SynqNet™

Product & Technology Overview

Motion Engineering

SynqNet™ Frequently Asked Questions

What is SynqNet?

SynqNet is an all-digital motion control interface for connections between controllers and drives, I/O devices, and other custom nodes. SynqNet motion network is based on the industry standard IEEE802.3 physical layer for robust electrical isolation and cable/connector availability with an open data layer implemented by Motion Engineering Inc. The 100BASE-T media system is based on specifications published in the ANSI TP-PMD physical media standard. The 100BASE-T system operates over two pairs of wires, one pair for receive data signals and the other pair for transmit data signals.

How does SynqNet compare to other networks?

SynqNet was designed for demanding multi-axis motion applications and to address industry trends towards all-digital interoperable connectivity. SynqNet gives machine designers an open platform on which to build their next generation machine and meets the market demands for reduced cabling, remote diagnostics, firmware download, multi-vendor support, network simplicity, and safety. SynqNet was developed specifically to address the lack of commonly available networks for high-performance motion control.

	SynqNet™	Ethernet (TCP/IP) (UDP)	FireWire IEEE1394	SERCOS	CAN
EMI Immunity	High Transformer Isolation	High Transformer Isolation	Low (Twisted Pair)	High Fiber Optic	Fair/High Regular/PhotoCoupler
Max. Inter-Node Distance	100m	100m	4.5m	40m	40m total
Min. Cycle Time/ Latency	<25µs	1..2ms	125..250µs	250µs	1ms
Bandwidth	100 +100 Mbit/s	100 Mbit/s	400 Mbit/s	16Mbit/s	1Mbit/s
Next Generation	1 + 1 Gbit/s	1 Gbit/s	800 Mbit/s	-	-
Transfer Mode	Full-Duplex	Half-Duplex	Half-Duplex	Half-Duplex	Half-Duplex
Max. Jitter	<1µs	20µs	<1µs	1µs	1..120µs
Fault Tolerance	Yes	No	No	No	No
Need of Switches/ Hubs	No	Yes	No	No	No
Max. Number of Nodes	254	No Limit	63	254	2032

Why is jitter an important issue for motion control networks?

Jitter in motion control networks can directly affect the motion produced by the system. For constant velocity scanning applications, jitter can result in undesirable velocity instability. SynqNet networks communicate with drives on the network in a synchronous manner, using timestamps for predetermined messaging. This synchronous operation all but eliminates the negative effects of jitter. In contrast, IEEE1394, which was originally designed to transport multimedia data for consumer electronics, only provides an isochronous mode which doesn't provide any data delivery guarantee. This results in the need for deep buffers and therefore increased latencies. Even worse for motion control, these latencies are variable.

Why is network electrical isolation an issue for motion control networks?

Ground-conducted electrical noise from other components in a machine (such as a noisy PC switching power supply) can have negative impacts on motion control networks. Electrical isolation is generally recommended to protect the network PHY component from this type of noise. SynqNet employs transformer-based electrical isolation to provide isolation of bus signals from power line ground noise currents. While other industrial networks such as CAN have features designed to protect against this type of noise, IEEE1394 has poor common noise immunity and offers no practical means of adding electrical isolation. These non-isolated interfaces can cause unpredictable behavior for motion control applications, especially in noisy industrial environments.

Is there a SynqNet Developer program?

Yes. Third-party manufacturers are developing SynqNet compatible drive products in a range of power ratings. In addition, a variety of digital and analog I/O, "RMBs" or analog bridge devices to connect analog drive to a synqNet network are also available from several servo suppliers worldwide. MEI has a formal SynqNet developer program for manufacturers or OEMs wishing to develop SynqNet compatible products. For additional information on SynqNet Developer Kits, contact us directly, visit us online at www.motioneng.com, or visit www.synqnet.org.

Additional technical information and white papers are available at www.SynqNet.org.

SynqNet™

Maximize performance

SynqNet is a high performance network technology designed by Motion Engineering, Inc. to simplify machine development and manufacture, and lower the cost of in-field support and upgrade. SynqNet replaces the noise-prone analog drive - motion controller interface (±10V + Encoder) with a real-time digital network that brings additional diagnostic, performance and reliability benefits to a machine. SynqNet was developed in response to customer demand and the lack of any other openly available solution. As a result, SynqNet is the only motion control network that offers all of the following:

• "Self-Healing" Fault tolerant operation using ring topology

• Firmware and drive configuration download

• Open, field-proven silicon (100 Base-T physical layer)

• Centralized control with distributed hardware

• Wide choice of drives & I/O devices from world-class servo vendors

• Support for up to 32 coordinated axes

• Network bandwidth for torque updates up to 48 kHz

• Remote diagnostics over SynqNet

• Remote drive configuration and setup

• Remote upgrade of drive firmware features

• Automatic network configuration and integrity check

• Cabling up to 100 Meters between each node

• Electrical isolation for robust noise immunity

SynqNet is the only digital motion control network that offers a dramatic reduction in system wiring while providing higher performance than conventional analog control systems. Because SynqNet networks support servo update rates of up to 48 kHz, it is suitable for machines requiring high levels of coordination and synchronization between axes.

Reduce wiring

SynqNet controllers connect directly to SynqNet drives, or to standard analog drives via a MEI Remote Motion Block (RMB). RMB's allow for instances where a custom analog drive, or I/O device is required. Unlike conventional analog systems that require hundreds of discrete wiring conductors, connecting SynqNet nodes only require plugging a single connector (CAT5 cable with RJ45's or custom connectors) into the SynqNet network interface on each node. Large analog wiring harnesses are expensive, prone to manufacturing errors, and are subject to failure in the field. SynqNet replaces these large wiring harnesses with a single network cable. Machines designed with SynqNet are lower cost, easier to build, more reliable, and easier to troubleshoot than machines designed with other digital networks or analog motion control systems.

Cut manufacturing time

Because SynqNet drives and controllers are connected together with simple "one-click" connections, large machines can be built in a highly simplified modular fashion, reducing machine wiring time from hours and days, to minutes. SynqNet allows for drive setup, configuration, and current loop tuning through the network, from one centralized PC. This eliminates the time consuming and error-prone process of connecting a serial cable to each drive in the system in succession.

Improve reliability & communicate from anywhere

Remote node diagnostics on a SynqNet network can be enabled on a local machine, across LANs and across the Web. SynqNet software allows real-time information to be obtained and analyzed for the ultimate in preventative maintenance and optimum uptime. SynqNet systems provide detailed information about individual drive status through the network to the host computer. The host software has direct access to drive setup, notch filtering, current and velocity loops, feedback setup, custom features, heat sink temperature, error and status information, and a host of other parameters. This results in software that can anticipate machine failures and easily identify problems when they do occur. If problems occur that cause a near failure to a drive, SynqNet controllers can be notified and alert the operator before a total failure.
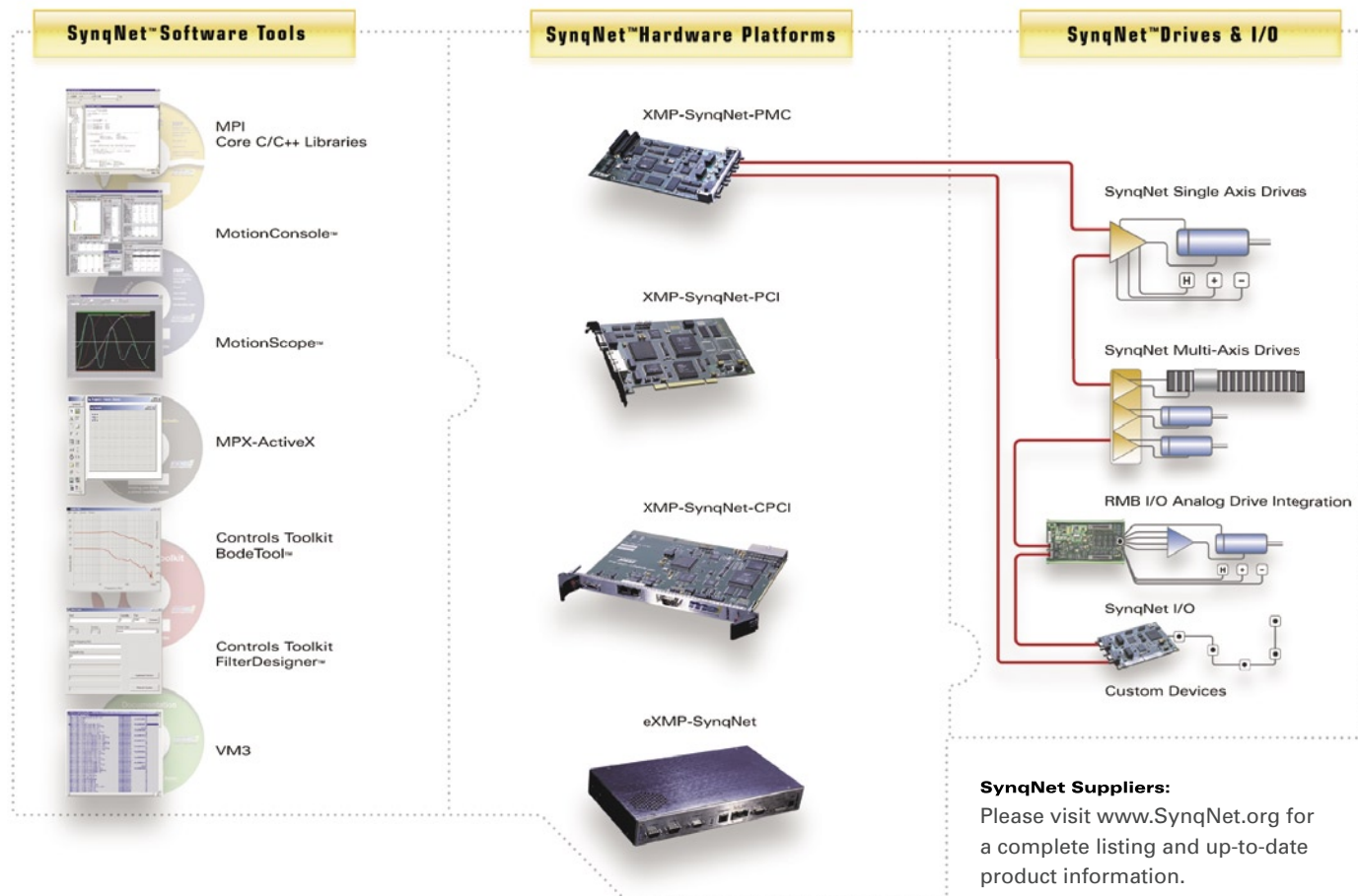
Open Technology

SynqNet is built upon openly available industry standard silicon, making it simple and cost effective for OEMs and drive vendors to embed SynqNet technology. No ASICs are required to implement a SynqNet design. By making SynqNet technology readily available and simple to integrate, OEM customers have multiple vendor options to satisfy the diverse needs of a complex machine application. SynqNet slave-device technology is openly available to qualified OEM machine builders and product developers. SynqNet master-device technology is available under license terms to OEM machine builders and product developers.

Controller Performance

The XMP-SynqNet controller platform provides a 32-bit motion co-processor and update rates up to 16 kHz. One API (the MPI) is used to program motion, I/O and SynqNet specific parameters. In addition, a suite of Windows® motion tools helps speed development of motion programming. The all-new ZMP-SynqNet family of controllers, provide true 64-bit processing, advanced algorithm support, and update rates up to 48 kHz for applications requiring the ultimate in motion precision. And motion applications developed today will remain compatible with the ZMP-SynqNet platform and future SynqNet controller developments.

MEI SynqNet Products

SynqNet™Software Tools
- MPI Core C/C++ Libraries
- MotionConsole™
- MotionScope™
- MPX-ActiveX
- Controls Toolkit BodeTool™
- Controls Toolkit FilterDesigner™
- VM3

SynqNet™Hardware Platforms
- XMP-SynqNet-PMC
- XMP-SynqNet-PCI
- XMP-SynqNet-CPCI
- eXMP-SynqNet

SynqNet™Drives & I/O
- SynqNet Single Axis Drives
- SynqNet Multi-Axis Drives
- RMB I/O Analog Drive Integration
- SynqNet I/O
- Custom Devices

SynqNet Suppliers:
Please visit www.SynqNet.org for a complete listing and up-to-date product information.

MEI Programming Software

MEI offers a complete suite of software tools that work across SynqNet platforms. MEI offers the Motion Programming Interface (MPI), an object-oriented, C/C++ programming interface as well as the MPX, ActiveX® motion libraries for use in any ActiveX environment.

MEI Software Tools

Motion Console™ configures software objects and exercises system motion. Motion Scope™ graphs real-time data from the controller recorder object including velocity, position, and output values. VM3 accesses any XMP memory location. BodeTool™ helps the controls engineer understand and optimize machine performance via frequency analysis. FilterDesigner™ allows for custom notch and low pass filters to be implemented on-the-fly in conjunction with the BodeTool application. In addition, the all-new MechaWare™ software plug-in package for Matlab® & Simulink® provides a means to quickly model a system, implement complex control loops, and optimize motion performance faster than ever before.

Controllers & I/O Modules

SynqNet Controller bus types include PCI, CPCI and PMC. In addition, the eXMP-SynqNet is a stand alone controller that features a Celeron processor and an XMP motion co-processor. MEI also offers Remote Motion Blocks (RMBs) for analog drive integration on SynqNet networks. SynqNet I/O interface blocks are also available for I/O over SynqNet.

SynqNet™ and Your Machine

Flexibility is the hallmark of MEI SynqNet technology. The XMP & ZMP-SynqNet Platforms include real-time tuning utilities, an innovative ControlsToolkit, and our C/C++ object-oriented Motion Programming Interface. For ease-of-use development, an ActiveX® motion library (MPX) is also available to speed development with common environments like VisualBasic®, LabView®, and other ActiveX enabled applications. MatLab®/Simulink® programming with MechaWare™ is also available for advanced control architectures and system modeling.
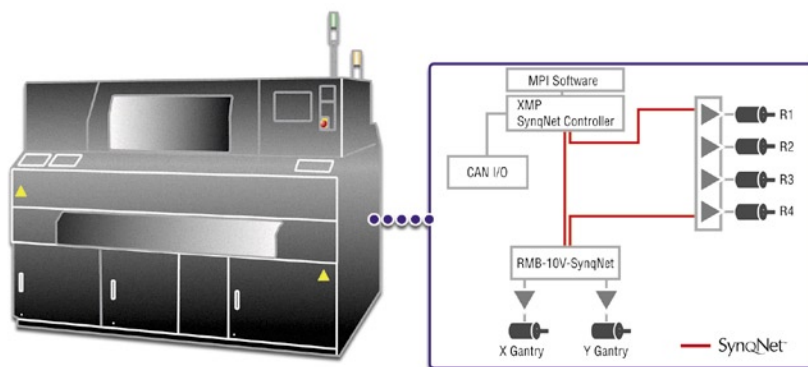
SynqNet systems are ideal for demanding chip mounting applications. With servo update rates of up to 48 kHz, advanced control algorithms for fast settling, and microsecond-reaction to I/O events, SynqNet controllers offer the performance required for next-generation chip shooters. SynqNet drives are small enough to be mounted directly to the placement head, thus reducing the amount of cable required to be routed to the head.

MEI offers a choice of SynqNet solutions for wafer-handling robots: bus-based SynqNet motion controllers for architectures with a central controller platform or fully embedded robot controllers designed to be placed inside the robot case.
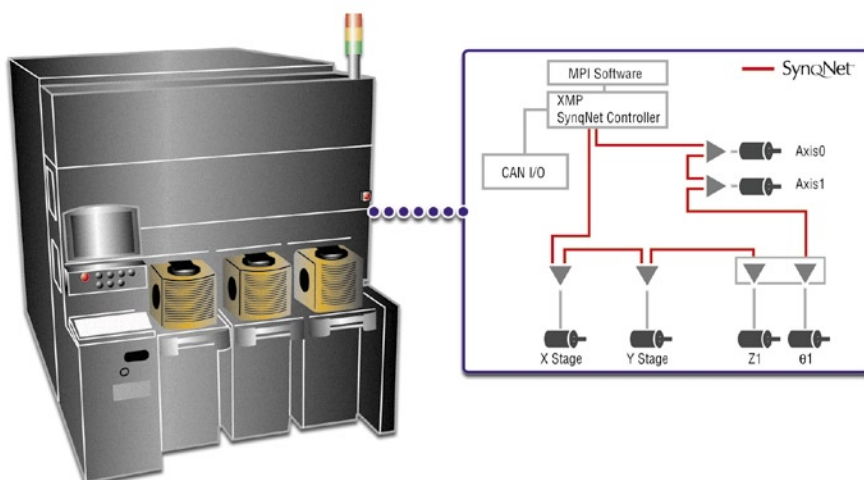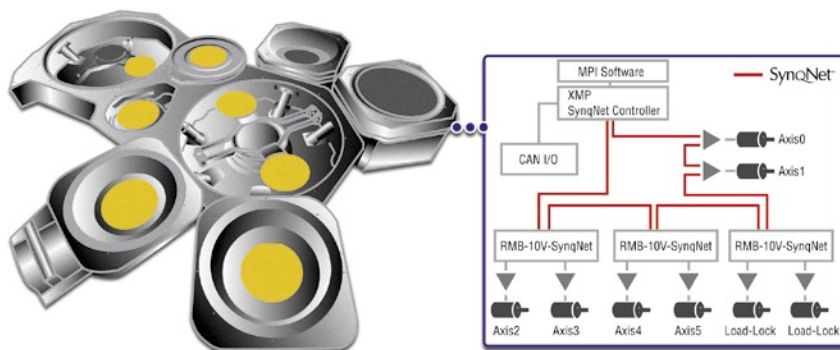
SynqNet-controlled positioning systems offer a range of features for both scanning and step-and-settle applications. Direct digital connections to amplifiers offer reduced electrical noise and increased positional accuracy. A single SynqNet controller can control positioning stages as well as auxiliary axes such as loaders, handlers, or auto-focus systems.

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Helping you build a better machine, faster.