



CPM SYSTEM

Channel Power Monitor (CPM)

Simplifying the Management of Land Mobile Radio Systems

The Bird Channel Power Monitor (CPM) system addresses the complexities of managing land mobile radio systems.

This system integrates high-quality, comprehensive components for RF power monitoring into a single reporting system that is capable of providing feedback through the Internet via integrated web software or SNMP messages. With it, managers can measure and track the performance of their LMR sites in real-time, and over time, from their desktops or mobile devices.

Managing Land Mobile Radio Systems

Anyone responsible for a multi-site, multi-channel land mobile radio communications system understands that managing even a single site can be a complex task. When end users report failures or degradation in performance, multiple site trips may be needed to diagnose and correct the issue. For sites located in remote areas with low accessibility, correcting a small failure can become a major hassle, requiring an extensive investment of both time and money.

Without the Bird CPM system, technicians often rely on a wattmeter to calculate VSWR. This process of inserting the wattmeter at different points in the system to determine and isolate power issues can be time-consuming.

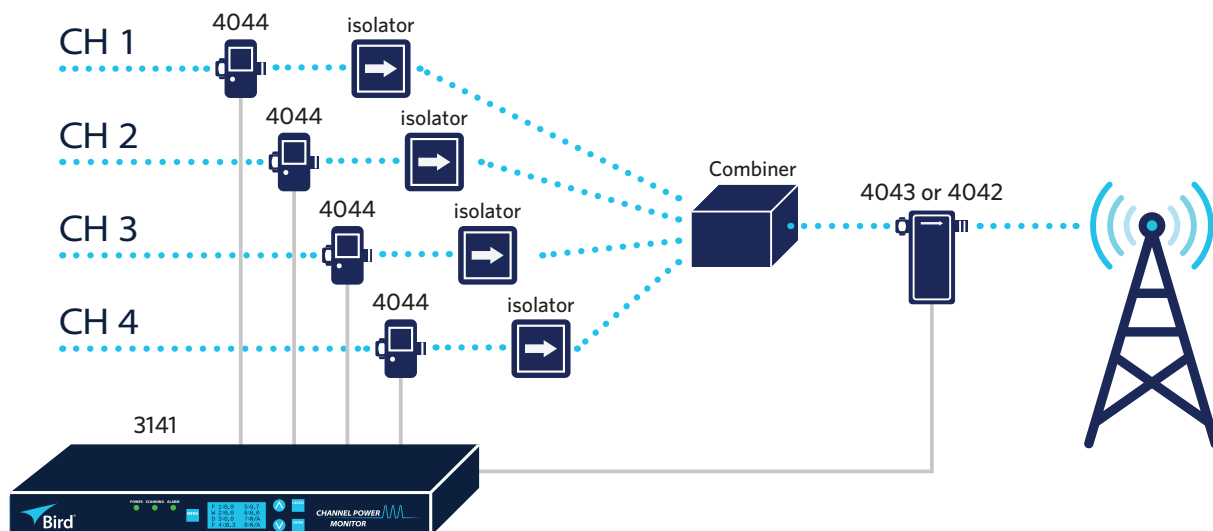
With the CPM System, sensing and monitoring equipment is in place at multiple points on the communications system. These components are continuously sensing, measuring, and when necessary, alerting managers to trends that begin as minor issues that they can observe over time, before becoming critical issues or failures. This ability to remotely monitor and diagnose most aspects of a full radio and combiner system without an on-site visit, provides maintenance personnel the information they need about the issue, and the ability to have the appropriate tools and equipment to resolve problems in one trip.

Components of a CPM Integrated Combiner System

The comprehensive information gathered and consolidated from the output of multiple directional and non-directional sensors is what gives the Bird Channel Power Monitor (CPM) system its power and versatility. Placing sensors at specific points within a combined multi-channel land mobile system allows for continuous diagnosing of radios to the output antenna and all points in between.

With non-directional sensors on the input of each combiner channel and a directional power sensor on the output of the combiner, users can log in over the network connection, monitor each channel for proper power levels, view the output power and VSWR to determine the health of the system and be notified about issues via alarms.

Figure 1 - CPM Integrated in Combiner System



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3141 - CHANNEL POWER MONITOR DISPLAY

The 3141 Channel Power Monitor Display is the heart of the CPM system. Made up of a central processor and connected to a variety of sensors, the 3141 can monitor radio performance, combiner loss, and antenna/feedline characteristics to provide continuous information on the status of each component.

The 3141 monitor logs and reports data via its front panel, web interface, SNMP traps, and alarm contacts. Easy system access is available from any computer, tablet, or phone through the CPM-hosted web page. The only requirement to connect to a network is a single IP address. This is the primary interface for users to monitor the overall system status.

Need additional monitoring? The 3141 has up to three additional user-defined inputs, which can be connected to sensors/contacts of the user's choice. These can be configured for normally open or normally closed circuits. An alarm condition is generated by the CPM system when the circuit is tripped.

The specific setup and operation of the CPM is covered in detail in the Installation and Operation Manual for the Model 3141 Channel Power Monitor (manual number 7-9587).

The 3141 monitor receives system status information directly from analog or digital sensors installed in the system. Currently, three such sensors are supported by the CPM system: the Model 4044 Non-Directional Power Sensor, the Model 4043 Directional Power Sensor (composite power), and the Model 4042 Directional Power Sensor (power by channel). A variety of sensor models are available for the accurate sensing of various frequencies.



4042
DIRECTIONAL POWER SENSOR
(power by channel)



4043
DIRECTIONAL POWER SENSOR
(composite power)



4044
NON-DIRECTIONAL POWER SENSOR



4044 – NON-DIRECTIONAL SENSOR

The 4044 Non-Directional Power Sensor is a small, low-cost sensor that provides a power measurement regardless of which connector the power is being applied to.

Because it is a non-directional sensor, it only provides a forward power measurement, not reflected power or a VSWR reading. The 4044 sensor is typically used on a 50Ω RF transmission line with a maximum forward power level of 125 W in a frequency band with an overall range of 118 to 960 MHz.

The 4044's accuracy depends on it being well matched to its 50Ω system. In other words, it requires a high return loss, and thus a low ratio of power being reflected back at the sensor. The 4044 power sensor is usually installed before the combiner isolator (as illustrated in Figure 1), and will only allow power to flow toward the antenna and not back toward the transmitter. When the 4044 is installed in this position, the isolator provides a high return loss for the sensor, while isolating the 4044 from the other transmitters on the combiner system.

This configuration results in the power reading from the 4044 being a highly accurate representation of the power being produced by the transmitter itself. It does not, however, provide a measurement of how much power is being reflected back toward the transmitter, other Bird sensors are available for this measurement. Bird recommends that one 4044 sensor be installed for each transmitter in the system. This allows the user to quickly verify whether a particular transmitter is producing the expected power output.





4043 – DIRECTIONAL POWER SENSOR - COMPOSITE POWER

The 4043 Directional Power Sensor displays the composite output power of the combiner (total power on each input port to the combiner).

It can provide a forward power reading, reflected power reading, and VSWR reading. The 4043 sensor is accurate regardless of the matching of the network and provides precise readings even if there is a complete break in the transmitter path. This makes the 4043 sensor ideal for characterizing the antenna and feedline path, regardless of path quality. If there is a problem on one of the input channels to the combiner, although users won't know which channel or channels has a problem, they will know that one exists. The 4043 digital sensors are available in a variety of frequency ranges (118 to 960 MHz) and must be matched to the bandwidth in use.



4042 – DIRECTIONAL POWER SENSOR - POWER BY CHANNEL

For accurate information about the output power of the combiner power by each individual channel, the 4042 Directional Power Sensor is recommended.

The center frequency of each channel must be programmed into the CPM, along with the channel width. If there is a problem with one of the input channels to the combiner you will know immediately and can take action.

Figure 1 shows the recommended position of the 4043 and 4042 sensors, between the output of the combiner and the antenna.



Eliminate complexity, maximize performance

In some applications, a system manager wants the flexibility to remotely monitor the LMR health via an Ethernet connection, but does not have a large combining system with many channels or can't otherwise justify a complete CPM system for an installation with only one or two radios. For these applications, Bird has developed the **4042E and 4043E Directional Power Sensors**, which eliminate the need for a 3141 monitor and additional sensors, and provide easy installation and quick commissioning.

Ethernet Sensors

These sensors are an excellent fit for installations with either only one radio, a couple of radios connected to a combiner, or a combiner with several radios on the input where the system configurator only wants to monitor the output of the combiner.

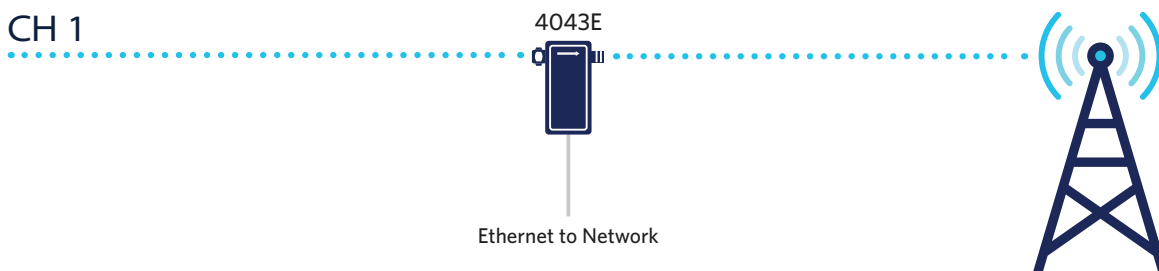


4043E – DIRECTIONAL POWER SENSOR - COMPOSITE POWER

The features and functionality of the 4043E are identical to those of the 4043 except that the unit contains its own processor and does not require a 3141 monitor.

The 4043E connects by using a built-in RJ-45 Ethernet connection to connect directly to the Internet or a private IP network. The frequency range includes seven bands between 118 MHz and 940 MHz and provides composite power readings with an accuracy of $\pm 5\%$. See Figure 2. The only requirements are the ability to connect to a network and access to AC power for the sensor. For users that do not have AC power available there is an optional pigtail with the 5A2232-21 connector plug where only 24VDC or 48VDC is available.

Figure 2 - 4043E Directional Sensor





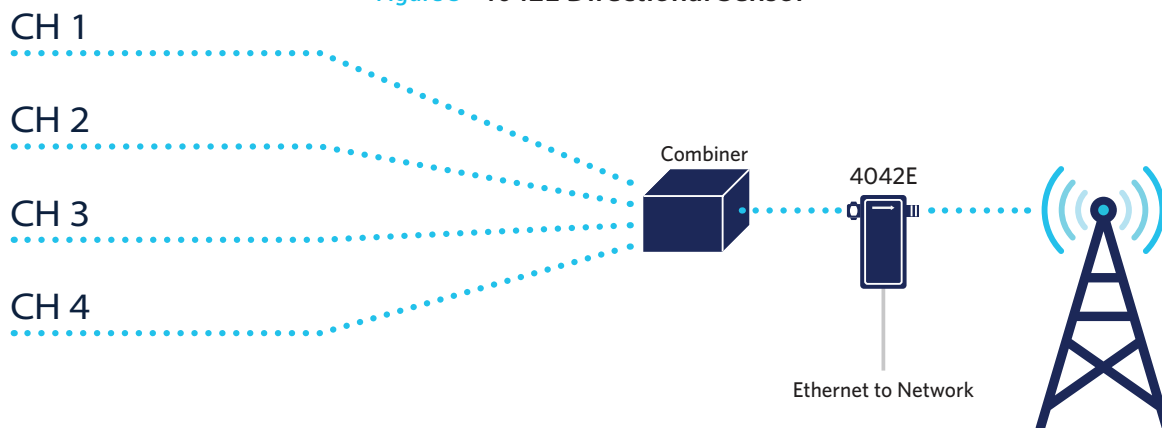
4042E – DIRECTIONAL POWER SENSOR - POWER BY CHANNEL

Some installations have several radios and a combining system, but the system manager isn't interested in monitoring the inputs to the combiner.

In these instances, a 4042E sensor can be placed at the combiner output, and each channel can be monitored. Just as with the 4043E sensor, the 4042E sensor connects by using a built-in RJ-45 Ethernet connection to connect directly to the Internet or private IP network. The 4042E covers frequency ranges between 100 and 1000 MHz and provides composite power readings with an accuracy of $\pm 5\%$ of a channel's selectable bandwidth of 6.25, 12.5, or 25 kHz. The 4042E monitors for antenna failure and radio output simultaneously providing in-line directional RF total power by user-specified channel lists. See Figure 3.

The only requirements are the ability to connect to a network and access to AC power for the sensor. For users that do not have AC power available there is an optional pigtail with the 5A2232-21 connector plug where only 24VDC or 48VDC is available.

Figure 3 - 4042E Directional Sensor



High Performance, High Return on Investment

Reliable communication is critical, especially during an emergency. Bird's scalable Channel Power Monitoring systems are ideal solutions to monitor radio system health in complex or smaller-scale communications systems. With its economical implementation and flexibility, the CPM is an excellent complement to any dependable T-Pass combiner system. With programmable alarm reporting, advanced data logging, and at-a-glance diagnostics, Bird's CPM system allows managers to guarantee 24/7 smooth operation of public safety networks of any size.

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