Who are you looking at

Kamil Herman

- Author of Ampl2m conversion tool

- Senior automation engineer
- Working in Automation with ABB control systems since 1995
- 6 years in ABB Slovakia
- 2 year working for ABB Mannheim, Rolling Mill Centre
- 4 years working for ABB Vienna, refinery projects

- Experienced in Metals, Paper mills, DRI control, ABB Drives

Automation backgroud

Ampl2m

Ampl2m tool is technical implementation of 23 years experience in ABB Engineering:

- ABB Advant Controllers detailed knowledge, programming and troubleshooting
  - AC450, AC410, MP200, AC110, APC, AC80, AC800M, AC800PEC controllers
  - AS500, 800xA HMI

- Expertise in Advant Controllers to AC800M upgrade
  - 47 Advant Controllers upgraded – AC450, AC110, APC (29 by automatic conversion)
  - Shadowing – parallel testing of the converted code in AC800M and AC450
  - 700 graphics of AS500 converted to 800xA

- Extensive experience with
  - Closed Loop controls
  - ABB Drive controls in Metals and Paper, DCS/ACS, Sinamics S120 drives
  - Automation projects leadership

IT background
  - Scripting – VB script, PHP, Java Script
  - Linux
  - SQL, databases, Dynamic Web interface

Idea was born

As a solution for challenging migration of 5pcs AC450 and 2pcs AC110

- Control system upgrade of the critical system in Hadeed Steel plant, K.S.A.
- 5 downday project, CPU replacement using existing IOs
- Almost 1000 controlled valves and motors
- 88 sequences containing 880 steps
- Symbolic names lost
- Type circuits disintegrated

Project bottleneck

- SW team consisted from junior engineers without AC450 experience

- Excel macro was developped for simple conversion

- **Finally all controllers were successfully replaced with no commissioning time and with empty puch list**

Ampl2m Project goals

Ampl2m

To provide cost efficient conversion solution as 1:1 functional copy of existing logic

- To provide easily accessible and user-friendly web tool for Advant Controllers migration

- Let the users keep migration process under own control by adjusting conversion preferences

- To provide 100% fidelity of the converted code to the original control logic

- To provide added value
  - Code optimisation for better readability, e.g. bypassing dummy PC elements
  - User Lib containing Function blocks compatible with Advant PC elements, verified in real projects
  - Interlock HMI graphics reading signals from converted code, including memory of first tripping conditions
  - Recovery of lost Symbolic names and Page breaks in AC450 source codes

- Conversion of the code using special AC450 libraries like RMC, RPC

Ampl2m Tool Benefits

Ampl2m

- Saving time, decreasing engineering efforts - cost saving

- Prevents human errors – significantly reduces technical risk and commissioning drama

- Allows short-shutdown PLC exchange if IOs are reused

- Utilises verified migration of particular PC elements

- Allows the user to decide for Libraries
    - Pulp & Paper – generally recommended for AC450 migration
    - Standard AC800M libraries + User Lib as cost-saving solution

- Several solutions for better readability of converted code

SW & HW solution of the tool

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HTTPS encrypted communication
via Internet

**VPS hosted at data centre
in Germany**

DDoS attack protection
by VPS provider

**Virtual Private
Linux Server**
Cent OS 7.3 64bit
- **Xeon CPU**
- **SSD HDD**

Web Server

**PHP, JavaScript
CSS**

SQL database

| Mapping Table of PC elements |
| Local / Global variables |
| DB / IO variables |
| Input / Output files |

Stored Procedures

User management

Automated PLC conversion – elimination of risk

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Our Goal is to provide reliable and the most efficient AC450 migration service:

- *by Elimination of technical risk*
  in order to minimize Shutdown time necessary for PLC revamp
  and to avoid any further harmful impact to the production
- *by better code readability*
  for easier maintenance of the Control logic
- *by demonstrating 100% functionality of converted code before PLC upgrade*
  Customers appreciate reports from automated testing of converted code

1. Tool for automated control SW conversion

• produces nearly working code if original AC450 logic is not written in tricky way → the tool saves 90% of engineering efforts on average

## 2. Shadowing – additional service important for customer

- The aim of Shadowing is
  - to fix all mistakes in control logic before commissioning
  - to make sure the Customer about the converted logic fidelity to the existing logic
- Efficient method for testing and verifying of converted code
  - In office / test field – is more efficient, enables frequent operation of simulated production
  - At site

Shadowing Pre-Commissioning principle

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Shadowing principle – existing and new PLC tested in parallel

1. Transfer of related field input signals from Advant controller to the new AC800M via AF100 fieldbus / MB300
2. Comparison of outputs from both Advant and AC800M controllers in OPC recording tool, tuning of functions in new PLC until all related ouputs from old and new PLC match each other

On-Site-Shadowing principle
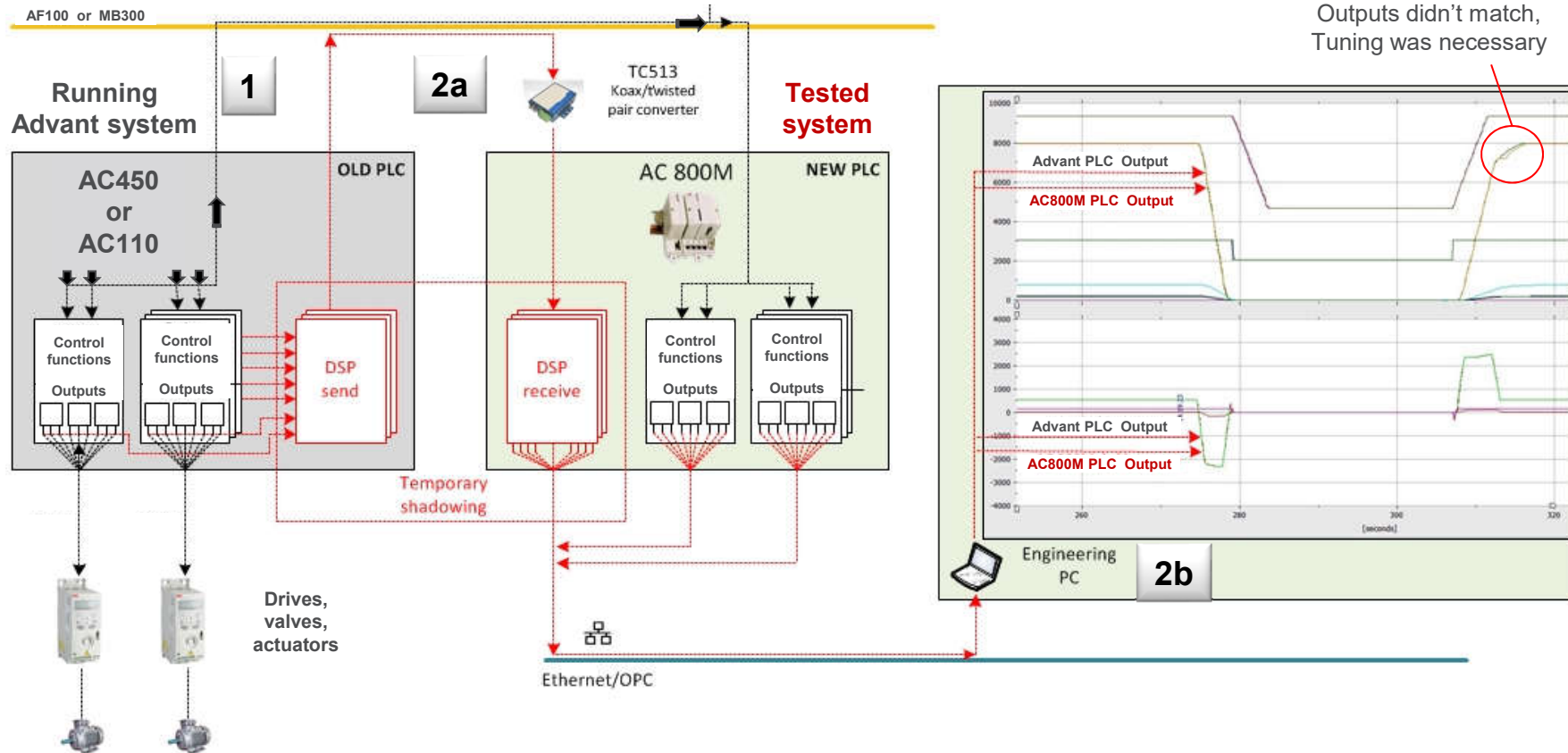
2. Shadowing during production before replacing controllers

Experience in Shadowing during 5 projects of Revamping Advant to AC800M PLCs
In U.S.Steel Kosice, Slovakia and in complex project in Hadeed, Saudi Arabia

The functionality of each new AC800M PLC application SW is being tested in parallel with running existing AC450 / AC110 control system before replacing by the new system in following steps:

- Installation of temporary panel with new AC800M PLC beside existing AC110/AC450 panel
- Temporary interconnection of Existing and New control system via communication bus
- Shadowing - Comparison of existing and new SW functions based on real data inputs
- Commands from old and new controllers will be compared via recording software.
- The aim of Pre-Commissioning/ Shadowing is to tune new function until all AO/DO commands match each other completely in the Graph / Event list recording
- After all SW functions are checked and evaluated it is possible to switch from old to new control system during short outage.

- The biggest advantage of Shadowing is minimization of necessary commissioning time and possible delays during the short outages by help of fixing of all possible mistakes/bottlenecks in new logic, which were not fixed during tests at testing field.

HMI upgrade

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Our Goal is Elimination of technical risk
in order to minimize Shutdown time necessary for PLC revamp
and to avoid any further harmful impact to production

3. **Tool for automated HMI displays conversion**
• Minimize manual HMI drawing, thus helps to avoid mistakes
• Labels, Colors and Shapes will be the same in existing & new HMI displays
• Operation and Functionality will be similar, compatible to AS500
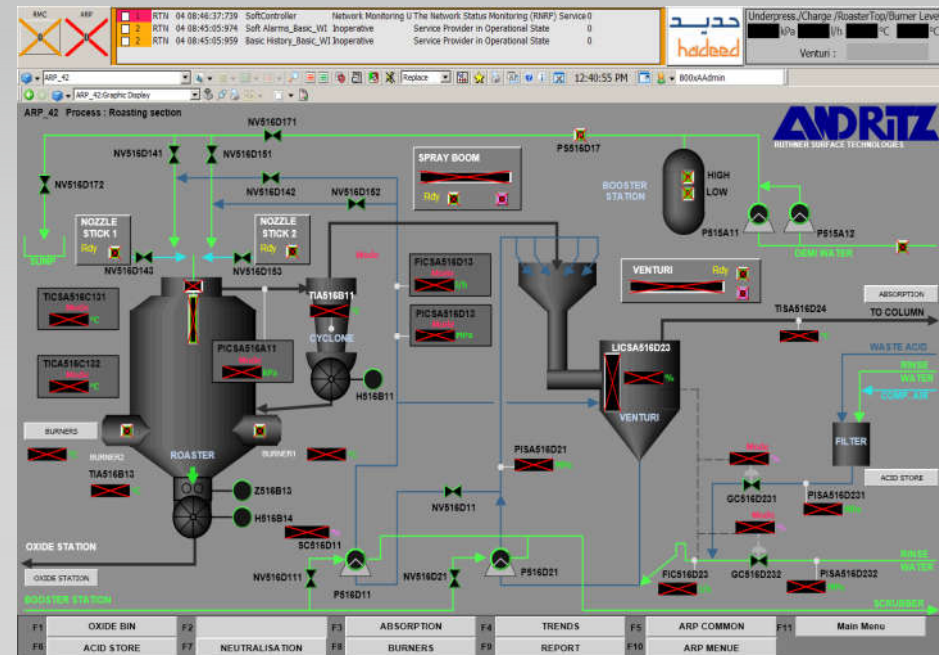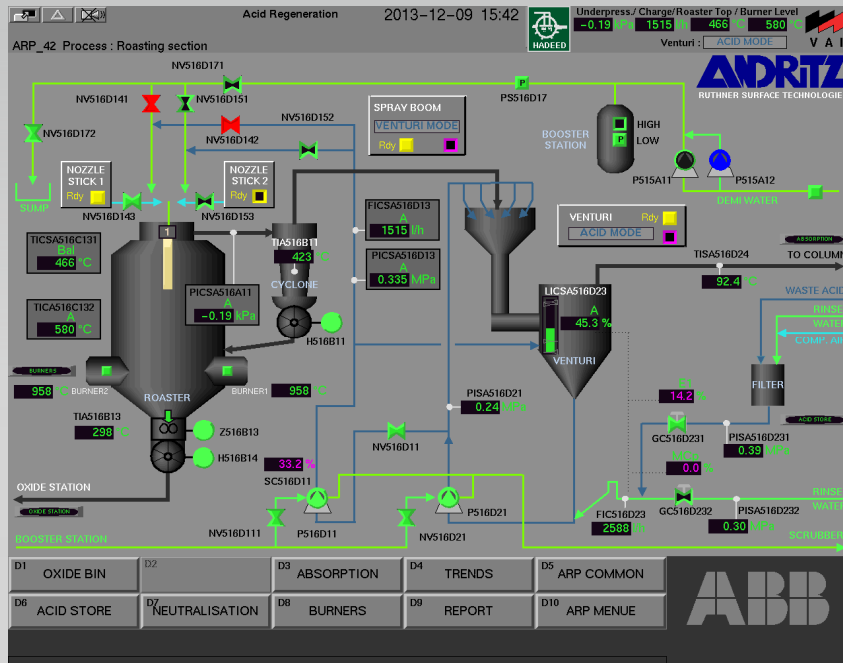
- **Automated conversion of ABB Advant controllers**

  Possible scenarios
  - Automated conversion performed by customer using on-line tool
  - Delivery of completely converted code in status "Ready for FAT/commissioning"
  - Delivery of converted and tested code by shadowing method
  - Delivery of completely converted code including commissioning
  - Delivery of complete solution package including SW and HW

- **Migration of older HMI based on Visual Basic6 / AdvaSoft to 800xA PG2**

- **Programming of new control logic**

- **Consulting services regarding ABB control systems and Drives**

- **Optimization of controls**

- **Commissioning**