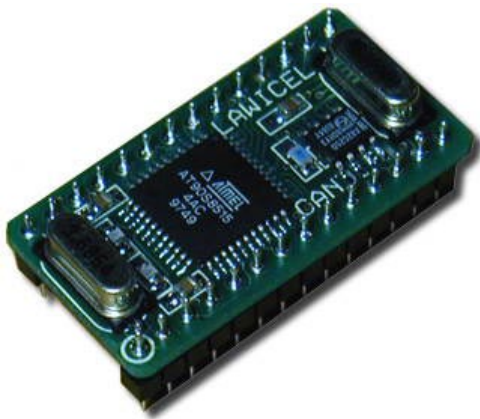


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# ***SBC - Single Board Computer***

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## **DATA SHEET**



### **CANDIP/AVR1**

Single Board Computer in DIP28 format with  
Atmel® AVR® AT90S8515 microcontroller and  
Philips® SJA1000 CAN 2.0B controller.

Product specification

September 17 2002

CANDIP/AVR1 Leaflet

Version 1.2

#### **History:**

Version 1.0 / Jan 2000 / Preliminary Specification  
Version 1.1 / May 2000 / Product Specification  
Version 1.2 / September 2002 / Product update

Single Board Computer in DIP28 format with Atmel® AVR®  
AT90S8515 microcontroller and Philips® SJA1000 CAN2.0B controller.

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**CANDIP/AVR1**

## DESCRIPTION

CANDIP/AVR1 is an embedded microcontroller with CAN (Controller Area Network), where you as a user can make a quick route to new products, maybe you just need some digital I/O connected to CAN or a smart node with a PID controlled motor etc. You can see the CANDIP as a very small "Single Board Computer" with the possibility to perform almost 4MIPS.

CANDIP/AVR1 isn't just a "ready to use module with pre-programmed software" which has a very narrow application field, such as a CANopen SLIO or a homebrewed Protocol SLIO, it is completely scalable with your own software (written in C, Basic, Forth, Pascal or any other compiler that supports the Atmel AVR AT90S8515). We can of course pre-program it to behave as you like incase you do not have the time or knowledge.

CANDIP/AVR1 also has on-board RS-232 transceivers and a RESET circuit that generates a proper reset after power up and will also halt the microcontroller if the voltage drops below 4.38V. Furthermore it has a standard ISO-11898 CAN transceiver on board, but could also use an external CAN transceiver with your own hardware with e.g. OPTO isolation.

CANDIP/AVR1 will get you a quick start where you do not have to start from scratch and debug hardware while trying to get your application running. We also provide simple routines for testing the CAN controller by sending and receiving frames. Today we provide samples in **ImageCraft ICCAVR** and **MCS Electronics BASCOM-AVR**. It is also possible to buy a full working CANlib for the SJA1000, written in ICCAVR or BASCOM-AVR with full source code.

CANDIP/AVR1 has 11(or 13 without RS232) I/O connections on board that could be used for general I/O, but it can easily be expanded to a real advanced and sophisticated system through the SPI port. Through the SPI port you could add hardware such as digital I/O, ADC, DAC, RTC, EEPROM, LCD and much more. You can also attach I2C devices and control them by software controlled I2C. There is also one external Interrupt line available (INT1), the other on the AT90S8515 (INT0) is used for the CAN controller.

CANDIP/AVR1 support In-System-Programming (ISP), which means you can program the software without removing it from the socket. Just use your favorite AVR ISP programmer or buy one from us with the CANDIP (we make a low cost for parallel port called ispAVRp).

We can offer a complete solution and get you started in just a few hours (such as compilers and customized software).

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**CANDIP/AVR1**

## What can I do with CANDIP/AVR1?

- CAN SLIO with your own protocol or with e.g. CANopen, DeviceNet, SDS, CAN Kingdom etc.
- Smart nodes with PID algorithms for controlling e.g. temperature, motors or valves.
- Data Acquisition via CAN. Add your favorite SPI/I2C ADC and collect data.
- Home Automation. Build smart nodes for turning ON/OFF lights, burglar systems etc.
- Add CAN simple in an existing system via e.g. SPI, RS-232 or your own way.
- Education. CANDIP offers a very low cost to learn CAN, we have many starter kits options.
- If you have a customer who want to see a prototype or even a ready product next week.
- Decentralized smart nodes for e.g. Robots.
- CAN monitor in an existing system. Add some Leds and you could monitor e.g. valves etc.

## Features

- Standard 28 pin DIP board with 0.1" pins, so use a standard DIP28 carrier.
- Needs only a 5VDC/30mA power source.
- Atmel AVR type AT90S8515 working at 3.6864Mhz (other crystals at request).
- 8k user FLASH, 512bytes user RAM and 512bytes user EEPROM.
- Up to 13 digital I/O points on DIP28 board, each capable to sink 20mA as outputs.
- SPI port for expansion.
- One Interrupt line available for user functions (INT1).
- SJA1000 CAN controller working at 16Mhz, which supports CAN2.0B.
- 82C250/251 High Speed CAN transceiver 1Mbit (ISO-11898).
- CAN controller can be interrupt driven (INT0).
- SI202 RS-232 transceiver which together with the AVR can send/receive up to 115kbit, 15KV isolated!
- MAX825M Reset circuit, the normal RESET and inverted RESET is on external pins.
- No interpreted software, it's programmed with compilers.
- Possibilities to implement higher level protocols, such as CANopen, DeviceNet etc.

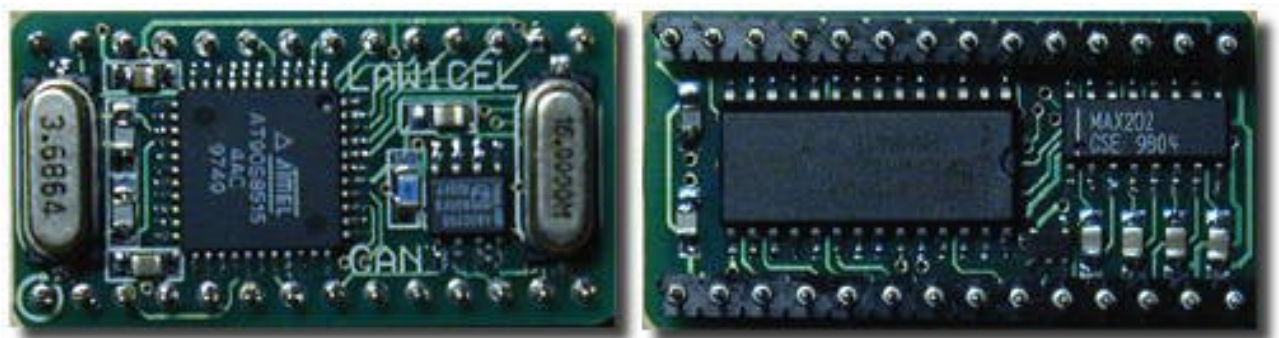


Figure 1: shows the CANDIP/AVR1 board (both sides) mounted with an AT90S8515, MAX202 (SI202), MAX825, SJA1000 and a 82C250 CAN transceiver. You only need to apply power and connectors of your choice and you are up running. No hassle trouble shooting hardware while learning CAN.

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## CANDIP/AVR1

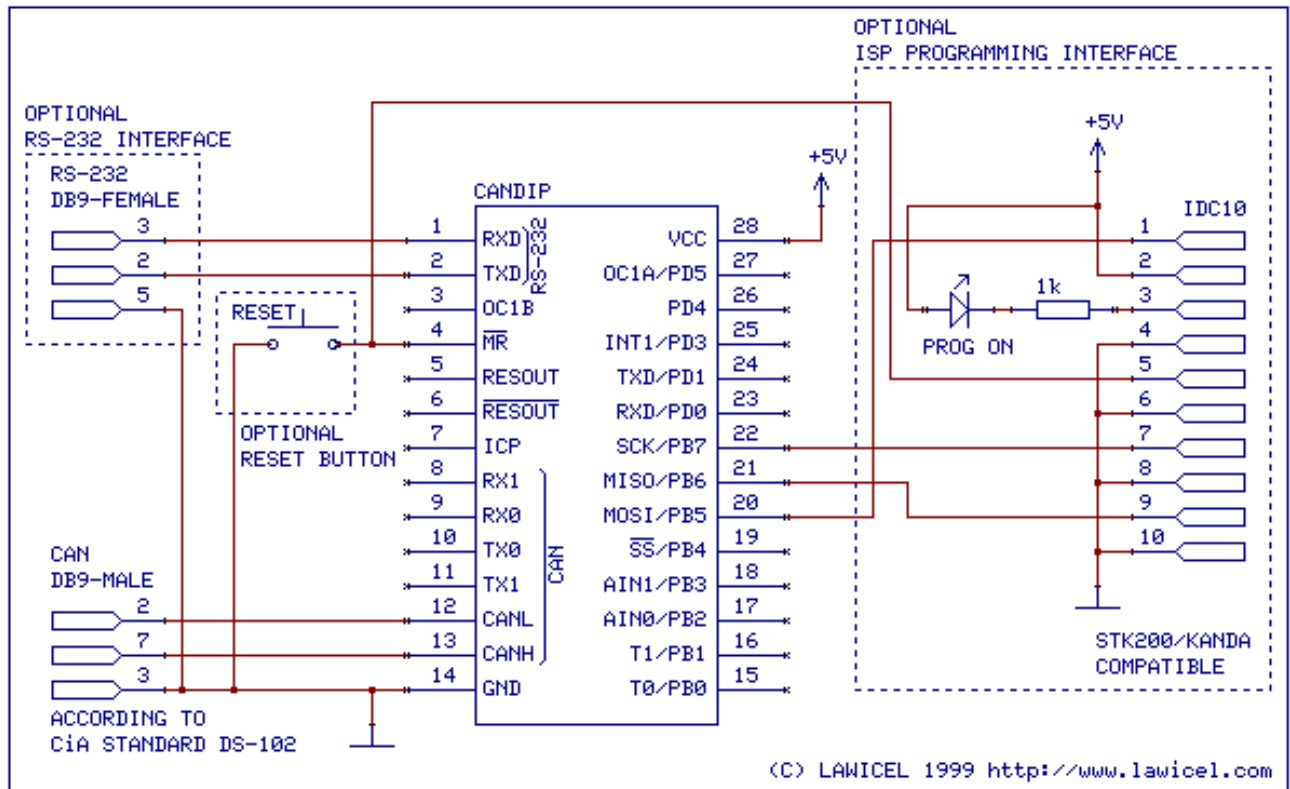


Figure 2: shows a block diagram of CANDIP/AVR1 and external components needed. Dashed blocks are optional connections depending on your application. The CANDIP/AVR1 supports In-System-Programming (ISP) through the SPI port and it supports the STK200 programmer from Atmel/Kanda (provided by us to if you like).

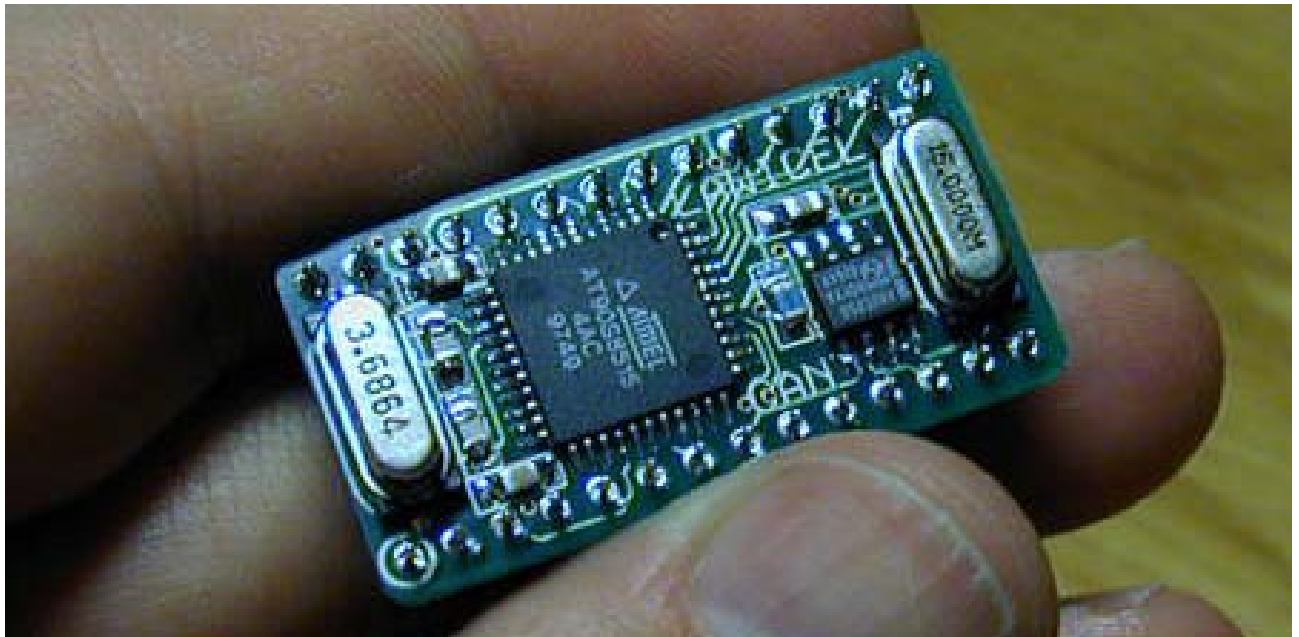


Figure 3: shows how small the CANDIP/AVR1 is. CANDIP/AVR1 is perfect for small systems such as Home Automation, small and effective CAN nodes with e.g. digital I/O or Analog I/O, use it for expanding your existing embedded system through the SPI or RS-232 channel. It can also be used for simple test and learning CAN. The CANDIP/AVR1 is easy to expand into a large system through the SPI port or via software controlled I2C.

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**CANDIP/AVR1**

## **CANDIP/AVR1 Software**

### **WiCAN CANlib for ImageCraft ICCAVR**

WiCAN CANlib is an easy way of getting up running quickly and you do not need a great knowledge in how CAN works. WiCAN supports both 11bit and 29bit Identifiers in Philips PeliCAN mode, easy initialization of the CAN controller with standard bitrates as well as user defined, FIFO queues for receiving and transmitting CANframes trough interrupt control, status information etc. The reason for minimal support is to minimize the resources in the AVR, so there is plenty of room for the actual application both in RAM and FLASH. It is easy to change the support to extended frames, but since many HLP (Higher Level Protocols) and applications today do not use or support the extended frame we didn't include it as default, just to save resources.

There are 3 versions of the WiCAN CANlib for ICCAVR. A free version (demo) with fixed 20kbit bus speed and FIFO queues are preset to 2 CAN frames. With this version it is possible to test the CANlib and to see if it fits your needs. Then next version (CLIB/1) is in Object form (LIB) and cannot be altered or adjusted, but there is no limits in the speed. The last version (CLIB/2) is with full documented source code and here is possibilities for you to modify or add functions to suit your need. The source code is treated as a site licence and you may not distribute or sell the source code further on. Contact us for more information regarding this.

CLIB/1 is on Object form and can not be changed. Both FIFO queues are preset to 4 CAN frames. This is an inexpensive way of testing the CANlib with full functionality and speed. All you need to do is to include the LIB in the project and add a header file where all CANlib defenitions are done. Sample programs are included to show how it works. We can of course change the size of the FIFO queues to suit your needs.

CLIB/2 is in fully documented C source code and be changed to suit your need. Both FIFO queues can be set to suit your needs but only in size of 1,2,4,8,16... to maximum RAM of the AVR. All you need to do is to include the WiCAN.C and WiCAN.H file to your project and you are up running. Sample prgrams are included to show how it works.

A simple C source code to demonstrate how to setup the CAN controller, send a frame and receive some frames, detect the received frams and then transmit them back on the bus can be seen on next page.

The WiCAN CLIB demo can be downloaded from <http://www.candip.com>

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**CANDIP/AVR1**

```
/*
** File:      TeWiCAN.C
**
** Purpose:   Test WiCAN LIB
**
** Chip:      AT90S8515 running at 3.6864MHz
**
** Version:   1.0.0, 4:th of May 2000
**
** Author:    Lars Wictorsson
**            LAWICEL / SWEDEN
**            http://www.lawicel.com    lars@lawicel.com
*/

#include <io8515.h>
#include <stdio.h>
#include "WiCAN.h"

WiCAN_Object MyFrame;

main()
{
    // Setup CAN controller
    if ((WiCAN_Init(WiCAN_SPEED_125K, 0, 0, 0xDE)) == WiCAN_OK) {

    // Start CAN driver
        WiCAN_Start();

    // Setup a frame to transmit
        MyFrame.id = 0x500;
        MyFrame.len = 1;
        MyFrame.byte[0] = 0x01;

    // Send the frame
        WiCAN_SendFrame(&MyFrame);

    // A forever loop
        while(1) {

    // Wait until 4 CAN frames are received and then echo them back
    // by transmitting the same messages back on the bus.
            if (WiCAN_GetRxQueueSize() == 4) {
                while (WiCAN_GetFrame(&MyFrame) == WiCAN_OK) {
                    WiCAN_SendFrame(&MyFrame);
                }
            }
        }
    }
}
```

*Figure 4: C source code demonstrating the WiCAN LIB.*

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**CANDIP/AVR1**

## CANDIP Activity Board

This is the Activity board (ACB1) for CANDIP/AVR1. With this board you get a quick start prototyping and testing CAN and your own system. This board is great for educational purposes and a low cost alternative to wire up something on your own.



Figure 5: Shows the Activity Board for CANDIP.

### ACB1 Features:

- Board covered with a ground layer on component side for good EMI performance.
- 28 pin DIP carrier for the CANDIP.
- AC/DC power input in standard 2.1mm, not sensitive to polarity. 7-15V AC/DC. A 7805 that generates +5VDC and a green LED for +5V OK indication.
- ISP connector for In system programming (STK200 compatible and KANDA AVR-ISP) with red led for programming indication.
- Reset button.
- DB9 female for easy RS-232 connections.
- DB9 male for CAN (CiA standard DS102). Possible to feed other nodes via one power supply and the CAN cable (selectable via jumper).
- CAN Termination resistor (120ohm) selectable via jumper.
- 3 ea. jumpers for input, can work as Node addressing (0-7) or other settings.
- 4 buttons and 4 leds (all 4 buttons and leds cannot work at the same time, but it is possible via jumpers to select e.g. 3 leds and 1 button).
- Large prototyping area with all signals from CANDIP easy accessible from the ends including many for power and ground. SPI signals from CANDIP is not hooked up with LED's or buttons, so it easy to expand the I/O points with SPI slave devices.

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## CANDIP/AVR1

### CANDIP Starterkits

**CANDIP/ST1** consist of one CANDIP/AVR1, one Activity board ACB1/1 (no sample programs included). As an option it is possible to include compilers, programmers, AC/DC adapters cables etc. Just ask us what you need and we can offer a bundle price.

**CANDIP/ST2** consists of two CANDIP/ST1 plus one RS-232 cable, one 1 m. CAN cable, AC/DC adapter (not included in all countries) and sample programs demonstrating distributed I/O and the Philips PeliCAN mode. When ordering CANDIP/ST2, we offer you a 10% discount on ImageCraft C compiler and MCS Electronics BASCOM-AVR compiler (this offer is only available if ordered direct from LAWICEL, check with your local dealer if they have similar offers). Sample programs are provided in ICCAVR, CodevisionAVR, GCC, IAR & BASCOM.

### CANDIP Products

| Product             | Remarks  |
|---------------------|--|
| <b>CANDIP/AVR1</b>  | CANDIP/AVR1 fully mounted with RS232 transceiver, enables 11 I/O points plus 2 for Timer1 control.                           |
| <b>CANDIP/AVR1M</b> | CANDIP/AVR1M fully mounted with RS232 transceiver, enables 11 I/O points plus 2 for Timer1 control. Equipped with ATmega161! |
| <b>ACB1/1</b>       | Activity Board for CANDIP, fully mounted.  |
| <b>CANDIP/ST1</b>   | CANDIP/AVR1 Starterkit (1 each of CANDIP/AVR1 and ACB1/1).   |
| <b>CANDIP/ST2</b>   | CANDIP/AVR1 Starterkit (2 each of CANDIP/1 and ACB1/1, RS232 cable, CAN cable, AC/DC adapter* and demos).                    |
| <b>CANDIP/ST2M</b>  | CANDIP/AVR1M Starterkit (2 each of CANDIP/1M and ACB1/1, RS232 cable, CAN cable, AC/DC adapter* and demos).                  |
| <b>CLIB/1</b>       | CAN LIB in OBJ for ICCAVR C.   |
| <b>CLIB/2</b>       | CAN LIB in SOURCE for ICCAVR C.  |



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**CANDIP/AVR1**

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## DEFINITIONS

| Data Sheet Identification | Product Status                  | Definition   |
|---------------------------|---------------------------------|--|
| Preliminary Specification | <i>Beta version / in Design</i> | This data sheet contains preliminary data and more data will be published later. Specifications may change without prior notice.                               |
| Product Specification     | Full Production                 | This data sheet contains the Final Specification. LAWICEL reserves the right to make changes at any time without prior notice, in order to improve the design. |

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**CANDIP/AVR1**

## **NOTES**