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UNDERSTANDING TERMINAL BLOCKS USED IN DISTRIBUTED CONTROL SYSTEMS

Distributed control is an important part of any factory or processing plant. Autonomous controllers, distributed throughout a system, provide many control loops for operations to take place, eliminating the bottleneck of a single central supervisory control. With the multitude of smart sensors and transducers, motors and encoders, and a range of other devices, industries are being forced to evolve so that control can be distributed throughout a facility. Companies with multiple locations are particularly interested in methods by which all the facilities can work together. Interconnection, through the use of specific terminal block technologies, between elements of a distributed control system is necessary to maintain a smooth operation.

Components of a Distributed Control System

Each distributed controller, regardless of application, has a standard method of operation (see Figure 1), which starts with field devices. Sensors and transducers are connected directly to the process or piece of factory equipment. Devices include digital sensors such as 0 or 24 VDC or 24 VAC devices and digital actuators such as infrared object counters. Similarly, analog sensors such as 4-20mA and 1-30V devices and analog actuators such as flow control valves are at the manufacturing floor end. These field devices are wired through a field junction box for easy distribution.

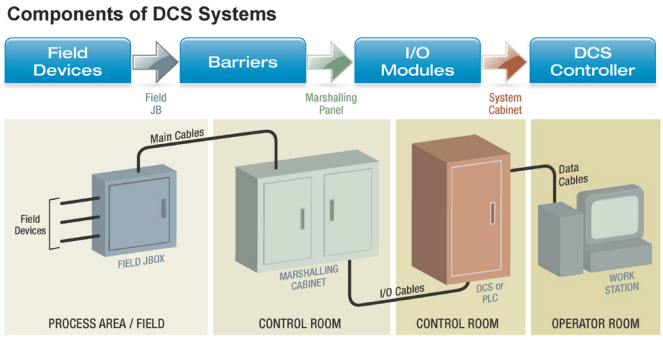

Figure 1: *Illustration of standard distributed control system configuration.*

Making sure your sensor or actuator is properly wired into the field junction box is critical (see Figure 2). Altech supports the distributed control system by providing users with a range of DIN Rail terminal blocks capable of interconnecting each segment of the system. Since digital and analog devices provide input signals with one, two, three, and four-wire configurations for a wide variety of uses, the proper terminal block and wiring configuration must be used. Simply put, one-wire connections carry only the sensor signal and nothing else. A two-wire sensor has a signal connection along with a supply connection. The three-wire digital sensor also has a supply grounding wire, and the four-wire sensor incorporates an additional earth ground—used for field sensors.

Figure 2: *Field junction boxes are located near the sensors and actuators wired to them.*

Terminal blocks are used to increase safety and circuit integrity by isolating, fusing, grounding, and otherwise protecting components in an electrical circuit. Standard function for terminal blocks used in field junction boxes is called a feed through block, which means that only the sensor line needs to be “fed through” the terminal block. Ground terminals can be tied together in this case because the sensors share a common ground. This makes the terminal blocks suitable for multiple connections that are insulated from one another. Other types include fused disconnect terminal blocks and

fused disconnect with failure indication. The same standard types of terminal blocks are also available for digital actuators.

Analog sensors are similarly designed as digital sensors except that the terminal blocks often have to accommodate shielded wires that are used to protect the analog signals from electromagnetic interference, which can interfere with proper output. Terminal boxes for analog signals come in the same, feed through, fused disconnect, and fuse disconnect with failure indication types that digital sensors do.

Sensor and actuator terminal blocks (see Figure 3) from Altech offer key benefits over other products on the market. For example, the company's fused/unfused terminal blocks have an outer profile that matches their feed through terminal block for ease of installation and use. All feed through terminal can be jumpered, thereby eliminating the need for external wire loops at the input. A number of types of cable connections are available, including screw, high performance screw, spring, and push-in.

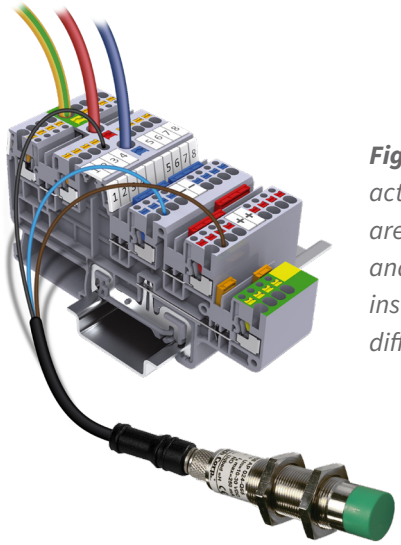

Figure 3: *Sensor and actuator terminal blocks are just 3.5mm thick and offer fast and easy installation in several different configurations.*

Once the connections from all the field devices have been made inside the field junction box, the appropriate cables are run through the marshalling panel—which is for connections of much higher densities. The marshalling cabinet is the interface between the system cabinet and the field junction boxes. So, not only are the main cables from the field junction box coming

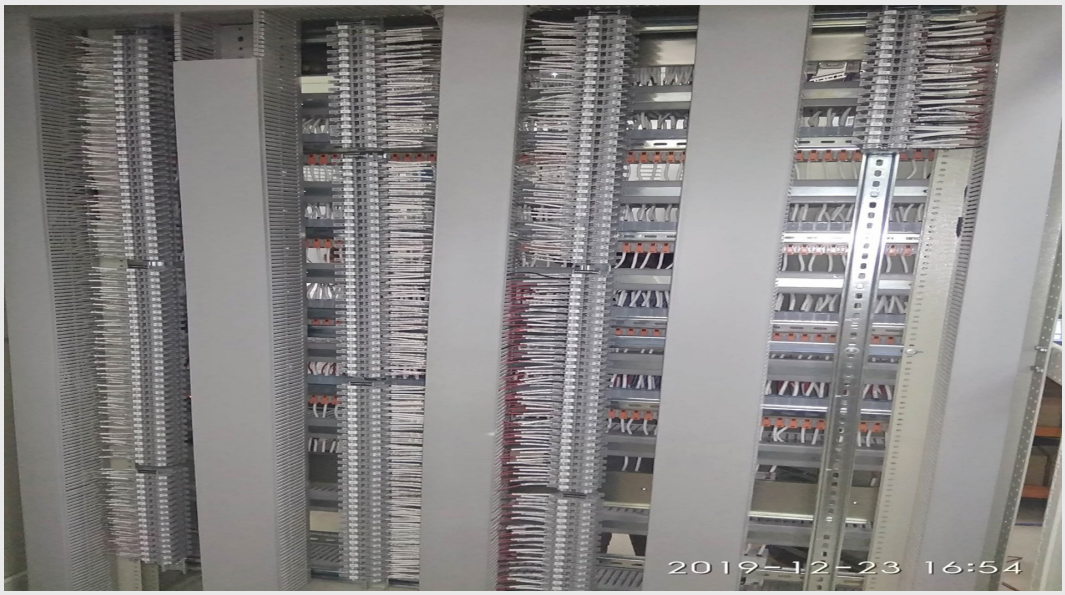

Figure 4: *The marshalling cabinet is where the field wiring and system cabinet wiring are interconnected.*

into the marshalling cabinet, but the cables from the system cabinet I/O cards are also terminated in the marshalling cabinet. Marshalling Panels provide cross wiring functionality between field instruments and the control system. By having this type of interface, input and output issues can be quickly identified and maintenance personnel can perform routine functions in the field without jeopardizing the heart of the control system.

The marshalling cabinet (see Figure 4) segregates digital and analog I/O connections in eight or 16 input form before going to respective I/O cards through barriers or relays. Altech has available eight, 16, and 32 connection assemblies with feedthrough or disconnect terminals and offers an eight-level terminal for extra dense wiring. The same goes for analog signals, except that for analog signals that carry pair wire termination, it is suggested that shield clamps be used. In general, where high volumes of signals are being passed through the junction box, compact designs are an essential part of the design decision being made early in the design cycle.

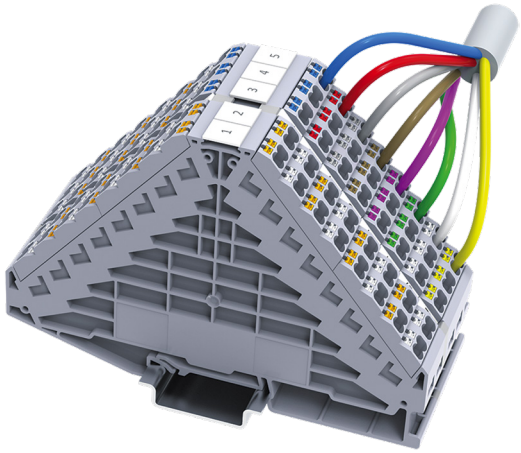

Figure 5: *Eight-level terminal blocks handle large numbers of wires.*

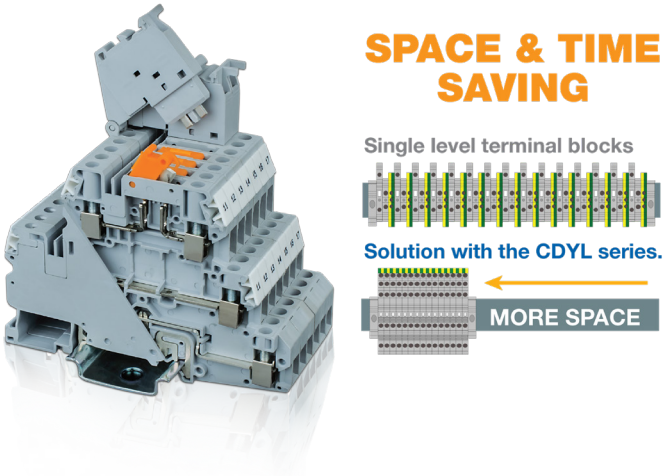

Figure 6: *The CYDL multi-function terminal blocks provide users with maximum space and time savings.*

Marshalling terminal blocks for distributed control systems must handle large numbers of wires, which is why Altech's eight-level terminal blocks (see Figure 5) are ideal. They help to simplify complex wiring in the process and power generation industries. These terminal blocks are extremely compact at only 9mm thick and 120mm wide. By increasing the wiring density, these marshalling terminal blocks save users a lot of valuable space. In addition, the company offers multilevel fuse terminal blocks that provide a fuse fail indication for high-level functionality, a middle level feed through portion, and a bottom level earthing connection. Combination terminal blocks can save over 50 percent of space over other terminal blocks on the market (see Figure 6).

Distributed control system components from field sensors and actuators through to the controller are subjected to a wide variety of conditions. In harsh and hazardous conditions, devices must be protected.

Table 1: Hazardous Zone Categorization

Zone	Description	State
Zone 0:	Area where an explosive atmosphere is permanently or frequently present as a mixture of air and flammable materials	Gas, vapor, or mist
Zone 20:	Area in which an explosive atmosphere is present in form of a cloud of flammable dust in air permanently or often	Cloud of dust
Zone 1:	Area where it must be expected that an explosive atmosphere is present occasionally in normal operation	Gas, vapor, or mist
Zone 21:	Area where it must be expected that an explosive atmosphere is occasionally present during normal operation	Cloud of dust
Zone 2:	Area where it must not be expected during normal operation that an explosive atmosphere is present but might occurs momentarily	Gas, vapor, or mist
Zone 22:	Area where it must not be expected during normal operation that an explosive atmosphere is present but might occur momentarily	Cloud of dust

One categorization occurs in different zones based on the presence of flammable or explosive gasses and the time a device might be exposed to them (see Table 1: Hazardous Zone Categorizations).

Conclusion

Regardless of your application, you'll need to use terminal blocks that are capable of handling your every need. When selecting a supplier, be sure you know their capabilities. Your supplier should understand your application needs, as well as be able to offer insight and suggestions into which products to use. Whether you are working in discrete manufacturing or process control industries, incorporating the right terminal blocks will save you time and money for years to come.