MSI-P604 Trimble Condor C2626 GPS & Digital I/O Card User Manual

(Rev. 0)

PC/104 Embedded Industrial Analog I/O Series

Microcomputer Systems, Inc.
1814 Ryder Drive ¨ Baton Rouge, LA 70808
Ph (225) 769-2154 ¨ Fax (225) 769-2155
Email: staff@microcomputersystems.com
http://www.microcomputersystems.com

CONTENTS

I. INTRODUCTION

The MSI-P604 is a low cost, high performance global positioning system which uses the Trimble Condor C2626 module. The module provides the popular protocol NMEA 0183 and is the protocol-only alternative to the Trimble Lassen iQ module. The C2626 is supplied in the same mechanical package as the Lassen iQ, but features greatly improved sensitivity and tracking abilities. The card provides a serial port for processing the GPS data at a default BAUD rate of 9600. Software selectable NMEA protocols are GGA, GSA, GSV, RMC, CHN, GLL, VTG and ZDA, where the first four are the default values. Baud rates are selectable from 2400 to 115,200.

The serial port is a standard IBM PC compatible UART jumper selectable for COM1 thru COM4 with an optional selectable 16-bit offset address.

A time mark of 1 PPS is available as an interrupt or as input into modem status line DCD of the UART for synchronizing events. The UART interrupt is also provided for allowing interrupt processing of GPS data. Interrupts are jumper selectable for IRQ3 thru IRQ7 and IRQ9, as described in the next section.

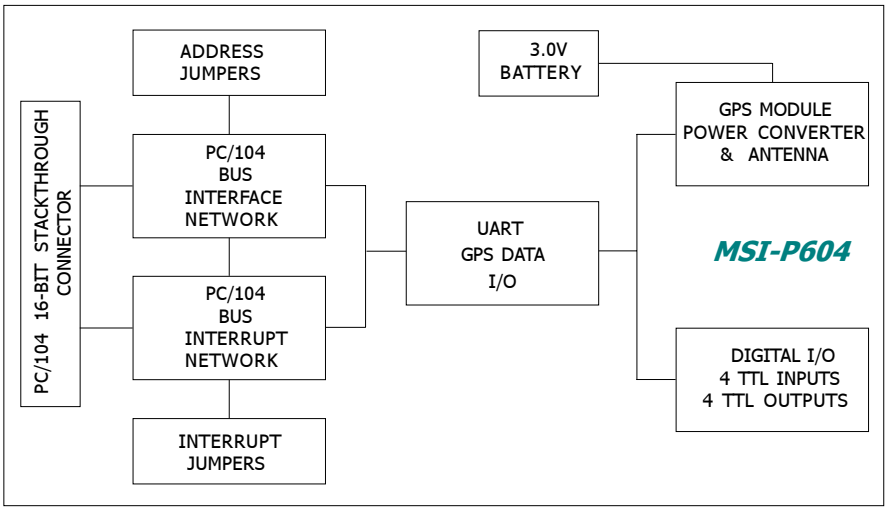

Figure 1. Block Diagram of the MSI-P604.

Four TTL level digital inputs are provided by status lines CTS DSR, RI and DCD of the UART. The DCD input is jumper selectable and is used as either a digital input or as status for the UART interrupt. Four TTL level outputs are provided by OUT1, OUT2, RTS and DTR of the UART.

The card is supplied with an active antenna having a 5 meter (16.5 ft.) cable and a spacer kit. A sample test program is supplied that illustrates programming of the UART for the various protocols and data transfer rates. Operates from -40° to 85° C.

II. HARDWARE DESCRIPTION

A. Card Configuration

The MSI-P602 card is a CMOS design using through-hole and surface-mounted devices. The card configuration is shown in Figure 2 and a circuit diagram of the network is given in Appendix B. The card contains the UART (U5) that communicates with the Condor C2626 GPS module. Connector J1 provides for the digital I/O connections and J2 is the mating connector for antenna of the GPS module.

Jumper block JP2 is used for address selection (Pins 1 thru 16) and JP1 for interrupt configuration (Pins 1 thru 12), as described below.

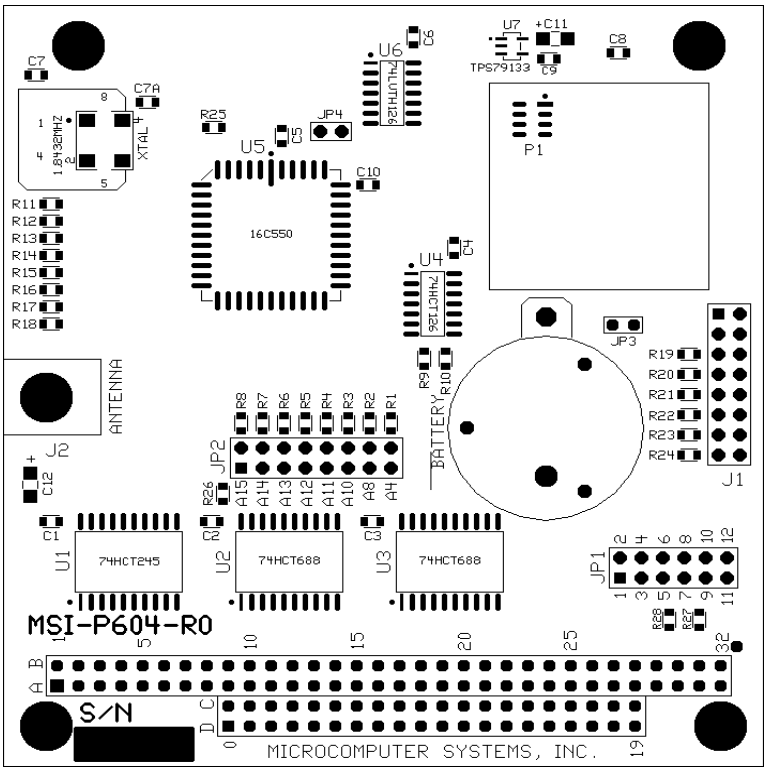

Figure 2. MSI-P604 card outline.

B. Card Addressing

The card address is set by installing appropriate jumper pairs on JP2, pins 1 thru 16, as shown in Fig. 3.

Addresses A15 thru A10 (JP2-1 thru 11) are jumper selectable for defining the *base address* of the card from 0000H to FC00H on integral 10H boundaries, where H denotes a hexadecimal number.

IMPORTANT: For addresses A15 thru A10 (JP2-1 thru 11), an installed jumper for a given address bit sets the bit to 1 (true) and an uninstalled jumper sets the bit equal to 0 (false).

Examples for setting the base address are as follow:

Example 1. Set a base address of 0000H.

No jumpers are installed for JP2-1 thru 11.

Example 2. Set a base address of 3800H.

Intall jumpers JP2-5, JP2-7 and JP2-9.

Jumpers JP2-13 and JP2-15 are used to select the serial port address for the UART. The card addresses for these selections are given in Table I. It should be noted that for a base address of zero, the addresses of the UARTs are the standard serial port addresses COM1 thru COM4 of the IBM PC.

IMPORTANT: For addresses A4 and A8 (JP2-13 and JP2-15), an uninstalled jumper for a given address bit sets the bit to 1 (true) and an installed jumper sets the bit equal to 0 (false).

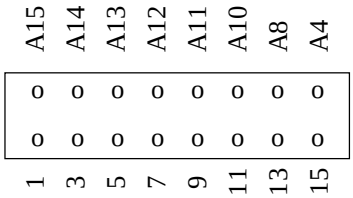

Figure 3. Jumper block JP2 configuration.

CAUTION: Make sure that the addresses you select for the MSI-P604 are not in conflict with the serial ports of your CPU card. For example, if your CPU uses COM1 and/or COM2, install JP2-13 and JP2-15 so that COM3 or COM4 is selected for the serial port. If your CPU contains COM1 thru COM4 ports and you are not using one of these, then disable the port of the CPU not being used and select this port for the MSI-P604 as shown in Table 1. If this is not permissible, then you will have to select a base address other than 0 by using jumpers for JP2-1 thru JP2-11. UART addresses in this case are given in Table 1.

Table 1. UART Addresses for JP2-13 & JP2-15 Selection.

Jumper JP2-13	Jumper JP2-15	UART (U5)
Uninstalled	Uninstalled	base address + COM1**
Installed	Uninstalled	base address + COM2
Uninstalled	Installed	base address + COM3
Installed	Installed	base address + COM4

** COM1 = 3F8H
COM2 = 2F8H
COM3 = 3E8H
COM4 = 2E8H

where H denotes hexadecimal notational.

C. Interrupt Connections

Interrupt connections are implemented by jumpers JP1-1 thru JP1-12. The steps in the procedure are as follows.

1) Pins JP1-10 and JP1-12 are connected to the interrupt request signal of the UART (U5), as shown in Fig. 4. JP1-12 can be jumpered to a desired interrupt, IRQ4 thru IRQ9 of JP1, using a wire-wrap type connection. A 1K Ohm resistor is available for pulling down the interrupt connection by installing a jumper from JP1-8 to JP1-10.

2) Pins JP1-2 and JP1-4 are connected to the 1 PULSE/SEC output of the GPS module for use in synchronizing GPS data,

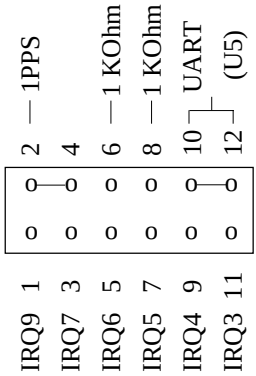

Figure 4. Interrupt jumper block JP1 configuration.

as shown in Fig. 4. JP1-2 can be jumpered to a desired interrupt, IRQ4 thru IRQ9 of JP1, using a wire-wrap type connection. A 1K Ohm resistor is available for pulling down this interrupt connection by installing a jumper from JP1-4 to JP1-6.

D. Digital I/O Registers and Connections.

Four digital TTL inputs and four digital TTL outputs are provided by the modem status and modem control registers of UART U5. These I/O are connected to the card via J1 using a 16-pin flat cable connector. Register designations and connector J1 pin assignments are given in Table 2. The inputs and outputs on connector J1 are the inverted values of those read or written in the modem status and control registers. For example, a 1 written to OUT1 of U4 results in a 0 at J1-1 (OUT1_BUFFERED). Similarly, a 1 applied to J1-9 (IN1) results in a 0 being read in CTS of U4.

Table 2. Digital I/O UART Register Designations and J1 Pin Assignments.

Name	I/O	UART Register	J1 Pin *
$\overline{\text{OUT1\_BUFFERED}}$	Output	OUT1	1
$\overline{\text{OUT2\_BUFFERED}}$	Output	OUT2	3
$\overline{\text{OUT3}}$	Output	RTS	5
$\overline{\text{OUT4}}$	Output	DTR	7
$\overline{\text{IN1}}$	Input	CTS	9
$\overline{\text{IN2}}$	Input	DSR	11
$\overline{\text{IN3}}$	Input	RI	13
$\overline{\text{IN4}}$ **	Input	DCD	15

* J1 even numbered pins 2 thru 16 are ground.
** Jumper J4 is not installed.

E. 3.0V Battery

A 3.0V battery is included for enhancing GPS data acquisition time by maintaining memory during no power periods. The unit is shipped without this jumper installed to conserve battery power.

III. GPS SOFTWARE COMMANDS

NMEA 0183 PROTOCOL

Appendix A, beginning on page 83 of the Condor Series GPS Modules User Guide

http://www.microcomputersystems.com/CONDORGPSModules_UG_2B.pdf

(also included on the CDROM of this manual), provides a brief overview of the NMEA 0183 protocol, and describes both the standard and optional messages offered by the Condor receiver.

NMEA 0183 is a simple, yet comprehensive ASCII protocol which defines both the communication interface and the data format. The NMEA 0183 protocol was originally established to allow marine navigation equipment to share information. Since it is a well established industry standard, NMEA 0183 has also gained popularity for use in applications other than marine electronics.

For those applications requiring output only from the GPS receiver, NMEA 0183 is a popular choice since, in many cases, an NMEA 0183 software application code already exists. The Condor receiver is available with firmware that supports a subset of the NMEA 0183 messages: GGA, GSA, GSV, RMC.

IV. SAMPLE BASIC LANGUAGE TEST PROGRAM

The BASIC language program below illustrates software sequences for the NMEA protocol that are displayed on the video monitor. Also provided are simple routines for inputting the /IN1 thru /IN4 digital inputs and writing to the /OUT1_BUFFERED output.

The program can be run under DOS using a BASIC interpreter such as QBASIC by Microsoft Corporation. An interpreter can be provided at no charge upon request.

```
'GPS terminal program for MSI-P604 with Condor C2626 module.
'Written by J. L. Hilburn, Microcomputer Systems, Inc. - 07/31/2012.
'UART (U5) Port at 9600 BAUD (default mode)

        COM1 = &H3F8: COM2 = &H2F8: COM3 = &H3E8: COM4 = &H2E8
        PRIMARY = COM1
        OFFSET = 0
        BAUD = 12  '9600 BAUD divisor
        CLS
        PRINT ""
        PRINT "Default address is COM1. No address jumper for JP2 should be
              installed."
        PRINT "": PRINT "Strike any key to continue!"
        WHILE INKEY$ = "": WEND
        GOSUB init
begin:
        CLS
        PRINT ""
        PRINT "(1) Display NMEA Protocol."
        PRINT "(2) Set digital output of J1 to hexadecimal 5 (&H5)."
        PRINT "(3) Set digital output of J1 to hexadecimal A (&HA)."
        PRINT "(4) Display digital inputs of J1 /IN1 thru /IN4."
        PRINT "(5) Set UART (U5) port address."
        PRINT "(6) Enable Interrupts."
        PRINT "(7) Set NMEA Protocol to Factory Default."
        PRINT "(8) Send NMEA Message to Condor C2626."
        PRINT "(9) Set address to COMx + &H800."
        PRINT "(10) Display UART (U5) address."
        PRINT "(11) Exit program"
        PRINT ""
        INPUT "Enter selection - ", GP$

        SELECT CASE GP$
              CASE "1"
                    GOSUB init:
                    GOTO start
```

```
CASE "2"  'set digital outputs to &h5 '(send &HA since MCR bits
                                        are inverted)
        outvalue = &HA  ' inverted bit is sent to J1
        GOSUB setDOutput
        GOTO begin
CASE "3"  'set digital outputs to &hA  '(send &H5 since MCR
           bits are inverted)
        outvalue = &H5  ' inverted bit is sent to J1
        GOSUB setDOutput
        GOTO begin
CASE "4" 'display digital inputs
        GOSUB getDInputs
        GOTO begin
CASE "5"
        CLS : PRINT ""
        INPUT "Enter 1, 2, 3 or 4 for COM1, COM2, COM3 or
                COM4 = ", x
        SELECT CASE x
                CASE 1: PRIMARY = &H3F8: PRINT "JP2
                        Jumpers: A8 Off, A4 Off"
                        WHILE INKEY$ = "": WEND: GOSUB init
                        OFFSET = 0
                CASE 2: PRIMARY = &H2F8: PRINT "JP2 Jumpers: A8
                                                On, A4 Off"
                        WHILE INKEY$ = "": WEND: GOSUB init
                        OFFSET = 0
                CASE 3: PRIMARY = &H3E8: PRINT "JP2 Jumpers: A8
                                                Off, A4 On"
                        WHILE INKEY$ = "": WEND: GOSUB init
                        OFFSET = 0
                CASE 4: PRIMARY = &H2E8: PRINT "JP2 Jumpers: A8
                                                 On, A4 On"
                        WHILE INKEY$ = "": WEND: GOSUB init
                        OFFSET = 0
                CASE ELSE: PRINT "Error. Repeat entry"
                        WHILE INKEY$ = "": WEND
        END SELECT
        GOTO begin
CASE "6"
        OUT PRIMARY + 1, 1
        GOTO begin
CASE "7" 'Set NMEA Protocol to Factory Default
        gpsmsg$ = "$PMTK104"
        GOSUB sendmsg
        GOTO begin
CASE "8" 'Send NMEA Message to GPS Module
        CLS : PRINT ""
```

```
                INPUT "Enter command (between $PMKT and * characters) =
                        ", gpsmsg$
                gpsmsg$ = "$PMTK" + gpsmsg$
                GOSUB sendmsg
                GOTO begin
        CASE "9"
                OFFSET = 1
                PRIMARY = PRIMARY + &H8000
                CLS : PRINT ""
                PRINT "UART (U5) Address = "; RIGHT$(HEX$(PRIMARY AND
                        &HFFFF), 4)
                PRINT "": PRINT "Install jumper JP2: A15 and strike any key to
                        continue!"
                WHILE INKEY$ = "": WEND
                GOSUB init
                GOTO begin
        CASE "10"
                GOSUB displayaddr
                GOTO begin
        CASE "11"
                END
        CASE ELSE
                GOTO begin
        END SELECT

start:
        CLS
repeat:
        C$ = INKEY$
        IF C$ <> "" THEN GOTO begin 'goto begin on keyboard entry
        GOSUB getchar
        GOTO repeat

init:  'init MSI-P604 port of U5
        cr$ = CHR$(13)
        OUT PRIMARY + 3, &H80
        OUT PRIMARY, BAUD
        OUT PRIMARY + 1, 0
        OUT PRIMARY + 3, 3
        x = INP(PRIMARY)  'dummy read
        x = INP(PRIMARY)  'dummy read
        IF PRIMARY = &H3F8 THEN x$ = "COM1"
        IF PRIMARY = &H2F8 THEN x$ = "COM2"
        IF PRIMARY = &H3E8 THEN x$ = "COM3"
        IF PRIMARY = &H2E8 THEN x$ = "COM4"
        GOSUB displayaddr
        RETURN
```

```
sendpchar:  'Send character pchar to UART (U5) port
        WHILE (INP(PRIMARY + 5) AND &H40) = 0: WEND
        OUT PRIMARY, ASC(pchar$)
        'PRINT pchar$;
        RETURN

getchar:  'Get UART (U5) character and display on console
        IF (INP(PRIMARY + 5) AND 1) = 1 THEN
                z = INP(PRIMARY)
                PRINT CHR$(z);
                charcount = charcount + 1
        END IF
        RETURN

setDOutput: 'set outputs of J1 to outvalue
        z = (outvalue AND 1) * 4 + (outvalue AND 2) * 4
                                ' get OUT1_BUFFERED (OUT1),
                                ' OUT2_BUFFERED (OUT2)
        z = z + (outvalue AND 4) / 2 + (outvalue AND 8) / 8
                                ' add OUT3 (RTS), OUT4 (DTR)
        s = INP(PRIMARY + 4)    'get MODEM control register contents
        z = (z AND &HF) OR (s AND &HF0)  'set corresponding output bits
        OUT PRIMARY + 4, z       ' output to port
        RETURN

getDInputs:    'get digital inputs from /CTS & /DSR of UARTS

        z = NOT INP(PRIMARY + 6) AND &HF0      'get digital inputs and invert
for MSR
        CLS   'clear screen
        PRINT "": PRINT "Digital Inputs for J1": PRINT ""
        PRINT HEX$(z / 16)
        PRINT ""
        WHILE INKEY$ = "": WEND    'delay until keyboard character entry
        RETURN

displayaddr:    'Display UART (U5) Address
        CLS : PRINT ""
        PRINT "UART Address = ";
        IF OFFSET = 1 THEN PRINT "8000H + ";
        PRINT x$ + " (HEX "; RIGHT$(HEX$(PRIMARY), 4); ")"
        PRINT "": PRINT "Press any key to continue."
        WHILE INKEY$ = "": WEND
        RETURN

sendmsg:    'send message to GPS module
        GOSUB getchecksum
        FOR i = 1 TO LEN(gpsmsg$)
```

```
                pchar$ = MID$(gpsmsg$, i, 1)
                GOSUB sendpchar
        NEXT i
        pchar$ = "*": GOSUB sendpchar
        pchar$ = MID$(pchar1$, 1, 1): GOSUB sendpchar  'send chechsum
MSD
        pchar$ = MID$(pchar1$, 2, 1): GOSUB sendpchar  'send LSD
        pchar$ = CHR$(&HD): GOSUB sendpchar  'send <CR>
        pchar$ = CHR$(&HA): GOSUB sendpchar  'send <LF>
        charcount = 0
        WHILE INKEY$ = "" AND charcount < 256'display 256 characters from
GPS
                GOSUB getchar
        WEND
        PRINT "": PRINT "": PRINT "Strike any key to continue!"
        WHILE INKEY$ = "": WEND
        RETURN

getchecksum:
        checksum = 0
        FOR i = 2 TO LEN(gpsmsg$)
                checksum = checksum XOR ASC(MID$(gpsmsg$, i, 1))
        NEXT i
        pchar1$ = HEX$(checksum)
        RETURN
```

V. SPECIFICATIONS

PC/104 16-bit, stackthrough

Condor C2626 GPS Receiver

See

http://www.microcomputersystems.com/Condor C2626 Technical Notes.pdf

Document is also included on the CDROM of this manual.

GPS Protocols

NMEA 0183	GGA, GSA, GSV, RMC, CHN, GLL, VTG and ZDA

GPS Antenna

Active	with 5m (16.5 ft) cable
Model	Compact Magnetic Mount
Connector	SMA

Digital I/O Port

4 Input	TTL level (Inverted)
4 Output	TTL level (Inverted)

Serial Port

Standard IBM PC UART (TL16C550) jumper selectable as COM1, COM2, COM3 or COM4 with optional offset address

Option Jumpers .025" square posts, 0.1" grid

Digital I/O Connector 3M 30316-5002

Electrical & Environmental

+5V @ 50 mA typical, continuous mode
-40° to 85° C

APPENDIX

Schematic Diagrams of the MSI-P604

1) P602-1.sch - Schematic sheet 1 of 2.

See P604-1.pdf

2) P602-2.sch - Schematic sheet 2 of 2.

See P604-2.pdf