**Company Profile**

TPM is an automation solution provider with investors from iBASE, NPM and several senior engineers in the automation industry. TPM focuses on the products of distributed control based on Motionnet® and EtherCAT®. The mission of TPM is to encourage the new way for automation by distributed control with PAC(Programmable Automation Controller).

**Industrial Fieldbus**

Industrial Fieldbus stands for a family of industrial computer network protocols used for real-time distributed control. Motionnet® (SEMI E54.21-1110) is a high-speed serial communication system based on RS-485 technology. EtherCAT® (SEMI E54.20-1108) is super high-speed communication system based on the improvement of Ethernet technology with “on-the-fly” processing.

Motionnet® uses both Cyclic Communication to communicate sequentially and regularly with local devices and Transient Communication to send the data when required. Cyclic Communication transmits I/O data and motor control status, while Transient Communication transits motor’s motion/speed data.

EtherCAT® telegram is encapsulated in an Ethernet frame and includes one or more EtherCAT® datagrams destined to the EtherCAT® slaves. Each EtherCAT® datagram is a command that consists of a header, data, and a working counter. Through the datagrams, the EtherCAT® master addresses the entire address space up to 4GB in which up to 65,536 EtherCAT® slaves can be located.

**Soft Motion: ECP/ECPW**

Soft motion control is a PC-based motion control approach that takes advantage of modern x86 CPU and reduces hardware requirements. Soft motion control is completely liberated from the limitations of hardware ASIC and eliminates the need for complicated cabling. TPM Soft Motion control is based on the innovative and open standard EtherCAT® network technology. Since it is open and based on industry standards, it enables engineers to effectively streamline the automation of motion control. TPM soft motion technology enables customers to build their own products without depending on the proprietary black box technology provided by motion control vendors.
Motionnet® is a high-speed serial communication system with data transfer rate at up to 20 Mbps. This technology is widely applied in factory and machinery automation industries. One Motionnet® master chip supports 64 slave devices including Digital Input/Output, Analog Input/Output, Pulse counter, Temperature and Motion control modules. Through Ethernet cables, slave devices are connected in a linear topology. It reduces a lot of wiring complexity and cable cost. Motionnet® transfers 4 bytes of data in 15.1μsec for cyclic communication. The cyclic communication command is executed every clock cycle processing 4 bytes of the reserved memory spaces for specific commands. Others are transmitted in a communication frame. The data change time of a specified module for both types of commands is predictable by a simple formula. With time deterministic feature of Motionnet®, which is a very important issue for real-time application requirements provides a perfect framework for factory and machinery automation systems.

**Motionnet® System Configurations**

```
Cyclic communication time: 15.1μsec. total send and receive: 4 bytes
```

**Motionnet® Features**

```
64 Slaves <0.97ms
CYCLE TIME
```

**WIRE-SAVING / LONG-DISTANCE**

**HIGH-SPEED / TIME-DETERMINISTIC**
EtherCAT® is an ultra high-speed serial communication system. This technology is widely applied in factory and machinery automation industries. EtherCAT® is real-time down to the I/O level. The transmission rate of EtherCAT is 2 x 100 Mbit/s, which makes it the fast ethernet. Each EtherCAT® slave device reads and writes the data by the function of "on the fly". One can extract or insert bits or bytes without suspending the system. Each EtherCAT® segment can connect up to 65,535 nodes. With 100BASE-TX, the distance between two nodes is up to 100M with EtherCAT®. With 100BASE-FX (fiber optics), the distance between two nodes is longer than 100M. Precise synchronization is one of the features of EtherCAT®. The Distributed Clocks (DC) can adjust the time of Master and Slaves to achieve the synchronization. The time of synchronization is less than 1 μs. EtherCAT also leads to lower solution costs because of the low cost slave controller with FPGA, small volume with EtherCAT instead of IPC, and so on. EtherCAT is IEC, ISO, and SEMI standard protocol. The slave controller can provide interoperability. The master stacks are suitable for various Real-time Operating System (RTOS).

EtherCAT® System Configurations

EtherCAT® Features

Wire-Saving Allocation
- With RJ45 Ethernet cables, slave devices are connected in different topology.
- It reduces a lot of wiring complexity and cable cost.

High-Speed Ethernet
- The transmission rate of EtherCAT® is 2 x 100 Mbit/s.
- It is the fastest Ethernet with full duplex.

Precise Synchronization
- Distributed Clocks (DC) is the function of synchronization in EtherCAT®.
- The time of synchronization is less than 1 μs.

Open Technology
- EtherCAT® is IEC, ISO, and SEMI standard protocol.
- The master stacks are suitable for various Real-time Operating System (RTOS).
Soft motion control is a PC-based motion control approach that takes advantage of modern x86 CPU and reduces hardware requirements. Soft motion control is completely liberated from the limitations of hardware ASIC and eliminates the need for complicated cabling. TPM Soft Motion control is based on the innovative and open standard EtherCAT® network technology. Since it is open and based on industry standards, it enables engineers to effectively streamline the automation of motion control. TPM soft motion technology enables customers to build their own products without depending on the proprietary black box technology provided by motion control vendors.

TPM Soft Motion software operates on the PC without additional devices and fully exploits the very fast and accurate computation power of today’s PCs. The core soft motion technology by TPM is real-time motion control software built on a hard-real kernel of Windows. TPM harness the ever-improving CPUs in modern computers: as the speed and the power of CPUs increase, so does the speed and the power of TPM soft motion control software. The host CPU performs all real-time motion tasks, including acceleration/deceleration, multi-axis coordination, as well as file management, data processing and graphical user interface, all simultaneously.

TPM soft motion software allows customer to use their valuable know-how to build the best possible motion control products. Additional benefits of TPM soft motion control include:

- Reduce time for project development
- Reduce cost for machine control operation
- Increase scalability for system configuration
- Increase flexibility for motion control application

**Architecture**

![TPM Soft Motion Architecture Diagram](image-url)

**Soft Motion Application**

- ECPW (EtherCAT Protocol Wrapper) on Windows
- EtherCAT Master Stack
- INtime
- PC Platform
- Standard Ethernet Port

**Driver / Motor**

- Panasonic
- Sanyo
- Oriental
- TPM