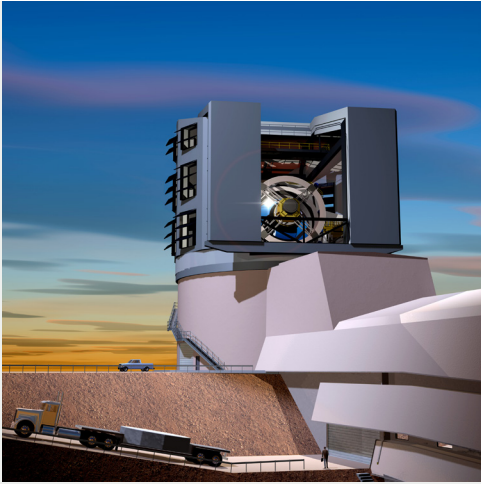


# You have to keep your cool when gazing at the stars .



If you are tasked with conducting a 10 year survey of the night sky to address some of the questions about the structure and evolution of the universe and the objects in it, chances are you will need something a bit more substantial than the camera on your phone. Particularly when it will deliver a 500 petabyte (1 PB = one thousand million million ( $10^{15}$ )) set of images and data products

The Large Synoptic Survey Telescope (LSST) is that project and rather than using a camera phone, will use the world's largest digital camera. Located on the Cerro Pachón ridge in Chile, it consists of an 8.4 metre large-aperture, wide-field optical imaging telescope combined with a 3 gigapixel CCD camera and data management system. The telescope and camera will survey the entire visible southern sky every few days for a decade.

With a camera weighing over 3 tons and containing over three billion pixels of solid state detectors, managing the generated heat is a vital function in maintaining the performance and reliability of the camera. Therefore, the camera's photoreceptor surface has to be continuously refrigerated to  $-100^{\circ}\text{C}$  by a matrix of small domestic refrigeration compressors kept under very tight control.

Six compressors work in parallel in a totally redundant system and pump the refrigerant 200 feet to the camera. Engineers need to monitor the level of the Polyolester (POE) oil in the compressor sumps at all times to provide the health status of each compressor.

Using a modified version of a commercial compressor with a remote reservoir, the operating temperature of the compressors will range between  $10-40^{\circ}\text{C}$ . The oil levels in the six refrigeration systems is critical with a need to maintain the level to  $\pm 2 - 3\text{mm}$  over the expected service life of 25 years.

To monitor this critical function with the long-term reliability and accuracy required, Gill Sensors inductive 7010 liquid level sensors have been specified.

[More information at gillsc.com](https://www.gillsc.com)

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Sensors & Controls

Three criteria were used in the selection process; Accuracy, long-term reliability and a leak proof seal. Engineered in 316 stainless steel, the Gill 7010 is rated to 10 bar of working pressure.

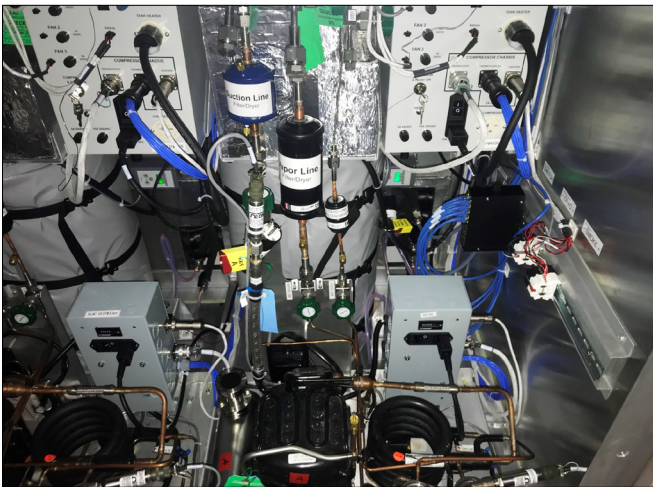
Each compressor has been fitted with one sensor, with six needed for the entire system. There is a back up system of another six sensors.

The refrigeration system is heavily instrumented with thermocouples, RTD temperature sensors and strain gauge transducers. The 0.25V - 10V analogue output from the Gill sensor feeds into the ADC conversion electronics, then into the custom control system designed by the LSST refrigeration engineers.

Final calibration of the sensors will take place once installed on the Chilean mountain top. The engineers have anticipated the difference in dielectric constant between vacuum and the pressurised refrigerant vapour above the oil level, thereby providing high confidence about the true oil level, in addition to a sight glass.

This unique and globally important project emphasises the long-term reliability and accuracy of Gill Sensors' inductive liquid level sensors. With no moving parts and engineered from high quality 316 stainless steel, the sensor easily accomplishes the critical level measurement accuracy required by the project.

Equally, they can provide this accuracy with the durability demanded of a 25 year project whose success is reliant on camera availability every day.



To learn more about this exciting project, visit <https://www.lsst.org/about>

To find out more about the Gill 7010 liquid level sensor and their other innovative level and oil condition sensors, please visit [www.gillsc.com/products](http://www.gillsc.com/products).