



# $\mu$ CAN.cpu.505

Manual Single Board Computer  
Version 1.00

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## μCAN.cpu.505

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# Warranty Limitations

## μCAN.cpu.505

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### Remarks on CE-conformance of μCAN-modules

μCAN-modules which have CE-conformance label, have passed test specifications of EU-criteria 89/336/EEG "Electromagnetic Emission and Immunity" and standardized European norms (EN).

Papers of declaration for EU-conformance, according to Art.10 of EN, are available at:

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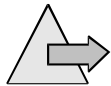
### 1. Safety Regulations

#### Symbol Explanation



**Attention !**

This symbol marks a paragraph which explains possible danger. This danger might cause a damage to the system / plant or damage to personnel.



**Note**

This symbol marks a paragraph which contains useful information for the work with the device or which gives just a hint.

#### 1.1 General Safety Regulations



**Attention !**

**Please read the following chapter in any case, because it contains important information about the secure handling of electrical devices.**

This paragraph gives important information about the conditions of use. It was written for personnel which is qualified and trained on electrical devices.

Qualified and trained personnel are persons who fulfil at least one of the following conditions:

- You know the safety regulations for automated machines and you are familiar with the machine.
- You are the operator for the machine and you have been trained on operation modes. You are familiar with the operation of devices described in this manual.
- You are responsible for setting into operation or service and you are trained on repairing automated machines. In addition you are trained in setting electrical devices into operation, to connect the earthing conductor and to label these devices.

Terms of use

The devices described in this manual can only be used for the mentioned applications. Other devices used in conjunction have to meet the safety regulations and EMI requirements.

# Safety Regulations

## General Safety Regulations

 **Attention !**

To ensure a trouble free and safe operation of the device please take care of proper transport, appropriate storage, proper assembly as well as careful operation and maintenance.

Hints for Installation

Please take care to observe the actual local safety regulations.

If devices are used in a fixed machine without a mains switch for all phases or fuses, this equipment has to be installed. The fixed machine must be connected to safety earth.

If devices are supplied by mains please take care that the selected input voltage fits to the local mains.

Safety Notice

If devices are supplied by 5V DC, this voltage has to be isolated from other voltages.

The cables for power supply, signal lines and sensor lines must be installed in a way that the device function is not influenced by EMI.

Devices or machines for industrial automation must be constructed in a manner that an unintentional operation is impossible.

 **Attention !**

By means of hardware and software safety precautions have to be taken in order to avoid undefined operation of a automated machine in case of a cable fraction.

If automated machines can cause damage of material or personnel in case of a malfunction the system designer has to take care for safety precautions. Possible safety precautions might be a limit switch or locking.

# Electrical Specifications

## Pin Configuration

### 2. Electrical Specifications

#### 2.1 Pin Configuration

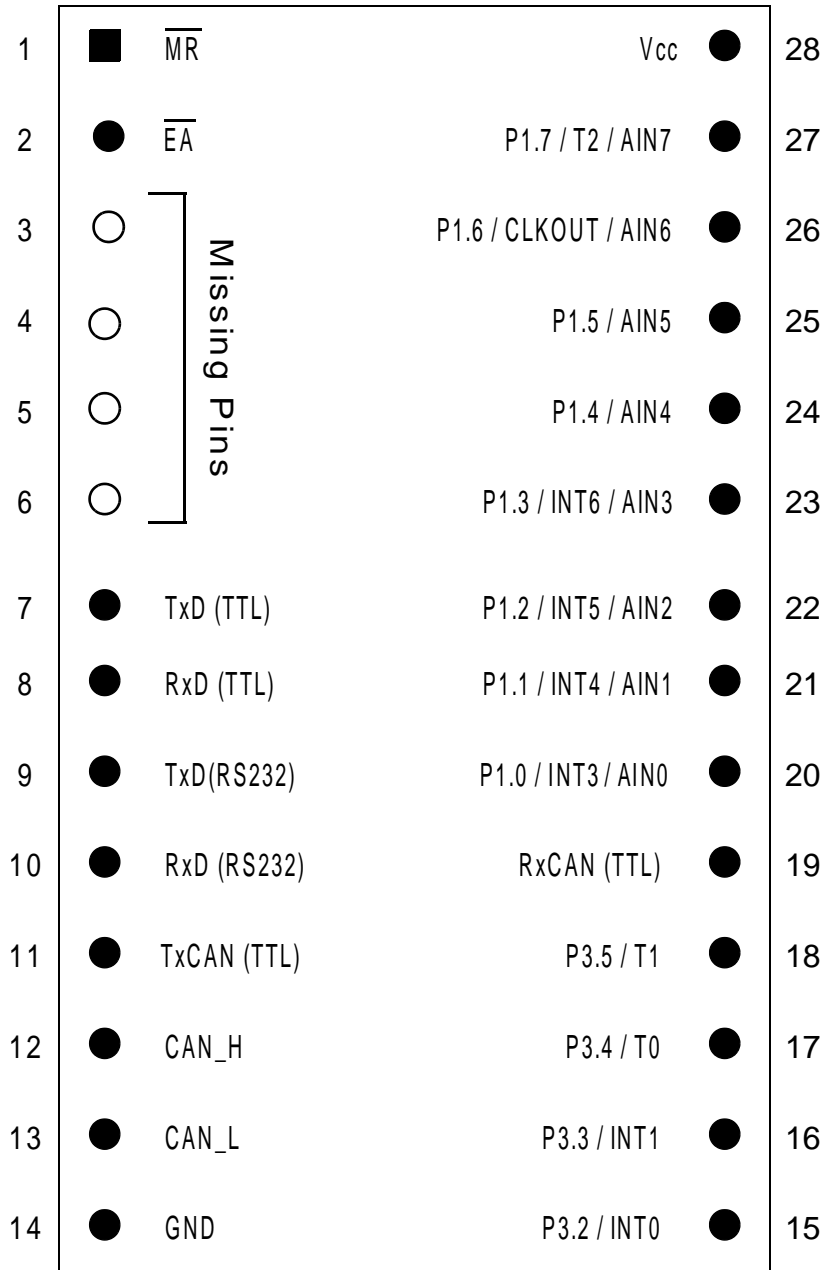


Fig. 1: Top View

### 2.2 Pin Definitions

<i>Pin</i>	<i>Mnemonic</i>	<i>Function</i>
1	$\overline{\text{MR}}$	Manual Reset (active Low) internally connected to reset generator. Reset generator sets reset pin of the C505 according to the data sheet.
2	$\overline{\text{EA}}$	<b>External Access Enable</b> When held at high level, the bootloader (firmware) is activated. When held at low level, the CPU fetches all instructions from external program memory.
3	---	Missing Pin
4	---	Missing Pin
5	---	Missing Pin
6	---	Missing Pin
7	TxD (TTL)	P3.1 / TxD Transmitter data output (asynch.) or clock output (synch.) of serial interface
8	RxD (TTL)	P3.0 / RxD Receiver data input (asynch.) or data input/output (synch.) of serial interface
9	TxD (RS232)	Same function as TxD (TTL) but with internal RS232-Transceiver
10	RxD (RS232)	Same function as RxD (TTL) but with internal RS232-Transceiver
11	TxCAN (TTL)	P4.0 / TXDC Transmitter output of CAN controller
12	CAN_H	CAN_H bus line (dominant high)
13	CAN_L	CAN_L bus line (dominant low)
14	GND	Ground (0V) Also reference ground for the A/D converter
15	P3.2/ INT0	P3.2 / INT0 External interrupt 0 input / timer 0 gate control input
16	P3.3/ INT1	P3.3 / INT1 External interrupt 1 input / timer 1 gate control input
17	P3.4/ T0	P3.4 / T0 Timer 0 counter input
18	P3.5/ T1	P3.5 / T1 Timer 1 counter input

Table 1: Pin Assignment

# Electrical Specifications

## Pin Definitions

2

<i>Pin</i>	<i>Mnemonic</i>	<i>Function</i>
19	RxCAN (TTL)	P4.1 / RXDC Receiver input of CAN controller
20	P1.0/ INT3/ AIN0	<b>Port 1</b> is an 8-bit quasi-bidirectional port with internal pull-up arrangement. Port 1 pins can be used for digital input/output or as analog inputs of the A/D converter. Port 1 pins that have 1's written to them are pulled high by internal pull-up transistors and in that state can be used as inputs. As inputs, port 1 pins being externally pulled low will source current, because of the internal pullup transistors. P1.0 / AN0 / INT3 / CC0 Analog input channel 0 Interrupt 3 input /capture/ compare channel 0 I/O
21	P1.1/ INT4/ AIN1	P1.1 / AN1 / INT4 / CC1 Analog input channel 1/ Interrupt 4 input / capture/compare channel 1 I/O
22	P1.2/ INT5 / AIN2	P1.2 / AN2 / INT5 / CC2 Analog input channel 2 / Interrupt 5 input / capture/compare channel 2 I/O
23	P1.3/ INT6/ AIN3	P1.3 / AN3 / INT6 / CC3 Analog input channel 3 Interrupt 6 input / capture/compare channel 4 I/O
24	P1.4/ AIN4	P1.4 / AN4 Analog input channel 4 <i>Serial EEPROM (Data Out)</i>
25	P1.5/ AIN5	P1.5 / AN5 / T2EX Analog input channel 5 / Timer 2 external reload / trigger input <i>Serial EEPROM (Data In)</i>
26	P1.6/ CLKOUT/ AIN6	P1.6 / AN6 / CLKOUT Analog input channel 6 /System clock output <i>Serial EEPROM (SCLK)</i>
27	P1.7/ T2/ AIN7	P1.7 / AN7 / T2 Analog input channel 7 /Counter 2 input <i>Serial EEPROM (CS)</i>
28	Vcc	Power Supply (+ 5 V) Also reference <b>voltage</b> for the A/D converter

Table 1: Pin Assignment



### 2.3 Dimensions

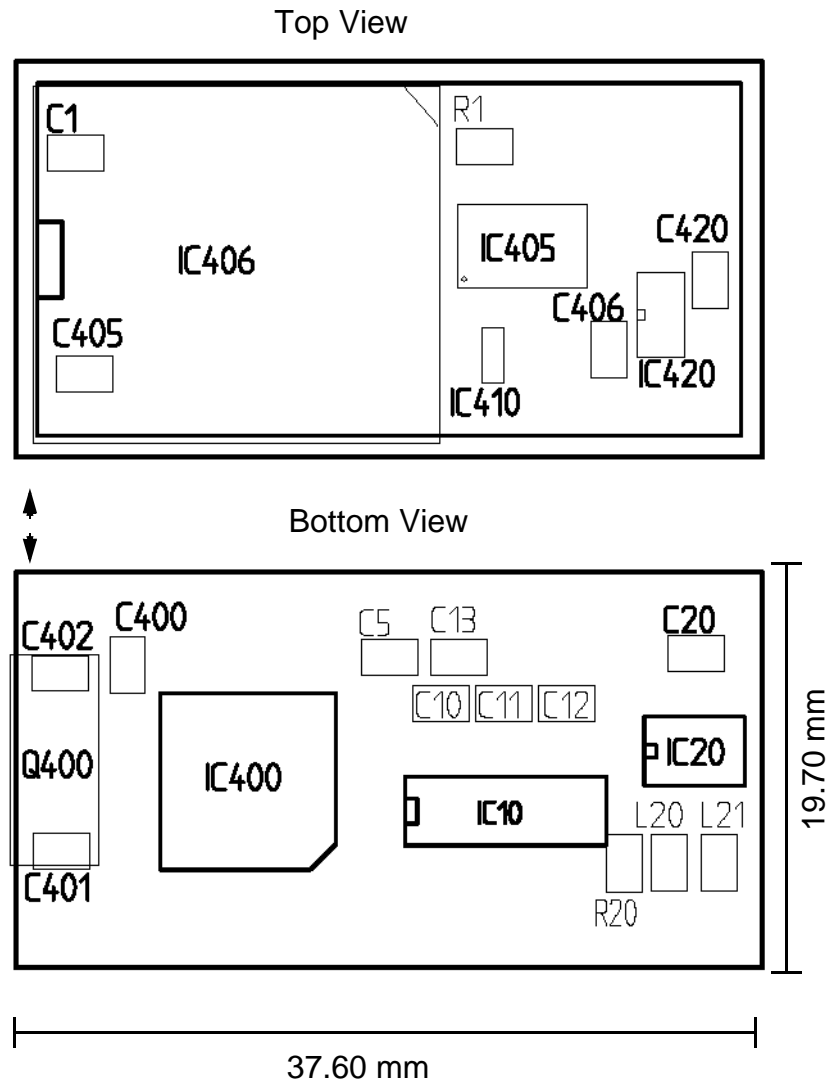


Fig. 2: Dimensions

Figure 2 illustrates the position of the components on the PCB. The following table describes briefly the components:

Code	Type	Description
Q400	Quartz	16 MHz crystal
IC20	82C250	CAN -Transceiver (Philips)
IC400	C505CA	8 bit Microcontroller (Infineon)
IC405	74HCT 573	8 bit Latch
IC406	29F010	1MBit, Flash-EPROM (AMD)

Table 2: Components of the  $\mu$ CAN.cpu.505

# Electrical Specifications

## EEPROM

Code	Type	Description
IC420	96C46B	1KBit serial EEPROM (Microchip)
IC10	MAX202	RS232-Transceiver (Maxim)
IC410	MAX825	Reset Generator (Maxim)

Table 2: Components of the  $\mu$ CAN.cpu.505

### 2.4 EEPROM

The Microchip 93C46B is a 1 KBit, serial Electrically Erasable PROM. The device memory is configured as 64 x 16 bits. For further information please refer to the the corresponding data sheet.

#### Features

- Industry standard 3-wire serial interface
- Device status signal during ERASE/WRITE cycles
- Sequential READ function
- 1,000,000 ERASE/WRITE cycles guaranteed



#### Note

Please note that the control pins of the EEPROM are tied to the ports 1.4 to 1.7 of the microcontroller. If you want to use these pins for other tasks you have to remove the EEPROM or put the CS signal (port 1.7) to an appropriate level.

Name	Function	Port
CS	Chip Select	P1.7
CLK	Serial Data Clock	P1.6
DI	Serial Data Input	P1.5
DO	Serial Data Output	P1.4

Table 3: Pin assigment of EEPROM

### 3. Evaluation Board

The  $\mu$ CAN.cpu.505-EB is an Evaluation Board for the Single Board Computer  $\mu$ CAN.cpu.505. The board has push buttons to easily simulate inputs and red light diodes for simulating outputs. All ports and important signals from the C505CA are available on the prototype area, which makes it easy to connect external boards or peripherals, such as RTC, LCD display, keyboards, motor controls etc.

Further, the board has two DB-9 connectors for the RS-232 communication port and the CAN (Controller Area Network) port according to the CiA standard. There are also 2 jumpers for easy CAN termination and enabling power supply onto the DB-9 CAN connector according to the CiA standard, which makes it possible to supply other CAN nodes with only one power supply.

Finally the board is equipped with two potentiometers for the On-Chip analogue inputs and two jumpers that can be used as digital inputs.

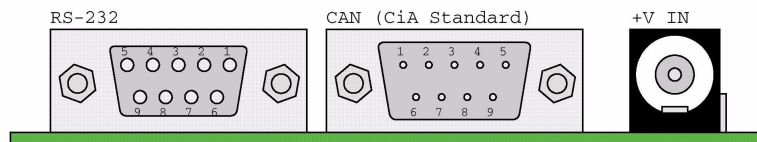


Fig. 3: Front view of the Evaluation Board

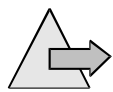
#### 3.1 Power Supply

The  $\mu$ CAN.cpu.505-EB Evaluation Board can be supplied with +9V to +24V (nominell +12V) through either the standard pin connector (marked +V IN on figure 3 above) or through the DB-9 CAN connector (marked CAN on figure 3) according to CAN in Automation (CiA) standard on pin 3 (GND) and pin 9 (+V). By this feature it is possible to have just one AC/AC adapter on one board and then supply the other boards through the CAN bus. Enabling the +V power from/to the CAN bus is performed by short circuit (close) the jumper marked J2. If this jumper is open the mother board can not be supplied with power from the CAN connector and instead the standard pin connector has to be used.



### Attention !

When several boards are interconnected and the power supply is fed via CAN (J2 closed), only one board can have an AC/DC adaptor. If each board has its own AC/DC adaptor the jumper J2 must be left open.



### Note

## 3.2 CAN Connector

The CAN bus is connected on the DB-9 male connector according to CAN in Automation (CiA). Termination of the CAN node is performed by short circuit (close) the jumper marked J1.

A CAN network must always be terminated on both ends.

Pin	Signal	Description	Conn.
1	-	Reserved	No
2	CAN_L	CAN_L bus line (dominant low)	Yes
3	CAN_GND	CAN Ground	Yes
4	-	Reserved	No
5	(CAN_SHLD)	Optional CAN Shield	No
6	(GND)	Optional CAN Ground	Yes
7	CAN_H	CAN_H bus line (dominant high)	Yes
8	-	Reserved (error line)	No
9	(CAN_V+)	Optional external positive supply	Yes

Table 4: Pinning of the DB-9 CAN connector

The table shows which pins are used for the DB-9 CAN connector. Pin 3 and Pin 6 are interconnected.

### 3.3 RS-232 Connector

The  $\mu$ CAN.cpu.505 is equipped with a RS-232 transceiver. Only the data lines of the RS-232 are supported (no control signals).

Pin	Signal	Description	Conn.
1	DCD	Data Carrier Detect	No
2	TxD	Transmit Data (from $\mu$ CAN.cpu.505)	Yes
3	RxD	Receive Data (to $\mu$ CAN.cpu.505)	Yes
4	DTR	Data Terminal Ready	No
5	GND	Signal Ground	Yes
6	DSR	Data Set Ready	No
7	RTS	Request to Send	No
8	CTS	Clear to Send	No
9	RI	Ring Indicator	No

Table 5: Pinning of the DB-9 RS-232 connector

### 3.4 Jumper Settings

Jumper	Function	Open	Closed
J1	CAN Termination	Termination off	Termination on
J2	Power via CAN	No supply	Supply via CAN
J3	Port 3 direction	see text on board	
J4	Port 1.2 / 1.3 input	Port pin is high	Port pin is low
J5	Boot Loader	On = Bootloader, Off = Flash	
J6	Analogue Input AIN1	Not connected	P1
J7	Analogue Input AIN0	Not connected	P2

Table 6: Jumper settings on the Evaluation Board

### 4. Software

The  $\mu$ CAN.cpu.505 is equipped with the OTP version of the C505CA controller from Infineon. The firmware in the internal ROM of the C505CA holds a bootloader. With the bootloader it is possible to download a binary file (program) into the Flash-EEPROM of the single board computer.

#### 4.1 Download Program

The tool CANdot (CAN Download Tool) is used to download the application software from the PC into the  $\mu$ CAN.cpu.505. The software is available free of charge under the following URL:

<http://www.lawicel.com/candip/download.htm>



**Attention !**

CANdot uses a Peer-to-Peer connection for the download process. Make sure that only one  $\mu$ CAN.cpu.505 is connected to the CAN interface of the PC.

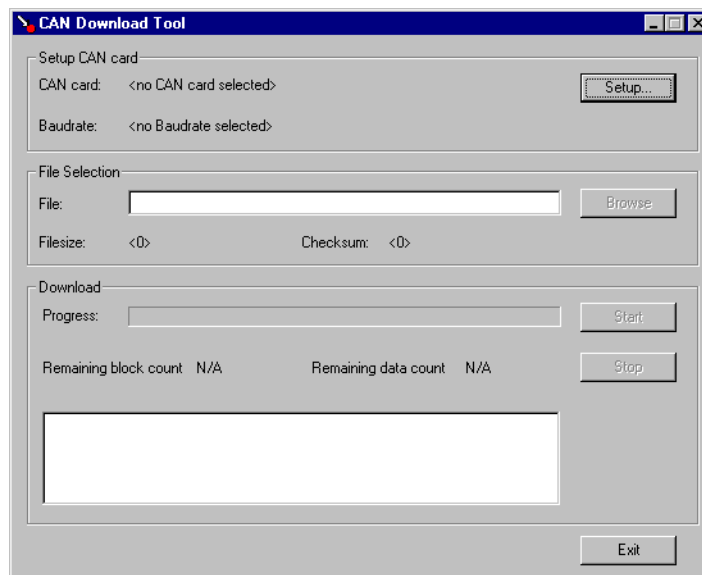


Fig. 4: Download program CANdot after startup

After starting CANdot, the dialog as shown above appears. First you have to setup the CAN card by clicking on the button 'Set-up...'.  
.

The baudrate for the download is fixed to 125 KBit/sec.

Now you have to select the (binary) file you want to download by choosing the button 'Browse'.

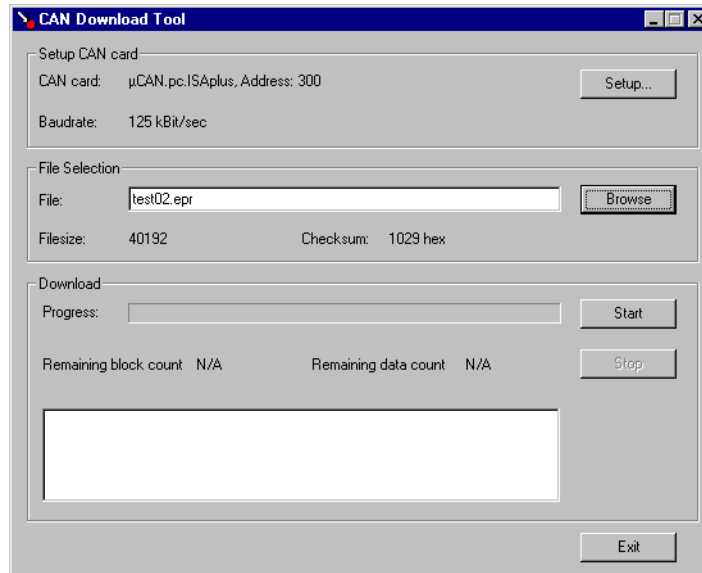


Fig. 5: Selecting a file to download

The file size and the checksum of the file are shown in the file selection group. Please note that the file maximum file size is limited to 63231 bytes (address 0xF6FF). The limitation is given because the CAN controller starts at address 0xF700 and overlaps with the Flash-EPROM.

The third step is to start the download. You can watch the download process in the progress bar and the message list in the download section.

### 4.2 Memory Organization

The C505CA CPU manipulates operands in the following four address spaces:

up to 64 Kbytes of program memory (32K on-chip programmable memory)

up to 64 Kbytes of external data memory

256 bytes of internal data memory

256 bytes of internal XRAM data memory

256 bytes CAN controller registers / data memory

128 byte special function register area

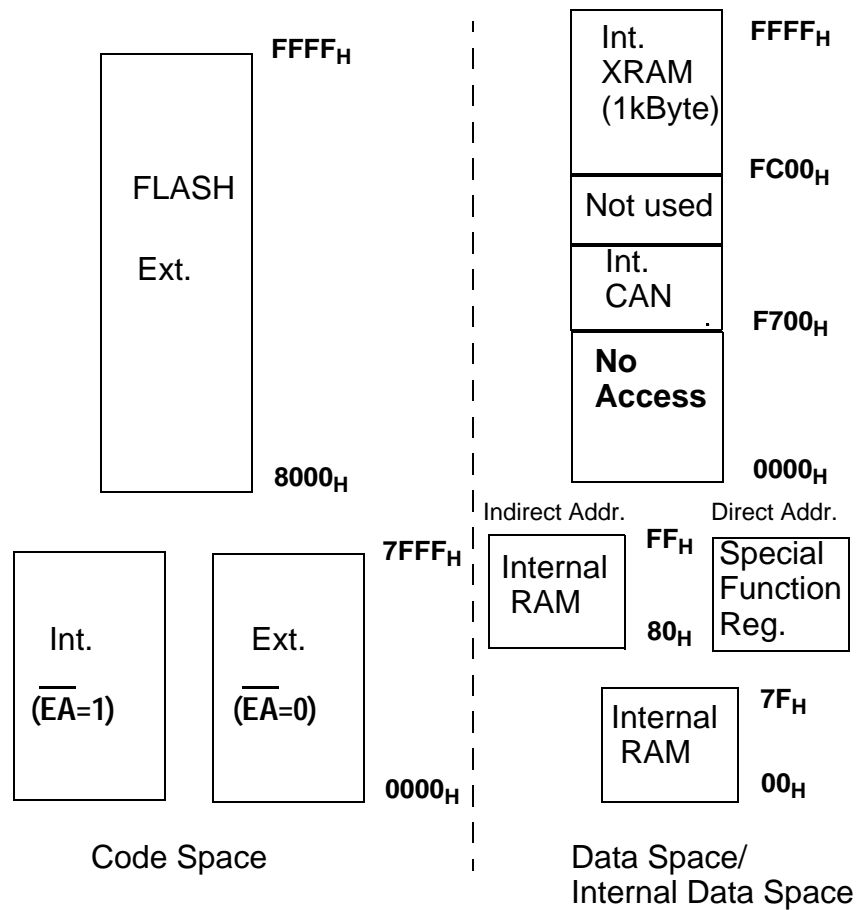


Fig. 6: Address spaces of the C505

You can choose between the access on internal memory space of the C505 and the external memory code space by setting the EA pin to high or low level.



**Note**

For further information please refer to the corresponding data sheet of the C505CA.