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硕 士 学 位 论 文

压力变送器法兰密封焊接系统的研究

Research of Welding System for Pressure Transmitter's  
Flange Sealing

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## 摘要

随着国内工业自动化的不断发展，仪器仪表行业得到了飞速的发展。同时，随着现代工业自动化的智能程度和控制要求的提高，用户对仪器仪表的稳定性、测量精度以及网络通讯能力提出了更高的要求。

对于仪器仪表类精密产品来说，人工操作易对产品质量产生较大不利影响，产品的稳定性和可靠性得不到保证。本课题来源于福建上润精密仪器有限公司的自动化设备的研发项目，以提高产品的稳定性和可靠性，加强巩固其产品在市场上的竞争力。

在压力变送器的生产过程中，影响其质量的关键生产工艺应采用半自动或全自动化加工技术，以保证产品的一致性。根据企业需要，研究设计了一台全自动激光焊接设备，专用于法兰式压力变送器中法兰与隔离膜片的密封焊接。此焊接机采用先进的光纤激光焊接工艺，可容易获得高质量的焊缝，延长压力变送器的使用寿命；以全自动的形式完成工件的装配、定位以及焊接，可有效保证产品的一致性。

本文通过对气动夹具系统、交流伺服定位系统、PLC 控制技术、人机界面技术、激光焊接工艺等进行研究，设计出一台由输送带、气爪机械手、吸盘机械手、可移动激光焊枪、旋转工作台、气动夹具等部件组成的全自动激光焊接机。并利用 CAD/CAM/CAE 一体化的三维软件 Pro/Engineer 完成了整个焊接设备的三维建模和虚拟装配。

关键词：压力变送器；密封焊接；自动化

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## Abstract

With the continuous development of the domestic industrial automation, instrumentation industry is developing rapidly. Meanwhile, the modern industrial automation has become more and more intelligent, and control requirements have got more and more strict. So, the instrumentation products must have better performance in stability, measurement accuracy, and communications capabilities, which is used in network control.

Since most of instrumentation products belong to precision level, manual operation may have a great negative impact on the quality of the instrumentation products when processing. Accordingly, the stability and reliability of those products also can't be guaranteed. So the automation equipment must be used in precise instrumentation products processing. The project referred to this paper comes from the Fujian Wide Plus Precision Instruments Co., Ltd. The company needs to develop automation equipment to improve the stability and reliability of its products, and to reinforce the market competitiveness of its products.

In order to guarantee the quality and consistency of pressure transmitter, semi-automation or fully automation technology should be used in critical processes. A laser welding machine for sealing flange with isolating diaphragm was designed, and this welded flange was used for flange-type pressure transmitter. This welding machine takes advantage of the advanced fiber-optic laser welding technology, which can easily obtain high-quality welding seam and extend service life of the pressure transmitter. The automatic process of assembly, clamping and welding helps to guarantee the transmitter consistency.

In this paper, many technologies had been referred, such as pneumatic clamping system, AC servo positioning system, PLC technology, human-machine interface (HMI) technology, the laser welding technology and so on. And then a laser welding machine has been designed, which was made up of a conveyor, a robot for flange, a robot for diaphragm, an adjustable laser torch, a rotary table, a pneumatic clamping system and some other components. By using CAD/CAM/CAE integration 3D

software Pro/Engineer for 3D modeling and virtual assembly, the mechanical design of the welding equipment has been completed.

Key Words: Pressure Transmitter; Seal Welding; Automation

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