



AVISTO

EASTERN EUROPE

CASE STUDY

IO Modules Enabling Device Connectivity and Control





Case Study: IO Modules

Enabling Device Connectivity and Control

Development and testing the new line of IO modules, 30+ Digital Input/Output AC/DC/Relay Modules

This client required full support and project empowerment in the areas of Hardware development, Firmware development, Firmware verification and System conformance testing, which have allowed us to deliver full range of our services and secure top-notch quality.



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Firmware Development



Tools/languages:

- C, Python
- IAR Embedded Workbench IDE
- Continuous integration / Klockwork

Technical requirements:

- Hard real time (synchronous mode of operation)
- Relatively limited memory and CPU resources
- Multithreading and synchronization

Hardware:

- Multicore ARM architecture (Cortex®-M7, Cortex®-M33)
- Proprietary HW solution for handling time critical signals
- GPIO/SPI interface



Activities:

- Complete Front-End FW
- Direct communication to HW using SPI/GPIO interface
- Real-Time data acquisition
- Input Signal filtering
- Real-Time data actuation
- Diagnostics handling
- Communication with Head
- OPC-UA Data Model
- Synchronous/Asynchronous (pub-sub/explicit) mode of operation



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Hardware Development



Tools:

- Allegro Design Authoring + Allegro PCB Editor
- Various simulators provided by IC suppliers (Tina, EE-SIM...)
- Jira & Confluence
- Centralized base for parts
- SharePoint

Instruments:

- Thermal Chamber
- Oscilloscope
- Digital DC load
- Programmable Power Supply, etc.

Additional competency:

- EMC testing within certified labs
- Jira administrating



Activities:

- HW feasibility
- HW simulation
- Schematic design & review
- FW complexity evaluation from HW perspective
- PCB design & review
- Testing – functional, EMC, emission, thermal...
- Validation



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Hardware Verification



Tools/languages:

- Python for test automation and test scripts
- Pytest module for test automation
- ST and Ladder diagram programming
- Signal generators, oscilloscopes, multimeters, voltage transformer, etc.

Permanent test setups:

- Setup with bypass HEAD, 16 DIO modules, PLC and existing module families. Used for test automation, test coverage was above 75%. Currently, it is used for regression testing and execution of tests that cannot be executed in larger system context.
- Setup with HEAD, 22 DIO modules, PLC and existing module families. Used for manual tests, Python scripts developed to help execution of manual tests and to serve as a basis for test automation in the future



Activities:

- Working with HW, FW and System Conformance test team
- Discuss product requirements with the stakeholders (product owner, marketing)
- Define acceptance criteria for every user story
- Ensure that digital IO modules functionalities are according to the product specification
- Detect issues as early as possible and provide fast feedback loop to the developers
- Perform regression tests to ensure that all functionalities still perform as expected and fixed bugs do not re-occur
- Performing functional black box tests in a minimal system context (components developed by other teams integrated)
- Tests are performed with simulated sensors/actuators connected to the terminal block of DIO module, DIO module connected to the HEAD module and (preferred option) HEAD connected to PLC

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System Conformance Testing



Goals:

Conformance testing of IO product line on a system level, which includes the coverage of:

- System performance and robustness
- Key system architectural requirements (system verification approach)
- Feature testing on a system level

Permanent test setups:

- Configuration with 25 clusters and 255 modules
- Configuration with 1200 IO points
- Specific configurations



Activities:

- Constantly updating the modules, manual testing of the newly delivered modules and features
- Updating and triggering of automatic software tests on regular basis
- Creating new test cases to increase the test coverage
- Switching manual test cases to automatic to increase the test automation level
- Detecting and raising bug tickets, retesting and closing delivered bug tickets
- **3000 test cases in our test repository, around 40% of tests executed (a lot of test cases still in blocked state), around 29% of automatic test cases (mostly software tests), over 350 raised bugs.**



LET'S CONNECT!

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*Where passion
leads to excellence*

ABOUT US

AVISTO Eastern Europe

AVISTO Eastern Europe is a service provider that focuses on empowering Industrial automation and Semiconductor projects by offering tailored made solutions in areas of Embedded Systems, Test Automation, Application Software and DevOps.

Established in 2007, AVISTO currently operates three design centers in Serbia and boasts a strong network of experienced engineers empowered by high level of technical adaptability to meet the specific requirements and demands of clients' projects.

As a French company and a member of the Advans Group, which comprises over 1000 engineers, AVISTO can deliver comprehensive product-based development support to clients at the enterprise level.

THANK YOU

