USER MANUAL

ANYBUS® IC EVALUATION BOARD

DOC. NO. ABSICEVB-UM-1.01E

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Revision Notes

Index	Date	Chapter	Autor	Revision	Revision note
1	2003-05-01	All	Mat	1.0	Build
2	2003-10-21	5.2	Mat	1.01	Tolerance for power supply updated

Preface

This document describes the technical features and usage of the AnyBus-IC Evaluation Board. The Evaluation Board allows you to set up a complete development environment for creating applications which use the AnyBus-IC Module with serial interface.

! Please refer to the appendix for a list of supported AnyBus-IC modules.

Table of contents

1. Introduction

This document will show the technical background of the connection between AnyBus IC and AnyBus IC Evaluation Board. It's strongly recommended to read chapter 3 "Simple StartUp" before using the AnyBus IC Evaluation Board.

Please contact our technical support department if you have any technical questions. Please refer to the end of the appendix of this document for the address. The appendix also contains a feedback form which you should use if you have any suggestions for improving this product.

1.1 Scope of delivery

Designation	Description
AnyBus-IC Evaluation Board	Development board for inserting an AnyBus-IC module. The board contains all needed parts to communicate between a fieldbus system like Profibus, DeviceNet or Industrial Ethernet and a serial connection with RS232 or direct communication to I/O signal lines with shift registers.
1 Serial 1:1 cable	D-SUB9 socket <–> D-SUB9 plug
3 Fieldbus Adapter Boards	Adapter Boards with typical fieldbus connectors for connection to Profibus, Devicenet and Ethernet
AnyBus-IC Tools CD-ROM	Contains: AnyBus-IC User Manual Example software AnyBus-IC Design Guides, Fieldbus Appendix, technical drawings Freeware Modbus/TCP Server

1.2 System requirements

Part	Requirement
IBM Compatible PC	min. Pentium I 100 MHz, 32MB RAM, free RS232 Port with D-SUB9
Operating System	Windows 9X,ME,NT,2K, DOS, LINUX
Programm	Standard Terminal Programm (Hyperterm…)
Power Supply	5V DC, 800mA
AnyBus Fieldbus Module	AnyBus-IC for Profibus, DeviceNet or Industrial Ethernet

1.3 Related documents

Name	Description	Document Number
AnyBus-IC Design Guide	General Engineering information for In-Design of AnyBus-IC	ABS-DESIGN-SER
AnyBus-IC Appendix - Profibus	Data sheet for AnyBus-S Profibus-DP	ABS-APPENDIX-PDP
AnyBus-IC Appendix - DeviceNet	Data sheet for AnyBus-S DeviceNet	ABS-APPENDIX-DEV
AnyBus-IC Appendix - Ethernet	Data sheet for AnyBus-S Ethernet	ABS-APPENDIX-ETN

2. Hardware description

2.1.1 AnyBus-IC Evaluation Board external

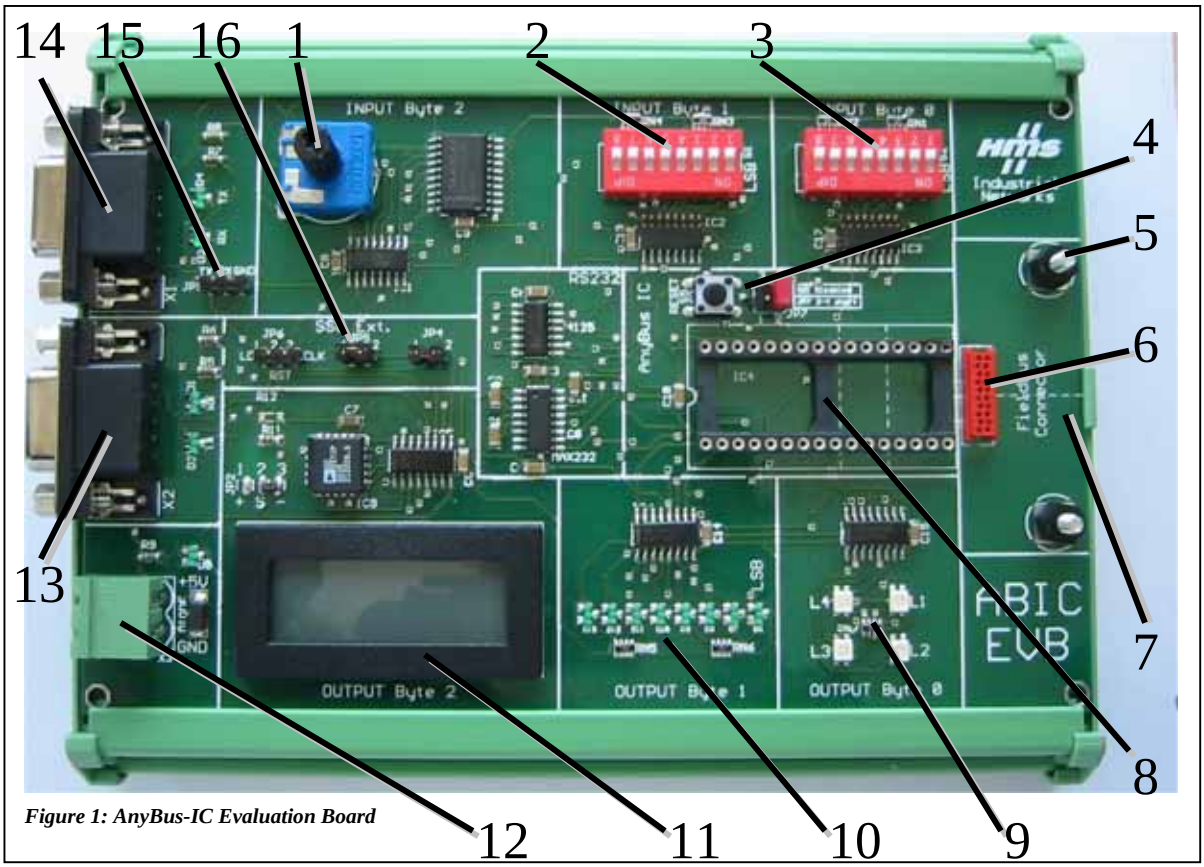

Figure 1: AnyBus-IC Evaluation Board

1. Potentiometer for Analogue value (Input Byte #2)

2. Digital switch for binary input values (Input Byte #1)

3. Digital switch for binary input values/ Address switch (Input Byte #0)

4. SCI DE Jumper to enable SCI communication/Reset switch

5. Mounting screws for fieldbus connector

6. Interface for fieldbus boards

7. Socket for Fieldbus connector

8. AnyBus IC

9. LEDs for digital output/Diagnosis LED (Output Byte #0)

10. LEDs for digital output (Output Byte #1)

11. Digital display for analogue output values (Output Byte #2)

12. Power supply connector (5V DC, 800 mA)

13. MIF interface connector (RS232)

14. SCI interface connector (RS232)

15. SCI interface connector (5V TTL)

16. SSC Expansion connectors

2.1.2 AnyBus-IC Evaluation Board Circuit Diagram

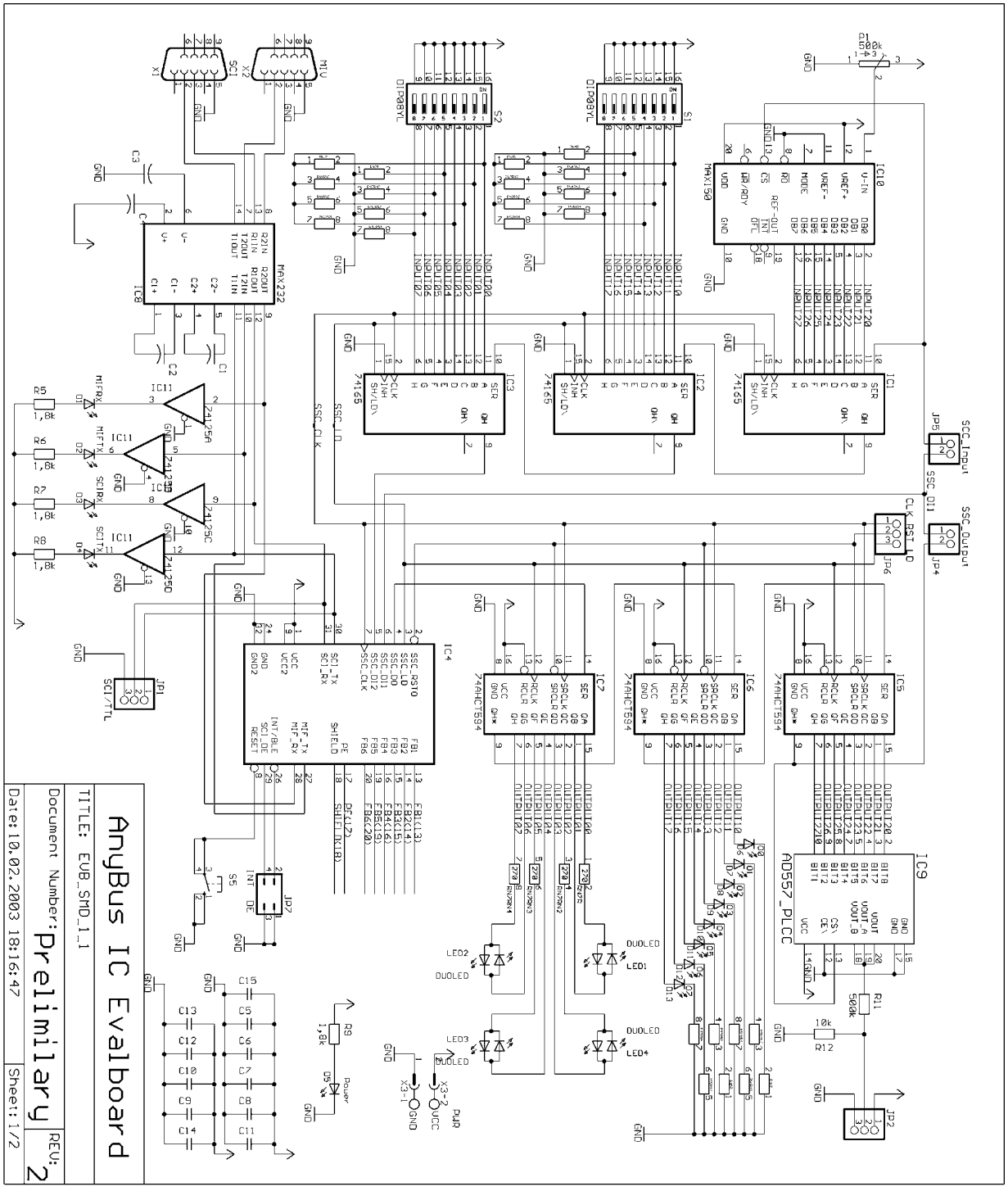

Figure 2: Schematic of AnyBus IC Evauation Board

2.1.3 AnyBus-IC Evaluation Board Fieldbus Boards

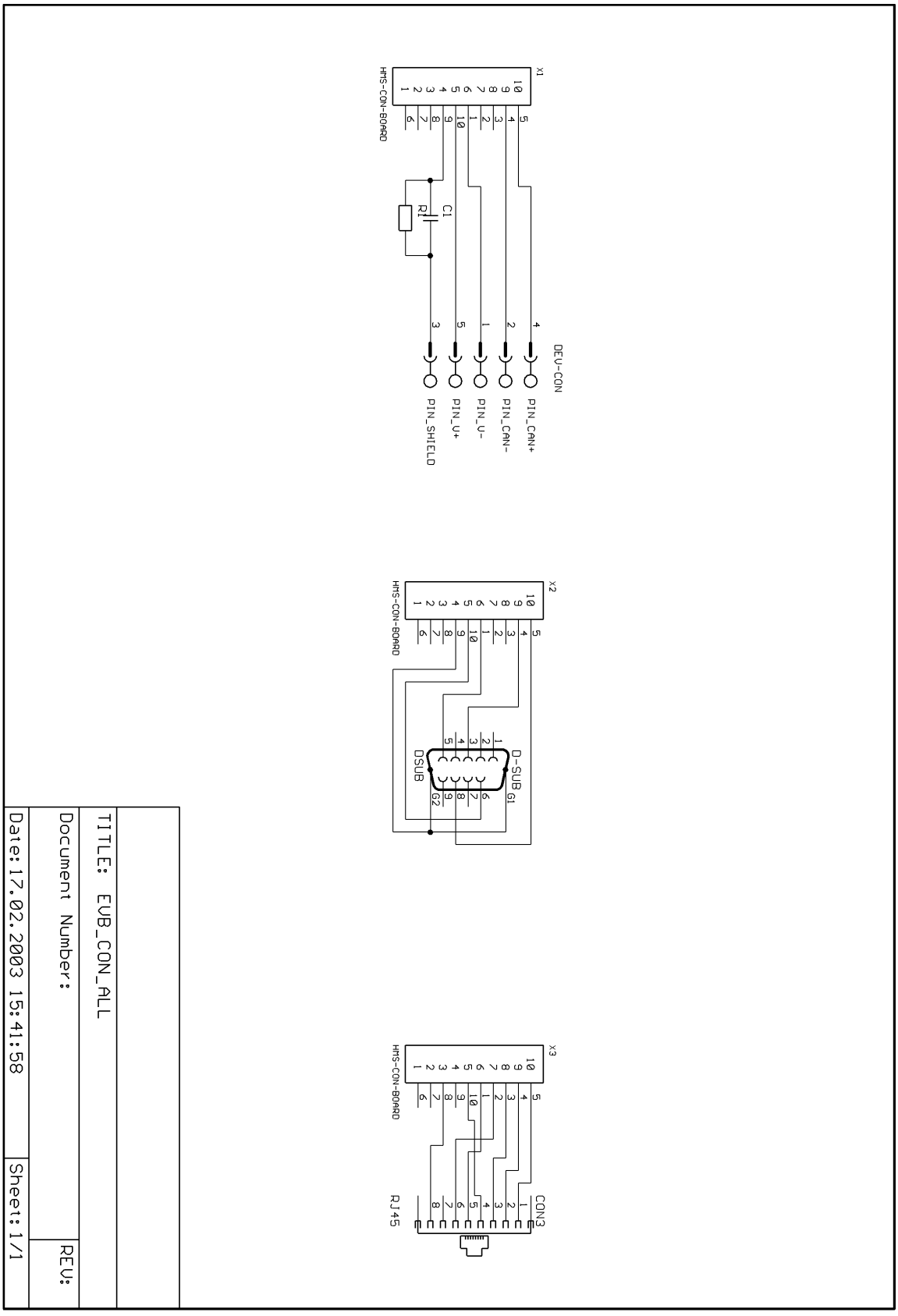

Figure 3: Schematic of Fieldbus connector boards

2.2 Connectors

2.2.1 Power supply

The Evaluation Board must be connected to an external 5V/800mA power supply using a plugable screw connector. Note that there is no over voltage protection implemented.

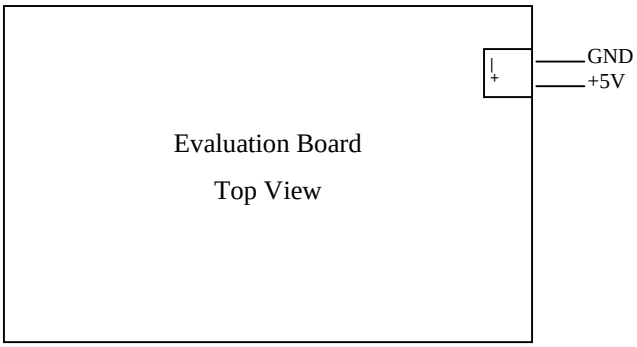

Figure 5: Position of power supply connector

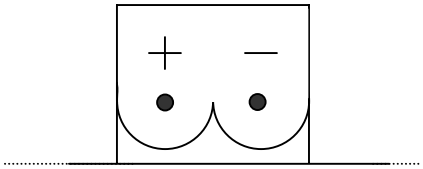

Figure 4: Power supply connector front view

2.2.2 MIF Interface (Hardware)

A PC is required to monitor and configure the AnyBus IC over the MIF Interface. See chapter 4 in the AnyBus-IC Design Guide for more information regarding the terminal program.

The serial interface of the Evaluation Board is connected directly to a serial interface of an IBM compatible PC (COM1 – COMX) using the supplied cable. The RS232 interface already has crossed over Tx and Rx lines and thus the connection is made with a 1:1 cable. The following pins are used:

1. **RxD (Pin 2)**
2. **TxD (Pin 3)**
3. **GND (Pin 5)**

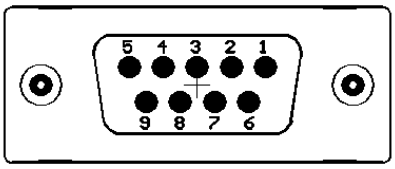

Figure 6: Front view of D-SUB 9 female PC connector

2.2.3 SCI Interface RS232 (Hardware)

A PC or other RS232 Device is required to communicate to the AnyBus IC over the SCI RS232 Interface. See chapter 3 to learn more about the used ModbusRTU protocol.

The serial interface of the Evaluation Board is connected directly to a serial interface of an IBM compatible PC (COM1 – COMX) using the supplied cable. The RS232 interface already has crossed over Tx and Rx lines and thus the connection is made with a 1:1 cable to the PC's COM-port. The following pins are used:

1. **RxD (Pin 2)**
2. **TxD (Pin 3)**
3. **GND (Pin 5)**

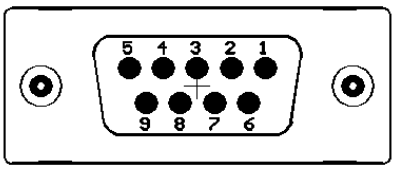

Figure 7: Frontview of D-SUB 9 female PC connector

2.2.4 SCI Interface TTL (Hardware)

A micro controller or other serial device with UART can communicate to the AnyBus IC over the SCI-TTL Interface. See chapter 3 to learn more about the used Modbus protocol. The difference between this and the SCI RS232 interface is the missing RS232 physics. Only 5V TTL based voltage level is used.

1. **TxD (Pin 1)**
2. **RxD (Pin 2)**
3. **GND (Pin 3)**

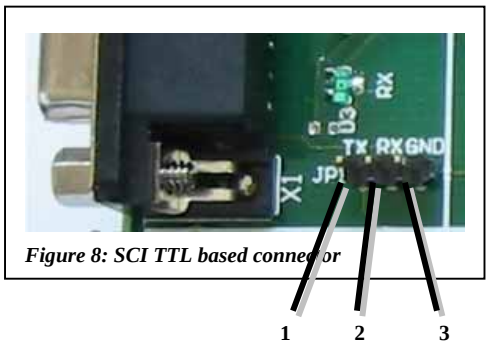

Figure 8: SCI TTL based connector

2.2.5 SSC Onboard Interface (Hardware)

The ABIC Evaluation Board has a fixed amount of mounted shift registers. These are 3 shift registers (3 byte) for Input and 3 shift registers (3 byte) for Output. If the auto configuration is used, the registers have the following functions:

Input Register Nr.	Meaning
1	Address setting
2	Digital Input
3	Analogue Input

Output Register Nr.	Meaning
1	Status LEDs
2	Digital Output
3	Analogue Output

If the auto config is not used, the first shift registers for input and output can also configured as digital Input/Output. Please note that the output byte one is made with revers bi-colour LEDs. Thus pair bit combinations are not possible. See chapter 2-6 in the AnyBus-IC Design Guide.

Hex-Value	Binary-Bit combination	Visualisation
0xAA	10101010	Yes, all pairs different: red
0x55	01010101	Yes, all pairs different: green
0x33	00110011	No, all pairs identical
0xFF	11111111	No, all pairs identical
0x78	01111000	No for the identical pair combination L1+L3, Yes for the different combination L2+L4

2.2.6 SSC expansion Interface (Hardware)

Additional shift registers can be used to expand the amount of I/O data over SSC interface. The additional shift registers can be mounted on a separate PCB connect to the SSC expansion interface. Please note that air wires may cause EMC problems and act as antenna. JP6 is connected to all shift registers for load, reset and clock signal. JP 5 and JP 6 should be short circuit by jumper if no external shift registers are connected. JP 5 is the serial connection for expanded input shift registers. Same for JP 4 as output expansion.

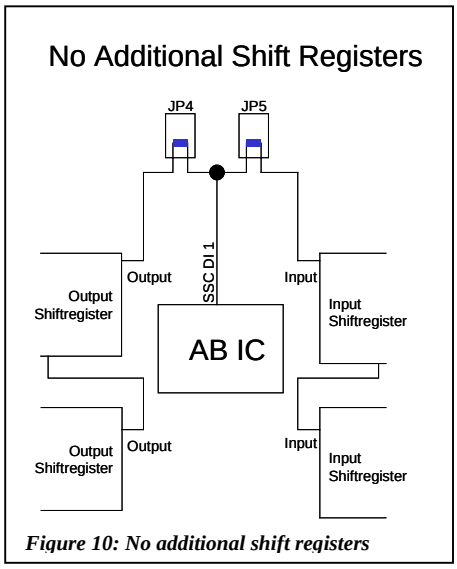

Figure 10: No additional shift registers

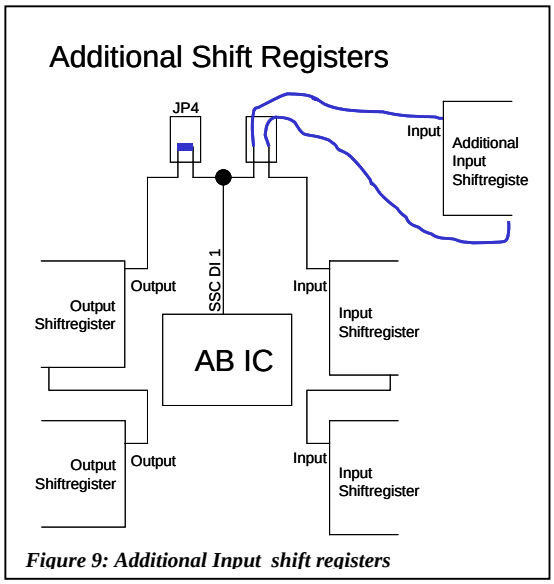

Figure 9: Additional Input shift registers

The SSC Interface connectors are used to expand the onboard mounted shift registers with additional external shift registers. Please note that air wires may cause EMC problems and act as an antenna.

Figure 11: Position of SSC external connection

JP6 will extend the LD, CLK and RST lines. See chapter 226 for more information. JP4 and JP5 will extend the shift register line for Input (JP4) and Output(JP5). Open the short circuit jumper and insert up to 14 8 Bit shift register devices to extend to the maximum size of 128 Bit I/O data.

2.2.7 AnyBus-IC DIL 32 Socket

The AnyBus-IC DIL 32 Socket at the Evaluation Board is used to plug in the AnyBus-IC module. The pin assignments are shown in following table:

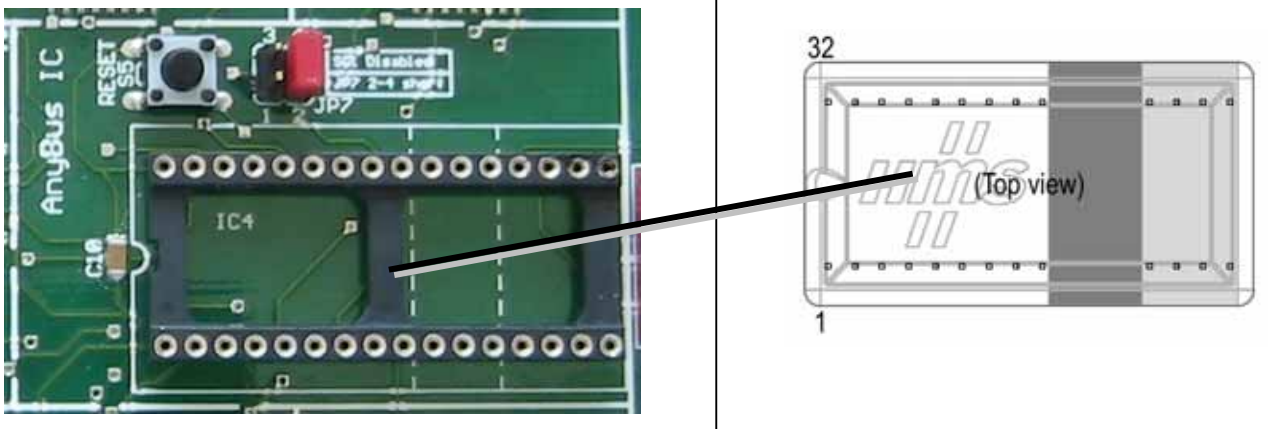

Figure 12: Position of AnyBus-IC DIL Socket

Pin	Name	Description
1	Vcc	+5V Power Supply
2	SSC Reset Out	SSC Reset signal to shift registers
3	SSC LD	SSC Load signal to shift registers
4	SSC DO	SSC Data output signal to shift registers
5	SSC DI2	SSC Data input 2 signal from shift registers
6	SSC DI1	SSC Data input 1 signal from shift registers
7	SSC CLK	SSC Clock signal for shift registers
8	Reset	Reset signal
9	Vcc	+5V Power Supply
10 - 12	NC	Not connected
13 - 16	FB1 – FB4	Fieldbus specific signals line 1-4
17	PE	Protective earth
18	Shield	Fieldbus shield
19 - 20	FB5 – FB6	Fieldbus specific signals line 5-6
21 - 23	NC	Not connected
24	GND	Ground Power Supply
25	NC	Not connected
26	INT/BLE	Interrupt / Bootloader enable
27	MIF Tx	MIF transmit signal
28	MIF Rx	MIF receive signal
29	SCI DE	SCI DE signal
30	SCI Tx	SCI transmit signal
31	SCI Rx	SCI receive signal
32	GND	Ground Power Supply

2.2.8 LEDs

The Evaluation Board is provided with the following status diagnostic or data LEDs:

The power LED indicates that the 5V DC power supply is present. The MIF communication LED TxD flashes when data is being sent to the PC. The LED RxD flashes when data is received from the PC. The LED SCI TxD flashes when data is being sent to the ModbusRTU Master. The LED RxD flashes when data is being received from the ModbusRTU Master. These LEDs are only for diagnostic purposes and cannot be controlled by your program.

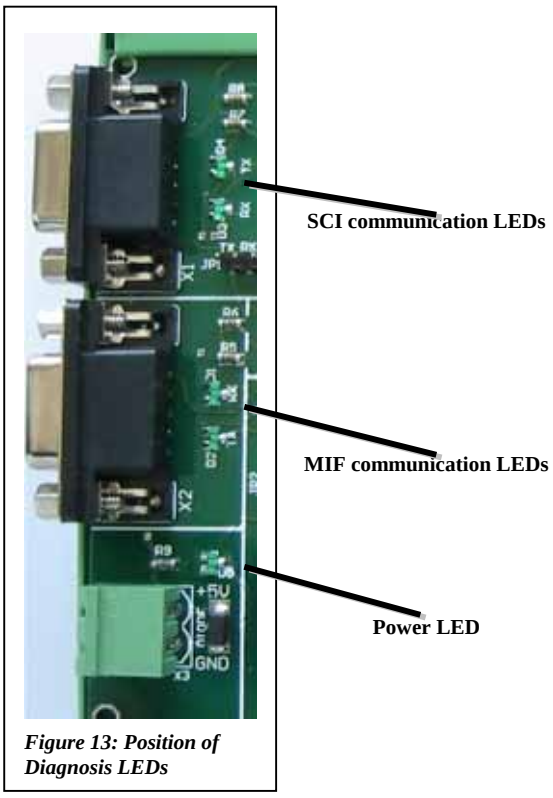

Figure 13: Position of Diagnosis LEDs

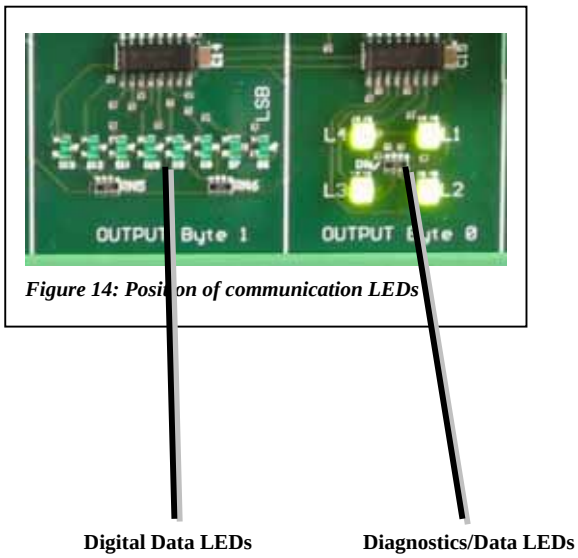

Figure 14: Position of communication LEDs

The Digital Output Byte0, Byte 1 LEDs are used to show the digital status of the first two bytes, sent from the ABIC to the shift registers. Byte 1 is made with 8 green LEDs. Each byte is representing one bit in the first data byte. Byte0 is made with four bi-color LEDs. Because of the Bi-Color LEDs at Output Byte 0 and its pre-defined function as Fieldbus Status diagnosis its not possible to transmit all possible data states to this LEDs. Only different binary values for bit-pair combinations will show a light:

L4		L3		L2		L1	
00	nv	00	nv	00	nv	00	nv
11	nv	11	nv	11	nv	11	nv
01	green	01	green	01	green	01	green
10	red	10	red	10	red	10	red

*nv=no visualisation

The reason is that 00 or 11 will cause a 0V-0V or 5V-5V connection to the LED. A Bi-Color LED needs a 0V-5V for lighting in green color or 5V-0V connection to light in red color.

2.2.9 Switches

The Evaluation Board is provided with two micro switches as follows:

Designation	Description
Input Byte 0	First data Byte. In “Only SSC Mode” this is used as address or address/baudrate switch. LSB is right
Input Byte 1	Second data byte. In “Only SSC Mode” this is used as first data byte

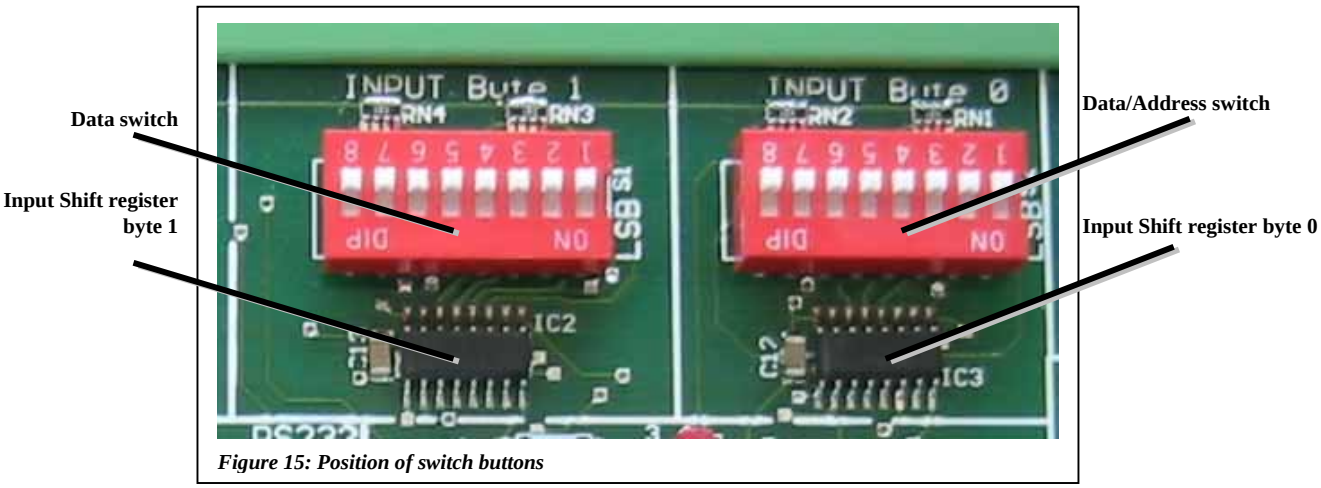

Figure 15: Position of switch buttons

The switches are connected directly to the shift registers with internal pull down resistors.

2.2.10 Potentiometer

The potentiometer on the Evaluation Board is used to provide an analog signal for generating user data for data transmission. The value set by the axis will demonstrate the incoming analog value that is converted by the A/D converter and moved with the shift register into byte 2.

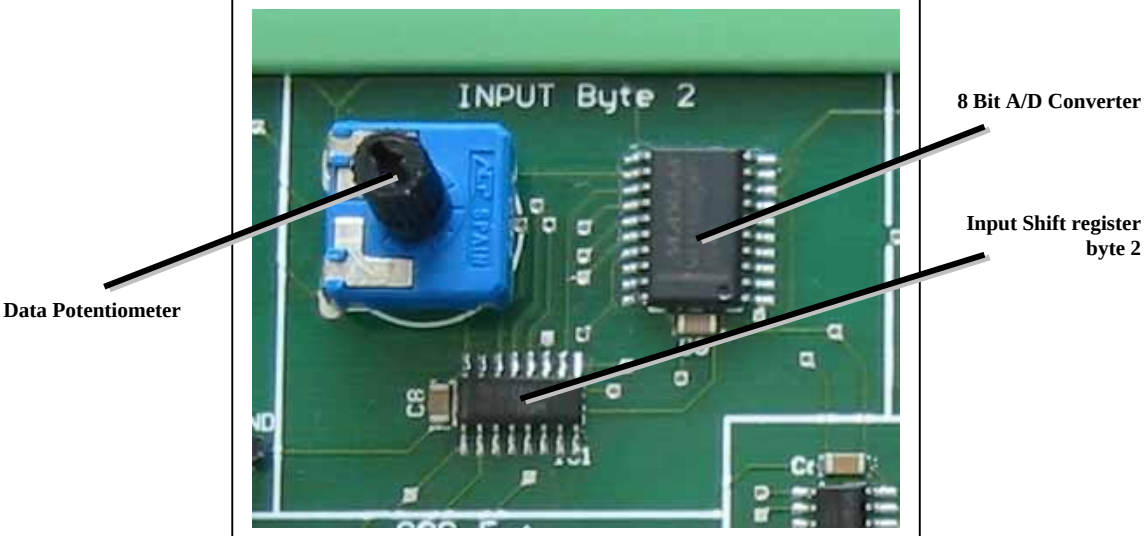

Figure 16: Analog Input

2.2.11 Display

The Display is used to show the byte 2 value as analog data. The data from ABIC transmitted to the shift register in output byte 2 is converted with the D/A converter into an 0-5V analog value. This value is connected to the display that will show its voltage value.

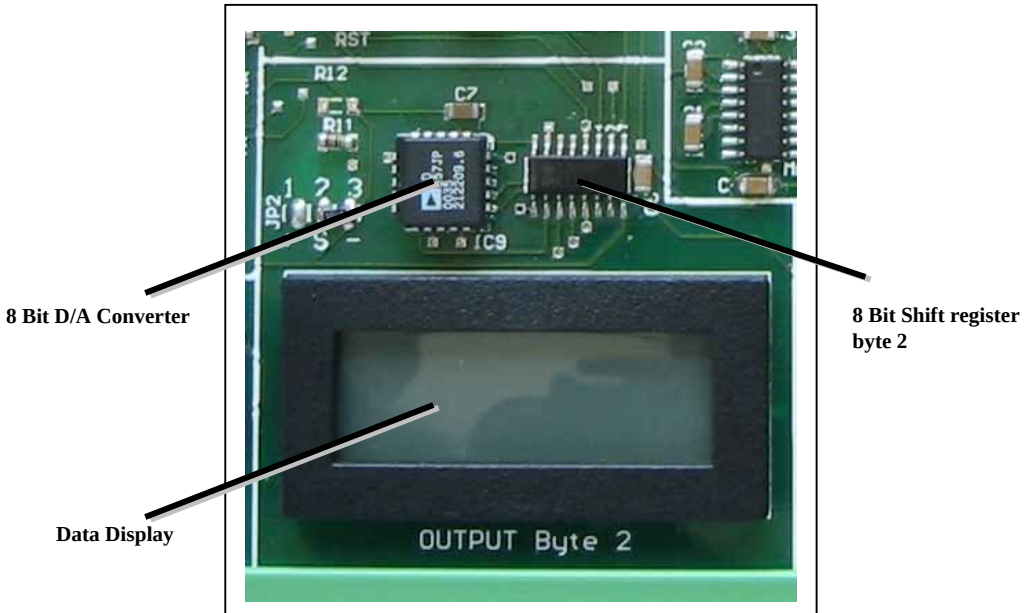

Figure 17: Analog Output

! If necessary, you can remove the LCD from the Evaluation Board and connect it using a cable of length < 10cm. However, you will lose the manufacturer's guarantee if you do this.

2.2.12 Reset Switch / SCI DE Jumper (Only SSC Mode)

The Evaluation Board is provided with a hardware reset switch. Using this switch will cause a hardware reset on the ABIC.

Near the switch is the location for BL/SCI DE switch. BL- (BootLoader) switch is only used for Bootloader enabling function. Please see chapter 8-2 in AnyBus IC Design Guide. The BootLoader switch can be closed by using a jumper. Same pin pair (1-3) is also used for detecting Interrupt requests. Pin 1 is GND and Pin 3 is the IRQ line.

The SCI DE switch is used for enabling the SCI communication interface. To enable the SCI-Interface the Jumper JP7 2-4 has to be removed. With short 2-4 pin the IC will detect the amount of shift registers and start automatically.

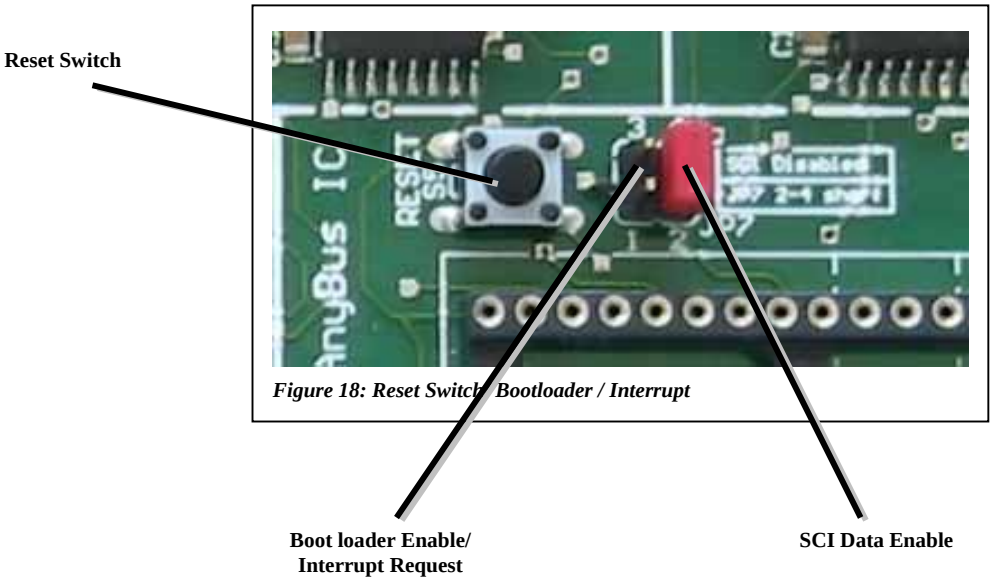

Figure 18: Reset Switch / Bootloader / Interrupt

3. Simple StartUp

- For a simple start up connection of the AnyBus IC it's necessary to prepare the hardware and software configuration. Please follow the steps to achieve the first communication:

- **check the jumpers**
  In a simple Startup 3 jumpers are needed: JP4;JP5 and JP7. JP4 and JP5 are used for closing the extended SSC connection. JP7 will disable the SCI interface. All other jumpers must left open.
  (see figure 11 and figure 18)

- **check the correct AnyBus IC connection**
  Don't connect the AnyBus-IC reversed to the socket. The HMS logo must be close to middle of the Evaluation Board (close to the capacitor C10, see figure 12)

- **Use the correct fieldbus connector**
  Use the fieldbus connector that match to the fieldbus system:
  - 9 Pin SUB-D fieldbus connector together with AnyBus IC PDP
  - Grey plugable Screw fieldbus connector together with AnyBus IC DEV
  - RJ45 fieldbus connector together with AnyBus IC EIT/EIP
  Other combinations can harm the AnyBus IC! Worst combination is PDP or EIT/EIP IC together with Devicenet connector and connected 24V supply! This will destroy the AnyBus-IC!

- **Connect a PC to MIF**
  Use the serial 1:1 cable to connect the EVB's monitor interface (MIF) to a PC's COM port. Start a terminal program like Microsoft's Hyperterm with this settings:
  - 38400 kBaud
  - 8 databits
  - 1 stopbit
  - no parity
  - no flowcontrol

- **Connect power to the Evaluation Board**
  We recommend to use a stabilized power supply with constant 5V±10% and a min. current of 800 mA . Connect the Plus polarity cable to the pin close to the SUB-D connector for MIF. Connect the ground polarity cable to the pin close to the lowest left corner. Please note that there is no over voltage protection implemented. Wrong voltage level or reversed power supply can harm the Evaluation board and the AnyBus IC.

The board is powered if the power LED is lighting. The menu for the configuration will be generated an transferred to the terminal program. Depending on the fieldbus system the dual-LEDs at the first output byte will light. Also the first input byte delivered by the first DIP-switches is used as address setting. See chapter 2 at the ABIC fieldbus appendix.
You can use now the ABIC-Evalboard as a fieldbus slave with two byte input and two byte output data. The first digital input data is "INPUT Byte 1" with DIP-switch and the first byte output is "OUTPUT Byte 1" with 8 green LEDs. The data for the second byte input is delivered by the potentiometer in "Input Byte 2" and the second byte output is shown at analogue values by the Display at "OUTPUT Byte 2".

You can use a master system or a master simulator to transmit data from/to the AnyBus IC Evaluationboard. Master simulators are available for Profibus-DP, Devicenet and ModbusTCP.

4. Master for fieldbus systems

When developing and testing programs for AnyBus-S modules, a master is required for the respective bus system. In addition to standard SPS masters, HMS recommends the use of so-called master simulators. These are simple fieldbus master systems with small limitations which simulate bus communication with the respective fieldbus system and allow the exchange of data between master and slave. Master simulators are currently available for Profibus DP, Profibus DPV1, DeviceNet and Interbus- S.

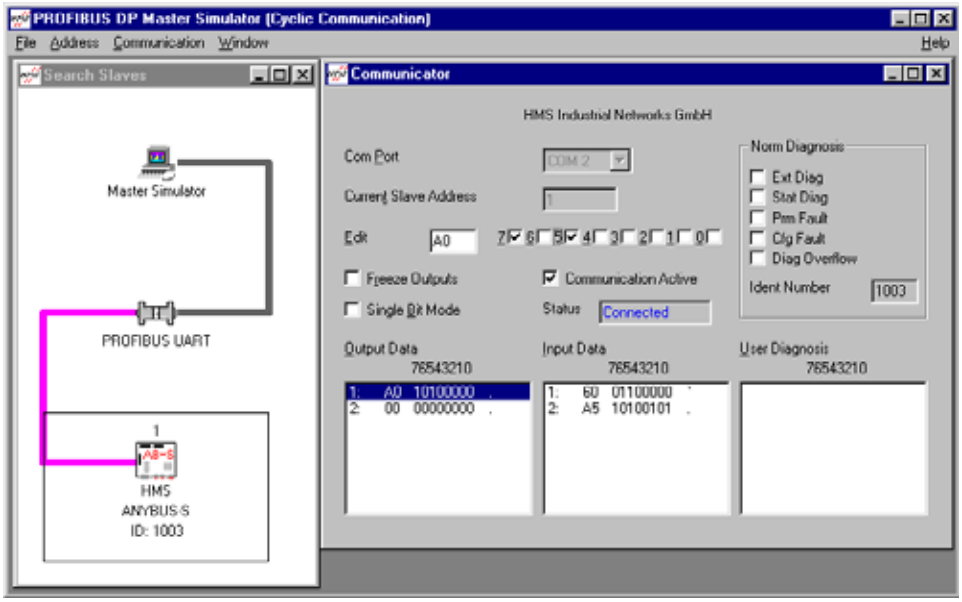

Figure 19: Profibus DP Master simulator

The supplied HMS CD-ROM also includes a simple freeware Modbus/TCP Server which can be used to test communication between an AnyBus-S Ethernet module / AnyBus IC on the Evaluation Board and a PC. Please observe the installation instructions!

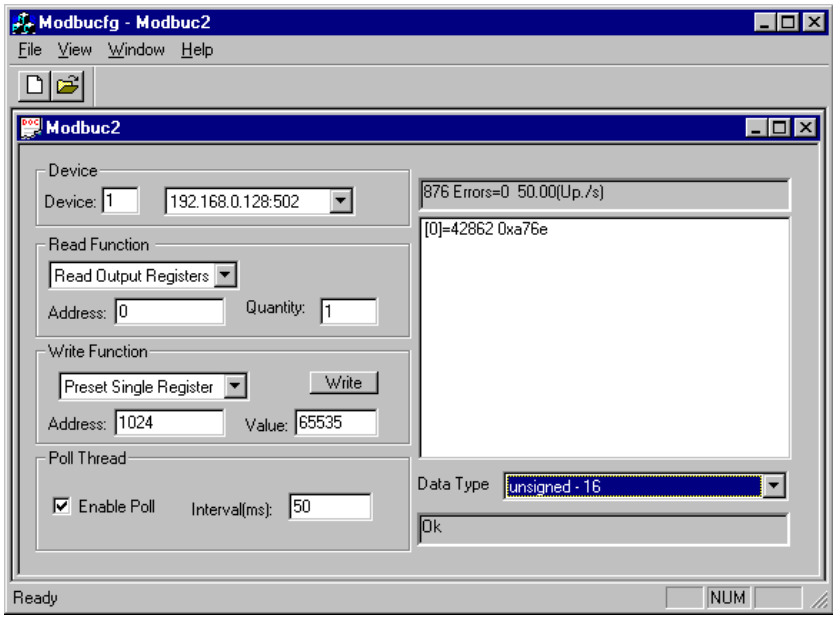

Figure 24: Freeware Modbus/TCP Server

! The supplied Modbus/TCP Server Software is demonstration software which is freely available in the Internet. HMS cannot provide support for installation and commissioning.

5. Appendices

5.1 Sample Code

The sample code is included at the AnyBus-Tools CD-Rom.

Each program is prepared to run at the Keil C51 compiler environment and the AnyBus Evaluation Board. It is downloadable with the monitor functionality described in chapter 4.4 at the Evaluation Board user manual.

For further questions and inspirations we have in the Club AnyBus an open ear for you any time .

http://www.hms-networks.com/club_anybus/club_area.asp

5.2 Technical Data

Measurement	
PCB	Standard Euro Format: 160 mm x 100 mm
Possible Case	Phoenix Case UM100 125 mm x 162 mm
Complete height with connected AnyBus IC	app. 50 mm (depending from fieldbus type)
Recommended Power Supply	5V regulated ±10% Tolerance

5.3 Abbreviations

Important abbreviations used in this manual:

ABC	AnyBus ComAdapter
ABS	AnyBus-S
ACK	Acknowledge
DPRAM	Dual-Port RAM
EVB; EvalBoard	AnyBus-S Evaluation Board
µC	Microcontroller (80XXX)
LED	Light Emitting Diode
LSB	Least Significant Bit
MSB	Most Significant Bit
NAK	Negative Acknowledge
NC	Not Connected
PAR	Parallel Interface
RO	Read Only
R/W	Read / Write
SER	Serial Interface
TBD	To Be Defined

5.4 Supported AnyBus-IC module types

The following AnyBus-S module types are suitable for use with the Evaluation Board. Special AnyBus-S module types are also supported (but see note below the table).

Description	Order Nr.	Fieldbus Type
ABIC-PDP	AB6000	Profibus- DP
ABIC-DEV	AB6001	DeviceNET
ABIC-EIT	AB6002	10/100 Mbit/s ModbusTCP+IT Funct.
ABIC-EIP	AB6003	10/100 Mbit/s ModbusTCP+EthernetIP+IT Funct.
ABIC-COP	*	

* in preparation

5.5 Recommended connector & accessory manufactures

Shift Registers

- 74AHCT594
- 74HCT165M

Europe	Schweden	Headquarter
EBV EUROPEAN SERVICE Im Technologiepark 2-8 D-85586 Poing, Germany Tel.: +49 - 8121 - 774 - 0 Fax : +49 - 8121 - 774 - 422	EBV EUROPEAN SERVICE Derbyvägen 20 S-21235 Malmö, Sweden Tel.: +46 - 40 – 59 21 00 Fax : +46 - 40 – 59 21 01	EBV EUROPEAN SERVICE Im Technologiepark 2-8 D-85586 Poing, Germany Tel.: +49 - 8121 - 774 - 0 Fax : +49 - 8121 - 774 - 422

Power supply connector

.

- 2 pins
- 2,54 mm grid

Europe	Schweden	Headquarter
Phoenix Contact GmbH & C0. Flachsmarktstraße 8 32825 Blomberg Tel.: +49 – 5235 – 300 Fax: +49 – 5235 – 341200 WEB: www.phoenixcontact.com		Phoenix Contact GmbH & C0. Flachsmarktstraße 8 32825 Blomberg Tel.: +49 – 5235 – 300 Fax: +49 – 5235 – 341200 WEB: www.phoenixcontact.com

Power Supply

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- Wide range power supply
- 100 V-250 V Primary
- 5V Secondary
- Changeable connector for US,EU,JP...

Europe	Schweden	Headquarter
RS Components GmbH Hessenring 13b 64546 Mörfelden-Walldorf Tel.: ++49 – 6105 – 401 – 234 Fax.: ++49 – 6105 – 401 – 100 WEB: www.rs-components.de	RS Components AB Box 15 162 11 Vällingby Tel.: ++46 – 8 - 445 – 8900 Fax.: ++46 – 8 – 687 – 1152 WEB: www.rs-components.com	RS Components International PO Box 99, Corby, Northants NN17 9RS, United Kingdom Tel.: ++44 – 1536 – 201234 Fax.: ++44 – 1536 – 204237 WEB: www.rs-components.com

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Revision: _____ 1.01E _____

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Haid-und-Neu Str.7
76131 Karlsruhe
Germany

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Fax: +49 (0)271 96472 10