



# **DIAMOND SYSTEMS CORPORATION**

## **User Manual**

Pyxis-MM

Carrier Module for GPS, Land Line Modem, and Wireless Modem

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## 1. DESCRIPTION

The product is a PC/104 carrier board that can be used to install a GPS module, a wireless modem, and a land line modem. The GPS can be used simultaneously with either modem. Either but not both modems can be used at one time. The board contains serial port circuitry connected to the PC/104 bus to provide communication links with the add-on modules.

### Serial ports

- ◆ 2 RS-232 serial ports based on 16C2850 dual UART
- ◆ Internal TTL-only signals, no transceivers for direct communication to on board UART to system bus.
- ◆ Jumper-selected addresses and interrupts
- ◆ Interrupt sharing capability
- ◆ Uses ISP Xilinx 9572 CPLD
- ◆ Serial port 1 is fixed to GPS primary channel
- ◆ Serial port 2 can be switched between modems and GPS auxiliary channel
- ◆ Serial port connections for land line and wireless modems are in parallel since only one is used at a time.
- ◆ Serial port connections may also be routed from auxiliary serial port connector on Prometheus or separate 20-pin header compatible with Emerald-MM-XT; these signals require transceivers to convert to TTL levels on the board. It must be possible to disable the transceivers when they are not in use.

### GPS

- ◆ Mounting holes and connector for Trimble Navigation Lassen SK2 module
- ◆ Dual TTL serial interface
- ◆ Primary port connects to port 1 of serial port circuit
- ◆ Auxiliary port can be connected to port 2 of serial port circuit
- ◆ Antenna connector protrudes beyond right edge of board
- ◆ Unit mounted on top side of board

### Wireless modem

- ◆ Mounting holes and connector for Cirronet WIT2410M module
- ◆ Single TTL serial interface connects to port 2 of serial port circuit
- ◆ "Configure" input wired to ??? (CPLD register bit or DTR)
- ◆ "Sleep" input wired to ??? (CPLD register bit?)
- ◆ Antenna connector protrudes beyond right edge of board
- ◆ Unit mounts on bottom side of board

### Land line modem

- ◆ Mounting holes and connector for Multitech MT5634SMI-ENI (-ITP) module
- ◆ Single TTL serial interface connects to port 2 of serial port circuit
- ◆ RJ-11 right-angle connector is mounted at right edge of board and fits within PC/104 height limit
- ◆ Unit mounts on top side of board

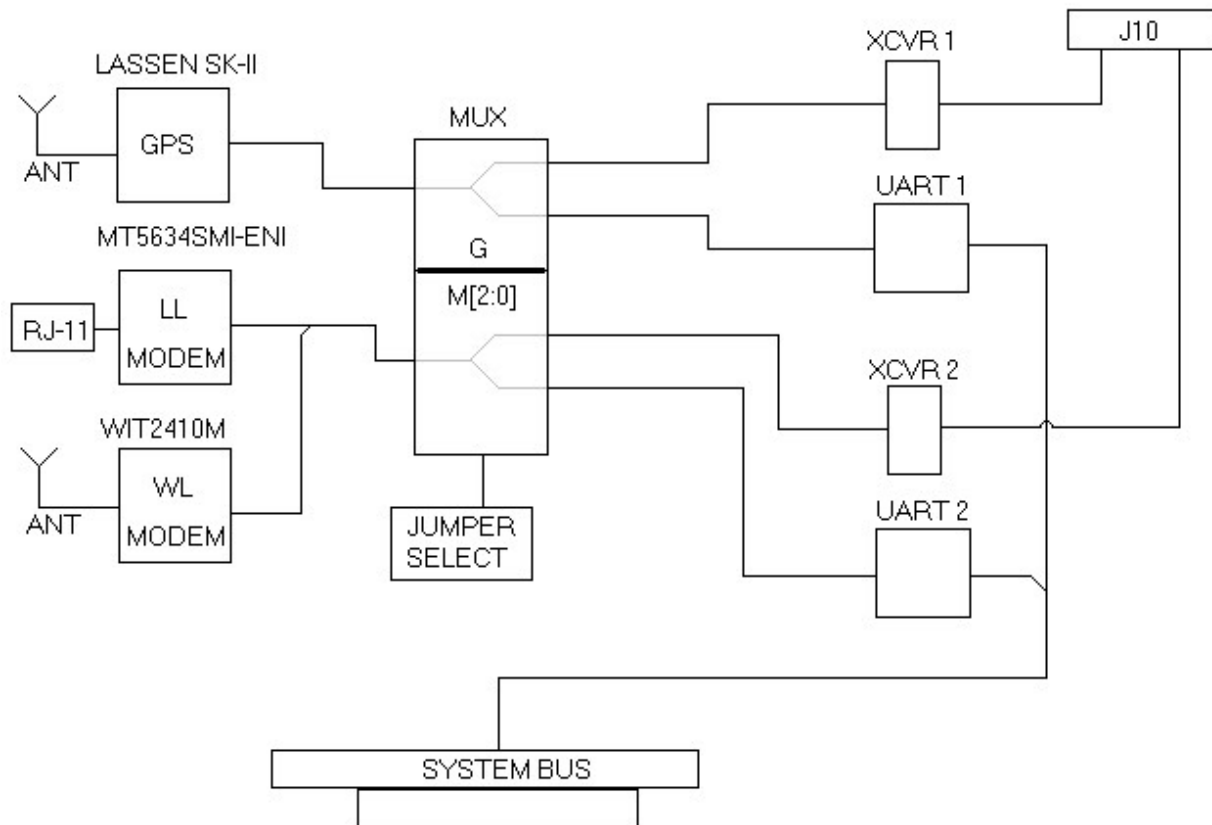
### System Features

- ◆ +5V power from PC/104 bus or from auxiliary connector for standalone operation (any additional voltages needed are generated on board)
- ◆ Extended temperature range (-40 to +85°C) compatible (based on module specs)
- ◆ 3.550" x 3.775" size , PC/104 compliant
- ◆ Driver software is not supplied by vendor

## 2. THEORY OF OPERATION

Pyxis-MM provides a connection for the 3 OEM modules listed to the PC-104 bus via an on board 16C2850 dual UART or to an external RS-232 DCE style connector to interface with standard DTE ports. A fairly simple switch is designed into a XC9572 CPLD which is controlled by hardware jumpers to select whether the OEM modules TTL level RS-232 signals are routed to the PC-104 bus through the UART or to a RS-232 transceiver and external connector. The OEM modules can be bypassed for testing or to create 2 extra serial ports with some limitations. By writing to BASE+0 and setting either PRT1\_LB or PRT2\_LB you can route the transceiver signals to the UART and bypass the OEM modules. The limitations are: Port 1 only connects TX, RX, CTS, and RTS and port 2 only connects TX, RX, CTS, RTS, DTR, and DSR. This function was mainly designed in for testing by installing a loop back connection onto J10, but this mode can also be used if 1 or 2 extra COM PORTS are needed. This function can be utilized at any time by setting the register bits to monitor and control devices external to the Pyxis-MM board then switched back to control the OEM modules installed onto the Pyxis-MM. To use Pyxis as stand alone (not in a PC-104 system) external power must be supplied. There are 2 ways this can be done either a stable +5V can be applied at J11 or +7V to +24V can be applied to the external input pins on J12. While in stand-alone mode the on board registers and UART ports are not accessible so the signals will be routed based solely on the jumpers on J6 and the selections are limited to routing to the transceivers only.

## 3. BLOCK DIAGRAM



## 4. PYXIS-MM PRODUCT CONFIGURATIONS

The configurations listed below are the only valid combinations of OEM modules. **Never connect a Multitech and Cirronet modem in the same Pyxis-MM board because the signal lines are connected together and can possibly damage both modems.**

### **GPS only**

- 1 ea. Pyxis-MM PC-104 multiple module serial interface board. Diamond System PN Pyxis-MM
- 1 ea. Lassen SKII 8 channel GPS module. Trimble PN 38116-00
- 1 ea. Trimble magnetic mount 26 dB GPS antenna. PN 34048-00
- 1 ea. Hardware Kit. Diamond Systems PN 680009

### **Wireless modem only**

- 1 ea. Pyxis-MM PC-104 multiple module serial interface board. Diamond System PN Pyxis-MM
- 1 ea. WIT2410M 2.4GHz spread spectrum wireless modem. Cirronet PN WIT2410M
- 1 ea. Right angle 4" rubber whip antenna. Cirronet PN RWA249S
- 1 ea. 4" RF cable w/ reverse SMA connector. Cirronet PN CBLRF4R
- 1 ea. Hardware Kit. Diamond Systems PN 680009

### **Landline modem only**

- 1 ea. Pyxis-MM PC-104 multiple module serial interface board. Diamond System PN Pyxis-MM
- 1 ea. MT5634SMI-ENI land line modem module, Multitech PN MT5634SMI-ENI
- 1 ea. Hardware Kit. Diamond Systems PN 680009

### **GPS and wireless modem**

- 1 ea. Pyxis-MM PC-104 multiple module serial interface board. Diamond System PN Pyxis-MM
- 1 ea. Lassen SKII 8 channel GPS module. Trimble PN 38116-00
- 1 ea. Trimble magnetic mount 26 dB GPS antenna. PN 34048-00
- 1 ea. WIT2410M 2.4GHz spread spectrum wireless modem. Cirronet PN WIT2410M
- 1 ea. Right angle 4" rubber whip antenna. Cirronet PN RWA249S
- 1 ea. 4" RF cable w/ reverse SMA connector. Cirronet PN CBLRF4R
- 1 ea. Hardware Kit. Diamond Systems PN 680009

### **GPS and landline modem**

- 1 ea. Pyxis PC-104 multiple module serial interface board. Diamond System PN Pyxis-MM
- 1 ea. Lassen SKII 8 channel GPS module. Trimble PN 38116-00
- 1 ea. Trimble magnetic mount 26 dB GPS antenna. PN 34048-00
- 1 ea. MT5634SMI-ENI land line modem module, Multitech PN MT5634SMI-ENI
- 1 ea. Hardware Kit. Diamond Systems PN 680009

## **Hardware Kit (DSC# 680009)**

681041	Screw, 4-40 x 1/4", Pan Hd, PH, Zn	8
681201	Screw, #2x56x5/8, Flat, Ph, Zn	2
682021	Nut, #2-56, Zinc	2
683022	Washer, #2, Locking	2
683044	Washer, #4 Locking	8
684244	Standoff, #4-40x.375"x.187" FF	4
684501	Standoff, Locking, Nylon .25"	1

\*For stand alone operation

## **5. I/O HEADER PINOUTS**

### **GPS connector U1**

VCC	2	1	TXD 2
BATT	4	3	TXD 1
1 PPS	6	5	RXD 1
GND	8	7	RXD 2

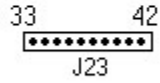
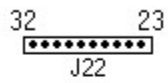
See Lassen SK2 product specification for more information.

### **Wireless modem connector U2**

GND	1	2	TXD
RXD	3	4	~CFG
~RTS	5	6	SLEEP
~DCD	7	8	~CTS
RSV	9	10	~RESET
RSV	11	12	RSV
RSV	13	14	RSV
RSV	15	16	VCC

See Cirronet WIT2410M product specification for more information.

## Land line modem connectors



1	TIP
2	RING
24	~RESET
26	DGND
29	DCD LED
30	RX LED
31	DTR LED
32	TX LED
33	~RTS
34	~RXD
35	~TXD
36	~RI
37	~DSR
38	~CTS
39	~DCD
40	~DTR
41	DGND
61	VCC
63	AGND
64	SPKR
others	NC

See Multitech MT5634SMI-ENI product specification for more information.

## Serial Port Headers

**J5 6-pin header (1x6 right-angle pin header) for connection to Prometheus**

1	TX1
2	RX1
3	GND
4	TX2
5	RX2
6	GND

**J10 20-pin header for DCE connection to EMM-XT or C-DB9F-2**

DCD 1	1	2	DTR 1
TXD 1	3	4	CTS 1
RXD 1	5	6	RTS 1
DSR 1	7	8	RI 1
GND	9	10	1-PPS
DCD 2	11	12	DTR 2
TXD 2	13	14	CTS 2
RXD 2	15	16	RTS 2
DSR 2	17	18	RI 2
GND	19	20	1-PPS

## Power Headers

**J12 5-pin header (1x5 pin header) for connection to external power and battery backup**

1	EXTERNAL POWER IN (+7 to +24VDC)
2	GND
3	1-PPS
4	GPS BATTERY BACKUP (+3.2 to +5.25VDC)
5	DOUT
6	GPS BATTERY BACKUP (+3.2 to +5.25VDC)
7	GND

**J11 2-pin header (1x2 right angle screw terminal pin header) for connection to external 5 VDC power.**

1	GND
2	EXTERNAL POWER IN (+5VDC +/- 5%)



## 6. JUMPER SETTINGS

### J4 3-pin landline modem power input select (1x3 pin header)

1	+5VDC
2	POWER In to LL Modem
3	+3.3VDC

Jumper across pins 1 and 2 for +5VDC commercial grade modem module.

Jumper across pins 2 and 3 for +3.3VDC industrial grade modem module.

**CAUTION:** Always check the Multitech modem modules data sheet prior to setting this jumper as the wrong input voltage can damage the modem!

### J6 6 pin base address selection (2x3 pin header)

A	B	C	Port 1	Port 2	Interrupt Status
IN	IN	IN	3F8	2F8	220
<b>*OUT</b>	<b>IN</b>	<b>IN</b>	<b>3E8</b>	<b>2E8</b>	<b>220</b>
IN	OUT	IN	380	388	224
OUT	OUT	IN	240	248	224
IN	IN	OUT	100	108	240
OUT	IN	OUT	120	128	244
IN	OUT	OUT	140	148	248
OUT	OUT	OUT	160	168	24C

### J8 22 pin Serial port 1 IRQ selection (2x11 pin header)

### J9 22 pin Serial port 2 IRQ selection (2x11 pin header)

Allows IRQ selection for both serial ports. Set a 2mm jumper vertically on the desired IRQ as noted on the silkscreen of the Pyxis board. If sharing the same IRQ for both serial ports only one of the 'R' jumpers needs to be installed. The 'R' jumper will add a 1K ohm resistor from the IRQ line to ground which allows for tri-stated (inactive) IRQ's to be held low. If both 'R' jumpers are installed and the IRQ selected is the same for both serial ports then the resistors will be in parallel creating a 500 ohm resistance and will load the IRQ line too much causing it not to function.

**J13 6 pin Serial port direction selection (2x3 pin header)**

<b>G</b>	<b>PORT1</b>
<b>IN</b>	<b>*GPS MAIN PORT TO PYXIS UART 1</b>
<b>OUT</b>	GPS MAIN PORT TO PYXIS XCVR 1

<b>M2</b>	<b>M1</b>	<b>M0</b>	<b>PORT2</b>
<b>OUT</b>	<b>IN</b>	<b>OU T</b>	GPS AUX PORT TO PYXIS UART 2
<b>IN</b>	<b>IN</b>	<b>OU T</b>	GPS AUX PORT TO PYXIS XCVR 2
<b>IN</b>	<b>OU T</b>	<b>IN</b>	<b>*MODEM TO PYXIS UART 2</b>
<b>IN</b>	<b>OU T</b>	<b>OU T</b>	MODEM TO PYXIS XCVR 2
<b>OUT</b>	<b>IN</b>	<b>IN</b>	GPS AUX PORT TO MODEM

<b>CK</b>	
<b>IN</b>	<b>*STANDARD BAUD RATE (up to 115K baud)</b>
<b>OUT</b>	STANDARD BAUD RATE X 4 (up to 460K baud)

## 7. REGISTER MAP

Note: These registers can only be accessed if the Pyxis-MM is on the PC-104 bus.

### Base + 0      Read      INTERRUPT STATUS

Bit No.	7	6	5	4	3	2	1	0
Name	X	X	X	X	PRT2_LB	PRT1_LB	INTB	INTA

#### Definitions:

INTB      Port 2 has a pending IRQ.

INTA      Port 1 has a pending IRQ.

Note: Used when both ports are sharing the same IRQ line. The interrupt service routine must be able to read this register to determine which port needs servicing.

### Base + 0      Write      TRANCEIVER/UART TEST

Bit No.	7	6	5	4	3	2	1	0
Name	X	X	X	X	PRT2_LB	PRT1_LB	X	X

#### Definitions:

PRT2\_LB      Connects RS-232 signals from transceiver 2 to UART 2. Mainly for testing the boards functions. Only TX, RX, RTS, CTS, DTR, and DSR are connected.

PRT1\_LB      Connects RS-232 signals from transceiver 1 to UART 1. Mainly for testing the boards functions. Only TX, RX, RTS, and CTS are connected.

### Base + 1      Read/Write      WIRELESS MODEM CONTROL

Bit No.	7	6	5	4	3	2	1	0
Name	X	X	X	X	0	0	DOUT	SLEEP

#### Definitions:

DOUT      One bit digital out register.

SLEEP      Set this bit to put wireless modem into sleep mode for lower power consumption.

**Base + 2      Read      SWITCH CONFIG STATUS**

Bit No.	7	6	5	4	3	2	1	0
Name	X	X	X	X	G	M2	M1	M0

**Definitions:**

- G      Reads current jumper setting.
- M2      Same.
- M1      Same.
- M0      Same.

## **8. OEM MODULES**

### **Trimble's Lassen SKII**

**Trimble's Lassen™ SK II** board is a miniature GPS receiver module with less than half-watt power consumption. Designed specifically for embedded solutions for navigation, tracking, data collection, and timing applications, the Lassen SK II module is approximately two-thirds the width of a business card and is fully compatible with first generation Lassen SK8 applications. Using Trimble's proprietary ASIC technology, the Lassen SK II board incorporates a tighter integration of the radio frequency (RF), which results in reducing power consumption to less than half a watt.

power consumption less than half a watt

reliable performance from -40° to 85° C

TSIP and TAIP protocols

Differential GPS (DGPS) ready for highly accurate applications

### **Cirronet's WIT2410M**

The WIT2410 is a 2.4 GHz frequency hopping spread spectrum OEM module with immunity to both jamming and multipath fading. Although it is smaller than a business card, its 100mW of transmit power provides for extraordinary range. The WIT2410 has been certified by both the FCC and ETSI specifications for license-free operation worldwide. The small foot print with power saving features combined with its high data rate make this an excellent fit for an unlimited amount of embedded applications. Combined with the 4" rubber whip antenna the WIT2410 can achieve a range of 450' to 900' indoors and up to 3000' outdoors. Other gain antennas available from Cirronet can achieve > 20 miles range.

Combining seamless roaming capability, a low operating voltage and low power consumption, the Cirronet™ WIT2410 represents the next generation of wireless OEM transceiver modules. Smaller than a business card and just 9mm thick, the WIT2410 utilizes 2.4 GHz frequency hopping spread spectrum technology providing immunity to both jamming and multipath fading. Certified to both North American and European requirements, the WIT2410 can be used license-free worldwide.

**Mobile.** Used with the companion SNAP2410 access point, the WIT2410 provides seamless roaming. With 16 million factory-set addresses available, the 2410 can move from access point to access point without the need for re-synchronizing. This means the application can be in constant communication with each 2410, even when the user moves from one access point to another.

Measuring just 80mm x 47mm x 9mm and weighing 43 grams, the WIT2410 can be integrated into a portable or handheld device with little impact on the size and weight. The 3.3 volt operating voltage and 12 mA standby current consumption make the 2410 well suited for battery operation.

**Versatile.** All of the module parameters are configurable under software control. Even transmit power can be selected through a straightforward command set. Point-to-point and point-to-multipoint modes are supported using a dynamically assigned TDMA scheme at up to 230.4Kbps. Non-standard rates are supported as well.

**Reliable.** The WIT2410 provides both reliable communication and reliable operation. With Frequency Hopping Spread Spectrum technology, the WIT2410 provides immunity to jamming as well as immunity to multipath fading. Using Automatic Retransmit Request (ARQ) in addition to a 3K buffer, transparent error-free communication is automatic. The built-in data scrambling adds a measure of security. Reliable operation is assured through our stringent QA processes. All WIT2410s go through a full 24-hour burn-in. And the WIT2410 is built in a ISO 9000 certified facility. Another reason Cirronet™ is the choice of hundreds of designers.

**Simple.** Simple to use and simple to integrate. Although the WIT2410 offers great flexibility, the factory default settings work for many applications. For those other applications, software control makes changing settings simple. The WIT2410, with its small size and low power consumption, is simple to integrate into your product. The RS-232 style interface with standard CMOS signal levels makes the electronic integration easy. Since the WIT2410 is FCC certified and CE marked, your 2410-based product does not have to repeat the FCC or EU type approvals.

## **Multitech's Modem Modules**

The Multi-Tech ModemModule creates communication-ready devices by integrating data/fax functionality into a single product design. The ModemModule is a space efficient embedded modem that provides V.90/56K or V.34/33.6K communication to any device without adding development time and costs for new products. It also complies with telecom requirements globally and is approved for worldwide shipments.

### **ModemModule Features**

- Integrates the controller, data pump and data access arrangement (DAA) in one module
- Space efficient (1" x 2.5")
- Typical power consumption is 260mA (1.3W @ 5V DC) with a maximum of 420mA (2.1W @ 5.25V DC)
- V.90/56K or V.34/33.6K data speeds
- V.17/14.4K fax
- Industry-standard AT-style modem commands
- DTMF detection and distinctive ring
- Industry-standard error correction and data compression
- TTL serial or parallel interface and asynchronous protocol support

- LED driver outputs for visual monitoring of Carrier Detect, Transmit Data, Receive Data and DTR signals
- Low cost data only module available
- Three-number storage for automatic dialing capabilities and non-volatile memory (NoVRAM) to store user profiles
- Full duplex over dial-up lines
- TIA-602 AT command compatible
- Auto-dial, redial and auto-answer
- 60 character command line buffering
- Global approvals with a single module design
- Flash memory to update firmware with the latest enhancements

### **Commercial-Temperature Serial Modules**

56K Data/Fax Modem Module

MT5634SMI-AUNZ

MT5634SMI-ENI

### **Medical-Device Models**

56K Data/Fax Modem Module

MT5634SMI-AUNZ-HV

MT5634SMI-ENI-HV

### **Industrial-Temperature Models**

56K Data/Fax Modem Module

MT5634SMI-AUNZ-ITP

MT5634SMI-ENI-ITP

### **Data-Only Models**

56K Data-Only Modem Module

MT5600SMI

33.6K Data-Only Modem Module

MT3400SMI

## 9. SPECIFICATIONS

### General

Power supply	+5VDC +/- 10%
Current consumption	198mA typical w/o OEM modules
(measured)	268mA Idle w/WIT2410M
	199mA Idle w/ WIT2410M in sleep mode
	397mA Idle w/ MT5634SMI-ENI
	296mA Idle w/ Lassen SK-II

## 10. OEM SOFTWARE INCLUDED IN DSC CD-ROM

### Cirronet

Setup.exe Installs Cirronets WinCOM24 software. It is basically just a serial terminal for talking with the modems.

### Multitech

5634smi.exe Self extracting INF file for Landline modem. Add new hardware and select "have disk" then point to this INF file.

flashpr.exe Program for upgrading the flash on the modem. The latest version should be downloaded from Multitechs website.

glwiz109.exe Installs Multitechs Global Wizard software. This configures country specific homologation parameters for the modem.

### Trimble

tk768.exe Self extracting file containing a lot of utilities and source code from Trimble for the Lassen SKII.