Lascar PanelPilot SGD 21-B

Is this the end of the Digital Panel Meter as we know it?

How Lascar Electronics is using entry-level ARM processors and electronic supermarket labelling technology to create the next generation of low-cost panel meters

Pic – Lascar PanelPilot SGD 21-B

Introduction

Most of us have seen and many own an e-paper reader such as the Amazon Kindle with its daylight-readable low power screen. The number one advantage of e-paper is that if there is no change needed in the output, the power can be turned off and the display remains visible. As with many new developments, what starts as a premium technology, soon finds its way into other applications as it matures and cheapens.

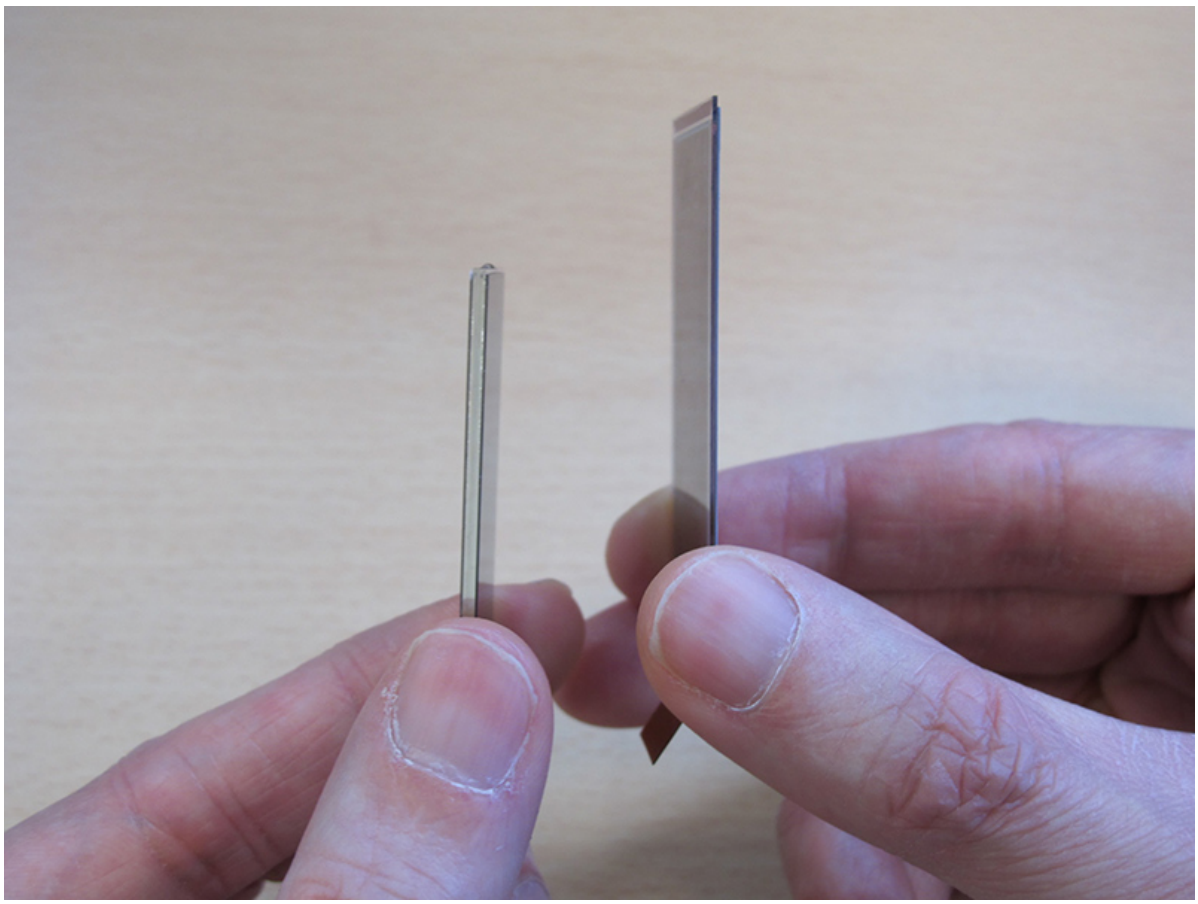
Pic – An e-paper supermarket label

The big development in e-paper has been the introduction of displays, which can be used for dynamic labelling of supermarket products. This is a high-volume area and extremely cost-conscious. With a connection to the shop's main computer, not only can shops be saved from time consuming work re-labelling goods but it makes it much easier to promote on-the-spot deals and special prices and the tills know straight away what the correct price is. These small, extremely thin, units are ideal for instrumentation and with the plethora of low-cost 32-bit processors such as the ARM M0, the traditional panel meter can now be replaced by a full-graphic equivalent and for around the same price.

What is E-paper?

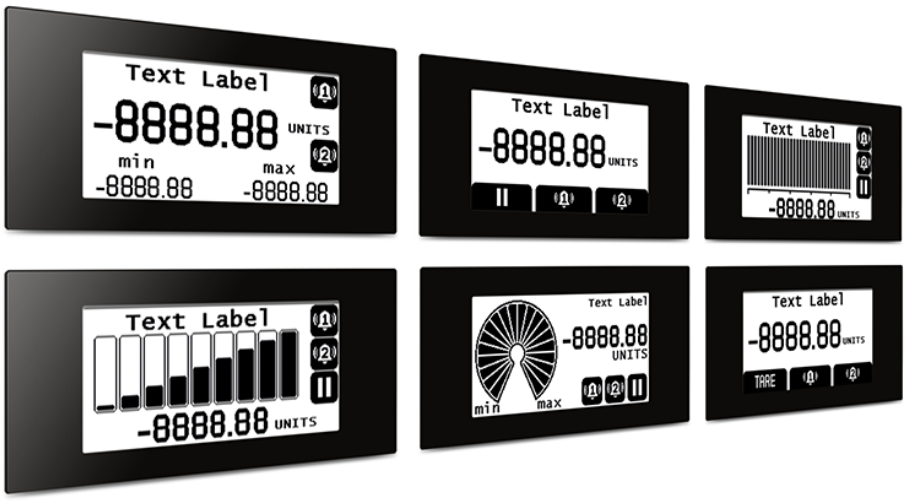
To give it its full technical term, e-paper uses what is known as electrophoretic ink. This consists of many tiny cells or microcapsules, each with a set of black and white ink particles. These particles carry a charge, black positive and white negative. When an electric field is applied, either the black or white particles rise to the top depending on the field's direction, giving the appearance required for that capsule. For a more detailed description, follow https://en.wikipedia.org/wiki/Electronic_paper.

Although it takes energy to move the particles, once moved, they stay there after the electric field has been turned off and this is where e-paper's advantage can be exploited by instrument manufacturers. Traditional segment type displays are very low power - think of how long the battery in an LCD watch or clock lasts - but as soon as you move up to graphic displays, the power consumption rises significantly. Unlike fast-moving displays such as those showing video, however, most instruments do not need to update their readouts nearly as fast. The low power of the e-paper instrument means that its consumption is now close to that of the traditional LCD panel meter and still offers a high-contrast sunlight-readable display. The e-paper panel is also thinner than all LCD technologies being only about 1mm (0.025") thick compared with traditional LCD glass panels that are typically 2 to 3mm thick.



Pic - Traditional LCD glass panel (left) vs SGD 21-B e-paper panel (right)

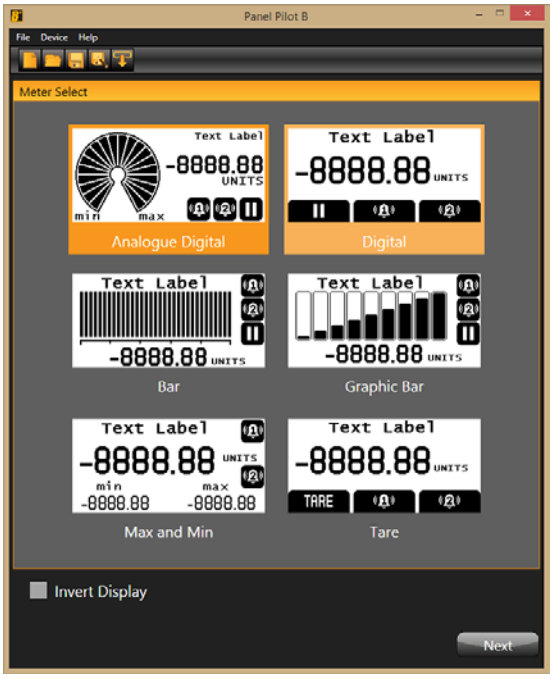
What is the benefit of graphic e-paper in instrumentation?



An instrument reading is more than just a number. It has units and the name of a process or condition to which it refers. A simple numerical readout might not be the best way to communicate the process state to the reader. Would a bargraph be better? (A good example here would be the state of charge of a battery.) Perhaps a facsimile of a more traditional moving-needle output? Other information might be relevant. Alarm conditions, warnings etc. The advantages of a graphical readout are well known but everything disappears as soon as the power is turned off. With e-paper, the information stays.

Ease of use

It is all very well having a technology that offers lots of possibilities but that is not much good if it is difficult to set up. The Lascar SGD 21-B comes with the free PanelPilot B application, which makes configuration very easy. The user simply selects from a range of meter styles and then sets up their scaling to suit the application.



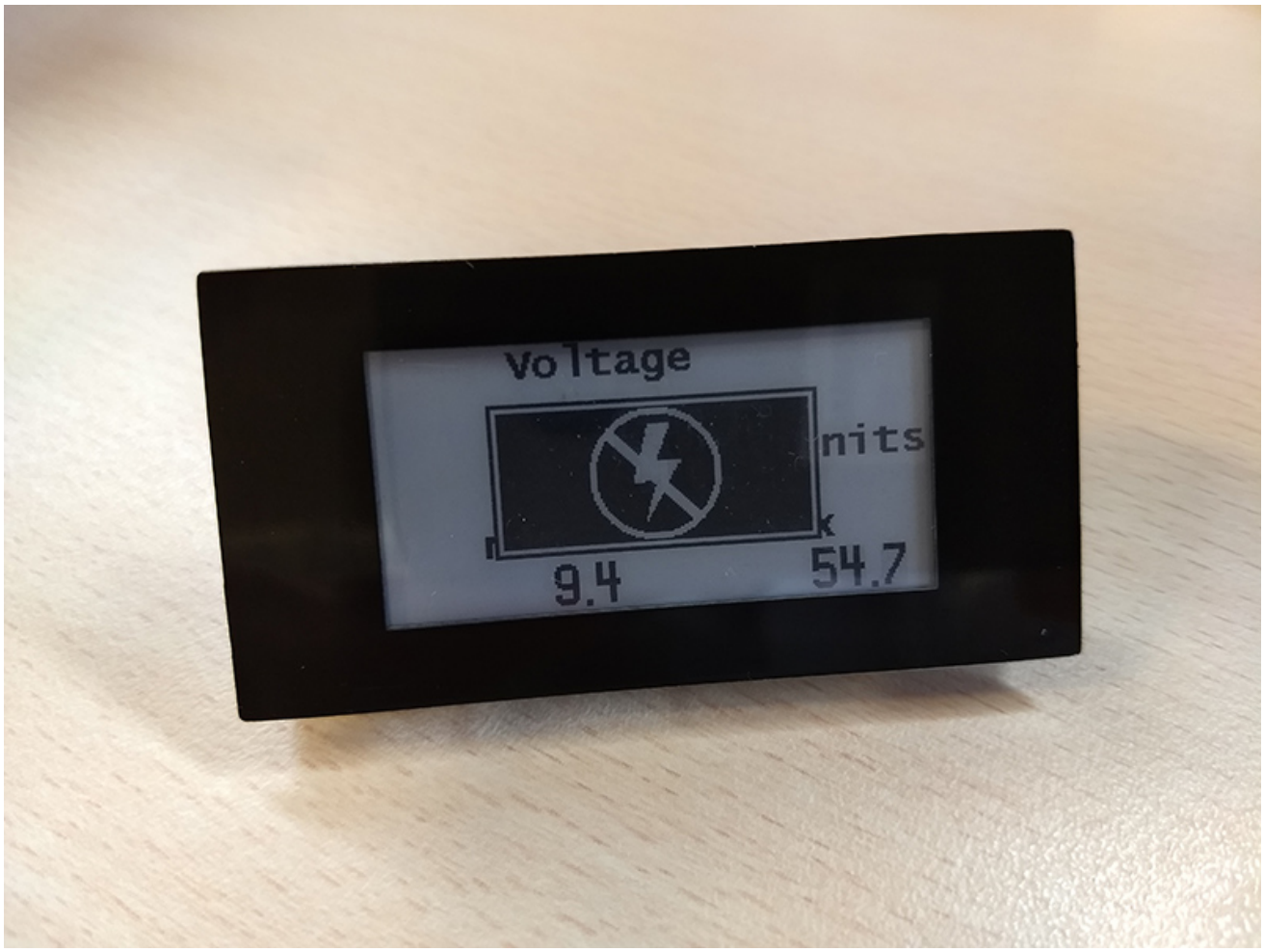
Pic - PanelPilot B setup app

Using a microcontroller instead of a panel meter ASIC opens up a new world of possibilities for instrumentation. For a start, different applications can be uploaded or selected via USB. Calibration of the meter can be done digitally instead of using a potentiometer, meaning that it can be done without physical access to the meter and minimises the problems of temperature drift and ageing associated with potentiometers. Calibration is not just about trimming a reading though, the processor can be employed to linearise sensor curves such as those with thermocouples or thermistors. Offsets can be applied, when reading 4-20mA loop outputs for example.

Connecting to the outside world

Microcontrollers come with many input and output pins, which can be employed for control and indication. The user might want to set an output when a given level is exceeded (high alarm condition) or receded from (low alarm). Industry-standard interfaces such as SPI mean that other devices and not just analogue signals can be connected to the meter. Text for labelling or information can be uploaded via USB.

Disadvantages



Pic - PanelPilot B powered down

One thing that became apparent during the development of the SGD -B series meters was that having a display that retained its indications, like engineering units or other labels after the power was removed, could lead to a confusing if not potentially dangerous condition. Consider this:- imagine the meter is being used to measure the voltage in some process, which could be at mains potential (200V+). Now suppose the power to the meter was removed when the process was at a low potential. If the power were removed at that moment and then later the process voltage were to return to a high level, the user might think it was safe because the meter was still showing the low reading. In order to avoid this, some method had to be developed to show that the meter was powered down and the reading was invalid. E-paper is zero power when nothing is happening but it needs power to change anything. The solution was to use a

super capacitor (also known as an ultra capacitor or dual-layer capacitor). This can store enough energy to enable the meter to modify its display to a “No Power” symbol when it detects that its power supply voltage is dropping below a certain level. Although the reading will no longer be relevant, any alarm conditions at the point of power failure might be.

Lighting

The nature of e-paper is that it cannot readily be made translucent or transmissive, so backlighting is not an option, but the displays can be front lit. This is in the form of a very thin layer of acrylic, which is side-lit by an array of white LEDs. The advantage of front lighting is that the display appears exactly the same as a normal display, retaining all of its high contrast and sunlight readability. Whilst the SGD 21-B does not currently have front lighting, it may be added to future products.

Future developments

At present, only mono displays have been considered but tri-colour displays are available now in the same format. These consist of black and white particles as well as one of a third colour. This is often red or yellow. Full colour is already being demonstrated but at a price and size that makes it unsuitable for small instrumentation but that will surely change.

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