# CHAPTER 6 CONCLUSIONS AND FUTURE WORK

## 6.1 Introduction

In this chapter, the conclusions are drawn. Definition of the AS-i and its advantages will be summarized. Recommendations for future work are also discussed.

## 6.2 Conclusions

The actuator-sensor interface (AS-i) is the standard solution for simple, cost-effective networking of sensors and actuators in the field. AS-i has established a strong position throughout the automation pyramid in the field level. AS-i replaces conventional wiring technology on the sensor actuator level. It has firmly established itself as a worldwide standard for the cost-effective transfer of power and signals along a single cable. The biggest advantage of AS-i is the quick and uncomplicated installation of the system. Communication (Manchester encoding) and energy are transmitted via a 2-wire cable. By using piercing technology for contacting the cable, it is possible to insert a new slave at any point in the system. In addition, the arbitrary structure of the bus (line, tree, star,...) permits the perfect adaptation to the relevant plant or machine.

An AS-i system comprises a master, an AS-i power supply unit, AS-i cables and the nodes called AS-i slaves. The AS-i master forms the connection to higher level controls. It independently organizes the data traffic on the AS-i line and, in addition to the signal call-up, is responsible for parameter settings, monitoring and diagnostic functions.

The special AS-i power supply unit generates a regulated 30 V DC with a high degree of stability and low residual ripple. It supplies the electronics of the network which means the AS-i modules and the master, as well as the connected sensor system. As a result of the integrated data decoupling, the power supply unit separates the data and power, as both are simultaneously transferred along the two conductor AS-i cable.
The yellow, flat cable is a characteristic for the AS-i. Data and power for the sensors are transferred along this cable. A second, black flat cable is used to supply the actuators with 24 V DC.

AS-i is an open standard. Thus, it is possible to operate different bus participants made by different manufacturers in one network. AS-i slaves are generally addressed via AS-i master or via an addressing unit. With the introduced AS-i specification V. 2.1 & v3.0 some innovations have been integrated into the AS-i system. The most important alteration is the possibility to operate 62 (instead of 31) slaves in one network. This became possible by the introduction of a differentiation between A and B slaves (From1A...31A to 1B..... 31B).

AS-i can be used as part of a distributed architecture, as a subsystem for higher level bus systems. Gateways or links are used for this philosophy such as the PROFIBUS gateways. This enables the end user to be more flexible in the general cabling layout of the system. It also allows for the configuration and commissioning of a control station prior to the programming and completion of the central control station. This makes commissioning much easier and reduces time.

## 6.3 Future Work Proposal

We suggest the use of the Ethernet protocol in industrial environments for automation and production machine control. This constitutes an important enhancement of the AS-i network.

# References

[1]     Introduction to Fieldbus systems, Available from: http://people.cs.pitt.edu/ ~mhanna/Master/Introduction.pdf [Accessed 25th Feb. 2013].

[2]     Jean-Pierre Thomesse, "Fieldbus Technology in Industrial Automation", *Proceedings of the IEEE* , June 2005, vol. 93, issue 6, pp 1073-1101.

[3]     Alexandru Pescaru, and Radu Dobrescu, "Improving Fieldbus Design with Opnet Simulation", *U.P.B. Sci. Bull.*, Series C, 2010, vol. 72, issue 4.

[4]     Industrial Networks for Communication and Control, Available from: http://anp.tu-sofia.bg/djiev/PDF%20files/Industrial%20Networks.pdf [Accessed 10th May 2013].

[5]     AS-I Interface Answers for industry, Available from: http://www.industry.usa. siemens.com/automation/us/en/industrial-controls/products/as-interface-field-bus /doc uments/e20001-a550-p305-v3-7600.pdf [Accessed 30th October 2012].

[6]     SIEMENS Training Course, "AS-i Training", Release Feb. 2014.

[7]     IFM Electronic GMBH, "IFM electronic Bus system AS- interface Catalogue 2008/2009", Available from: http://www.ifm.com/ifmweb/downcont.nsf/files /ifm_as-interface_catalogue_gb_08/$file/ifm_as-interface_catalogue_gb_08.pdf [Accessed 2nd December 2013].

[8]     Schneider Electric, Actuator-sensors interface AS-i-bus User guide, Jan 2000, Available from: http://www.global-download.schneiderelectric.com/mainRepos-itory/EDMS_CORP5.nsf/69f5d72c7a0cf811c12573d800389503/71d296d6b8fad0d 68525787f005fa8ba/$FILE/XDOC5011EN.pdf [Accessed 20th January 2014].

[9]     SIMATIC NET AS-Interface - Introduction and Basics Manual, Available from: https://w3.siemens.com/mcms/industrial-communication/en/support/ikinfo/Docum-ents/SYH_asi_grundlagen-76.pdf [Accessed 15th July 2013].

[10]    AS-i Interface Simple, Robust, Device-Level, Bus, Available from: https://www.ulpgc.es/hege/almacen/download/31/31119/asitutorial.pdf [Accessed 17th April 2013].

[11]    AS-i Gateway Manual, "DP/AS−i INTERFACE LINK Advanced, as of hardware version 1, as of firmware version 2.0", Release 03/2008, Available from: http://cache.automation.siemens.com/dnl_iis/jE/jExNzI1OQAA_22710305_HB/G H_dp-asi-link-advanced_76.pdf [Accessed 19th September 2013].

[12]    IFM Electronic GMBH, "AS-i Module AC2264 installation instructions", Available from: http://www.ifm.com/mounting/7390465DEFRUK.pdf [Accessed 20th November 2013].

[13]    SIEMENS Training Course, "Siemens SIMATIC S7 PLC Basic", Course Code ST-7PRO1 [Accessed 28th August 2013].

[14]    C.T. Jones STEP 7 in 7 Steps, Available from: http://www.etf.unssa.rs.ba/~ slubura/Procesni%20racunari/step7in7step/Step7in7step.pdf, ISBN 1-889101-03-6.

# ملخص الرسالة

## مقدمة:

شهد مجال شبكات الاتصالات فى التطبيقات الصناعية تطوراً ملحوظاً فى السنوات الاخيرة. حيث ان هذه الشبكات تلعب دوراً هاماً فى الربط بين أجهزة القياس المختلفة و مشغلات التحكم الآلى. يعتبر نظام الربط بين المشغلات والحساسات من أهم أنظمة الربط التى تُستخدم فى معظم التطبيقات الصناعية ، حيث يقوم هذا النظام باستبدال نظام التوصيل التقليدى بين مختلف الحساسات والمشغلات بكابل واحد يقوم بنقل البيانات من هذه الأجهزة إلى أجهزة التحكم الآلى ، وبالتالى يؤدى إلى تقليل تكلفة إنشاء هذه الشبكات بالإضافة إلى سرعة بناؤها.

## الغرض من هذه الرسالة:

سوف نقوم فى هذه الرسالة العلمية بدراسة نظام الربط عن طريق كابل واحد بين المشغلات والحساسات من حيث المزايا وكيفية بناء هذه الشبكة والتعرف على مختلف مكوناتها ، بالاضافة إلى القيام بإجراء تجربة عملية تشرح خطوات إنشاء هذا النوع من شبكات الاتصالات وكيفية استخدامها فى التطبيقات الصناعية.
و تحتوى هذه الدراسة ستة فصول:

## الفصل الأول:

يحتوى على تعريف لانظمة ال "Fieldbus" ومميزاتها وطرق بناء شبكات الإتصالات فى نظم التحكم الصناعى .

## الفصل الثانى:

يناقش نظام الربط بين المشغلات والحساسات "AS-i " من حيث الخصائص والمميزات والإصدارات المختلفه لهذا النوع من شبكات الإتصالات.

## الفصل الثالث:

يقوم بدراسة المكونات الاساسية لبناء شبكات ال" AS-i " ووظيفة كل جزء من هذه المكونات.

## الفصل الرابع:

يقوم بدراسة المبادئ الاساسيه لكيفيه عمل نظام ال" AS-i " والمراحل المختلفة التى من خلالها يتم تبادل البيانات بين مختلف المكونات .

## الفصل الخامس:

يشتمل على دراسه تجربة عملية لكيفية تطبيق نظام ال" AS-i " من خلال التحكم باستخدام ال" PLC واتصاله بشبكة ال" AS-i " عن طريق شبكة ال"PROFIBUS"

## الفصل السادس:

يشتمل على خلاصة ما تم إستنباطه خلال هذه الرسالة و بعض الأفكار المقترحة للعمل المستقبلى