Intronics Power ®

High Performance STD Bus Compatible Analog I/O Subsystems

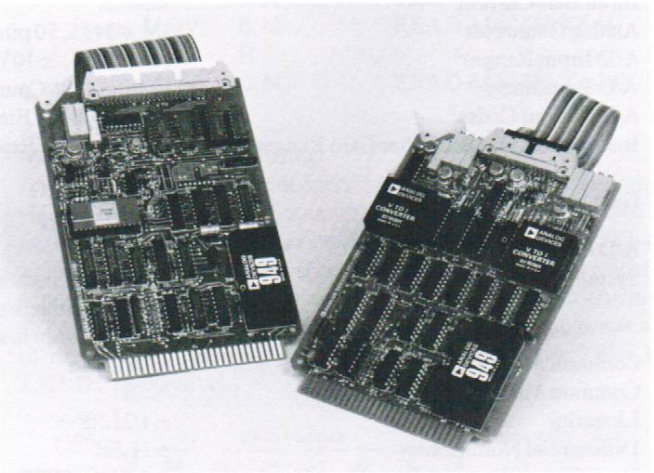
RTI-1260/1262

FEATURES

RTI-1260 ANALOG INPUT CARD
- 32 Single-Ended/16 Differential Channels
- User Configurable Gains of 1 to 1000
- 12-Bit A/D Resolution

RTI-1262 ANALOG OUTPUT CARD
- 4 Analog Output Channels
- 12-Bit D/A Resolution
- Optional 4-20mA Current Loop Outputs

GENERAL
- Low Cost
- Single +5V Power Requirement
- Memory Mapped or Port I/O Selectable
- Compatible with All STD CPU Cards



GENERAL DESCRIPTION

The RTI® Series products from Analog Devices are high performance analog input and output cards compatible with the STD bus. They provide a cost effective and convenient means of interfacing your microcomputer to the real (i.e., analog) world. The cards feature 12-bit resolution, resistor programmable gain for low-level signals, analog channel expansion capabilities, 4-20mA outputs and on-board dc/dc converter.

The series consist of an analog input card (RTI-1260) and an analog output card (RTI-1262). The cards interface to the STD bus as either a memory mapped or an I/O port peripheral through a user-selection jumper option.

The RTI-1260 Analog Input Card provides data acquisition for 16 single-ended or 8 differential channels with optional expansion to 32 single-ended or 16 differential channels. The instrumentation amplifier is user configurable for gains of 1 to 1000. Combining this with a sample-hold circuit and 12-bit a/d converter, the data acquisition section features ±0.01% accuracy, 12-bit resolution and throughput rates up to 25kHz.

The RTI-1262 Analog Output Card uses four 12-bit d/a converters to provide independently programmed voltage output channels. In addition, two channels can be converted to 4-20mA outputs by using optional voltage-to-current modules which install on the board.

Reliable analog connections are made using 3M's "Scotchflex" socket and header connectors which enables a flat ribbon cable to be combined with gas tight and corrosion resistant connectors. An optional screw termination panel is also offered for simple and convenient field wire connections.

All cards have an operating temperature range of 0 to +70°C and come complete with dc/dc converter, allowing them to operate from the microcomputer's +5V supply.

		INPUT				OUTPUT		
		Channel Capacity						
Card Type	Model No.	STD	OPT	Gain Range	A/D Resolution	Channel Capacity	D/A Resolution	4-20mA (OPT)
Analog Input	RTI-1260	16SE/8D	32SE/16D	1-1000	12 Bits	← N/A →		
Analog Output	RTI-1262	← N/A →				4	12 Bits	2

RTI-1260/1262 Function Chart

Represented/Distributed By

1400 PROVIDENCE HIGHWAY • BUILDING 2 NORWOOD, MASSACHUSETTS 02062-5015
PHONE: 781-551-5500 FAX: 781-551-5555

SPECIFICATIONS (typical @ 25°C with nominal supply voltage unless otherwise noted)

RTI-1260 ANALOG INPUT CARD	
Number of Input Channels	16 Single-Ended or 8 Differential (Jumper Selectable) Expandable to 32 Single-Ended or 16 Differential Using Two Plug-In Multiplexers (ADI Part #OA10)
Input Overvoltage Protection[1]	± 35V (Dielectrically Isolated)
Input Impedance	$>10^8\Omega$
Input Bias Current	± 50nA
Analog Connector	3M #3433, 50 pin
A/D Input Ranges[2]	0 to + 10V, ± 10V
A/D Resolution	12 Bits (4096 Counts)
A/D Output Codes[2]	Binary, Offset Binary, Two's Complement
Instrumentation Amplifier Gain Ranges	1 to 1000V/V (Resistor Programmable Gain)
Gain Equation	$G = 1 + \frac{20k\Omega}{R_G}$
A/D Conversion Time	25µs
System Throughput[3]	25,000 Channels/sec (G < 150) 20,000 Channels/sec (150 < G > 300) 11,000 Channels/sec (G = 1000)
Common Mode Voltage (CMV)	± 10V min
Common Mode Rejection (CMR)	78dB
Linearity	± 1/2LSB
Differential Nonlinearity	± 1LSB
Total System Error (Adjustable to Zero)	± 0.01% of FSR (Gain = 1 to 10) ± 0.05% of FSR (Gain = 100) ± 0.1% of FSR (Gain = 1000)
Temperature Coefficient	
Gain	± 30ppm/°C of FSR (G = 1) ± 100ppm/°C of FSR (G = 1000)
Offset	± 10ppm/°C of FSR (G = 1) ± 100ppm/°C of FSR (G = 1000)
INTERFACE PARAMETERS	
Compatibility	Meets all Electrical and Mechanical STD Bus Specifications
Implementation	Memory Mapped I/O Compatible with All CPU Types Port Mapped I/O Compatible with 8080, 8085, 8086, Z-80 and 8088 Family of CPUs
Address Selection	3 Contiguous Bytes in a 16 Byte Block. (Jumper Selectable in Any One of 256 Locations in 64K of Memory Space.)
Port Selection	3 Contiguous Ports in a 16 Port Block (Jumper Selectable on Any 16 Port Boundary in Either an 8-Bit or 16-Bit Port Image.)
Expansion Options	MEMEX and IOEXP Fully Supported with Jumper Selectable Enable High, Enable Low or Ignore Expansion Options.
POWER REQUIREMENTS	+ 5V ± 5% @ 450mA (On-Board dc/dc Converter Generates an Isolated ± 15V to Power the Data Acquisition Components.)
TEMPERATURE	
Operating	0 to + 70°C
Storage	− 55°C to + 85°C
RELATIVE HUMIDITY	Meets or Exceeds MIL-STD 202 Method 103

NOTES
[1]Specified with power applied, ± 20V with power off.
[2]User selectable with wire-wrap jumpers.
[3]Does not include CPU latency time.

Specifications subject to change without notice.

SPECIFICATIONS (typical @ 25°C with nominal supply voltage unless otherwise noted)

RTI-1262 ANALOG OUTPUT CARD	
Number of Output Channels	4
D/A Resolution	12 Bits (4096 Count)
D/A Input Codes[1]	Binary, Offset Binary
Output Voltage Range[1]	0V to +5V, 0V to +10V, ±5V, ±10V @5mA
Output Current Range[2]	4-20mA Using 2 Voltage-to-Current Modules
(Optional – 2 Channels Only)	(ADI Part #OA08)
Analog Connector	3M #3429, 26 pin
Nonlinearity	±1/2LSB
Differential Nonlinearity	±1/2LSB
Output Settling Time	25μs (to ±1/2LSB)
Gain Error (Adjustable to Zero)	±0.01% of FSR (Full Scale Range)
Offset Error (Adjustable to Zero)	±0.02% of FSR
Temperature Coefficient	
Gain	±15ppm/°C of FSR
Offset	±25μV/°C
INTERFACE PARAMETERS	
Compatibility	Meets all Electrical and Mechanical STD Bus Specifications
Implementation	Memory Mapped I/O Compatible with All CPU Types
Address Selection	8 Contiguous Bytes in a 16 Byte Block. (Jumper Selectable in Any One of 256 Locations in 64K of Memory Space)
POWER REQUIREMENTS	+5V ±5% @ 550mA (On-Board dc/dc Converter Generates an Isolated ±15V to Power the Data Acquisition Components)
TEMPERATURE	
Operating	0 to +70°C
Storage	−55°C to +85°C
RELATIVE HUMIDITY	Meets or Exceeds MIL-STD 202 Method 103

NOTES
[1]User selectable with wire-wrap jumpers.
[2]Solder in option, +16V to +30V loop power required.
Specifications subject to change without notice.

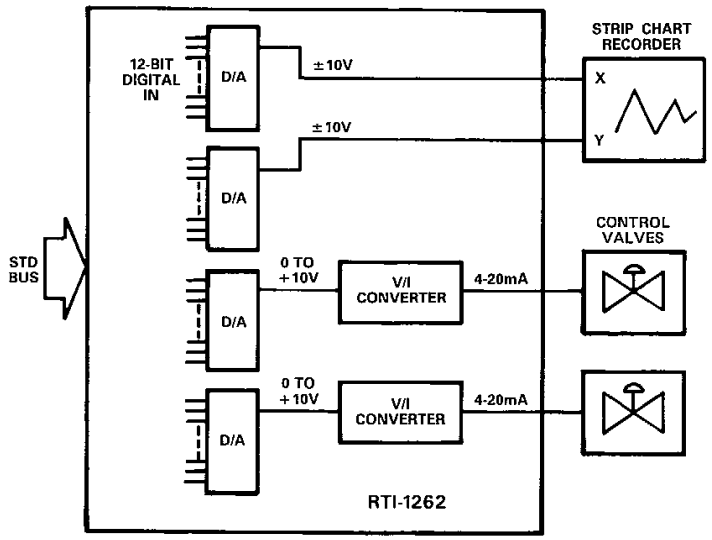


Figure 1. Analog Output Application

GENERAL DESCRIPTION

RTI-1260 ANALOG INPUT CARD

The RTI-1260 is used to acquire analog signals and present them to the microcomputer in a digital form. The data acquisition section consists of a multiplexer, a programmable gain instrumentation amplifier, a sample-hold circuit, a 12-bit A/D converter. Associated interface logic for transferring the resultant digital signal to the bus. This basic architecture is shown in Figure 2.

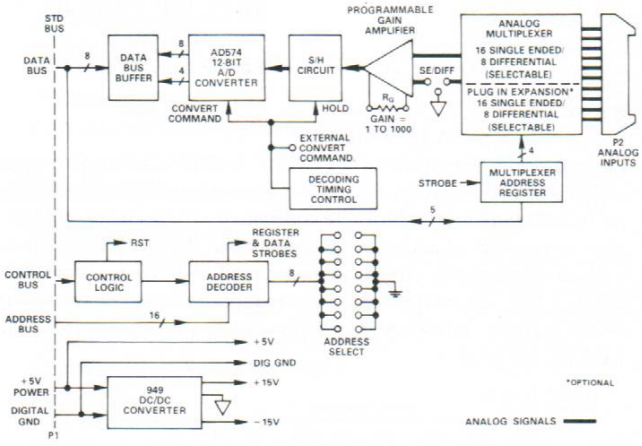


Figure 2. RTI-1260 Block Diagram

Multiplexer

The card has 16 analog inputs which are multiplexed, one at a time or as a pair to the input of the programmable gain amplifier. There are three multiplexer input configurations: *single-ended*, *differential* and *pseudo-differential*. In the *single-ended mode*, sixteen separate analog signals may be randomly selected with reference to a common ground. For noisier environments, the *differential method* can be used to reduce the effects of noise and bias current. This mode reduces the channel capacity to 8 inputs. The *pseudo-differential mode* takes advantage of differential inputs and provides a full 16 channel input capacity. It is necessary for all input signals to have a common reference point. The multiplexers used on the RTI-1260 are dielectrically isolated and can handle signals up to ±35V without damage. For applications requiring input protection, isolation and sensor excitation, we recommend the use of the RTI-1270 Sensor Based Data Acquisition Subsystem or the 3B Signal Conditioning I/O Subsystem.

Channel Expansion

The channel capacity on the RTI-1260 can be *doubled* by ordering the Multiplexer Expansion Kit (P/N OA10). This kit contains two multiplexer ICs which plug into on-board sockets.

Programmable Gain Amplifier (PGA)

The outputs of the multiplexer are connected to a programmable gain amplifier where the gain can be set to between 1V/V and 1000V/V, depending on the value of the user installed programming resistor. By using the equation

$$G = 1 + \frac{20 \text{ kilohms}}{Rg}$$

the value of the programming resistor can be determined for any gain. Thus for a gain of 10, a 2222Ω resistor, with very low temperature coefficient (+25ppm°C) would be used. In addition to signal amplification, the PGA also provides: high input impedance (10MΩ) and common mode signal rejection (78dB) when used in the differential configuration.

Sample-Hold Circuit (S/H)

The output of the PGA is connected to the sample-hold circuit which "freezes" the analog input voltage while the A/D converter is performing a conversion. This prevents the voltage from varying while the conversion is taking place.

Analog/Digital Converter (A/D)

The RTI-1260 contains a fast, 12-bit, successive approximation, A/D converter (AD574). Jumper selectable input ranges of 0 to +10V and ±10V used in conjunction with the programmable gain amplifier allows for a full scale input range as low as +10mV. The digital output of the A/D can represent the analog input voltage using either binary, offset binary, or 2's complement coding.

Power Supply (dc/dc)

The STD bus +5V supply is all that is required to power the RTI-1260 card. An on-board dc/dc converter is supplied with each card to convert the +5V bus supply to a low noise, isolated ±15V supply required by the analog circuitry.

RTI-1262 ANALOG OUTPUT CARD

The RTI-1262 is used to take a digital word from the microcomputer and convert it into an analog signal (voltage or current). As shown in Figure 3, the design consists of digital registers which store the 12-bit digital words, four 12-bit D/A converters, two option 4-20mA converters and associated interface logic to interface to the bus.

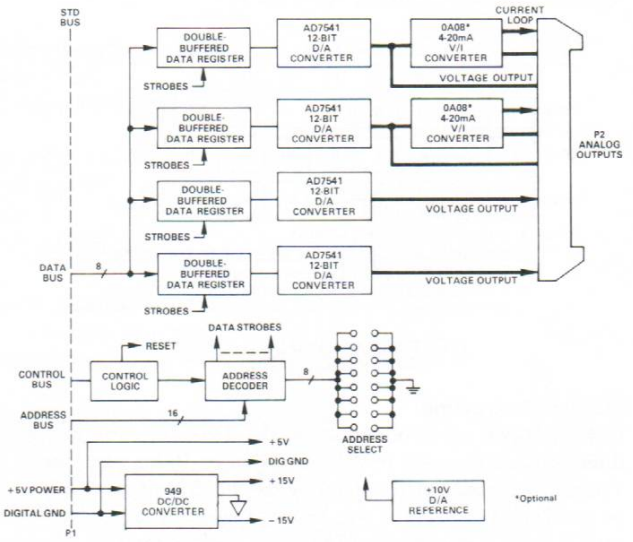


Figure 3. RTI-1262 Block Diagram

D/A Registers

The D/A converter inputs are software driven via double buffered storage registers which allow two bytes of data to be loaded simultaneously into the D/A converter so that the output changes directly from one 12-bit value to another. These registers "memorize" the 12-bit digital word and keeps the D/A converter output constant until updated with a new value.

Digital/Analog Converter (D/A)

The RTI-1262 contains four CMOS 12-bit D/A converters (AD7541). Each D/A output can be independently selected. The user has four output voltage ranges from which to select. The 12-bits of resolution provide least significant bit values down to 1.22mV for a 0 to +5V output range.

Current Output (V/I)

It is often desirable to transmit an analog signal as a current rather than a voltage since noise and IR drops in the cable and connectors will not degrade the accurcy of a current signal.

Two of the four voltage outputs can be converted to a 4-20mA current loop output. These voltage-to-current modules (ADI

P/N OA08) meet all requirements of the ISA-S50.1 Standard for Type 3, Class L, nonisolated 4-20mA current loop transmitters which makes them ideal for use in process and control applications. A user supplied +16V to +30V supply is required to power this loop.

Power Supply (dc/dc)

The STD bus +5V supply is all that is required to power the RTI-1262. An on-board dc/dc converter is supplied with each card to convert the +5V bus supply to a low noise, isolated ±15V required by the analog circuitry.

RTI-1260

Memory Mapped Addressing

In the memory map mode of operation, the RTI-1260 card occupies consecutive bytes of memory. The address is determined by on-board jumpers which can be configured to any one of 256 locations in the 64K of address space. Since the RTI card is treated as a block of memory, simple memory read and write instructions (STA, LDA) can be used. Memory mapping allows one to use any of the memory reference instructions in the repertoire (SHLD, LHLD, MOV M, r).

BYTE ADDR.	DATA FORMAT D7	D6	D5	D4	D3	D2	D1	D0	FUNCTION	OPER.
XFYB	ϕ	ϕ	ϕ	M_4	M_3	M_2	M_1	M_0	MUX ADDR/ CONV	WRITE
XFYC	B_7	B_6	B_5	B_4	B_3	B_2	B_1	LSB	A/D DATA LO	READ
XFYD	BUSY	0 MSB	0 MSB	0 MSB	MSB MSB	B_{10}	B_9	B_8	A/D DATA HI	READ

NOTES: 1. X AND Y ARE USER SELECTABLE.
2. BITS SHOWN AS ⊟ HAVE THE UPPER VALUE FOR UNIPOLAR CODES AND LOWER VALUE FOR 2's COMPLEMENT.
3. THE SYMBOL ϕ MEANS THE BIT IS IGNORED.
4. BUSY BIT EQUALS "1" DURING CONVERSIONS AND "0" WHEN DONE.

RTI-1260 Memory/Port Map

I/O Port Addressing

In the I/O port mode of operation, the RTI-1260 card occupies three consecutive ports in either an 8-bit or 16-bit port image. The port address is determined by on-board jumpers which can be configured to begin at any 16 port boundary. Since the RTI card is treated as a group of I/O ports, simple input and output instructions (INP, OUT) can be used. Port addressing eliminates the need to allocate memory when interfacing to the STD Bus.

MUX ADDRESS/CONV BYTE

Any random input channel can be selected by writing the channel address code into the MUX ADDR/CONV BYTE. This write command also triggers a timer which automatically sets the S/H into the hold mode and starts the A/D conversion once the input signal has settled. This A/D conversion can also be initiated via an external control line.

A/D DATA LO BYTE

The 8 lowest order bits of the A/D are available at this address.

A/D DATA HI BYTE

The 4 highest order bits of the A/D are available at the address. In addition the STATUS bit provides the status of the A/D converter. A logic "0" indicates that the conversion is complete and the A/D data is now ready to be read.

Example

This example uses 8085 assembly language to address channel 1, do an A/D conversion and store 12 bits of A/D data in register pair B and C. Base address has been set at FFFB.

```
        LXI   H,FFFB
        MVI   M,ϕ1          SELECT MUX ADDRESS
        LXI   H,FFFD
LOOP    MOV   A,M
        RLC
        JC    LOOP          TEST BUSY BIT
        MOV   B,M           READ ADC DATA HI
        DEC   H
        MOV   C,M           READ ADC DATA LO
```

RTI-1262

Memory Mapped Addressing

In the memory map mode of operation, the RTI-1262 card occupies eight consecutive bytes of memory. The address is determined by on-board jumpers which can be configured to any one of 256 locations in the 64K of address space. Since the RTI card is treated as a block of memory, simple memory read and write instructions (STA, LDA) can be used. Memory mapping allows one to use any of the memory reference instructions in the repertoire (SHLD, LHLD, MOV M, r).

BYTE ADDR.	DATA FORMAT D7	D6	D5	D4	D3	D2	D1	D0	FUNCTION	OPER.
XFY0	B_7	B_6	B_5	B_4	B_3	B_2	B_1	LSB	D/A DATA 0 LO	WRITE
XFY1	ϕ	ϕ	ϕ	ϕ	MSB	B_{10}	B_9	B_8	D/A DATA 0 HI	WRITE
XFY2	B_7	B_6	B_5	B_4	B_3	B_2	B_1	LSB	D/A DATA 1 LO	WRITE
XFY3	ϕ	ϕ	ϕ	ϕ	MSB	B_{10}	B_9	B_8	D/A DATA 1 HI	WRITE
XFY4	B_7	B_6	B_5	B_4	B_3	B_2	B_1	LSB	D/A DATA 2 LO	WRITE
XFY5	ϕ	ϕ	ϕ	ϕ	MSB	B_{10}	B_9	B_8	D/A DATA 2 HI	WRITE
XFY6	B_7	B_6	B_5	B_4	B_3	B_2	B_1	LSB	D/A DATA 3 LO	WRITE
XFY7	ϕ	ϕ	ϕ	ϕ	MSB	B_{10}	B_9	B_8	D/A DATA 3 HI	WRITE

NOTES: 1. X AND Y ARE USER SELECTABLE.
2. THE SYMBOL ϕ MEANS THE BIT IS IGNORED.

RTI-1262 Memory/Port Map

I/O Port Addressing

In the I/O port mode of operation, the RTI-1262 card occupies eight consecutive ports in either an 8-bit or 16-bit port image. The port address is determined by on-board jumpers which can be configured to begin at any 16 port boundary. Since the RTI card is treated as a group of I/O ports, simple input and output instructions (INP, OUT) can be used. Port addressing eliminates the need to allocate memory when interfacing to the bus.

D/A Bytes

Each D/A receives update information from the data written into the corrresponding D/A data registers.

Example

This example uses 8085 assembly language to set the output of DAC0 to +FS (1111 1111 1111). Base address has been set at FFF0.

```
LXI    H,OFFF    Loads H and L register with
                 0000 1111 1111 1111.
SHLD   FFF0      Stores contents of the L register
                 in memory location FFF0 and
                 it registers in FFF1.
```

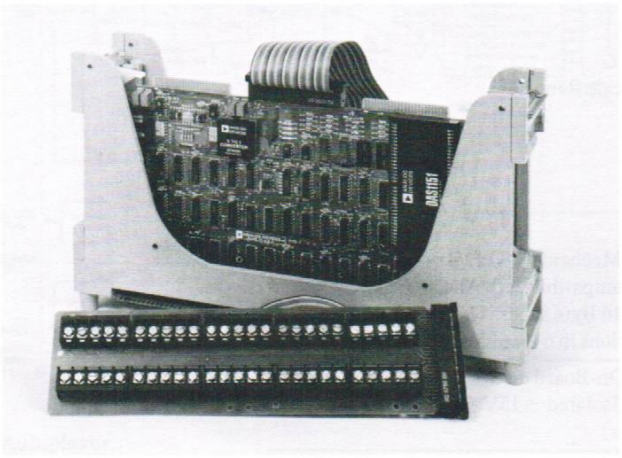
. . . OTHER STD BUS PRODUCTS FROM ANALOG DEVICES

RTI-1225
Low Cost, Analog Input/Output Card
16 Input Channels, 10-Bit A/D
2 Output Channels, 8-Bit D/A

RTI-1226
Low Cost, Analog Input Card
16 Input Channels, 10-Bit A/D

RTI-1270
Sensor Based Data Acquisition Subsystem optimized for temperature and low level signal measurements. Includes sensor signal conditioning (±1000V isolation), 16-channel analog multiplexing, 13-bit A/D conversion, data manipulation (cold junction compensation, linearization, conversion to engineering units) and maps as a contiguous block of memory onto the STD bus.

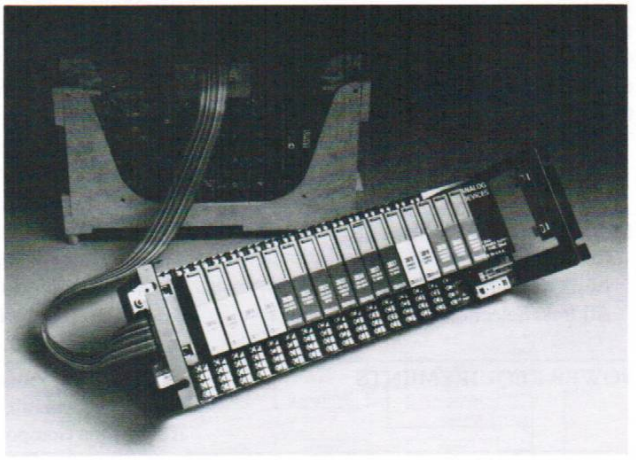
SCREW TERMINATION PANEL



FEATURES
Easily Interconnects Analog I/O Cards to Field Wiring
Barrier Strip Screw Terminals
Ribbon Cable Compatible to RTI Cards

GENERAL DESCRIPTION
The AC1585 Termination Panel is a printed circuit board which contains screw terminal connectors, provides a one-for-one connection to the RTI cards and comes complete with a 3′ ribbon cable which is compatible to analog connector on the RTI.

SIGNAL CONDITIONING I/O SUBSYSTEM



FEATURES
Complete Signal Conditioning Function
Wide Variety of Sensor Inputs
Thermocouples, RTDs, Strain Gage
High Level Output Compatible to RTI Cards
Provides High CMV Isolation and Input Protection

GENERAL DESCRIPTION
The 3B Series Signal Conditioning I/O Subsystem provides an easy and convenient solution to signal conditioning problems associated with connecting sensors to an analog card. It is designed to interface directly to sensor or analog signals such as thermocouples, RTDs, strain gages, millivolt or process currents and convert the inputs to high level analog outputs compatible to the RTI analog cards. Features include 220V rms input protection, isolation (±1500V), filtering low drift amplification and sensor excitation.

For more information call or write for 3B Series Data Sheet.

ORDERING GUIDE

ADI Model No.	Description	Used On
Cards		
RTI-1260	Analog Input Card	–
RTI-1262	Analog Output Card	–
Accessories		
OA08	V/I converter provides 4-20mA output from D/A. One required per channel.	RTI-1262 (2 max)
OA10	Multiplexer Expansion Kit expands channel capacity from 16SE/8D to 32SE/16D. One required per board.	RTI-1260
Mating Connectors		
AC1553	50-pin flat cable connector with 3′ color coded cable (Analog Input).	RTI-1260
AC1554	26-pin flat cable connector with 3′ color coded cable (Analog Output).	RTI-1262
AC1585-6	3B01 to RTI-1260	RTI-1260
AC1585-7	3B01 to RTI-1262	RTI-1262
Screw Termination Panel		
AC1585-1	Screw terminal connection to field wiring – includes 3 pt. of cable.	
AC1585-2	Screw terminal connection to field wiring – includes 3 pt. of cable.	
User's Manual*		
AC1563	User's Manual for RTI-1260/1262	

NOTE
*A user manual is furnished with each shipment. Additional copies are available under this part number.