

All You've Ever Wanted In a Relay or Switch Tester

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Commercial pressures drive us all.



- Low-cost high-power relay and switch life-testing required – an in a very flexible manner.
- Pressures to drive down costs.
- With the cost of the humble PC continually falling, everyone expects to pay less and less

The design goals for a new test architecture.

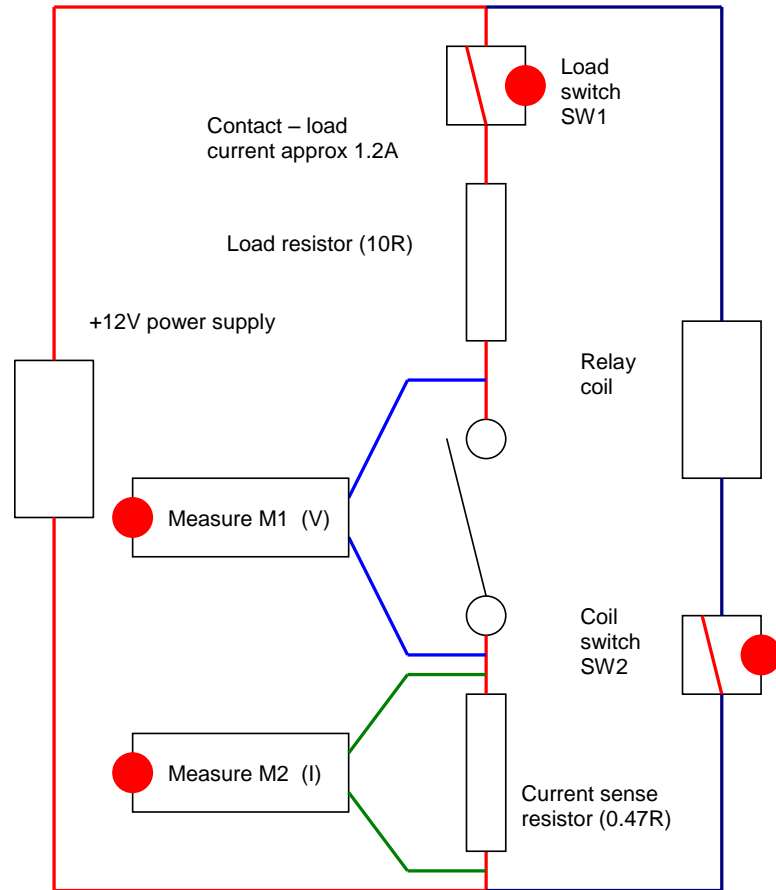


- Uncomplicated electrical environment.
- Minimal hardware.
- Operates over a wide cycle rate range.
- Copes with high or low power devices.
- Measures contact resistance & stick voltage
- Tests against failure limits.
- Produces logged data and reports.

First thoughts – a simple life-test requirement.



- The relay is enabled and disabled by a semiconductor switch SW2
- The load can be enabled or disabled by semiconductor switch SW1
- Contact voltage is measured by a voltage measurement input channel M1
- Contact current is measured by a voltage measurement input channel M2.



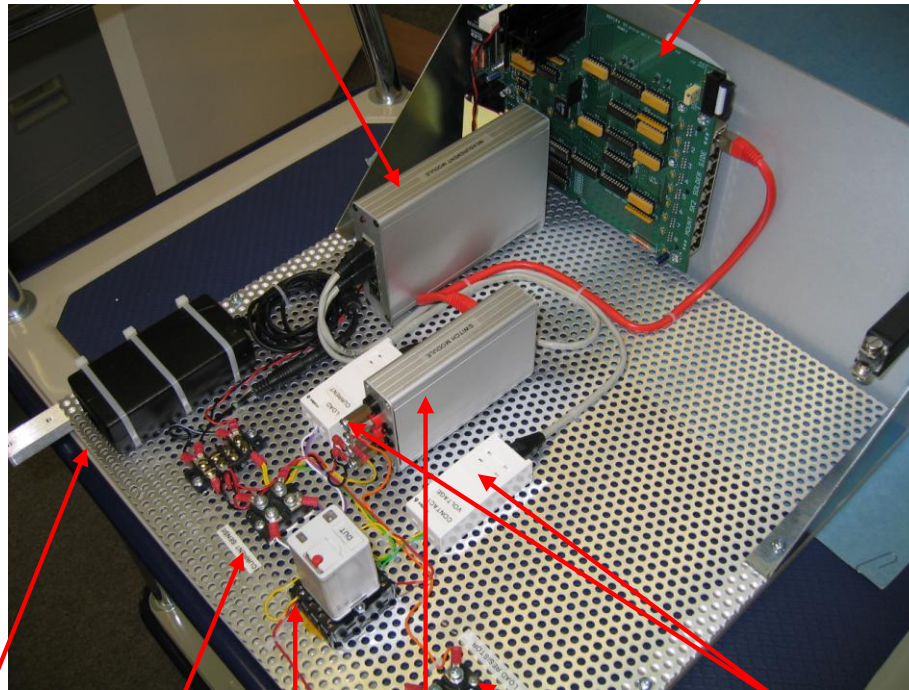
● Denotes a software-controlled resource

A 'concept vehicle' for a new test platform.



Measurement unit (up to 4 per system)

System card and front-panel display



12V power supply

Relay under test

Contact voltage and current breakout connections

Load current sense resistor

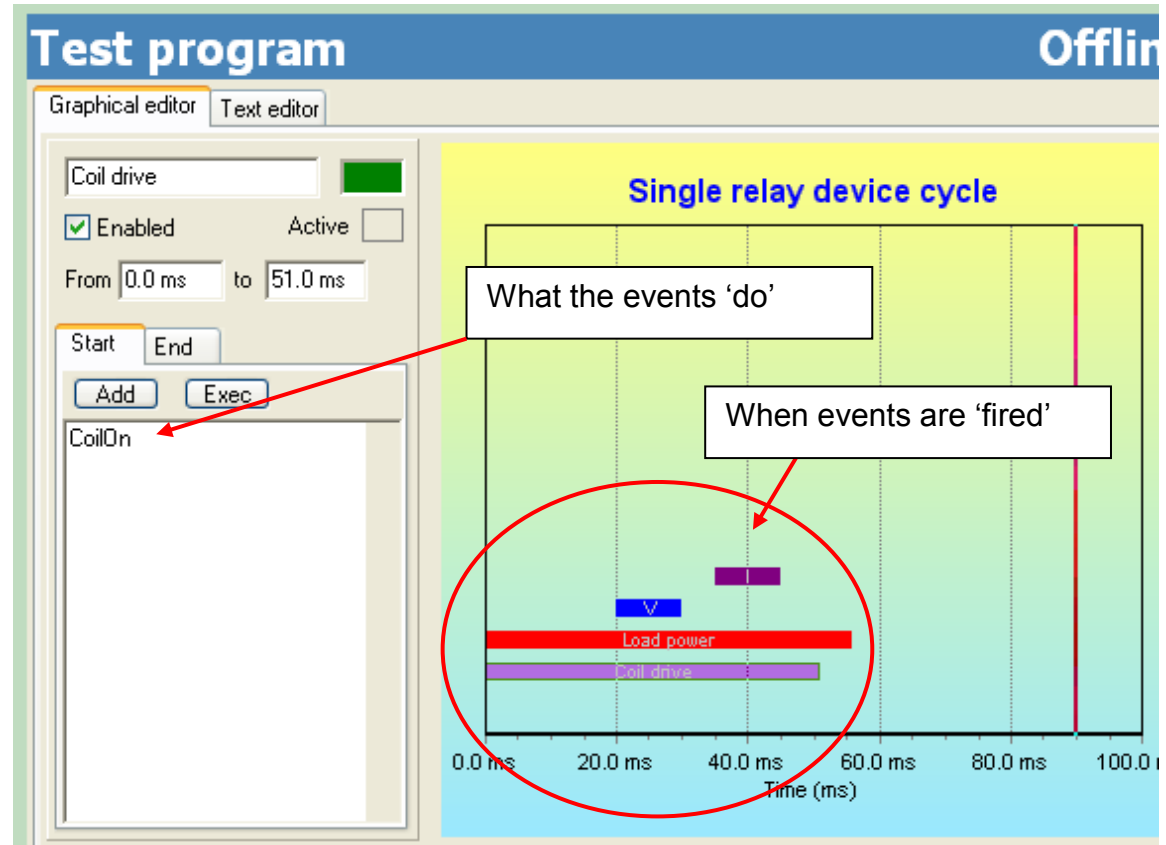
Coil and load dual switch

Contact load resistor

Fundamental programming principles – event based.



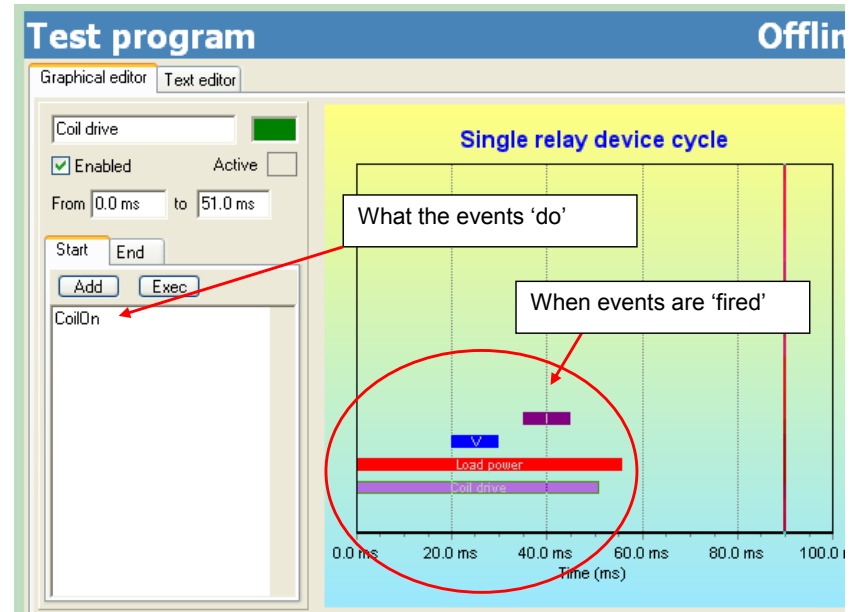
- ‘Time slots’ control the time positioning of events groups.
- Events control the actual hardware switching and measurement.
- The effect is much like a player-piano with punched music rolls.



A rich, multitasking command set.



Time	Command	Purpose
0 ms	CoilOn	Turn coil on
20 ms	VContactStart	Start contact voltage drop measurement
30 ms	VContactStop CR:=VContact/1.2	Stop contact voltage drop measurement and calculate contact resistance
50 ms	CoilOff	Turn coil off



The Reflex 51 test component range was born.



- A general-purpose control system core.
- A number of switch modules capable of a range of DC and AC switching.
- Measurement signal conditioning modules.
- Mechanical housing that would suit both rack-based and stand-alone implementations.

Reflex 51 system presentation is flexible – chassis or case.



The Reflex 51 system interfaces directly to the device environment.



Measurement signal conditioning module

High-power switching module



Isolated cabling to the measurement system

Flexible device interface module mounting.



- Behind chassis front panel
- Within chassis on standard fixing centres
- DIN-rail locally or remote
- DIY



Solid-state switches for coil and load circuit.



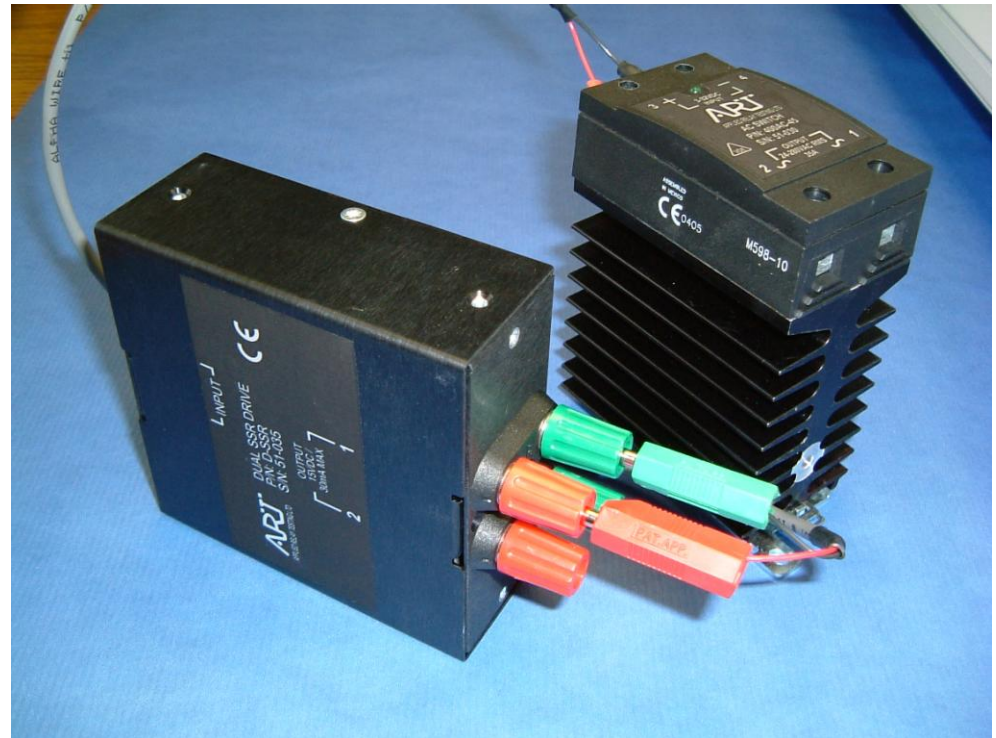
- Quad isolated switch in one box
- Up to 30A or 400V per channel
- Parallel to achieve up to 120A
- H-Bridge drive variants.



Very high switch powers using SSR or MOSFET module.



- Switch 'exciter' module designed to drive solid-state relays or MOSFET power modules.



Reflex 51 'kit' concept encourages fast test development.



- Portable control system.
- Switch and measure modules.
- Relay test bench.
- Just add a PC!



Event-driven software brings the hardware to life.



The screenshot displays a software interface for a test program. The main window is titled "Test program" and is currently in "Offline" mode. The interface is divided into several sections:

- View:** A top menu bar with "View" and "Offline" (with a red 'X' icon) and a clock icon.
- Operator:** A vertical sidebar on the left with icons for "Operator", "Result output", "Test hardware", "Test program", "Reporting", and "Inputs and switches".
- Graphical editor:** The central area shows a "Single relay device cycle" graph. The x-axis is "Time (ms)" from 0.0 to 100.0. The y-axis represents different signals. A red oval highlights the event-driven components: a blue downward arrow at approximately 30ms, a red horizontal bar for "Load power" from 0ms to 50ms, and a purple horizontal bar for "Coil drive" from 0ms to 40ms. A vertical red line is at 90ms.
- Control Panel (Left):** Includes a "Coil drive" status indicator (green), an "Enabled" checkbox (checked), and an "Active" checkbox (unchecked). It also shows "From 0.0 ms to 51.0 ms" and buttons for "Start", "End", "Add", and "Exec".
- Control Panel (Bottom):** Includes a "Clear" button, "Cycle 0 of 30,000", "Duration 50 min, 0 s", "Interval 1 of 1000", "Cycle 0 of 30", and "Duration 3 s". It also has "Stop", "Single tick", "Continue", and "Single cycle" buttons.
- Reporting:** Radio buttons for "Time", "Percentage", and "Tick index".

Annotations:

- A white box with the text "Events – eg 'CoilOn'" has a red arrow pointing to the "CoilOn" entry in the "Add" list below the graph.
- Another white box with the text "When events occur in the device cycle" has a red arrow pointing to the red oval on the graph.

At the bottom left, the status "Ready" is displayed.

Macro commands improve readability, reduce errors.



The screenshot shows a software interface titled "Test hardware" with a status of "Offline". The main area is "Execute commands". On the left, a sidebar contains icons for "Operator", "Result output", "Test hardware", "Test program", "Reporting", and "Inputs and switches Engineering".

The "Execute commands" section features a table of commands:

Command	Description
M CoilOn	Turns the coil on
Beep	Issues a beep
Delay(1.2)	Waits for a specified number of seconds (0.0 to 10.0)
DelayMS(100)	Waits for a specified number of milliseconds (0 to 10,000)
DelayUS(100)	Waits for a specified number of microseconds (0 to 10,000)
Halt	Halts command execution
HaltMsg("I've stopped")	Halts command execution with a message
PlaySound("tada")	Plays a sound file (Arg1)
Rand	Returns a simple random number in the range 0..1
RandG(1.0,0.01)	Returns a random gaussian number fr
Tone(1000,100)	Issues a sound of specified frequency
FPLED1.BlinkOff	Disables blinking for this panel led
FPLED1.BlinkOn	Enables blinking for this panel led
FPLED1.Green	Turns on the panel led green
FPLED1.Off	Turns the led off
FPLED1.Red	Turns on the panel led red

A red arrow points from a box labeled "Macro - 'CoilOn'" to the "CoilOn" command in the table.

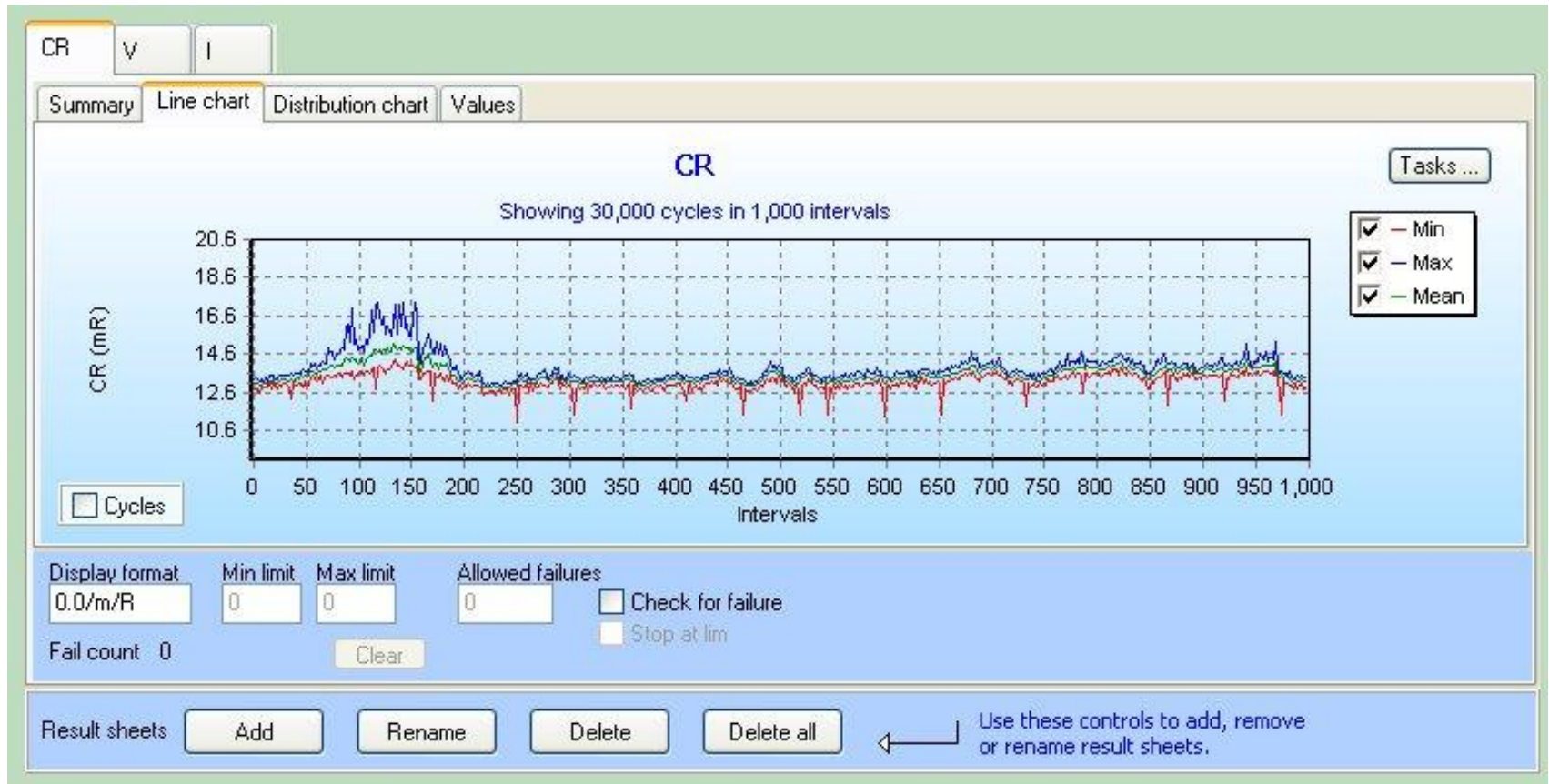
The "Workpad" section on the right shows a macro definition:

```
Name  
CoilOn  
Description  
Turns the coil on  
Commands  
Sw1_On  
FPLED1.Red
```

A red circle highlights the "Commands" section of the macro, with a red arrow pointing to a box labeled "Macro commands executed by 'CoilOn'".

At the bottom, there is a "Filter mask" field, a "Test command" dropdown set to "FPLED1.Red", a "Go" button, a "0.00000" display, an "Elapsed" field, a "Syn" button, and a "Save as macro" button.

Example result output sheet – line chart..



Example result output sheet – distribution chart.



Derived result parameters are powerful and free.



- If multiple measurements are already available, e.g. CRNO1 and CRNO2 then additional checks are possible for example on the difference $CRDiff = (CRNO2 - CRNO1)$
- This permits more detailed 'quality' checks during testing with no overhead at all.

Measuring other device parameters during life-test.



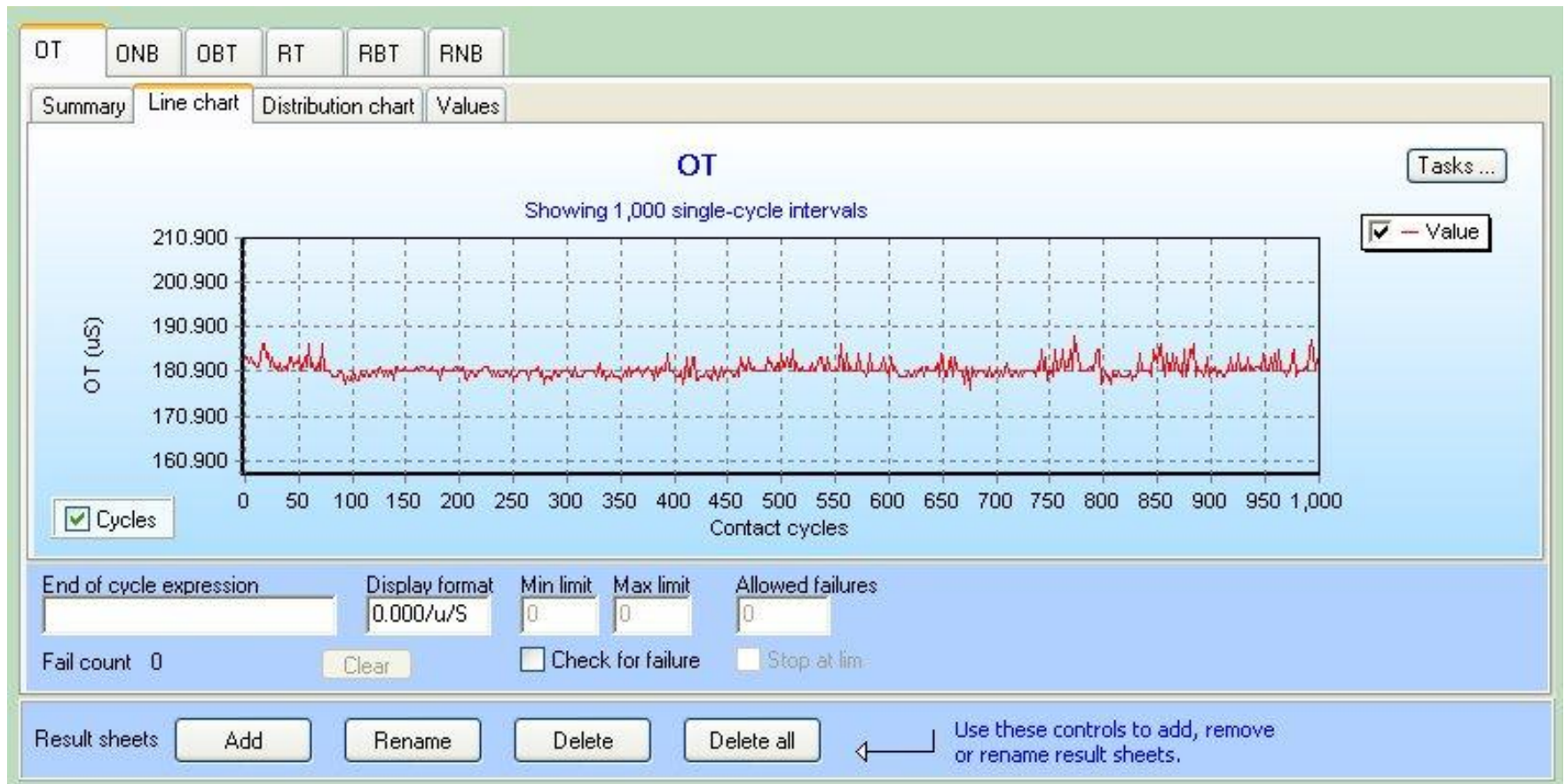
- Relay performance during life may show up in other measurements than contact resistance.
- Measurements of device dynamics (timing) and operate / release voltage is desirable.

Measurement modules available with:



- Measured time to the first contact edge (operate or release time).
- Measured time between the first and last contact edge (bounce time)
- Counted number of edges (bounces).
- These values can be mixed fully with other voltage measurements.

Measured operate time during life-test.



Measuring operate and release voltage during life-test.



- An operate and release coil-drive module can be used for interval tests of operate and release voltage during life.
- Results integrate perfectly as an additional result sheet.
- With timing measurement, device is now fully characterised during life.



To conclude..

- We have shown the new Reflex 51 test architecture that uses compact, re-usable low-cost modules that can be built into a variety of test solutions.
- Parametric testing can now be fully integrated within life-tests.
- Life-testing is now possible at very low cost to exactly your requirements for switch and relay testing.

