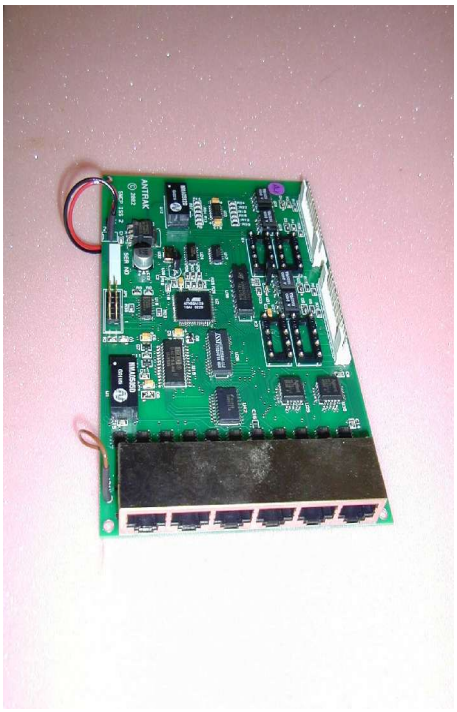
AMC102

AMC102 Two-axis precision servo controller module

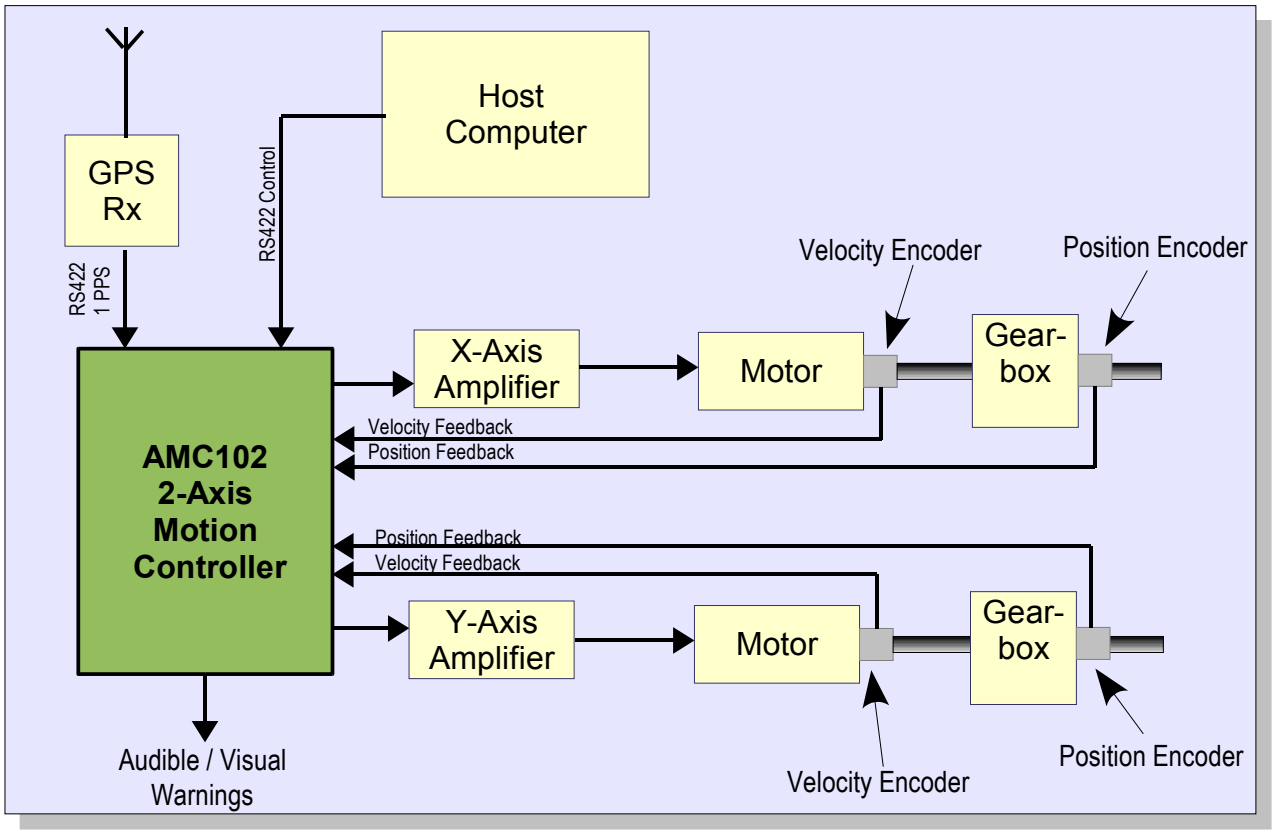
Applications

- X-Y or Az-El antenna positioning systems
- General motion control/servo systems
- Programmed track motion systems



Features

- Manual move or Table track modes
- Real-time position and velocity reporting
- Interpolative tracking algorithm
- On-board tracking table storage
- Environmental monitoring sensors
- Relays for audible & visual warning alarms
- Dedicated RS422 1Hz clock input (e.g. from GPS)
- Emergency stop facility
- Non-volatile storage of servo constants
- On-board velocity profile generator



Product Description

The AMC102 is a Eurocard-sized two-axis motion controller bringing unique features to both traditional Azimuth/Elevation and X-Y type tracking heads. The system has been designed from the ground up with performance in mind. Unlike some other controllers, the system can perform axis tracking whilst executing other tasks such as host command invocation (including position requests), time and station position determination and the normal limit sensor monitoring.

Servo Motor Control Processor

The AMC102 is a stand-alone unit which directly interfaces to servo motor amplifiers, axis position encoders and axis limit sensors. The AMC102 incorporates separate servo motor tracking loops for each axis and is controlled by a host computer via a single RS232 (or RS422) serial port interface.

All tracking events, including position requests, are time tagged with a resolution of 1mS. The AMC102 can accept commands and return axis information whilst simultaneously performing all tracking functions. The system has a look-ahead table driven mode of tracking which supports host machines which are not able to process requests in real time.

A brief summary of the controller's capabilities are listed below:-

- Twin Axis - stackable.
- Fast axis tracking response (less than 2mS tracking loop time per channel).
- On board profile generator for object tracking and manual control modes (10mS update rate).
- Time tagged position requests (1mS resolution).
- Time tagged current position returns (1mS resolution).
- Differential quadrature encoder inputs for axis position determination.
- GPS resolution of station position and time (UTC).
- Independent differential voltage feeds for servo amplifiers (12 bit DAC).

Detailed Description

At the heart of the AMC102 is an Atmel Atmega128 processor running at 12MHz, which enables the controller to execute tasks whilst simultaneously accepting commands and returning status data via its RS422 serial port. Possible baud rates are 19200, 28800, and 57600. A second RS422 port is provided for a time synchronisation signal, which can be provided by a GPS engine.

In normal operation, a command and control computer will be connected to the RS422 port. This computer will issue commands to the AMC102, and receive back status information, such as servo positions and velocities, in near real-time. The operator is able to set servo parameters such as limit positions, and maximum speeds; these values being stored in non-volatile memory. Stored values may be read back or altered at any time.

Velocity Profiles

Acceleration and deceleration terms may be programmed into the AMC102 to establish limiting values in the event of a step input. This can be important in order not to over-stress gearboxes and other servo components. In the event of an emergency stop, the deceleration profile is ignored.

Axis Brakes and Limits

By default, all axis brakes are applied even when power is not supplied to the unit. When command by the host computer, the brakes will be released. At this point, the AMC102 dynamically maintains the current position (or will move to a new requested position) aided by feedback information provided by the position and velocity encoders. However, when a request is made by the host to apply axis brakes, they are not immediately applied. Instead, the controller slows each axis to zero velocity independently at the maximum allowable deceleration rate defined for each axis. When all axes have stopped moving (zero velocity) the brakes are applied. In this way, the gearbox and servo motor lifetimes are not compromised due to excess dynamics.

The user may specify a set of 'soft' limits which define the minimum and maximum possible positions for each axis. It is not possible to command an axis to exceed these limits in normal operation. However, if a fault should occur in the system and an axis moves past any of these points then a secondary set of hardware limit switches are activated which prevent any damage to the system. Uniquely, the AMC102 is able to automatically recover an axis in this condition by driving out of the limit in a controlled fashion without regard to the position and velocity encoder readings (which may themselves have been the cause of the problem). The user simply requests that the brakes be released for the axis in limit and the controller card does the recovery automatically.

Table Tracking

The host computer may send a table of axis positions (equally spaced in time) to the controller store for later use. The controller automatically calculates a velocity profile from the position table data supplied. The host computer then instructs the controller to move to the start of a table track pass and then issues a run command with a time offset relative to the next 1PPS reference pulse. When the exact number of milliseconds after this 1PPS pulse have occurred, the table track mode will commence and all tracking will be performed completely automatically – all time aligned to the supplied 1PPS pulse stream. Position and velocity feedback are of course always available to the host to show progress during the table track run. The host computer can at any time abort the run simply by applying the brakes, requesting a manual move to a new position or by requesting an emergency stop.

Manual movements

When a new position is requested by the host, the controller independently calculates the optimum movement profile for each axis based on a maximum acceleration rate, maximum speed and maximum deceleration rate defined for each axis. For large position changes, the axis speed will ramp up to maximum speed, stay at this speed and then decelerate at maximum rate to end at the desired position. New position requests can be issued by the host at any time even when the controller is midway through the above process for a previous request. If a new requested position is in the opposite direction of travel, the controller will decelerate at maximum rate, change direction and accelerate at maximum rate toward the target position as before. For short position change requests an axis may never reach maximum speed before having to decelerate to the final requested position.

Temperature & humidity monitoring

The AMC102 incorporates separate sensors for measuring temperature and humidity; these can be useful for monitoring the operating environment of the system enclosure. The temperature sensor may be used, for example, to control system heaters at low ambient temperatures, or perhaps to provide a high temperature warning. The temperature sensor range is 0C to +85C.

The Humidity sensor can be useful in sealed systems, providing a means of monitoring the seal integrity, and/or an early warning of when a desiccator requires replacement. The humidity sensor output is 0% to 100% RH.

Electrical Characteristics

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Static					
Supply Voltage	5.4		10	V	
	8		40	V	With optional switching regulator
Supply current		180		mA	Brake and alarm relays not active
		340		mA	Brake and alarm relays active
Alarm relays switch rating			24	V	
		1.25	2	A	
Dynamic					
RS422 Baud rate		19.2		kbaud	28.8kb, 57.6kb may also be used
Maximum table size (tracking points)	3		1700		
Internal interpolation rate	0.02		50	Hz	Internally generated points between table steps
Position feedback data rate	1		20	Hz	
Amplifier drive voltage	0		±10	V	Output is differential ±5V
Encoders	-		16-bit		SSI output format
Humidity sensor output	0		100	%	Factory-settable shutdown threshold available
Temperature sensor output	0		85	°C	System shuts down @ +85°C
Maximum internal real-time timing error		0.2	1	mS	Defined as the synchronisation error between sync pulse and execution
Maximum accumulated timing error over duration of			<1	mS	Defined as the timing drift during a typical 16min. satellite pass see fig. 2
Real-time tracking error		±0.01	±0.02	°	Using 16-bit encoders. Degrades with lower resolution encoder.
Environmental					
Temperature range - Operating	-40		85	°C	Factory set cut-out @ +85°C
- Storage	-55		+100	°C	
Hunidity range - Operating	0		90	%RH	Non-condensing
- Storage	0		100	%RH	Non-condensing

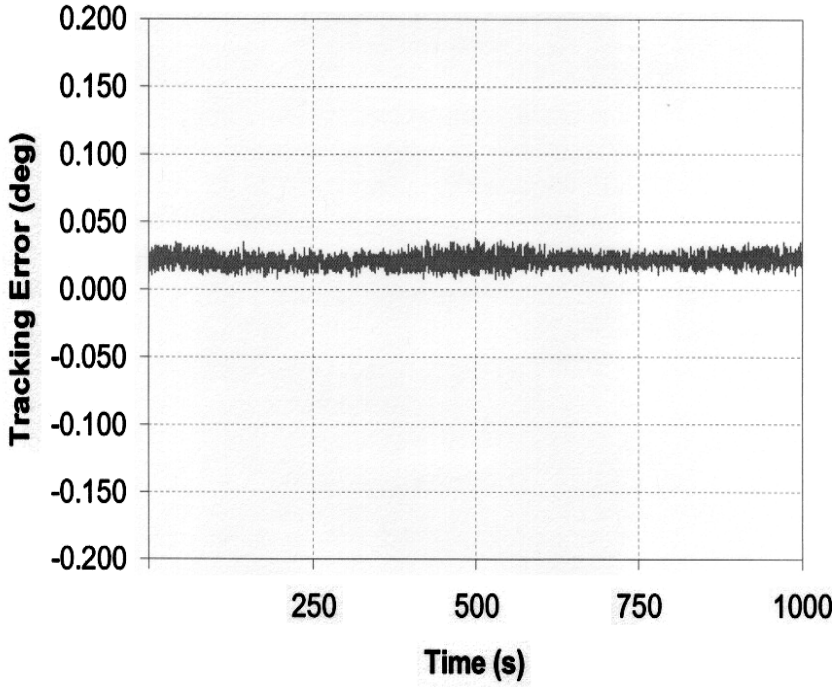


Fig. 1 Typical real-time tracking error plot over a 1000Sec table-track.

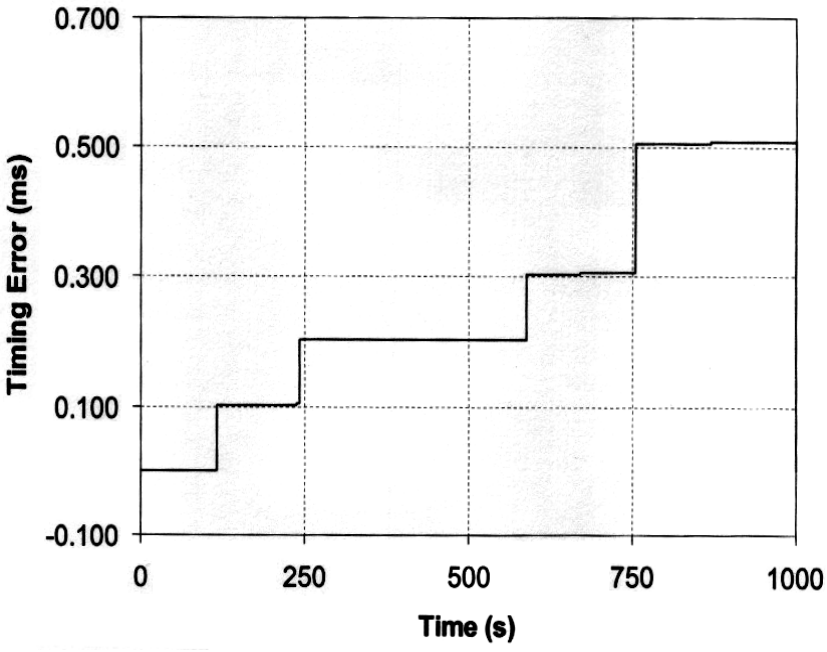
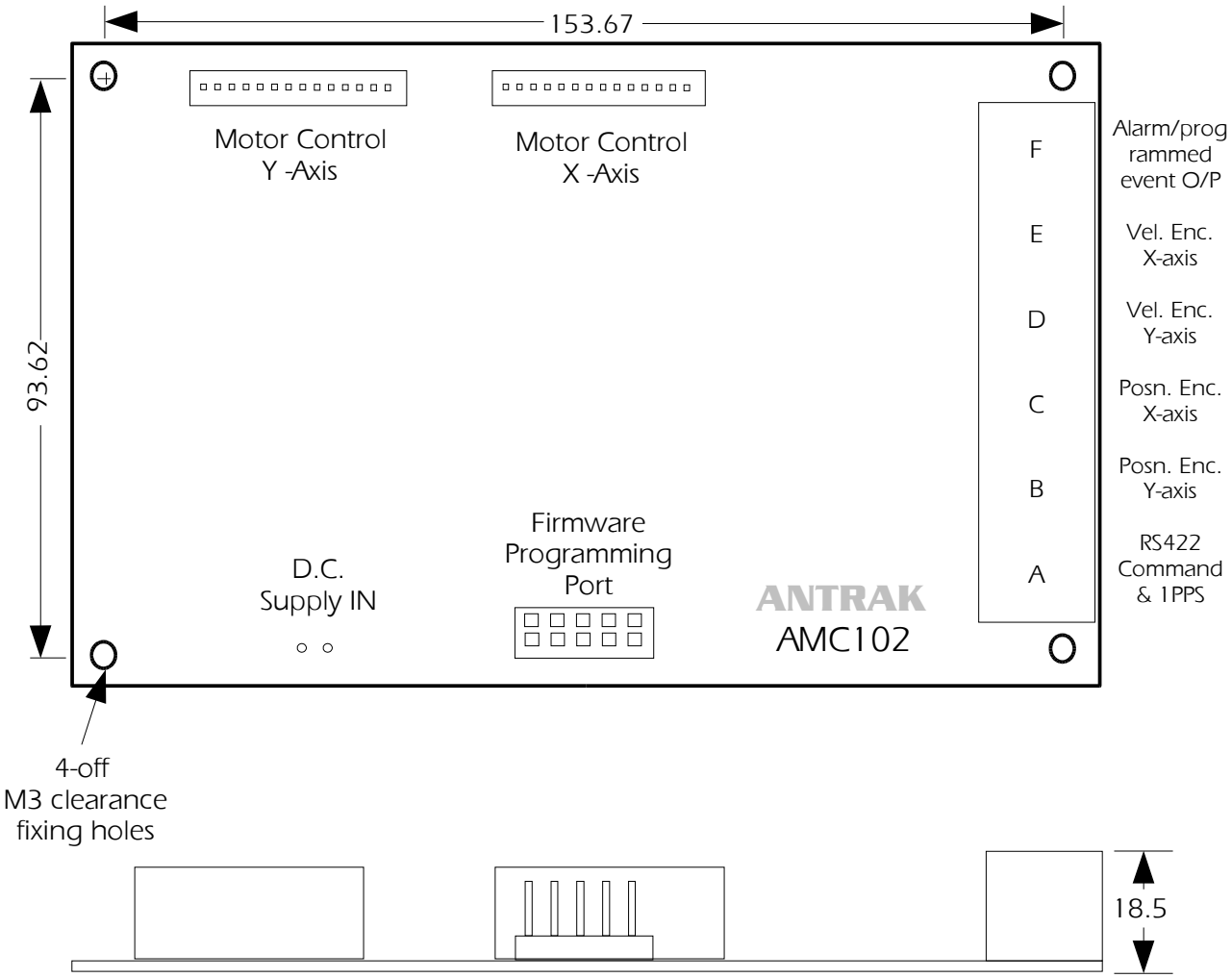


Fig. 2 Typical timing error accumulation over a 1000Sec table-track

Dimensional Outline & Connections



Connector	Type	Function
A -	RJ45/8	Serial communication with host computer and 1PPS clock
B -	RJ45/8	Y-Axis position encoder feedback
C -	RJ45/8	X-Axis position encoder feedback
D -	RJ45/8	Y-Axis velocity encoder feedback
E -	RJ45/8	X-Axis velocity encoder feedback
F -	RJ45/8	Programmable event or alarm relays (2-off)
Programming Port	0.1" 10-way pin header	Used for factory loading of CPU software
Motor Axis Control X-Axis	0.1" 15-way pin header	Amplifier drive and brake control
Motor Axis Control Y-Axis	0.1" 15-way pin header	Amplifier drive and brake control