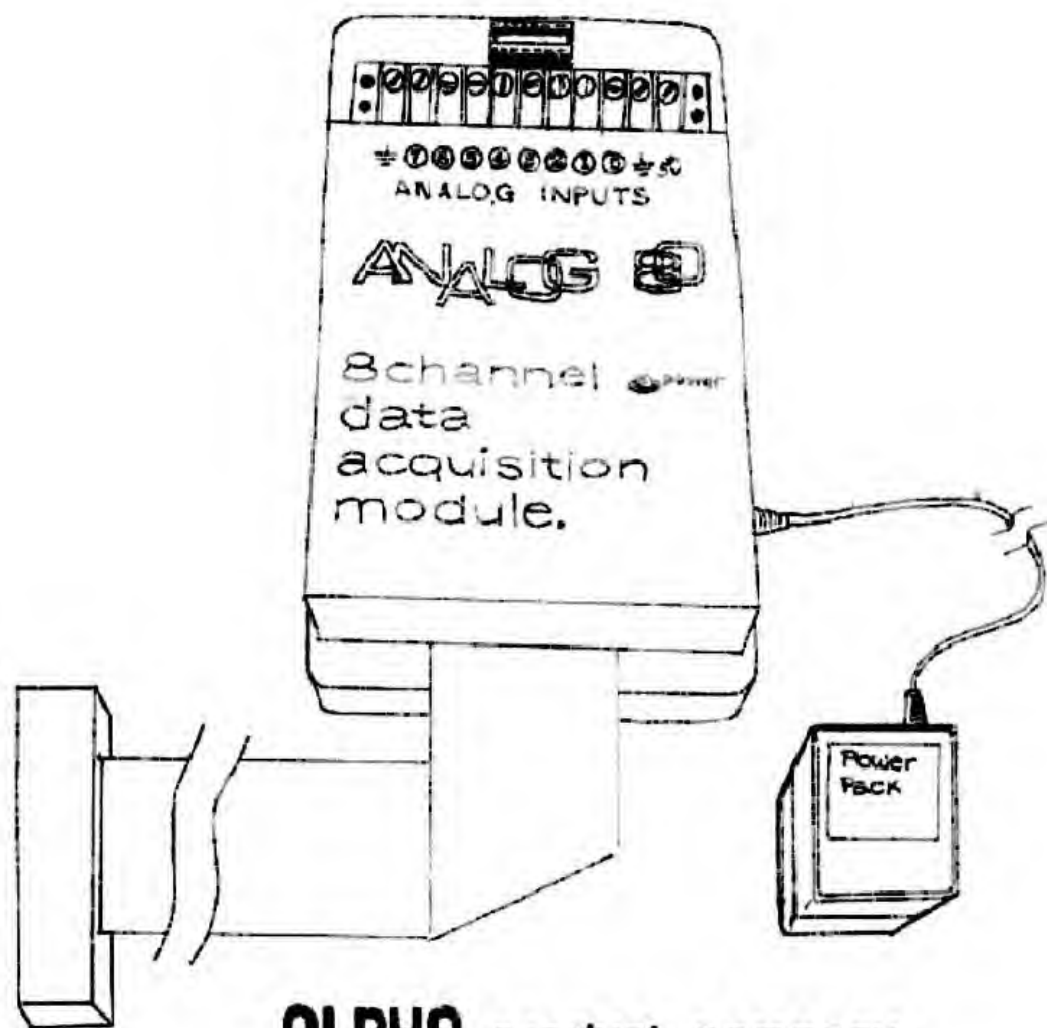


# A/D Converter For the TRS-80



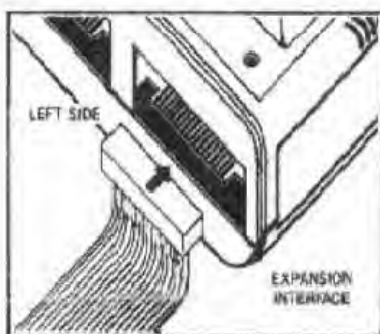
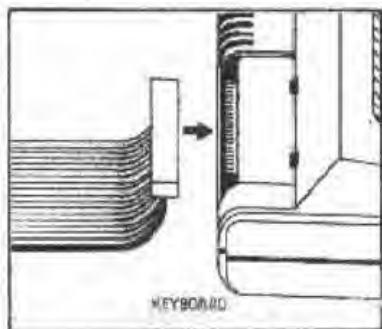
**ALPHA** product company

85-71, 79<sup>TH</sup> ST. WOODHAVEN N.Y. 11421 (212) 295-5916

## CONNECTION

Read carefully before making any connections.

1. Plug the power supply's mini-plug into to the mini-jack located on the right side of the Analog-80.
2. Locate the 40 pin edge connector on the left rear of the TES-80 keyboard. If you have an expansion interface, use the expansion connector on the left side panel to the right of the parallel printer port.
3. Plug the Analog 80's cable connector into the proper TES-80 connector as shown in the diagram. **MAKE SURE THAT THE RIBBON CABLE COMES OUT OF THE BOTTOM OF THE CONNECTOR.**

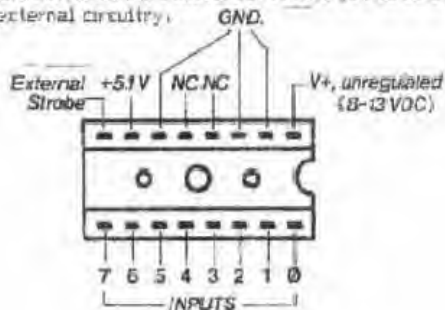


## ANALOG INPUTS

The eight inputs are labeled 0 through 7 on the terminal strip. All eight inputs are referenced to a common ground. For convenience there are two ground terminals. They are internally common. Each input has an internal RF filter for rejection of noise.

All inputs are preset for a voltage range of 0 to +5.10 volts. Be careful not to exceed the maximum input voltage on any input channel. There are provisions on the circuit board to add a resistor to any channel in order to obtain a higher voltage range. Each channel may be set for a different voltage range if desired.

The 5.10v reference is available (marked "5V" on terminal strip) and is useful for making ratio metric type readings. **DO NOT DRAW MORE THAN 10 mA** from this terminal. The Analog 80 also contains a 16-pin DIP socket containing all input channels as well as +5.10 v, GND, V+ unregulated and External Strobe connections. This socket allows for ready connection to front-end circuitry and solderless breadboards. It also provides a means of quick connect/disconnect to external circuitry.

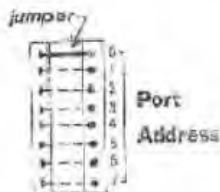


## PORT SELECTION

The operating "port address" of the AN-80 (Analog 80) is jumper selectable. It has been set to port 0 at the factory. Altering the port address is only necessary when more than one port operated device is being used on a TRS-80 system. Up to eight Analog 80's may be used on a single system by selecting a different port address for each unit and addressing each unit separately.

To change the port address, remove the top cover of the AN-80 and locate the 16-pin DIP socket on the left side of the circuit board. Select port # 0 through 7 by moving the single jumper to the desired position according to the diagram. Never put more than one jumper in the socket.

**IMPORTANT NOTE!** These instructions assume the AN-80 to be programmed to port # 0 as preset at the factory.



## ACCESSING THE ANALOG 80

Accessing the AN-80 is a two step process. The first step uses the BASIC "OUT port#, value" statement to tell the AN-80 which channel is to be read:

```
10 OUT 0,3
```

The 0 represents the port 0 that the AN-80 is jumper programmed to operate on. The 3 commands the AN-80 to select, read and convert channel # 3. When the OUT statement is executed, the AN-80 performs the A to D conversion and stores the resultant value in its buffer.

The next step is to read the result of the conversion with a BASIC "INP (port#)" statement:

```
20 A=INP(0) 'the variable A now holds the result  
30 PRINT A 'value of A is printed on screen
```

The process would be the same to read channel 5 except that line 10 would be changed to:

```
10 OUT 0,5
```

## INTERPRETING RESULTS

The Analog 80 uses an 8 bit A to D converter with a dynamic range of 0 to 255 counts. Since the full scale input is 5.10v, each count is equal to  $5.10 \text{ V} / 255$ , which is 20 mV per step. The AN-80 will always return a number between 0 (input grounded) and 255 (input connected to 5.10V reference). You can use division or multiplication to scale up or down to obtain any type of unit. In order to display the result directly in millivolts change line 30 to read:

```
30 PRINT A*20
```

The result of each conversion is stored temporarily in the AN-80's 8 bit latch or "buffer".

That value remains latched until a subsequent DUT statement updates the value. There is only one buffer for all eight channels; thus a read performed on channel 2 for example will clear the results of a previous read on channel 3. It is recommended that that results be stored immediately after reading. Use separate variables or an array to accumulate successive data.

### CALIBRATION

After approximately 6 months the AN-80 may require recalibration. Connect a calibrated digital volt meter (DVM) between the ground and +5V terminals. Remove the AN-80 cover and locate the small trimpot on the circuit board. Using the the DVM's 10 volt scale, adjust the trimpot for a voltage of 5.10V (5.08 to 5.13 is OK). Check this calibration every 6 months or so. No other type of calibration is necessary.

### EXTERNAL STROBE

Normally the computer controls the AN-80. In some cases however, it is advantageous to have an external device or signal tell the AN-80 when to take a reading. This may be accomplished by using the External Strobe input which is available on the 16-pin DIP socket. This line is pulled low internally with a 1K resistor. When a positive pulse (5V) is applied to the Ext. Strobe input, the falling edge (high to low transition) causes the AN-80 to perform a single reading and A to D conversion. Since the AN-80 always stores the last conversion in it's buffer, the result of that last reading is available to the TRS-80 and can be obtained via the A=INP(0) statement.

To test this feature, connect a normally open momentary type pushbutton between the Ext. Strobe and +5V terminals.

### TRIGGERED READINGS

It is sometimes useful to be able to trigger the computer so that it will begin taking readings on cue. The computer idles until the occurrence of some external event and then begins initializing and storing a single or series of readings. When readings are complete the computer resumes idling until the next triggering event.

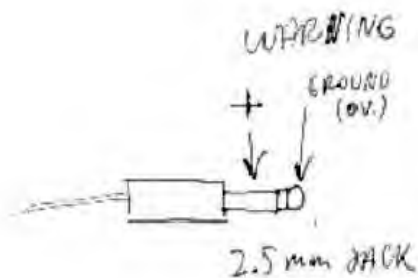
This can be easily accomplished by using one or more channels to monitor the status of the triggering device(s). A software loop would continually check any input channels that have been designated as triggering inputs. When the anticipated event occurs, the program branches to a routine that could, for example, load an array with the readings taken from various other channels. Data stored in the array can be analyzed at a later time.

### EXPANSION

Up to eight of these units may be used on a single TRS-80 thus providing as many as 64 independent analog inputs. Other devices such as our "Interfacer 80" can be used on the same system to allow a complete input/output control loop. Our "Expandabus" series of bus branching cables offers a convenient means of connecting multiple devices on the TRS-80 bus.

### LIMITED WARRANTY

The manufacturer warrants that the item furnished hereunder is free from defects in material and workmanship to perform to published specifications for a period of ninety (90) days from the date of original purchase. Under no circumstances will manufacturer be liable for special or consequential damages as a result of any alleged breach of this warranty provision. The liability of manufacturer hereunder shall be limited to replacing or repairing, at it's option, any defective units that are returned F.O.B. manufacturer's plant. Units or parts which have been subjected to abuse, misuse, alteration, neglect, or unauthorized repair are not covered by warranty.



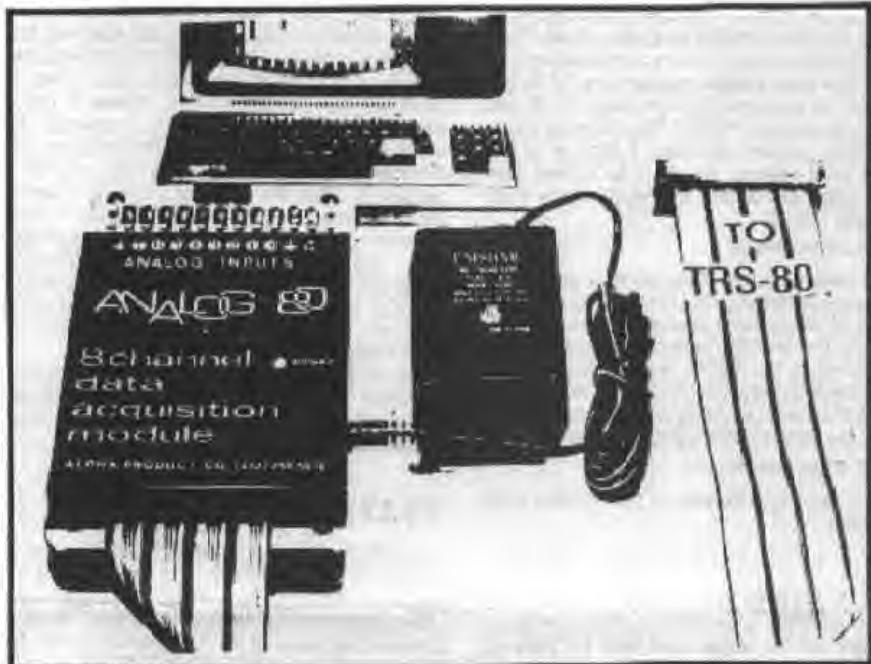
POWER : 9 to 12 Volts DC @ 350 mA

Thanks



# ANALOG 80

## 8 Channel Analog Input Module for the TRS-80



### 8 ANALOG INPUTS...

ANALOG 80 opens a wide range of application possibilities for the TRS-80 microcomputer. Eight input channels of 8-bit analog to digital (A to D) conversion are contained in a single plug-in module. Now you may measure or monitor up to eight separate varying inputs simultaneously. Accuracy, versatility, simplicity of programming, and great cost effectiveness are all features of the unique design of the ANALOG 80.

### ACCURATE...

Each of the eight individual inputs has a resolution of better than 0.5% (8 bits) with a sensitivity of 20 mV per step. This digital voltmeter type of accuracy and sensitivity is more than adequate for almost any application.

An extremely high input impedance of 20 megohms assures that the ANALOG 80 will have virtually no loading effect on what you are reading. Each channel has an RF filter for noise protection.

### VERSATILE...

Flexibility is a key feature. ANALOG 80 is capable of reading a wide range of voltages. It comes with all inputs set for a range of 0-5.10 volts, however, there are on-board provisions for adding a resistor to each channel so that higher voltage ranges can be selected. Each channel may be set for a different range, thus no limit on customized applications.

An on-board, calibrated +5.10 voltage reference is included to provide the proper source voltage for reading external variable resistances.

For applications requiring it, there are provisions for "external strobe" and "external trigger". This allows a reading to be taken on command of an external device or signal, an important capability.

### SIMPLE TO USE...

ANALOG 80 was designed specifically for the TRS-80. It plugs directly into any Model I (or into the Model III with our MOD III/I BUS CONVERTER) and is instantly ready for use.

 **ALPHA Products**

## USE BASIC...

A rate of 200 readings per second is attainable with very simple BASIC language programming so there is no need for machine language unless a very high sampling rate is required in your application.

Here is how truly simple programming is! In this example let us assume that the ANALOG 80 has been set to operate on PORT 0. The following single line of BASIC program will take a reading of the channel 1 input voltage, convert it to a three digit numerical value and display that value on the video screen of the TRS-80!

```
10 OUT 0,1 : PRINT INP(0)
```

OUT 0,1 commands the ANALOG 80 to select and read channel number one. The ANALOG 80 performs a fast (150 microseconds) analog to digital conversion, storing the resulting value in it's buffer. Then, INP(0) commands the TRS-80 to read the ANALOG 80 buffer contents and print the value on screen.

Reading channel 2 would be just as easily accomplished by the addition of this program line:

```
20 OUT 0,2 : PRINT INP(0)
```

Note that the only difference is OUT 0,1 has been changed to OUT 0,2.

## CONVENIENT...

All inputs are on screw terminals for ease of wiring. These connections are also provided on a 16 pin socket to allow for a quick connect and disconnect arrangement. A small plug-in power supply is included which connects to a jack located on the side of the ANALOG 80.

ANALOG 80 comes completely assembled, tested, and ready to use. Power supply, instructions and connector cable are included.

## SPECIFICATIONS...

|             |  |
|-------------|--|
| Inputs:     | 8 independent channels, all preset for 0-5.10 V range. Input Impedance: 20 Megohms.  |
| Resolution: | Better than 0.5% (8 bits), 256 steps @ 20mV ea.  |
| Speed:      | Conversion time: 150 microsec.   |
| Power:      | AC adaptor supplied: 117V,60Hz/9VDC, 100mA   |
| Port:       | Jumper selectable address  |
| Physical:   | 3 1/2" x 6" x 1 1/2" H, 1 lb. shipping wt.   |
| Connection: | 15' cable and connector are supplied. Connects directly to Model I TRS-80 edge connector located on rear of keyboard or to Expansion Interface (left side panel, right of printer port). For Model III TRS-80, a bus adaptor is required (Alpha Products MOD III/1 BUS CONVERTER). |
| Price:      | \$139.00 + \$2.50 shipping & handling. Model III users add \$39.95 for MOD III/1 BUS CONVERTER.  |

## APPLICATIONS...

The ANALOG 80 can measure voltage, current and resistance directly and therefore can be used as a multichannel, multifunction, digital metering device, replacing a host of digital voltohmm meters, digital panel meters, chart recorders, etc. Data from readings can be manipulated, stored in memory, monitored, displayed on screen, or printed, all by virtue of your TRS-80 system. With additional BASIC programming, create real-time bar graphs, line graphs, or other live graphics displays, to enhance your application. Very sophisticated multi-data monitoring systems can be readily implemented.

By adding various types of transducers, the ANALOG 80 is able to read much more. Anything that can be measured electrically can become data for your TRS-80, for example: temperature, light level, pressure, rotational position, etc.

The reliability of ANALOG 80 has been proven in hundreds of applications ranging from laboratory experiments to energy management systems to medical instrument interfacing.

## SYSTEM EXPANSION...

The Port address that ANALOG 80 operates on is jumper selectable allowing it to be used in conjunction with other TRS-80 accessories. Up to eight of these units may be used on a single TRS-80 thus providing as many as 64 independent inputs. Other devices such as our INTERFACER 80 can be used on the same system thus providing a complete input/output control loop. Our Expandabus series of bus extender cables offers a convenient means of connecting multiple devices on the TRS-80 bus.



**ALPHA Products**

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