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BUILDING A PRODUCTIVE DESKTOP

for Hybrid Work and Education

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For many years most AV professionals have been reluctant to give any real thought or design input to desktop productivity systems. Certainly, those impressive command-and-control consoles seen in corporate security centers and first responder facilities have been an important part of commercial AV integration. The typical working desktop, on the other hand? Not so much...

However, societal and workplace changes, accelerated to near light speed by the pandemic, have encouraged us to look at desktop technology with renewed vigor. As of late 2021, studies by Gallup and the Society of Human Resource Management (SHRM) revealed that over 60% of workers are currently remote. As many as 83% of workers polled have expressed the desire to be able to work from home at least one day per week, according to Global Workplace Analytics. With this global shift in the work environment, workers generally don't have access to the advanced technology typically associated with corporate huddle spaces and conference rooms.

By and large the engine driving both business and education communications today resides on the individual desktop, wherever that may be. It's time to give desktop productivity technology the attention it deserves. After all, can you think of any application that doesn't benefit from seeing more information on the screen with better legibility, hearing dialog with greater clarity, or completing tasks with more efficiency and in greater comfort?

The Return on Investment

Peter Drucker said, "The most important thing in communication is to hear what isn't being said." The delivery of content in both verbal and nonverbal forms is the value of advanced AV solutions. More than simply a computer and monitor, a productive desktop is an ecosystem that needs to be maintained and periodically upgraded.

Why should we invest time and money refining our desktop AV solutions for individual productivity when we already have something that seems to be working?

It will boost the bottom line.

Consider this: Visual eye strain can lower productivity by an estimated 15 minutes of work per day. It may not sound like much, but this adds up to nearly 65 hours of individual productivity lost over the course of one year. Think about that for a minute. A week and a half of productivity lost because of subpar AV technology!

What is the value of 65 working hours? Is it less than the cost of a good, productive desktop AV solution?

Let's examine that question.

The U.S. Census Bureau lists the annual median individual income in the United States at $35,977 (tabulated in 2019). There are 261 working days in a calendar year and, not accounting for the impact of vacation or sick time, a loss of 15 minutes each working day equals a median loss of $1,119.97 in productivity. This, of course, includes both those who are involved in hybrid work and those who are not.

Let's use an example that's even closer to home.

You're likely reading this because you're an AV professional. According to Glassdoor.com, the national average salary for an AV Design Engineer is $81,360 in the United States. At this compensation level, 65 hours of productivity equates to more than $2,532 in payroll investment. Add in lost opportunity cost and then multiply that number by the fact that an AV technology investment has a useful lifetime of several years. It's easy to see that investing in a high-performance desktop productivity solution makes excellent business sense!

Desktop Needs Analysis

AV design projects should always start with a careful needs analysis. Personal productivity solutions are no different in this regard. We must approach the needs analysis without bias or expectation to identify the factors that impact task productivity and design sufficiency.

Even a casual inventory of job tasks is a vital element of a professional needs analysis. AV design professionals should interview end users to discover the kind of work that is done most often with the solution under examination. Review the technology currently in use, and weigh it against the real productivity challenges arising due to inadequate image real estate, awkward display positioning, barely legible content elements, or a washed out, uninvolving image. The goal of analyzing technology choices is to increase productivity by making desktop systems more enjoyable, easier to use, and a better fit for the job tasks.

Being able to see content is not the same as being able to read it without strain. The value of an investment in technology improves when multiple content windows can be adjusted to a useful size to support real work. The volume of high-quality output grows noticeably when sight, sound, and ergonomic experiences support switching between specialized software programs, computer peripheral devices, and powerful communications platforms seamlessly.

An important element of any needs analysis, but of particular importance here, is determining and analyzing the average viewing distances from the eyes of the user to the surface of the screen, factoring in the types of content accessed most often. It's not something we should estimate.

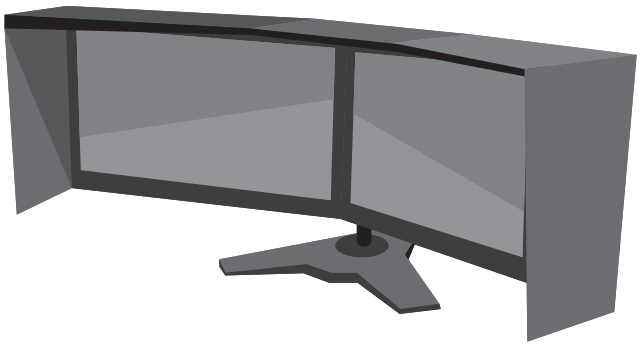
Viewing distance may change based on content, activity, ambient light levels and even time of day. Understanding the ideal range of distances in the viewer-to-image equation allows us to accurately determine the appropriate display resolution and size of the screen as well as the number of screens and their ideal position. To help in this calculation, most people sit 2 to 3 feet away from their desktop monitor.

A thorough needs analysis will also include an examination of ambient light. Is there glare on the display? Where are the windows in relation to the display? Will lighting and glare change as the day progresses? How do fixed ceiling lights impact the workspace? Should shading and light control be part of this project? Improper ambient lighting can interfere with the perceived quality of the image, increasing viewer fatigue. Remember, viewer fatigue is the enemy.

Perception of color is dependent on external light quality. If the work to be done on our desktop productivity solution

requires accurate evaluation and application of color (think corporate logos, marketing graphics, fashion design, etc.), then we must consider ambient light and how it might change over the course of the day.

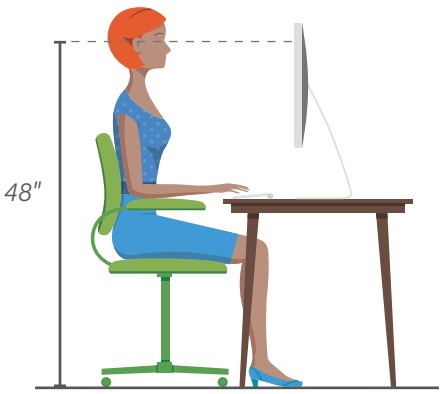
AV applications are expected to produce accurate, repeatable color quality regardless of environment. In fact, these color quality requirements are sometimes identified as a key performance metrics in installations. But regardless of any color performance mandate, color quality remains a differentiator in all installations and solutions. Something as simple as a monitor hood can have an outsized impact on viewer fatigue while adding to color accuracy and overall perceived system quality.



Well-designed AV solutions could also incorporate the ability to control light level, light color temperature and shading solutions. This is easily accomplished with network-controlled LED luminaires and shades, even in a modest home office installation. For example, energy-harvesting wireless switches allow for easy control of these devices without having to run wires!

The Viewer-to-Display Relationship

Getting the physical geometry of a desktop productivity system right is at the core of optimizing its impact on efficiency. Get the screen size and position right, and the rest will follow. Here are a few 'best practices' that will have a notable impact on desktop system performance and user satisfaction.



The top of the display image should be level with the viewer's eyes.

Human ergonomic studies suggest we use 48 inches from the floor as an average height for a seated viewer's eyes. This is just a starting point.

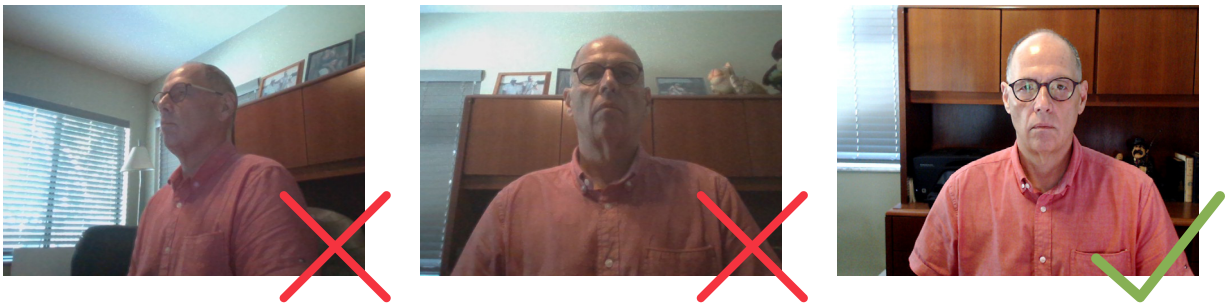
To fine tune beyond the basics, we should consider the physical stature of the system user and, where possible, do actual measurements. While off-the-rack clothing sometimes fits well, proper tailoring is often the difference between looking sloppy or looking sophisticated. When we think in terms of "wearing" a desktop AV solution for 8 or more hours per day, the importance of fitting the solution to the user becomes clear.

Consider the point of view of the camera.

Our technology must allow the recipient of the communication to know we are actively listening and paying attention. In most desktop AV solutions a web camera should be mounted to the top bezel of the main display. This properly places the lens' point of view just above the user's eyes, facilitating natural eye contact. We can learn a lot here from the art of filmmaking.

Eye contact is a type of body language that is extremely important during communication and conversation. A head-on frontal view fosters a feeling of engagement during a video call. Face-to-face communication is the most effective and efficient way to enhance social connectedness, develop meaningful relationships, and build social capital. This is critically important in business and education.

If the camera is lower than the user's face, the result will be an unflattering view that detracts from the quality of video communication. Even more, an unflattering view can impact how the receiver reacts to the message. In professional communications, the camera angle should be head-on, and the best results come when the camera's point of view is just above the bevel of the primary monitor.

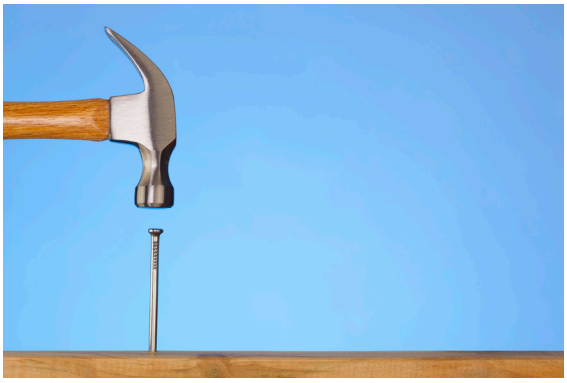


Ensure you have the appropriate display size, shape and configuration.

If you want to maximize productivity and output, apply the largest possible workspace to the best viewing position possible, and you'll get the most from your desktop Investment. Like RAM memory, the cost of screen size has dropped precipitously. Take advantage!

Many people work from multiple monitors in order to have access to more visual real estate. Most often, the main monitor is an indiscriminately chosen desktop LCD flat panel (often left over from a 10-year-old tower computer), and the other monitor is the built-in laptop screen. This isn't good practice; it's AV's version of Maslow's hammer. Abraham Maslow wrote in 1966, "If the only tool you have is a hammer, it is tempting to treat everything as if it were a nail."

There is a way to determine, with mathematical precision, the best size for a video display in nearly any application. All we need to do is adapt it to the desktop productivity system.



What Is DISCAS?

DISCAS is an American National Standards Institute (ANSI) recognized standard for determining Display Image Size for Content in 2D Audiovisual Systems. It was created by a team of volunteer engineers working with the Audiovisual and Integrated Experience Association (AVIXA) and was originally intended for application to systems in classrooms, conference suites, and other multi-viewer environments.

DISCAS provides a repeatable, verifiable way to optimize display image size and resolution for a variety of applications. It allows us to select an optimal image height, and use that metric to select a specific diagonal measure for a given system. It does this by mathematically calculating visual acuity (our ability to see content clearly) based on the arc-minutes of angle subtended by a pixel or picture element using the same formulae an optometrist uses to evaluate vision.

Beyond just pointing the way to the right monitor size, the DISCAS standard helps us to determine the appropriate resolution for various visual tasks. DISCAS calculations help determine the optimal nearest and farthest viewing distances and calculate the size of a font or visual element within the image. The application of the DISCSAS standard can help ensure that money isn't spent "overbuilding" an AV solution.

The DISCAS standard breaks down installed AV solutions into two essential categories: Basic Decision Making (BDM) and Analytic Decision Making (ADM).

Basic Decision Making is very much what you are experiencing right now. There is a high likelihood that you're reading this on a computer monitor at your work desk. BDM allows us to optimize display size and resolution for activities such as consuming presentations, scrutinizing charts and graphs, or participating in conference calls and video meetings. Basic Decision Making is concerned with assimilating and understanding information and the ability to efficiently communicate concepts clearly.

Analytic Decision Making is concerned with pixel-level detail. The viewer should be able to see everything a person with excellent vision would be able to see if they changed places with the camera. We are approaching the limits of human vision with this specification. ADM is used for examining scientific images, creating high quality graphic content, and working with commercial computer-aided design and drafting software.

While we may be working on a document or spreadsheet most of the time, it's also quite possible that we'll be using the same technology to customize high resolution images, edit video content and complex graphics, or analyze technical content, such as wiring diagrams, engineering designs, or medical images.

In practice, there isn't a significant price penalty for installing a desktop system that satisfies both BDM and ADM performance levels, however the likelihood of multiple uses for a single desktop system is high. Thus, it is good practice to strive to design any desktop solution to the ADM level, which by definition will deliver exceptional BDM results. By doing this, we ensure maximum utility from our technology investment.

This paper isn't intended to be a tutorial on the DISCAS standard. You will find a very good introduction to DISCAS and its intended application in Legrand AV University's online course, 4K Video: What You Can See, What You Can't, and What You Need to Know. Additionally, AVIXA has created a powerful, easy-to-use online DISCAS image size calculator, the results of which are referenced here. To get a better grasp on the subtleties and context of this standard, you may want to review these resources or even take a more comprehensive DISCAS class.

Now let's take a closer look at how DISCAS can point us to an optimal screen size for desktop productivity applications.

Using DISCAS To Determine Monitor Size

We've used AVIXA's DISCAS online calculator to determine screen size for a typical hybrid work productivity solution. We've used the combination Basic Decision Making / Analytic Decision Making calculator to generate the following results.

Let's assume the needs analysis revealed the average distance from the viewer to the screen in this desktop solution ranges from about 28 inches to 38 inches. A 32-inch diagonal monitor has an image height just under 16 inches. The AVIXA DISCAS calculator shows the farthest recommended viewing distance for 4K UHD content with that image size is just over 25 inches from the screen to the viewer's eyes. Using that same screen size, but with 1440p resolution (also known as QHD), we see that the farthest recommended viewing distance is about 38 inches.

Finally, when we input a viewing distance of 28 inches with a 1.78:1 image aspect ratio and a 16-inch screen height, the calculator indicates the best resolution is about 2,000 vertical pixels. This is just below 2160p, which is UHD 4K. We now know that a high performance desktop productivity solution optimized for a BDM/ADM hybrid application is best served by a QHD or UHD monitor.

Additional Monitor Specifications to Consider

Poor color reproduction can take our focus away from what's happening on screen and make the viewing experience unenjoyable. The electronics industry has defined how various screens, monitors, and projectors deliver color through the use of defined color space.

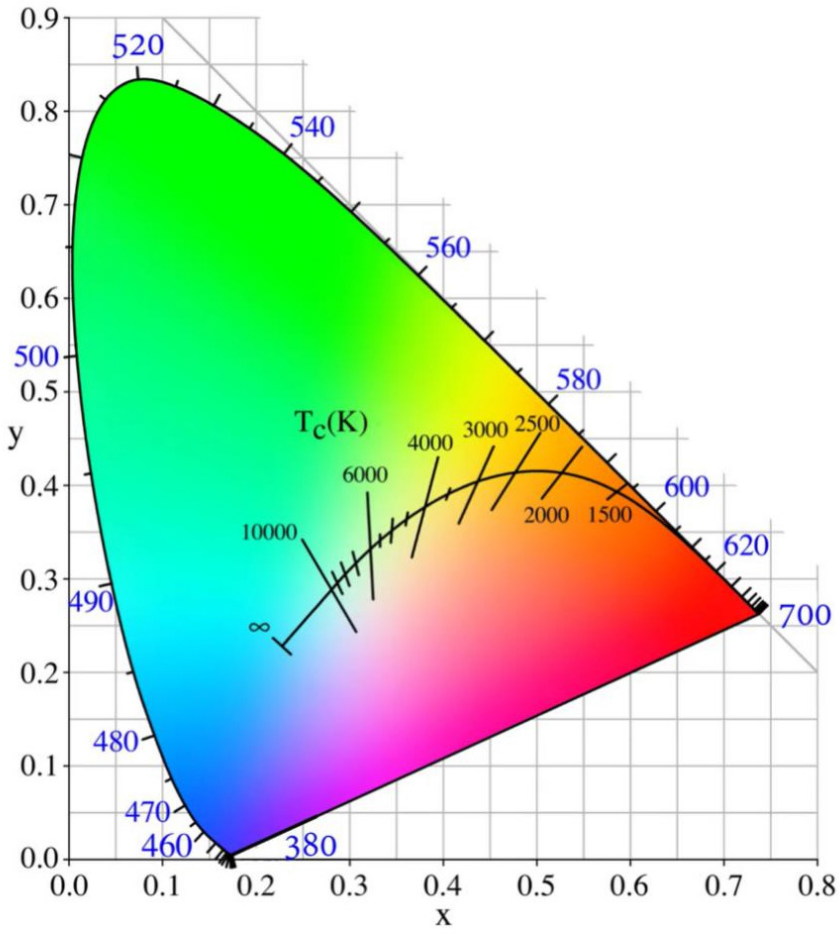
What's a color space?

A color space is an organization of color models and mapping that supports accurate, reproducible color on a screen. sRGB stands for Standard Red Green Blue and is a set of specific colors, created by Hewlett Packard and Microsoft in 1996. sRGB is the most used color space today, and most consumer applications, devices, printers, and web browsers will default to the sRGB color space.

We may encounter a slightly different name for this – Rec. 709. Rec. 709 is the standard camera encoding color space used for HDTV. It has a color space identical to sRGB but uses a slightly different transfer function to make it a better fit for video applications. Functionally, Rec. 709 or sRGB will deliver identical results.

For a complete treatment of color space and refresh rate, please consider A Guide to Color Space and Refresh Rates, a short online course found in Legrand's AV University.

Beyond color reproduction, there is a choice in the way a computer monitor produces an image. There are three major types of desktop LCD monitors: Twisted Nematic, Vertical Alignment, and In-Plane Switching. Each has its own strengths and weaknesses and, depending on the work to be done, each has a place and time in AV design. Considering just desktop productivity, an In-Plane Switching monitor that can reproduce the sRGB color space is the best and most versatile choice.



Summing It Up

Many 24-inch diagonal monitors are still in use, and there's little reason to increase resolution beyond 1080p for this size monitor. The value of high resolution desktop displays is primarily realized when we move beyond 27-inches diagonal. If you are limited to using a monitor smaller than 27-inch diagonal, then Full HD (FHD) 1080p is the right choice.

Using what we've learned from the needs analysis and applying the DISCAS standard tells us that a good resolution for almost all contemporary systems is QHD (1440p). This is an excellent resolution for 27 – to 32-inch diagonal monitors and the sweet spot for most productivity solutions.

Text and picture elements will be clearly visible, there will be enough visual real estate for some multiple window work, and full-screen images will pop with detail.

A top-of-the-line choice for an individual productivity system is a 32-inch diagonal UHD In-Plane Switching monitor with USB Type-C, DisplayPort, or HDMI inputs. It will display every bit of information we're capable of appreciating, even those of us with "perfect" 20/20 vision. For most knowledge workers, this is the right choice today and will carry the work load far into the future. There are very few reasons to consider moving beyond 4K resolution in a 16:9 format anytime soon.

When upgrading or designing a new system, we may be tempted to install two screens of identical size. This is a great way to improve multitasking and increase efficiency, but it comes at a cost. Two side-by-side monitors may look impressive, but right in the middle of the field of view is the bezel of each monitor. The user is always looking off-axis because a spit image is very distracting and distorted.

An ultrawide monitor, in contrast, offers up a high-quality image spanning the full real estate of the workspace, and there won't be any bezels or mullions in the middle of the image to interfere with full-screen viewing options. This is a serious advantage and one that must be experienced to be appreciated. Images or videos can be placed in the center of the display, where our visual acuity is at a maximum, while leaving the sides of the display free for supporting tabs and content.

For the ultimate in productivity technology, a 39 – to 49-inch 1440p 5k display is a fabulous choice. This is the equivalent of two QHD 27-inch monitors set up side-by-side. It can provide all the detail we can see, plus the display real estate is easily the most flexible available.

Tying It Together

The best monitor in the world, coupled with a high-performance video camera and quality microphone, will make the work experience richer and more rewarding only when it's comfortable to use. Starting at the viewing position, supporting good posture is critical to both productivity and health. A quality seating solution that offers adjustable seat height, width and depth sets the stage for a truly productive desktop system, but ergonomic considerations don't stop there.

As important as the chair itself is the quality of the monitor mounting solution. Over the course of the day we'll find ourselves moving about, leaning in and stretching back. In a recent Legrand survey a majority of respondents pointed to the need for improved ergonomics. The Human Factors and Ergonomic Society identifies adjustable tilt, rotation and display centering as critical features to optimize user safety and comfort.

A dynamic mount that can compensate for the weight of different displays and deliver easy, dynamic positioning with minimum physical effort lets the content and work take stage center.

Maintaining the critical relationship between keyboard/mouse peripherals, the user and the display via the use of a well-designed mounting system is at the center of optimizing the desktop for productivity.

The Bottom Line

It's time to stop wasting productive hours, losing profit, and limiting the success of business opportunities by clinging to outdated technology and outmoded thinking. An aging desktop system usually isn't "good enough." The small monitor purchased with that 10-year-old tower computer simply can't do what a modern productivity desktop demands. A decade old investment shouldn't be the anchor keeping outdated, underperforming technology in place while the competition moves forward with turbocharged efficiency and a better return on investment.

We are at a moment in time when we must improve our technology to meet the needs of hybrid work and education.

We need to upgrade the way we think about and use desktop productivity solutions!