

Introduction

AMC Digiflex Performance servo drives offer a variety of network options for connecting servo drives in a multi-axis configuration. Choosing the right network depends on a variety of factors such as required bandwidth, update rate, performance, and cost. The network options supported in AMC Digiflex Performance servo drives are outlined below.

CANOpen (CAN)

A robust serial protocol that is low cost and offers enhanced diagnostic and control capabilities with reasonable bandwidth. Digiflex Performance CANOpen drives also support RS232 as a secondary communication channel. DriveWare software can run over the RS232 channel during operation to monitor quantities in real time making system design and commissioning fast. Visit <http://www.can-cia.org/> for more information. Some of the strengths of CANOpen are:

- 3-wire bus is all that is needed to connect drives together (CAN_H, CAN_L and GND).
- Differential transmission for noise immunity.
- Up to 1Mbit/sec speeds possible.
- Up to 128 nodes per CAN network.
- Robust message arbitration with collision detection/prevention built into the physical layer.
- Many microcontrollers have built in CAN ports.
- CAN Hardware for many different platforms readily available (Desktop, PC/104, etc.)
- Many different operating systems supported (Windows, VxWorks, Linux)
- Bi-directional (non-polled) communication possible.
- PVT – Position, Velocity Time trajectory interpolated by the drive from points sent by the host. Reduces overhead at the host. Countless trajectories possible.
- Coordinated motion capabilities.

How Fast Can Messages Be Sent?

The average CAN message is 130 bits, so it takes 130µsec per message PER NODE to physically send out a message. Different CAN message types improve on this time, but update rates close to 1Khz are possible.

RS232 (serial)

An economical single-axis solution that offers reasonable diagnostics better suited toward low-bandwidth applications. All AMC Digiflex Performance servo drives support this communication interface.

- Many PCs have serial port hardware. No extra host hardware needed.
- Simple 3 wire bus (TX, RX, and GND).
- Speeds up to 115.2K baud are possible.

How Fast Is RS232? - RS232 messages can be longer than CAN. A read command to a 16-bit index takes 8 databytes (64 bits / 115.2K = 560µsec). The reply is another 12 bytes (96 bits / 115.2kK = 834µsec). Total message time (both command and reply is 560µsec + 834µsec = 1.3msec. The result is much slower than a 1Mbit/s CAN bus.

RS422/RS485

An economical multi-axis solution that yields reasonable diagnostics and control capabilities at higher bandwidths than RS232.

- Can support multiple nodes (up to 32)
- Operates at speeds higher than RS232 (115.2K) baud (921.6K) possible with host hardware supporting it.
- Full-Duplex (RS485 4-wire only) or Half-Duplex (RS422 2-wire).

How fast can I go with RS485? - Max speed is 921.6K baud. RS485 messages can be longer than CAN. A read command to a 16-bit index takes 8 databytes (64 bits / 921.6K = 70µsec). The reply is another 12 bytes (96 bits / 921.6K = 104µsec). Total message time (both command and reply is 70µsec + 104µsec = 174µsec. This is almost as fast as a 1Mbit/s CAN bus.

EtherCAT®

An open, Ethernet based protocol for high-bandwidth high-performance networked applications. EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany. Visit <http://www.ethercat.org/> for more information.

Some key benefits include:

- Industrial Ethernet Technology
- Deterministic network (real-time)
- Protocol runs on standard Ethernet physical layer
- Standard Ethernet cabling (CAT5+)
- No specialized hardware required for EtherCAT Master. Standard Ethernet port can be used.
- High-performance - cycle times down to 100 µs
- High-precision – synchronization of nodes with jitter down to 1µs
- High data rate – 2 x 100Mbit/s (Fast Ethernet, Full Duplex)
- Flexible Network Topologies
- Wide variety of EtherCAT masters to choose from.
- AMC EtherCAT drives implement CANopen over EtherCAT (CoE), CANopen device profile for drives and motion control (CiA 402)

How fast can I go with EtherCAT? –

The high data rate and implementation of an EtherCAT network allows for very high-speed

performance. Here are some example update times achievable with an EtherCAT network:

- 256 digital I/O in 11 µs
- 1000 digital I/O distributed to 100 nodes in 30 µs
- 200 analog I/O (16-bit) in 50 µs, 20 KHz sampling rate
- 100 Servo-Axis (each 8 Bytes In + Out) in 100 µs.
- 12000 digital I/O in 350 µs

Synqnet™

A proprietary high-speed digital protocol developed by Danaher Motion with a wide bandwidth. Based on 100baseT physical layer (Ethernet). Visit <http://www.synqnet.org> for more information.

Some key benefits include:

- High bandwidth. Can update at rates in excess of 2KHz (500 µsec).
- Several different control algorithms available.
- Self-healing network with different topologies possible.
- Robust network/node diagnostics.
- DriveWare software for setup and configuration runs over SynqNet
- Secondary RS232 Channel for direct connection to DriveWare. Can monitor quantities using Driveware without interrupting over SynqNet.

Network Options Comparison

	CANOpen	RS232	RS485 2wire	RS485 4wire	SynqNet™	EtherCAT®
Type	Serial	Serial	Serial	Serial	100BaseT	100BaseT
Max Speed (bit/sec)	1M	115.2K	921.6K	921.6K	100M	2 x 100M
Transfer Mode	Half Duplex	Half Duplex	Half Duplex	Full Duplex	Full Duplex	Full Duplex
Message Time	130 µsec	1.3 msec	174µsec	174µsec		
Max Nodes	128	1	32	32	32	65536
Digiflex Part Number	DPC, DZC	DPR, DZR	DPR, DZR	DPR, DZR	DPQ	DPE, DZE
Wires To Node	3	3	3	5	2	CAT5+
Secondary Channel	RS232	N/A	RS232	RS232	RS232	USB
Relative Cost	\$\$	\$	\$\$	\$\$	\$\$\$\$	\$\$\$\$

Visit <http://www.a-m-c.com> to learn more about network options available on Digiflex Performance series servo drives.