Sequencer
Software Manual

Schap Specialty Machine, Inc

http://www.schapmachine.com/
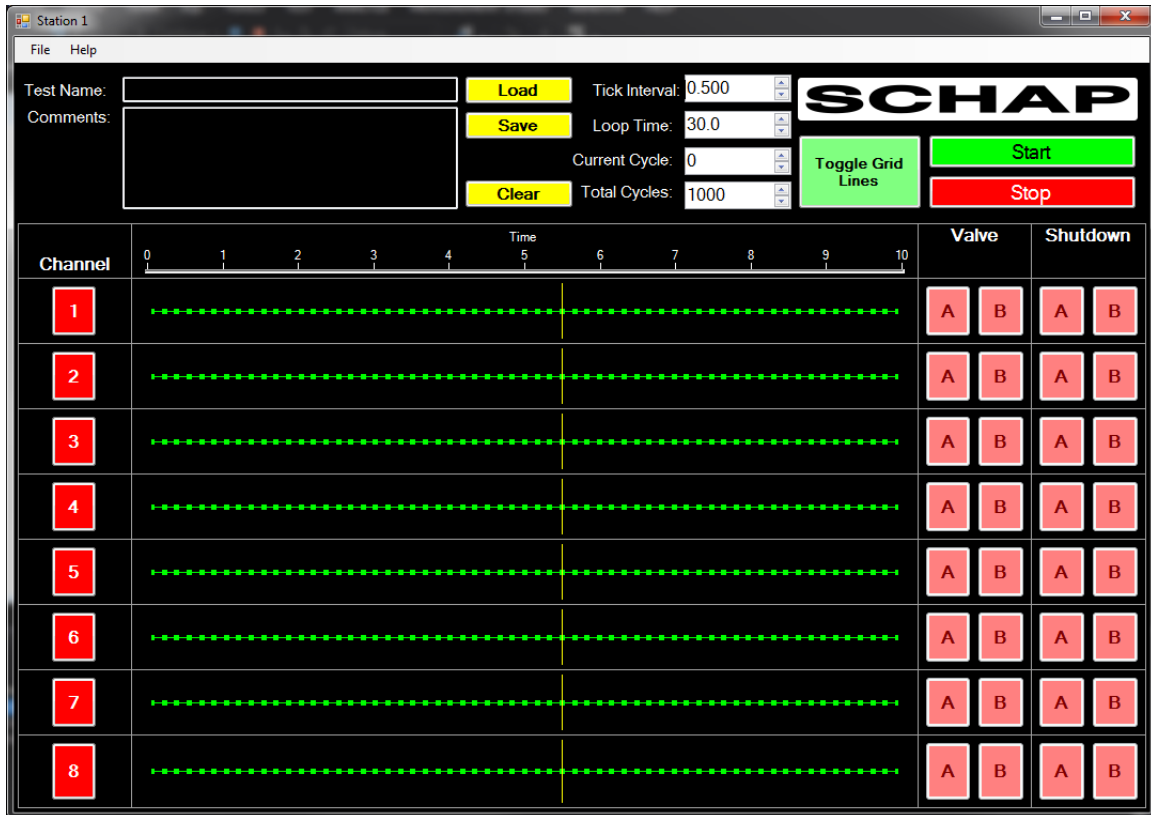
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Introduction

The 8 Station Pneumatic Sequencer is a simple machine for on-off control of pneumatic devices. It uses easy click-and-drag programming to control the status of the integrated valves at regular intervals in a repeating sequence.

During the test the displacement of the cylinder is measured and displayed (3 of 9 cylinders) on the same graph as the load. This allows determination of displacement at any specific load via the software provided.

All data can be saved for later re-use or recovery including test parameters, actual loads, actual displacements, operator information, and any comments. Binary data files are automatically saved after every test and can be recalled into the software. It is also possible to generate PDF and .csv reports.

Equipment

Connector, Shut-Off Valve, Filter, and Pressure Sensor
Air is provided to the tester by a standard 3/8" male quick-disconnect. This fitting is attached to a shut-off valve, which can be closed by pressing down on the yellow plunger, or opened by lifting the plunger. This shut-off valve is attached to a 5-micron filter. This filter has a sight glass to see the level of accumulated water, and a manually-actuated drain to remove the water. After these elements, the air supply is connected to a programmable pressure sensor, which the software uses to check whether air pressure is available, and to the valve pack.

Pressure Sensor

To run tests with just a minimum pressure limit for channel 1 some things have to be done to the pressure sensor. First hold the set button for 2-3 seconds until the screen changes to the Quick Setup Mode if you hold it too long it will go to Pro Setup Mode and to get back to Run Mode (normal) hold the set button for 2 seconds. Once in Quick Setup Mode make sure that ot1 is in EASY mode if not use the up and down arrows to set it. Next hit the set button twice and make sure that the noC is in 1C2o mode if not use the up and down arrows to set it. Then you have to press the set button two more times and make sure that CLr is in r-on mode. After that you have to hold the set button for 2 seconds to go back to Run Mode, and once in run mode you have to hold the set button for 4-5 seconds until the screen changes to Pro Setup Mode. Once in Pro Setup Mode you have to press the set button four times and make sure that dPy is in oUt1 mode. Finally you have to go back to Run Mode by holding the set button for 2 seconds then you can set the 1-P value to your desired minimum pressure value and then you are all set to run tests. For more complex setups please refer to the pressure switch instructions at the URL: http://cdn.automationdirect.com/static/manuals/prosense/prosense_qps.pdf , or contact Schap Specialty Machine, Inc.

Valve Pack
The valve pack contains eight valves with independent regulators. The maximum air pressure is 150 psi. The valves are direct-acting; there is no minimum pressure required.

The valves have a flush, non-latching manual override, which can be used to check the plumbing when the software is not in use. To use the override, press the silver button on either side of the valve. A small tool may be required to depress the button fully. The valves also have solenoid status LEDs just above the override, which can be used to check that the software is actuating

the valve correctly. If the LEDs do not light, check the status of the emergency stop and air pressure sensor.

The output pressure can be adjusted with the integrated regulators and monitored on the provided pressure gauges. The pressure regulator adjusts the output pressure of both the A and B ports simultaneously.

To adjust the flow rate, flow controls should be installed on the pneumatic cylinders, because flow controls work best when mounted as close to the cylinder as possible. No flow controls are provided on the valve pack.

Limit Switches

The tester has 16 M12 connectors for limit switches on the front panel. These connectors provide 24V power on pin 1, ground on pin 2, and an input on pin 3 which can be used to stop the test on errors or maintain a step until the limit switch status changes.

Computer

The computer provided contains a fourth-generation Intel Core i3 processor, 4 GB of RAM, and a 128 GB SSD. The front panel includes USB ports for importing or exporting tests and data, though the sequencer does not produce very much data. The PC also contains an NI PCIe-6509 DIO card, which is used to control the electrical systems. This system is designed to provide fast input and output data response such that updates to the software occur every 100 milliseconds. It is also designed for low-power operation, typically requiring less than 30 watts for the PC and less than 20 watts for the display. An industrial rackmount enclosure is provided for filtration and cooling.

Software

The software provided is Schap Specialty Machine, Inc.'s Windows 7 8-Station Pneumatic Sequencer. This software was written with NI's Measurement Studio libraries and .NET code. Source code is not included in the system but can be modified by Schap Specialty Machine, Inc. as necessary. If the machine is connected to the Internet through the Ethernet connectors in the rear of the console, support or upgrades can be performed remotely through the installed TeamViewer software.

The software provided allows the user to set up tests, load tests, and run tests on any of 8 virtual stations.

Virtual Stations

The tester has 8 valves. However, most tests do not require 8 valves. Therefore, virtual stations are provided to allow the single physical test controller, or station, to be treated as up to 8 separate virtual stations.   These virtual stations can be configured to run completely

independently, creating, loading, saving, and running tests on one station, while another station continues to run a test without interruption.

Setting Up a New Test
The following steps detail the creation of a new test.

1. Turn on the main power to the tester.
2. Turn on the computer.
3. Initiate the software on the computer by double-clicking the icon in the middle of the desktop that says "Schap Sequencer".
4. Select a virtual station by clicking on the station name.
5. Set the tick interval and loop time to the desired values. The default values of a 0.5 s tick interval and 10 s loop time are appropriate for many pneumatic systems. Also enter the total number of cycles desired.
6. Select an available channel by clicking on the "Channel Enable" button in the left column. The Channel Enable button will change from red to green, showing that it is enabled. If the channel is in use on another virtual station, this button will be disabled and the channel cannot be modified.
7. Click on the channel graph to program tick points. Click and drag to enter multiple points quickly. Double-click to change the point type between a normal tick, wait-for-limit tick, and an error-on-limit tick.
8. If desired, select one or both of the "Shutdown on Limit" buttons. This will cause the tester to stop the test if a limit switch is sensed. Repeat steps 6-8 for all desired channels.

The test is now ready to run. If desired, save the test so it can be used in the future using the Save button or File>Save Test menu item.

Running a Test
Running a test with this machine is very simple.

1. Create the test as described above or load a test with the load button or File->Load Test menu item.
2. Check that air pressure is present and that the control power button is on.
3. Check that the current cycle and total cycles counters are set to the appropriate values.
4. Check the pressure measured by the pressure regulator. Adjust if required.
5. Use the manual enable buttons to check that the cylinders are moving as required. If necessary, move the channels, adjust the pressure, or adjust the limit switches as required to achieve the required profile.
6. Click the "Start" button.

Other Station Features and Test Settings

Channel Enable button
The Channel Enable button is used to enable the channel on the current virtual station. The button will change from red to green when clicked, and the channel can be turned off by clicking the button again. If the channel is in use on another virtual station, this button will be disabled and the channel cannot be modified.

Move Channel Dropdown
The Move Channel dropdown is directly below the Channel Enable button. If a cylinder is moved to another valve, or a test is loaded with a channel profile that is currently active on another virtual station, this dropdown can be used to move the channel profile to another channel. This exchanges the graphical tick data and shutdown on limit states with the selected channel. If a disabled channel is moved to an available channel, the data of the available channel is not copied; a disabled channel will get all tick points and shutdown on limit settings in the default states.

Entering Tick Types
There are three types of tick points:

- Normal, green tick points simply actuate the solenoid to one of three positions. In the center position, both the A and B ports are vented. In the "up" direction, the A port is pressurized and the B port is vented. In the "down" direction, the B port is pressurized and the A port is vented. The valve simply goes to the programmed position and then proceeds to the next tick point at the normal tick interval.
- Wait for Limit blue tick points pause the test across all channels until the associated limit switch changes its value. This tick type is useful for verifying that a cylinder has completed a programmed move. This tick type is not applicable to the center position.
- Fault on Limit red tick points generate a test error and stop the test if the limit switch is sensed. This is useful for checking that a latch mechanism activated by another channel is working correctly. For general overtravel sensing, it is easier to use the channel shutdown options, which essentially apply this tick type to the full duration of the cycle. This tick type is not applicable to the center position.

Valve Limits buttons
The valve limits buttons have two functions: They indicate the status of the limit switches, and they manually move the cylinder associated with the channel. The channel must be enabled on this station for these features to work.

They indicate the status of the limit switches by changing color. When the limit switch is inactive, they are red, and when it is sensed, they are green.

They can be used to move the cylinder by clicking the button to toggle the position of the valve. Note that the valve cannot move in both directions simultaneously. If desired, they can also operate in a push-and-hold mode where they will turn off when the mouse button is released. This is selectable in the Machine Settings dialog.

Shutdown on Limit

The shutdown on limit setting is configurable for each direction of each active channel. It stops the test if the limit switch is detected at any time, even when the valve is in the neutral positon. This is useful for checking that the device under test has not failed.

Tick Interval

The tick interval controls the granularity of the steps in the test. The tick interval must be a multiple of 100 ms or 0.1 seconds. Note that the tick interval does not guarantee that a motion will be completed in the programmed time, only that the solenoid will be enabled for the programmed time.

Loop Time

The loop time controls the duration of the cycle. The cycle will start over at the beginning when the loop time is exceeded.

Total Cycles

The total cycles is the number of times to repeat the cycle to complete the test.

Clear button

The clear button resets the station to a default state, removing the entered test settings. Be sure to save before using this button!

Toggle Grid Lines

The Toggle Grid Lines buttons can be used to add vertical grid lines to the graphs to more clearly show the times at which various points occur.