CY545

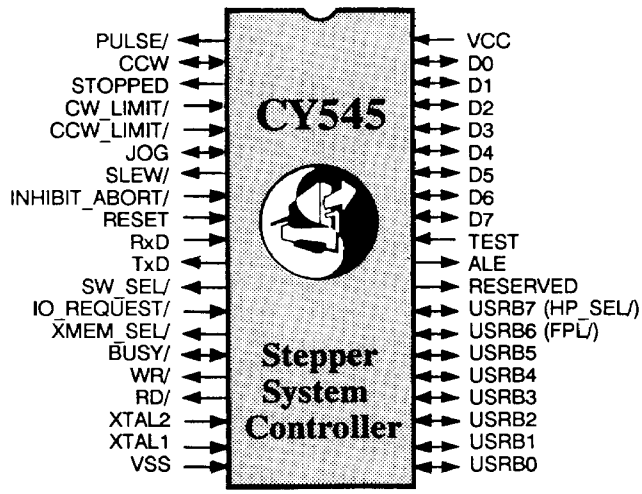
High Performance Stepper System Controller

The CY545 High Performance Stepper System Controller is a single, 5 volt, CMOS, 40 pin device designed to control a stepper motor and peripherals. The motor control signals include pulse and direction outputs, used by most high performance power drivers, along with power, status, and motion controls. The CY545 will interface to any host computer through an 8-bit parallel TTL data bus, or through an RS-232 compatible serial port. In addition, the CY545 supports up to 64K bytes of local external memory, which may be RAM, EPROM, or EEPROM, allowing standalone operation with no host computer at all. Parameter values may be specified in the CY545 commands, or they may be optionally specified through external thumbwheel switches. The CY545 features linear to optimal acceleration curves and very fast step rates, up to 27,000 steps/second, useful with motors running in half-step, quad-step, and micro-step modes.

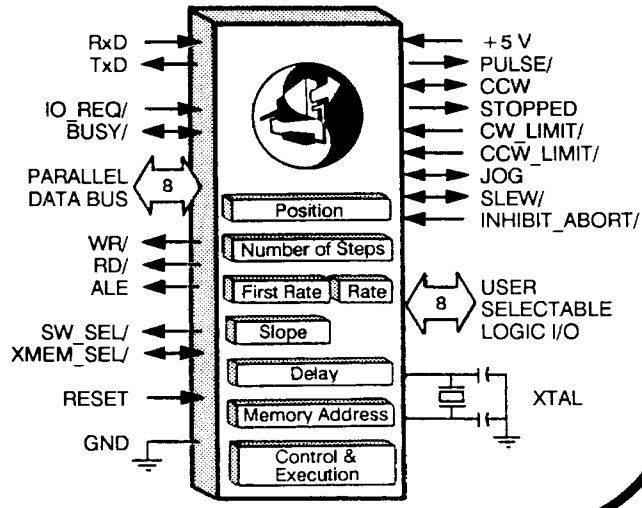
Standard Features

- Single 40 pin 5v CMOS IC
- 8 user I/O lines
- Pulse & Direction Output
- Simple ASCII based commands
- Operate from Host or Stand Alone
- External Memory support
- 27,000 Steps/Sec !
- 16 million step motions !
- Serial or Parallel interface
- LED display interface
- LCD display interface
- Thumbwheel switch interface

Pin Configuration



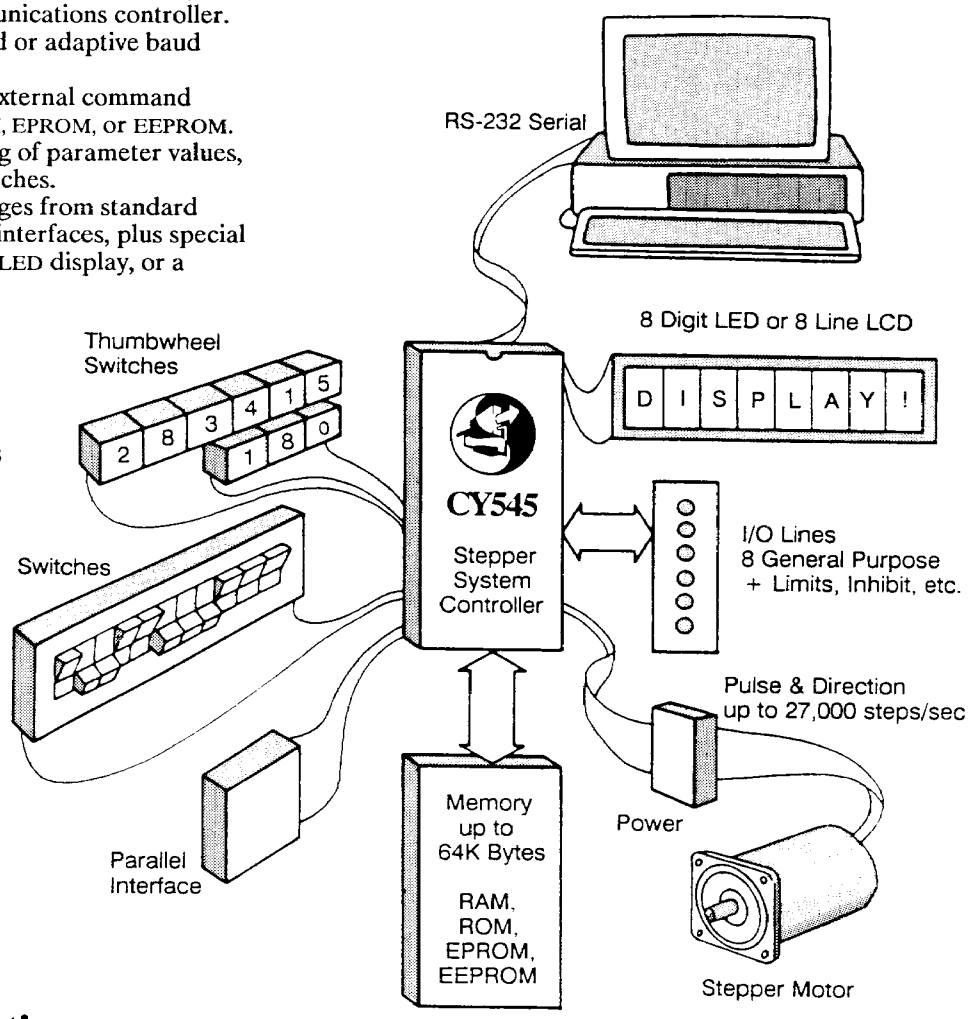
Logic Diagram



Cybernetic Micro Systems, Inc. Post Office Box 3000 • San Gregorio, California 94074 • U.S.A.
Phone: (415) 726-3000 • Fax: (415) 726-3003 • Telex: 910-350-5842

General Command Functions and Special Features

- Parallel command interface with two line handshake, compatible with CY233 network communications controller.
- Serial command interface with fixed or adaptive baud rate selection.
- Support for up to 64K of optional external command memory implemented as RAM, ROM, EPROM, or EEPROM.
- Support for optional external setting of parameter values, through standard thumb-wheel switches.
- Selectable display for output messages from standard serial, standard parallel, or CY233 interfaces, plus special support for a parallel HP HDSP-211x LED display, or a CY325 based serial LCD display.
- User controlled, multi-purpose I/O lines, for:
  - set and clear bit functions
  - test bit and branch functions
  - wait for bit value functions
  - automatic home seek functions



Basic Features

- Single 40 pin 5 volt CMOS IC.
- Simple ASCII letter based commands and parameters.
- Simple application for basic step motor functions.
- Operation with a host computer or stand alone.
- Built-in LED and LCD Display interfaces.

Motion Control Functions

- Programmable step rates from 20 steps/sec to over 27,000 steps/sec provide extremely large dynamic range.
- Linear acceleration for optimal performance.
- Partial accelerations make short moves in the least time.
- Separate parameters for starting rate, final rate, and acceleration values allow totally programmable motions.
- Relative moves of +/- 16 Mega steps from current position. Absolute moves within a 16 Mega step range.
- Continuous moves with no specific number of steps, allow acceleration from the starting rate to final rate, followed by indefinite run length.
- All motions update internal step position.

Motor Support Signals

- Step Pulse and Direction signals work with standard power driver modules.
- Internal or external direction control.
- Forced ramp down and abort signal for emergency or externally controlled end of motion.
- Separate CW and CCW limit signals inhibit stepping beyond one limit, but allow stepping in opposite direction.
- Moving/Not Moving signal for use as Motion Complete or to switch stepper power driver between high and park power.
- Externally operated jog mode, with direction control and start/stop control from one signal, all at programmable, manually controllable step rates between 1 and 1K steps/sec.
- Automatic home sensor seek, with backlash compensation.

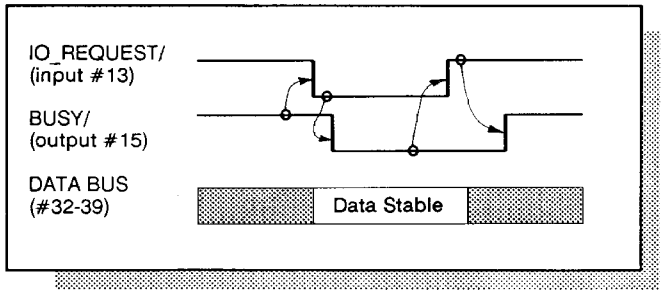
Cybernetic Micro Systems • P.O.Box 3000 • San Gregorio CA 94074 • Telephone: 415-726-3000 • Fax: 415-726-3003

Command Interfaces

The CY545 supports two basic command interfaces, a parallel interface and a serial interface. These signals are similar to functions on other CYxxx controllers from Cybernetic Micro Systems.

Parallel Interface

The parallel interface uses only two handshake lines, IO_REQUEST and BUSY/. When you wish to send a command character to the CY545, you first check that it is not busy; the BUSY/ signal should be high.



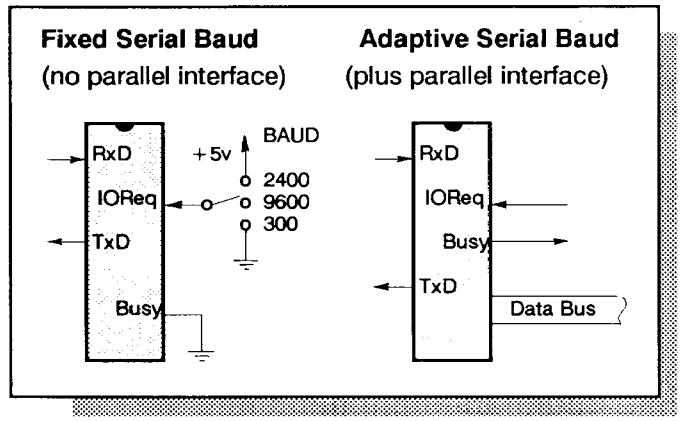
Serial Interface

The CY545 also provides a direct serial command interface, which may be connected to a host computer or terminal. Since the CY545 signals are all TTL voltage levels, external RS-232 line drivers and receivers must be provided, to translate the RS-232 voltage levels to the CY545 TTL levels. The serial interface may be operated in one of two ways, with a fixed baud rate, selected at power up, or with an adaptive baud rate, selected by two carriage return characters from the host.

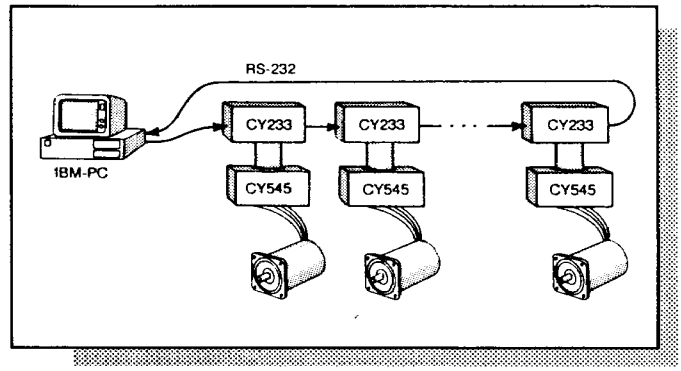
The fixed baud rate mode is selected by tying the BUSY line low, so the CY545 will read it as a zero value on power up. The CY545 IO_REQUEST line value will determine the baud rate, based on an 11 MHz crystal, as follows:

F	**9600**
1	**2400**
0	**300**

The adaptive serial mode is chosen by default, when the BUSY signal is left floating, so the CY545 can drive it at power up. In this mode, the serial baud rate is not set until the CY545 receives two carriage return codes. Be sure to send these characters after power up or any reset (hardware or software). Once the two carriage returns are received, normal CY545 commands may be sent.

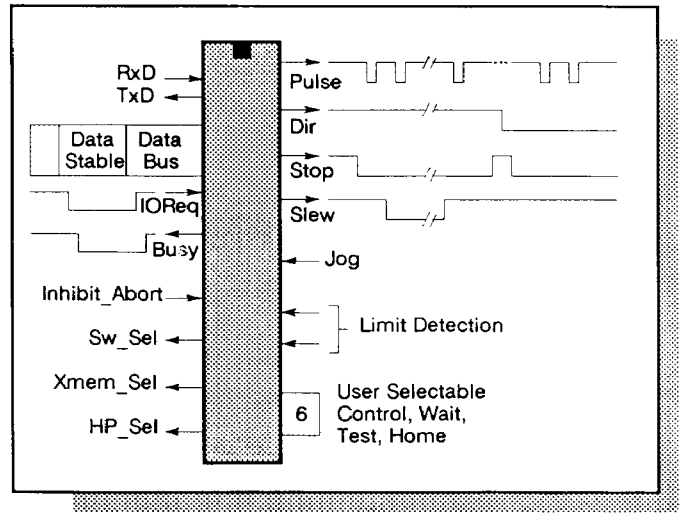


The CY233 Network Control chip allows you to connect up to 255 devices to a single RS-232 serial communications line such as an IBM-PC COM1 or COM2 port, with unique addresses assigned to each device. The CY233 Network is ideal for distributed systems where central control is required but very high speed communication is unnecessary.



Timing & Control Signals

The CY545 provides a simple I/O interface to any 8-bit parallel port or a serial port.



CY545 Command Summary

Commands are upper case ASCII letters, followed by a space and argument value, as needed. Arguments without a suffix are single-byte values. Arguments with a *16* suffix are two-byte numbers and arguments with a *24* suffix are three-byte numbers up to 16777215. Multiple arguments may be separated by a space or comma.

Command		Function
A	Pos24	**A**t position, sets current step position
B	Bit	**B**it set or clear of user selectable bits
C		Set **C**ontinuous step mode
D	Del16	**D**elay for specified milliseconds
E		**E**nter following commands to external mem
F	Rate	Specify **F**irst step rate
G		**G**o step, relative mode
H	Bit	Seek **H**ome, using specified bit
I		**I**nitialize CY545, perform software reset
J	Addr	**J**ump to byte address of current mem page
L	Cnt,Addr	**L**oop to byte address for specified count
N	Num24	Set **N**umber of steps for relative motions
O	Mode	Set **O**perating mode of CY545
P	Pos24	Step to specified absolute **P**osition
Q		**Q**uit entering commands to external memory
R	Rate	Specify slewing step **R**ate
S	Slope	Specify acceleration **S**lope value
T	Bit,Addr	Loop to address **T**il bit matches value
U		Reserved command
V		Reserved command
W	Bit	**W**ait for specified bit to match value
X		e**X**ecute external memory commands
Y	Addr16	Set external memory address pointer
Z	Cnt16,Addr	**Z**illionLoop to byte address for 16 bit count
+		Select **CW** direction for relative motions
–		Select **CCW** direction for relative motions
/		Negate prefix used with Bit commands
?	Cmd	Query specified command parameter value
0		Stop execution of commands from memory
[	Addr,Cnt,D1,...,Dn	Special HP Display support command
"String"		Display all characters between quotes

Electrical Specifications

Absolute Maximum Ratings:

Ambient Temperature under bias	0°C to 70°C
Storage Temperature	-65°C to +150°C
Voltage on any pin with respect to GND	-0.5V to V_{CC} + 0.5V
Power Dissipation	1.0 watts

DC & Operating Characteristics (T_A = 0°C to 70°C, V_{CC} = +5V +/-10%)

SYM	PARAMETER	MIN	MAX	UNIT	REMARKS
I_{CC}	pwr supply current		26	mA	
V_{IH}	input high level	1.9	V_{cc}	V	(3.5V for XTAL, RESTART)
V_{IL}	input low level	-.5	0.9	V	
I_{LO}	data bus leakage		10	uA	high impedance state
V_{OH}	output high level	2.4		V	I_{OH} = -60 uA
V_{OL}	output low level		.45	V	I_{OL} = 1.6 mA
F_{CY}	crystal frequency	3.5	16	MHz	see clock circuits

CYB-545 Proto Board

The versatile CYB-545 board supports most of the features of the CY545. In its minimum configuration, the CYB-545 will support motor control signals, limit switch detection, home seek sensor, jog, and power down signal. It also provides programming features such as jump, loop, and wait, with eight user-definable I/O lines. The board provides both parallel or serial interfaces. Partial circuitry is provided for a minimal thumbwheel switch interface, which may be more fully implemented in the wire wrap area.

In the maximum configuration the board supports an 8-character LED display and up to 32K external memory. For multi-board or multi-axis control, a CY233 network chip is fully supported, and provides addressing for up to 255 boards on a single serial network.

The CYB-545 is provided in kit form and is a compact 100mm x 160mm (4" x 6.3") format. A 2"x 3.5" wire wrap area is available for custom circuits such as thumbwheel switches and power drivers. The board requires +5volts and internally generates RS232 level signals for the serial interface. You must add your own external power drivers and pulse-to-phase translators for your motor.