

Upgrades to the slow control of the IDMAR Junction Box

THE IDMAR Junction Box (JB)

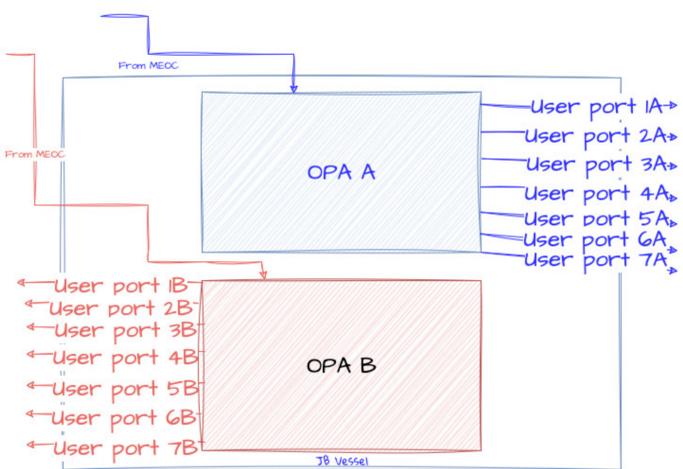
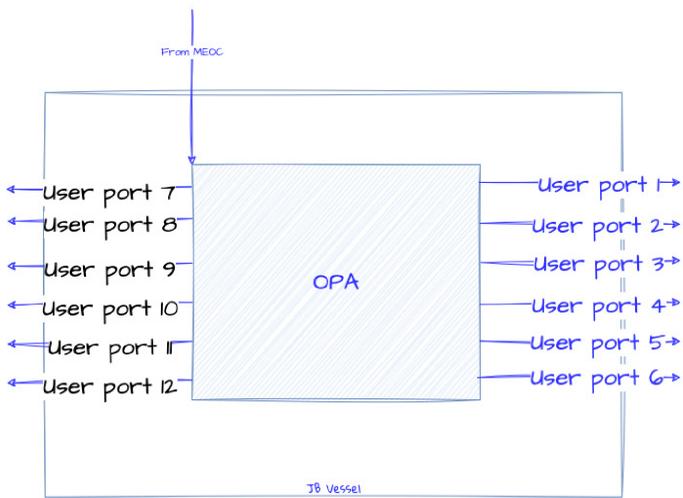
IDMAR is an offshore multidisciplinary research infrastructure located at a depth of 3500 meters and approximately 100 km off the southeastern coast of Sicily. It is connected to shore via electro-optical cables, which carry both power and data. These signals are branched to second-level nodes—**Junction Boxes (JBs)**—that distribute electrical power and optical connectivity to user systems such as the **KM3NeT/ARCA Detection Units**.

From a logical point of view, JB can be divided in Optical, Power and Instrumentation subsystems. Those modules are connected on shore via the main control unit (**MCU**).

In late 2022, a new, higher-capacity electro-optical cable was deployed, enabling a major architectural upgrade: each JB can now host two independent **Optical and Power Assemblies (OPAs)** within the same vessel, increasing the total number of output ports from 12 to 14.

INFN IDMAR JB SLOW CONTROL

The upgraded JB dashboard enables remote control of both OPA A and B from a single web interface. Additional improvements include synchronization status of each submodule and login via remote Identity Provider (IdP), allowing privilege mapping based on user roles within the experiment.



Slow control in action

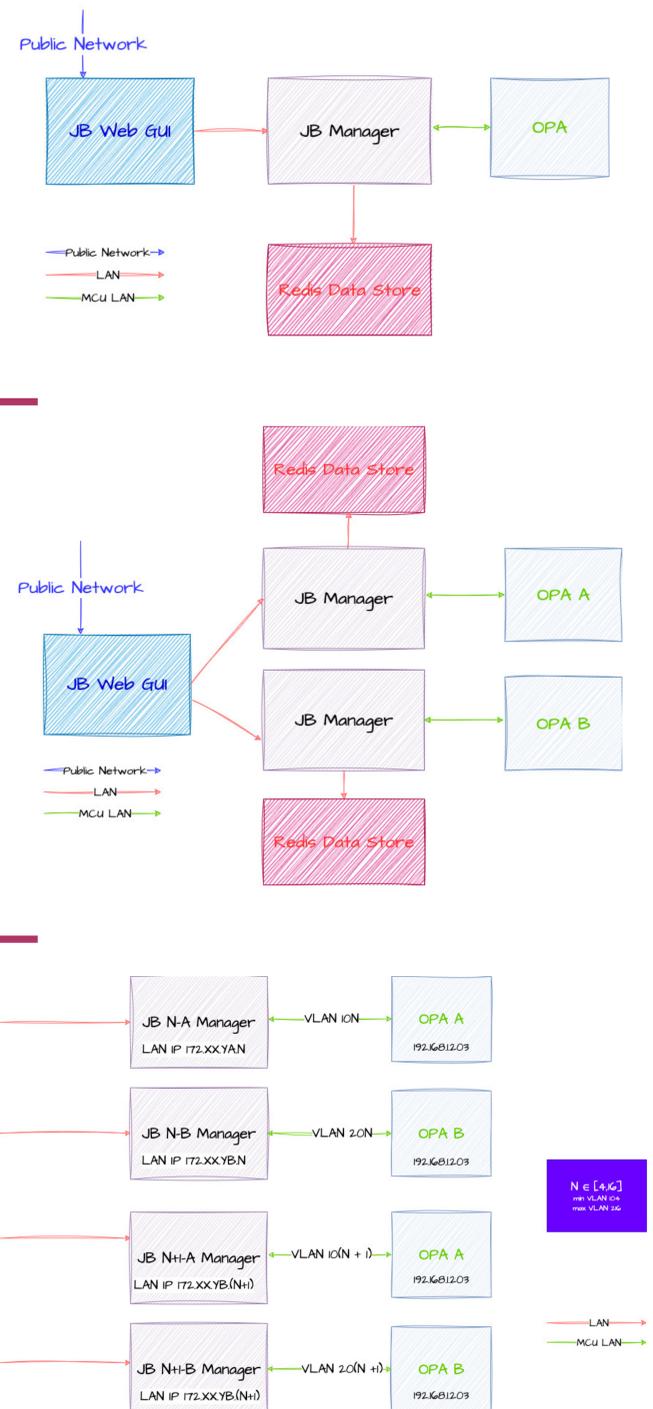
Slow control enables remote control of JB, and monitoring of its functional parameters. The three main components are:

◆ **JB Manager:** it's a Flask web app that maps low level interactions with the hardware to high level API, to be consumed by clients for the JB interactions. It also performs continuous read of hardware functional params that are saved on Redis.

◆ **Redis Data Store:** An open source component here used to store and expose, in form of tuples (key,(val,timestamp)), values sent by JB manager refresh cycles. Timestamps allows the creation of historical trends of values.

◆ **JB Web Interface:** is another Flask web app, developed in Python, exploiting JB Manager API to provide a GUI for the interactions with JB.

Changes to the hardware architecture were mirrored in the upgraded slow control system aiming to preserve the existing user experience. For this reason, a single web interface continues to control both OPAs, exploiting JB Manager API, while the low-level components responsible for hardware interaction have been duplicated and isolated per module.



To maximize reliability, each onshore MCU retains its default static IP address. Network conflicts are avoided by placing each MCU in a dedicated VLAN, ensuring separation and stability across multiple units.

Future evolutions

The hardware is now stable, so major changes to the software are no longer expected, just minor improvements concerning usability, and bug fixed. Future efforts will rely on improving authorization layers, in order to extend interoperability and in particular the possibility of managing the instruments via the KM3NeT Control Unit.

