

Training Aid Development For a Fire and Rescue Service

Grant Squirrel 2020-1F8 Portable Universal Input Data Logger

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CAS DataLoggers recently provided the datalogging solution for a large county's Fire and Rescue Service (FRS) whose workers were acknowledged national leaders in the field of fire behavior training. Firefighters wearing heavy breathing apparatus and protective clothing often had to work in smoke-filled environments with very low visibility; hearing was limited by the roar of the fire and the noise of the appliances; the senses of smell and taste were blocked by the breathing apparatus; and the sense of touch was hampered by thick gloves. Under such dangerous conditions, extensive training was paramount for protecting firefighters. This training regime relied on starting substantial fires in the confined spaces of specially modified steel road haulage containers in patterns and intensities that replicated realistic conditions and were repeatable so firefighters could practice tackling the same fires over and over again. Accurately logged data also had a vital safety role to play in the training environment--if an officer was injured during training, a high-precision datalogger could help reveal the problem. These dataloggers were also crucial in training firefighters to control potentially lethal blaze conditions such as flashovers and back drafts. However, existing systems for capturing information during exercises were frequently damaged from water and condensation and were prone to giving inaccurate and inconsistent results. Consequently, FRS instructors saw the need for a waterproof and highly durable data logger to provide the county's firefighters in training with a second-by-second record of how quickly and effectively they brought a blaze under control. Portability and the versatility to measure several different values including temperature and current were also necessities, as well as user-friendly software with graphing capabilities for data analysis.



County firefighters installed a specially modified **Grant Squirrel 2020-1F8 Portable Universal Input Data Logger** in their sealed training rooms. Within the small spaces, electronics, water, and heat all combined to form dangerous interactions, and there was a lot of water flying around in the training exercises. In view of this hazard, the modified Squirrels were encased in robust waterproof cases with waterproof power links. To combat condensation, the logger was calibrated and sealed in the comfort of an office rather than on the training ground. While designing the logger, CAS technicians looked at the practical problems firefighters could face while using the Squirrel in the field. In addition to developing a completely waterproof case for the datalogger, they developed oversized switches and ports so firefighters wearing large padded gloves could operate the equipment more easily.

The SQ2020 universal data logger offered program instructors a high-quality, highly accurate (0.05%) battery-powered solution able to measure a wide range of physical values including temperature, humidity, current, voltage and resistance; this custom version also measured pressure. Renowned for their ruggedness and durability, the handheld and portable SQ2020 dataloggers featured 24-bit analog-to-digital converters enabling precise measurements. The logger's built-in display and keypad allowed it to be used either in stand-alone operation or as a PC-linked data acquisition system. The logger featured 8 to 16 universal analog inputs and 8 digital inputs as well as up to 16 derived/calculated channels and 4 pulse rate/counter inputs. 4 alarm outputs notified engineers when engine temperatures went out of specification, and the device also recorded up to 14 million readings utilizing a removable MMC/SD card. The datalogger was easily configured via integral interface or via PC and offered both USB and RS232 connectivity.

Three sensors were fitted in the steel training containers at the average level head height in 3 positions: while standing, kneeling down, and in the crawling position. As a training fire fighter tackled a blaze, the logger plotted the temperature from these three sensors at one-second intervals. The datalogger was then simply plugged into a PC and the data was downloaded. Each sensor's data was then displayed on one graph so that the firefighter and instructors could analyze performance in the classroom later. For example, to avoid flashovers, the safest technique was to spray the ceiling area in front of the blaze with just enough water to lower the temperature of the atmosphere, but not too much water to push the heat down on to the firefighter. The ideal graph profile in these controlled training conditions would show temperatures at all three heights being reduced at roughly the same rate. If the middle graph (monitoring temperature at kneeling head height) went up while the ceiling temperature graph came down rapidly, this was a clear indication that the firefighter had sprayed too much water at the ceiling and created dangerous levels of hot steam lower down.

A further modification to the SQ2020 measured the pressure of a sealed room during a fire; this was used to help instructors better understand how to recognize and combat lethal backdraft conditions which occurred as fire in a sealed space such as a bedroom became starved of oxygen and began to die down. If a fire fighter opened a door or window into such a space, fresh oxygen was suddenly sucked in and supercharged the fire. Within seconds the blaze would explode out of the newly created opening and could engulf the unwary firefighter. The county's firefighting instructors plotted the cycle of fires in these sealed spaces in order to better understand how to fight them safely, and the Squirrel logger produced graphs of these events that resembled roller coasters.

Another serious danger was posed when fires took hold at the far end of the training container and the heat intensity near the ceiling reached a point where the atmosphere and smoke were close to

spontaneous combustion. If firefighters didn't react quickly and apply water, the ceiling would ignite and engulf the entire room in flame, creating the deadly 'flashover' conditions. However, if the firefighter applied too much water, the intense heat mixed with superheated steam would instead be forced down and burn the firefighter. The safest technique was to spray the ceiling area in front of the blaze with just enough water to lower the temperature of the atmosphere, but not enough to push the heat down and risk a burn. Instructors repeatedly looked for the ideal graph profile in these controlled training conditions that showed temperatures at all three heights being reduced at roughly the same rate. If the middle graph (monitoring temperature at kneeling head height) went up while the ceiling temperature graph came down rapidly, it was a clear indication that the firefighter had sprayed too much water at the ceiling and created dangerous levels of hot steam lower down. In this way, the datalogging directly contributed to firefighting experience and safety.

The Grant datalogger also included FREE SquirrelView configuration and analysis software, complete with a user-friendly, spreadsheet style interface enabling quick set-up of the data logger for any application, speedy download of data, and direct export to Excel. The optional SquirrelView Plus software featured additional benefits such as graphical data analyses and advanced reporting options.

The county's Fire & Rescue Service benefitted in several important ways after installing the Grant SQ2020-1F8 datalogger in their firefighting training rooms. The Grant datalogger's precise measurements on temperature and pressure contributed the necessary data to the program, and the logger was well-protected in its sealed waterproof case. Earlier datalogging systems for capturing information had suffered from water and condensation damage, but after a year of searching for alternatives, the Fire and Rescue Service had solved both problems. The Squirrel logger was easy to modify for a wide range of different measurements, and its ease of use and portability made for convenient, hassle-free operation at an affordable price.

The specially modified Squirrel 2020 series data logger proved so successful under the training program's hazardous conditions that the county's Fire and Rescue Service recommended the datalogger to neighboring fire services, as it aided in training firefighters to practice controlling potentially lethal flashover and backdraft blaze conditions. The project's success was the result of a merging of practical experience controlling fires with the high-tech expertise to accurately monitor every facet of the development of a fire and of a fire fighter's progress in controlling it. A fire officer conducting training commented: "We have seen great results from our training program and we are now seeing an interest from other counties and services too. Our new Squirrel data logger is tough, easy to use and accurate. We are extremely happy with it."



For further information on the Grant SQ2020-1F8 Portable Universal Input Data Logger, other dataloggers in the highly successful Squirrel series, or to find the ideal solution for your application-specific needs, contact a CAS Data Logger Applications Specialist at (800) 956-4437 or visit the website at www.DataLoggerInc.com.

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