TOCONs for fire and flame detection

with reduced dead-times

sglux
The UV Experts

HIGH TIME CONSTANT OF THE STANDARD-TOCONS

The standard sglux TOCONs are featured by a relatively high time constant that extends from 30ms (low sensitivity TOCONs) until 80ms (high sensitivity TOCONs). Most of the TOCON applications benefit from this high time constant because usually the TOCON's application is to measure a UV irradiation that slowly changes. Such applications are e.g. the control of UV disinfection and UV curing sources. Short changes of signal caused by electromagnetic or high frequency influences are averaged – which is a benefit. The below figure 1 shows the TOCON's time resolved reaction on a UV irradiation.

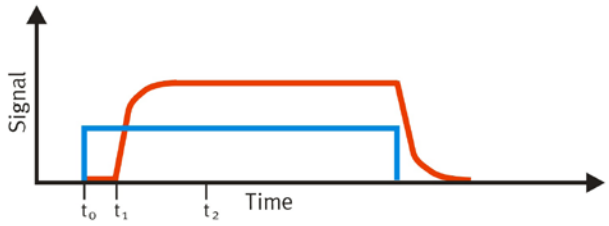

Fig. 1: Signal of a non saturated standard TOCON

The figure shows a slight delay of the signal's increase after the beginning of the UV exposition. This dead-time (to – t1) is up to 10ms. The delay is caused by an initial charge effect of the circuit inside the TOCON.

When the TOCON is driven to saturation the output voltage freezes at some mV below the supply voltage and does not further rise in case of a further increasing irradiation. While saturated, the TOCON shows a certain off dead-time (figure 2, t3 – t4) after extinction of the UV irradiation. This off dead-time depends on the grade of saturation and can be up to several hundreds of ms.

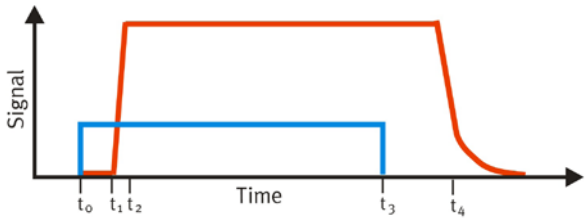

Fig. 2: Signal of a saturated standard TOCON

REDUCED OFF DEAD-TIME NEEDED FOR COMBUSTION CONTROL

As previously explained the dead-times are favorable features for most of the TOCON applications. However, looking at flame detection in heaters or looking at fire detection applications this relatively high time constant may cause problems. Burner flame detecting TOCONs need to swiftly detect the flame's extinction, preferably without any off dead-time. This is to avoid that non combusted fuel surges into the combustor. Flame sensing TOCONs are frequently operated in the saturation mode where the off dead-time as depicted in figure 2 (t4-t3) does not comply with the required fast detection of the flame's extinction. This problem is solved with the sglux logarithmic TOCONs that do not saturate. Hence, the dead-time t4-t3 does not occur and the TOCON's output voltage rapidly decreases after the flame's extinction (2ms only).

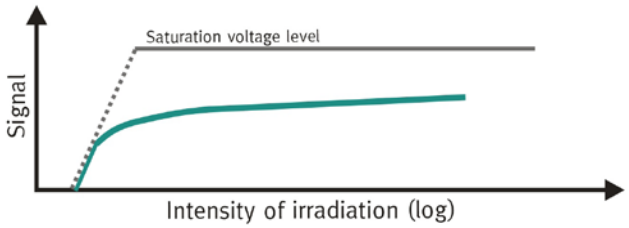

Fig. 3: Signal of a logarithmic TOCON depending of the irradiation intensity (logarithmic scale)

Figure 3 shows the intensity-resolved output of a logarithmic TOCON. While only softly irradiated, the output voltage of the TOCON rises in linear correlation with the irradiation. Beginning with approx. 200mV output voltage the curve starts bending. With further increasing irradiation the curve turns to a slightly increasing linear curve. A saturation output voltage will never be reached. Because of the fact that a logarithmic TOCON never turns to a saturation mode the off dead-time after the flame's extinction, as depicted in figure 3, will not occur and the TOCON's output voltage rapidly decreases within 2ms after the flame's extinction. The nomenclature of these logarithmic TOCONs is e.g. "TOCON_F6". "F" means "flame" and "6" is the sensitivity. Usually the sensitivity is a matter of individual customization.

REDUCED START OFF-TIME FOR FIRE DETECTION APPLICATIONS

If the presence of a fire needs to be detected the TOCON's start reaction time at needs to be as short as possible. Accordingly the start dead-time to-t1 as depicted in figure 1 needs to be reduced. This can be realized by applying a negative supply voltage via a forth pin. The start dead-time can be reduced to a value below 1ms. The nomenclature of these TOCONs is e.g. "TOCON_NC1F". "N" means "negative supply", "C" means the use of a UVC-filter (if applicable), "1" means the sensitivity and "F" means "fast". Usually the sensitivity and the eventual use of a filter is a matter of individual customization.

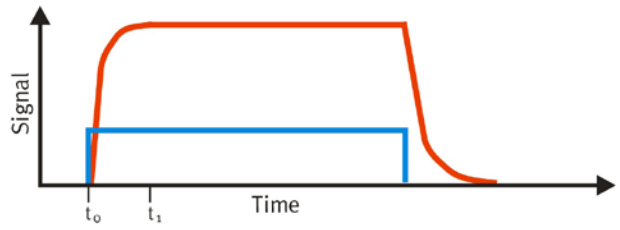

Fig. 4: Signal of a TOCONs with applied negative supply voltage

COMBINATION OF BOTH FEATURES

In general both features, the negative supply voltage to reduce the start dead-time and the logarithmic amplifier circuit to reduce the off dead time can be combined.