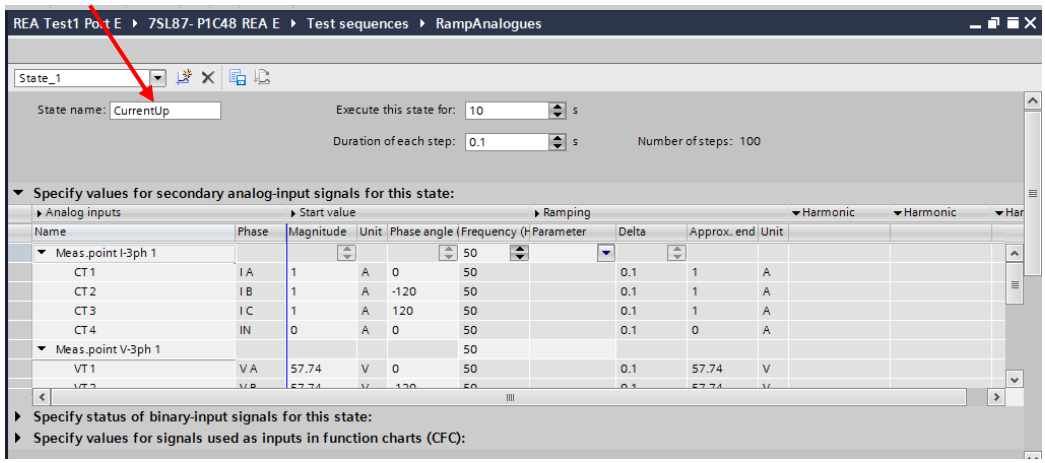


2. Right click and rename

HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

2: Setup the first step

Rename

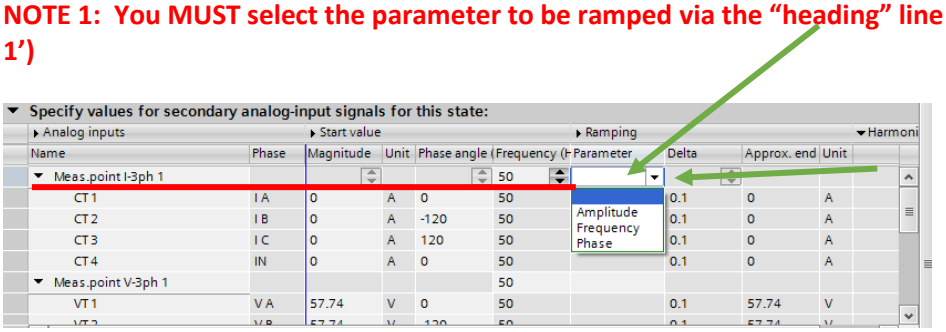


Settings to be entered:

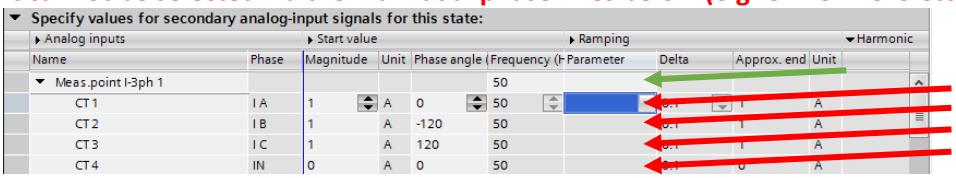
Execute state for = 5 s
Duration of each step 0.5 s
Ramping Parameter (for current) = Amplitude [Note 1]
Start Magnitude = 0
Delta [Note 2] = 0.1 (to make 'Approx. end' value = 1) (for IA, IB. IC)
Voltage Start Values = 63.5 V

Test Sequence values are entered as secondary values. Keep in mind if relay is set for 1A or 5A input, and the effect CT/VT ratio settings will have on display and SCADA values.

NOTE 1: You MUST select the parameter to be ramped via the "heading" line (e.g. 'Meas.point 1-3ph 1')



It cannot be selected via the individual phase lines below (e.g. CT1 CT2 CT3 etc).

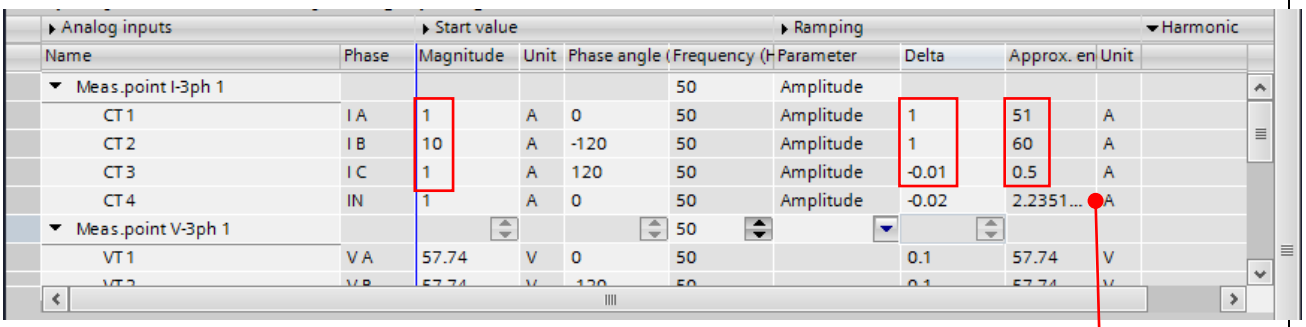


HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

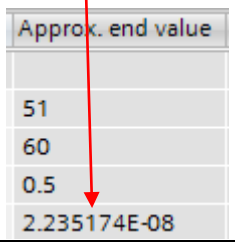
NOTE 2: Setting value "Delta"

The setting value 'Delta' is a multiplier of the 'number of steps'
The resulting change = Start Magnitude + (delta setting * number of steps)
The delta value can be a minimum value of -0.01/0.01
You may need to alter the number of steps to be able to obtain the desired resolution of the delta setting.

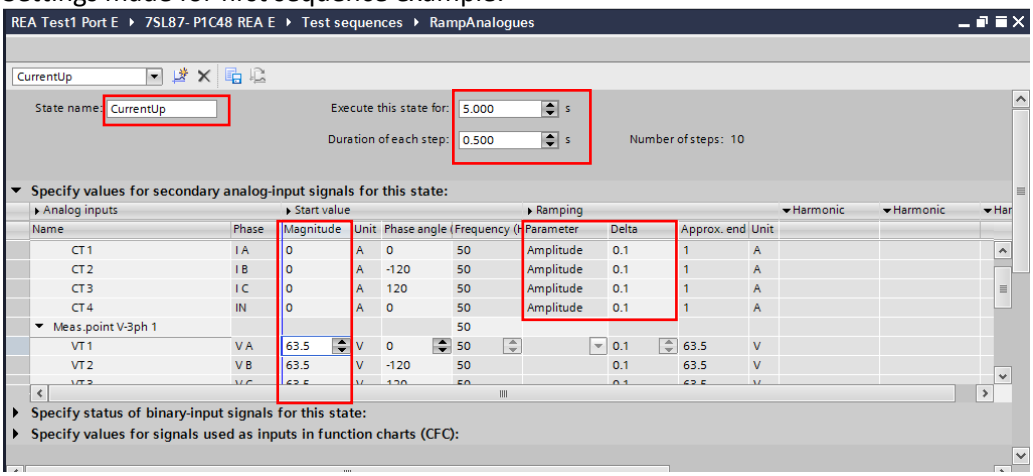
Worked example:
Number of steps (in this step of the sequence) = 50
Therefore if using Delta = 1, '50' would be added to the magnitude
In below example:
Phase A, current start magnitude = 1, Delta = 1, therefore end value = 1+ (1 x 50) [i.e. 51]
Phase B, current start magnitude = 10, Delta = 1, therefore end value = 10 + (1 x 50) [i.e. 60]
Phase C, current start magnitude = 1, Delta = -0.01, therefore end value = 1+ (-0.01 x 50) [i.e. 0.5]



Warning:
Values may be given in engineering units. Enlarge the column to see the full detail.

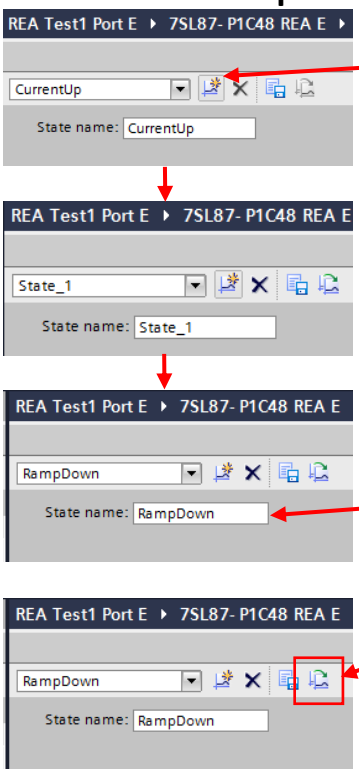


Settings made for first sequence example:



HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

3: Add second step

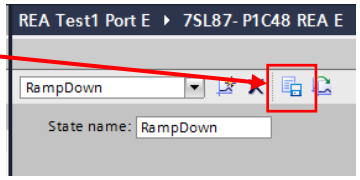


1. Add new test sequence state

2. Rename

3. "Take end values from last step as start values for this step".
   Use this button to pre-set the start condition to the same values as the end of the preceding step

The save button is only for saving the test sequence as a text file for use in other applications. The test sequence is saved as part of the DIGSI 5 project file.



4: Settings for second stage.

Specify values for secondary analog-input signals for this state:

Analog inputs		Start value				Ramping				Harmonic
Name	Phase	Magnitude	Unit	Phase angle	Frequency (H	Parameter	Delta	Approx. en	Unit	
Meas.point I-3ph 1					50	Amplitude				
CT 1	I A	1	A	0	50	Amplitude	-0.01	0.9	A	
CT 2	I B	1	A	-120	50	Amplitude	-0.01	0.9	A	
CT 3	I C	1	A	120	50	Amplitude	-0.01	0.9	A	
CT 4	IN	0	A	0	50	Amplitude	0	0	A	
Meas.point V-3ph 1					50	Amplitude				
VT 1	V A	63.5	V	0	50	Amplitude	-0.64	57.1	V	

Settings to be entered:

Execute state for = 5 s
Duration of each step 0.5 s
Ramping Parameter (for current) = Amplitude

HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

Delta = -0.01 (to make 'Approx. end' value = 0.9) (for IA, IB, IC)
Ramping Parameter (for voltage) = Amplitude
Delta = -0.64 (to make 'Approx. end' value = 57.1)

As the minimum possible Delta value is 0.01, the number of steps was chosen as 10, to allow a current magnitude change of 0.1 A (i.e. 10 %). For voltage, this results in Delta=1, being a 10 V change, hence the Delta needs to be -0.64 to obtain a 6.4 volt decrease for the voltage value (i.e. to obtain a 10 % reduction from the start voltage)

5: Save

Save the setting file (Save Project).

QUICK GUIDE TO: Running a Test Sequence

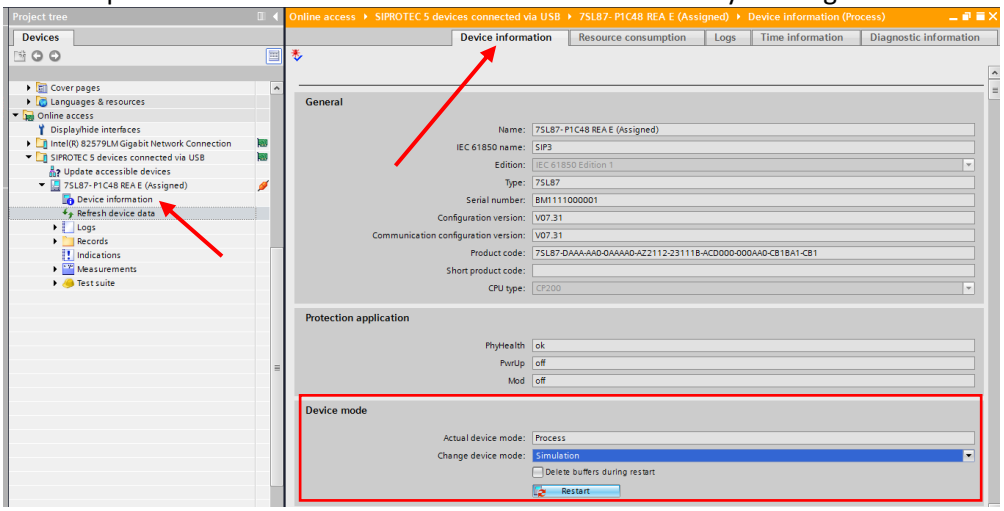
1: Device Mode = Simulation

The relay must be in Simulation Mode to allow Test Sequences to operate.

Commissioning Mode	All protection functions are inactive to allow wiring and other tests to be performed. Allows binary input/outputs to be checked, SCADA points to be operated etc.
Process Mode	Normal operation.
Simulation Mode	Similar to Process mode, but allows test sequences to be run, replacing actual measured inputs with simulated values.

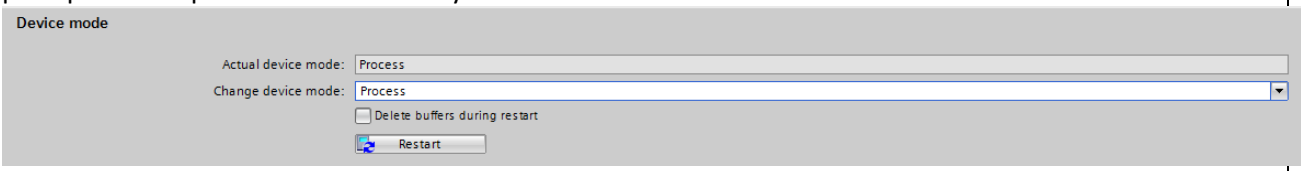
On the SIPROTEC 5 relay the red Error LED will be illuminated when in Commissioning or Simulation mode, and the top line of the LCD will intermittently flash with the current mode indicated.

It is also possible to see the mode from the online instance by viewing the online 'Device Information'.



HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

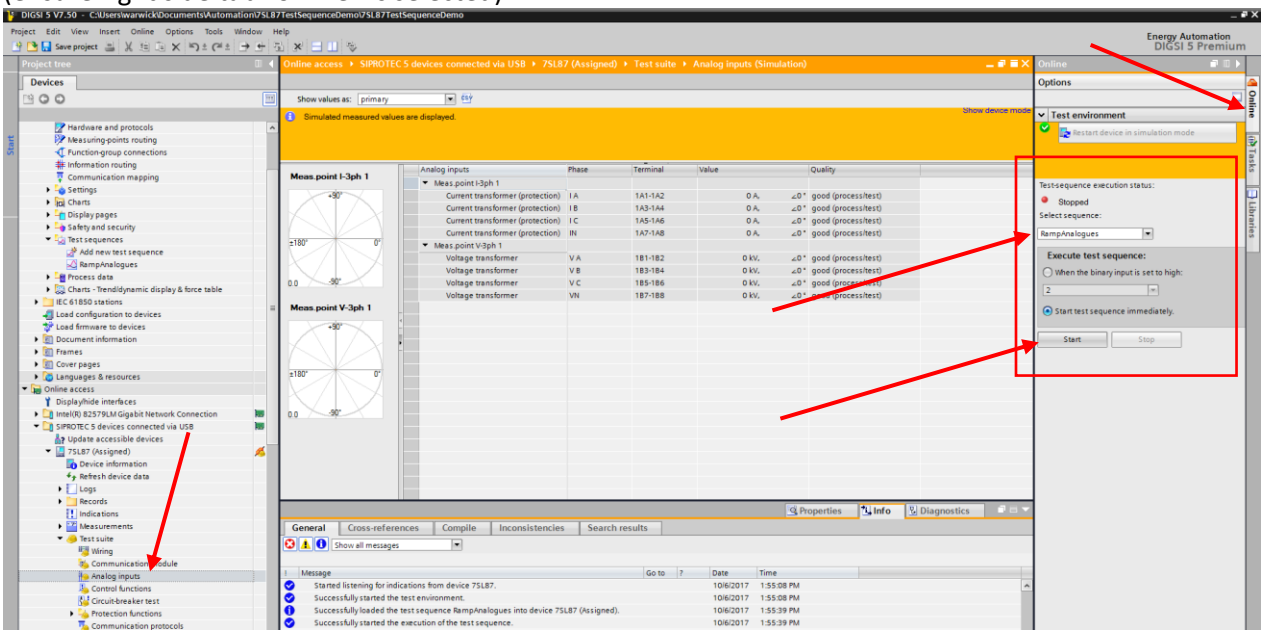
To change the mode, use the Online version “Device Information” screen (above), and using the Device mode area, change the mode to Commissioning. To change to a mode other than “Process” you will be prompted for a password – the factory default is 222222.

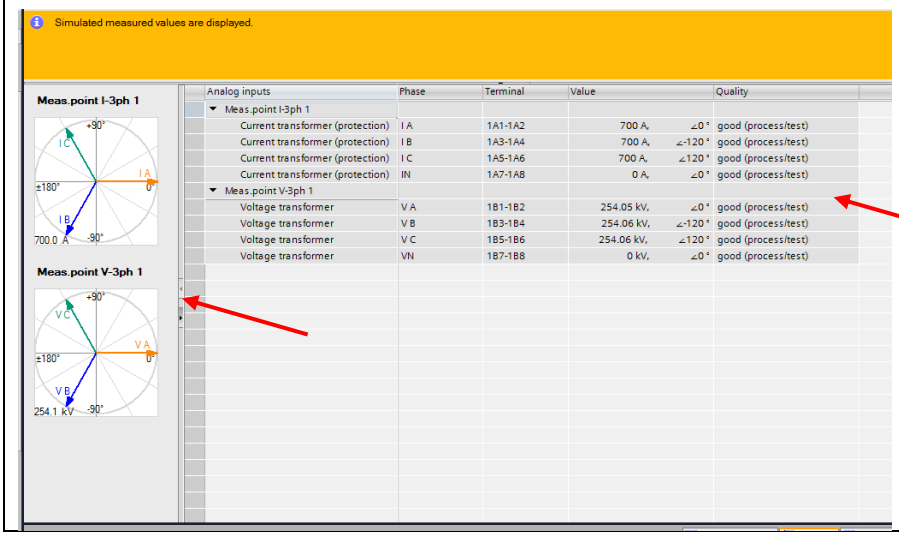


Changing the mode caused the relay to restart, and USB communications will need to be re-established.

2: Use the “Test suite”

When in Simulation Mode, the “Analog Inputs” Test suite, allows the Test Sequence to be selected and run (ensure right side tab “online” is selected).



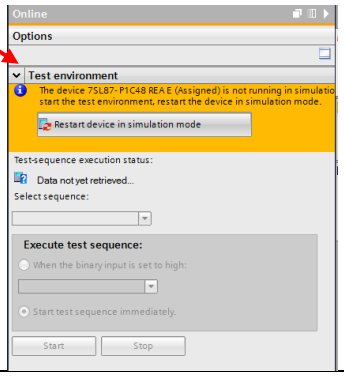


Simulated measured values will be displayed as test sequence is run

HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

If the relay is not in Commissioning mode notification will be given.

Test Sequences can also be run via the Protection function testing routines, the Communication protocol test suite, and effects of the Test Sequence simulation can be seen in many other screens.

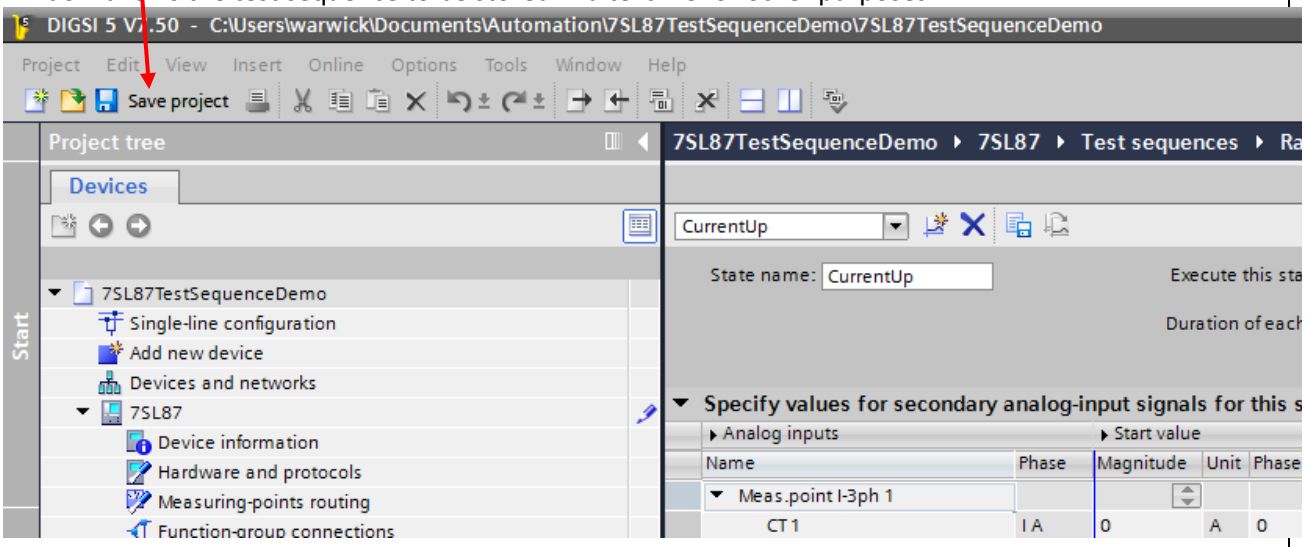


QUICK GUIDE TO: Saving and Errors

1: Saving

Test Sequences are stored in the offline project (only), and are not stored in the relay as part of the "setting file".

Use 'Save Project' to save any changes to Test Sequence files. The "save" button in the Test Sequence window allows the test sequence to be stored in a text file for other purposes.



Iterative changes can be made to the Test Sequence and 'played' via the Online instance 'Test suite' without the need to save project or upload new settings.

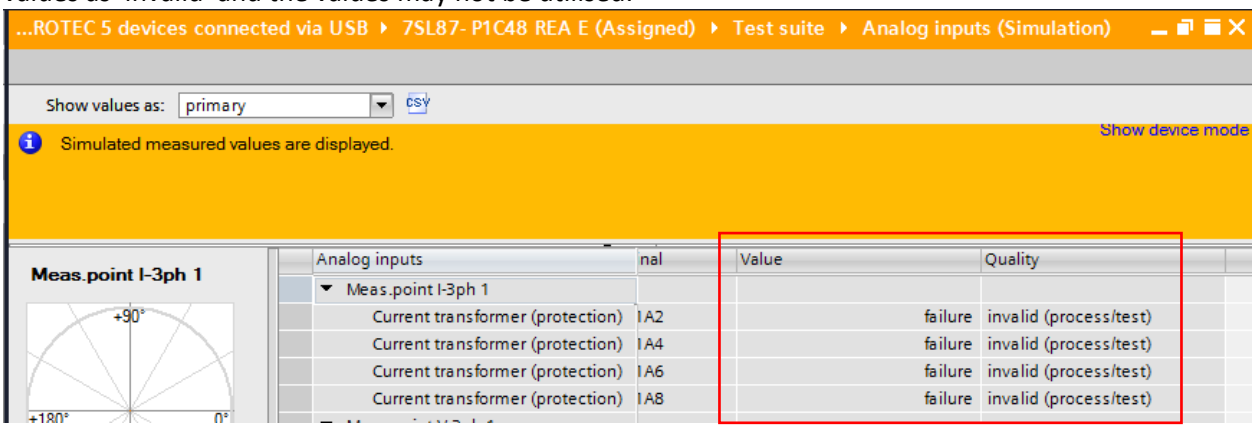
Note that DIGSI 5's 'Device Comparison' functions do not react to any changes/differences in the (offline) Test Sequences.

HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142

2: Value = failure

If a simulation value is reported as 'Failure' during a test, consider the validity of the input values.

For example with the current inputs the SIPROTEC 5 relay preforms an "Analog-Channel Supervision via Fast Current-Sum" check, where the unbalance currents from the three phases are summed and checked against the expected neutral current (Refer to manual specific to the relay being used). If the simulated values used do not inlcude the correct neutral unbalance values/angles, the relay may flag the quality of values as 'invalid' and the values may not be utilised.



Example valid single phase setting:

Analog inputs		Start value				Ramping			
Name	Phase	Magnitude	Unit	Phase angle	Frequency (H	Parameter	Delta	Approx. end	Unit
Meas.point I-3ph 1					50				
CT 1	I A	1	A	0	50		0.1	1	A
CT 2	I B	0	A	-120	50		0.1	0	A
CT 3	I C	0	A	120	50		0.1	0	A
CT 4	IN	1	A	180	50		0.1	1	A

In a single phase injection of current in Phase IA, the IN phase will expected the same magnitude but 180 deg opposite – otherwise the supervision functions of the relay may flag data as 'failed/invalid' and expected outputs may be prevented by the relay error checking routines.

HV Power Measurements & Protection Ltd
Unit 4, 1 Porters Ave, Eden Terrace, Auckland
P O Box 26-074, Epsom, Auckland 1030, New Zealand
Tel: +64-9- 377 2001
Fax: +64-9- 302 2142