

Agilent
U2100A Series USB Digital I/O

Automated Handler Machine for Test Systems

Application Note



Abstract

Digital inputs and outputs are used in industrial machines for control and automation purposes. This application note describes how you can incorporate Agilent's U2100A USB digital input/output (DIO) device in an automated handler machine for a test system. The following description explores how you can interface various sensors and actuators with different parts of such an industrial machine in order to obtain control and to establish automation. Figure 1 shows a typical system.



Figure 1. Automated handler machine

An industrial machine is centrally controlled by a computer. The computer is used to control the digital inputs and outputs through the U2100A (Figure 2) with the use of a programming software, such as Agilent VEE Pro (Figure 3), for the following purposes:

- To prevent accidental user interaction with the industrial machine while in operation.
- To make sure that the probe and locator pin is set correctly.
- To determine that the device under test (DUTs) have been dropped to the designated bins.
- To ensure safety of the operators.



Figure 2. The U2100A is incorporated in the automated handler machine.



Figure 3. The software interface of the automated handler machine.

Overview

In this particular test system handler, the DUT is a Light Emitting Diode (LED). Other possible DUTs could be any other optoelectronics components, such as the backlights of automobiles or camera modules. The system consists of a bowl feeder, a test bench and a test bin. In a typical operation, a test operator loads the LEDs into the feeder prior to starting the test. The feeder then transfers the LEDs to the test bench via a conveyor belt. The locator pins are then activated by the valves to lock the LEDs in place before the probe pins are activated by the valves to measure the required parameters like voltage, current, and optical wavelength. Upon completion of the test, the LEDs are dropped into the designated bins. The proximity sensors are used to ensure that the LEDs are sorted to the desired bins. In addition, the proximity sensors are also used to count the number of LEDs going into the bins in order to avoid overflows.

Figure 4 shows the flow diagram for the entire system, while Figure 5 illustrates how the various components interface with each other.

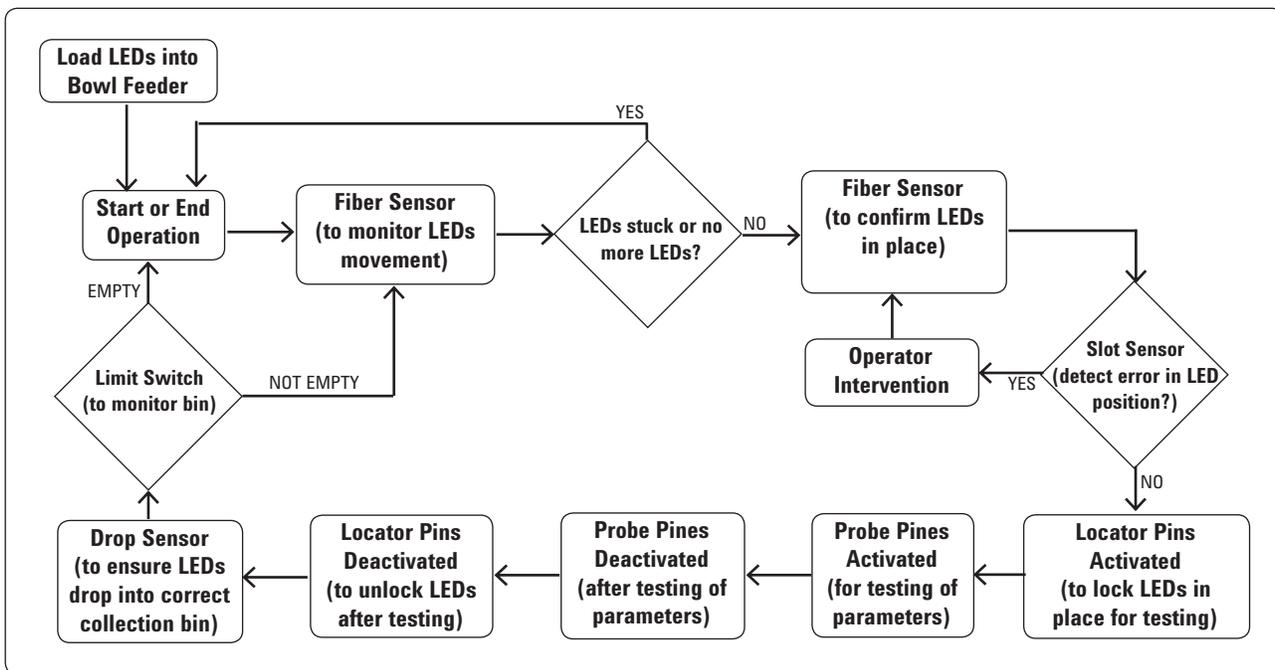


Figure 4. The flow diagram of the automated handler machine operations.

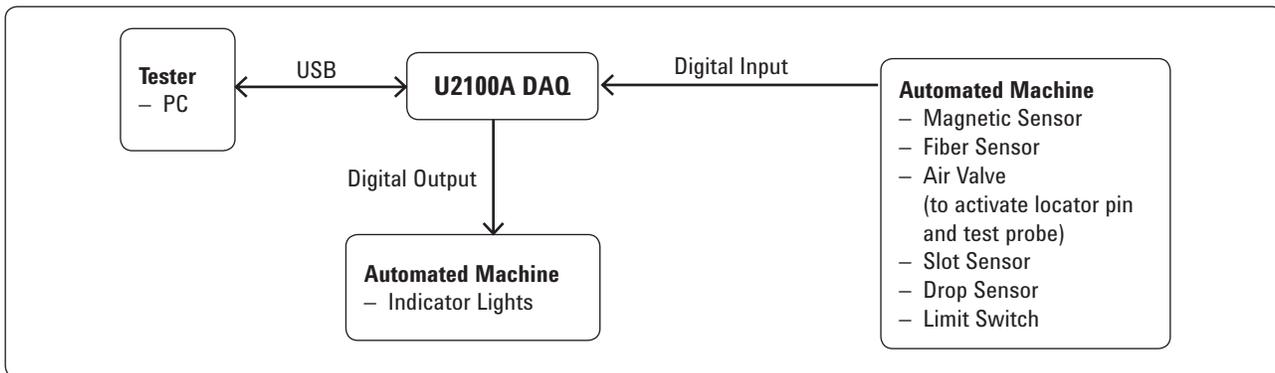


Figure 5. The connection of tester with the U2100A and the automated machine.

There are three indicator lights (Red, Green, Yellow) used to indicate the status of the machine. The green light will light up during normal operation. The red light indicates that an error has occurred and the machine is required to stop. The intervention of an operator is required to correct the error. On the other hand, the yellow light represents a warning. When the yellow indicator lights up, it indicates that the machine is still functioning but requires an operator's attention. An example of a situation when a warning alert will appear is when an overflow of DUTs in the collection bins are about to happen.

The incorporation of the U2100A in the test system

The following description explains in great detail how you can integrate the U2100A in the test system handler as explained in previous section.

Magnetic sensors are mounted to the front and the back of the machine door closure. The magnet is attached to the door while the contact part of the sensor is attached to the handler frame, as shown in Figure 6. The digital inputs of the U2100A are used to interface with these parts of the magnetic sensor. When the door is open, the sensor will output a digital signal representing "1" to the digital inputs of the U2100A. To prevent the accidental user interaction during the operation of the machine, the U2100A returns a signal to the computer in order to stop the operation, once the U2100A receives the output signals from the sensors.



Figure 6. The magnetic sensors are mounted to the test system door.

Once the doors are closed, the operator can start the test program upon which the bowl feeder begins to feed the LEDs to the test station as shown in Figure 7.



Figure 7. The bowl feeder with the fiber sensors on the test system machine

When the LEDs are fed into the test system, they pass through the fiber sensor that regulates the flow of the LEDs. If the LEDs pass through the fiber sensor at a very fast pace, the sensor signal will be captured by the U2100A which, in turn, feeds this information back to the computer. As a result, the computer slows down the speed of the bowl feeder. If a longer period of time elapses with no LED passing through the fiber sensor, the system will display a warning message that may indicate that there are LEDs that are stuck at the conveyor.

The LEDs will then be transferred to the test system by the conveyor. If the fiber sensor detects that the LED, which is next in line is in place, the U2100A sends an output signal to activate the valves in order to move the locator pins to lock the small LEDs in place. Once that is done, another set of valves is activated to place the probes onto the LED to start measuring the required parameters. These parameters can be measured by using a digital voltmeter, such as the Agilent's 34405A. If multiple points and LEDs are to be measured, you can also use a DAQ device such as the Agilent's U2300A Series. The slot sensor is placed onto the test system to ensure that the LEDs do not get stuck when the valve pushes the LEDs out onto the conveyor to be sent to the bins. Once the test is done, the valves will be deactivated so that the LEDs can be sent to their designated bins when the required measurements have been carried out.

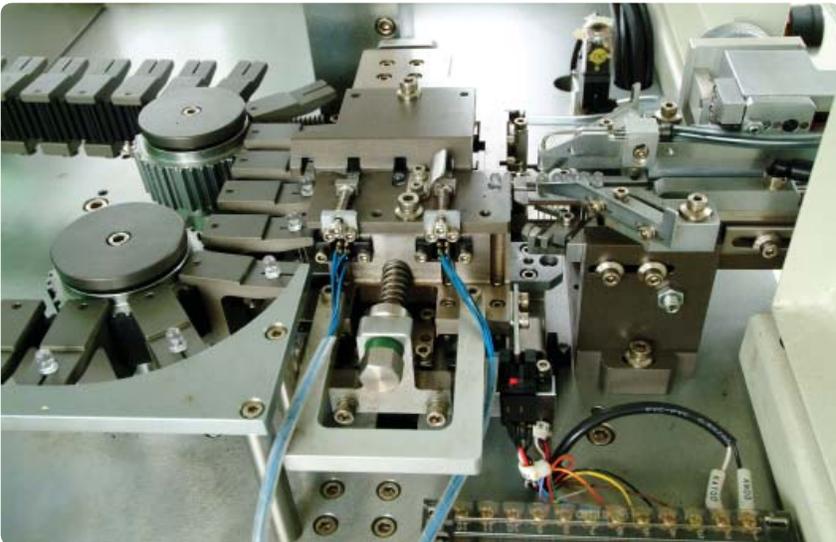


Figure 8. The test system with the fiber sensor, test probes, and slot sensors.



Figure 9. The LEDs on the conveyor to be sent to the designated bins.

Upon completion of the entire test, you must ensure that the DUTs have been dropped to the correct designated bins. Drop sensors are connected to the digital inputs of the U2100A, which use the infrared technology to determine that the units have been properly distributed to the desired bins. The drop sensors also serve as a counter to count the total number of DUTs being dropped into the bins. Once the total number approaches a defined limit, the yellow indicator of the system lights up. Figure 10 shows what the sensors look like.

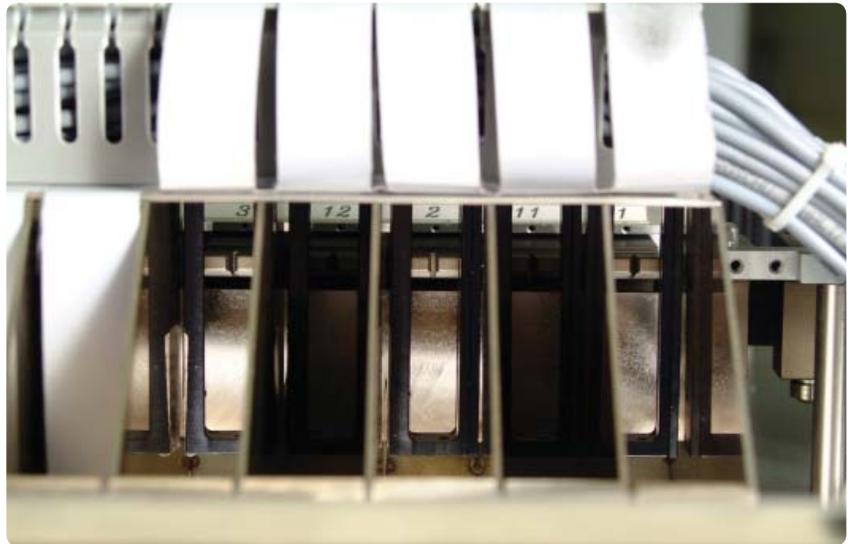


Figure 10. The drop sensors are fixed to the designated bin slots for the LEDs.

The limit switch shown in Figure 11 is used to check whether or not the bins are full. As soon as the weight of a bin exceeds a certain threshold value, a sound will notify the operator about the fact that the bins are full.

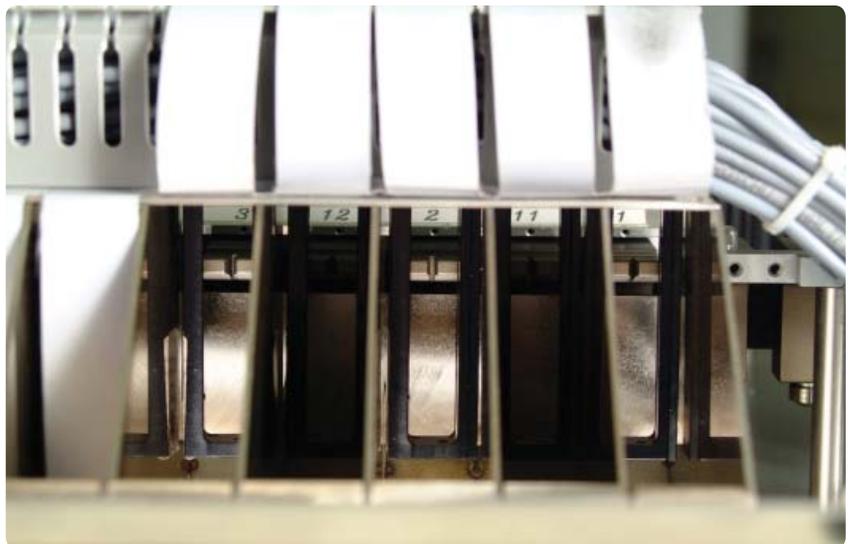


Figure 11. The slot levers at the bottom of the designated bins.

At this stage, the control and automation purposes of the test system have been achieved by means of software programming as well as by using the multiple inputs and outputs of the U2100A , which interface with the various sensors.

Conclusion

In this application note, we have described how you can incorporate the U2100A USB DIO device in an automated handler machine for test systems. The control and automation purposes of the test system have been achieved by means of programming using VEE Pro and the multiple inputs and outputs of the U2100A, which interface with the various sensors of the machine. The USB connectivity of the device is chosen as it allows easy setup without the need to open the chassis of the PC during setup and troubleshooting.

References

- [1] Agilent U2100A Series Digital IO, 32-Terminal User's Guide, part number U2121-90002.
- [2] Agilent U2300A Series Multifunction USB DAQ Devices User's Guide, part number U2351-90002.



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