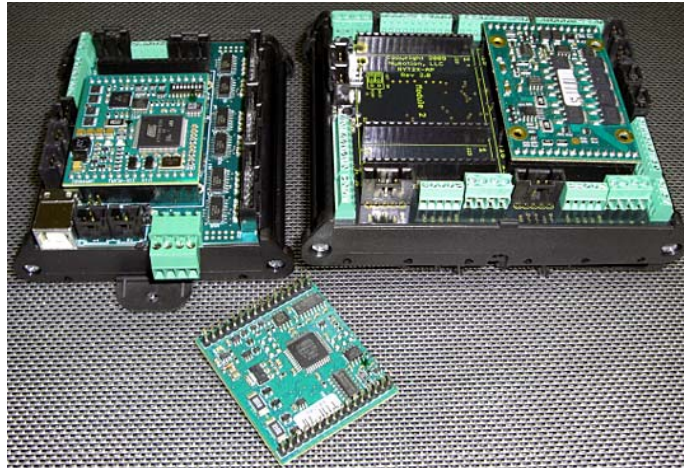


Moving an innovative lab-automation product from concept to market is an incredibly difficult task. Linear and rotary mechanics, bearing systems and the drive/controls used to position samples, well plates or imaging sensors add another level of design complexity. Larger organizations can tap design teams with motion control experience and years on the learning curve. To compete, smaller design teams with finite resources need to work smarter.

This paper discusses the use of plug-in stepper or servo drive/ controls to simplify the critically important prototype and preproduction phases of new product development. The goal is a level playing field.



***NYT1X-AP and NYT2X-AP with TCM-103 and PIM2403 Plug-In Modules***

Over the past 20 years the internet has brought about a logarithmic expansion of product knowledge and resources that can be brought to bare in the idea generation, screening and feature “needs” analysis phase of the product development cycle. As your world-wide competition has the same information at their finger tips the luxury of time and poorly executed first efforts are a thing of the past. Prototype and preproduction runs need to move quickly while addressing key customer needs. Design teams with limited resources can deliver top quality prototypes and preproduction units using plug-in drive/control modules while side-stepping time consuming and costly errors.

Where will you be in 18 months? Your customers are placing orders and your production line is turning out an efficient, first class product that assembles quickly, tests well, ships and bills. Your engineering team is focused on improved features, functions and better code for the next generation of your machine; Rather than a nightmare of time intensive and costly rework.

How does it happen?

- Listen to your customers. Reading and analyzing hundreds of pages of product documentation on relevant web sites is helpful but key customer feedback, early in the development cycle, is critically important. The sooner customers can see and evaluate how well your product solves their needs, the sooner they will provide feedback.

*Customer feedback from full feature prototype demonstrations, becomes the to-do list, that when completed, generates a purchase order.*

- Simplify the motion system. Far too much time and money is spent on overly complex, high performance motors and mechanics; Ill advised design overkill increases drive/controller complexity and cost.
- The “make” decision is generally the best decision for higher volume, production machine controls but rarely, ever, in the prototype and preproduction phase.

The following is an overview of several outstanding plug-in drive/control modules manufactured by Trinamic Motion Control (Germany) and Technosoft Motion Technology (Switzerland).

#### 1. TMCM-103 Module

A. Single axis stepper drive/controller module with encoder feedback.

B. Manufacturer: Trinamic Motion Control

- 1) Motion DSP: TMC428
- 2) Embedded CPU: ATMEL AT91SAM7X256
- 3) Stepper Drive IC: TMC-249A

C. Electrical: 2A (rms) / 2.8A (peak), 7 – 28.5Vdc

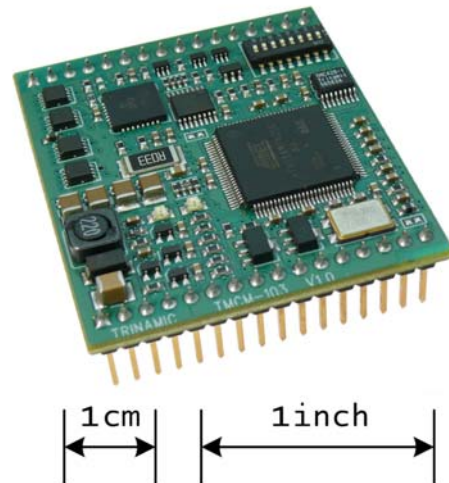
D. Two inputs and two outputs with limit + and –

E. Motion Features

- 1) /64 microstepping
- 2) Automatic ramp generation in hardware
- 3) On the fly alteration of motion parameters (e.g. position, velocity, acceleration)
- 4) Closed loop for highly dependable drives
- 5) **StallGuard™** feature for sensorless motor stall detection
- 6) **ChopSync™** feature for high motor velocity by reducing resonances

F. Software Development

- 1) Stand-alone or remote controlled operation using **TMCL™** (Trinamic Motion Control Language)
- 2) PC-based application development software, TMCL-IDE



- 3) Application testing and development software using **Nycomm Tools for Windows** (Nymotion LLC): Axis parameters, user units, exercising, coordinate capture, cycle testing and NYT-AP Setup.
- G. Prototype and Preproduction Machine Control Modules. (Pictured on page 1)
- 1) Single Axis: [NYT1X-AP](#)
  - 2) Two Axis: [NYT2X-AP](#)
- H. Plug-In Drive/Control modules with Nymotion LLC engineering support and programming services level the playing field.
- 1) **A reasonably complex, open or closed loop, single or two axis stepper application can be programmed, tested and running in 1 – 2 hours.**
  - 2) Nymotion stocks and sells the TCM-103 with customer specified QuickStart programs using the NYT1X-AP or NYT2X-AP Machine Controls.
  - 3) Mechanical Engineering can begin immediate work testing and refining linear and rotary positioning systems. As the user interfaces are straight forward Windows applications there is no need for SW Development or Electrical Engineering support to accomplish the key mechatronic tasks.
  - 4) Electrical and Software Development can proceed immediately using the plug-in module and either NYT1X-AP or NYT2X-AP for the basis of a custom layout.
  - 5) Industrial Design is an art form that encompasses all aspects of the design. Quick Mechanical and Electrical Engineering decisions provide valuable product envelope and human-machine-interface information that enables an attractive and fully functional product to be packaged and prepared for initial contact and feedback sessions with key customers.
2. PIM2401 / PIM2403 Modules.
- A. PIM Modules are single axis digital servo amplifiers with embedded intelligence and PLC functionality which control brushless (sinusoidal / trapezoidal) or DC brushed servo, linear servo, hybrid servo or step motors.
- B. Manufacturer: Technosoft Motion Technology. Motion DSP: MotionChip™ (Texas Instruments TMS320FXXX). A word of caution. *As full featured digital servo amplifiers, PIM modules are significantly more difficult than TCM-103 modules.* If an application needs brushless or brushed servo or “50 pole” servo (stepper) performance, PIM modules are the right choice.
- C. Electrical:
- 1) PIM2401: 1A (rms) / 3A (peak), 6 – 24Vdc
  - 2) PIM2403: 3A (rms) / 6A (peak), 12 – 24Vdc
- D. Two inputs and two outputs with limit + and –
- E. Motion Features
- 1) Control Modes



- Torque
  - Speed
  - Position
- 2) Electronic gearing, contouring and profiling
  - 3) Step motor emulation (step and direction output)
  - 4) Single-Axis or Multi-Axis control (master or slave mode)
  - 5) Standalone operation with stored motion sequences.

F. Software Development

- 1) Stand-alone or remote controlled operation using the TML instruction set.
- 2) PC-based application development software includes a simple tuning and parameter setup utility called EasySetUp and a full featured development suite called EasyMotion Studio.
- 3) Nymotion quotes on turn-key TML and NYT1X-AP and NYT2X-AP applications on a time and materials basis. Contact [sales@nymotion.com](mailto:sales@nymotion.com) for more information.

G. NYT1X and 2X-AP Machine Control Modules are socketed for one or two PIM modules. These are the identical machine controls used with TCM-103 applications. With the NYT2X-AP PIM and TCM modules can be mixed.

- 1) Single Axis: [NYT1X-AP](#)
- 2) Two Axis: [NYT2X-AP](#)

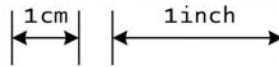
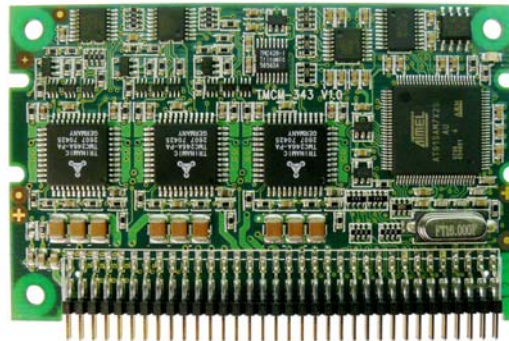
3. TCM-303/343 Modules

A. Three axis stepper drive/controller module

B. Manufacturer: Trinamic Motion Control

- 1) Motion DSP: TMC428
- 2) Embedded CPU: ATMEL AT91SAM7X256
- 3) Stepper Drive IC: TMC-249A

C. Electrical: 1.1A (rms) / 1.5A (peak), 7 – 34 Vdc



TCM-343-TMCL

D. Motion Features

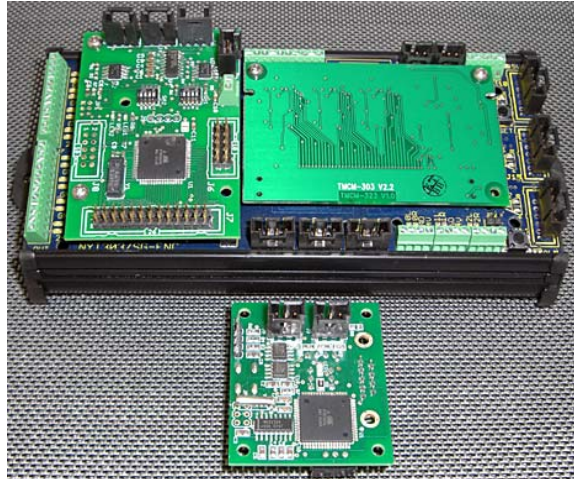
- 1) Up to /64 microstepping
- 2) Memory for 2048 **TMCL™** commands
- 3) Automatic ramp generation in hardware
- 4) On the fly alteration of motion parameters (e.g. position, velocity, acceleration)
- 5) Full step Frequencies up to 20kHz
- 6) Dynamic current control
- 7) **StallGuard™** feature for sensorless motor stall detection
- 8) **No heat sinking required**

E. Software Development

- 1) Stand-alone or remote controlled operation using **TMCL™** (Trinamic Motion Control Language)
- 2) PC-based application development software, TMCL-IDE
- 3) Application testing and development software using **Nycomm Tools for Windows** (Nymotion LLC): Axis parameters, User Units, Exercising, Coordinate Capture, Cycle Testing and NYT-AP Setup.

F. With Nymotion LLC support and documented QuickStart programs the TMCM-303/343 levels the playing field.

- 1) ***A reasonably complex, open or closed loop, three axis stepper application can be programmed, tested and running in 1 – 2 hours.***
- 2) Nymotion stocks and sells TMCM-303/SG and TMCM-343/SG modules with customer specified QuickStart programs using the NYT3X-AP Machine Control “Application Platform”.
- 3) As NYT-AP software development has evolved over the past six years, key multiaxis applications have migrated into NYT-AP firmware where National Instruments LabView, Visual Basic or C++ programs can call 1 – 3 axis routines with a single command.
- 4) Mechanical Engineering can begin immediate work testing and refining multiaxis sequential and coordinated linear and rotary positioning systems. As the user interfaces are straight forward Windows applications there is no need for SW Development or Electrical Engineering support to accomplish mechatronic testing and refinement.
- 5) Electrical and Software Development can proceed immediately using the plug-in module and the NYT3X-AP as the basis for a custom layout.
- 6) Quick Mechanical and Electrical Engineering decisions provide valuable product envelope and human-machine-interface information that enables an attractive and fully functional product to be packaged and prepared for initial contact and feedback sessions with key customers.



*NYT3X-AP Shown with a daughter mounted NYT-AP CPU and TCM-303 Encoder Feedback Module. The lower PCB is a remote mountable NYT-AP.*

Plug-In Drive Control Modules level the playing field by enabling quick, full featured motion control product development with off-the-shelf Nymotion supported modules.

With NYT1X, NYT2X and NY3X-AP machine controls, your customers will see and evaluate machine prototypes and preproduction units that address their needs immediately. With live demonstrations, customer feedback provides the list of refinements needed to book orders

With simplified motion mechanics, harnessing and profoundly simple hookups, design overkill is reduced thereby lowering overall system costs and risk.

Off-the-shelf, Plug-In Drive Control modules with NYT-AP Series Machine Controls are a smart "buy" for prototyping and preproduction as when your machine enters volume production plug-in drive/control modules can be moved to their new homes (sockets) on high volume, definite purpose machine controls. The firmware and application software transfer seamlessly.

*Plug-In Drive Control Modules are Ideal for Prototype and Preproduction Runs using Step Motors, Linear Actuators, Brushed & Brushless DC Servo and Linear Motors*

*Lab-Automation - Inspection - Microscopy - Life Sciences*