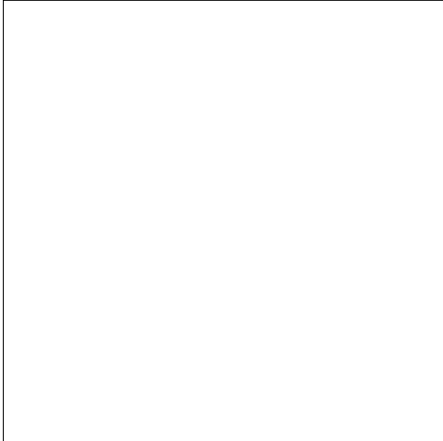# V40 Single Board Computer with A-to-D Converter SBC2040

Features

- ✓ V40 (80188) processor, 8 or 10 MHz
- ✓ 512K EPROM/flash, 512K static RAM
- ✓ PC/104 expansion connector
- ✓ CMOS construction, 5V only
- ✓ RUN.EXE™ firmware for PC languages
- ✓ COM1, COM2, LPT1, clock
- ✓ Third RS232 port, watchdog timer
- ✓ COM1 serial port RS232 or RS485
- ✓ Optional 6 channel, 12-bit ADC
- ✓ Built-in Turbo Debugger™ support

The SBC2040 Single Board Computer is an extremely cost effective basis for embedded systems. PC compatibility is provided by a V40 processor operating at 8 MHz or 10 MHz. Ease of implementation is provided by RUN.EXE™ firmware that allows the SBC2040 to run any IBM-PC language as if it were a native language to the board. With four 32-pin JEDEC memory sockets, the SBC2040 allows up to 1MB to be installed on-board. The PC/104 expansion connector allows a wide range of options to be fitted to SBC8040 systems.

A high degree of integration allows much of a system's basic I/O resources to be included on the SBC. COM1 (RS232/RS485) and COM2 serial ports, LPT1 parallel printer port, and 8259A interrupt controller are all included. COM3 is a non-PC compatible RS232 port. 13 TTL lines, some with optional on-board uses, are included.

Options include clock/calendar, on-board flash EPROM programming, battery-backed RAM, and a 6 channel, 12-bit analog-to digital converter.
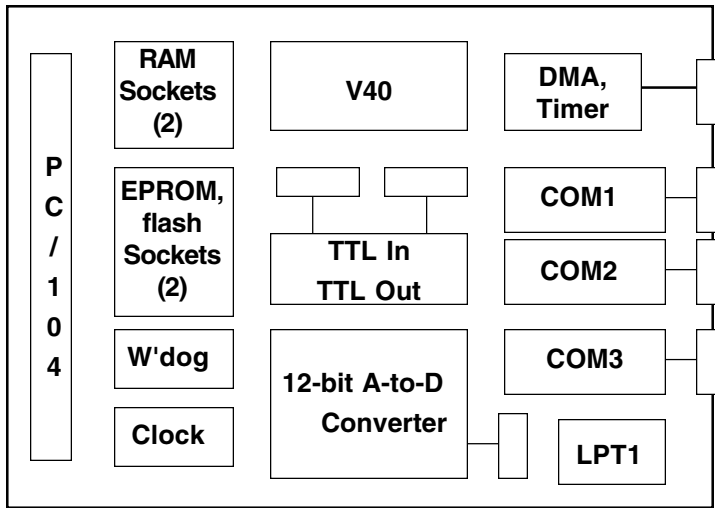
Software Support

DOS emulation, RUN.EXE™
Turbo Debugger™
Comm library, CommBLOK™
PID loop library, PidBLOK™
BITBUS™ library, NetBLOK™
OPTOMUX™, OptoBLOK™
C, BASIC, Pascal compilers
  [Items above in Section 6]
Third party PC libraries

Compatible Hardware

LCD and keypad ,LCDKBD1
  [Item above in Section 4]
Power Supplies
  [Items above in Section 5]
PC/104 expansion cards
RS232, RS485 devices
PC LPT devices

Mounting/Packaging

Enclosure, ENC104-3
Standoffs, STDOFF01
  [Items above in Section 5]
Custom

Micro/sys 3730 Park Place, Montrose, CA 91020 (818)244-4600 Fax (818)244-4246   1
email: info@embeddedsys.com

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┌─────────────────────────────────────────────────────────────┐
│         ┌─────────┐  ┌───────────┐  ┌───────────┐           │
│  ┌───┐  │  RAM    │  │           │  │   DMA,    │  ┌──┐      │
│  │ P │  │ Sockets │  │    V40    │  │   Timer   │  └──┘      │
│  │ C │  │  (2)    │  │           │  │           │            │
│  │ / │  └─────────┘  └───────────┘  └───────────┘           │
│  │ 1 │  ┌─────────┐  ┌──┐   ┌──┐   ┌───────────┐           │
│  │ 0 │  │ EPROM,  │  └──┘   └──┘   │   COM1    │  ┌──┐      │
│  │ 4 │  │ flash   │  ┌───────────┐ └───────────┘  └──┘      │
│  └───┘  │ Sockets │  │  TTL In   │ ┌───────────┐           │
│         │  (2)    │  │  TTL Out  │ │   COM2    │  ┌──┐      │
│         └─────────┘  └───────────┘ └───────────┘  └──┘      │
│         ┌─────────┐  ┌───────────┐ ┌───────────┐           │
│         │  W'dog  │  │           │ │   COM3    │  ┌──┐      │
│         └─────────┘  │ 12-bit    │ └───────────┘  └──┘      │
│         ┌─────────┐  │ A-to-D    │ ┌──┐┌───────────┐       │
│         │  Clock  │  │ Converter │ └──┘│   LPT1    │       │
│         └─────────┘  └───────────┘     └───────────┘       │
└─────────────────────────────────────────────────────────────┘
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Technical Details:

The NEC V40 processor is 80X86 code compatible, allowing the SBC2040 to be a PC-compatible embedded processor. On-board memory is composed of four 32-pin JEDEC memory sockets. Two are sequential, starting at 00000 in the V40's 1MB memory space, and are configured to accept static RAM (SRAM) devices. One is located at the top of the 1MB address space, and is configured for EPROM or flash EPROM devices. The fourth socket can be located in various areas, and is configured for RAM, EPROM, or flash EPROM devices.

Four different memory maps are provided by a PAL device, with two plug-on jumpers selecting the active map. An option allows on-board programming of flash EPROM in two of the sockets. The battery-backed clock option includes enough battery power to back up one of the RAM sockets if desired.

The SBC2040 includes a PC/104 expansion connector. Using this stackable expansion technique, numerous expansion cards can be added to SBC2040 systems.

RUN.EXE firmware "loads" an .EXE file by copying it from EPROM into RAM and executing it upon reset.

Three serial ports are implemented. The first serial port is mapped as COM1 and, under RUN.EXE firmware, C statements "printf()/scanf()" and Pascal statements "Writeln/Readln" directly access this serial port. The COM1 port is shipped with both RS232 and RS485 drivers installed. Plug-on jumpers are available for configuring COM1. The second serial port is mapped as COM2, and is RS232 only. COM2 is used by Turbo Debugger to communicate with the target system. COM3 is the V40 internal serial port. All serial ports are brought to 10-pin headers. Connecting a ribbon cable to a 9-pin male D connector creates an IBM-PC AT compatible interface (cable available from Micro/sys).

The printer port may be configured for standard parallel printer operations, or general purpose bidirectional operation by installing plug jumpers. In parallel printer mode, a ribbon cable attached between the 26-pin header and a 25-pin female D connector creates an IBM-PC parallel adaptor pinout (cable available from Micro/sys). For reliable OEM system operation, the SBC2040 is designed with CMOS technology. A watchdog timer subsystem allows a system reset to be initiated automatically upon abnormal system operation. Three 16-bit timers and two DMA channels are also included.

The analog input option adds a 6 channel, 12-bit analog-to-digital converter to the SBC2040. The addition of data acquisition capabilities to the CPU card reduces card count. This provides a very cost effective method of adding analog input to a system.

The RUN.EXE firmware available for the SBC2040 automatically creates a BIOS/DOS environment upon power-up. Any application program .EXE file that has been placed in EPROM on the SBC will be executed as if MS-DOS were present. Therefore, the SBC2040 is directly programmable in such languages as Microsoft C, Turbo Pascal, QuickBASIC, Turbo C, and MASM without any further development expense.

When power is applied, RUN.EXE looks for a user-installed .EXE file in an EPROM or flash EPROM. If an .EXE file is present, it is "loaded" and run, full speed, from RAM.

If an .EXE file is not present, a debugger kernel is entered that communicates with Turbo Debugger. By connecting a cable between the SBC2040 COM2 port and any PC, full remote source-level debugging can be performed on software running on the SBC2040.

Specifications:

Mechanical:
❑ 4.75" x 8" x 0.6"

Power Requirements:
❑ +5V ± 5% at 175 mA max (no memory)

Environmental:
❑ 0° - +70°C operating
❑ -40° - +85°C storage
❑ 5%-95% relative humidity, non-condensing

Processor Core Section:
❑ V40 (80188 class) CPU
❑ 8 or 10 MHz clock rate
❑ 2 DMA channels, three 16-bit timers
❑ PC-compatible 8259A interrupt controller

PC/104 Interface:
❑ 64-pin connector per PC/104 standard
❑ Simple unmultiplexed 8-bit data transfers
❑ Supports memory, I/O, interrupt, and DMA devices on PC/104

On-board Memory:
❑ Two contiguous sockets for byte wide RAM, from 00000 to 0FFFF, 3FFFF, or 9FFFF
❑ One socket for EPROM or flash, from C0000 or E0000 to FFFFF
❑ One socket for RAM, EPROM, or flash, starting at 10000, 40000, A0000, or C0000
❑ 4 memory maps, selectable with jumpers
❑ On-board programming of flash optional

TTL Inputs/Configuration Header:
❑ 4-bit input port reads state of 4 plug jumpers/TTL inputs
❑ Useful for soft configuration of card at power-up, or 4 TTL inputs
❑ 2 additional TTL inputs through unused modem control lines

TTL Outputs:
- ❑ 7 TTL outputs available at connector
- ❑ 4 lines have alternate on-board uses for flash programming or ADC options
- ❑ Eigth bit in port controls on-board LED

Serial Ports:
- ❑ PC-compatible devices and mapping for COM1 and COM2
- ❑ COM2 has full set of modem controls
- ❑ COM1 has all modem controls except DCD and RI
- ❑ COM1 is RS232 or RS485
- ❑ COM2 is RS232
- ❑ COM3 is V40 internal serial port, RS232 RX and TX signals, no modem controls
- ❑ 50 to 115,200 baud operation, all ports

Parallel Printer Port:
- ❑ Complete Centronics interface, per PC standard
- ❑ Can be used as bidirectional 8-bit port

Printer Port Connector		
Pin	Direction	Signal
1	O	Strobe*
2	O	AutoFD*
3	I/O	D0
4	I	Error*
5	I/O	D1
6	O	Reset*
7	I/O	D2
8	O	Sel in*
9	I/O	D3
11	I/O	D4
13	I/O	D5
15	I/O	D6
17	I/O	D7
19	I	Ack*
21	I	Busy
23	I	Paper out
24		
25	I	Select
26		
Even pins 10-26 are GND		

Serial Port Connectors				
Pin	J5 COM1 RS232	J5 COM1 RS485	J6 COM2	J4 COM3
1			DCD In	
2	DSR In	+TXD Out	DSR In	
3	RXD In	-TXD Out	RXD In	RXD In
4	RTS Out	+RXD In	RTS Out	
5	TXD Out	-RXD In	TXD Out	TXD Out
6	CTS In		CTS In	
7	DTR Out		DTR Out	
8			RI In	
9	GND	GND	GND	GND
10				

Watchdog Timer:
- ❑ Program must refresh watchdog timer every 1.6 seconds, or SBC will be reset
- ❑ Enabled or disabled with jumper

Battery-backed Clock Option:
- ❑ Implements year, month, date, day of week, hours, minutes, and seconds
- ❑ Can be used to back up one RAM socket

Analog-to-digital Converter Option:
- ❑ 6 channels, 12-bit conversions
- ❑ 0-5V full scale input range
- ❑ Linearity ±.5 LSB
- ❑ 1K current limiting resistors on inputs
- ❑ Software-based sample rate, approx. 1K per second

DK2040 Development Kit:
- ❑ Free with first SBC2040 purchase
- ❑ BIOS and DOS compatible O/S
- ❑ "Implied AUTOEXEC.BAT" on reset
- ❑ Allows SBC2040 to directly execute programs written in Microsoft C, Turbo Pascal, QuickBASIC, Turbo C, etc.
- ❑ No modified libraries or start-up code
- ❑ No royalties for O/S
- ❑ Support for with Turbo Debugger
- ❑ Download and program on-board flash
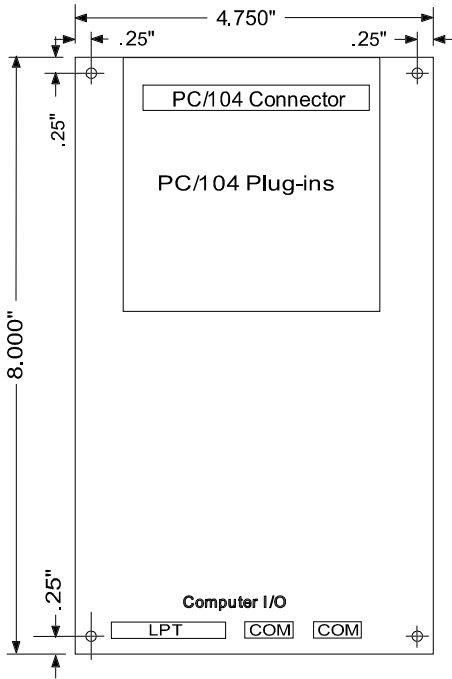- ❑ Includes memory, cables, documentation

J3 Analog Input Connector	
Pin	Signal
1	Analog In 0
3	Analog In 1
5	Analog In 2
7	Analog In 3
9	Analog In 4
11	Analog In 5
13	
Even pins 2-14 are Analog GND	

W3 Dig Input/Config Connector	
Pin	Signal
1	-DCD 1 In
3	-RI 1 In
5	Dig In/CFG 1 In
7	Dig In/CFG 2 In
9	Dig In/CFG 3 In
11	Dig In/CFG 4 In
13	
Even pins 2-14 are GND	

External Connections:
- ❑ COM1, COM2, COM3 Serial I/O Ports: 10-pin header, mating connector Ansley 609-1001M
- ❑ LPT1: 26-pin header, mating connector Ansley 609-2601M
- ❑ Digital Inputs: 14-pin header, mating connector Ansley 609-1401M
- ❑ Digital Outputs: 14-pin header, mating connector Ansley 609-1401M
- ❑ Analog Input Option: 14-pin header, mating connector Ansley 609-1401M
- ❑ PC/104: standard 64-pin female connector
- ❑ Power input, 5-position pluggable terminal strip, 5mm spacing

J2 Digital Output Connector		
Pin	Signal	Alt On-board Usage
1	DO2	Flash Wr Enb
2	DO6	
3	DO3	ADC Ctrl
4	DO7	
5	DO4	ADC Ctrl
6	DO8	
7	DO5	ADC Ctrl
8	GND	
9	IRQ1	
10	GND	
11	IRQ1	
12	TMR 2 OUT	
13	TMR 2 IN	
14	GND	

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        ← 4.750" →
  ← .25"          .25" →
  ┌─────────────────────┐
  │ ⊕                 ⊕ │
  │  ┌───────────────┐  │
  │  │ PC/104 Connector │
  │  └───────────────┘  │
  │                     │
  │   PC/104 Plug-ins   │
  │                     │
  │                     │
  │                     │
  │                     │
  │                     │
  │                     │
  │   Computer I/O      │
  │ ⊕ ┌───┐ ┌──┐ ┌──┐ ⊕ │
  │   │LPT│ │COM││COM│   │
  └─────────────────────┘
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(dimensions: 8.000" height, .25" margins)

Ordering Information:

Single Board Computer:

SBC2040	V40 SBC, 8 MHz
SBC2040-10	V40 SBC, 10 MHz
DK2040	No charge development kit, available first order only

SBC Options:

40OPT1	Battery-backed clock, power for backing one RAM
40OPT3	6 channel analog input
40OPT4	32K battery-backed RAM
40OPT5	128K battery-backed RAM
40OPT6	512K RAM, 256K Flash

Accessories:

TB1485-1	RS485 Terminator Board
CA4020	RS232/RS485 cable to male 9-pin D connector
CA4021	Parallel printer cable to female 25-pin female D connector
CA5052	Cable to TB1485-1
ENC104-3	Metal enclosure for SBC2040 plus 3 PC/104 add-ons
MPCxxx	PC/104 add-on cards

Cables nominally 15", other lengths available

RUN.EXE trademark Micro/sys, Inc.
IBM-PC trademark IBM Corp.
MSDOS, QuickBASIC, Microsoft trademark Microsoft Corp.
Turbo Pascal, Turbo C, Turbo Debugger trademark Borland Intl.
OPTOMUX trademark OPTO 22
BITBUS trademark Intel Corp.