



# Customized CCTV system solutions in hazardous areas

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Figure 1: The visual monitoring of critical industrial plants and process monitoring increase safety and improve internal processes.

These days video surveillance or CCTV (Closed Circuit Television) has become an everyday occurrence in many areas of public life. Surveillance cameras can be seen on public buildings and railway stations etc. for protection against crime and on road junctions for reconstructing accidents. This technology is also increasingly used in the industrial sector to reduce accidents at black spots or to monitor processes remotely. This desire for more safety and increasing process automation also exists of course in hazardous areas.

Whereas in the past only industrial cameras in large flame-proof enclosures were used (Figure 2), R.STAHL HMI has gone a step further. With the models EC-710-090, EC-730 and EC-750 special cameras designed for installation in hazardous areas zones 1, 21, 2 and 22 are available for these applications.

Due to their very compact design and their light weight (e.g. EC-710-090, 435 g (Figure 3)) the cameras are also easy to install if space is at a premium.

The dome camera EC-750 is available as an analogue camera and as an IP camera. Due to the enclosed design with internal mechanics, the dome camera is also maintenance-free and therefore also ideally suited to installation in places where access is difficult.

## Customer-specific solutions

A large portion of customers require, along with individual explosion-protected cameras, also complete CCTV hardware for integrating and controlling the cameras. R.STAHL HMI can meet this requirement. As a provider of explosion-protected CCTV systems R.STAHL HMI supply customized products to suit customer requirements. The product spectrum ranges from the simple recording system to the PTZ (Pan Tilt Zoom) control module for use in potentially explosive atmospheres with which several cameras can be controlled.

## CCTV on drilling platforms

There are two fundamentally different tasks on drilling platforms:

- › Monitoring of safety-related areas
- › Support to drilling personnel in their work

These two applications differ in numerous points. For monitoring safety-related areas, recording systems are needed so that accidents can be reconstructed afterwards. Here data integrity is the priority along with the recording capacity. Digital water marks are automatically applied to the films to prevent subsequent tampering. In this system with 4 cameras the field of view is recorded for 10 days. The monitor installed in a stainless steel enclosure displays either the individual images or reduces the size of all the camera images and displays them at the same time. Access is password-protected. This protection can be increased even further using the two-sets-of-eyes principle so that strict internal requirements can also be met.

This monitoring camera system was specially designed for a customer application. It is equipped with four EC-710-090 cameras that are installed at a distance of around 100 m in Zone 2 and 1. The cameras are centrally supplied with power via a control unit for the system. This control unit is located in the safe area. The system also has a network connection so that physically remote personnel with appropriate access authority can view the camera images in case of technical problems. The system is designed such that it can be expanded to include with further cameras with little effort, e.g. to 8 cameras.

Video recording is not necessary for systems for support to the drilling personnel. Here real-time display is the priority. Even though digital IP solutions have the advantage that they can be integrated into existing networks relatively easily and data is easy to store using hard disk storage (DVR, PC, server etc.), these solutions are not used to support the drilling work due to one significant disadvantage. IP cameras or video servers (video encoders) supply the images with a slight time delay. Depending on the resolution selected and the processor performance, this delay can be significantly more than 100 ms. Analogue cameras are therefore used in the majority of cases for time-critical tasks that are controlled using a camera. Here the composite video signal from the camera is sent to an analogue monitor without any delay. The image signal is not converted in this case.

The push buttons for controlling the camera are positioned underneath the monitor. These controls can be used to pan and tilt the dome camera EC-750, as well as, to change the actual camera indication on the monitor). The control unit with monitor (Figure 4) can be



Figure 2: Older Ex design for a camera, installed in a standard enclosure with type of protection flameproof enclosures 'd'



Figure 3: Compact camera EC-710-090 in lightweight design (weight 435g)

installed in Zone 2, while the four cameras (2x EC-750, 2x EC-710-090) can be installed both in Zone 2, and in Zone 1 (Figure 5). As a result a system is available here for which the control, data display and cameras can be installed in the hazardous area. The stainless steel enclosure and the controls are designed for harsh environmental conditions. Operation when wearing gloves is possible without a problem. The system is of modular design and therefore easy to →

expand or adapt to special requirements.

The situation is different for CCTV projects where only the cameras are installed in the hazardous area, and access to the system is via network and PC. Here expandability and network integration are the priority. These days practically only IP cameras are used in this sector, as they are easy to integrate into networks.

### Integration in existing installations

By using video servers and video encoders, even analogue cameras in existing installations can be integrated in IP networks. An existing network with a small number of cameras can often be further expanded, as the data flow from the cameras can be adapted to the situation. A reduced data flow can be achieved by various means:

- › Reducing the frames per second (fps), standard 25 fps
- › Reducing the camera resolution (fewer pixels)
- › Changing the type of video compression (MPEG (H.264), M-JPG)
- › Changing the compression rate

PAL television pictures are transmitted at 25 fps (frames per second) (25 full frames, 50 half frames). In the industrial sector this large number of frames per second is only rarely needed, as in 40 ms (the time between two frames at 25 fps) there are often no significant changes. At 5 fps the time between frames is 200 ms. This period is adequate for the majority of process monitoring tasks. With this small change in the frame rate, the bandwidth required can be reduced to around 20% of its original size. Changes in the resolution and the compression rate further reduce this value, however with a reduction in the picture quality.

Along with the necessary bandwidth, the length of the recording is also a critical point. For example, a PAL frame in M-JPG format has a size of around 52 Kbyte. If recorded for 24 hours at 25 fps a volume of data of around 107 Gbyte per camera is accumulated very quickly. Larger camera systems therefore accumulate in the area of several terabytes of data per day. It is therefore crucial to determine the requirements in advance and to keep the volume of data as low as possible using the methods mentioned above such as, the compression method, fps or other techniques. The latest compression methods, like H.264 (MPEG-4 AVC), support this goal, as they require significantly less bandwidth and therefore less storage space than previous systems for the same picture quality.



Figure 4: Control unit for a camera system for supporting work on a drilling rig



Figure 5: Stainless steel dome camera EC-750, available as IP or analogue version



## Process monitoring

Along with the general monitoring of hazardous areas, process monitoring is gaining increasing importance [1], [2]. Certain chemical or physical processes are difficult to acquire by measurement, and require a 'trained eye' in the field, for instance during process start-up with phase separation [3]. Without a camera system, it is necessary to send a member of staff to monitor the process by looking through windows at regular intervals during the start-up phase and use the information provided to manage the process as appropriate. By mounting the small compact camera EC-710-090 on one of the windows it is easy to display the video image on monitors in the control room. A member of staff is then able to continuously monitor and better control the process even in several reactors without having to leave his/her workplace. Additional recording is also useful, as in certain circumstances this may provide information in case problems occur later in production. This information can otherwise only be recalled from memory. By comparing the start-up conditions with the video recordings, processes can be further optimized and therefore costs saved in the future.

## Conclusion

Modern CCTV system solutions for use in potentially explosive atmospheres have become an important tool in the monitoring of industrial plants these days. With cameras specially developed for these applications, R.STAHL HMI makes it possible to install cameras in very tight spaces or in difficult conditions where older designs with larger standard flameproof enclosures could not be used for lack of space.

## References

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