

## Data/Chart Recorders 101

### What is a data/chart recorder?

A data/chart recorder is an electronic instrument that keeps track of various measurements required in industrial and laboratory environments. Broadly speaking, it is used to record:

- process measurements for such variables as temperature, pressure, flow, pH, and humidity
- scientific and engineering data for applications such as testing and diagnostics, statistical analysis, and other laboratory work that requires a graphic or digital record of variables

There are scores of data recorder models on the market, ranging from \$100 standalone chart recorders that use paper and a pen to measure a single input, such as temperature, to \$4000-plus high-speed models that accept 30 inputs. These, however, are the extremes—gone are the days when most data recorders could be classified as either simple, midrange, or complex. In recent years, for example, conventional analog chart recorders have hybridized with data loggers, and PC-based functions have been added to most of the product categories outlined below.

### Types of Data/Chart Recorders

#### Strip Chart Recorders

Strip chart recorders consist of a roll or strip of paper that passes linearly beneath one or more pens. As the signal changes, each pen's deflection records the process being measured in the form of a chart. Well suited to recording of continuous processes, strip chart recorders are commonly used in both laboratory and process-measurement applications. For future reference, sections of the paper can be torn off and archived.

#### Circular Chart Recorders

A circular chart recorder records data on a paper disc rotated beneath one or more pens, which, as in a strip chart recorder, deflect with fluctuating electrical signals. The difference is that the resulting chart is circular rather than linear. Circular chart recorders are ideal for batch processes that operate within a known timeframe. They can be configured so that each rotation of the chart covers a standard time period—1 hour, 24 hours, 7 days, etc. Some recorders will also accommodate non-standard periods. The advantage of a circular chart is that, at a glance, it gives a complete history of one or several variables over the specified period.

#### XY Recorders

These recorders accept two inputs and create a chart or graph that displays the activity of one set of data against another. They are useful for determining relationships between the two inputs; for example, an XY recorder might be used in a chemical process to monitor the effect of temperature on pressure.

#### Hybrid Recorders

A hybrid recorder can function not only as a recorder but also as a data logger, a device that accepts an input, or channel, that is fed into an analog-to-digital converter. The results are stored digitally or printed out as a series of time-stamped values. A hybrid recorder can combine analog trend representations and digital information on the same chart paper. Hybrid recorders typically come in multichannel designs, with one print head normally handling all channels. They offer a cost-effective solution for multichannel processes, though they have a slower response time than recorders that dedicate a different pen to each channel.

#### Paperless Recorders

Paperless or videographic recorders display their charts on an integrated screen. Display technology has continually improved, with sharpness and color quality now approaching that of newer PCs. The digital data can usually be stored locally on a disk or card, either of which can be

removed for downloading to a PC. An engineer can then bring up any of the stored information for review and analysis, zooming in, for instance, on the time of a process upset. Where conservation of paper, easy data retrieval, and sharing of data are important benefits, paperless recorders are the charting method of choice.

Traditional chart recorders remain popular, however. For many users, the tried and true output is so easy to handle, read, and interpret that they wouldn't dream of switching to paperless technology. When the processes to be tracked involve limited variables that do not require a PC-based interface, paper and pen can still be the way to go. A data logger may accept a greater number of inputs, but only a recorder provides a truly continuous trend display of a variable's change with time. With advanced electronics such as microprocessors, improved ergonomics, and new user-interface features, the latest models are anything but low tech.

Omega Engineering's CTXL series, for example, is a portable circular chart recorder that can be configured to operate on a 1-, 7-, or 32-day chart. It comes in dual-thermocouple input, dual-process input, and temperature and relative humidity models. The dual-thermocouple input model uses a type J, K, or T thermocouple input that can measure and record the temperature of virtually any machine part, large or small, of any machine-building operation, such as injection molding, painting, cutting, melting, and sand casting. By monitoring temperature over time, machine builders can determine whether process improvements are indicated. For example, the charted graphs could provide insight into the correlation between temperature and, say, the wear and tear of an engine.

The dual-process input model records any standard process voltage/current signal—0/5 VDC, 4/20 mA, 0/10 VDC, etc.—providing a representative measure of flow, pressure, AC voltage/current, and other processes. One application for this model would be to monitor the AC current of a machine vs. the temperature build-up in a component of the same machine. The charted graphs would show how the two parameters correlate, perhaps indicating that the component's temperature rise will lead to premature failure. Another application would be to monitor a machine's AC current and AC voltage over a selected period. The resulting graphs would let the user calculate total power consumed vs. time.

Monitoring air quality in a factory, laboratory, hospital, office, museum, or other environment is a typical application of the temperature and relative humidity model. The charted data can indicate whether air quality needs improvement. A dual-backlit display shows temperature and humidity in real time, and the same data is stored in the recorder's non-volatile memory. Stored data can be downloaded to a PC through an RS-232 serial port. For controlling outside processes, the unit has two built-in relays and two voltage alarm outputs.

"These are just a few of the CTXL recorder's applications," said Shahin Baghai, Omega's manager of product development. "There are probably hundreds of ways in which the three models can help machine builders needing to monitor and record two processes over time. The charted graphs give a tremendous amount of information on each process and how the two correlate, often providing insight into how improvements can be made."

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