AUTOMATICS

Simplifying pneumatics

Control pneumatics PLUS

CP4957

MATRIX
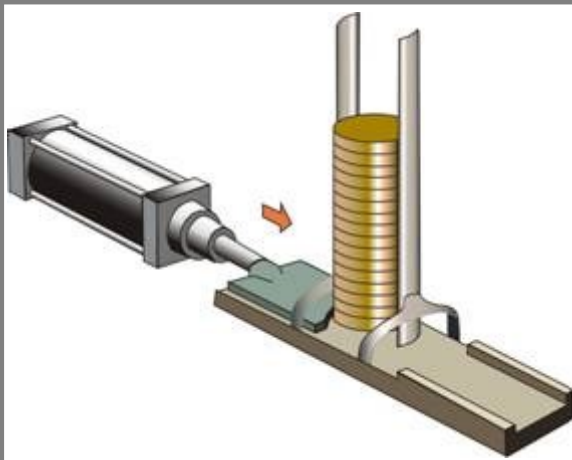www.matrixmultimedia.com

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Magazine feed

In automated production, it is often necessary to feed blanks into the process from a store, known as a magazine.

Pneumatics offers a reliable and speedy way to do this, as the diagram illustrates. A single-acting cylinder pushes a new blank onto the conveyor belt, and then retracts.

This worksheet examines how an electronic control system can automate this part of the process.

Over to you:

- **Read the safety rules given on the next page before you start.**

- **The red lever on the manifold must be turned off at this stage.**

- Build the arrangement shown on the next page. Compare the physical and pneumatic circuit diagrams, as you do so.

    - Clamp a switch and a 3/2 solenoid valve to the platform.

    - Add a flow-control valve, to restrict flow in the direction shown by the arrow.

    - Make the following electrical connections:
        - power panel - red to MIAC V+ and black to MIAC 0V;
        - switch - red socket to power panel red and black socket to MIAC input 1;
        - solenoid valve - positive to MIAC output **C** and negative to power panel black.

- Plug in the power supply (12V), and switch on.

- Turn on the air supply.

- Next, create and transfer the controlling program 'Program 2A' to the MIAC. Instructions for doing this start on page 11.

- The switch represents a safety device:
    - It could ensure that a cover is in place over the machinery.
    - It could be a 'dead-man's handle' (emergency stop button) which stops the process unless the operator keeps the switch pressed.

- Press and hold down the switch. The cylinder extends and retracts repeatedly, governed by the time delays built into the program. This is described later.

- Adjust the flow rate with the flow control valve so that the cylinder extends fully, within the time allowed, but does so at a moderate speed.
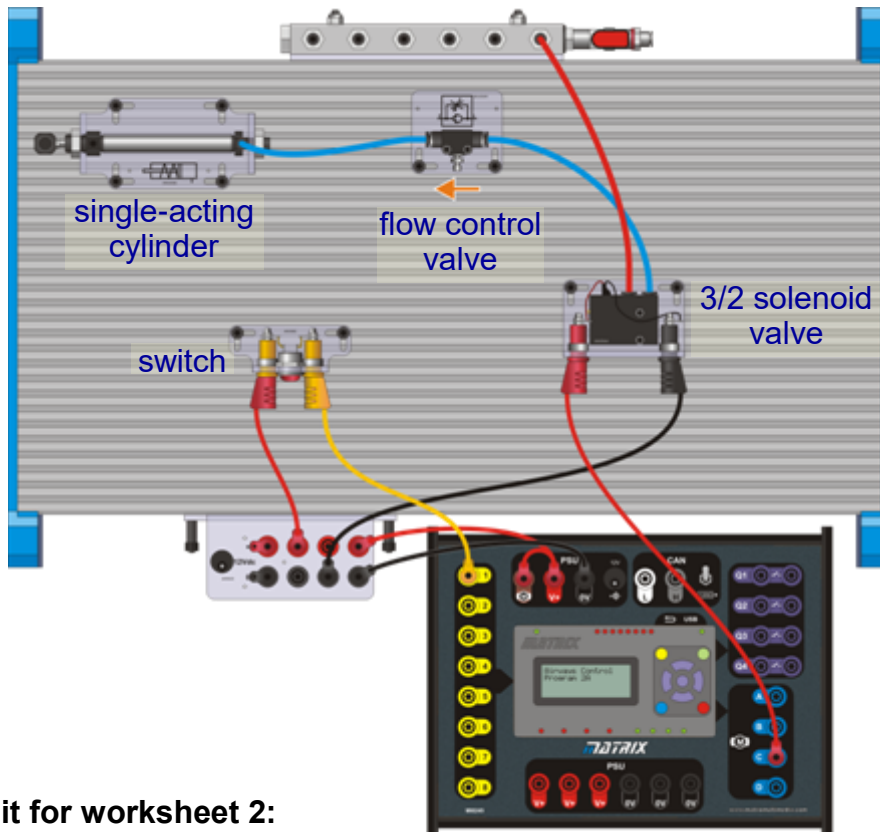
Worksheet 2
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Layout for worksheet 2:

single-acting cylinder

flow control valve

3/2 solenoid valve

switch

Pneumatic circuit for worksheet 2:

| single-acting cylinder | flow control valve | 3/2 solenoid valve |
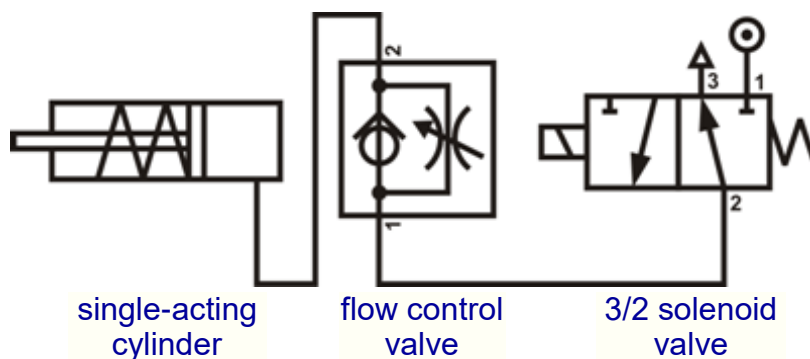
Worksheet 2
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Over to you:

**Overview of Program 2A:**

The program is similar to that used in worksheet 1, except that the light sensor is not needed. There are two delays, one to allow the cylinder to extend fully, and one to delay the next blank until the production process is ready for it.

The sequence is:

- check whether the switch is pressed;
- if it is, switch on the control valve;
- wait while the valve extends (1 second);
- switch off the control valve;
- wait until the process needs the new blank (3 seconds);
- go back and start the sequence again.

Creating program 2A:

- Open the Flowcode program.
- Select 'Create a new Flowcode flowchart...'
- In the 'Project Options, Choose a Target' dialogue box, select 'MIAC' and click 'OK'.
- A flowchart window appears. In it, drag and drop a loop icon.
- Inside this loop icon, add:
  - a component macro,
  - then, a decision icon with, in the 'Yes' loop:
    - a component macro,
    - a delay,
    - a second component macro,
  - and finally a second delay icon.
- The flowchart should resemble the one opposite:
- Next, add a MIAC icon to the panel area, by clicking on 'MIAC' under the 'Misc' tab.
  (If the panel is not visible, click the 'View / Panel' item.)
- The next step is to configure the icons.
- First, create a new variable - switch, as a byte variable.
  You can do this by clicking on the down arrow which appears when the cursor is next to the 'Variables' label in the 'Edit / Variables...' dialogue box.
- Configure each icon by double-clicking on it and then modify it to match those shown on the next page.
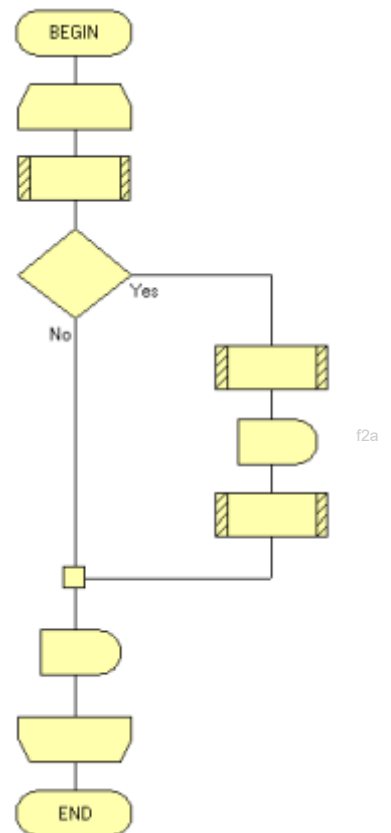
Worksheet 2

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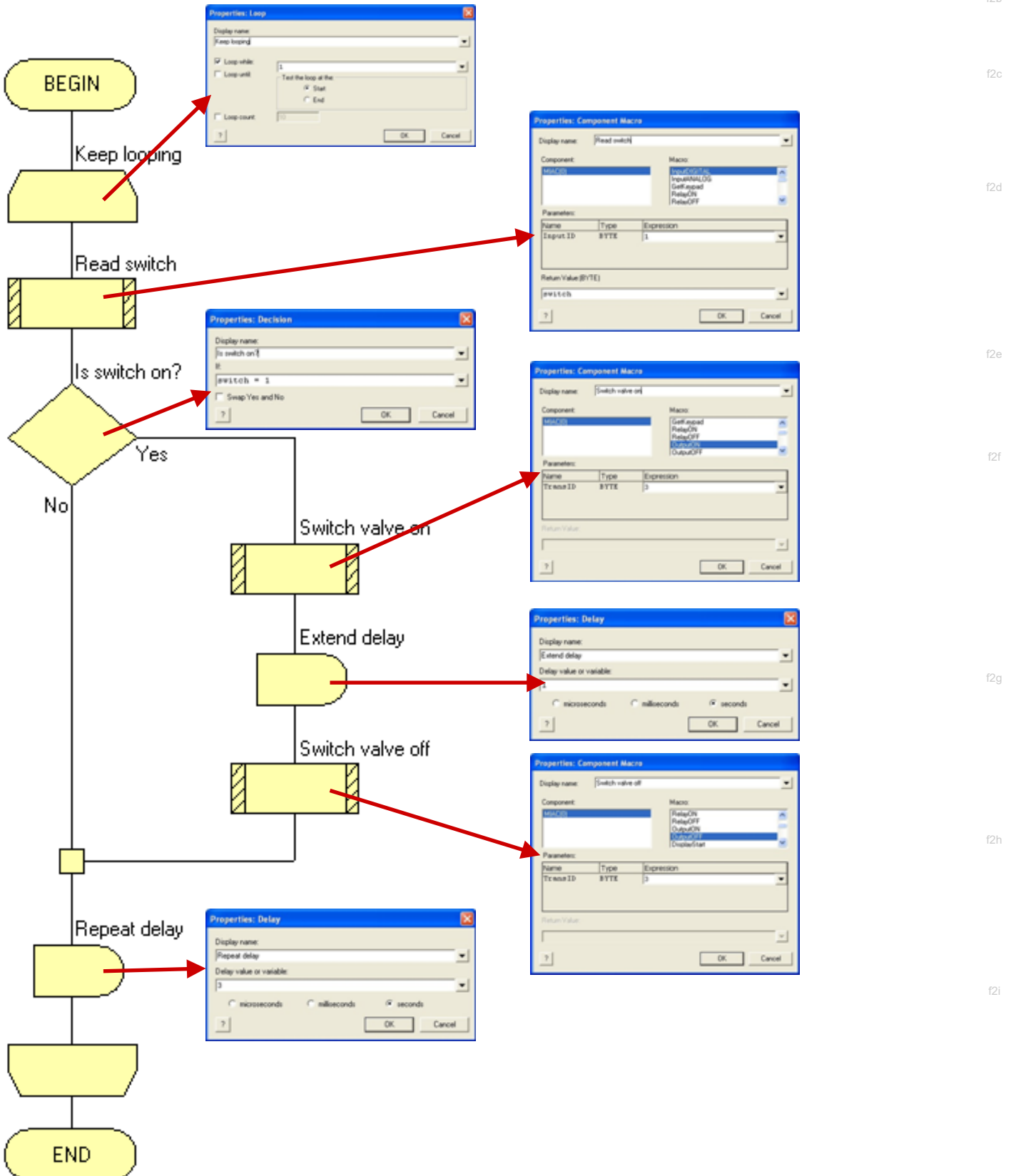
Over to you:

Over to you again:

Save and transfer program 2A:

- Save your program as 'Program 2A'.

- Connect the USB port of your computer to the MIAC USB port.

- Transfer the program to the MIAC by clicking on 'Build / Compile to Chip...' option.

- The system is now ready for testing, following the procedure described on page 9.

A modification:

The processing company may want a limited run on a particular commodity. The program you just developed keeps running as long as the switch is pressed.

A modification to this, Program 2B, will loop back only ten times, causing only ten blanks to be processed.

- The only change needed is to the way the loop is configured. This is shown in the diagram opposite:

- Save the modified program as 'Program 2B', and transfer it to the MIAC as described above.

- Test it by pressing and holding down the switch. The cylinder now extends and retracts only ten times. The microprocessor keeps a loop count, and only carries out the looping ten times.
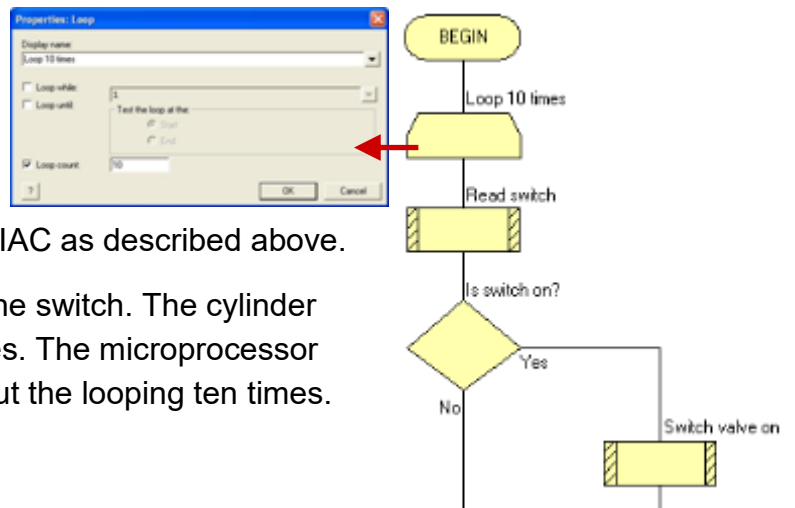
For your records:

- Copy the flowchart for program 2B, given above.

- Explain the function of each icon in the flowchart.

- Which icon would be modified to:

    - make the process repeat 20 times;
    - increase the time between the cylinder extending and retracting;
    - increase the time between process cycles.

- How would you make the cylinder extend more quickly?

Tutor's notes

Worksheet	Notes for the Tutor	Timing
1	The worksheet introduces the MIAC controller, and demonstrates its role in operating control valves in response to signals from input devices. It also revisits the method used to attach components to the Automatics platform. In carrying out the assembly, students should consult the MIAC diagram, and the component layout on page 4. The next page lists features of the device. In particular, students should be aware that LEDs monitor the MIAC inputs and outputs, and are reliable indicators of the progress of the 'program running on the MIAC. Page 5 onwards provides an overview of this program, and details of how to create and configure it. No previous knowledge of Flowcode programming is required, though some reassurance and help from the instructor may be needed.	**40 - 60 minutes**
2	This worksheet starts with the safety rules for pneumatic circuits. Instructors should emphasise their importance and enforce them strictly. The task involves setting up a reciprocating cylinder. The action is initiated by pressing a switch, though it is pointed out that, in practice, this may be an emergency stop button, attached to a safety guard, for example. Page 10 shows two diagrams - the physical component layout and the pneumatic circuit diagram. Students should take time to relate one to the other. Later worksheets will offer only the pneumatic circuit diagrams, and so the student must be adept at interpreting these. The instructor should stress that the circuit diagram is an abstract representation, that does not reflect the actual position of the components on the platform, but only the connections between them. Students should be encouraged to make the layout clear by using coloured pipes. In particular, it is a useful convention to use red pipes in all connections to the manifold. Page 11 gives an overview of 'Flowcode' program 2A. It contains an infinite loop, making the sequence repeat indefinitely as long as the switch is pressed, a 'component macro' to copy the state of the switch into a variable, a decision box that uses the value stored in that variable to check whether the switch is pressed or not, two further 'component macros', to actuate the control valve that extends the cylinder, and to actuate the valve that retracts it, and two delays, that cause the controller to make no changes until these have expired. Again, students are given detailed instructions on how to create, save, transfer and test this program. Program 2B modifies this behaviour by re-configuring the loop to cycle only ten times. This is shown on page 13.	**50 - 70 minutes**