

We claim:

1. A measurement system comprising:
 - a gain chain configured to amplify an analog input signal;
 - a range selector configured to select a gain between the analog input signal and a plurality of analog-to-digital converter (ADC) outputs from a plurality of ADCs, wherein each ADC output has a path, and a gain of each output path is made up of a plurality of gain stages in the gain chain; and
 - a mixer configured to combine the plurality of ADC outputs into a single mixed output.
2. The system of claim 1, wherein:
 - the plurality of ADCs comprises a first ADC and a second ADC; and
 - the combining the plurality of ADC outputs is performed in accordance to:
$$\text{mixed output} = \alpha E_{\text{first}} + (1 - \alpha) E_{\text{second}}$$
where:
 - E_{first} is the output of the first ADC;
 - E_{second} is the output of the second ADC; and
 - α is a mixing parameter that varies from one to zero.
3. The system of any one of claims 1 and 2 comprising two or more ADCs.
4. The system of any one of claims 1-3, wherein at least one of:
 - a first portion of the gain chain is connected to a first one of the plurality of ADCs and a second portion of the gain chain is connected to a second one of the plurality of ADCs; and
 - the plurality of ADCs comprises at least two types of ADCs.
5. The system of claim 4, wherein the range selector selects a gain for the first one of the plurality of ADCs from the first portion of the gain chain and selects a gain for the second one of the plurality of ADCs from the second portion of the gain chain.

6. The system of any one of claims 1-5, wherein each of the gain stages in the gain chain is connected to each of the plurality of ADCs via one or more switch banks.
7. The system of claim 6, wherein the range selector selects a first portion of the shared gain stages for a first one of the plurality of ADCs and a second portion of the shared gain stages for a second one of the plurality of ADCs by setting switches in the one or more switch banks.
8. The system of claim 6, wherein the range selector comprises a first and second multiplexer and,
 wherein the first multiplexer selects the first portion of the shared gain stages; and the second multiplexer selects the second portion of the shared gain stages.
9. The system of claim 8, wherein selection of the first portion of the shared gain stages comprises configuring a gain for the first one of the plurality of ADCs and selection of the second portion of the shared gain stages comprises configuring a gain for the second one of the plurality of ADCs.
10. The system of claim 9, wherein the configuring a gain for the first and second one of the plurality of ADCs comprises configuring the gains according to at least one range of the input signal.
11. The system of any one of claims 1-10, wherein the mixer is configured to:
 when the input signal is in a first range, select an output from a first ADC as the single mixed output;
 when the input signal is in a second range, select an output from a second ADC as the single mixed output; and
 when the input signal is in between the first and second ranges, select a mix of the outputs from the first and second ADCs as the single mixed output.

12. The system of claim 11, wherein the system:
 - maintains the second ADC online during a first transition period when the input signal is in the first range; and
 - maintains the first ADC online during a second period when the input signal is in the second range.
13. The system of claim 12, wherein the range selector is configured to configure a gain for at least one of the first ADC and second ADC based on an anticipated range of the input signal.
14. The system of claim 12, wherein, during a hysteresis period, the system:
 - maintains the first ADC offline;
 - maintains the second ADC online; and
 - maintains a gain of the second ADC constant.
15. The system of claim 14, wherein the hysteresis period is between the first transition period and the second transition period.
16. The system of any one of claims 1-15, wherein the plurality of ADC output paths comprises:
 - two ADC output paths that can independently be configured into a high range and a low range path;
 - the low range path having a first gain for converting the analog input signal;
 - the high range path having a second gain for converting the analog input signal, the second gain being lower than the first gain;
 - a mixing device configured to combine an output of the lower range with an output of the higher range; and
 - a device configured to vary an amount of gain combined from the low range path and the high range path.

17. The system of claim 16, wherein the high range path is connected to a first gain chain and the low range path is connected to a second gain chain.
18. The system of claim 16, further comprising a selector to select gain stages of the first gain chain for the first gain and to select gain stages of the second gain chain for the second gain.
19. The system of claim 16, wherein each of the first and second gains comprises gain stages in a gain chain common to the low range path and the high range path.
20. The system of any one of claims 1-19, wherein:

the gain of each output path is substantially the same; and
the mixer averages the outputs from each path to reduce noise in the single output.
21. A method comprising:

amplifying an analog input signal using a gain chain;
selecting a gain between the analog input signal and a plurality of analog-to-digital converter (ADC) outputs from a plurality of ADCs, wherein each ADC output has a path, and a gain of each output path is made up of gain stages in the gain chain; and
combining the plurality of ADC outputs into a single mixed output.
22. The method of claim 21, wherein a first portion of the gain chain is connected to a first one of the plurality of ADCs and a second portion of the gain chain is connected to a second one of the plurality of ADCs.
23. The method of any one of claims 21 and 22, wherein each of the gain stages in the gain chain is connected to each of the plurality of ADCs via one or more switch banks.
24. The method of any one of claims 21-23 further comprising:

configuring two ADC output paths independently into a high range and a low range path;

applying a first gain from the low range path to convert the analog input signal;

applying a second gain from the high range path to convert the analog input signal, the second gain being lower than the first gain;

combining an output of the lower range with an output of the higher range; and

varying an amount of gain combined from the high range path and the low range path.