

1999/04 Phytec mm537 with CAN

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Abstract

This project is about adding an Intel 82527 CAN controller to a Phytec miniMODUL-537. This ready to go module has a 80C537 MCU, 64kB FLASH-ROM, 64kb SRAM, 14 interrupt sources, analog inputs and a powerfull Capture/Compare Unit (CCU). It's size equals the size of a credit card.

1 Project characteristics

Project code	1999/04
Project name	Phytec mm537 with CAN
Started	16.12.99
Ended	22.12.99
Used tools and libraries	Eagle 3.55 light.
Used for other projects or applications	#1999/01

2 Schema

This wiring diagram just shows the details which are important about interfacing the miniMODUL-537 with the 82527. It does not show the RS232 connector nor the VG64 connector.

This schema works for the 80C517/537, too. Except for the pinout. There is a difference between miniMODUL and MCU (refer to the miniMODUL-537's and the 80C517/537's reference guides/data sheets).

3 Memory Mapping

The miniMODUL provides four chip select lines $\overline{CS0} \dots \overline{CS3}$ where $\overline{CS0}$ is reserved for Phytec purposes only. After reset $\overline{CS1}$ maps to 0xfd00 - 0xfdf. Those are exactly the 256 Bytes the 82527 needs.

4 Resetting the 527

Port P5.1 is used as the 527's reset generator. It is connected to the 527's \overline{RESET} pin (29) which is triggered by a falling edge. Before initializing the CAN controller the MCU has to hold P5.1 low for at least 15ms before pulling it high to enter the normal work mode. Then the CAN registers are ready for initialization.

*Thanks to Alexander Wiedekind-Klein (awie@roboterwelt.de)

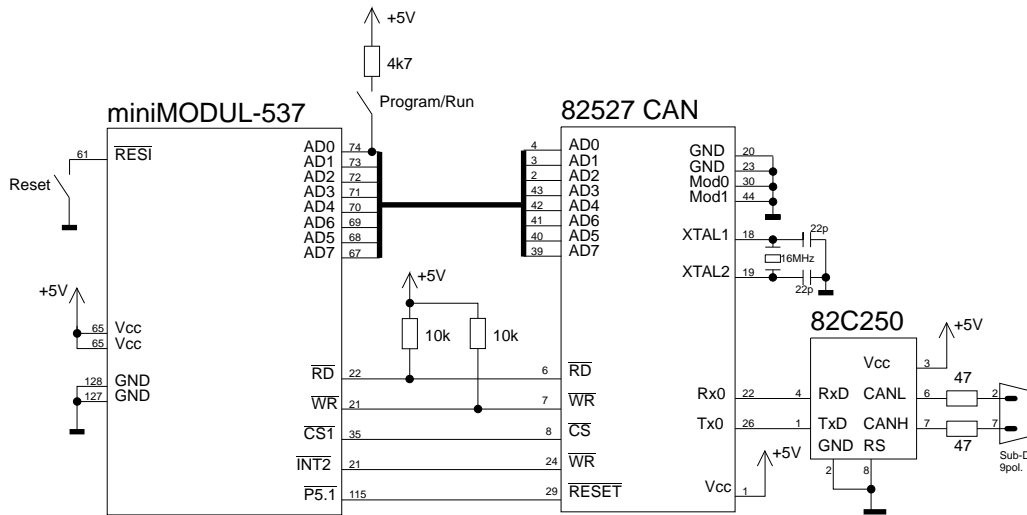


Figure 1: The Wiring Diagram

5 527's Interface Mode

here are several modes possible to interface the 527 with a MCU or CPU. The pins Mod0 (30) and Mod1 (44) are pulled low. During reset interface mode 0 is entered which implements a multiplexed 8-Bit interface. This perfectly fits with the 8051 MCU derivates.

It is always good practice to utilize pull up/down resistors. In this case it is important to pull up \overline{RD} and \overline{WR} . If $Mod0 = 0 \wedge Mod1 = 0 \wedge \overline{RD} = 0 \wedge \overline{WR} = 0$ during reset the 527 enters the SPI interface mode (serial interface). This is not what we want.

6 Ports Already in Use

There are two port pins which are in use already. It is P5.1 as shown above and P5.0. P5.0 is used as a sign of life indicator while 5.1 is used to reset the '527 CAN controller.

7 CAN and RS-232 Connector

There is a female RS-232 connector located on the board. Even though there is no CAN connector, except for the VG64 backplane, a standard CAN connector is described herein.

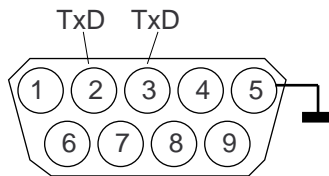


Figure 2: RS-232 Connector

8 Extension Connector

There is a extension connector (male, 20 pins) mounted on the board. Application specific circuits (motor control, sensor circuitry, ...) are to be connected there.

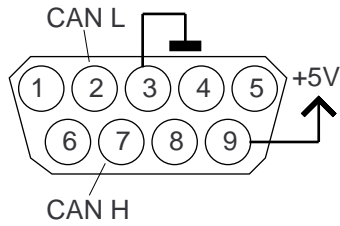


Figure 3: CAN Connector

One may use P1.0 - P1.3 as pulse width modulated outputs (motor control), P3.4 and P3.5 as counter inputs for measurement of rotations per minute (motor control). The interrupt inputs P3.2 and P3.3 might be used for that purpose, too.

The +12[V] supply is not ment to supply power consumers. It is just ment for switching purposes. Consumers have to be supplied with their own power.

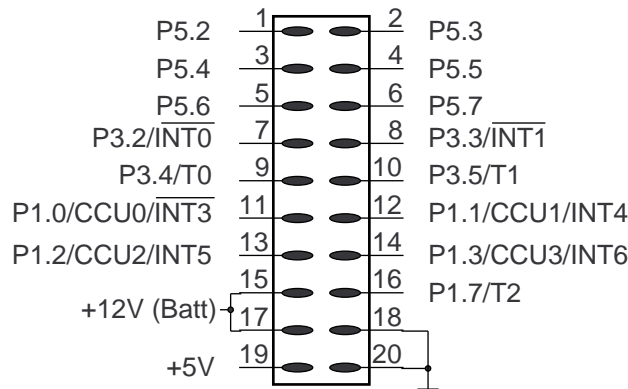


Figure 4: Connector for Application Specific Extensions

9 VG64 Backplane Connector

There is a VG64 backplane connector agreed between Alexander Wiedekind and me. This agreement provides a higher flexibility in exchanging components of Alex's and my robots. For more details see www.roboterwelt.de and www.computers-n-robots.de/index.html.

Pin	Description
1a, 1c	GND
2a, 2c, 3a, 3c	+12V (battery)
30a, 30c, 29a, 29c	+15V (regulated)
31a	CANH
31b	CANL
32a, 32c	GND

Table 2: Extension Connector Pinout

10 Test

10.1 Setup

To check whether the CAN extension is working or not just connect the board via a CAN bus cable with a PC. My PC is equipped with a PCAN CAN controller card by Peak-Service GmbH. It is based on the 82C200 CAN controller by Philips.

There is a MS-DOS testprogram (CAN-View) shipped with the ISA card. Use the program to edit and send CAN messages to the miniMODUL or to display messages sent by the module. My PCAN works at base address 0x300, IRQ 5. This is specific and depends on your PC. *Adjust your PC CAN interface to 500 kBits/s.*

Connect the PC and the module by RS232 as well. The program will display additional messages. *Adjust your COM interface to 9600 Baud, eight Bits, one stop Bit and no parity.*

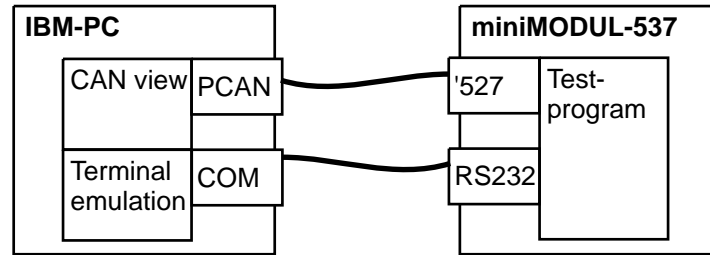


Figure 5: Setup for the Test

10.2 Testprogram

The testprogram originally was written by Alexander Wiedekind (awie@roboterwelt.de) for his C505 board using his C505 CAN driver. I adapted the program and the driver for my 80C537 board.

The testprogram allows you to print a dump of the 80527 registers or to send four different CAN messages with CAN IDs 0x01, 0x02, 0x03 and 0x04. The program is able to receive CAN messages with IDs 0x11, 0x12, 0x13 and 0x14.

10.3 Getting Started

1. Connect PC and module by CAN and RS232 cables while PC and miniMODUL-537 switched off.
2. Switch on the PC. On the module select the program mode with the mode selector switch an swich on the module.
3. Start the FLASH-Tool program provided by Phytec. Load the testprogram `test537can.hex` into the miniMODUL as told in the miniMODUL-537 handbook by Phytec. Quit FLASH-Tools.
4. Start CAN view and terminal emulator on the PC side.
5. Select the run mode and reset the module. This starts the testprogram on the module side.
6. Use CAN view to send CAN messages to the module. Use the terminal to choose whether you want to print a 80527 register dump or to send a CAN message.

A Parts list

Name	Part/value	Comments
	Prototype Board	160 x 100 mm
C1	22pF	Capacitor
C2	22pF	Capacitor
C3	100nF	Capacitor
IC1	82C250	CAN bus transceiver
IC2	82527	CAN bus controller
LED1	LED	red
LED2	LED	green
Q1	16MHz	Crystal
R1	10k Ω	Resistor
R2	10k Ω	Resistor
R3	4k7 Ω	Resistor
R4	150 Ω	Resistor
R5	1k Ω	Resistor
R6	150 Ω	Resistor
R7	47 Ω	Resistor
R8	47 Ω	Resistor
S1	Button	Reset button
S2	Switch	Program/run mode selector switch
ST1	VG64 jack	Male, 64 pins (as backplane connector)
SV1	Connector	2 rows, 12 columns each (for miniMODUL)
SV2	Connector	2 rows, 64 columns each (for miniMODUL)
SV3	Connector	2 rows, 64 columns each (for miniMODUL)
X1	Sub-D connector	Female, 9 pins (for RS-232)

Table 3: Parts list

B List of project files

File Name	Comments
CanTest2\CANDRV.C	CAN bus driver implementation for 80527. Preliminary.
CanTest2\CANDRV.H	CAN bus driver declarations for 80527. Preliminary.
CanTest2\test537.c	Test program for 80C517/537.
CanTest2\TEST537.HEX	Test program for 80C517/537.
MM537CAN.SCH	Wiring diagram.

Table 4: Project files

C Suppliers

[S1] **PEAK-Service GmbH**
Brenzweg 4
64293 Darmstadt
Germany
www.peak-service.de/

CAN bus interface cartridges for PCs.

[S2] **Phytec Meßtechnik GmbH**
Robert-Koch-Strasse 39
55129 Mainz
Germany
www.phytec.de/

Microcontroller boards with 8051, C166/167, x86 MCUs/CPUs. Vision systems for automation. Development tools.

D Related web pages

[W1] **CiA - CAN in Automation**
www.can-cia.de/

About CAN in general and CAN-based higher layer protocols: CAN Application Layer (CAL), CAN Kingdom, CANopen, DeviceNet.

E Related literature

[B1] **Siemens:**
SAB 80C517/537 8-Bit CMOS Single-Chip Microcontroller
Siemens AG Semiconductor Group (05.1994)

User's Manual 05.94 (B258-H6075-G1-X-76500).

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