# Module name: ROS peripheral interface

- **Main functionalities**:

The module provides a ROS interface to pre-existing peripheral elements that lack ROS compatibility. It acts as a proxy between the standard periphery connections and the ROS system. It allows users to quickly integrate existing cell periphery into the ROS-based software system. It can be customized to meet the needs of different production system peripheral equipment in terms of shape, size and connectivity.

- **Technical specifications:**

The ROS peripheral interface is provided as an enclosure that can be mounted on the desired peripheral element. The interface is protected by an enclosure of size and shape not strictly defined and can be adapted and customized. Figure 1 depicts the interface in a metal enclosure and mounted to peripheral fixturing system while Figure 2 depicts the interface in a 3-D printed enclosure mounted on a robotic servo gripper.
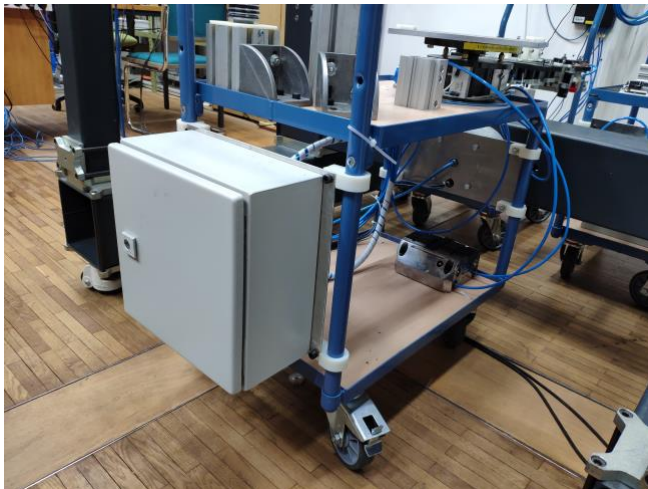


*Figure 1: The ROS peripheral interface attached to a peripheral element in a robot cell.*



*Figure 2: The ROS peripheral interface attached to a robot servo gripper.*

The interface's enclosure typically houses a micro-computer, power converters (5V, 12V, 24V) and digital relays. An example can be seen in Figure 3. The relays can be used to transfer the digital signals inputs and outputs (IOs) from the micro-computer to the peripheral elements. The micro-computer has all the software components necessary to develop ROS compliant interfaces to the IOs, which consequently interface with the periphery.



*Figure 3: The main components of the ROS peripheral interface from left to right: safety fuse, power converters (24V and 5V), micro-computer and relays.*

- **Inputs and outputs:**

An example of the connections to the interface can be seen in Figure 4.

*Figure 4: Example of inputs and outputs to the enclosure of the ROS peripheral interface.*

*Inputs:*

Power and Ethernet are mandatory, though power can be also provided via the Power over Ethernet (PoE) standard. Additionally, pressurized air can be delivered to the interface if needed.

Interfacing with the peripheral components is done through standard ROS services and/or action servers.

*Outputs:*

Digital signals in different voltage ranges, pressurized air for actuation of pneumatic periphery, electric power.

The status of the peripheral components can be monitored through standard ROS topics.

- **Interface specification:**

*Micro-computer*

The micro-computer is at the core of the peripheral module. It runs a Linux instance with all ROS software components pre-installed.

*Software interface to the periphery*

The ROS instance on the micro-computer runs automatically when the peripheral interface receives power. Commands to the peripheral interface are received via standard ROS communication protocols. They are relayed to the peripheral component it controls through a proxy program. This program is specific to the peripheral component.

- **Formats and standards used**:

*ROS-based robot control system, ROS topics, ROS services, ROS action servers, Power over Ethernet.*

- **Availability:**

The modules for standard periphery can be provided. The custom-made modules are available to be ordered.

- **Application scenarios:**

When integrating a robot solution in a pre-existing production facility, the user can use this module to quickly provide an interface of various production machines the to the robot cell.

- **Offered for internal / external use**

The ROS peripheral interface is available for internal and external use.