



User Manual

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2 INTRODUCTION

SCRLogic is a software simulation package for training rig electricians to troubleshoot SCR systems which pre-date or have no PLC logic control.

Although it is based on a Hill Graham Controls land rig, the control philosophy is almost identical to Ross Hill and systems, and the fault-finding techniques learned by using the software can be applied to a whole range of equipment.

The software is built of two parts: the graphic representation of the system equipment, and a mathematical simulation of the analogue circuits. The student can probe terminals on the simulation screens and measure the voltage at each point. Faults can be applied to the circuit, which then allows the student to practice identification of faults by understanding the schematics and the observed measurements.

Faults can be introduced manually or from a pre-defined timed sequence of events controlled by a script running in the background. Scripts can be customised and saved and can create complex scenarios which will test the abilities of the most experienced technician.

The simulated system contains four SCRs, dual motor Drawworks, a Rotary Table and two parallel-motor Mud Pumps. Access is available to all four SCRs, the Drillers Console and Foot Throttle, blower MCC starters and the motor terminal boxes. Note that SCRLogic incorporates no generator control logic because the system complexity lies with the DC Motor and Auxiliary control circuits.

This program assumes that the user understands what an SCR system is, what it is used for and how it works, and is familiar with the terminology associated with a drilling rig. However it could be used as a training aid to introduce SCR systems to electricians from an industrial or domestic background.

3 INSTALLATION

The software is available as a free download from the Contrelec web site.

The software has complex calculations to perform to simulate the analogue circuitry, so a Windows (version 7 or later) PC with plenty of memory (at least 4Gb) and a powerful CPU will improve the user experience. The software will run on 32-bit machines, but these may experience memory problems due to memory fragmentation, so 64-bit is recommended. A mouse with a scroll wheel is required.

To install the software download the installation file from this link:

<http://www.contrelec.co.uk/pages/scrlogic>

This installs a demo of the version which has some features restricted (most notably scripting and a limited number of faults) and will time out after 20 minutes of use. To unlock all the features a full license is required.

4 LICENSING

A license can be purchase in one of two ways:

PURCHASING ON-LINE:

If this machine is connected to the Internet click the BUY LICENSE under Help→Enter License in the program and complete the payment details. Follow the payment instructions and, once complete, copy and paste the License File into the box provided under Help→Enter License. Click LICENSE to store the license.

PURCHASING OFF-LINE:

If this machine can not connect to the Internet copy the Machine ID from Help→Enter License.

On a machine which is connected to the Internet follow this link:

<http://www.contrelec.co.uk/pages/scrlogic-buy>

and follow the payment instructions. Copy and paste the License File into the box provided under Help→Enter License. Click LICENSE to store the license.

Restart the program to complete the licensing process.

5 QUICK START

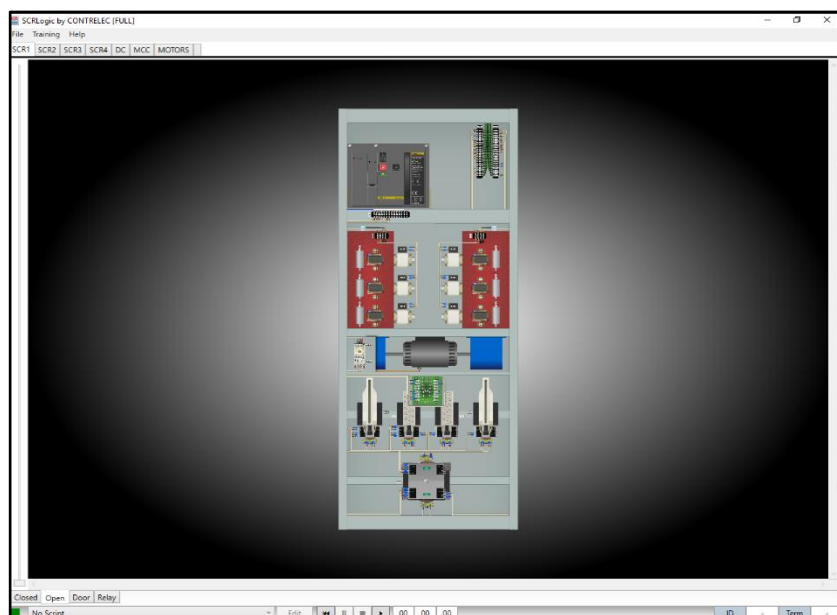
5.1 General Operation

On start-up the opening screen looks like this:



This shows SCR1 with the door closed.

Below the top menu bar are 7 tabs corresponding to the equipment which can be accessed. Below the image are tabs which reveal various views associated with the equipment. So to look inside SCR1, click OPEN:



Now the SCR internal components are revealed.

The view can be zoomed in using the mouse wheel or by clicking and dragging the slider to the left of the display.

To look at a particular part of the equipment click and hold down the left mouse button and drag the view.

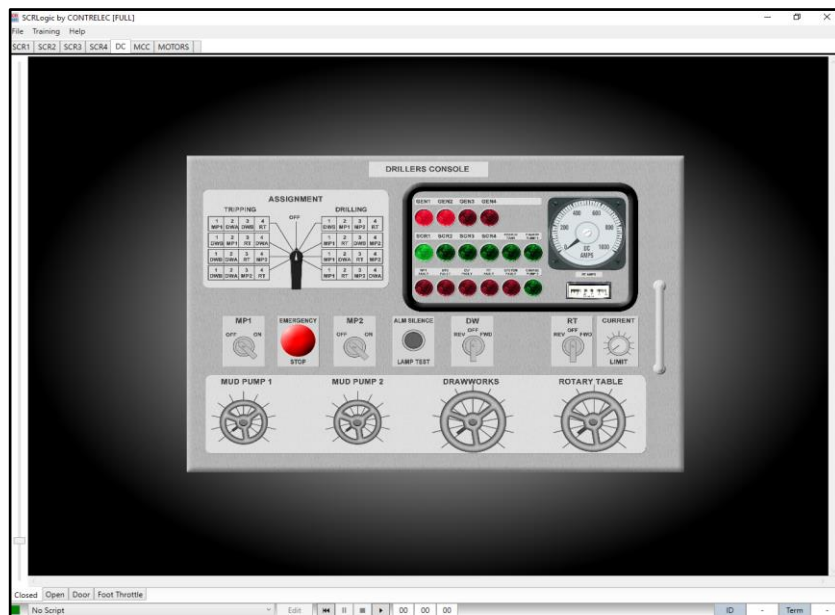
To control an item, such as closing a circuit breaker or operating a switch, the CONTROL key is used. To operate a pushbutton hold down the control key and left-click on the button. So to close the SCR circuit breaker zoom into the circuit breaker, hold down the CONTROL key and click the I button. The circuit breaker will be heard to close, the blower will start and the SCR ON indication on the SCR door and Drillers Console will light up.



TIP

To turn off sounds check the box Training→Sound Mute.

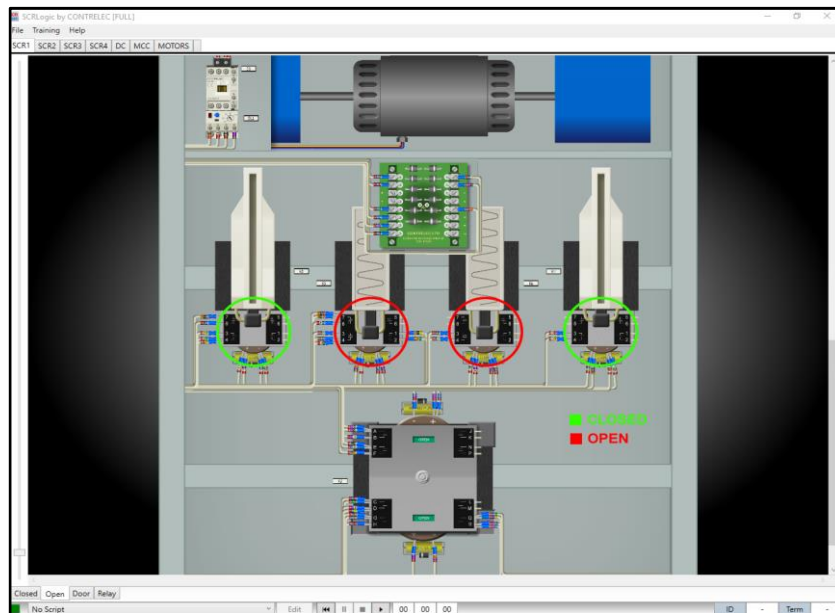
Navigate to the Drillers Console using the tabs at the top of the display:



SCR1 can now be assigned to Mud Pump 1. The assignment switch is operated by holding down the CONTROL key and moving the mouse wheel up or down to move the switch anti-clockwise or clockwise respectively. Turn the assignment switch to a position which assigns SCR1 to Mud Pump 1.

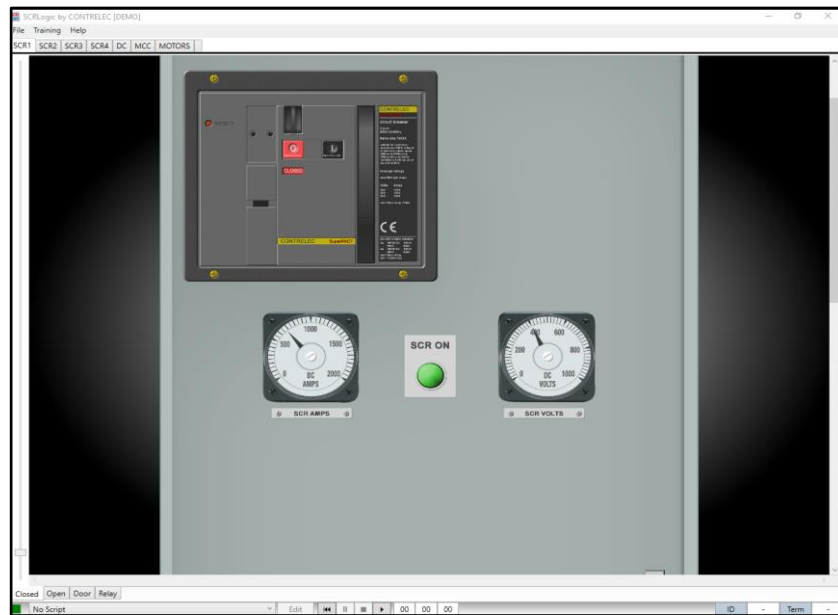
Next, move the mouse over the MP1 OFF-ON selector switch. Hold down the CONTROL key and flick the mouse wheel up to turn the switch to the ON position. You will hear the blower MCC contactors close followed by the main SCR DC contactors.

Navigate back to SCR1 (Open) by clicking the SCR1 tab at the top of the display (and the OPEN tab at the bottom if not already selected). The Mud Pump 1 contactors (K2 and K7) can be seen to have closed as opposed to K1 and K6 which are open because the bar in between the auxiliary contact blocks has lifted.



Note that the reversing contactor below (K5) has additional indicators for open and closed which don't exist on the real thing. These have been added in the simulation because it is difficult to see which way this contactor is closed on-screen. This is one of several modifications which have been made to the appearance of objects to make working the simulation easier but in general every attempt has been made to keep the component images as true-to-life as possible.

Navigate back to the Drillers Console (Closed) screen. Place the mouse cursor over the Mud Pump 1 hand throttle. Hold down the CONTROL key and flick the mouse wheel up, and the handwheel begins to turn. As the handwheel passes the first scale mark the hand throttle microswitch will be heard to click, and Charge Pump 1 will start. Continue turning the hand throttle up to about half way.



Navigate back to SCR1 (Closed) and note that the front panel SCR Amps and SCR Volts meters are indicating that the Mud Pump is running.

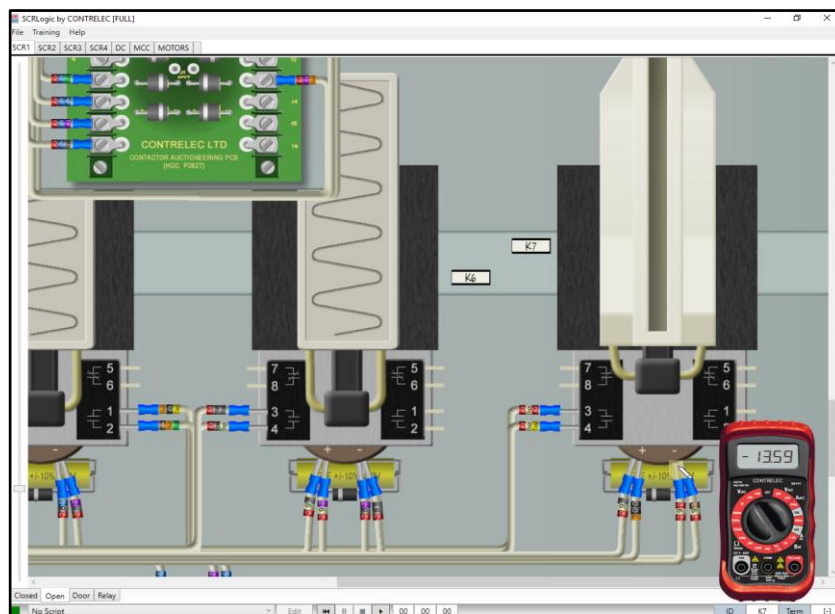
5.2 Fault Finding

An essential part of troubleshooting is to be able to measure voltages at various points in the circuit. Zoom up on K7 and place the mouse cursor over the negative contactor coil connection.

The connection will highlight and the mouse cursor will change to a probe. In the bottom left hand corner of the screen the ID box will show K7 and the Term box will show [-] indicating that the terminal is K7-.

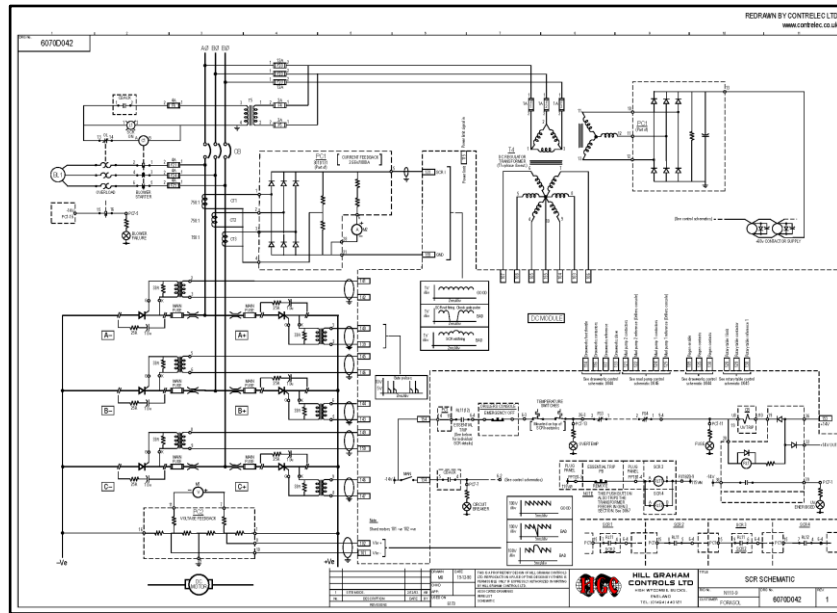
Click and hold the mouse right-hand button and a meter pops up showing the measured value. The meter is auto-ranging and auto-sensing, so will automatically switch range and AC or DC. Release the mouse button and the meter stays in place.

To make it disappear and re-appear on every probe check the Training→Auto hide meter option on the main menu. Probe the other terminals to get a feel for how this works.



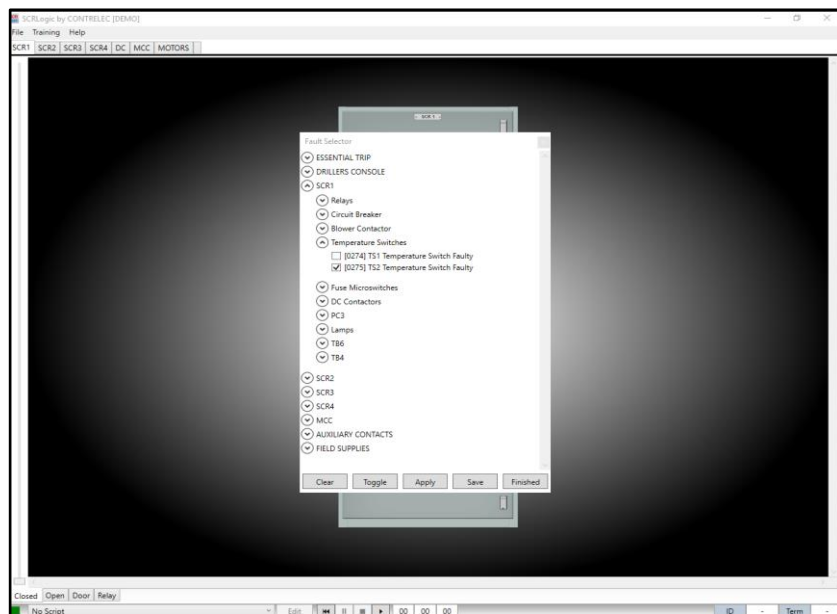
Now let's try some fault-finding.

To troubleshoot the simulation you will need some schematics. Select Help→Schematics to open up the system drawing book, which is a PDF file which can be printed off for easier working (A3 recommended). The drawings are reproductions of the original system drawings for this project. Open the drawing book at drawing 6070D042 SCR Schematic.



Follow pin 154 of the DC Module (the DC Module appears on the Door tab, bottom of screen) through to the circuit breaker UV coil and probe each point. Everything to the left of the UV coil should be around -14VDC, and everything to the right will be about +14VDC.

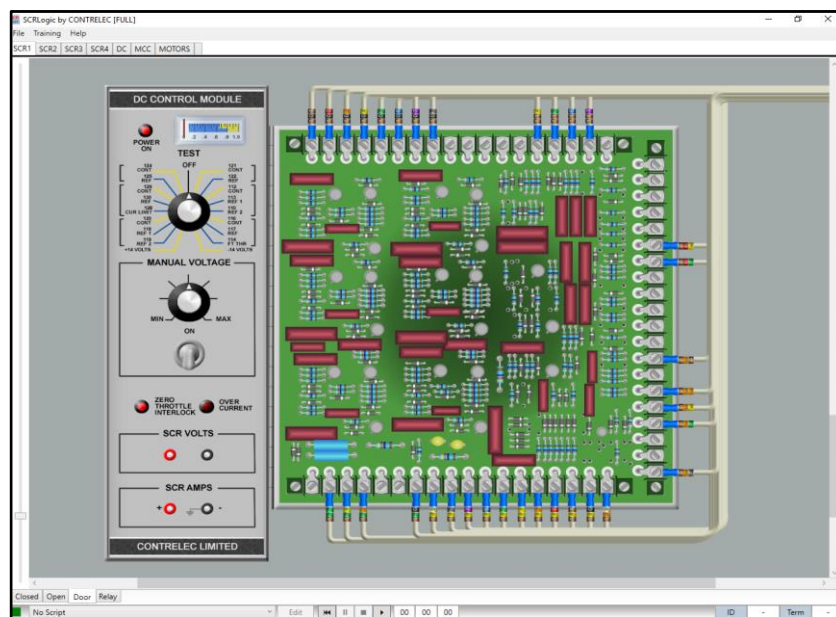
Select Training→Fault selector, expand the SCR1 tab, then Temperature Switches. Check the TS2 temperature Switch box then click Apply. SCR1 circuit breaker will trip. Close the fault selector window by clicking Finished.



Follow pin 154 of the DC Module through to the circuit breaker UV coil and notice when the voltage changes from -14VDC to +14VDC. This will be at one of the temperature switches. Try and close the circuit breaker – it won't close because the voltage either side of the UV coil is +14VDC.

The fault can be cleared several ways, but this time click Training→Fix fault, expand SCR1 and Temperature Switches. Click the TS1 box and click Fix. The system will tell you that the wrong fault has been identified. Repeat the process but this time select the correct fault.

Once fixed, SCR1 circuit breaker can be closed again. Once the breaker is closed the main contactors will close, but Mud Pump 1 will not run. Navigate to SCR1 (Door) and notice that the Zero Throttle Interlock is lit, and the SCR will not run until the Mud Pump 1 hand throttle on the Drillers Console is returned to zero, just like the real thing.



Note that all the DC Module front panel controls work, including the diagnostics meter and switch and manual control. The module itself is one of the components which is represented graphically in a way which makes working the simulation easier.

Using the manual fault setting facilities a supervisor can guide a student through the fault finding process. The scripting facility allows simple or complex scenarios to be prepared. Scripting is only available with a FULL license.

5.3 Additional Tips

Please read through these notes:

Moving Between Locations

When fault-finding remember that moving between the Drillers Console and the SCR room is quick in the simulation, but a lot slower in real life. Practice your fault finding with this in mind.

Drillers Console Assignment Switch and Pots

The Drillers Console (Door) screen shows the assignment switch and hand throttle potentiometers 'stacked'. The hand throttles have front and rear pots (and microswitches), so to access each one CONTROL-click the FRONT/REAR selector adjacent to the pot. Note that the pots can be rotated from the rear as well.



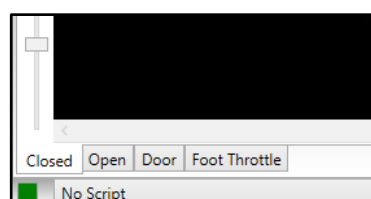
Similarly the assignment switch has 4 decks (one for each SCR) and these are selected by CONTROL-clicking the corresponding selector. The assignment switch has also been graphically flattened to make accessing the terminals easier in the simulation

Drillers Console and MCC Pushbuttons

Unlike the circuit breaker pushbuttons, these require a CONTROL-click to set and a CONTROL-click to release. This is to allow fault finding to be done with the button pressed.

Processing Indicator

In the bottom left-hand corner of the screen is an indicator showing the status of the simulation. During normal operation the indicator flashes green/grey, but if the simulation fails it will turn red, and may require a program restart.



Certain operations, such as assigning the Drawworks, involve complex recalculation of the circuit, and (depending on computing power) the indicator may be greyed out longer than usual and controls may not respond for a short while.

Multiple Faults

Take care when introducing multiple short-circuit faults. The simulation can be forced into an unresolvable configuration when power supplies are short-circuited together.

Fault List

A complete list of available faults can be obtained for reference by selecting File→Print Faults. Note that the number of faults available under a DEMO license is limited.

6 SCRIPTING