Introduction

One of the basic tests in the Quality Control of mobile phones is checking the output signals after pressing keys on the keypad. This can be done manually by an operator (pressing the keys one by one and verifying the signal output with a multimeter), but a far more efficient and quality-assuring process can be created with a few Advantech I/O cards and a fixture. A leading ODM mobile phone manufacturer in China created a solution with the PCI-1758UDIO to drive mechanical silicon fingers, and a PCI-1711L to capture the output signals from the phone. This simplified the operator’s tasks, reduced errors, and increased the overall speed and efficiency of the testing process.

Project Requirements

In mobile phone production lines there are usually many different models being quality tested simultaneously, making it very problematic to depend on a fully automated system. Human operators are required in order to manually place each phone into a corresponding test station, and make quick judgments when discarding malfunctioning units. In this type of production line, it is better to increase the efficiency of human operators rather than work towards creating an automated system.

Solution Description

The process starts with the operator placing the phone in the test station’s fixture and pressing a button. This sends a signal to a digital input channel on PCI-1758UDIO, which initiates the test program on IPC-6806. The test starts with PCI-1758UDIO sending a digital output signal to a relay on the fixture, which starts the mechanical process of pressing a silicon finger towards the first key on the phone’s keypad. At touchdown, several functions will activate (depending on phone model).

If a numeric key is activated, a digital output code for the Touchtone signal is output to PCI-1711L, and compared to the correct codes by software.

Pressing a numeric key should also make the speaker of the phone output an analog output signal at the correct frequency. This is tested by an analog input of PCI-1711L. For color LCD displays, the difference
in voltage levels defines the color. By testing these voltage signals with PCI-1711L, correct color display can also be tested.

After verifying the various functions of the first key, a signal goes to PCI-1758UDIO to inform that it can proceed to the next key. The process continues to check each key on the keypad. When complete, a digital output channel is used to alert the operator so that the tested phone can be exchanged with a new one.

If a key press results in an error, it can halt the output of signals for the silicon fingers, and wait for operator action. The system can also record the error into the database together with information on where in the test procedure the error occurred and the serial number of the product. This makes it easier for production engineers to troubleshoot the production line and do quicker repairs.

The system diagram shows a well balanced system to test four phones simultaneously, but can easily be scaled by adding more cards. PCI-1758UDIO can activate the 16 numeric keys on four phones with its 64 output channels.

The 16 digital inputs of PCI-1711L are used to capture the digital Touchtone codes (four channels per phone), while the 16 analog inputs are used for testing the LCD, LEDs and speaker. The 16 digital outputs can be used to activate more silicon fingers for extra function keys, bringing the maximum number of keys on a phone up to 20.

### Conclusion

- The new system has led to clear productivity and quality improvements. The keypad functionality test has reduced testing processes from a minute to 5 seconds, and test accuracy has increased from 95.7% to 100%
- The system is adaptable as minor modifications can make the system capable of running many similar tests, and adding identical cards can increase capacity
- With open standard components, there is a choice of suppliers for the application