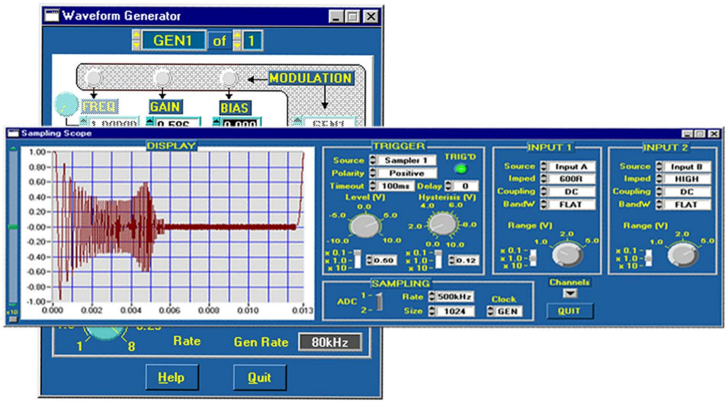
ATE

4200 Series Analogue Functional Card



The Analog Functional Card is designed to extend the test capability of the 4200 series range of advanced manufacturing test systems

- Sampling Oscilloscope
- Arbitrary Waveform Generator
- Frequency Measurement
- Graphical Signal Routing

The need to overcome test access issues and the desire to constantly extend fault coverage are re-occurring issues within the arena of in-circuit testing. Although an element of functional testing can overcome these issues, there has always been a downside as the tests can take too long to write and commission.

The ever-decreasing size of printed circuit boards means that competition for real estate becomes more keenly fought, with the test engineer's access pad often becoming a casualty. Consequently, more and more has to be achieved through fewer and fewer access points. By treating the board as a number of functional clusters, groups of components can be tested as unique entities. Additionally, these functional tests give a greater degree of confidence than that obtained by testing each individual component in turn.

The 4200 Series Analog Functional Card has been designed to allow the test engineer to quickly and efficiently invoke functional cluster tests. A full graphical user interface is provided, including a virtual digital storage oscilloscope. This approach presents a familiar and well-proven interface in order to quickly develop functional code without the need to climb an excessive learning curve.

Typical Usage

A typical scenario for the use of the Analog Functional Card would be a simple transistor based amplifier circuit. After board power-up the waveform generator would be used to inject a range of signals into the amplifier. The sampling voltmeter, using a predetermined envelope, would then analyse the results against the requirement specification. All of the test programming would be performed using the mouse driven graphics to achieve the highest level of fault coverage in the shortest possible time.

The Analog Functional Card requires a single slot in the 4200 Series interface rack. The necessary software is provided as an element of the standard system build for PC controlled testers.

On-line help in addition to normal written manual coverage covers all aspects of the software.

Arbitrary Waveform Generator (ARB)

The ARB is made up of 4 waveform generators each capable of using a range of standard waveform types, external signals and a wavetable synthesis capability.

There are 6 standard waveforms, sine, square, triangular, ramp up, ramp down and DC. Where appropriate, signal parameters including gain, frequency and phase can be varied via the graphical user interface.

The ability to take and manipulate an external waveform is particularly useful when reference signals need to be supplied to the unit under test. When this approach is necessary, and no external signal is available, the arbitrary wavetable capability can be used.

The output stage of the ARB allows routing directly to a DAC for signal application or directly into one of the remaining generators for use as a modulator. This approach allows the use of frequency, amplitude and offset modulation.

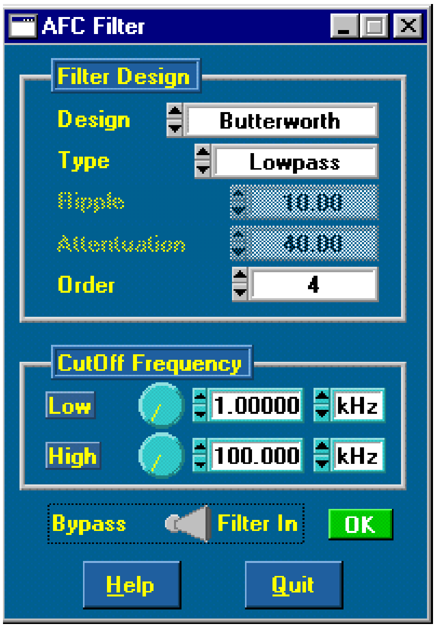


Figure 2 - Digital Filter Selection

Sampling Voltmeter

With a maximum sampling rate of 40 MHz, the dual channel sampling voltmeter can be triggered from a range of internal and external events. Once sampled, a range of graphical options can be used to post-process and analyse the captured signal.

The filter control panel implements a general-purpose digital filter that processes the captured data. A range of filter designs are available, such as Butterworth and Chebyshev, combined with the ability to specify types such as high and low pass.

The necessary cut-off frequency can be selected either digitally or using mouse driven buttons.

To perform frequency domain analysis of the sampled waveform an FFT capability is provided. This powerful option performs the necessary time to frequency domain transform and presents the data in a graphical manner.

A simpler, but no less useful capability, is the DMM display. Designed to auto range, this element displays DC voltages, AC RMS and pk-to-pk values, frequency and total harmonic distortion figures.

Where a particular signal is displayed using the sample and FFT screens, it is often useful to define a waveform envelope to enable a go/no-go test to be performed. Graphical in nature, the comparator allows envelopes to be visually set and stored for use in production test. Measurement cursors can be placed graphically on a captured waveform and various measurements made between them. This allows simple measurements to be quickly taken on complex waveforms.

Signal Routing

Signals can be routed to and from the AFC using a graphical ‘patch bay’ tool. Depending on the nature of the signal in question, options exist to route signals directly from the AFC to the fixture or via the analog bus running through the system backplane. The graphical tool enables choices to be made by the click of a mouse button as tests are quickly configured.

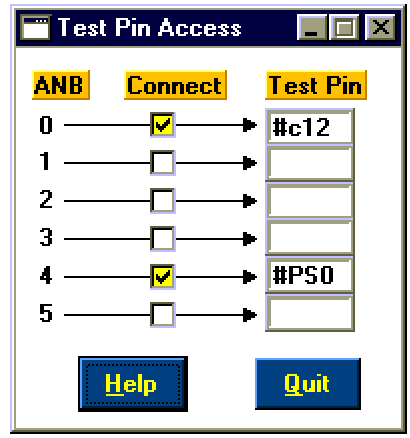


Figure 5 - Signal Routing Display

SAMPLER SPECIFICATION

Crystal Accuracy

Accuracy

80 MHz + 100 ppm

The sampler and generator “rates” are produced from the 80 MHz crystal.

Sampler Timebase

ADC1 - 5 kHz to 40 MHz in 1:1, 2, or 5 ratios generated from the 80 MHz crystal)

ADC2 - 5 kHz to 10 MHz in 1:1, 2, or 5 ratios generated from the 80 MHz crystal)

The reference clock can be switched between the 80 MHz crystal and an external source (sampler only) then divided as per the 80 MHz crystal.

Sampler RAM

Maximum sampler length is 16 K

Sampler Triggering

The sampler can be triggered in a number of ways:

a) immediate

b) level triggered from ADC1

c) level triggered from ACD2

d) independently through channel C

Level Trigger Resolution Hysterisis

Dynamic range of input/255 up to the dynamic range of the input (depends on trigger level).

ADC 1

*Routed from the fixture interface, the internal analog buses, or the rear access SMB connectors to the ADC1. Routed through a filter of none, 1 MHz, 500 kHz, 100 kHz or 50 kHz and via an amplifier with a selection of ranges between *1 and *50 with a 1:1, 2, or, 5 ratio.*

(The 1 MHz and 500 kHz 5th order elliptic with 5% bandpass ripple & 60 dB stopband attenuation, 100 kHz & 10 kHz 4th order Butterworth)

DC Characteristics

Gain

Basic:

+/- 0.5 % of reading

With filter or 500 mV, 200 mV, or 100 mV range:

+/- 0.2 %

Offset

Basic:

+/-0.4 % FSD +/- 1 mV

With filter or 500 mV, 200 mV, or 100 mV range:

+/- 0.6 % FSD

Noise

+/-0.2 % FSD +/- 1 mV

AC Characteristics

Bandwidth

20 MHz into 50 R

Slew Rate

400 V/us

ADC 2

*Routed from the fixture interface, the internal analog buses, or the rear access SMB connectors to the ADC2. Routed through a filter of none, 1 MHz, 500 kHz, 100 kHz or 50 kHz and via an amplifier with a selection of ranges between *1 and *50 with a 1:1, 2, or 5 ratio.*

(The 1 MHz and 500 kHz 5th order elliptic with 5 % bandpass ripple & 60 dB stopband attenuation, 100 kHz & 10 kHz 4th order Butterworth).

DC Characteristics

GAIN

Basic:

+/- 0.4 % reading

With filter or 500 mV, 200 mV, or 100 mV range:

+/- 0.2 %

OFFSET

Basic:

+/-0.1 % FSD +/- 1 mV

With filter or 500 mV, 200 mV, or 100 mV range:

+/- 0.7 % FSD

NOISE

+/- 0.1 % FSD +/- 1 mV

AC Characteristics

Bandwidth

10 MHz into 50 R

Slew Rate

400 V/us

Input Channel A, B or C

Channels A & B are identical input channels that connect via a relay array to ADC1 and ADC2. (channel D = A-B)

*Each channel (A & B) has isolation, AC/DC selection (1 uF decoupling), termination impedance and protection. Input is between +/- 5 V with an ADC gain of *1 (see ADC1 & 2 above)*

Termination

600 R +/- 6 %

50 R +/- 6 %

Input Channel C

*Input attenuator of 1, 2, 4 and 10. The output can be routed to ADC1, ADC2, ADC3_TRIGGER directly or via a comparator / divider circuit. The input has isolation, AC/DC selection (1 uF decoupling), termination impedance and protection. Input is between +/- 5 V with an ADC gain of *1 (see ADC1 & 2 above)*

Termination

1 MR +/- 6 %

600 R +/- 6 %

50 R +/- 6 %

Attenuator

(Divide by 1, 2, 4 & 10) +/- 10 %

Comparator

Conditions an input signal by converting it to a digital signal and divides the result. (Used for example to process a signal in order to measure its frequency - see Frequency Measurement accuracy.)

Trigger level

*From Generator channel D. ("D voltage" * Attenuator gain)*

FREQUENCY DIVIDER

/16

DIVIDER HYSTERESIS

HI for low frequencies and

LO for high frequencies

Input/Output Protection

Sampler Protection

Sampler inputs A & B

+/- 15 V

(Inputs exceeding 200 mA are "thermistor fuse" protected.)

Sampler input C

+/- 50 V

(Inputs exceeding 200 mA are "thermistor fuse" protected.) Repeatedly tripping the "thermistor fuse" may damage the terminators.

Sampler I/O triggers and strobes

TTL 5 V logic outputs with 121 R and inputs with a 10 kR series resistance. Inputs are tied high with a 10 kR resistor.

GENERATOR SPECIFICATION

Generator Rate

The rate is dependent on the software (see DSP generators)

Generator timebase

Software generated

DAC A & B

12 bit DAC +/- 5.12 V output optimised for AC waveform generation

These are outputs routed to the fixture interface, the internal analog bus and the rear SMB connectors.

They may be routed through:

- *-a (4th order Butterworth) filter of none, 100 kHz, 10 kHz, 1 kHz or 100 Hz*
- *a summer*
- *an attenuator*
- *a buffer*

The accuracy of the summer, attenuator or the buffer is in addition to that given below.

DC Characteristics

Gain

Basic:

+/- 0.4 % reading

OFFSET

Basic:

+/- 0.6 % FSD +/- 1 mV

Basic + No filter:

+/- 0.3 % FSD

Basic + 100 kHz filter:

+/- 0.35 % FSD

Basic + 10 kHz filter:

+/- 1.2 % FSD

Basic + 1 kHz filter:

+/- 0.45 % FSD

Basic +100 Hz filter:

+/- 5 % FSD

NOISE

+/- 5 mV

OUTPUT TERMINATION

600 R +/- 6 %

50 R +/- 6 %

Slew Rate

100 V/uS

DAC C & D

12 bit DAC +/- 5.12 V output optimised for DC accuracy

These are outputs routed to the fixture interface, the internal analog bus and the rear SMB connectors.

They may be routed through:

- *a summer*
- *an attenuator*
- *a buffer*

The accuracy of the summer, attenuator or the buffer is in addition to that given below.

DC ACCURACY

GAIN

+/- 0.4 % Reading

OFFSET

+/- .1 % FSD +/- 1 mV

NOISE

+/- 5 mV

OUTPUT TERMINATION

600 R +/- 6 %

50 R +/- 6 %

GEN ATTENUATOR

Can be selected to attenuate a signal from DACA, B, C, D and the summer.

A signal routed through the attenuator reduces the signal by /2, /4, /10, /20, /40, /100, /200, /400, /1000

ACCURACY

+/- 10 %

OUTPUT TERMINATION

600 R +/- 6 %

50 R +/- 6 %

GEN BUFFER

Can be selected to buffer (non-inverting) the signal from DACA, B, C, D, the Attenuator or the Summer. It has AC/DC selection (1 uF decoupling), output impedance selection and protection

ACCURACY

+/- 2 %

OFFSET

+/- 10 mV

OUTPUT TERMINATION

600 R +/- 6 %

50 R +/- 6 %

Lo < 5 R

GEN. SUMMER

Can be selected to add the signals from DACA, B, C, D and an external input. It has AC/DC selection (1uF decoupling), output impedance selection and protection.

Accuracy

+/- 2 %

Offset

+/- 10 mV

Output Termination

600 R +/- 6 %

50 R +/- 6 %

Lo < 5 R

Frequency Measurement

The range and accuracy depends on the software technique used; the number of cycles processed; and the coherence of the 80 MHz reference and the signal being measured.

Typical Accuracy

2.44 Hz to 16 MHz - 0.01 %

10 MHz to 100 MHz - 0.1 %

Input Output Protection

Generator Protection

Channel IA, IB, IC, ID, the buffer, summer and attenuator outputs all emerge from channel A, B, C and D, which themselves come from the fixture interface, internal analog bus (ANB) or the rear SMB connectors.

Channel IA, IB, IC, ID, the buffer and summer outputs

+/-15 V

The buffer and summer "low" output is diode limited and "thermistor fuse" protected.

Attenuator Input and Output

+/- 5 V

The attenuator input and output are diode limited and "thermistor fuse" protected.

Input and Output triggers

TTL 5 V logic outputs with 121 R and inputs with a 10 kR series resistance. Inputs are tied high with a 10 kR resistor.

Reference Output

0 to + 5.12 V

The Reference Output is diode limited and "thermistor fuse" protected.

Summer Input

+/- 5.12 V

The Summer input is diode limited and "thermistor fuse" protected.

Multiplier Input

0 to + 5.12 V

The Multiplier Input is diode limited and "thermistor fuse" protected.

Environmental

Safety

Designed to comply with EN61010 -:1993 / IEC1010-1:1990, for class 1, and are for use in a pollution degree 2 environment when installed in a 42XX series system.

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