



BasicX BX-24



BX-24 Hardware Reference

Version 1.46 (Modified)

BasicX quick tour

What is BasicX?

BasicX is a complete control system on a chip, combined with a software development environment on an PC-compatible computer running Windows. A BX-24 system combines a BasicX chip with additional devices to make it a standalone computer:

BX-24 Hardware -- In the BX-24 system there is a fast core processor with a ROM to store the BasicX Operating System, 400 bytes of RAM, 32 KBytes of EEPROM, and lots of I/O devices such as timers, UARTs, ADCs, digital I/O pins, SPI peripheral bus, and more. The BX-24 uses an Atmel AT90S8535 as its core processor.

BasicX Operating System (BOS) -- The BasicX Operating System on-chip provides the multitasking environment that make the BasicX Chip so powerful. The operating system also contains a high speed BasicX execution engine.

BasicX Development Environment -- BasicX programs are developed on an IBM-PC compatible computer under Windows 95/98/NT. The BasicX Development Environment includes an editor, compiler, various debugging aids, and source code for examples.

The environment incorporates a true 32-bit Windows IDE. There is no reliance on DOS programs hidden behind a Windows shell, which also means there are no hidden 8-character filename limitations.

What happens when I make a program?

After you create your program, you compile it. The compiler translates the BasicX source code into an intermediate binary language that the BasicX chip understands, and writes the data to a file (*.BXB). The compiler also takes startup preferences such as pin I/O, RAM configuration information and other important startup parameters and puts them in a preferences file (*.PRF)

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Source Code --> BasicX Binary file (*.BXB) plus  
                BasicX Preferences (*.PRF)
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If you're familiar with the PC programming environment, an EXE file on a PC is equivalent to the combination of BXB and PRF files in BasicX.

Once you have these two files, they are the complete representation of your program. These files can be stored on disk, e-mailed, or given away without releasing any source code. This way you could sell BasicX programs without anyone having access to your source code.

The development environment downloads the program directly into the development system or your own board.

Where does the code go when I download it?

On a BX-24 computer, once you have a BasicX binary file and preferences file, the code is downloaded into the 32 KB EEPROM. When the BasicX chip starts (after reset), it goes out and begins executing instructions from the EEPROM. Since the EEPROM is non-volatile, it is safe from power outages. If the power goes out, the code is still retained in the EEPROM. Of course any RAM data that the BasicX chip was working on would be lost.

Why Basic and not C or C++ or assembler?

Typical microcontroller applications use C or assembly language. That is why they are also typically expensive to produce and maintain.

With BasicX, NetMedia did the hard stuff for you, such as building a multitasking network operating system, language processor, and compiler. You get the benefit of all this power which is not available on most microcontrollers at any price.

With this power you can write structured programs in a simple, straightforward language. In fact BasicX's language was modeled after the language used in Microsoft's Visual Basic® development system, which is the most popular programming language in existence.

What is BasicX's relationship with Visual Basic?

You do not need Visual Basic to use BasicX. The BasicX language is subset-compatible with the Visual Basic language, and it is possible to write code that will run in both PC and BasicX environments, as long as you use a common subset.

Obviously you must accommodate differences between operating systems as well as hardware, but if you choose, you can develop and debug your algorithms in Visual Basic and make use of the same code in BasicX.

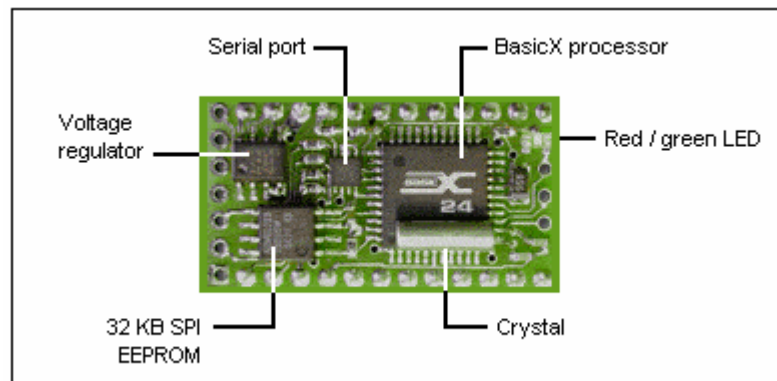
NetMedia also provides source code for Visual Basic applications that lets you communicate with the PC from a BasicX application.

Using a Visual Basic development system on the PC side and BasicX as the controller makes a powerful combination. NetMedia recommends that you get Visual Basic 6.0 or higher if you are codeveloping PC applications and BasicX applications.

What are the power requirements of the BX-24?

The BX-24 computer requires a DC power supply in the range of 5.5 V to 15.0 V, which makes it ideal for battery power. Current requirements are 20 mA plus I/O loads, if any.

BX-24 computer



BasicX processor

The BasicX processor is the heart of the BX-24 computer, and is based on a Atmel AT90S8535 chip. This custom-programmed 44 pin chip reads and executes the program stored in the 32 KB EEPROM.

The BX-24 has 16 general purpose I/O lines that are TTL and CMOS compatible. When used for digital I/O, each line can be set to 1 of 4 states -- output high, output low, input tristate (hi-Z) and input with pullup. Up to 8 of the 16 lines can be used alternatively as 10-bit analog to digital converters (ADCs) for sensing analog voltages.

SPI EEPROM chip

When you write a program, the SPI (Serial Peripheral Interface) EEPROM chip is where the program is stored. When the BasicX processor is executing, it fetches instructions from this chip. The 32 KByte EEPROM (AT25656) can store approximately 8000 lines of BasicX code, depending on the complexity of the program.

Serial port

A high speed 5 volt serial port is provided for connection to modems, PCs, terminals or other controllers. The maximum communication speed is 460 800 baud. A hex inverter (TC7WH04) inverts the serial signals coming to and from the processor's serial port. The hex inverter is also used to isolate the processor's 5 V serial port from the higher voltage levels (typically ± 12 V) present on standard PC serial ports.

The serial port uses 3 wires -- RxData, TxData and DTR. The DTR line is used only for downloading programs. The BasicX Development Environment on the PC has a built-in window that allows 2-way communication with the BasicX serial port.

Voltage regulator

The BX-24 is equipped with a 5 V low-voltage dropout regulator/monitor (LP2951). The regulator can accommodate an input voltage range between 5.7 V and 15 V. When you apply power to pin 24 (Vin), the regulator produces 5 VDC at a maximum current of 100 mA. Since the BX-24 only consumes 17 mA to 25 mA of current, the remaining current capacity can be used for your own purposes.

Low voltage monitor

To prevent the BX-24 from locking up or running erratically during power-on or any other periods of transient or low voltage, the BX-24 employs a low voltage monitor. The monitor is an internal part of the on-board regulator chip.

The monitor constantly checks the system's voltage level. If the BX-24's 5 V supply voltage drops below 4.75 volts, the monitor immediately places the BX-24 in reset until the voltage level rises again.

Analog to digital converter

The BX-24 includes an 8 channel, 10-bit analog to digital converter (ADC). The ADC channels are tied to pins 13 to 20, and is an integral part of the processor. All 8 channels can be used either as analog or digital inputs.

The ADC inputs are 0 V to 5 V level and will not tolerate either higher or negative voltages. For reliable ADC conversions it is recommended that the ground connection of the source voltage (the voltage you are measuring) share a common ground with the BX-24 ground connections at pin 4 or pin 23.

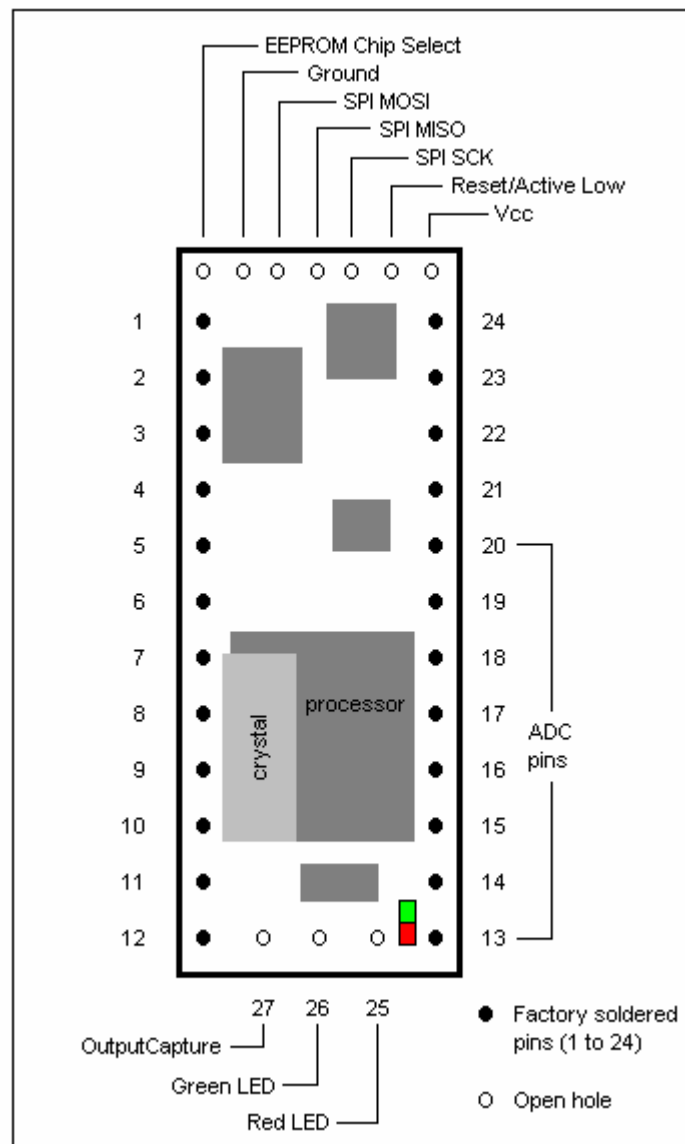
BX-24 technical specifications

General

| | |
|---|---|
| I/O Lines | 16 total; 8 digital plus 8 lines that can be ADC or digital |
| EEPROM for program and data storage | On-board 32 KB EEPROM Largest executable user program size is 32 KBytes |
| RAM | 400 bytes |
| Analog to digital converter | 8 channels of 10 bit ADC, can also be used as regular digital (TTL level) I/O |
| ADC sample rate | 6 k samples/s maximum |
| On-chip LEDs | Has a 2-color surface mount LED (red/green), fully user programmable, not counted as I/O line |
| Program execution speed | 60 microseconds per 16 bit integer add/subtract |
| Serial I/O speed | 2400 baud to 460.8 Kbaud on Com1 300 baud to 19 200 baud on any I/O pin (Com3) |
| Operating voltage range Min/Max | 4.8 VDC to 15.0 VDC |
| Current requirements | 20 mA plus I/O loads, if any |
| I/O output source current | 10 mA @ 5 V (I/O pin driven high) |
| I/O output sink current | 20 mA @ 5 V (I/O pin pulled low) |
| Combined maximum current load allowed across all I/Os | 80 mA sink or source |
| I/O internal pull-up resistors | 120 k Ω maximum |
| Floating point math | Yes |

| | |
|--|---|
| On-chip multitasking | Yes |
| On-chip clock/calendar | Yes |
| Built-in SPI interface | Yes |
| PC programming interface | Parallel or serial downloads |
| Package type | 24 pin PDIP carrier board |
| Environmental specifications Absolute maximum ratings | Operating temperature: 0 °C to +70 °C Storage temperature: -65 °C to +150 °C |

BX-24 pin numbering



BX-24 Pin Definitions

Each pin on the BX-24 computer has a primary and alternate function as shown in the table below. The primary function describes how the pin can be configured. The alternate function describes how the pin is configured when BasicX built-in options are selected.

| Pin # | Primary Function | Primary Description | Alternate Function | Alternate Description |
|-------|--------------------|---|--|----------------------------------|
| 1 | Com1 Transmit | High speed Com port | Serial download transmit | See Com Ports |
| 2 | Com1 Receive | High speed Com port | Serial download receive | See Com Ports |
| 3 | ATN line | For serial downloading | | |
| 4 | Ground | Common with pin 23 | | See below for DC characteristics |
| 5 | PortC, Bit 7 | General Purpose I/O Port | | |
| 6 | PortC, Bit 6 | General Purpose I/O Port | | |
| 7 | PortC, Bit 5 | General Purpose I/O Port | | |
| 8 | PortC, Bit 4 | General Purpose I/O Port | | |
| 9 | PortC, Bit 3 | General Purpose I/O Port | | |
| 10 | PortC, Bit 2 | General Purpose I/O Port | | |
| 11 | PortC, Bit 1 | General Purpose I/O Port | Interrupt pin | |
| 12 | PortC, Bit 0 | General Purpose I/O Port | Input capture pin | |
| 13 | PortA, Bit 7 | ADC channel 7 | General Purpose I/O Port | |
| 14 | PortA, Bit 6 | ADC channel 6 | General Purpose I/O Port | |
| 15 | PortA, Bit 5 | ADC channel 5 | General Purpose I/O Port | |
| 16 | PortA, Bit 4 | ADC channel 4 | General Purpose I/O Port | |
| 17 | PortA, Bit 3 | ADC channel 3 | General Purpose I/O Port | |
| 18 | PortA, Bit 2 | ADC channel 2 | General Purpose I/O Port | |
| 19 | PortA, Bit 1 | ADC channel 1 | General Purpose I/O Port | |
| 20 | PortA, Bit 0 | ADC channel 0 | General Purpose I/O Port | |
| 21 | VCC | 5 V output from regulator (when powered at Vin) | 4.8 V to 5.5 V power input (when Vin not used) | |
| 22 | Reset | Low Active Reset | | |
| 23 | Ground | Common with Pin 4 | | See below for DC characteristics |
| 24 | Vin, 5.5 V to 15 V | Input to 5 V regulator (see note below) | | See below for DC characteristics |

Note -- If regulated 5 V power is connected directly to VCC (pin 21), Vin (pin 24) can be left unconnected.

BX-24 DC characteristics

| Parameter | Condition | Min | Typ | Max |
|---|--|--------|--------|--------------|
| Pin 24 power input to voltage regulator | Cannot be used as input if pin 21 is connected | 5.5 V | 6.0 V | 15.0 V |
| Pin 21 regulated input/output | Cannot be used as input if pin 24 is connected | 4.8 V | 5.0 V | 5.5 V |
| Ground is common to pins 4 and 23 | | | | |
| Output low voltage | Vcc = 5.0 V Output current = 10 mA | | | 0.5 V |
| Output high voltage | Vcc = 5.0 V Output current = 10 mA | 4.5 V | | |
| Output source current | Vcc = 5.0 V | | | 10 mA |
| | Vcc = 2.7 V | | | 5 mA |
| Output sink current | Vcc = 5.0 V | | | 15 mA |
| | Vcc = 2.7 V | | | 10 mA |
| Maximum total | for all output pins | | | 70 mA |
| Analog comparator input offset voltage | Vcc = 5.0 V | | | 40 mV |
| Analog comparator input leakage A | Vcc = 5.0 V Vin = Vcc/2 | -50 nA | 50 nA | |
| Analog comparator propagation delay | Vcc = 5.0 V | | 500 ns | |
| I/O pin programmable pull-up resistor | | 35 kΩ | | 120 kΩ |

BasicX FAQ

Frequently asked questions

1. Question: Do I need to have Visual Basic to program the BasicX?

Answer: No, Our Development software comes with all the software that you need to write your own programs and download them to the BasicX.

2. Question: What makes the BasicX chip so fast? I noticed it only has a 7.37 MHz crystal.

Answer: A number of factors determine overall speed -- the BasicX's speed is partly due to its RISC core processor and mostly due to its Basic interpreter engine. Our internal engine executes most Basic instructions about 10 to 50 times faster than most competitor's chips.

3. Question: Can I give a copy of my BasicX software to my friend so that he doesn't have to buy the development system?

Answer: No, the BasicX Editor/Compiler and Downloading software is not shareware. The software only comes with our development System and is not sold separately at this time.

4. Question: How much Basic code can I fit in your 32 KB EEPROM chip?

Answer: About 8000 lines of Basic code can be fit into this chip.

5. Question: How fast is the BasicX?

Answer: The BasicX can execute a 16 bit integer addition or subtraction in approximately 60 microseconds. The speed is considerably faster if you use our soon to be released cache RAM option.

