All you need to know about the Industrial Ethernet

In the past, field busses were used for communication between automation machines in industrial automation. In the office world however, Ethernet was standard. The fact that these two communication systems are incompatible with one another meant that communication from the office to field level was restricted and a consistent communicative structure was not possible. The integration of Ethernet technology in the world of automation is the solution to all these problems. The advantages are obvious: Consistent use of Ethernet for example, enables ERP systems (Enterprise Resource Planning) to access data in the production systems. Service technicians have simple access to the automation system through the company network and even through the internet, enabling them to find and correct faults. Operators and manufacturers of machines and plants do not require any specialised know-how for the various communication systems. However, it is necessary that the industrial Ethernet user becomes familiar with certain new techniques and terms. We at Safety Network would like to support these users. In our “Ethernet Know How Series” in the forthcoming newsletters, we will be defining many of the most important terms of the Ethernet world.

Part 1:
Protocol, what does TCP / IP and Co. actually mean?

Protocols are often mentioned in connection with the industrial Ethernet. It is very important to understand network protocols when using Ethernet. The following report will explain the most important protocols. Basically, protocols are regulation and syntax agreements which apply for communication partners within a network. The TCP/IP protocol family belong to the most important protocols in Ethernet based networks. TCP/IP also includes a variety of applications from the office world and the internet such as the term “http” to view websites or “SMTP” to send emails. TCP / IP houses a whole family of protocols, three of which are defined below:

IP
The Internet Protocol, IP in brief, has the authoritative duty, to address data packets and transfer them to a connectionless packet oriented network (routing).
Each station and terminal has its own individual address within the network, the IP address.
For example: 127.0.0.1
The address consists of 4 Byte. Each Byte can accept a value of 0 to 255. The IP V6 was introduced to increase the address room and consists of a 128 Bit address.

TCP
The Transmission Control Protocol, TCP in brief, is part of the TCP/IP family.
Every TCP/IP data connection has a transmitter and a receiver. This principle is a connection oriented data transmission. In the TCP/IP protocol family the TCP, as a connection oriented protocol, takes on the task of data security, data flow control and adopts measures after data loss.

UDP
The User Datagram Protocol (UDP) has the same role as the TCP. The difference is that as a connectionless protocol, it has no means of confirming the arrival of the data packet at the recipient. This duty is passed on to superior levels. UDP is the faster communication variation in comparison to TCP.

Example TCP/IP:

1. Computer 1 sends a packet stating that it would like to make a connection to computer 2.
2. Thereupon computer 2 replies it is ready.
3. Computer 1 confirms computer 2, that it has understood that computer 2 is ready.

The connection is now established, and the actual data transmission can begin.

Due to its complexity however, TCP / IP has an important disadvantage which restricts its use in automation technology: It does not function in real-time. For this reason, special industrial Ethernet protocols have been developed for critical real time demands in automation. In order to maintain consistent communication with the office world, it is important that the industrial Ethernet also supports the TCP / IP. SafetyNET p is a true example which proves that the balancing act between TCP / IP compatibility and real time is possible.

Safety NET p offers two varieties of communication:

1. RTFN: based on TCP / IP and therefore ideally suited for the communication between computers, control and visualisation. Real time at a range of 1ms cycle time is possible. The frames TCP, UDP or MAC are used according to the required speed.

2. RTFL: bypasses the TCP / IP protocol pile to achieve cycle times of up to 62,5 µs and can therefore be used for fast E/A communication or even directly in regular cycle drives. Even so, transport from the TCP /IP frame to RTFL is possible. A TCP / IP partner must be connected to a RTFL machine. The TCP / IP frames are then sent, depending on the cycle times, to the communication gaps between RTFL frames, or “packed” in fragmented form into the RTFL frames and then put back together at the receiver.