

ALFA CENTAURI

Charge Amplifier for mASTRO conditioning system



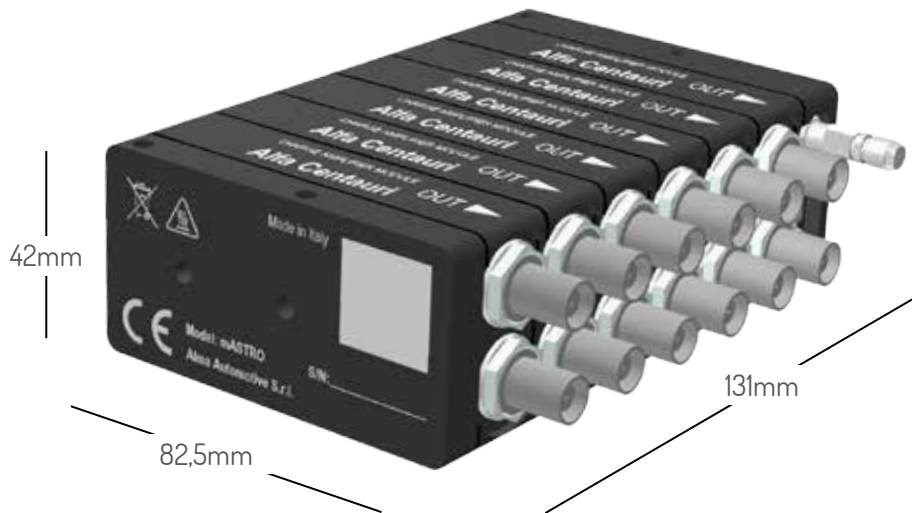
mASTRO is a modular analog conditioning system .

mASTRO is a platform designed to be customizable and configurable. It allows to add channels at any time.

mASTRO is the best solution for signal conditioning in motorsport environments.

Distinctive features at a glance

- Reduced dimensions, waterproofness and robustness allow installations in any situation
- Channel to channel insulation guarantees very low noise
- Strong immunity to disturbances due to galvanic isolation between channels
- Large range of operating temperature and possibility of installation near engines
- Programmable with our software or free API
- Easy firmware update for improvements and custom request
- Custom channel development on request



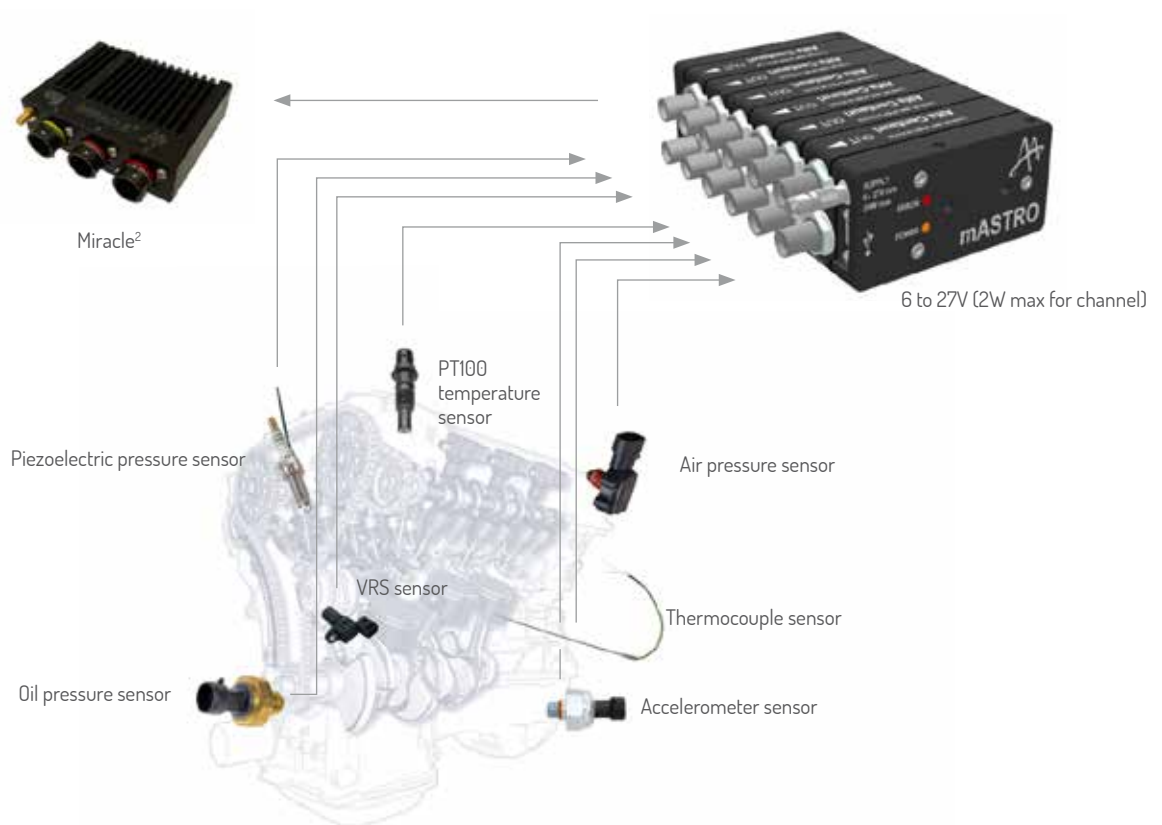
Alfa Centauri is the first of a full set of modules under development.

They'll be capable of conditioning all the commonly used sensors in the automotive environment.

Conditioning module currently under development include:

- A fully programmable square waveform processor capable of threshold detection on any type of signal (VRS, PWM, Spark signal, etc.). It will be capable of virtual encoder signal generation.
- Fully programmable amplifier (Gain, Offset, Filter)
- IEPE amplifier
- Universal input conditioner (Strain gage, PT100, PT1000, NCP, PTC and thermocouple).

Acquisition system



Alfa Centauri

Alfa Centauri is the new Alma Automotive's charge amplifier designed for mASTRO.

Extremely compact and rugged: all the components are 105°C, high vibrations, guaranteed.

It's perfect for pressure piezoelectric sensor, but it's also compatible with piezoelectric accelerometer sensor. Alfa Centauri support sensor range from 250pC up to 28000pC.



Ready-to-use products

- Pre-calibrated. You can set sensor characteristic and desired bar/volt
- BNC connector for rapid plug and play
- Wide supply range: 6V to 27V
- USB with auto installing driver

Noise free

- <math><1\text{mVRMS}</math> noise
- Channel to channel and channel to supply isolated
- Programmable filter
- Small and rugged, could be placed near the sensors to minimize cable length

Fits all the systems

- Output bar/volt selectable
- Offset programmable (for single ended/bipolar mode)
- Two output configuration available: differential or single ended

Mechanical

| | |
|---------------|---|
| Input channel | 1 to 12 modules |
| Dimension | 82.5mm x 42mm x (23 +18 each module) mm. |
| Weight | 150g + 80g each module |
| Case | IP64, 7075 (Ergal®) CNC machined aluminum |

Operating Conditions

| | |
|-------------------|---|
| Power supply | 6-27 V DC or 100-240V via optional AC adapter |
| Power consumption | 1.7W per channel |
| Temperature range | -25-105 °C ambient (storage -40-125°C) |

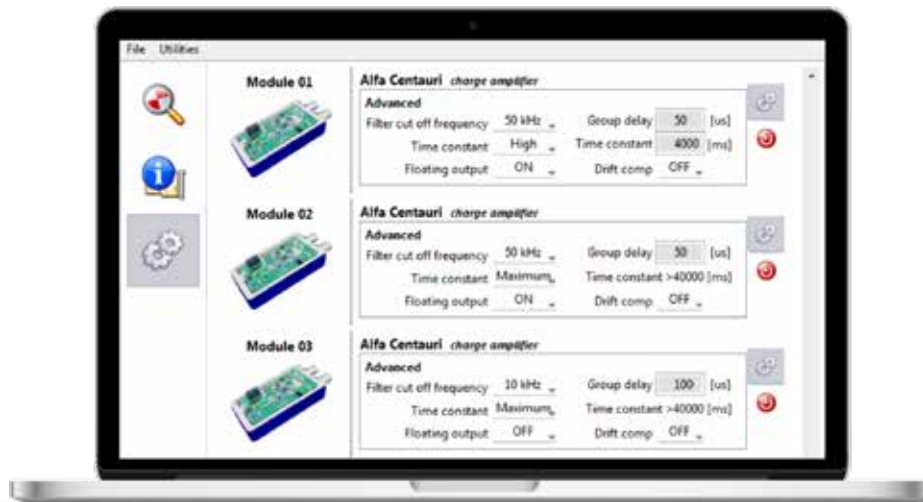
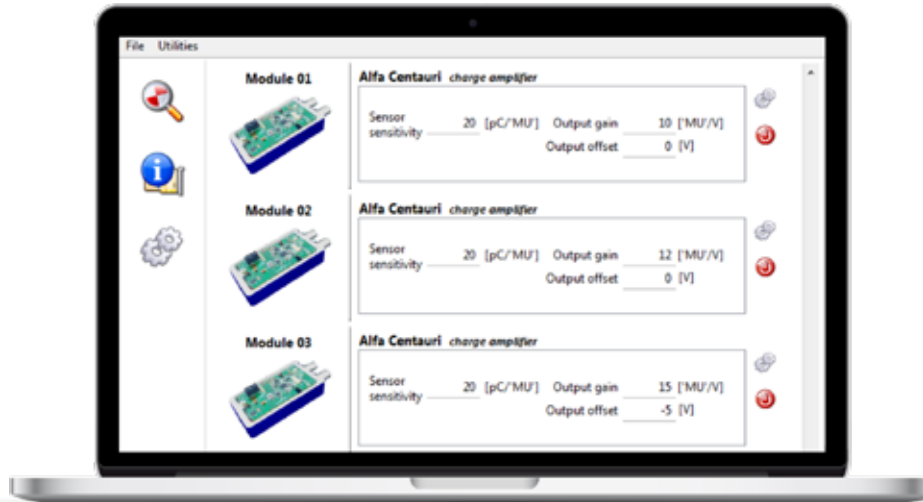
Electrical Characteristics

| | |
|--------------------|---|
| Input range | Double range: up to 5000pC or up to 28000pC |
| Precision | 0.1% |
| Output range | -10-+10V with GND engine isolation for single-ended and differential acquisition system |
| Gain | user selectable output range, in bar/V |
| Output Offset | -10-+10V (user selectable with 0.1V step) |
| Filter (Low Pass) | 10-150kHz (user selectable in 10kHz step) |
| Group Delay | 8us to 104us (depends to filter) |
| Noise | <1mV RMS (1Hz-400kHz) |
| Drift compensation | Cyclic drift compensation or continuous drift compensation |
| Time constant | User selectable: 1s to infinite |
| Isolation | 300V channel to channel, channel to ground isolation |

Connectivity and Extra

| | |
|------------|--|
| Connectors | BNC for signals, mini USB for programming, LEMO B series for supply. |
| Extra | Customizable input range, USB upgradable firmware |

Graphic interface for mASTRO channel configuration



CASE STUDY

Electrical noise on engine test bench



THE CHALLENGE

Improve the Signal To Noise ratio in piezoelectric pressure sensors acquisition.

Due to the noisy environment the pressure sensors are commonly mixed in, their weak signals often suffer of spikes generated by other high-power, high-frequency signals.

In the image you can clearly see the spark noise interfering with a pressure sensor signal.

This will result in a considerable error in the acquired data and later analysis.

THE SOLUTION

Analyzing the source of this problem we found that it was a mix of factor:

- The sensors, despite being connected to the same engine block, were referred at different ground references
- The conditioning system lacked a configurable filter, which could be tuned to match the noise exact frequency

This challenge led us to develop a new charge amplifier, with complete galvanic isolation and a programmable filter.

From the first prototypes Alfa Centauri was able to delete the ground interference. So, we decided to add all the other possible features to realize a complete product (programmable offset, programmable gain, auto-calibrated system, auto drift compensation, ecc).



Originally established as a spin-off of University of Bologna, Alma Automotive represents the synergy between knowledge acquired in academic research activities and years of experience in developing applied solutions. The company has now evolved to offer both ready-to-use products and engineering services supported by bespoke hardware and software solutions.

Highly oriented towards new challenges, Alma Automotive's mission is to provide innovative solutions

and tools to help customers in the development of ever more efficient engines and powertrains. Our partnership with National Instruments and the strong relationship we have with top-tier automotive companies is testimonial to the high level of skill and quality of services offered to our clients.



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