



**Intronics**  
**Power®**

# IBM PC/XT/AT Compatible Modular Analog and Digital I/O Board

## RTI-820

### FEATURES

Analog and Digital I/O on One Board

12-Bit A/D and D/A Resolution

High Channel Expansion Capacity

64 Analog Inputs

16 Analog Outputs

24 Digital I/O

Analog Input Acquisition Rates up to 19kHz

Analog Output Update Rates of 400Hz on Each Channel

Wide Range of Interface Panels Used for Direct Connection to Thermocouples and RTDs

Choice of Isolated or Nonisolated I/O

### SOFTWARE

Callable I/O Drivers For Use with Multiple High Level Languages

Calibration Routines

Menu-Driven Application Software Support

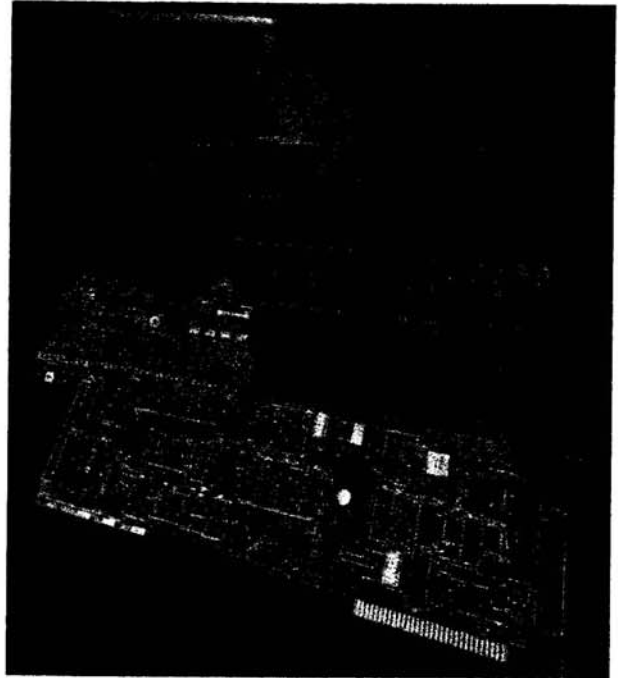
### APPLICATIONS

Laboratory R&D

Data Logging

Product Test

Process Control



### GENERAL DESCRIPTION

The RTI-820 is a low-cost analog and digital I/O board that plugs into one of the long expansion slots in the IBM PC/XT/AT\* or equivalent personal computer. Used with a wide variety of interface panels, the board accepts a variety of signals with up to 64 analog input channels, 16 analog output channels, and 24 channels of digital I/O accommodated in a single PC slot. The RTI-820 provides 12-bit A/D and D/A resolution, acquisition rates up to 19kHz, and a wide variety of signal conditioning options for either isolated or nonisolated I/O.

Three analog I/O interface panels are available for use with the RTI-820. The high-level voltage panel (STB-HL) provides screw terminations for 16 high-level (V) single-ended analog inputs and 4 analog outputs and open positions for user installed attenuators, filters or current shunts. The thermocouple panel (STB-TC) provides screw terminations for 16 low-level (mV) differential analog inputs or 15 thermocouples with cold junction compensation. Finally, the 5B interface panel (5B02) provides 16 galvanically isolated analog I/O channels using the 5B Series

signal conditioning modules. The 5B modules provide for direct connection to volts, millivolts, current input and output, thermocouples and RTDs at up to  $\pm 240V$  input protection and 2000 volts peak isolation. If isolation is not required, the high-level voltage and thermocouple panels provide an economical solution for signal termination. In addition, the 24 channels of digital I/O connect via a ribbon cable to either a nonisolated panel (AC1585-1) for TTL level I/O or to an isolated digital I/O subsystem (DB-24) for high-level digital I/O.

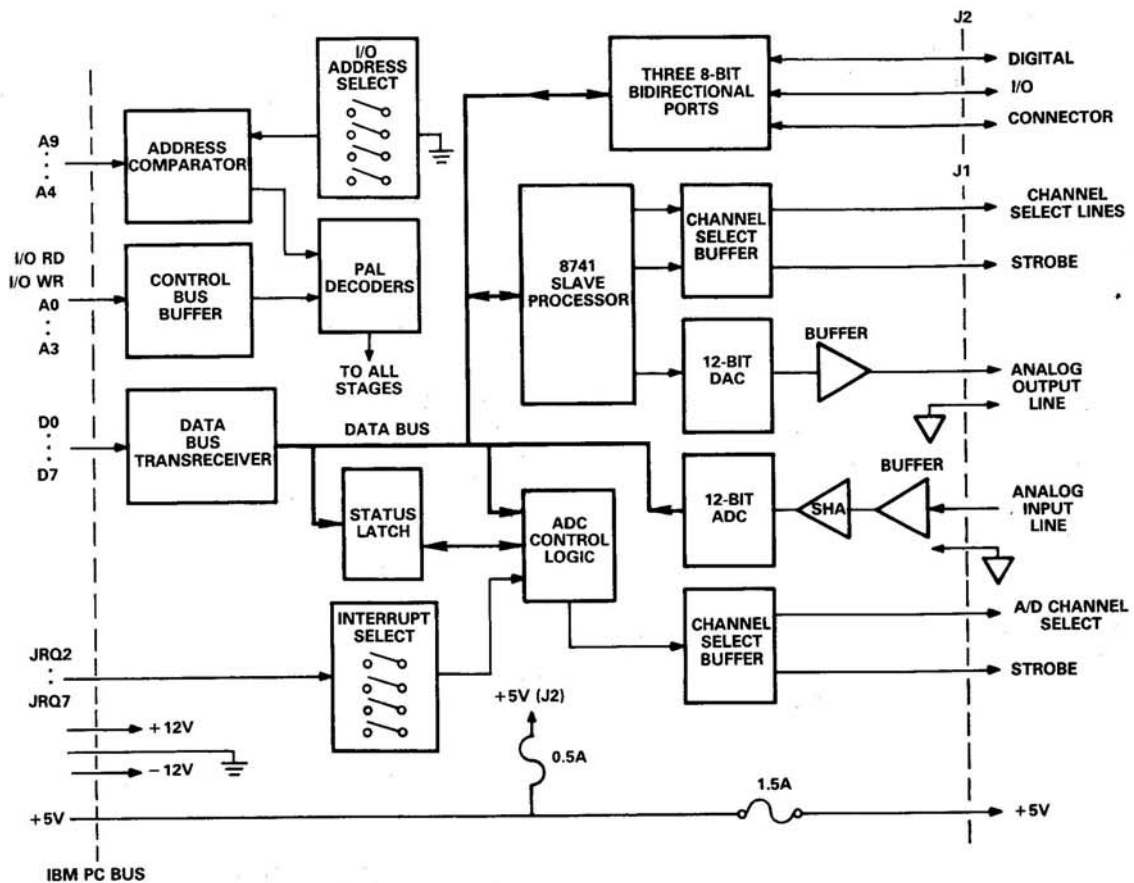
The RTI-820 and its hardware accessories are supported by three levels of software: assembly language programming, high-level language drivers, and menu-driven application software. Refer to the separate software data sheets for more detailed information.

The RTI-820 is a member of the RTI® I/O Board Family.

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\*IBM PC/XT/AT is a trademark of International Business Machines Corp.

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### ANALOG I/O

The RTI-820 contains one 12-bit A/D converter and one 12-bit D/A converter that provide one channel of analog input and one channel of analog output, respectively. Multiple channels are accommodated with the interface panels by multiplexing several input and output channels into the single I/O lines of the RTI-820 through the J1 connector. The multiplexing functions on the interface panels are controlled by the decoding lines on the analog I/O connector. Six analog input lines and four analog output lines are supplied to provide for a maximum of 64 analog inputs and 16 analog outputs into a single RTI-820 board.

A/D conversions can be initiated from a software convert command or triggered externally from a TTL level pulse to allow the conversion process to be synchronized with external events. The RTI-820 has the capability to generate an interrupt upon completion of an A/D conversion or when an overrun condition has occurred (i.e., an attempt has been made to initiate an A/D conversion before the necessary settling time).

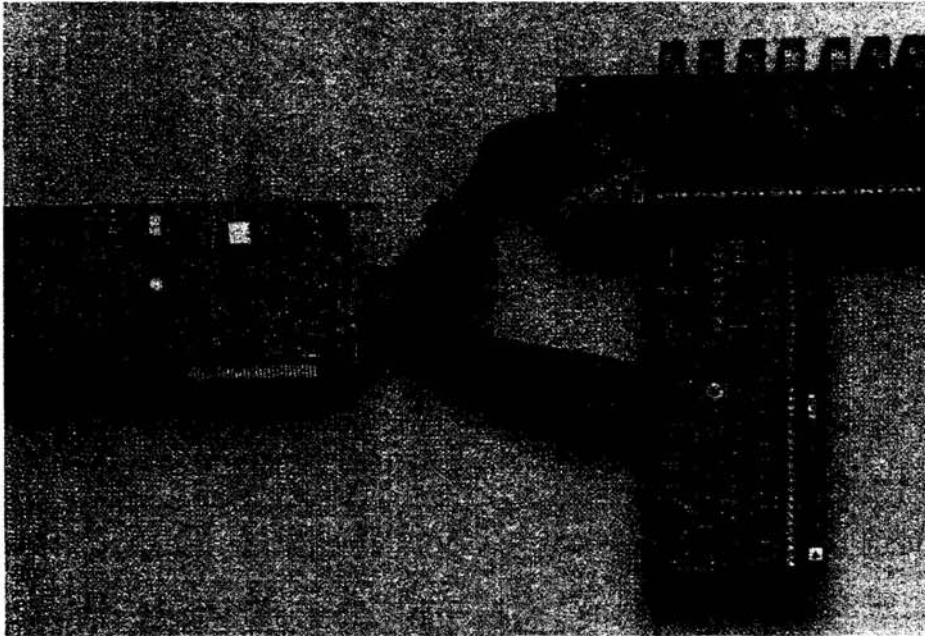
Analog output, on the other hand, is implemented with a single D/A converter coupled with an on-board slave microprocessor.

The microprocessor's principle task is to periodically update all active output lines by storing the output data in RAM memory and controlling the D/A refresh rate. Individual sample and hold amplifiers (SHAs) will hold each output signal constant until the microprocessor updates the value, which occurs about once every two milliseconds. A timer inside the slave microprocessor will insure that each D/A channel is periodically refreshed. In this manner, one D/A converter is able to serve multiple analog output channels.

### DIGITAL I/O

The RTI-820 has three 8-bit digital I/O ports, each of which may be configured as either an input or output port. All digital I/O channels are inverse TTL level signals and are compatible with industry standard solid-state relay subsystems such as the Analog Devices DB-24 24-channel Isolated Digital I/O Subsystem. The DB-24 panel uses up to six plug-in quad modules (four channels each) to provide optically isolated digital I/O. If isolation is not required, the AC1585-1 screw termination panel is available for direct connections to the RTI-820 board.

## CONNECTING THE INTERFACE PANELS TO THE RTI-820



### Analog I/O

The Analog I/O interface panels are connected to the RTI-820 through a 26-pin connector (J1). A 26-pin, 3 ft. ribbon cable connects the J1 connector to the 26-pin connector on the interface panel. If more than one panel is used, a second ribbon cable is daisy-chained off of the 26-pin connector of the cable, as shown in the above photo. Up to four interface panels, in any combination, can be connected in this manner.

### Digital I/O

Digital I/O channels are also connected to the RTI-820 via external interface panels. The digital I/O interface panel is connected to the RTI-820 through a 50-pin connector (J2) and a 50-pin ribbon cable. The cable is connected to the J2 connector and runs through the retaining bracket and out to the digital interface panel.

### PANEL SELECTION GUIDE

Several interface panels are available for use with the RTI-820. Analog I/O interface panels (rack mountable) are available for isolated or nonisolated high-level voltages, low-level voltages and specialized I/O such as thermocouples and RTDs. The multiple panel options not only provide the user with the opportunity of

expanding the I/O configuration but also to condition the I/O as needed on a panel-by-panel basis. Similarly, there are two digital I/O panel options for either nonisolated TTL level I/O or isolated, high-level sensing and switching.

Below is a list of the screw termination panels available for both the analog and digital I/O connections.

Model #	Channel Capacity	Input Types	Output Types	Isolation	Power Required	Rack Mount Kit
<b>Analog I/O</b>						
STB-HL	16 AIN (SE) 4 AOT	High-Level Voltage	High-Level Voltage	No	+ 5V @ 350mA	RM-02
STB-TC	16 AIN (DI)	Thermocouples Low-Level Voltage	None	No	+ 5V @ 200mA	RM-02
5B02	16 Analog I/O	Thermocouples RTDs Current Low-Level Voltage High-Level Voltage	Current (Voltage)	Yes $\pm 1500V$ rms	Dependent On Modules Used	AC1363
<b>Digital I/O</b>						
AC1585-1	24 Digital I/O	TTL Level	TTL Level	No	None	None
DB-24	24 Digital I/O	High-Level ac Voltage High-Level dc Voltage	High-Level ac Voltage High-Level dc Voltage	Yes $\pm 4000V$ rms	Dependent On Modules Used	RM-02

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Panel	Input Type	Input Range	Output Range	Model #	Resolution	Accuracy	
<b>Analog Inputs</b>							
STB-HL	Volts	±5V	±5V		2.44mV	5.6mV	
		±10V	±5V		4.88mV	11.2mV	
STB-TC	Millivolts/ Thermocouples (0-8Hz)	±5V	±5V		2.44mV	5.6mV	
		±0.1V	±5V		48.8μV	112μV	
		±0.05V	±5V		24.4μV	59μV	
		±0.025V	±5V		12.2μV	32μV	
		±0.01	±5V		4.88μV	19μV	
		±0.005V	±5V		2.44μV	16μV	
5B02	Millivolts (0-4Hz)	±0.01V	±5V	5B30-01	4.88μV	11.2μV	
		±0.05V	±5V	5B30-02	24.4μV	56μV	
		±0.10V	±5V	5B30-03	48.8μV	112μV	
		±0.01V	0-5V	5B30-04	9.76μV	22.4μV	
		±0.05V	0-5V	5B30-05	48.8μV	112μV	
		±0.10V	0-V	5B30-06	97.6μV	224μV	
	Volts (0-4Hz)	±1V	±5V	5B31-01	0.488mV	1.12mV	
		±5V	±5V	5B31-02	2.44mV	5.6mV	
		±10V	±5V	5B31-03	4.88mV	11.2mV	
		±1V	0-5V	5B31-04	0.976mV	2.24mV	
		±5V	0-5V	5B31-05	4.88mV	11.2mV	
		±10V	0-5V	5B31-06	9.76mV	22.4mV	
	Milivolts (0-10kHz)	±0.01V	±5V	5B40-01	4.88μV	11.2μV	
		±0.05V	±5V	5B40-02	24.4μV	56μV	
		±0.1V	±5V	5B40-03	48.8μV	112μV	
		±0.01V	0-5V	5B40-04	9.76μV	22.4μV	
		±0.05V	0-5V	5B40-05	48.8μV	112μV	
		±0.1V	0-5V	5B40-06	97.6μV	224μV	
	Volts (0-10kHz)	±1V	±5V	5B41-01	0.488mV	1.12mV	
		±5V	±5V	5B41-02	2.44mV	5.6mV	
		±10V	±5V	5B41-03	4.88mV	11.2mV	
		±1V	0-5V	5B41-04	0.976mV	2.24mV	
		±5V	0-5V	5B41-05	4.88mV	11.2mV	
		±10V	0-5V	5B41-06	9.76mV	22.4mV	
Current (0-4Hz)	4-20mA	0-5V	5B32-01	7.81μA	17.9μA		
	0-20mA	0-5V	5B32-02	9.76μA	22.4μA		
Thermocouples	RTD (0-4Hz) 100 Pt	-100°C to +100°C	0-5V	5B34-01	0.097°C	0.22°C	
		0 to +100°C	0-5V	5B34-02	0.048°C	0.12°C	
		0 to +200°C	0-5V	5B34-03	0.097°C	0.22°C	
		0 to +600°C	0-5V	5B34-04	0.29°C	0.67°C	
		0 to +120°C (0°C)	0-5V	5B34-C-01	0.058°C	0.13°C	
		0 to +120°C (25°C)	0-5V	5B34-C-02	0.058°C	0.13°C	
	10 Cu	0 to +300°C	0-5V	5B34-N-01	0.146°C	0.34°C	
		120 Ni	-100°C to +760°C	0-5V	5B37-J-01	0.42°C	0.96°C
			-100°C to +1350°C	0-5V	5B37-K-02	0.71°C	1.62°C
			-100°C to +400°C	0-5V	5B37-T-03	0.24°C	0.56°C
			0 to +900°C	0-5V	5B37-E-04	0.44°C	1.01°C
			0 to +1750°C	0-5V	5B37-R-05	0.85°C	1.96°C
0 to +1750°C	0-5V		5B37-S-06	0.85°C	1.96°C		
B	0 to +1800°C	0-5V	5B37-B-07	0.88°C	2.02°C		
<b>Analog Outputs</b>							
STB-HL	Volts		0-5V ±5V		1.22mV 2.44mV	2.8mV 5.6mV	
5B02	Current	0-5V	4-20mA	5B39-01	3.91μA	8.96μA	
		±5V	4-20mA	5B39-02	7.81μA	17.9μA	
		0-5V	0-20mA	5B39-03	4.88μA	11.2μA	
		±5V	0-20mA	5B39-04	9.76μA	22.4μA	

Panel	Input Range	Output Range	Model #
<b>Digital Inputs</b> AC1585-1 DB-24	TTL Level	TTL Level	
	4-16V dc	TTL Level	ID16FQ
	10-32V dc	TTL Level	ID32Q
	15-32V ac	TTL Level	ID32Q
	90-140V ac	TTL Level	IA120Q
	90-140V dc	TTL Level	IA120Q
	180-280V ac	TTL Level	IA240Q
	180-280V dc	TTL Level	IA240Q
<b>Digital Outputs</b> AC1585-1 DB-24	TTL Level	TTL Level	
	TTL Level	12-280V ac	OA240Q
	TTL Level	5-60V dc	OD60Q

Table I. Panel and Module Selection Table

# RTI-820 SPECIFICATIONS (typical @ +25°C and +5V dc)

## ANALOG INPUT (RTI-820 BOARD ONLY)

Number of Analog Input Channels <sup>1</sup>	Up to 64 (Dependent on Interface Panel Used) Supports Up to 4 Interface Panels in Any Combination
Input Resolution	12 Bits (4096 Counts)
A/D Converter Time	30µs typical
System Throughput <sup>2</sup>	19kHz maximum
Accuracy	0.025% (± 1LSB)

## ANALOG OUTPUT (RTI-820 BOARD ONLY)

Number of Analog Output Channels <sup>1</sup>	Up to 16 (Dependent on Interface Panel Used) Supports Up to 4 Interface Panels in Any Combination
Output Resolution	12 Bits (4096 Counts)
Update Rates	400Hz Each Channel
Accuracy	0.025% (± 1LSB)

## DIGITAL I/O (RTI-820 BOARD ONLY)

Number of Channels	24 (Software Selectable in Groups of 8)
Signal Levels	Inverted TTL (Compatible to Solid-State Relay Subsystems) $V_{OL} = 0.4V$ maximum $I_{OL} = 23mA$ maximum

## SYSTEM CONFIGURATION

Bus Resource Utilization	Occupies One IBM PC Long SLot
Data Acquisition Modes	Polled Status or Interrupt
Base Address Selection	DIP Switch Selectable, 16 Consecutive Bytes
Compatibility	IBM PC/XT/AT and 100% Compatibles

## PHYSICAL/ENVIRONMENTAL

Operating Temperature Range	0 to +70°C
Storage Temperature Range	-25° to +85°C
Relative Humidity	Up to 90% (Noncondensing)

## POWER REQUIREMENTS (RTI-820 BOARD ONLY)

Power Consumption	+5V @ 650mA +12V @ 25mA -12V @ 40mA
+5V Power Available on Analog I/O Connector	Up to 1.5 Amps (Fused)
+5V Power Available on Digital I/O Connector	Up to 0.5 Amps (Fused)

## NOTES

<sup>1</sup>The RTI-820 contains only one analog input line and one analog output line. The individual input and output channels are multiplexed at the interface panels. The RTI-820 itself is not able to measure multiple analog inputs and outputs but does provide the channel address and strobe lines for outboard accessory panels.

<sup>2</sup>System throughput includes A/D conversion time, multiplexing settling time (single channel only) and amplifier settling time, data transfer time, and minimal software overhead (assembly language).

The system throughput represents the maximum rate measured in benchmark testing during development.

Specifications are subject to change without notice.

# INTERFACE PANEL SPECIFICATIONS (typical @ +25°C and +5V dc)

## HL PANEL SPECIFICATIONS (Model #STB-HL)

Number of Analog Input Channels	16 Single Ended
Analog Input Voltage Range <sup>1</sup>	± 5V, ± 10V
Analog Input Accuracy	0.05% of span
Input Protection <sup>2</sup>	± 35V (powered), ± 20V (unpowered)
Number of Analog Output Channels	4
Analog Output Voltage Range	0-5V, ± 5V @ 5mA
Analog Output Accuracy	0.05% of span
Analog Output Noise	1mV rms, 10kHz Bandwidth
Power Requirements	+5V @ 350mA
Physical Dimensions	8.25" × 6" × 1.41"
Operating Temperature Range	0 to +60°C