IBM PC/XT/AT Compatible Counter/Timer I/O Board

Intronics Power ®

RTI-827

Features

- *5 Independent Counter/Timers*
- *Simultaneous Operations on Different Counter/Timers*
- *Counter/Timer*
  Inputs interface to AC or DC signals of ±24V
  High-Current Peripheral Output Drivers interface to signals up to +35V dc
- *7 Digital I/O Channels (3 Outputs and 4 bit-configurable I/O)*
- *External Gating and Triggering*
- *Software Programmable Debounce*
- *External Interrupt Line*
- *Frequency Measurement from 0-5MHz*
- *Event Counting Supported at Rates up to 5MHz*
- *Single Pulse Outputs with Variable Widths*
- *Programmable Pulse Train Outputs*
- *Period Measurement*
- *Time Proportional Outputs with 0 to 100% Duty Cycle*

ANALOG DEVICES

Applications

- ***Product Test & Machine Control***
  Monitor Tachometers, Turbine Flowmeters, Optical Encoders
  Position Measurement with Linear/Rotational Devices
  Drive X-Y Incremental Plotters, Analog Controllers
- ***Pilot Plant or Process Control***
  Monitor Flowmeters
  Control Valves, Heaters, Motors
  Drive Relay Coils, Lamps, Fans
- ***Laboratory Automation***
  Flow and Volume Measurement
  Generate Pulse Trains for Stimulus
  High- and Low-Speed Event Counting with External Stop/Start Control

The RTI-827 is a counter/timer I/O board that provides five counter/timers and seven digital I/O channels. The RTI-827 can be installed in either a long or short expansion slot in the IBM PC/XT/AT. The board operates from the +5V supplied by the bus and provides fused +5V power on the user connector.

Counter/Timer I/O Features

The RTI-827 employs the AM9513A counter/timer device from Advanced Micro Devices. The AM9513A has five independent 16-bit counter/timers. Each counter/timer has its own source input line, gate input line and output line which are brought to the RTI-827's I/O connector. The gate inputs may also be programmed for use as trigger inputs.

The counter/timers can be used independently or can be programmed to be used in conjunction with other counter/timers. The counter/timers

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functions can be segmented into input operations, which include event counting, frequency measurement, and interval (period) measurement and output operations, which include single-, counted-, and continuous-pulse outputs. For input operations, the counter/timers can be programmed to count up or down in binary or BCD and the counter/timers can be cascaded to form an effective counter length of 80-bits ($>10^{24}$). The input and output polarities of the counter/timers can be programmed as active-high or active-low. For ouput operations, the counter/timers can be programmed to provide either pulses or levels.

The RTI-827 I/O map allows access to all of the AM9513A registers. All of the AM9513A programming modes can be used. The AM9513A/AM9513 Technical Manual is required when programming/operating the RTI-827 without Analog Devices' Driver Software or an application specific software package.

The RTI-827 supports event counting the counting of transitions from a real-world signal. Frequency input and period measurement entail measuring the time over which these counts occur. Frequency input and period measurement applications require the use of more than one counter/timer.

The counter/timers can output square waves with fixed or variable duty cycles. The output frequency of the square waves can be adjusted in real time. The RTI-827 supports single pulses of predefined widths, and continuous and counted pulse trains with programmable frequency, duty cycle and period.

Counter/Timer Input/Output Interface Characteristics

The input circuitry for the five source inputs and five gate inputs of the counter/timers and the external interrupt line uses line receiver buffers which allow the counter/timers to interface to TTL and high-level AC or DC signals up to ±24V. The required drive current varies depending on the input voltage.

The output circuitry allows the RTI-827 counter/timer outputs to sink the amount of current necessary to drive the loads of relays, lamps, coils, etc. The outputs can be configured for either TTL or open collector. Each counter/timer output is protected by a clamp diode which prevents negative spikes from damaging the RTI-827 when it is connected to inductive loads.

Software Programmable Debounce Circuitry

The RTI-827 has software programmable debounce circuitry for the source and gate inputs of the counter/timers and the external interrupt line. The clock for the debounce circuitry is provided by the F_{OUT} of the AM9513A and is common to all debounced signals.

The debounce circuitry disregards noise from signals during event counting, frequency measurements, and from the external interrupt line. The debounce circuitry is very useful in eliminating the false triggering or recording of events caused by slow switching mechanical contacts, which tend to bounce on both edges.

Interrupts

The RTI-827 has three interrupt sources. Two of the interrupt sources are dedicated to terminal count on counter/timers 1 and 2. The third is jumper-selectable as external interrupt or terminal count on counter/timer 3. The interrupt sources can be directed to IRQ2 through IRQ7 on the host computer. Each of the interrupt sources has interrupt overrun circuitry.

The three sources can be enabled/disabled individually in software. The sources are "OR"ed together and the host computer is interrupted if any of the interrupts is activated.

Utilities Disk

The Utilities disk shipped with the RTI-827 contains a menu-driven exerciser program (EXER) and the configuration program (CONF) for the RTI-800 Series Analog and Digital I/O Boards. The Utilities are shipped on 5.25" media. To get the Utilities on 3.5" media, order SW-UTIL-D3 at no cost.

The EXER program is a self-documenting menu-driven program that allows you to access all of the RTI-800 Series I/O board's functionality through software. EXER can be used as a diagnostic tool, or as a means of becoming familiar with the capabilities of the board, prior to developing an application program.

Counter/Timer I/O Board

SPECIFICATIONS (typical @25°C)

COUNTER/TIMER I/O	
Number of Counter/Timers	5
Modes of Operation	Event Counting, Frequency Input Measurement, Time Proportional Pulse Output
Event Counting	
Maximum Count Rate	
Debounce Disabled	5MHz
Debounce Enabled	400KHz
Range	65,535 (16 bits)[1]
Frequency Measurement	
Frequency Range	
Debounce Disabled	0-5MHz
Debounce Enabled	0-400KHz
Gate Time	1µs to 2147s
Resolution	0.0015% (16 bits)
Time Proportional Pulse Output	
Operations Supported	Counted and Continuous Pulse Outputs
Duty Cycle Range	0 to 100%
Period Range	1µs to 2147s
Resolution	0.0015% (16 bits)
Pulse Output	
Operations Supported	Single Pulse Output
Pulse Width	1µs to 2147s
Resolution	500ns
Time Base	
Reference	2.0MHz Crystal
Accuracy	±0.01% typ, ±0.02% max

COUNTER/TIMER INPUT SIGNAL CHARACTERISTICS	
Inputs Supported	Source, Gate, and External Interrupt Line
Type	Line Receiver Active-Low
$+V_{TH}$	1.75V min., 2.25V max.
$-V_{TH}$	0.75V min., 1.25V max.
I_{IL} (Driver Sink Current)	
@V_{IN} = 0V	-1.3mA
@V_{IN} = -5V	-3.6mA
@V_{IN} = -24V	-13mA
I_{IH} (Driver Source Current)	
@V_{IN} = +5V	1mA[2]
@V_{IN} = +12V	-3.6mA
@V_{IN} = +24V	12mA
Hysteresis	1.15V
Maximum Input Voltage	±30V peak

COUNTER/TIMER OUTPUT SIGNAL CHARACTERISTICS	
Type[4]	TTL or Open Collector[3]
Output Voltage Range (O.C.)	+35V max
Output Sink Current	300ma max
V_{OL} (Output Low Voltage)	
@ IOL=50ma	0.3V
@ IOL=300ma	0.8V max
Output Frequency Range	0 to 800 Khz

SOFTWARE PROGRAMMABLE DEBOUNCE CIRCUITRY	
Inputs Supported[5]	Gate, Source and External Interrupt Line
Debounce Time	2.5µs to 2.6s

NOTES:

[1]The Counter/Timers can be cascaded externally if a higher maximum count value is desired.

[2]This specification assumes a source impedance of 0Ω. If the source impedance is Infinite, (open collector) then the internal pull-up will yield a logic "1" input voltage; however, the open circuit logic high voltage is ≈ +3 volts. This implies that the inputs are directly compatible with all 0 to +5 volt types of logic (i.e. TTL, DTL, CMOS, HC, HCT and open collector).

[3]The counter/timer output circuitry contains a socketed resistor pack that, when installed, provides an interface for TTL-level signals and, when removed, provides open collector outputs in the range of 0 to +35V.

[4]The output circuitry of each of the five counter/timers contains a clamp-diode for protection when driving relay coils directly.

[5]The external interrupt line and each source and gate input of the 5 counter/timers can be individually configured for debounce (jumper-selectable). The debounce clock is software programmable and the time base is common to all debounced channels.

[6]The RTI-827 provides circuitry (jumper-selectable) for operating in the 8th slot of IBM XT and 100% compatibles.

[7]The part number of the connector is AMP 1-202161-0 and its female mating connector is AMP 1-746288-0.

[8]The +5V power is fused (socketed) at 500mA.

DIGITAL I/O	
Number of Channels	3 Outputs and 4 Bit-Configurable I/O
Compatibility	Polarity Inverted for Solid-State Relay Subsystem Compatibility (Active Low)
Input/Output Voltage Range	-0.5V to +7.0V
Input Type	Active Low TTL (Pulled Up)
Input Signal Levels	V_{IH}=2.0V min @ I_{IH}=20µA max V_{IL}=0.8V max @ I_{IL}=-0.1mA max
Output Type	Open Collector with 47KΩ internal pull-ups
Output Signal Levels	V_{OH}=2.4V min @ I_{OH}=3mA V_{OL}=0.4Vmax @ I_{OL}=12mA
EXTERNAL INTERRUPT LINE	
Function	Initiates Interrupt Request to Host
Characteristics	Debounce Selectable, Double Latched for Interrupt Overrun Detection
Polarity	Falling Edge Triggered
Input Type	Line Receiver
Compatibility	TTL,DTL,CMOS,LSTTL,HC,HCT, and ±24V
Minimum Pulse Width	75ns
SYSTEM CONFIGURATION	
Bus Resource Utilization[5]	Occupies one Short or Long slot in IBM PC/XT/AT Bus
Board Address Selection	DIP Switch Selectable, 16 Consecutive Bytes
Bus Compatibility	IBM PC/XT/AT and 100% Compatibles
PHYSICAL/ENVIRONMENTAL	
I/O Connector	50-pin Male Header[7]
Dimensions (Including Connector)	5.88" (14.92cm) x 5" (12.7cm) x 1" (2.54cm)
Operating Temperature Range	0 to +70°C
Storage Temperature Range	-25°C to +85°C
Relative Humidity	Up to 90% (Noncondensing)
POWER	
Power Consumption	+5V @500mA
Power Available Through I/O Connector[6]	+5V @375mA

Specifications subject to change without notice.

ORDERING INFORMATION

RTI-827

Software

Each of the RTI-827 driver software packages is available on 3.5" or 5.25" media. The -D3 version of the software should be ordered if your system accepts 3.5" media and the -D5 if your system accepts 5.25" media.

SW-C-827-D3
SW-C-827-D5
DOS Driver Software for Microsoft C and Borland International TURBO C. This software can be linked with SW-C-800-D and/or SW-C-860-D.

SW-B-827-D3
SW-B-827-D5
DOS Driver Software for IBM Interpreted BASIC, Microsoft Interpreted, Compiled, and QuickBASIC. This software can be linked with SW-B-800-D and/or SW-B-860-D.

SW-TP-827-D3
SW-TP-827-D5
DOS Driver Software for Borland International TURBO Pascal. This software can be linked with SW-TP-800-D and/or SW-TP-860-D.

I/O Panels

STB-50A
Screw-Termination Panel with 3' (0.9 m) cable.

DB-24
Isolated Digital I/O Subsystem (24-Channel). Provides sockets for up to 6 Quad Solid-State Relay modules. Order modules and cable separately. All of the RTI-827's functionality can be accessed with the DB-24.

DB-16
Isolated Digital I/O Subsystem (16-Channel). Provides sockets for up to 16 Single Solid-State Relay modules. Order modules and cable separately. Only the counter/timer functionality of the RTI-827 can be accessed with the DB-16. The seven digital I/O lines are not brought out to the DB-16.

Cables

AC1585-9
3' (0.9 m) Cable Connects RTI-827 to DB-24 or DB-16 Isolated Digital I/O Subsystems

CAB-03
5' (1.5m) Cable Connects RTI-827 to DB-24 or DB-16 Isolated Digital I/O Subsystems

Manuals

A user's manual is supplied with the RTI-827. Additional manuals are available.

AC1937
RTI-827 User's Manual

AC1938
RTI-827 Software Manual