SINGLE BOARD COMPUTER

with Flash Program Memory

SBC PIC16F87X SERIES
SBC PIC16LF87X SERIES
DT106 and SBC106

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This manual applies to the the following Vikon Technologies products:

Single Board Computers Assembled and Tested - **SBC PIC16F872, SBC PIC16F877, SBC PIC16LF877, SBC PIC16LF876, and SBC PIC16F876.**

Single Board Computers Assembled and Tested with no Microcontroller or other integrated circuits - **SBC 106**

Single Board Computers KIT – **SBKIT PIC16F872** and **SBKIT PIC16F877**

Single Board Computers KIT with no Microcontroller or other integrated circuits – **SBKIT 106**

Single Board Computer Bare Board (no parts) - **DT106**

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1.0 Introduction:

The SBC PIC16F87X series, SBC 106, and DT 106 board computer modules are based on the Microchip PICmicro PIC16F87X family of microcontrollers. Vikon Technologies offers several different variations of the module. These modules offer low cost and high performance.

The modules can be used stand alone or with the SimmStick bus . They feature a SimmStick compatible edge connector.

1.1 Features:

- 28, and 40 pin footprints to suit all current PICmicro flash PIC1687x devices.
- Alternative RS-232 or RS-485 Communications option.
- Optional on board 78L05 Regulator for stand alone operation.
- Optional EEProm. Same pinout as MicroChip 24LCxx family.
- Optional 8570 RAM can be used as second EEProm location.
- Brown out (power monitor /supervisor) integrated circuit can be installed if the user chooses to use one, the DT106 and SBC 106 can use the 40 or 28 pin older PICmicro devices that may require this circuit.
- Provision for LCD 14 pin header and LCD contrast pot.
- Crystal or Resonator Oscillator.
- 40 pin header (40 pin dip compatible) at the top edge of the board.
- Optional Dallas DS-1302 Real Time Clock.
- SimmStick compatible, which means it is a Load/Run operation for Flash Micros if used in conjunction with a suitable programming platform such as the DT001.
- 10 pin in circuit programming header allows various programmers (with appropriate cable) to program the PIC16F87X chips in circuit. Vikon offers the EPIC programmer with the optional cable.
- PIC16F87X and PIC16LF87X offer multi channel A/D conversion up to 10 bits.

- PIC16F87X / PIC16LF87X versions can be used as a development platform for other PICMicro parts such as the PIC16C62, PIC16C63, PIC16C64, PIC16C72, PIC16C73, PIC16C74, PIC16C774 and others (see Microchip Application Note: TB033).
- Board can accept various PIC Micro parts - 28 pin and 40 pin.
- Compatible with 1 to 4 line character LCD or VFD (emulator type) displays.

SBC106 or DT106 Users:

The Micro can be any of the flash 87x family and many other PICmicros that fit the 28 pin skinny Dip and 40 pin DIP footprints. You can even change Micro types if you install a 28 pin socket in the U5 position, and two 20 pin machine pin strips into the U1 position.

2.0 Product Variations

2.1 SBC PIC16F87x version differences:

Microcontroller Part Number	Pins	Memory Flash / RAM / EEPROM	Vdd range	Additional Features
PIC16F872	28	2K/128/64	4-5.5V	5 ch. A/D, MSSP
PIC16F877	40	8K/368/256	4-5.5V	8 ch. A/D, MSSP, USART, PSP
PIC16LF876	28	8K/368/256	2.0-5.5V	5 ch. A/D, USART, MSSP, low power
PIC16LF877	40	8K/368/256	2.0-5.5V	8 ch. A/D, MSSP, USART, PSP, low power
PIC16F876	28	8K/368/256	4-5.5V	5 ch. A/D, USART, MSSP

- LF parts are available up to 4Mhz only, F parts are available in 4 or 20Mhz versions.
- For more information please consult the Microchip data sheets.

2.2 Manufacturing Options

The SBC PIC16F877, SBC PIC16LF876, SBC PIC16F872 and SBC PIC16LF877 are available with several manufacturing options. Depending on how you ordered the board you may have one or more of the following options.

Board designated (or ordered) as “base version” boards have none of these options.

Option	Description of Option	Notes
RS232	RS232 level converter IC circuit	If installed RS485 can not be installed.
RS485	RS485 level converter IC	If installed RS232 can not be installed.
PASSIVE232	Two resistors for a passive style RS232 type interface. Not true RS232 specs.	Not true RS232 requires software based serial comms with inverted signals
5VREG	5 Volt regulator circuit	100milliamp max only
EEPROM	I^2C EEPROM 8 pin	Available 512 bytes to 16K bytes
EEPROM2	Second I^2C EEPROM 8 pin	Available 512 bytes to 16K bytes
I^2C-RAM	I2C 8 pin RAM device	Call for availability
RTC	Dallas Real Time Clock circuit	
LCD	LCD 10K Pot and 14 pin header	
SIMMHEADER	30 pin straight or right angle header installed over edge connector.	

3.0 Parts List

Part designation on schematic shown in **bold**

1. 1 X Capacitor **C5** 15pf – 27pf Ceramic (Depending on type & frequency of crystal)
2. 1 X Capacitor **C6** 15pf – 27pf Ceramic (See data sheet for full details.)

Note: A Crystal of a suitable value, or a 3 pin Resonator. If a crystal is fitted then C5 and C6 must be installed. If you use a Resonator, then you should not install these two caps if the resonator has internal capacitor.

3. 1 X Crystal or Resonator **X1 (**frequency depends on board part number)
4. 1 X Resistor **R3** 470 Ohms .25 watt

Note: There is an option for a series resistor (R3) between OSC2 and the crystal. The 16F87x data sheet shows this resistor in Figure 12-2 on page 135 of the data sheet. Use a 470 ohm resistor there when running the chip in HS mode, or it will burn up the crystal very quickly. Most users should simply install the 470 Ohm resistor., Resonators and low frequency crystals may not need this resistor.

5. 1 X Resistor **R1** 10K .25 watt
6. 1 X Resistor **R2** 10K .25 watt Note on some SBC versions **R2** may be replaced by a **D2** 1N4148 or equivalent diode , **these versions should not install a IC at U6 or the diode needs to be replaced by a 10K resistor.**
7. 1 X Resistor **R4** 10K .25 watt **(installed only when a I^2C device option installed)**
8. 1 X Resistor **R5** 10K .25 watt **(installed only when a I^2C device option installed)**
9. 1 X Resistor **R6** 10K .25 watt
10. 1 X Capacitor **C11** .01uf (or .1uf) Ceramic
11. 1 X Capacitor **C12** 10uf Tantalum or Electro.
12. 1 X Capacitor **C13** .01uf (or .1uf) Ceramic
13. 1 X Capacitor **C14** .01uf (or .1uf) Ceramic

3.1 Options:

3.1.1 On board regulator circuit

100 milliamp max:

1. 1 X 780L5 +5 **VR1** Voltage regulator in TO-92 case. (Optional)
2. 1 X Capacitor **C9** 10uf Tantalum or Electro.
3. 1 X Capacitor **C10** .01uf (or .1uf) Ceramic

Important! When using VFD displays or LED backlit LCD displays use an off board 5 volt regulator capable of handling the higher power requirements of these displays (typically greater than 300ma) !

3.1.2 Important info when using VR1 and JP5

JP5 is used to Isolate the +5V signal on the edge connector from the 78L05 regulator output if it is installed. Both outputs should never be used together. The track on the solder side of the board under JP5 needs to be cut to isolate the 78L05 regulator output. A test link and two male posts are used to reinstall the regulator output.

Note: When running a LF part at lower voltages (below 5 volts) you may need to replace VR1 with a lower voltage unit or not use VR1 at all and use an external source of regulated low voltage power.

3.1.3 I^2C EEPROM Option

1. **U4** - EEPROM 8 pin 24Cxx or 24LCxx
2. **U3** - EEPROM (2^{nd} device) or RAM options 8 pin
3. 8 pin dip socket(s) 1 or two depending on options ordered
4. 10K Resistors are installed at **R4** and **R5**

3.1.4 Optional second oscillator for U1 timer 1 input:

1. **C7** and **C8** (22pf Ceramic)
2. **X2** 32.768khz Crystal

3.1.5 Optional real time clock circuit

1. 1 X Dallas DS-1302 **U8**
2. 1 X 32.768khz **X3** Crystal with a load capacitance of 6pf. (For Optional DS-1302 Clock) Note: X3 may have a small 5 – 8 pf capacitor across it to compensate for crystal capacitance variations and improved timekeeping accuracy.

3.1.6 Optional LCD /VFD interface

1. 14 pin header
2. 10K **POT 1** (For Optional LCD only , not used by VFDs)

3.1.7 Optional RS-232 Serial Communications

1. 1 X Capacitor **C1** 1uf Electrolytic (PCB mount.) or Tant. @16 V.
2. 1 X Capacitor **C2** 1uf Electrolytic (PCB mount.) or Tant. @16 V.
3. 1 X Capacitor **C3** 1uf Electrolytic (PCB mount.) or Tant. @16 V.
4. 1 X Capacitor **C4** 1uf Electrolytic (PCB mount.) or Tant. @16 V.
5. 1 X **U2 -** MAX-232 or DS14C232 Integrated Circuit (or equivalent)

Note the MAX232 and DS14C232 are designed for 5 volt operation, if you have a board capable of low voltage operation and intend to use it at a lower voltage, these parts will not function correctly.

3.1.8 Optional RS-485 Serial Communications

1 X **U5** - DS75176B, MAX-485, LTC-1485 Integrated Circuit (or equivalent)
Note: on boards designed for operation other than 5volts (2 – 5.5volts) such as PIC16LF87x you must use a device capable of operating at the lower voltage if you intend to operate the board at the lower voltage.
Note: RS-232 and RS-485 Comms can't be installed together as the chip footprints overlap each other.

3.1.9 Brown-Out Circuit

Not installed or required on PIC16F87X boards:
The power monitor / supervisor IC (U6) in a TO-92 package is used to stop the Micro operation becoming unpredictable during a power 'brown-out'. In most cases this isn't required. It's just an added precaution for reliable operation. The older PICmicros may well need this device. You don't need it for any PIC16F87x or PIC16LF87x chip and many of the newer PIC16C devices, consult your PICmicro data sheet for more information.

If U6 is populated some compatible devices are Microchip MCP-120, Panasonic MN13811-S (open collector), MN1381-S (cmos), Motorola MC33064/P, Zetek ZM33064. The device should be a TO92 style package with a switching (level) voltage of 4.2 to 4.85 volts when operating at a 5 volt supply. If you operate the board at lower voltages you must select a part with the appropriate voltage**. Note if you must use U6 check to see if the part at R2 is a diode if it is replace with a 10K resistor.**

For DT106 or SBC106 users: By just simply ignoring the brown-out circuit and installing resistors R1 and R2, the circuit operation should be fine. R1, R2, and R3 must be installed at all times for normal operation. Yes, even if you don't use a brown-out circuit.

4.0 Headers and jumper info:

JP1:
Serial Out Jumper block, default connected.

JP2:
Serial In Jumper block, default connected.

JP1 and JP2 can easily be isolated or reversed, by cutting the tracks on the solder side of the board, and soldering in a 4 pin male header (2x2) to suit. Jumper links, or test links can be used to connect, isolate, or swap over the comms lines. The links horizontal will be the default, the links vertical will swap them over.

JP3:
Header block for unused gates of the MAX-232. These are spares, but can be useable if jumpered correctly for other handshaking RS-232 lines.

JP4:
VCC Isolate to 40 pin header J1. Default Isolated. If you wanted to run a target board from the DT106 board via J1, then it may need to have the +5V removed if it had it's own supply, as you can't have two +5V sources connected together.

JP5:
Used to Isolate the +5V signal on the edge connector from the 78L05 regulator output if it is installed. Both outputs should never be used together. The track on the solder side of the board under JP5 needs to be cut to isolate the 78L05 regulator output. A test link and two male posts are used to reinstall the regulator output.

J1:
40 pin header, pin for pin layout compatible with 40 pin Micro.
Also read the notes on the J4 Programming header.

J2: Real Time Clock:
Used for Dallas DS-1302 to get power from a standby battery to it's VCC2.
The Dallas DS-1302 (U8) requires a crystal (X3) with a load capacitance of 6pf.

J3:
The Real Time Clock control lines can be connected to here. Make sure you don't conflict with other signals used.

J4:
Programming header. Default connected through J4 on the solder side of the board.

This header mates with J1, the 10 pin programming Header on the DT001 board, and if a 10 pin header cable is made up with flat ribbon cable, the board can be programmed via this cable. You have to cut the tracks on the solder side of the DT106 board, but make sure you don't cut the earth track (pins 9 and 10) The other 4 tracks can be cut.
This allows the program/run switch on the DT001 board to be used. To return the header to a stand alone controller, 4 Test Links need to be used when the IDC crimp connector cable is removed. These must be placed across header J4, pins 1 and 2, 3 and 4, 5 and 6, and 7 and 8. This header pinout is the same as the Dr. Russ Reiss Configuration, however a suitable cable can be made up to match it with any ISP programmer.

5.0 IMPORTANT INFORMATION PLEASE READ:

5.1 In Circuit Programmers

All programmers use pins RB7 and RB6 on the PIC (B7 & B6 on the SimmStick Bus) as well as the MCLR or reset lines. The MCLR or reset line will be brought up to a minimum of +12.5VDC to about +13.1VDC during programming. You must isolate any circuitry (including any on the SimmStick bus) that is connected to the Reset (MCLR) line or damage may occur to other circuitry or your programmer!

You must also isolate B6 & B7 (RB6 & RB7) if they are being used as inputs, have a low impedance device connected to them, are connected to a bi-directional data bus (such as a LCD) or are being driven from a device output with a low impedance source, or you can not properly program the device in circuit. Best rule of thumb is to isolate them always. You can do this via J4 however this does NOT isolate the SimmBus.

5.2 I^2C Devices use C3 and C4 (RC3 & RC4 on PIC):

If you are using on board I^2C EEPROM or RAM, please note that I/O lines C3 and C4 are used for this function. Any external circuitry attached to these lines may interfere with this. These lines appear on the SimmStick bus.

If you are not using I^2C devices they can be used as general I/O and they are pulled up to Vcc using 10K resistors at R4 and R5.

5.3 A4 (RA4) is pulled up on board using a 10K resistor.

5.4 Real Time Clock DS1302

If you have a RTC IC installed at U8 it is a Dallas DS1302. You need wire the DS1302 I/O lines to your microcontroller's I/O lines. The header J3 will need to be wired to three available I/O lines. If you plan on using battery back up , the external battery must be wired to J2.

The DS1302 charges any battery attached to J2. You must use the **correct type of battery** or damage will occur to the battery and the circuit**. Also an incorrect battery can be a safety hazard!**

Please read all data and application notes about the DS1302 before using! Available from Dallas Semiconductor.

6.0 Power Supply

When using this module stand alone or in a SimmStick bus, a voltage level of greater than 5 volts DC CAN NOT be applied to pin 7 of the SimmStick edge connector or if you are powering from pin 21 of J1!

Power supplies must be regulated and filtered for proper operation. Unregulated and unfiltered power sources may damage the unit and provide unreliable operation, they will also violate any warranty!

6.1 AC adapter precautions

DO NOT USE AN AC ADAPTER OR POWER SUPPLY THAT PROVIDES NO AC POWER LINE ISOLATION – YOU MUST USE A TRANSFORMER TYPE UNIT THAT IS UL AND / OR CSA APPROVED! YOUR POWER SOURCE MUST BE ISOLATED FROM THE AC LINE.

WHEN USING AC ADAPTORS - THE AC POWER ADAPTOR UNIT SHOULD BE MARKED: CLASS 2 TRANSFORMER or PLUG IN CLASS 2 TRANSFORMER. Failure to comply with this requirement may cause a unsafe or hazardous condition to occur!

6.2 Current requirements

The amount of current (power) depends on what options are installed on your board and what types of devices are being driven by the board (i.e. LEDS, LCD display etc…) The speed of the board will also determine some of the power requirements, example a 20Mhz clocked PIC requires more power than a 4Mhz clocked PIC.

Consult device data sheets for power requirements.

Typically a SBC PIC16F87X series module running at 20 Mhz requires less than 80 milliamps with most options and a LCD (no backlight power) attached.

7.0 General Information

7.1 Handling Precautions:

When working with a circuit board please take normal anti-static handling procedure precautions. Keep unused boards in antistatic bags or packaging. Use antistatic mats or other devices at your workstation to reduce the chance of static electricity from your body discharging into the board.

Always remove power when installing a board into a circuit or a SimmStick bus backplane. Always remove power when attaching or removing devices connected to any of the headers on the board.

7.2 Connecting to external circuitry

The I/O pins of the SBC module are connected directly to the PIC microcontroller with the exception of the RS232 and RS485 which are connected to level converter chips.

Care should be taken that the maximum voltage for an input is not exceeded. Typically you should not drive an input greater than 5 volts (or the VDD supply) or go below ground (negative voltage). If the signal may exceed these limits a resistor should be placed in series with the input. This resistor should be high enough in value to limit the current that will flow through the input

protection diodes on the PIC. How ever if the voltage is to high you may need some type of interface circuit. Also you may need optically coupled inputs for safety or isolation purposes.

When using the PIC I/O as an output, it can sink or source up to 25 milliamps per output. When supplying multiple outputs at high current levels care must be taken the maximum chip power dissipation is not exceeded and the maximum combined current output is 200 milliamps. Consider using buffer ICs capable of supplying high currents such as ULN2803 / ULN2804 or ULN2003.

When using the analog inputs of the analog to digital converter , noise on the analog input or Vref can affect conversion accuracy. If you are using VDD /VSS as Vref , noise on the power supply can be a factor.

The PIC oscillator should not be used to drive other circuitry. If you want to drive multiple device with the same clock, use an external clock circuit to drive the PIC and the other devices. When using external clocks, remove the crystal or resonator and any associated capacitors.

Finally if external signal sources are being used to supply counter, timer inputs, or interrupts you must make certain noise and glitches will not affect circuit operation. Short glitches or spikes can false trigger PIC's internal circuitry.

7.3 Testing SBCs:

When ever you attach test equipment make sure you understand the loading of the equipment on the circuit (both from a DC and AC stand point). Be careful where you attach test equipment grounds. Always use proper probes and leads for your equipment.

Please note that capacitive loading effects of a scope, frequency counter, logic analyzer, or meter test lead or probe when probing the PIC oscillator circuit can cause the crystal or resonator to stop oscillating or shift its operating frequency. In fact even a 10 to1 100Mhz probe with about 14pf input cap. can cause a 20Mhz crystal on a PIC to shut down or not start up.
Note when debugging with a scope, the PIC timer / counter inputs can miss trigger on short (fast) glitches that your equipment may not properly display. Even when your source is a slow pulse a fast glitch from some outside interference can cause this problem.

Ground loops are source of many problems when connecting external signals, they may be further enhanced by test equipment grounding introduced into the circuit.

8.0 Pinouts and Jumper Locations

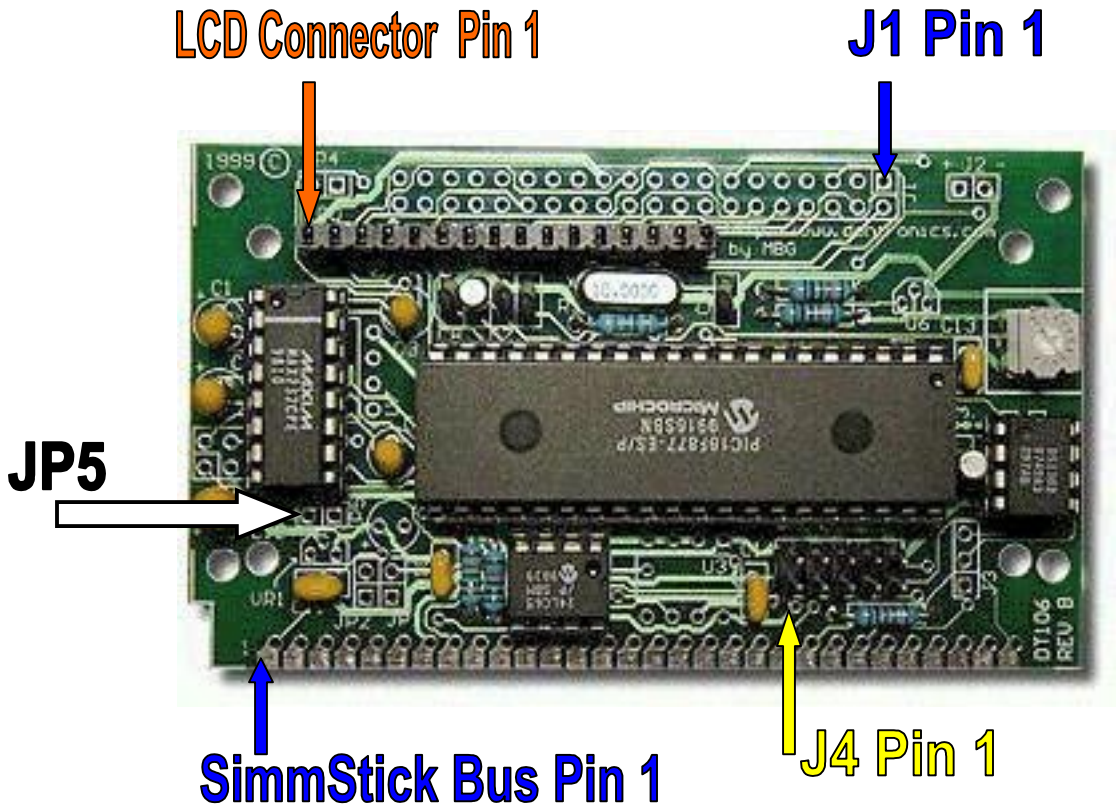
8.1 SimmStick Bus signals on 30 pin edge connector:

Pin	Description	Pin	Description	Pin	Description
1	Serial Out	**11**	C4 and I^2C SDA	**21**	B6
2	Serial In	**12**	C7 / SI	**22**	B7
3	N/C	**13**	C6 /SO	**23**	A0
4	+VDC In Unregulated	**14**	C5	**24**	A1
5	N/C	**15**	B0	**25**	A2
6	N/C	**16**	B1	**26**	A3
7	VDD power in (regulated +5VDC)	**17**	B2	**27**	A4
8	Reset (MCLR)	**18**	B3	**28**	A5
9	Ground	**19**	B4	**29**	C2
10	C3 and I^2C SCL	**20**	B5	**30**	C3

8.2 LCD / VFD Header Pin Definitions:

Pin	Micro – LCD	Pin	Micro - LCD	Pin	Micro - LCD
1	- Ground	6	B3 - Enable	11	B4 – Data 4
2	- Vcc	7	N/C	12	B5 – Data 6
3	- Contrast Pot	8	N/C	13	B6 – Data 7
4	B1 – R/S	9	N/C	14	B7 – Data 8
5	B2 – Read/Write	10	N/C	15/16	N/C

8.3 Jumper Locations



9.0 Compatability with In Circuit Debuggers

The SBC PIC16F87X , DT106, and SBC106 are compatible with various in circuit debuggers.

Vikon Technologies offers the PIC-ICD. Both 28 pin and 40 pin versions can be debugged with the PIC-ICD. **The PIC-ICD is an improved version of the MPLAB ICD** and is fully compatible with Microchip's MBLAB software. Therefore you get all the same debugging capability (plus more) as you do with the MBLAB ICD.

The Microchip MPLAB ICD can also be used with these boards. Vikon supports these boards with the MPLAB ICD and has tested the boards with it. The following limitations have been observed.

The following resources are not available when using the MPLAB ICD (or PIC-ICD), I/O pins RB6 and RB7, MCLR (reset) , low voltage ICSP is disabled, one stack level is used, last 288 words of program memory is used, 6 file registers are used, and the first program memory location must be a NOP.

Your circuits can not make use of RB6 and RB7 when the MPLAB ICD is used. Because the onboard LCD header uses these as Data pins to the LCD or VFD display the on board LCD header can not be used when the MPLAB ICD is being used.

We have also observed that the in-circuit module can cause the PIC oscillator not to start properly when inserted into a SBC with a 20 Mhz crystal (in fact any crystals above 4Mhz may exhibit this). The 4Mhz versions appear to work properly. The fix may be to reduce the values of the C5 and C6 capacitors to about 10pf Or remove the crystal and capacitors C5 /C6 and drive the PIC with a Crystal oscillator. **The PIC-ICD has the ability to use a Oscillator you install on it and then set the PIC-ICD jumper to use it, in this case you do not have to modify your circuit.**

If U6 the on board power supervisor IC is installed it will not work with the MPLAB ICD.

Please read the manual that was supplied with MPLAB ICD or PIC-ICD to understand the limitations.

When using PIC BASIC Pro with either the MPLAB ICD or the PIC-ICD be sure to include the ICDDEFS.BAS file in your program:

```
Include "ICDDEFS.BAS"
```

When developing programs using Microchip's assembler MPASM please follow the information and limitations as outlined in the PIC-ICD or MBLAB ICD manuals for proper operation with assembler generated code and the SBC PIC16F87X / DT106 / SBC106 products.

10. Software related information

You should always refer to the proper Microchip data sheet to obtain all the information about the device's register layout and on board modules. Microchip also publishes application notes which may help you in understanding on how to use PICmicro devices.

The serial I/O is located on RC6 - transmit data and RC7 - receive data. These are the pins used with the hardware's USART. On PIC16F872 based boards there is no USART but you can use software based UART routines similar to other PIC devices (such as the PIC16F84). Of course you can use software UART even on devices with the hardware USART.

For RS485 applications the data direction line is controlled by RB0. The board supports half duplex two wire only. The RS485 data lines are the same as above.

PIC Basic Pro software based serial I/O work fine, just make sure you specify the correct port pins. In addition PIC Basic Pro supports hardware serial I/O on all except the PIC16F872 parts. When using standard PIC Basic (not the PRO version) only software base serial I/O is supported and only on Port B. You can of course access the hardware registers of the USART directly in PIC Basic or write an assembly routine and call it from PIC Basic.

The I^2C signals are located at Port C , RC3 is SCL (clock) and RC4 is SDA (data). All the PIC16F87X family devices feature a hardware MSSP module that supports I^2C communications using hardware. Pic Basic and Pic Basic Pro feature a software I^2C approach and do not use the MSSP. You can access the MSSP registers directly from PIC Basic or PIC Basic Pro and write your own routines to access the I^2C bus. If you decide to use the software based routines in PIC Basic and Pro , make sure you specify the correct port and pin. In Pic Basic you modify an include file, in Pic Basic Pro it is specified as part of the command.

The LCD header is directly accessible from PIC Basic Pro's LCD routines but you must specify the correct DEFINEs in your program. Example PIC BASIC PRO code snippet below:

```
DEFINE OSC 4            '4 Mhz oscillator

'Define ports on SBC PIC16F87X , DT106 or SBC 106:
DEFINE LCD_DREG PORTB
DEFINE LCD_DBIT 4
DEFINE LCD_RSREG PORTB
DEFINE LCD_RSBIT 1
DEFINE LCD_EREG PORTB
DEFINE LCD_EBIT 3
DEFINE LCD_BITS 4
DEFINE LCD_LINES 2          'for two line displays
DEFINE LCD_RWREG PORTB
DEFINE LCD_RWBIT 2
DEFINE LCD_COMMANDUS 2000
DEFINE LCD_DATAUS 50

pause 200       'wait about 200 milliseconds for LCD to initialize internally

Lcdout $fe,1,$fe,2, "TEST PROGRAM"
```

PIC Basic (not the Pro version) does not have LCD functions built in, but you can still access the LCD from a PIC Basic program:

```
'PIC Basic (for non Pro version) LCD 2 line Display Test

Symbol PortLCD = 6
Symbol TrisB = $86
Symbol Lcde = 3
Symbol Rs = 1
Symbol Rw = 2

poke trisb,0
low lcde
low rw
gosub lcdinit
gosub lcdclr
gosub lcdhome

For B4 = 0 to 17 'send string to lcd one letter at a time
        Lookup B4,("VIKON TECHNOLOGIES"),B2  'get letter from string
        Gosub lcddata   'send letter in B2 to lcd
Next B4

b2=$c0 'second line
gosub lcdcom

For B4 = 0 to 19 'send string to lcd one letter at a time
        Lookup B4,("DISPLAY TEST PROGRAM"),B2  'get letter from string
        Gosub lcddata   'send letter in B2 to lcd
Next B4

End
'=============================================================
'SUBS

' subroutine to initialize the lcd - uses B2 and B3

lcdinit:
        Pause 15      'wait at least 15ms
        Poke PortLCD,$30    ' 3 shifted up initialize the lcd
        gosub lcdtog       'toggle the lcd enable line
        Pause 5         'wait at least 4.1ms
        Poke PortLCD,$30  'initialize the lcd
        gosub lcdtog       'toggle the lcd enable line
        Pause 1         'wait at least 100us
        Poke PortLCD,$30    'initialize the lcd
        gosub lcdtog       'toggle the lcd enable line
        Pause 1         'wait once more
        Poke PortLCD,$20   'put lcd into 4 bit mode
        gosub lcdtog       'toggle the lcd enable line
        B2 = $28        '4 bit mode, 2 lines, 5x7 font
        Gosub lcdcom    'send B2 to lcd
        B2 = $0c        'lcd display on, no cursor, no blink
        Gosub lcdcom    'send B2 to lcd
        B2 = $06        'lcd entry mode set, increment, no shift
        Goto lcdcom     'exit through send lcd command
```

```
' subroutine to clear the lcd screen - uses B2 and B3
lcdclr:   B2 = 1          'set B2 to clear command and fall through to lcdcom
          goto lcdcomp:

' return cursor home
lcdhome: B2 = 2

lcdcomp:
          gosub lcdcom
          pause 1
return

'COMMAND
' subroutine to send a command to the lcd - uses B2 and B3

lcdcom:
          B3 = B2 & $f0   'isolate top 4 bits
          Poke PortLCD,B3   'send top 4 bits to lcd
          gosub lcdtog      'toggle the lcd enable line
          B3 = B2 * 16    'shift bits up to B4-B7
          B3 = B3 & $f0
          Poke PortLCD,B3   'send  4 bits to lcd
          gosub lcdtog      'toggle the lcd enable line
          Pause 1        'wait 1ms for write to complete
          Return

' subroutine to send data to the lcd - uses B2 and B3

lcddata:
          low rw
          B3 = B2 & $f0  'isolate top 4 bits
          B3 = B3 + 2   'add in register select to indicate data
          Poke PortLCD,B3   'send upper 4 bits to lcd
          gosub lcdtog      'toggle the lcd enable line
          B3 = B2 * 16     'shift bits up to B4-B7
          B3 = B3 & $f0
          B3 = B3 + 2       'add in register select to indicate data
          Poke PortLCD,B3   'send lower 4 bits to lcd
          gosub lcdtog      'toggle the lcd enable line
          Pause 1        'wait 1ms for write to complete
          Return

' subroutine to toggle the lcd enable line

lcdtog:
          High Lcde       'set lcd enable line high
          Low Lcde        'set lcd enable line low
          Return
```

11.0 Additional Information:

11.1 Issues with the Epic Plus Programmer

The EPIC Plus programmer is compatible with the SBCPIC16F87X SBC with the proper cable. If you purchased a bundle from Vikon Technologies with the EPIC Plus programmer and a SBCPIC16F87X you are supplied this cable. The cable attaches the EPIC Plus programming header to the J4 programming header on the SBC board. Note this is not a straight through cable and requires a custom cable.

The EPIC Plus should only be attached when both its power and the SBC boards power is off. When the EPIC Plus is attached the SBC may not reset and run, you must remove the programming cable to free up the reset line. Also note that RB6 and RB7 on the PIC are the programming pins, if these bus signals have a low impedance source on them during programming you will get programming errors. These pins are brought out to the SimmStick bus and are used by the LCD. Both of which are a potential source of interference with programming. If you are not using the bi-directional bus capability of the LCD display, you should wire its R/W line so that the LCD bus will always in the write mode and not read, this helps in some situations. You can also try isolation resistors on RB6 and RB7 such that they are in series with your circuitry (if this does not affect your circuit performance or function). The programming line would connect directly to the pins on the PIC. Try values from 22K to 33K ohms. If all else fails you will need to isolate RB6 and RB7.

Vikon Technologies offers an optional switched cable to help isolate RB7, RB6 and Reset lines during programming (contact Vikon or your dealer for more information and pricing). This requires modifying the board by cutting the circuit traces beneath J4 on pins 4-3, 6-5, and 8-7. When the switched cable is not in use, jumpers need to be placed on J4 pins 4-3, 6-5 and 8-7 for proper operation.

11.2 Loading and Isolation Problems with programming:

Using Slot one of the DT001 board:

The SBCPIC16F87X / DT106 / SBC106 will program in much the same manner as the DT101 using an 84, however there are some conflicts.

As you have only 30 pins on the Simm Bus, some signals will be missing between the slot 1 DT106, and slots 2 to 7.

These would need to be manually jumpered from perhaps the J1 header to a second DT106 board, if the full signals need to be transferred between SimmSticks.

As the board has provision for peripherals on RB6 and RB7, which are programming pins, you would either need to remove these devices (LCD and JI I/O), or use the programming header principle.

For instance, you could put the DT106 into Slot 2, install the programming header between the DT001 and DT106 board, remember to cut the correct tracks on the solder side of the DT106 board, and you have full isolation of the LCD and J1 header.

11.2 Using a stand alone board with a programming header:

You install the header cable, cut the tracks so you have full isolation. You can then connect a 40

wire header cable (on the solder side of the board) off to your target system. This can be any 87x target board. You just pop the 40 pin header into your board. Depending on VCC requirements, you may choose to use JP4 to isolate or extend the power to the target board.

28 pin Skinny Dip:
OK, there is no way you are going to get this matching up via a 40 pin header system, but it's not that hard to do.
1) Crimp a special cable.
2) Use a small proto board to give you a 40 pin input to a 28 pin output with male header pins, and 28 wires. and use crimp connectors in and out.