WHITEPAPER

Is Direct View LED Ready?

Seven Questions to Consider Before You Buy a Direct View LED display or Display Wall

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If you've ever been to the Auto Show or taken in a game at a stadium with a video scoreboard, chances are you've noticed the brightness and color depth of a direct view LED display.

It's an interesting technology. Rather than using light emitting diodes as the light source for a projector, projection cube or flat panel monitor, direct view displays use the LEDs as individual pixels.

Until very recently it had not been possible to build diodes small enough to be useful in anything but a scoreboard or very large trade show display. Yet pixel pitch is coming down, and some manufacturers are touting their products for use 24/7 in a display wall, whether in a command and control room or a similar mission critical application. Potential advantages include brighter images, quieter operation, less cabinet depth, smaller gaps between display modules, and greater uniformity. There are some drawbacks as well, the biggest being price, but others including power consumption and the heat generated by the display.

Still, we have to ask, what are the tradeoffs of direct view versus more established technologies, especially LED-based projection cubes? Does the price premium you'll have to pay make sense given the plusses and minuses of the technology?

There are seven areas that are worth asking about before you consider direct view for a 24/7 application.

1. Pixel Pitch

The pixel pitch (or dot pitch) is a crucial specification of a display wall because it will determine the amount of information that you'll be able to show and its readability at a given distance.

Sometimes people confuse pixel pitch with a related specification, resolution. Pixel pitch measures the distance between the center points of two adjoining pixels; resolution is the total number of pixels across the width and height of the display. As the display gets larger, the pixel pitch will be larger if the total resolution stays constant.

For example, a 24" diagonal display with a resolution of 1920 x 1200 will have a pixel pitch of .270mm, a 55" display with the same resolution a pixel pitch of .617mm, an 84" display will have a pixel pitch of .942mm and a 130" display 1.5mm.

In a display wall, the resolution of the individual displays is not crucial, because it combines a number of displays of whatever resolution into the larger display. The pixel pitch, however, combined with the viewing distance, determines whether the information shown on the display wall will be readable.

If the pixel pitch is too large for a given distance, fonts will be less readable and the amount of information that can be shown on the display wall will be limited. There will be a point, as pixel pitch increases, where viewers will be able to discern the individual pixels and the space between them, and readability will drop even more. If the pixel pitch is too small, however, fonts and diagrams that are readable on an operator's local monitor will not be readable on the display wall.

How to determine the display wall size and pixel pitch for a given application is not the subject of this paper, but you will normally want a pixel pitch in the range of .6 to 1.3mm.

Mitsubishi Seventy Series LED Projection Cubes		
Diagonal	**Resolution**	**Pixel Pitch**
50"	XGA 1024 x 768	0.992
50"	SXGA+ 1400 x 1050	0.725
60"	XGA 1024 x 768	1.190
60"	SXGA+ 1400 x 1050	0.870
60"	1080p 1920 x 1080	0.690
62"	WUXGA 1920 x 1200	0.695
67"	XGA 1024 x 768	1.329
67"	SXGA+ 1400 x 1050	0.972
70"	1080p 1920 x 1080	0.817
72"	WUXGA 1920 x 1200	0.807
80"	SXGA+ 1400 x 1050	1.161

2. Price

At this writing, direct view displays with a pixel pitch of 1.5mm are selling for roughly 3 times the cost of a projection cube of comparable size and brightness. Those with a 1.0mm pitch are not yet available, but industry experts expect an initial price of about 4 times that of a projection cube.

It's important to note that direct view installation costs will be considerably higher as well. Projection cubes are simple to install, stacking one on top of another, with only a single pedestal for each column of displays. Direct view, on the other hand, requires a more complex mounting structure to hold each cabinet. This structure must encompass the entire display wall.

Prices will no doubt decrease in time, but these are very high prices, and there are some other factors that affect the lifetime cost that must be taken into account.

3. Expected Life

Surprisingly, the lifespan of direct view displays is, at least in most cases, lower than that of other display technologies.

It depends on the manufacturer and the technology used. Some of the newer displays promise a lifespan of 100,000 hours; others much less.

One large and prominent manufacturer is listing a lifespan of only 50,000 hours. Another is not listing an expected life. Compare that to Mitsubishi's projection cubes with an LED light source, which, depending on the operating mode, are rated for 80,000 – 100,000 hours.

The problem is, if you're using the display wall 24/7, you really can't afford a shortened lifespan. If the panel you are considering has just a 50,000 hour life, a 3 times premium price becomes a 4.8 – 6 times premium.

With a comparable or even a 25% longer lifespan (100,000 vs 80,000 hours), the direct view display, at a 3 times or 4 times initial price premium, is still a very expensive technology.

4. Power Consumption

All of the direct view manufacturers talk about low power consumption, but if you carefully compare the specifications, you start to wonder why.

It's difficult to compare apples to apples in this case, given that the pixel pitch and display sizes are different in each technology.

We'll look at the specification using two methods, the first being the power consumption for one square meter out of a larger display wall. For this purpose we'll compare the Mitsubishi 50" SXGA+ display cube, which has a screen size of 1015 x 761mm (or 77% of a square meter); a direct view manufacturer that packages its 3mm product into 768 x 768 cabinets (59% of a square meter) and a third that offers a 1.5mm product in a cabinet that's smaller still, but gives its power specification per square meter.

It's important to note that direct view displays and projection cubes can be set at various brightness levels, and for this white paper, we are comparing them at essentially the same brightness as well as the same size. Here we're comparing the projection cube (in normal mode) at 1040 cd/m² (or nits), and the 3mm and 1.5mm direct view displays at 1000 cd/m². Comparing them that way, the projection cube appears to use less power than the direct view displays, although not remarkably less: 190 watts per square meter for the cube vs. 305 watts for the 3mm product and 195 watts for the 1.5mm product.

That method, however, grossly understates the direct view requirements, because you would need a larger display wall to show the same image with direct view. The 3mm product would require 17 times the surface area and about 27 times the power to produce an image of comparable resolution to the Mitsubishi SXGA+ cube.

With the 1.5mm product, you'd need slightly more than double the display size compared to the cube (with its pixel pitch of .725mm), but more than four times the surface area. That is to say, you'd need 4.28 times as many square meters of display to show the same image at the same resolution, and thus must multiply the 195 watts times 4.28 to have an apples to apples comparison. If we factor in the difference in wattage required to produce a 1000 cd/m² image, we find the 1.5mm product requires 4.39 times the power of the Mitsubishi cube.

Certainly, as the pixel pitch gets smaller and the technology improves, we're trending in the right direction, but that's still a lot of power compared to the LED projection cube.

5. Heat Dissipation

Heat dissipation is perhaps an even more important consideration, because it affects the size and cost of the air conditioning unit you will need as well as the power requirements of your HVAC system. If you are adding a display to an existing control room and it will generate significantly more heat, you should expect to replace or supplement your cooling unit.

That being said, heat dissipation is tougher to compare, because, at this writing, no smaller-pixel direct view manufacturer publishes a spec.

Still, basic physics leads us to expect the heat output to be directly proportional to the power consumption at a given brightness. That's because the power that goes in must come out in one of two forms: light and heat. Thus if the direct view display takes a similar amount of power to run at a given brightness, the heat dissipation should be the same or very close. If you need a larger display wall to show the same information, you'd expect the heat generated to be proportionally larger.

Direct view manufacturers talk about low heat dissipation and, as proof, offer the fact that these displays need no fans or cooling systems. That's very misleading, however. Because the LEDs are on the outside of the display, they can rely on the room air to cool them, but in the end, the HVAC system still has to deal with that heat.

It appears that the 1.5mm direct view product will generate almost 4.5 times the heat of the Mitsubishi .725mm cube, given that you'll need to increase the surface area of the video wall by 4.28 times to display the same image, and the power consumption per square meter is slightly higher. That is a dramatic increase. The power requirements for, and heat dissipation of 1.0mm direct view displays is unclear, but these will definitely be important considerations.

6. Cabinet Depth

Cabinet depth appears to be a definite advantage for a direct view display. The 3mm product we've looked at has a cabinet depth of 6.9," the 1.5mm product 3.7," compared to a 24.8" depth for the Mitsubishi 50" projection cube.

Still, there's a caveat. The Mitsubishi cube is available in a front-access form. That is to say, all maintenance can be performed from the front and thus the cabinet can be positioned directly against the wall of any room where space is at a premium. At the time of this writing, the direct view displays readily available on the market are rear access only, and thus must be positioned several feet out from the wall to allow access. Thus they actually take as much (or possibly more) floor space than the cube-based display wall.

7. Calibration

At this writing, calibration for most or all direct view displays is an issue, in that it must be performed by the manufacturer with special equipment and training required. Since the display wall will need recalibrating from time to time, the cost of maintenance is definitely a question, and the cost of a service contract an important consideration.

Conclusion

Direct view LED technology offers several advantages, but for now, perhaps more in potential than in reality for a 24/7 application.

For many specifications, we see a significant but perhaps not remarkable advantage. On the downside are two major drawbacks: pixel size is still too large for most applications, and the price premium is very large.

Every application has its own requirements, but it's worth considering eight important areas before you make a decision on the use of this technology: pixel pitch, price, expected life, power consumption, heat dissipation, cabinet depth and access, uniformity, and maintenance cost, especially the cost of field calibration.

It appears that, for most mission-critical applications, the LED-based projection cube will remain the display of choice for some time to come.

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This report has been created by Mitsubishi Electric US Visual & Imaging Systems Division (www.me-vis.com) and Mitsubishi Electric Sales Canada (www.mitsubishielectric.ca).

Mitsubishi Electric, one of the core companies that comprise the $40 billion multi-national Mitsubishi Group, is the global leader for command and control display wall products, with a wide variety of rearprojection DLP display wall cubes and LCD display wall panels. This report has been created agnostically to compare the two technologies and for certain specifications, is based on Mitsubishi Electric products.