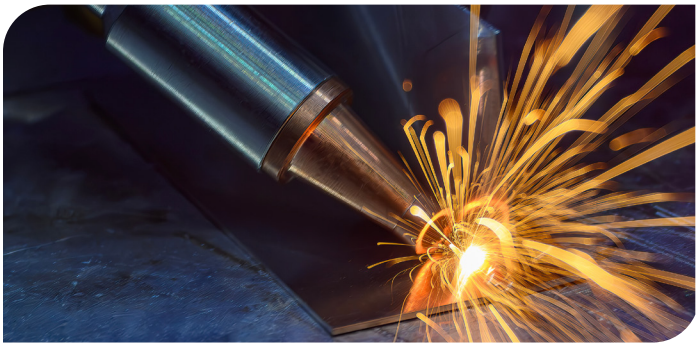
Delivering cost-effective process monitoring for the welding industry

Enabling universal weld monitoring through smart sensing and scalable design

Context

Regulation of welding is increasing, driven by an aging workforce and an industry commitment to streamline traceability and harmonise standards under the Welding Procedure Specifications (WPS). In response to these demographic and regulatory shifts, a leading industrial gas company sought to develop a compact, smart connector (SC) system to capture welding data.

Existing monitoring tools provide real-time feedback and documentation for traceability purposes, but they are expensive and compatible only with high-end welding machines. The client wanted a cost-effective, retrofittable product that worked on a wide range of welding equipment and transmitted logged data to mobile devices. They engaged Sentec to develop a prototype that delivered technical reliability, supported the welding industry's digitalisation journey and complied with regulations.



Challenge

The project centred on developing a prototype for a user-friendly data logging device compatible with all welding equipment. The smart connector needed to record voltage, current, gas flow and wire feed speed during welding – without altering machine performance – and wirelessly communicate this data to mobile devices. Delivering non-contact wire speed measurement posed a technical challenge, as traditional mechanical methods risked disrupting the wire feed. The device also needed to integrate seamlessly with external software, operate reliably across different power sources and support regulatory compliance.

> From the initial concept right through to developing the working prototype, Sentec's team worked seamlessly across disciplines."
>
> Dr. Andreas Betz, Global Product Manager, Xylem (formerly Sentec project team)

Solution

Sentec's multi-disciplinary team drew on physics, mechanical design, electronics and software expertise to deliver the project in a phased approach. They began with proof-of-concept testing, evaluating multiple sensing principles to determine whether the client's required measurements could be delivered without disrupting welding operations.

Armed with these insights, they developed an innovative non-contact wire speed measurement technique. Drawing on optical sensor technology, it removed the risk of mechanical interference. To measure gas flow across varying conditions, Sentec adapted heat-based sensing, ensuring accuracy without disrupting the shielding gas stream.

The electronics team designed circuits capable of capturing high-speed voltage and current signals, while embedded software processed and stored this data securely. Bluetooth connectivity enabled seamless integration with the client's mobile application. Parallel development with the client's software partner ensured that data formats and wireless communication were aligned.

For physical prototyping, Sentec's in-house mechanical engineering and laboratory teams enabled rapid iteration. This expertise facilitated the development of functional 'looks-like, works-like' models and refined the prototype for ease of use in the field and with regulatory compliance baked in from the outset.

Outcome

Sentec delivered a compact, retrofittable smart connector prototype with the potential to unlock new levels of traceability and quality to the welding industry. The solution demonstrated not only technical reliability, but a clear, scalable path toward cost-effective commercial production.

Through rigorous testing, precise sensing and seamless integration with external software systems, the prototype proved that accurate, real-time welding data can be captured without disrupting workflows.

Sentec gave the client a validated, compliant prototype that provided the potential for market expansion and a new method for wireless data logging.

> "As the welding sector shifts toward greater digitalisation and quality standards, this prototype demonstrates how innovative sensing can lead the way."
>
> Dr. Andreas Betz, Global Product Manager, Xylem

Conclusion

By combining expertise across physics, electronics, mechanics and software, Sentec transformed an early concept into a practical, scalable data logging device designed for a rapidly evolving industry.

The prototype directly addresses rising demands for transparency and quality while giving the client a significant commercial advantage: wireless, universal logging for all welding equipment.

This project showcases Sentec's ability to solve complex sensing challenges and accelerate innovation – demonstrating how multidisciplinary engineering can redefine what's possible in industrial environments.

Non-contact

Wire speed measurement with zero interference