*m*STEP-407
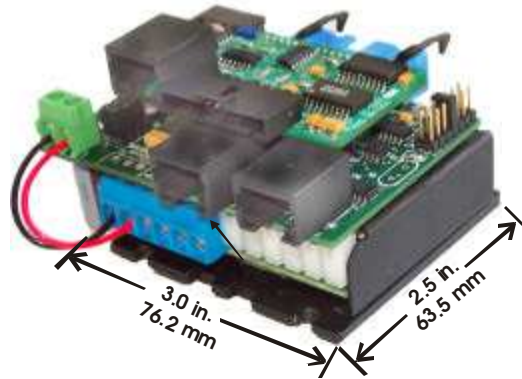
Microstep Positioning System

7 Amps / 80 Volts of High Performance Motion Control


Shown here with "Encoder Feedback" option

3.0 in. 76.2 mm
2.5 in. 63.5 mm

OVERVIEW

The *m*STEP-407 is an intelligent microstep positioning system that packs all the desired features for accurate, high torque positional control into a small 3.0"W, 2.5"D, 1.5"H (76.2mm, 63.5mm, 38.1mm) footprint. It integrates AMS' award winning programmable indexer with a high performance (7 amp - 80 volt) bipolar chopper drive and 1/10 step resolution for optimal results in the most demanding applications.

Designed to operate the full range of step motors, from NEMA 17 to 42 frame size, the low cost *m*STEP-407 is the most versatile, value-packed motion controller available. Standard features include serial link communication, non-volatile memory for stand-alone operation, home, limits, go, stop and multiple user input/output ports. A power filter for the supply input provides de-coupling to increase stability and noise immunity. Available options are analog "joystick" control and encoder feedback for closed–loop operation.
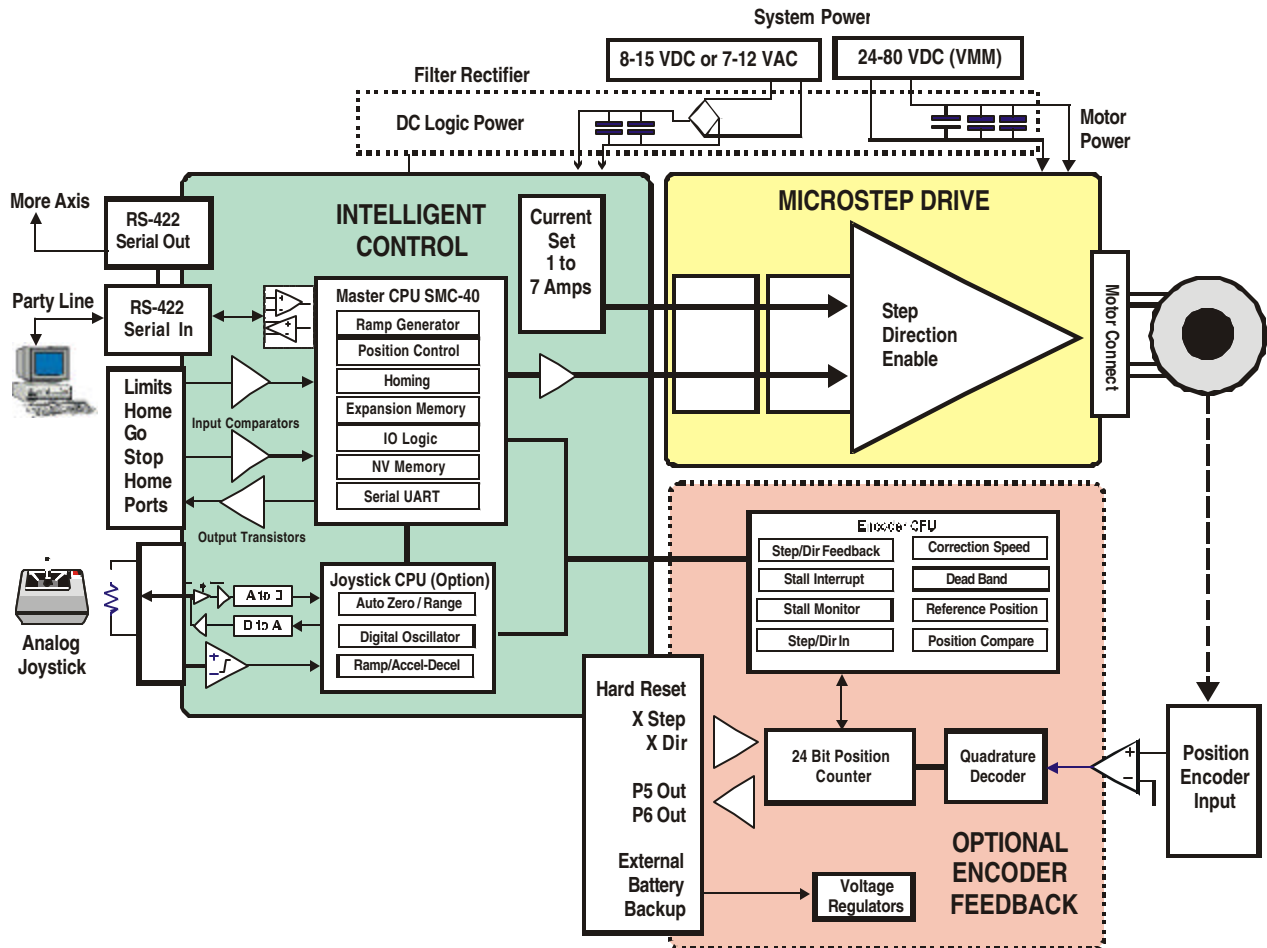
STANDARD FEATURES

- 0.3 to 7 Amp adjustable phase current
- 24Vdc to 80Vdc power supply input
- 1/10 microstep resolution
- Size 17 to 42 motors
- Mid-band resonance compensation
- Low-speed resonance nulling pot
- Auto current reduction
- 200kHz max step rate
- Opto-isolated step and direction
- 20W dissipation at 7 Amp per phase
- Silent, 20kHz oscillator PWM
- NV RAM for stand-alone operation
- 32 axis control from one COM port
- Powerful ASCII program command set
- Speeds over 60,000 steps/second
- Limit and home inputs
- Go and soft stop inputs
- User port outputs
- Power filter supply input

PROGRAM COMMANDS

ASCII	Description	ASCII	Description
^C	Software Reset	Q	Query Program
^N	Name Controller	R	Index to Position
^P	Party Line Mode	S	Store Parameters
ESC	Abort/Terminate	T	Trip Point
+	CW Index	V	Slew Speed
-	CCW Index	W	Wait
@	Soft Stop	X	Examine Parameters
[	Read NV Memory	X1	Examine (Analog)
]	Read Limits	Z	Display Position
\	Write to NV Memory	g	Branch to Location
^	Read Moving Bit	h	Microstep Count
A	Read/Write User Ports	i	Special Trip
C	Erase Memory	j	Jump 1
D	Divide Steps	k	Special Trip
E	Settle Delay	l	Set Options
F	Find Home	m	Analog Joystick
G	Go	u	Print Character
H	Set Resolution	1	Auto Calibrate
I	Initial Velocity	3	Dead Zone
J	Jump	4	Acel/Decel Analog
K	Ramp Slope	5	Start Speed
L	Loop on Port	6	Top Speed
M	Move with Ramping	7	Hysteresis
O	Set Origin	8	Divider
P	Program Mode	9	Read Voltage

PROGRAMS

Using a host computer or dumb terminal, programs can be stored in non-volatile memory (2k bytes) and initiated via the serial communication port, the "GO" input or auto power-up.

POWER SUPPLY and FILTER

The mSTEP-407 consists of two separate, fully opto-isolated, components. The power driver is a "chopper" design that regulates current into the motor windings, generating sine and cosine waveforms necessary for microstepping. The motor supply (Vmm) may range between 24 and 80 Vdc. The choice is highly dependant on motor characteristics and performance requirements .

A power filter logic circuit on *the m*STEP-407 implements a bridge rectifier and filter capacitors, thus either AC or DC voltage may be applied. The logic power is regulated to 5 Vdc so an unregulated power supply can be used as long as the output voltages do not exceed the maximums specified.

SERIAL INTERFACE

The mSTEP-407 has full duplex, RS-422 party line communications. The 4-wire interface implements a differential transmission and receiver pair. This type of operation provides a high degree of reliability in noisy environments.
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I/O SIGNALS

An auxiliary I/O connector provides all input and output functions. Inputs are buffered through comparators, capable of withstanding 30 volts. Buffered output signals can sink in excess of 0.5A @ 40 volts, non inductive.

Pin	Name	Function	Pin	Name	Function
1	GND		2	VCC	+5V Power
3	P1	Input	4	P2	Input
5	P3	Input	6	P4	Output
7	P5	Output	8	P6	Output
9	LimA	CW stop	10	LimB	CCW stop
11	Home	Input	12	Stop	Input
13	Step	Output	14	Dir	Output
15	MVG	Output	16	VIO	In/Out
17	Go	Input	18	Ana	Analog
19	VCC	+5V Power	20	Gnd	Power

ENCODER FEEDBACK OPTION

The *m*Step-407-E includes a quadrature decoder circuit with filtering. This design produces a 4X output. With a quality disc and properly phased encoder, this 4X signal will be accurate to better than 1/2 count. A 500-line encoder mounted to the rear of a stepper motor will generate 2,000 counts per revolution.

Features include:
 • Use with 50-1024 line (CPR) encoders
 • Monitor for stall condition during index
 • Retry index "n" times upon stall detect
 • Position maintenance mode with deadband
 • Battery backup input to keep position registers
 • Two additional user output ports
 • External step and direction inputs

The *m*STEP-407 encoder system is composed of the following components:

1. Input buffers receive encoder signals A-B, and optional index pulse.

2. Quadrature input that decodes encoder A-B signal to obtain 4X resolution. For instance, a 500 "line" encoder will produce 2,000 counts per revolution.

3. A 24 bit bi-directional counter that tracks incremental encoder position at count rates to 1 MHZ.

4. A seperate microprocessor that provides stall detection, re-position outside dead zone control and math functions to convert encoder motion commands into step motor index distance. It communicates with the *m*STEP-407 CPU via serial bus and step and direction signals to maintain target and encoder counter position.

ENCODER HARDWARE

The encoder option is a separate module that plugs into the *m*STEP-407. Two interface connectors, EJ-1 and EJ-2, provide additional signal connections.
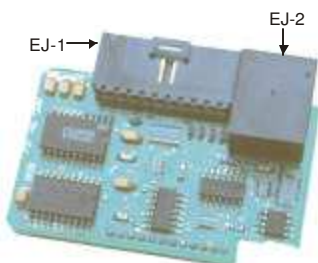
SUPPLEMENTAL SIGNAL CONNECTOR EJ-1

Pin	Name	Signal	Function	Type
1	BUB	Battery	Backup input 8-15 VDC	10mA
2	GND	GND	Power common	Earth
3	RST	Reset	Hard reset	Input
4	GPI	GP Input	Currently undefined	Input
5	DIR	Dir/Phase A	External direction	Input
6	STP	Step/Phase B	External step pulse	Input
7		Reserved		
8	P5	Port 5	User port 5	Output
9	P6	Port 6	Fault output /User Port 6	Output
10	BU5	BU5	Back-up 5 volt	

SUPPLEMENTAL SIGNAL CONNECTOR EJ-2

Pin	Name	Function	Type
1		Reserved	
2	GND	Gnd	Power supply
3		N/C	
4	QA	Phase A	Quadrature A signal from encoder
5		N/C	
6	QB	Phase B	Quadrature B signal from encoder
7	VIOE	VIOE	Output to encoder
8		5V Reg.	Regulated battery voltage

ENCODER COMMANDS

ASCII	Description	ASCII	Description
X3	Examine Encoder Values	s	Stall Detect
d	Set Deadband	t	Test Distance
e	Enable Encoder	v	Hunt Velocity
h	Set Resolution	w	Hunt Timeout
o	Force Position	x	Hunt Distance
q	Fault Funtions	y	Lock position
r	Set Stall Retry Count		

ANALOG JOYSTICK INTERFACE OPTION

The analog joystick interface adds yet another dimension of motion control possibilities by providing the capability of speed that is proportional to the input voltage. Features include:
• A digitized analog input
• A "dead-zone" that is applied before stepping starts
• Stepping that starts at a specified rate
• Speed increases and decreases, with ramping, as voltage increases and decreases
• Speed decreases as voltage decreases
• A maximum speed setting
• An auto-zero function that can remove any offset
• Auto-mode selects uni-directional or bi-directional mode
• Two multi-turn potentiometers adjust range and gain

Integral ramping prevents motor "stalls" that could be caused by abrupt input changes. When the "Joystick" mode is selected, there is a separate set of parameters governing speeds and acceleration/deceleration slope.
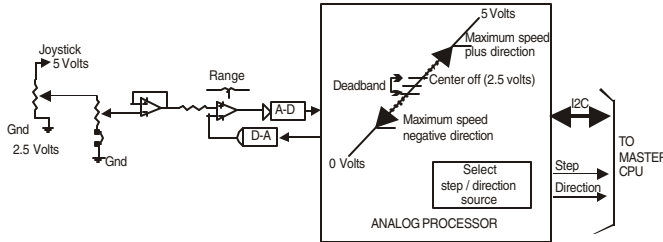
The 8-bit analog to digital converter includes a voltage range of 0 to 5 volts. The mode will be bi-directional with a dead-band, preventing unwanted drift to cause motion. Motion will start in the "plus" direction when the wiper voltage exceeds dead-band. Motion will be in the "minus" direction when the voltage goes below the dead-band. If the measured voltage is near zero the single direction mode is activated. The input voltage must be above the "dead-band" for motion to begin. The motor direction is controlled by the mode command.

Uni-directional operation always rotates in the same direction starting at zero volts input. The input voltage range and gain is adjustable by two potentiometers, allowing for a full-scale range up to 24 volts. The gain pot allows gain adjustment to accommodate joysticks with different full-scale ranges.

ORDERING INFORMATION
*m*STEP-407-.................................Step Motor Controller
    50..50 Vdc Power Filter
    80..80 Vdc Power Filter
Options:
    A..Analog Control
    E...Encoder Feedback

SPECIFICATIONS
Power Supplies
Logic Supply …….....................................4.7 - 5.5Vdc
Supply Voltage.. 24 to 80 Vdc

Controller
Step Rate Range……...................56 - 65,535 SPS*
Non-Volatile Memory…......................512 + 2048 Bytes
Communication ……......Full Duplex RS-422, 9600 Baud
Maximum Networked……...............32 Axes - 4,000 Feet
*Divisible between 1 and 255

I/O (Standard)
Digital Inputs (3)…….................Limits (2), Home, Go, Stop
Outputs………………........Moving (1), User Defined (3)

Joystick
Analog Joystick Input (1)......................0 -12V or 2.5 + 5V
Analog Speed Range.............................56 - 65,535 SPS*
*Divisible between 1 and 255

Driver
Phase Current... 1 to 7 Amps
Auto Current Reduction.......................33% of Set Current
Quiescent Current ....15 mA or Less
Power Dissipation......................1 to 18 W (1 to 7 Amps)

Physical
Size (*m*STEP-407)..........................3.0"W, 2.5"D, 1.5"H
                  (76.2mm, 63.5mm, 38.1mm)
Size (*m*STEP-407-E)......................3.0"W, 2.5"D, 2.0"H
                  (76.2mm, 63.5mm, 50.8mm)
Mounting Pattern.............4 6-32 screws, 1.75" by 2.375"
                  (44.5 mm, 60 mm)
Weight..5.5 oz. (156 gm)
Temp...0 to 70 C
Humidity................................0 to 95 % (non-condensing)