

## Outgrowing the Switching Cabinet

**In a distributed installation of machines and systems, the I/O signals have to be processed directly in the field. An efficient solution in this context is a modular I/O system with protection rating IP67**

**As a modular IP67 fieldbus station, BL67 can be mounted directly in the field installation. The compact extensions with a width of only 32 mm come with a choice of M8, M12, M23 and 7/8" plug-in connection technology.**

One of the present trends in automation is the distributed, remote installation of machines and systems with the help of modular peripheral devices. This is particularly reflected by the development of the fieldbus market, where PROFIBUS is on constant course for growth. From 2004 until the end of 2007, the Profibus User Organisation has planned to double the number of installations from 10 to 20 million stations. In 2004, more than 2.5 million new stations were installed, so that the manufacturers of Profibus devices could benefit from an annual turnover increase of 30% per cent; for 2005 the PNO is expecting further growth.

Fieldbus technology is largely concerned with remote peripheral devices, but which requirements must these meet in more concrete terms? I/O systems for the IP20 area, mounted in a protective control cabinet, are part of the well-established technology in this field. This first idea that springs to mind is to simply install these IP20 systems in a separate protective housing and to mount this directly at the machine base. This concept would surely shorten the cable routes to the peripheral sensors, but has no other distinct advantages. The user would still have to invest a lot of time to route the sensor cables, lead these through cable glands and wire them to the IP20 bus terminals. Polarity errors, which negatively affect valuable installation and set-up times, can easily occur. And if the fieldbus station is to be expanded by some other signals, then problems are bound to occur. Additional cable glands have to be integrated into the protective housing, which, at worst, may not provide enough space for such additions. And this is exactly where IP67 fieldbus devices come into play. Their percentage share within the fieldbus market is growing continuously. According to estimations, the number of fieldbus stations, which may be mounted directly in the field due to their high protecting rating, will account for 15% of the fieldbus turnover in 2005.

### Assisted by Software

In order to be able to compare the diverse modular I/O systems with each other, it is not sufficient to look at the mere hardware cost and functionality. An approach, which considers the entire life cycle of a system, is far more appropriate. The software also plays an important role. The significance of this component for advanced I/O components is clearly demonstrated by the „I/O Assistant“ for the IP67 I/O system BL67 from TURCK. The I/O Assistant accompanies the user during all stages of a system, starting with the configuration of a modular fieldbus station. At the beginning, this comprises the selection of the needed components, as well as identification of type designations and associated order numbers. Basically, the software is not indispensable for these procedures, but it is an efficient tool for such tasks. It saves costs, time and efforts by assembling a station graphically and the related documentation, including order lists, technical and dimension drawings as well as parameter lists are generated automatically. The software additionally indicates the logically associated base and electronic modules and calculates the maximum total current of the digital inputs and outputs. The user is warned if an additional source of power is needed. The next decisive step is the set-up procedure. Here the user connects his PC and the BL67 gateway via a serial service cable and the I/O Assistant. Then all digital and analogue inputs can be read on-line and all digital and analogue outputs set and assigned to certain values. With this method it is possible to verify the entire sensor and actuator wiring immediately. It is not necessary to set-up the controller connection in conjunction with a Profibus Master in order to check the sensors; with the I/O Assistant this can be easily accomplished in advance via software. As a result, the set-up time of a system can be clearly reduced. Should any problems occur, then the I/O Assistant can also be used for diagnostics. Since all diagnostic messages are indicated via a clear-text display, it is not required to go into the bits and bytes in order to localize the error meanings.

### System construction

The above mentioned characteristics describe all the important features of the support software. Which impact, however, does a modular I/O system have on the system construction? The BL67 system is used here again as an example: The modular I/O system consists of the gateway and the extension modules. The gateway is the "head" station and acts as a communicator between the internal system bus and the fieldbus. To date TURCK offers gateways for the bus systems Profibus-DP, DeviceNet and CANopen and from autumn on, there will be an Ethernet gateway available. This Ethernet gateway will support three protocols. Modbus TCP, Profinet IO and Ethernet IP. Consequently it is irrelevant which Ethernet protocol will finally dominate the market or which market the user opts for.



With the Ethernet gateway, the functionality of the I/O Assistant will also be available for an Ethernet network, so that all fieldbus stations can be dealt with from a central point. The gateways can be integrated into the configuration tools of the various control system manufacturers via GSD or EDS files. In terms of connection technology, TURCK relies on existing cabling concepts which are widely accepted in the IP67 world. The gateways for Profibus and CANopen are equipped with round M12 connectors, whereas the DeviceNet gateway features 7/8" connections. The plug & play concept simplifies system and machine installation because wiring errors are largely excluded. Pilot installation, system expansion and maintenance are facilitated, so that the system costs are reduced. Especially for machine and system engineers, who have to dismantle their systems after initial installation, in order to transport these to the sites of their domestic or foreign customers for re-assembly, this approach provides considerable saving potentials – e.g. the installation can be carried out directly on-site by less highly qualified staff.

### **Individual assembly**

However, the gateways are merely the foundation of an I/O system. They operate in conjunction with various extension modules for application-specific configuration of a fieldbus station. These extensions are simply added to the right of the gateway, without an integral backplane or module rack. A key aspect is that the extension modules separate the connection technology (base modules) from the electronics. TURCK offers base modules with a choice of M8, M12, M23 and 7/8" plug-in connections. These can be freely combined with the electronic modules. Should it be necessary to replace an electronic module within the system's life cycle, then this can be done during operation due to the stationary wiring concept, the separation of electronic and connection level and the integral hot-swapping function. The electronic modules are inserted into the base modules from the top and then simply secured with two screws. The mechanical coding function additionally prevents faulty insertion of the wrong electronic module during servicing. The electronic modules come with various digital input and output configurations, such as pnp, npn and high-end modules. The pnp and npn modules are the „basic“ modules and provide standard module diagnostics. High-end modules offer channel-specific diagnostics and provide additional characteristics, such as output mode selection, programmable filter times and short-circuit performance, as well as freely configurable combinations of output and input channels. There are analogue input and output modules for current (0/4 to 20 mA) and voltage (-10 V/0 to +10 V) as well as PT and thermo-element inputs in a dual channel design. The analogue 4-channel input modules can be configured for current or voltage. This line is expanded by technology modules with SSI and serial interface (RS232, RS485/422).

### **Selective power supply**

An important issue – particularly in terms of system availability – is the selective power supply. A current limitation for the supply of the gateway or via power-feeding modules ensures that the current cannot exceed 4 A, even in the event of a short-circuit, and that only the affected system sections, or potential groups, are turned off. All other system sections remain unaffected and available. The power feeding modules enable combining signals to potential groups or to supply load voltage to the outputs. Safety-related shut-down proceedings are also permitted due to the all-pole disconnection characteristic of the power-feeding modules. This power supply concept supports another technology, which results from the remote I/O structure: the integration of pneumatics into electronic I/O systems. Our first approach for BL67 is a separate special connection for valve terminals. For this there are several multi-channel digital output modules with up to 16 channels available. The user simply selects the connector type optimally suited to his application and the passive junctions and valve terminals can be smoothly integrated into the system via the M23 multicore base modules with 12 or 19 poles.

### **The author**

Markus Ingenerf  
is product specialist for BL67  
within the product marketing team of  
Hans Turck GmbH, Mülheim.