What else can a combustion analyser do?

In accordance to the modern trend to multifunctional equipment, further features have been added to the flue gas analyser over the years. The first electronic combustion analysers split into two separate camps: There were the cheaper instruments with oxygen and carbon monoxide measurement. Often these devices only had one temperature sensor that was applied alternately to ambient air and flue gas. Then there were a range of very expensive flue gas analysers that measured a large number of components and provided some comfort for the operator in the form of extra features such as printers or external connections. There was very little in between.
Nowadays, even the smallest flue gas analyser boasts a printer connection and a RS232C interface. Graphic displays are very common, as are various methods to personalise the data output. Software for data analysis or for setting combustion analyser parameters is often supplied free of charge, at least as a limited version.
The main "extras" to be found on combustion analysers today are listed below:

1. **Graphics** – This is for most purposes unnecessary on the instrument itself. A tendency indication for finding the hottest part of the gas stream, for instance, can be useful, but graphics are best created with the results at a later date.
2. **Backlighting** – This is a matter of taste, but, if available, is very useful. Many screens are hard to read in direct sunlight and backlighting on a flue gas analyser will increase operator comfort dramatically. The only drawback is that it increases battery consumption markedly.
3. **Soot test** – An integrated soot test is offered by a few manufacturers and saves the bother of carrying an extra hand pump to every site. This is generally a useful option if available. In this way the soot number can be included in the results automatically, instead of being recorded separately. Such a combustion analyser is, however, only really interesting if a soot test is regularly needed. Someone testing mainly gas burners will find this unnecessary.
4. **Computer communication** – This is now often standard equipment, but is definitely an advantage on a flue gas analyser. In this way, a complete customer profile can be constructed and changes in the equipment that indicate possible defects can be caught in time. Many flue gas analysers use the computer communication to change basic settings, making this feature essential instead of simply desirable.
5. **Conversion of units** – There are different sets of units used to display the results from a combustion analyser depending on country and local standards. A flue gas analyser should be capable of displaying the results in the local units and possibly those used in neighbouring areas.
6. **Fuel choice** – Many flue gas analysers offer a wide choice of fuels for various applications. These are generally standard, but are part of the "extras" that have been added with time. These must be appropriate to the use intended and the flue gas analyser must conform with the local standards in the fuel parameters stored. Ideal is the ability to programme extra fuels.
7. **Flow measurement** – Some countries require that a combustion analyser measure flow velocity or total flow or that a separate instrument is used for this purpose. Flow can be measured using pitot tubes or vaned anemometers. Again, it depends on necessity. Total flow is a useful factor to know and combustion analysers with this feature can be acquired at a reasonable price. The range of measurable velocities should, however, be considered in advance.
8. **Peltier cooler** – This is useful when a flue gas analyser is used to measure soluble gases, or used for longer periods to measure wet gases. The cooler will dry the gases and hence protect the sensors in the flue gas analyser. This is particularly valuable for flue gas analysers fitted with infrared sensors, since it will prevent fogging of the optics. Applications where this is needed are particularly natural gas burners and biogas systems.

9. **Differential pressure –** Most combustion analysers are now fitted with a pressure sensor as standard. Differential pressure measurement is needed in certain cases instead of a single pressure tap. If the combustion analyser is to be used with a pitot tube for velocity measurement, then obviously a differential pressure connection is essential. For certain industrial applications it can be of value to measure the pressure drop across an obstruction such as a heat exchanger. Changes in this value will suggest either sooting or damage. It is much simpler if this can be carried out with the combustion analyser, which will be at the site anyway.
10. **Infrared sensors** – For certain components an infrared sensor will give a much more accurate result and certain flue gas analysers have the alternative available. In some countries, specific components must be measured using this technology. Carbon dioxide and methane are otherwise difficult to measure, and sulphur dioxide must often be measured using this technology. A flue gas analyser using such sensors will be much more expensive, but will give correct readings with no worries about cross sensitivities. Some other options may be required as mentioned above.
11. **Ambient carbon monoxide** – Today's houses are much less draughty than earlier buildings. This is naturally a fuel saving when heating, but allows leaky piping to cause a build-up of carbon monoxide in extreme cases. A combustion gas analyser can be equipped to measure this and the option is often available. Some countries require this measurement at every inspection and such combustion gas analysers will hence save costs in the long-run by covering both measurements. The accuracy is mostly sufficient for this use.
12. **Dilution system** – A number of manufacturers offer this system for use with high concentrations of gas. A flue gas analyser fitted with a dilution system will no, in my opinion, give acceptable results. Even where the flue gas analysers have been approved, there is every likelihood that the system will not work correctly. Dilution depends on two gases mixing with precisely controlled partial pressures, and this type of portable equipment is simply not capable of such accuracy over time. Parts wear in a flue gas analyser, the same as anywhere else, and the precision must suffer as a result. Partially blocked filters or other minor matters will lead to grave discrepancies in the readings. Flue gas analysers are available with multiple sensors for the appropriate ranges. Whilst more expensive, the extra cost will prove worthwhile in the long run.
13. **Purge pump** – purge pumps are set to ventilate a sensor, usually carbon monoxide, when a specific concentration has been reached. This is designed to prevent damage to the combustion gas analyser and hence reduce maintenance. This is only really of value where multiple sensors for one component are fitted to the combustion gas analyser. These will be set for different ranges and will be used at greatly differing concentrations. Such combustion gas analysers will be likely to suffer damage to the sensor for the lower range due to long exposure. Under normal circumstances a slight over-range will not damage a sensor permanently, but may lead to a slow response an especially a long delay in reaching zero.
14. **External temperature sensor** – This is required in some countries. The main purpose is to be able to measure the ambient temperature directly at the air inlet. Most flue gas analysers now have an integrated sensor for ambient temperature, but this will only measure the general ambient temperature and may be warmed by the electronics in the flue gas analyser as well. In many cases this is a useful addition, especially with large industrial equipment, which may have a direct air supply from outside.
15. **Remote control** – This is only necessary if the combustion gas analyser is used at a considerable distance from the boiler regulation point. The connection may be wireless or with a cable. Although the wireless option sounds simpler, the frequency used and the power allowed make the connection amongst industrial equipment somewhat difficult, if not impossible. With a cable connection there is only need for one power supply as well, and the wireless connection requires a relatively high power input. Fitting a remote control to combustion gas analysers is generally unnecessary, since two people are mostly needed on

such installations, and most large industrial plants have a few two-way radios available for the maintenance personnel. These generally have enough power to be used anywhere in a building.

As can be seen, there are many varied options these days on such instruments. Some of them are of very limited value, others are very application-dependent. The final choice will always theoretically lie with the operator. A system that allows options to be added later is of great value in most cases.