

MICROLINK 304x
A-D Converter
User Manual

Biodata Limited

Manual Code: M3000-3.2

Issue Date: December 1998

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10 Stocks Street
Manchester
M8 8QG
Tel: 0161–834 6688
Fax: 0161–833 2190
Email: sales@microlink.co.uk
<http://www.microlink.co.uk/>

Analogue-to-Digital Converters

The 304x modules are a range of analogue-to-digital converters for use with the analogue input modules (305x and 306x). You don't need to make any connections to these modules. This chapter gives details of their specifications.

6.1 3040—12-Bit A-D Converter

The 3040 gives 12-bit analogue to digital conversion, dividing the input range into 4096 steps. The measured voltage is therefore known to within 0.025% of the full scale range. The 3040 can convert analogue voltages at speeds in excess of 50 000 samples per second. Most personal computers cannot continuously process incoming data at this sort of speed, so the sampling rate will normally be adequate for any applications where the data is to be processed as it is captured.

The 3040 is a successive approximation converter. It works by first comparing the input with a voltage which is half the input range, and keeping the half if the input is above the level. The converter then adds a quarter of the input voltage and compares again. Twelve such steps give 12-bit resolution.

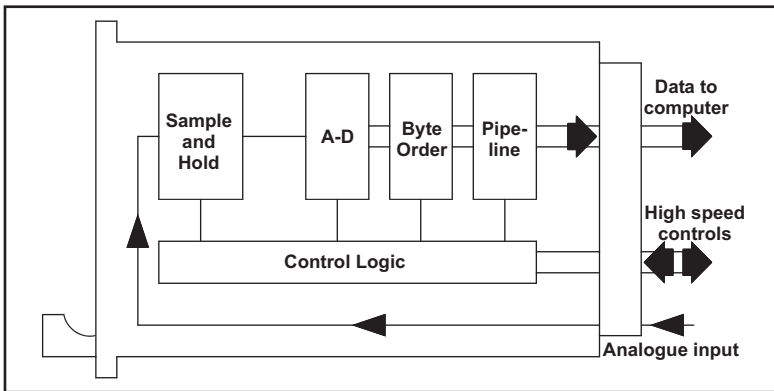


Figure 6.1 Successive Approximation A-D Converter

Conversion takes place in four stages.

1. The analogue signal is frozen in the sample and hold circuit.
2. The analogue signal is converted to a digital number.
3. The order in which the two bytes required for this number are sent to the computer is selected.
4. The two bytes are placed into a pipeline store. A pipeline store enables the A-D converter to do another conversion while the previous data is transferred to the computer.

6.2 3041—Buffered 12-Bit A-D Converter

The 3041 provides 12-bit A-D conversion with buffer storage. The buffer can hold up to 16 K samples (expandable in 16 K steps) and is used for uninterrupted streaming of analogue data to computer disk.

The 3041 is a successive approximation converter, like the 3030. The buffer replaces the pipeline store (see Figure 6.1). If the 3041 is used with the 3070 module, the computer can allow values to accumulate in the buffer and read them when it is convenient. This frees the computer from having to deal with the samples in real-time, allowing them to be processed in convenient batches without losing data.

6.3 3042—16-Bit A-D Converter

The 3042 gives 16-bit A-D conversion, dividing the full scale range into 64 K steps. The analogue input modules of the Microlink system all have adjustable gain ranges and so the 3042 is normally specified only when the signal to be captured has a very wide dynamic range, or the purpose of the measurement is to examine very small fluctuations in the value of a large DC signal.

The 16-bit number represents a signed integer, i.e. a number in the range -32768 to $+32767$. It makes sense then to use the analogue input modules selected for bipolar input ranges so that 0 V gives a 0 A-D reading. Don't use the higher gain ranges of the analogue input modules with the 3042, because it will then attempt to resolve the internal noise of the amplifier, giving fluctuating readings.

The 3042 is a successive approximation converter.

6.4 3043—Buffered 16-Bit A-D Converter

The 3043 is similar to the 3041 in that it is a buffered A-D converter. It has greater resolution however, being a 16-bit converter, like the 3042.

6.5 3044 and 3045—Integrating A-D Converters

The 3044 and 3045 use a dual slope integrating converter, which means the modules are suitable for relatively slow sampling. The 3044 has 13-bit resolution and a throughput of up to 12.5 samples per second. The 3045 has 16-bit resolution and a throughput of up to 40 samples per second. Each sample is based on an integration of the signal over a period of 20 msec. This covers one complete 50 Hz cycle, so the 3044 and 3045 are particularly useful when signals are contaminated with mains (or line) frequency pick-up, or higher frequency noise. They are ideal for slow data logging from transducers such as thermocouples, or in electrically noisy environments.

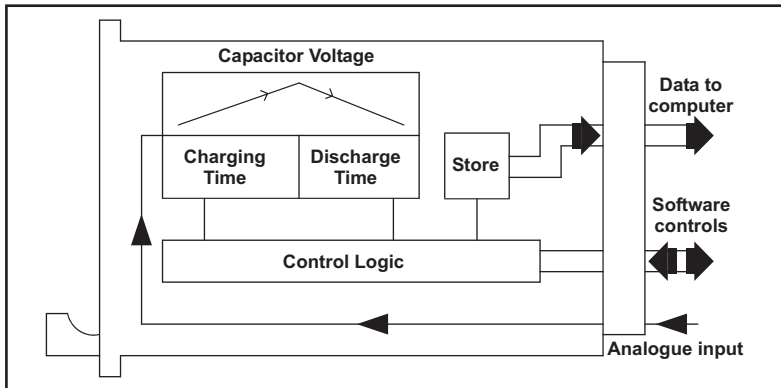


Figure 6.2 Dual Slope Integrating Converter

Conversion takes place in three stages:

1. A capacitor is charged at a rate proportional to the input signal voltage for 20 milliseconds.
2. The capacitor is then allowed to discharge at a fixed rate and the time to fully discharge the capacitor is measured. This time is a measure of the integrated input voltage.

3. The value of the measured time is placed in store ready to be transferred to the computer.

6.6 304x Specifications

6.6.1 3040 and 3041 Specifications

Resolution	12-bit
Samples per second	50 000
Maximum linearity error	$\pm 0.025\%$
Sample and hold acquisition time	$< 1 \mu\text{sec}$
Conversion time	$5 \mu\text{sec}$
FIFO buffer memory size	16 K (3041 only)

6.6.2 3042 and 3043 Specifications

Resolution	16-bit
Samples per second	40 000
Maximum linearity error	$\pm 0.006\%$
Sample and hold acquisition time	$< 10 \mu\text{sec}$
Conversion time	$15 \mu\text{sec}$
FIFO buffer memory size	16 K (3043 only)

6.6.3 3044 Specifications

Resolution	13-bit
Samples per second	12.5
Maximum linearity error	$\pm 0.0122\%$
Conversion time	80 msec

6.6.4 3045 Specifications

Resolution	16-bit
Samples per second	40
Maximum linearity error	$\pm 0.002\%$
Conversion time	23 msec

