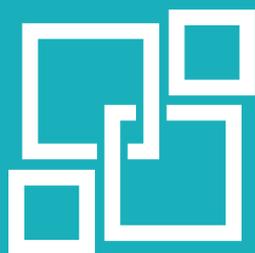# How to migrate a DCS without a plant shutdown?
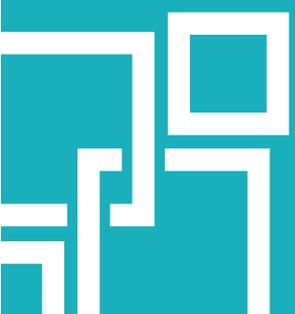
whitepaper

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1. Introduction

Many process-related facilities like refineries and chemical plants are using control systems to safely control their process. Often, thousands of I/O connections like field instruments, valves and operator interfaces are connected to the DCS.

Plant operators should periodically benchmark their control system and check if the DCS meets all the requirements concerning efficiency, safety and finance. However, this is often not the reality, which means that many control systems are getting older and older without improvements. Issues will be repaired with a replacement but this doesn't mean it improves efficiency, safety or finance. After all, the core of the DCS remains still the same which was installed around 1980 - 1990.

So despite the fact that a DCS is the heart of a plant which manages the process and thus the safety of human and enviroment, many plants are sitting on a "time bomb". On short term, these plants should start with a migration to a new DCS before big issues will occur.

There are several approaches for a migration:
- Offline (cold) cutover; complete replacement at once
- Stepwise migration
- Online (hot) cutover; migration without plant shutdown

> **"Many plants are sitting on a 'time bomb' because of an outdated DCS."**

Definition: Hot Cutover

In this whitepaper we discuss the approach called Hot Cutover:

> *"A hot cutover is an approach of replacing the obsolete DCS while the plant is in operation or 'hot'. The obsolete and the new DCS operate simultaneously and the new system is cutover point by point, loop by loop."*

2. Four reasons why you should consider a hot cutover!

Less downtime, Less costs

One of the main reasons to perform a hot cutover is because the process is not interupted. This means that the plant is fully operational so there is no financial loss as a result of poduction stand still.

Easy troubleshooting

Because all loops are being migrated loop by loop, it is very easy to locate a problem when an error occurs. Another additional benefit of a hot cutover is the possibility to fall back (temporarily) on the obsolete DCS when there seems to be some problems with the new DCS.

Less risk

During a hot cutover, loop by loop is transferred to the new DCS. This means that a plant can migrate step by step. This means there is less pressure on the engineers, resulting in less problems as a result of human errors.
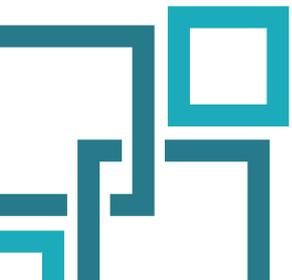
Easy training for engineers

With a step by step cutover, operators and maintenance personnel can also be introduced with the new DCS step by step. This will result in a smooth cutover and gives operators the time to learn and use the new DCS.

Drawbacks

- Takes up more space
- Requires simultaneous operation of obsolete and new automation systems
- Takes longer

3. Solution: DCS Migration 'Hot Cutover' Tool

For some I/O's an online migration can be problematic because of their critical nature to the process. Disconnecting these critical control loops can result in unstable process conditions. In these situations **the IST-203 Cutover Tool** proves its value; it can take-over even the most critical loops, while maintaining optimal control of the process. The tool facilitates a 0(4)-20 mA electrical loop take-over to help perform a DCS migration without interrupting the active production process in just 5 simple steps. These steps will be explained furtheron in this whitepaper.

IST-203 Advantages

The IST-203 Hot Cutover Tool, made by Istec International (Netherlands), has many advantages over other hot cutover methods:

- The IST-203 is the only electrical loop take-over device specially developed for DCS migrations
- Suitable for all 4-20 mA based DCS and PLC control loops
- Easy operation
- Safe and controlled hot cutover
- Maximum efficiency
- Minimization of human errors and risks
- MODBUS interface for parallel migrations
- Less preparation costs
- Less equipment costs
- Preventing production downtime
- Saving on man-hours and migration duration

Man hours
Downtime
Equipment
Preparation

Cold cutover   Hot cutover Mechanical   Hot cutover Electrical
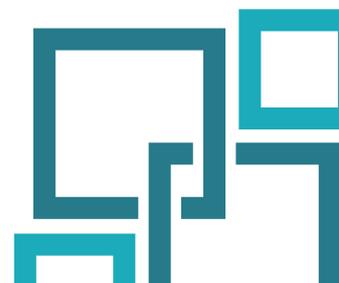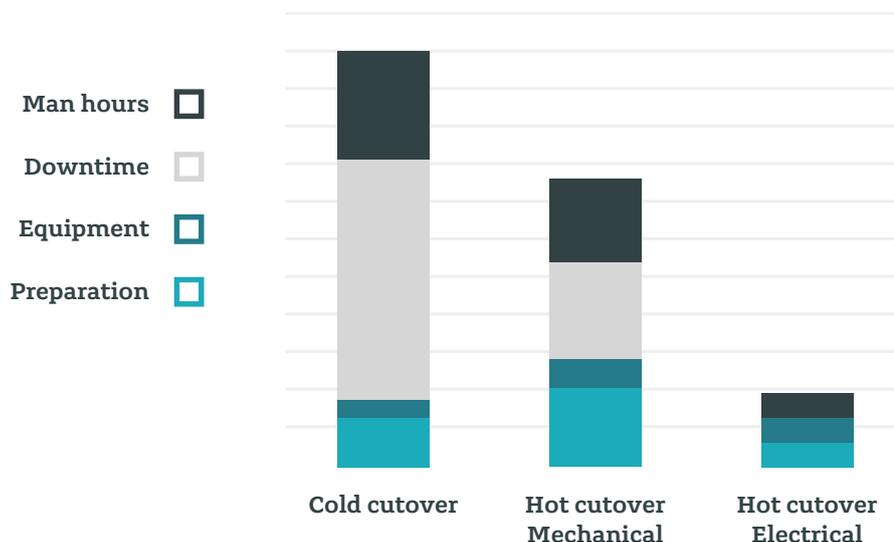
Training- and test unit

Besides training and presentations provided by their specialists, Istec also offered a training- and test unit. The training- and test unit is specially designed to train migration teams, replicate field situations and gain confidence with the tool and the concept.

During the training sessions, users were learned about the use and the concept of the product. This increased safety, efficiency and confidence.

## Five easy steps to use the 'Hot Cutover' tool
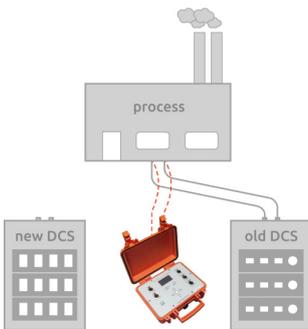
STEP 1 – Connect the device

The process starts with an inventory of all processes and related instruments that will be affected by the DCS migration. Define the critical loops and perform the necessary hazard and operability studies. Connect the device to the loop in parallel with the DCS.

STEP 2 – Sample mode

When take-over is selected in the main menu of the device, it will switch to sample mode. In this stage, the Hot Cutover Tool verifies if it is connected to an active loop and receives a stable signal. If it does so, the device will show "Ready for take-over". At this point, the Hot Cutover Tool is ready to take over the control loop from the DCS. To verify if the tool is connected to the right loop, the IST-203 comes with a check connection option. With this option, a pulse is send down from the DCS and received by the tool as verification.
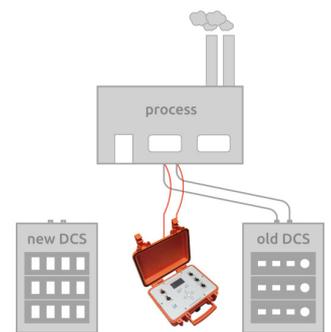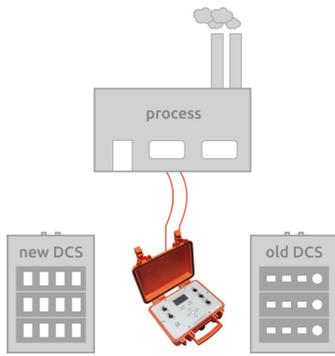
STEP 3 – Connect the device

When in take-over mode, the Hot Cutover Tool takes charge of the loop. Any changes made to the DCS after entering take-over mode will have no effect on the loop. At this point, the obsolete DCS can be disconnected from the loop and the new control system can be connected. During the take-over mode, the offset control function of the hot cutover tool can be used to change the loop values if necessary.

STEP 4 – Match output

To avoid any offset in the loop when ending take-over mode, the new DCS should be set to the same value as the obsolete DCS. The new DCS output can be changed until it matches the obsolete DCS output – the tool will absorb any offset generated. When the output matches, the device will show "Output match OK", and take-over mode can be ended. In this stage, the Output Match function can be used to verify the new DCS output.
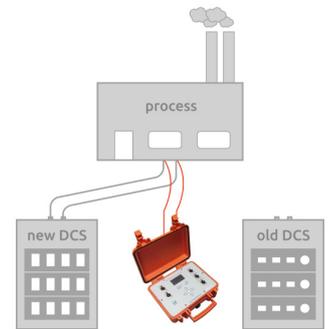
STEP 5 – End take-over

When the new DCS is connected, working properly and the output matches, take-over mode can be ended. At that point, the new DCS will take control of the loop. The hot cutover tool can now be disconnected.
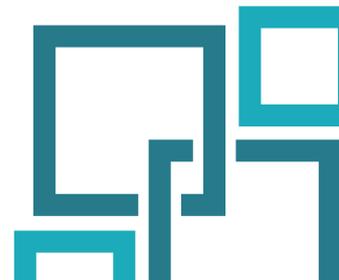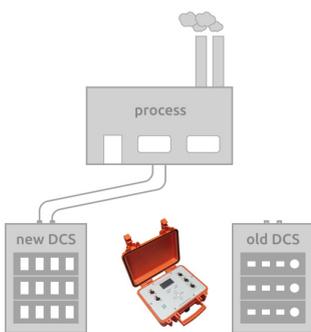
4. Case-study: Emerald Kalama Chemical ("Great Migration Project")

In March 2016 Emerald Kalama Chemical started their "Great Migration Project" in the Botlek, the industrial area in the port of Rotterdam. The project includes, amongst others the replacement of an obsolete non-Yokogawa Distributed Control System to a Yokogawa CENTUM VP DCS. Yokogawa was awarded this DCS and safety migration project by Emerald. The collaboration between Yokogawa and Emerald Kalama Chemical, for this DCS migration project, started in early March 2015 and was finished at the end of 2016. A total of 4200 I/O's wer migrated during the DCS migration project.

The obsolete DCS in the Emerald Kalama Chemical plant had reached the end of its useful life and needed replacement. In order to minimize production downtime, the migration needed to take place during online process conditions. Therefore Emerald required a
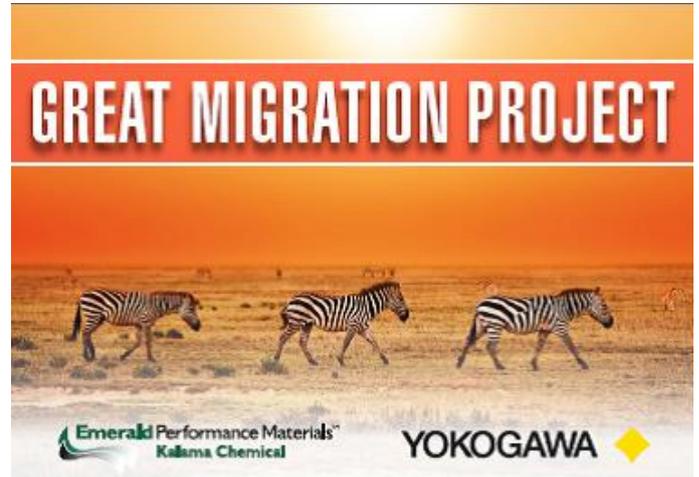
so-called hot cutover for this DCS migration project. Replacing the obsolete DCS for the new Yokogawa CENTUM VP DCS requires a well-planned strategy and time schedule. At this part of the project Istec International was involved. The first online migration to test the concept has taken place in March 2016. The migration of the remaining I/O's took place from April to December of 2016.

About Emerald & Yokogawa

Emerald Kalama Chemical plant, which is part of Emerald Performance Materials LLC. is located in the Botlek, the industrial area of the port of Rotterdam. With about 165 people Emerald produces and sells benzoic acid and derivatives, used in food, products for personal care and pharmaceuticals.

Yokogawa's global network of 88 company spans in 56 countries, Yokogawa is a major industrial supplier in the industrial automation and

control, test and measurement, aviation, and other business segments. The company plays a vital role in a wide range of industries including oil, chemicals, natural gas, power generation, iron and steel, pulp and paper, pharmaceutical- and food. Yokogawa has contacted Emerald in an early stage of the project to present Yokogawa's brownfield experience and their customer commitment. Also, Yokogawa uses a "value-added migration" approach. This approach is part of Yokogawa's answer to market challenges such as increasing productivity, operational efficiency, human reliability, safety and reduction of emissions and energy consumption.

Istec's contribution

Istec International was involved in this project with the IST-203 Hot Cutover Tool, a tool designed to support online DCS migrations by taking over active control loops during the migration. After a costs and benefits analysis the tool proved to be the best choice amongst other options, as it is very cost-efficient, safe and easy to operate, while minimizing human errors and risks. Therefore, Emerald and Yokogawa had decided to use this tool during the DCS migration project. A total of 1750 I/O's were migrated with the support of the IST-203 Hot Cutover Tool.

One of the main reasons for Yokogawa to use to the tool for this DCS migration project is the minimization of time pressure during the migration. The tool temporarily takes-over a loop, which ensures keeping control and a stable process. Whereas without the tool there is a very limited amount of time the loop can be out of operation in order for the process to remain stable.

Another main reason for Yokogawa to use the tool for this DCS migration project is their previous experience with the Hot Cutover Tool during similar migrations. Previous success has proven the tool to be a very good option to perform an online DCS migration.

As expected, the use of the tool has been successful and is received well, with positive reactions from both Emerald and Yokogawa. Istec is proud to contribute to the success of the DCS migration project at Emerald Kalama Chemical with the support of the IST-203 Hot Cutover Tool.

Training prior to the project

Before the start of the DCS migration at Emerald, Istec provided training to the complete migration team. The migration team consisted of Emerald's E&I engineers and process engineers and Yokogawa's DCS specialists. It was very important that the migration team would not encounter any surprises during the migration. This training was meant to ensure that all possible outcomes were discussed and offered the opportunity for the involved engineers to discuss their concerns and rule out any remaining questions.

Conclusion

The project was a great success! Emerald wanted to minimize production downtime and loss of income as well as a DCS migration progress without any flaws. The good collaboration between Yokogawa and Emerald, with the help of the IST-203 Hot Cutover Tool from Istec, led to good results. As mentioned before, Yokogawa had previous experience with the IST-203 Hot Cutover Tool during other projects, making it even easier to operate the tool. The tool has proven its worthiness during this DCS migration project at Emerald Kalama Chemical.
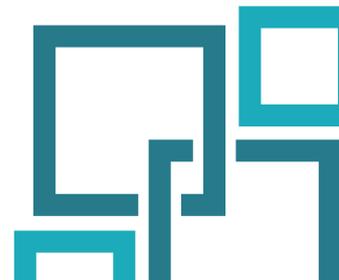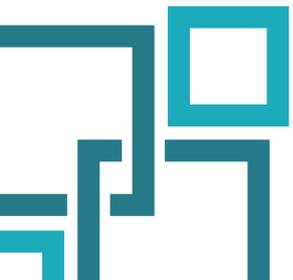
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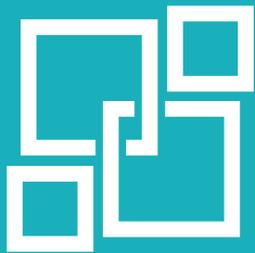
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