Services, products and expertise in: Concept, design and manufacturing of electronics and mechatronic systems

Intelligent Motion Control System
The Intelligent Motion Control System (IMCS) is a cost and time effective solution to implement complex and high-performance motion control/test systems or prototypes.

It constitutes a family of ready-to-use hardware and firmware components which use a modular and distributed intelligence approaches. A bespoke solution can be quickly and easily assembled from these components, corresponding to a particular combination of actuators and sensors.

**Main applications**

- Research, development and test platforms
- High-performance industrial, robotics and medical applications
- Educational platforms (student and PhD work)

The IMCS combines three electronic parts:

- Power Supervisor Unit (PSU), one for each implementation.
- Accessories (ACC) as BackPlane, pre-cabled rack etc
- Intelligent Motion Control Unit (IMCU) one for each axis or actuator(s)
  to be controlled by the IMCS
What is IMCU?

The IMCU is a DSP-based controller suitable for a large spectrum of control applications. Its modular design includes:

- common for all applications main board (MAIN),
- designed for each specific application mezzanine (MEZZ) for as example sensor interface
- range of power amplifier(s) (PA) (power linear, Brushless, step etc.) allows the user to match the IMCS precisely to the requirements of each motion control project.

Once programmed with suitable and open source firmware, it combines in a single unit all the functions necessary to control one actuator(s).

The IMCU is designed around reprogrammable (CPLD and DSP) and reconfigurable technologies allowing it to be tailored exactly to a particular requirement.
What is IMCU?

**Development**
- C compiler & IDE
- Matlab/Simulink direct programming & debugging

**PowerAmplifier(s)**
- (standard or custom)
- Linear (5A@150V), Brushed, brushless, stepper (4 x 7A@50V)

**Power Interface**
- (optional customising)
- Digital isolated interface to power amplifier, current and voltage measurement, protections, configuration, adjustment (fixed or digital by I2C)

**MEZZanine**
- (custom)
- Specific for given application interface as Resolver, LVDT, high resolution ADC, analogue isolation etc.

**MAIN**
- (common for all applications)
- DSP (fixed point), programmable CPLD, CAN bus, USB/RS232, Enable/state, SPI, I2C, Digital I/O

**Digital**
- Isolated: Enable/State, CAN bus

**Analogue**
- Custom: connections to MEZZ as analogue reference, current and voltage measurement, high speed SPI etc.

**Isolated**
- USB/RS232

**Development**
- (C compiler & IDE), Matlab/Simulink direct programming & debugging

**Isolated**
- 7 x power pins: +Vs, 4 x actuator’s outputs
- 24 x digital I/O applied to interface Resolver, LVDT, digital I/O, high speed SPI, I2C hall sensors etc.

**dSpace, Galil, PMAC, VME’s boards, NI, IMCU as master, EtherCat (optional)**

**Resolver, LVDT, high resolution ADC, analogue isolation etc.**
What is IMCU?

**MAIN**

The MAIN board, common to all IMCU configurations, contains the devices and interfaces generic to all applications.

It is designed with highly flexible interfaces to customized mezzanine boards and available power modules.

The main digital signals are connected to the common programmable CPLD device allowing large possibilities of interconnection and interface.

**PM**

The PM Power Module differs between IMCU implementations depending on the actuator technology used. These modules include analogue measurements of actuator voltage and current, and also the usual protective circuitry including configurable over-current and over-temperature cut-outs, power supply verification and an enable/disable input. Available modules are based on two technologies: linear and PWM in three-phase bridge or stepper configurations.

**MEZZ**

The IMCU mezzanine board is customised for each application. It acts as the interface between the IMCU and the particular sensor such as resolver, LVDT, incremental and/or communication technologies used in a specific application.

**Development**

The IMCS system provides large software development possibilities. The application can be generated by a commercial C-compiler and IDE (MPLAB X) or already tested Matlab/Simulink platform (direct programming).

Users can easily develop and implement their own applications or commands using the USB or RS232 interfaces and pre-installed on the IMCU firmware including downloading capabilities.

**Firmware**

The IMCS is provided with firmware (source code available) corresponding to a given application, but can be easily reprogrammed by the user to implement customized control behaviors including interface with a host control system or work in a standalone or distributed context.

The provided firmware includes a *downloader* but also a *command interpreter*, which accepts simple, two-character/argument instructions. As examples: “pm50” (PWM at 50%), “en” (enable), “ec” (error cancel) etc.

As a function of dynamic requirements any different combinations of low (CAN, RS232), high speed (SPI, RT etc.) and analogue interconnections could be used. This approach allows use the IMCS in different control configurations. It is also possible to use the IMCU (or one of the IMCU in multi-axis context) as the Host.
What is PSU?

Power Supervisor Unit (PSU), one for each implementation. Its goal of the PSU is to provide the centralized emergency-loop management of the whole IMCS based on CPLD and wired technologies.

- IMCS internal power supplies (optional) analog ±15 VDC,
- digital +5 VDC and +24 VDC power supply control on/off as a function of the emergency-loop state
- External and internal control signals: manual or remote on/off, limit switches, emergency loop etc.
- Rack ventilation and coiling temperature control

Emergency and closed loop protection

The frontal connectors of the IMCU and PSU include opto-isolated: Enable/Disable input and State output. They could be used to provide an individual or closed-looped wired emergency management. In this case any local default state (protection activation) disables the given IMCU, opens the wired emergency-stop loop and depending on the defined function switches-off power supplies.

Current development

The new PSU’s version shall include Raspberry PI (Linux) computer. It allows to extend largely IMCS’s interconnection as:

- Wired or WiFi Ethernet including Web server to configure remotely IMCS
- CAN as master
- Modbus including downloading facilities
What are ACCessories?

The IMCS includes an assembly of the different accessories such as: the Back Plane (ACC-BP) common for all electronic boards, pre-cabled rack (ACC-RACK) etc.
IMCS (Previous application: CSEM’s activities)

- Research, development and test platforms
- High-performance industrial, robotics and medical applications
- Educational platforms (student and PhD work)