ADVANCED MOTION CONTROLS

Network Options for DigiFlex Servo Drives

Introduction

ADVANCED Motion Controls®' 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 *ADVANCED* Motion Controls' 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, Linnux)
- 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 / RS485 (serial)

The serial drives offer an economical asynchronous interface. RS232 supports single-axis solutions with reasonable diagnostics better suited toward low-bandwidth applications. The DPR series supports RS232/485, and the DPC series supports RS232 as a secondary interface.

RS232

- Inexpensive hardware
- Simple 3 wire bus (TX, RX, and GND)
- Speeds up to 115.2K baud are possible

RS485

- Supports multiple nodes (up to 32)
- Speeds higher than RS232 supported, up to 921.6K.
- Full-Duplex (RS485 4-wire only) or Half-Duplex (RS422 2-wire).

How Fast is Serial?

Serial messages can be longer than CAN. A read command to a 16-bit index takes 8 databytes. The reply is another 12 bytes. The serial interfaces are asynchronous, and have a typical delay of 150uS between master and drive messages.

RS232 at 115.2k
8 Bytes Out: 64 bits / 115.2K = 560μsec
Typical Asynchronous Delay =150μsec
12 Bytes In: 96 bits / 115.2kK = 834μsec

Total Time = 1.544msec.

RS485 at 921.6K
8 Bytes Out: 64 bits / 921.6K = 70μsec
Typical Asynchronous Delay = 150μsec
12 Bytes in: 96 bits / 921.6K = 104μsec

Total Time = 324μsec.

Some drive processes cause the delay between the messages to increase, particularly those involving NVM. If synchronous data is required, consider CANopen or EtherCAT products.

EtherCAT®

A high-performance Ethernet based deterministic network protocol developed by Beckhoff. Visit the EtherCAT Technology Group http://www.ethercat.org for more information. Some important features of EtherCAT are:

- Transmission rates up to 2x 100Mbit/sec.
- Based off standard Ethernet for 100baseT.
- Real-time down to the I/O level.
- Multiple topologies possible - Line, Star, Tree, Daisy Chain + Drop Lines. Can be used in any combination.
- Requires no special Ethernet hardware – Standard Network Interface Cards (NIC) can be used for EtherCAT.
- CANopen over EtherCAT (CoE) allows use of CANopen protocol and feature set over EtherCAT.
- Off-the-shelf EtherCAT masters available that implement full language features of IEC 61131.
- Open protocol – Designers can implement their own EtherCAT master.
- Secondary USB port for direct connection to DriveWare. Can monitor quantities using DriveWare without interrupting over EtherCAT.

How Fast Is EtherCAT?

EtherCAT is based off 100BaseT physical layer and can send multiple datagrams per EtherCAT packet. Cycle times can reach as low as 100µsec.

Network Options Comparison

	CANOpen	RS232	RS485 2wire	RS485 4wire	EtherCAT®	POWERLINK
Type	Serial	Serial	Serial	Serial	100BaseT	100BaseT
Max Speed (bit/sec)	1M	115.2K	921.6K	921.6K	2x100M	100M
Transfer Mode	Half Duplex	Half Duplex	Half Duplex	Full Duplex	Full Duplex	Half Duplex
Message Time	130 µsec	1.54 msec	324µsec	324µsec	~	~
Max Nodes	128	1	32	32	65535	240
DigiFlex Part Number	DPCANxx	DPRxxxx	DPRxxxx	DPRxxxx	DPExxxx	DPPxxxx
Wires To Node	3	3	3	5	2	4
Secondary Channel	RS232	N/A	RS232	RS232	USB	USB
Relative Cost	$$	$	$$	$$	$$	$$