Equipping your product with communication interfaces requires a fast analysis of market targets for developed equipment. Today there are many network protocols and it is often necessary to be compatible with many of them in the simplest way possible. This can be achieved in different ways depending on the technical and financial criteria. Solutions are either to develop an additional “communication board”, buy such a board from specialized manufacturers or build a device with a processor, which is also able to communicate on the selected communication technology in addition to process management.

The last solution, even if processor usually limits application complexity, has anyway some advantages and can be used for different reason:

- Using just one processor with on-chip network controller can dramatically reduce the PCB (printed circuit board) footprint. This approach doesn’t require any additional hardware except a transceiver chip.
- The form factor criteria is totally controlled.
- The BOM cost is optimized and customs hardware interfaces may be implemented, like analog or digital I/O’s.
- Optimum performances corresponding to device’s features may be achieved by selecting the right processor
- The communication part of embedded software is the only software part that changes depending on desired network technology.

Coval decided to equip its Lemcom vacuum pump with an embedded CANopen interface using the already existing hardware resources of the product. For the design of the network interface, the company cooperated closely with Isit. The Lemcon is the first vacuum pump with CANopen connectivity.

The vacuum pump is based on an innovative, efficient product structure based on a CANopen coupler and additional vacuum secondary pumps. The master pump module has the responsibility to manage the CANopen communication, the communication with the secondary pumps, and its own fully-integrated vacuum pump. The two CANopen connectors enable a continuous network chaining. The secondary pumps are connected to the master pump via the Coval bus.

Contact between the master pump and the secondary pumps is confirmed by an M8 connecting bridge for island configurations or by an M8/M8 cable for configurations based on remote modules.

Figure 1: The modular Lemcom vacuum pump with embedded CANopen interface (Photo: Isit)
Based on an ARM (Cortex M3) processor by Renesas, the master pump module has enough power to handle at the same time CANopen communication, internal vacuum regulation, and also the internal bus for the secondary pumps. It also acts as a gateway for updating the secondary pump’s firmware. The processor runs the CANopen protocol stack providing SDO segmented and block transfer, PDOs transmitted synchronously and change-of-state, as well as Heartbeat functionality. The product uses a proprietary device profile and a proprietary PDO mapping. All vacuum pump configuration parameters are represented in the CANopen object dictionary and can be written by means of SDO services. The CANopen software also features a “safe” boot-loader with SDO block transfer. The EDS (electronic data sheet) file coming with the product eases the integration in host controllers, e.g. PLCs (Programmable Logic Controller). The Lemcom pump with CANopen connectivity has been awarded with the French trophy “Cap Tronic 2015”. The product has been tested successfully on CANopen conformity by CAN in Automation.

The secondary pumps are equipped with ARM (Cortex M3) processors by NXP. The source code versions in the master as well as the secondary pumps are managed by means of the SVN tool, and bugs are managed by means of the Jira tool.

Coval, since 30 years, set out to provide their clients and users with vacuum handling solutions that meet their goals in terms of profitability, productivity, quality, safety, and environmental conservation. The company addresses several markets and industries: food processing, aeronautics, robotics, plastic processing, packaging, and more. Due to continuing its export development, the French supplier is now acknowledged at European level in the domain of vacuum management. The pump manufacturer offers CANopen protocol trainings for its customers.

Isit, founded in 1991 and now part of ICE Group since 2015, has built its success on a strong customers commitment based on a full service approach, technology and methods assistance and the ability of providing customized turnkey solutions. The service provider leverages long term relationship with its suppliers and partners (silicon and software vendors, integrators and contractors) and over the years, has developed strong skills in functional safety, security, and industrial communication systems especially in embedded real-time systems. For 15 years, the French company has participated in numerous projects integrating the CANopen protocol at all levels, be it for training, software integration, consulting, audit, or expertise.

The Lemcom is the result of an excellent collaboration between Isit and Coval in both technical and relational terms. The support and technical expertise of Isit have been continuous from the specifications to the certification and deployment phases for our customers. Undeniably a successful partnership!

Johan Chevallier,
Coval’s Embedded Products Manager