

A photograph of a Black male worker wearing an orange hard hat and a high-visibility orange and yellow safety vest. He is looking upwards and to the right with a slight smile. In the background, there is a large, light-colored industrial control panel with various cables and components. A dark blue geometric shape, resembling a downward-pointing triangle, is overlaid on the top right corner of the image. Inside this shape, the Panduit logo and the text 'White Paper' are displayed. A white hexagonal grid pattern is also visible over the right side of the image.

**PANDUIT**<sup>®</sup>

White Paper

# Maximizing Space, Time and Cost Savings Through Optimized Control Panel Design



## Introduction

Real estate is typically one of the most significant costs for a manufacturing operation. Facility managers are under constant pressure to manage their space most efficiently in order to minimize capital and operational expenses. The need to fit more equipment into an existing space prompts machine designers to reduce the size and footprint of the machines, which in turn challenges the control engineers to design and build control panels within a smaller footprint or make more efficient use of the space they have.

When designing smaller control panels, control engineers need to consider several variables: cable segregation, thermal management, cable entry, electromagnetic interference (EMI), and cable bend radius, not to mention allowing extra space for future additions. A control engineer's job is further complicated by safety considerations such as arc flash hazards, standards compliance, and minimum separation requirements for electronic components.

This white paper explores how applying more effort during the design process can save significant space compared to conventional panel design approaches. It presents design approaches and components that allow for greater design flexibility. This design flexibility includes reducing the space needed for components and optimizing layout. The result is space, equipment, and cost savings to the panel builder.

# Control Panel Space Optimization

## Start with Enclosure Flexibility

Selecting the proper control enclosure is an essential factor when space optimization is the objective. Enclosures are designed to support a variety of accessories that facilitate component mounting based on the targeted application. For greater flexibility, it is important to choose an enclosure designed to work with the broadest range of accessories.

After this step, specifying the correct wire management components will allow full utilization of the space between the enclosure door and components mounted to the sub-panel in the rear of the enclosure, sometimes referred to as the three-dimensional (3D) space. To accomplish this, the enclosure must be designed to accept supporting structural members along the sides, top and/or bottom of the enclosure, and ideally, on the door as well.

This offers the designer full use of the interior for component mounting and cable and wire management, such as in Figure 1. Here the enclosure includes a full side mount panel with additional wire duct, relays, and grounding provisions that traditionally would have been mounted on the rear sub-panel. This design reduces the wall or machine space needed by 20% compared to the same controls in a more common sub panel mounted design.

**Figure 1:** An example of an enclosure with a full side panel application.



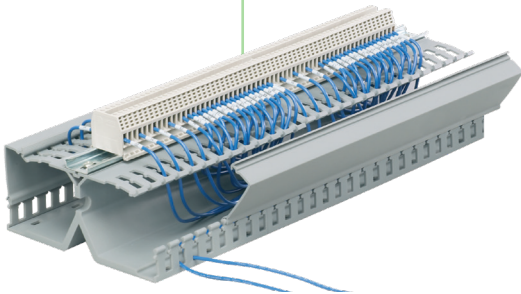
UP TO  
**20%**  
SPACE SAVINGS

## Optimizing Enclosure Space and Reducing MRO Costs

There are several products available today designed to help control panel engineers better utilize this 3D space, as well as often underutilized corner space in control panels that use traditional side equipment mounting plates.

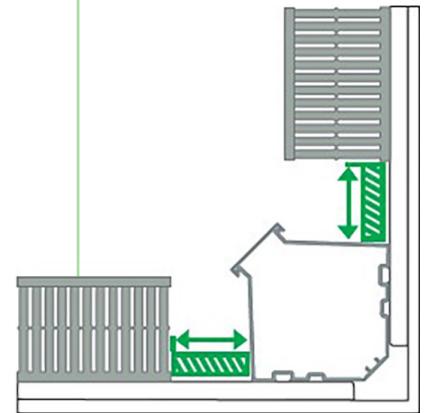
DIN rail wiring duct with two separate wiring channels (Figure 2) enables the user to mount a DIN rail with components directly on top of the duct, rather than alongside, thereby utilizing the 3D space, potentially saving up to 30% of the space on a sub-panel. Figure 3 shows how corner wiring duct can provide good wiring transition from the rear sub-panel to side sub-panels while reducing the amount of sub-panel space needed by up to 20%. Done well, utilizing the 3D space inside an enclosure saves space, allowing for smaller panel footprint or future upgrades. It also eases wire and component access for faster wire termination, labeling, and future MRO needs.

UP TO  
**30%**  
SPACE SAVINGS



**Figure 2:** Panduct® PanelMax™ DIN Rail Wiring Duct

UP TO  
**20%**  
SPACE SAVINGS

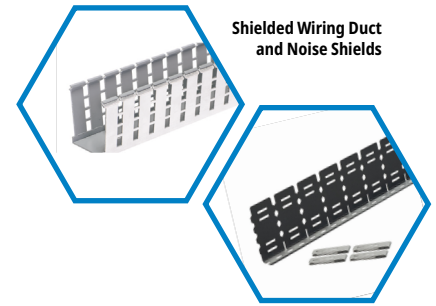


**Figure 3:** Panduct® PanelMax™ Corner Wiring Duct

## Space Saving Advantages of Noise Mitigation

Products generally used for noise mitigation are not typically considered to be space-saving tools. However, a fresh look at approaches to control panel layout can result in improved reliability and performance along with optimized usage of panel space.

Today's EMI noise shielding technology allows designers to bring wiring that would normally require at least six inches of separation much closer together. Figure 4 shows Panduit Panduct PanelMax Shielded Wiring Duct and Noise Shield separating noisy motors and drive cables from sensitive Ethernet or control cables while reducing the space between them.



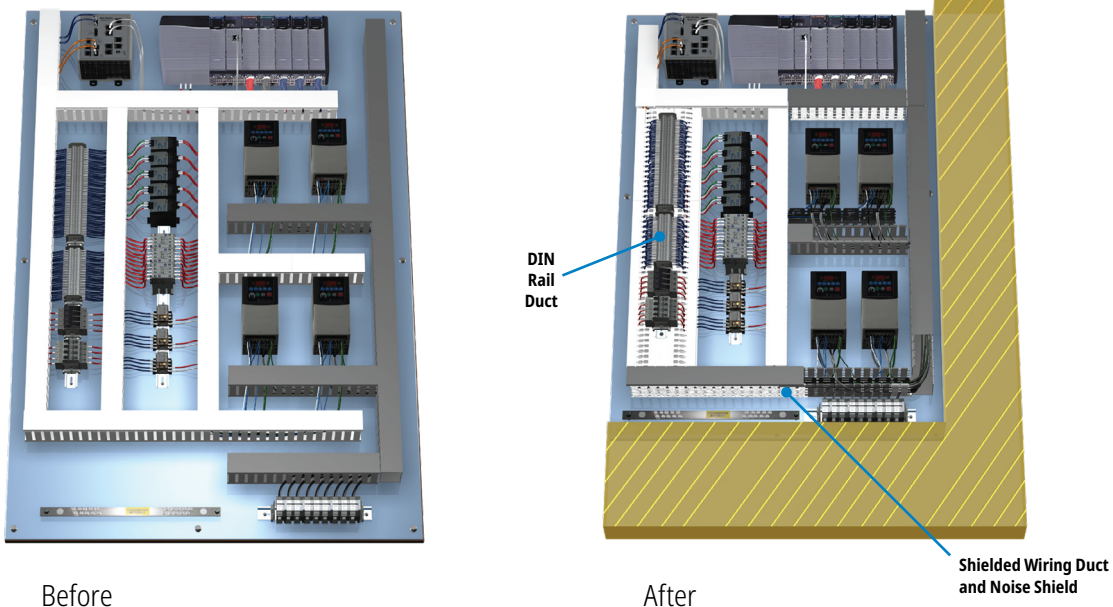
## Saving Space Outside the Control Panel

There are also considerations to be made that can minimize the external footprint. One consideration is how the control panel will be mounted to the floor, wall, or pole. Flexibility with the mounting of the control panel allows the designer to put the control panel anywhere in the design, making the control panel enclosure part of the integrated system solution.

Another consideration is whether to use an air conditioner or other cooling device. While an air conditioner can allow for a more compact control panel solution, it can also add space to the overall footprint of the control panel. The most optimal solution will depend on the application.

**Figure 4:** The effect of space saving solutions: A 40% or greater panel space savings is achievable with components that utilize 3D space.

**40%  
OR GREATER**  
PANEL SPACE  
SAVINGS



# Control Panel Security

## Security Considerations

When the enclosure houses valuable mission-critical equipment and/or information, space optimization may take a back seat to control panel security.

Most times an investment in the right security will be far less than the cost of a potential loss, but the level of protection needed can vary. The owner of the system needs to weigh the following when choosing a control panel security solution:

- (1) The value of the information or equipment
- (2) The risk level of the panel environment
- (3) The appropriate investment to protect it
- (4) The functional requirements (e.g., whether WiFi signals need to be able to pass through the enclosure)

## Access Control Solutions

The expense of lost or stolen data or the cost of injury from unintentional access can be mitigated cost effectively with a layered approach to controlled access.

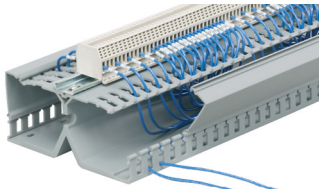
Access control and power distribution capabilities typically associated with building security can now be integrated directly into network enclosures. Innovations like electronic swing handles and built-in low frequency card readers can reduce risk by limiting access to critical IT equipment to authorized personnel. Intelligent power distribution units can enable remote monitoring capabilities and improve efficiency by continuously scanning for electrical circuit overloads and other conditions that place critical IT/OT equipment at risk.



## Conclusion

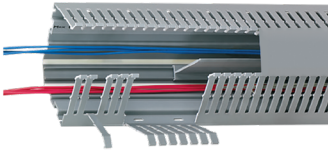
Control engineers must overcome a tremendous amount of complexity when designing control panels in today's industrial environments. Whether the application is in oil and gas, food and beverage, automotive, water treatment, or pharmaceutical, competing design criteria make decisions about optimizing the control panel critical to the success of the project. Space optimization can provide more design flexibility both for the control panel itself and the plant floor, and help facilitate integrated access control solutions.

## Easy and Economical Space Savings with Panduct® PanelMax™



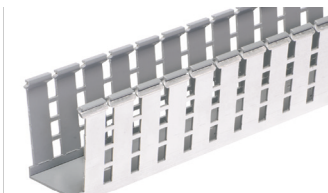
### **PanelMax™ DIN Rail Wiring Ducts**

PanelMax™ DIN Rail Wiring Ducts feature two separate wiring channels.



### **PanelMax™ Corner Wiring Ducts**

PanelMax™ Corner Wiring Ducts providing wiring transition from rear sub-panels to the side sub-panels.



### **PanelMax™ Shielded Wiring Ducts and Noise Shields**

PanelMax™ Shielded Wiring Ducts and Noise Shields provides up to 20dB reduction in noise, or 90% noise voltage reduction (NVR).



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