

STEPPER MOTOR CONTROLLER M1486

- ◆ FULLY PROGRAMMABLE SINGLE CHIP INDEXER AND SEQUENCER
- ◆ MOTOR SPEEDS UP TO 40 000 STEPS/SEC
- ◆ UP TO 64 MICROSTEPS PER STEP
- ◆ HIGH PERFORMANCE MOTION PROFILES
- ◆ ONE STANDARD AND TWO MICROSTEP MODES OF DRIVER INTERFACE:
 - STEP AND DIRECTION
 - DUAL DAC INTERFACE
 - TWO DACs INTERFACE
- ◆ POWERFUL INSTRUCTION SET OF MORE THAN 50 COMMANDS
- ◆ 16 MILLION STEPS PER MOTION
- ◆ INTERNAL MEMORY ENABLES PRE-PROGRAMMED MOVE SEQUENCES TO BE REPEATED OFF-LINE
- ◆ UP TO 21 GENERAL PURPOSE I/O
- ◆ PROGRAMMABLE MAXIMUM VELOCITY, START/STOP VELOCITY, ACCEL/DECAL RAMPs, MICROSTEPPING CURRENT PROFILES
- ◆ ESPECIALLY SMOOTH ACCELERATION AND DECELERATION
- ◆ SERIAL HOST INTERFACE, UP TO 16 DEVICES PER PORT
- ◆ LOW POWER CMOS, TTL COMPATIBLE CHIP
- ◆ AVAILABLE IN 40-PIN DUAL IN-LINE (DIP) OR 44-PIN PLCC PACKAGES

The M1486 controller provides the user with an integration of precision motion control with other programmable machine control functions such as I/O on a single chip, thus eliminating a need to use additional units for complete machine control.

- Powerful Command Language

The M1486 commands and data are sent from the host computer via a serial link as ASCII code (it is possible to use both uppercase and lowercase alpha characters). The user can employ any text editor for ASCII command files constructing. New commands are sent via the RS232 interface. Up to sixteen controllers may be daisy-chained by setting up the address of each controller to allow simultaneous control of multiple axes. The baud rate can be set at one of four speeds, from 1200 to 9600 bits/sec.

A broad palette of 50 commands is provided to enable to implement various application requirements using command file only. These requirements often encroach upon PLC field - command file branching according to user input status, outputs, loops, dwells. A small PLC that provides above mentioned functions is therefore integrated in the M1486 controller and is controlled by command file.

Complete application solution through a command file is easier and faster than a hardware solution and in addition command file can be flexibly changed according to application requirements. Controller commands are very simple and easy to remember. The first letter of the command name is a code of all basic commands. For example the "Velocity" command 500 steps/sec: V500. For programming simplicity the M1486 controller (indexer part of the CD series boards and modules) is also suitable for users without programming experience.

- Stand Alone Mode

The controller can be linked to a PC or any host computer equipped with the RS232 serial port only once for command file transmitting. The controller can be used in stand alone applications. In the stand alone mode the internal memory enables pre-programmed move sequences to be repeated off line. The program stored in the memory can be easily changed by re-connecting a computer and transmitting changed command file.

- Minimum Torque Necessary For Accel/Decel

The precise and smooth speed control method including high speed range explores maximum of the stepper motor torque in an open loop system, allowing the use of a smaller motor and more compact driver package. This means lower motor and drive costs or increased safety margin of an open loop stepper motor system.

While many motion controllers available today use the trapezoidal velocity profile, this profile has serious drawbacks at a speed range where motor torque decreases. The "Profile" command enables the programmer to set a point where acceleration characteristic changes from linear to parabolic and back at deceleration.

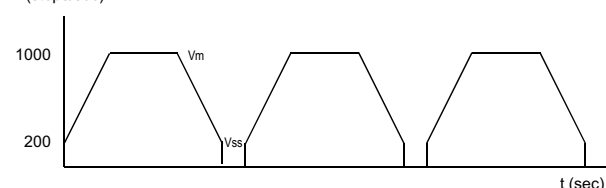
- Microstepping

The M1486 provides higher step resolution that virtually eliminates low speed resonance and step-to-step oscillation in stepper motor systems. The number of microsteps per full step can be programmed from 1 to 64 separately for the low speed range and the high speed range in order to achieve maximum speed as well as very high resolution at low speed. The driver interface of the M1486 controller outputs digital values of phase currents for both phases of a stepper motor. Standard Step and Direction outputs for an external drive control are also available.

- Motion Program Example:

```
S200 .....;"Start/stop" - start/stop velocity 200 steps/sec
V1000 .....;"Velocity" - 1000 steps/sec
A5000 .....;"Acceleration" - 5000 steps/sec2
F39616 .....;"Forward" - 39616 microsteps in positive direction
L3.....;"Loop" - the subsequent commands will be repeated
                three times until the "End of loop" command
R.....;"Run" - make a specified move
W250 .....;"Wait" - wait for 250 milliseconds
E .....;"End of loop"
```

V (steps/sec)



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- Numeric Unit

The M1486 provides the numeric unit for more complex applications. The numeric unit is controlled by nine commands which use internal variable. The actual value of the internal variable may be specified by means of the "Load" command directly or through the user inputs by the "Query" command. The numeric operations add, subtract, multiply and divide are available and can be used for internal variable modification. The internal variable data can be moved to a register and back. The value of the internal variable may be used as argument of the M1486 commands. For example if velocity is set by the command "V" without argument, the actual value of the internal variable is used as argument.

The command arguments can thus be specified also in stand alone applications by user inputs (binary or BCD format) without the serial link.

It is possible to cope with most application specifications using a small number of commands only. However powerful command set is provided to enable easy and complete solution of complex applications by command file only, without additional external hardware.



M1486 FAMILY MEMBERS

M1486A

- 96 bits input buffer, RAM command memory
864 bits, speed up to 20 000 steps/sec
(M1486A2x up to 40 000 steps/sec)

M1486B

- pin and function compatible with M1486A,
80 labels, 256 bits input buffer, RAM command
memory 2032 bits

The customer version of controllers M1486A,
M1486B with user command file in non-volatile
memory on-chip are available for a mass
production.

M1486C

- pin and function compatible with M1486A,
RAM command memory 4000 bits, four integrated
8-bit PWM outputs

M1486E1

- pin and function compatible with M1486A,
80 labels, 256 bits input buffer, on-chip
2000 bits EEPROM command memory -
the commands are automatically executed on
power-up without battery back-up

M1486E2

- pin and function compatible with M1486E1,
80 labels, 256 bits input buffer, on-chip
4000 bits EEPROM command memory

All above mentioned controller types are also
delivered in two times faster versions 2x, that can
use 24 MHz crystal. The controller runs two
times faster in this case.

More details in the M1486 user's manual.

Command Summary

Command	Description
\	"Reset" - set default values
@ (Num)	"Address" - specifies label number on current program line
A (Num)	"Acceleration" - range = 1 to 65 000 steps/sec ²
B (Num)	"Backward" - move (Num) steps in negative direction; range = 1 to 16 000 000
C (Num 1 to 21)	"Clear" - clear output; range = 1 to 21
C (Num 40 to 63)	"Clear" - clear auxiliary function; range = 40 to 63
C75	"Clear Kill" - resume program execution
D	"Direction" - reverse next move direction
E	"End of loop"
F (Num)	"Forward" - move (Num) steps in positive direction; range = 1 to 16 000 000
G (Num)	"Go absolute" - go to absolute position
G+	"Go positive" - go continuously in positive direction till external interrupt
G-	"Go negative" - go continuously in negative direction till external interrupt
H	"Home" - run home
I (Num) (Value) (Num)	"If" - if (Num) input is equal to (Value) transfers program control to the (Num) label
J (Num)	"Jump" - transfers program control to the (Num) label
K	"Kill" - decelerate immediately, stop program execution
L (Num)	"Loop" - repeat subsequent commands (Num) times
M (Num)	"Microstepping" - number of microsteps per full step at low speed range (up to 64)
N (Num)	"Number" - select current profile characteristic
O (Num)	"One" - wait for input (Num) to go to logical one
P (Num)	"Profile" - set maximum velocity for linear acceleration profile, acceleration continues with parabolic profile
Q (Num)	"Qualification" - number of microsteps per full step at high speed range (up to 16)
R	"Run" - make a move
S (Num)	"Start/stop" - start/stop velocity; range = 16 to 1950 steps/sec
T (Num 1 to 21)	"Turn on" - set specified output high; range = 1 to 21
T (Num 40 to 63)	"Turn on" - turn specified auxiliary function on; range = 40 to 63
U (Num)	"Upload" - upload absolute position, user variable, user flags and auxiliary functions status
V (Num)	"Velocity" - set maximum velocity
W (Num)	"Wait" - wait for (Num) milliseconds; range = 1 to 16 000 000
X (Num)	"indeX" - select indexer (Num)
Z (Num)	"Zero" - wait for input (Num) to go to logical zero
["Disable" - following commands execution
]	"Enable" - previous commands execution
((Num)	"Seek negative" - seek limit in negative direction
) (Num)	"Seek positive" - seek limit in positive direction
= (Num)	"Equal" - load position counter with specified data
: (Num)	"Load" - load internal variable with specified data
? (Num)	"Query" - query data on specified inputs and load them to internal variable
! (Num)	"Order" - put user variable data to specified outputs
+ (Num)	"Add" - add specified data to user variable
- (Num)	"Subtract" - subtract specified data from user variable
/ (Num)	"Divide" - divide user variable by specified data
* (Num)	"Multiply" - multiply user variable and specified data
> (Num)	"Move to register" - copy data from specified register to user variable
< (Num)	"Move from register" - copy data from user variable to specified register
' (Num)	"Subroutine" - call subroutine starting at specified label
.	"End of subroutine"