can be adjusted to absorb all the power that the engine can produce at nearly any rpm.

A CPP also permits the skipper to vary the engine rpm as needed to obtain the most favorable reduction in engine vibration and noise, as well as to vary the pitch and blade loading as a means of eliminating cavitation (formation of a vacuum around a propeller) at any rpm.

As for testing, CPPs have their own requirements. "I built a controller for a ship with a CPP that had exhibited severe power problems," said Steven Braun of Marindas, a provider of marine engineering services for large vessels. "The system before it had failed constantly. It blew out 24 V dc power supplies, as well as supplies from 15 V dc all the way down to 5 V dc. On the redesign, we went to a 24 V dc supply to power everything except pitch handles and speed control pods, which run at 10 V. It took a fair amount of design to get it right, including monitoring waveforms on a Fluke 123 ScopeMeter™ test tool, but today it runs smoothly and without incident."

## Mixed signals

A ship's power is not always clean power. Often supplied by an unregulated source, power can be wracked by undetermined noise, transients, and under-voltages. The proximity of the wires to onboard gear and systems exacerbates the problem, creating the risk of additional noise on sensitive data lines.

"In working with much of the ship's gear, we want to see a perfect square wave, but often I encounter termination problems, spurious noise, or spikes," adds Braun. "The problem is, a spike often looks like a rising edge of the intended signal, and it can create chaos with communications systems." Braun uses his ScopeMeter to deal with such predictable anomalies. "I can spot spikes or transients as short as 5ms or 10ms and take corrective measures," he says.

Instantaneous power draw is also a problem. When a deck winch or other large piece of machinery starts up, voltage can vary throughout the ship and current can drop. Therefore, certain readings must be monitored, for fear that sensitive equipment could be damaged. "We're always concerned with surges, and especially stability on ac lines," says Braun. "A scope is necessary, for example, when I turn on the radar scanner, which can draw as much as 50A instantaneously just to start the motor."

Can the instantaneous power draw of these devices compromise power quality elsewhere on the ship? "It can and it does, especially on older ships," says Seacoast's Dave Smith. "This is where I place the ScopeMeter in what I call 'babysitting mode.' "It will continue to monitor the lines over time, and I can set it to record anomalies such as spikes that may be quicker than 5ms – or, for that matter, any variations from nominal voltage."

## Shipboard communications

With the advance of integrated bridges comes the need for a new approach to wiring and signaling systems on commercial vessels. A case in point: voyage data recorders. With the requirements of today's recorders, engineers have a lot of data to collect and maintain. "Often, in fact, a ship's recorder has more sensors feeding it – measuring temperature, pressure, speed and liquid flow rates, for example – than in a commercial airliner." All of these analog signals need to be monitored, especially when regulations require stringent records from all corners of the ship.

According to Braun, the 4-to-20mA current loop is today ubiquitous in marine systems for mechanical monitoring and ship-wide communications, as well as for providing vital ship-wide information to recorders. A current loop is particularly useful when the information must travel a long distance to a remote location. Current-loop signals and their power can be derived from a remotely supplied voltage.

Testing ship systems in such an environment can present challenges. According to Dave Smith of Seacoast Electronics, a provider of communication, navigation, and safety equipment for commercial and military vessels, "The need in testing today is for a meter that can do double duty as a sort of 'simulation power source' – in this case a source of a 4-to-20mA signal. An advanced multimeter that provides its own 4-to-20mA signal output is a huge advantage. It allows me to simulate a signal right on the spot." For this purpose, Smith is evaluating a Fluke 789 Process Meter, which provides its own 4-to-20mA power supply.

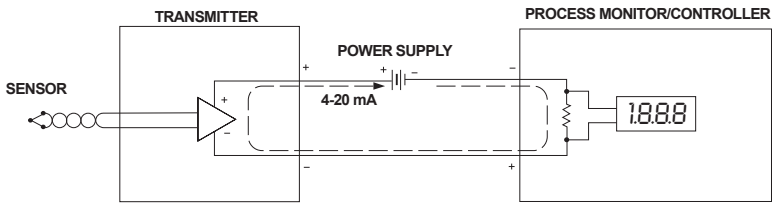


Figure 1. A 4-to-20mA current loop can be used effectively to tie multiple sensors on the ship with a controller. Low-current, low-voltage loops (voltage is typically between 12V and 24V) can be used with distances of 1,000 feet or more and are relatively insensitive to noise.