



## 1: Introduction

Congratulations on your purchase of the Micronica MASTERA-IV Universal Card programmer.

## What is new?

The “MASTERA-IV” programmer is the latest version of the popular series of MASTERA 1 to 3 smartcard programmers. This new version has the same extended REPLICATOR function as the MASTERA-III, but this new member of the MASTERA family has an extended- internal EEPROM storage. The EEPROM size is doubled from 256K to 512K. The hardware of the MASTERA-IV is now ready to deal with the new emerging larger smart cards.

The MASTERA-IV programmer combines the functionality of several discrete programmers in one design. MASTERA-IV is developed especially to program ISO-CARDS and many variants of the "GOLD" card and GOLD card replica family containing different PIC or ATMEL processors. The different programmer mode's are selected trough a push-button. The selected program is clearly indicated by a bright seven-segment LED display. A 8.3 to 12V net adapter powers the programmer. The net adapter is delivered with the programmer. MASTERA-IV is connected to the host PC COM port with a 9 pin RS-232 cable. The programmer is measures 7 x 12 x 3cm and is mounted in an appealing PVC housing. The strong pocket size housing gives the programmer certain robustness and an effective protection against ESD (Electro Static Discharge).

**Note:** Investigation proves ESD to be the major cause of failure in non-protected programmers on the market today.

The programmer uses professional quality SMD components. The heart of the circuit is an EPLD, a large RISC processor and a large (512K) EEPROM. The Programmable Logic Device enables upgrading of the programmer in the case that a new programmer mode would emerge.

# MASTERA-IV

## 1: General operation

MASTERA-IV presently contains 10 different programmer modes (Display 0 to 6, L, C and P).

The user can step through the different modes by pressing the bush button on the programmer. The display will indicate the selected mode. When no card is inserted you will step through mode 0, 1, 2, 3, 4, 5, 6, L, P and C and then back to 0.

The mode can not be changed when a card is inserted and mode L, P or C is selected. You can change the mode with a card inserted only when in mode 0 to 6, the mode will then rotate from 0, 1, 2, 3, 4, 5, 6 and then back to 0.

The programming process can be followed on the PC and also on the LED of the programmer. Depending on the selected mode, the LED will be on continuously or blink. The Decimal point of the display indicates that power is applied on the smart card in the adapter.

## 2: Programmer Modes



### MODE 0:

Mode 0 is the well-known PHOENIX or SMARTMOUSE programmer mode with a 6MHz clock frequency. This mode is generally used to program ISO-CARDS through CRD's or to program the EEPROM section of GOLD cards.

### MODE 1:

Mode 1 is identical to Mode 0 but operates at 3.58Mhz. This mode can be required for some cards with a limited clock speed. The 3.58 MHz is the normal operation frequency for SAT type SmartCards.

### MODE 2:

Mode 2 is compatible with the JDM or LUDI programmer. This mode is used to program the PIC section of, e.g. a GOLD card. The PIC's are usual 16F84 devices but in principle all serial programmable PIC devices can be programmed in this mode. The programmer has an internal voltage boost circuit that generates the required accurate 13V programming voltage.

### MODE 3:

Mode 3 is used to program EEPROM's on cards with separate I2C contacts (8 pin contacts). You can program the EEPROM on these cards completely separate from the PIC processor.

### MODE 4:

This mode is compatible with the ATMEL-JUPITER. It programs AT90s2343 on a JUPITER card but it is also capable of programming other AVR type microprocessors on this type of cards.

### MODE 5:

Mode 5 is used to program the EEPROM direct on the JUPITER card over the separate I2C contacts.

### MODE 6:

Mode 6 is used to read and write GSM cards, German and Dutch telephone cards and German Cash and Insurance cards.

### GSM cards

- You can manage the telephone book and move telephone books to other cards.
- You can create, print and edit Short Messages (SMS).

# MASTERA-IV

- Select and disable networks from the roaming list.
- Activate cost blocking and set the cost per unit.
- Create backup copies from your card.
- Modify, unlock and deactivate PIN's
- View and modify the contents of card files.

## Telephone cards:

- You can read the card contents and display the data and value this mode works on Dutch and German telephone cards.

## Cash and Insurance card:

- You can read and print out card information, the current balance and the last transactions of the German Cash and Insurance cards.

## **MODE L-C- P:**

Mode L-C-P is the "REPLICATOR" or card Clone mode. These 3 modes are used to read a unprotected card completely into the internal memory of the programmer (Load mode). The card can then be duplicated (cloned) in a unlimited number of cards. The whole duplication can be performed without the need of an external PC. The only thing needed is the MASTERA-IV and its power supply. The operation can even be done in, e.g. a car or caravan using a suitable power cord or adapter.

## The PEPLICATOR mode supports following card types.

- JUPITER card: containing an ATMEL AT90S2343 (or AT90S2313) and a 24L16. The Read and Program time is approximately 40sec to 1min.
- FUN card: containing an ATMEL AT90S8515 and a 24L64 \*\*. The read and program time is approximately 2min 30sec
- SILVER card: containing a PIC 16F876 or 877 and a 24L64 \*\*. The Read and Program time is approximately 2min 30sec
- GOLD card: containing a PIC 16F84, 16F84A or 16C84 \* and a 24L16. The Read and Program time is approximately 35 to 45 sec.

*Note: \* The cards are recognized by the processor Identification code. This presents a small problem for older GOLDCARDS. MICROCHIP started to implement an identification code with the PIC16F84A processor. Older GOLD cards could contain a PIC16F84 or even a PIC16C84. The later two can not be identified and are therefor handled as a PIC16F84A. Pls. Note that the Power Up Timer bit (PWRT) is inverted in the 16C84 chip.*

*\*\* New FUN and SILVER cards are now available, using the same ATMEL or PIC processor but using a larger EEPROM, e.g. 24L128 or 256. The hardware of the programmer is prepared to deal with these cards. For the moment, only the first 64K of the EEPROM will be programmed to shorten the programming time!*

## • **MODE L:**

Mode L is the LOAD mode, when a card is inserted in the programmer and the button is pressed then first the Processor code and next the EEPROM is copied in the programmer's non-volatile memory. The card is tested first to check the type and the security bit status. Secured cards can not be read and are refused, the content of the card is not affected. The read operation takes approximately 35sec to 2min-30sec depending on the card type. The card type is also stored in the programmer.

## • **MODE C:**

Mode C is the COPY Mode. Select mode C and insert a card in the programmer. The programming starts after pressing the KEY. The security bit of the card is not set in this mode. It is clear that you can not copy the code from, e.g. a FUN card into a GOLD card, the code

# MASTERA-IV

will not work anyhow, so the card type is first compared with the stored card type from the LOAD mode. Only a card from the same type as used in the L mode can be programmed. Other cards are refused, indicated by 5 LED flashes. The card is automatically erased before programming.

- **MODE P:**

Mode P or PROTECTED Mode is identical to mode C but the Copy protection bit is set at the end of the programming cycle.

- **L.C.P. Error indication:**

- The LED is continues on during the read or write operation and will go off after reading is completed.

*The LED will blink repetitively when an error is encountered during reading or writing of the card.*

- 1 Blink = WRONG or DEFECTIVE card detected.
- 2 Blinks = COPY protection of master card is ON, (copying is not possible).
- 3 Blinks = Verify error of the PIC section.
- 4 Blinks = Verify error in the EEPROM section.
- 5 Blinks = Wrong card type detected (copying is not possible).

## 3: Software

The programmer can be used in combination with several different software packages, depending on the programmer mode. The software can be found on the Internet. The following paragraph give's a short description of the software and the URL where you can find the software. It is wise to check these URL's regularly to get software updates for bug fixing or for new devices.

All programs are working under WIN95-98.  
Windows 2000, Win NT and other recent released WINDOW versions are not supported by all programs, check the system requirements and updates of the individual programs on the Internet.

### **3.1: WinPhoenix**

This program is capable of writing the embedded EEPROM trough the Processor on the smartcard. The processor (PIC) is first programmed with "LOADER" software. Next the EEPROM is programmed in mode #0 or #1.

### **3.2: CardWizard**

This program is designed to upload .crd files to smartcards using a WinPhoenix or SmartMouse interface. This software can be used in mode #0 and #1

### **3.3: CardMaster**

This is a similar program as CardWizard. It is also used to upload .crd files in mode #0 or #1

### **3.4: ICProg**

This program is mainly used in mode #2 and #3 to program PIC's and EEPROMS directly on the board. But the program can also be used in mode #1 to program embedded EEPROMS trough the PIC using a Loader program.

The use of this program is described in more detail in the next chapter.

You can find this beautiful written program from Bonny Gijzen at his home page:

<http://www.ic-prog.com/> The newest version of this program is supported by all Windows versions.

# MASTERA-IV

## **3.5: PonyProg 2000**

This program is used in mode #4 and #5 for the ATMEL devices and the EEPROM on the Jupiter cards. Also this program is explained in more detail in the next chapter.

You can download last version of PonyProg at <http://www.lancos.com/prog.html>  
(<http://www.lancos.com/ppwin95.html> )

## **3.6: ChipCard**

This program is used for MASTERA-IV mode # 6. It enables read/ write operation of phone and GSM cards. The program can be installed in different languages. It is largely self-explaining and has an extensive help menu embedded in the program.

You can download last version this program at <http://www.teledata-update.de>

## **3.7: CHIP-CAT**

This program makes optimum use of the MASTERA mode 0 to 5. It enables you to program the internal EEPROM different card types. This software uses it's own loader files. Following cards can presently be programmed directly with the CHIP-CAT Revision 2.0:

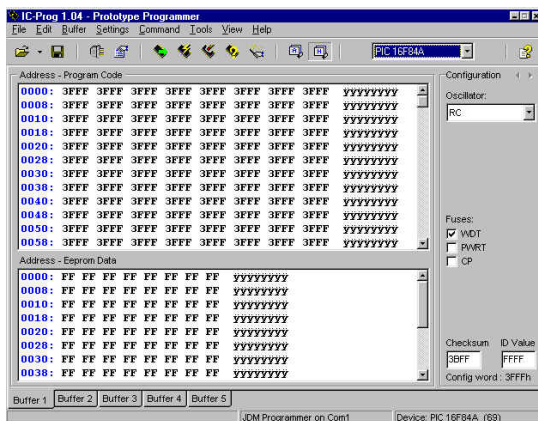
- The PIC/Wafer-CARD (GOLDCARD) 16F84 + 24C16.
- The AVR/Jupiter-CARD, AT90S2323 + 24C16
- The AVR/Jupiter-CARD, AT90S2343 + 24C16
- And the FUN-Card AT90S8515 + 24C64

**Note:** MASTERA-IV is a universal programmer and can therefore be used with different software programs. When the programmer is used with Shareware or Licensed software then royalties should be paid to the developer or reseller of that software package.

## 4.2: ICProg

The user could use different software to control this programmer as already mentioned. However the IC-Prog software of Mr. Bonny Gijzen is very complete and free on the Net. The next paragraphs containing screens from this programmer. The program is very much self-explaining and contains a good HELP function. This part of the manual is therefore not intended as a user manual for the software but the could help you on the way in making the correct settings to use it in combination with the Universal Programmer. Mr. Gijzen is continuously improving his software and adding new devices, so check from time to time his website for upgrades. The description below is created from IC-Prog Revision 1.04 newer revisions could be slightly different.

### 4.2.1: Port Settings and Hardware selection:



← A similar, general overview screen is displayed when IC-Prog is started.

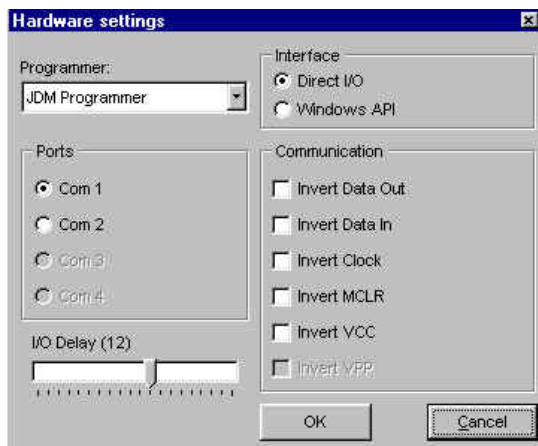
The first time you have to select the serial port and the type of programmer: These settings are entered as shown below: ↓



Select the proper serial port (Com1 to Com4) And select the JDM Programmer. For WIN9x you should select Direct I/O. Windows API

Could be selected for Windows NT. The Communication checks boxes are usually not required. These are intended for special hardware and test purposes.

The settings are automatically stored when you close the program.



### 4.2.2: General Programmer settings:

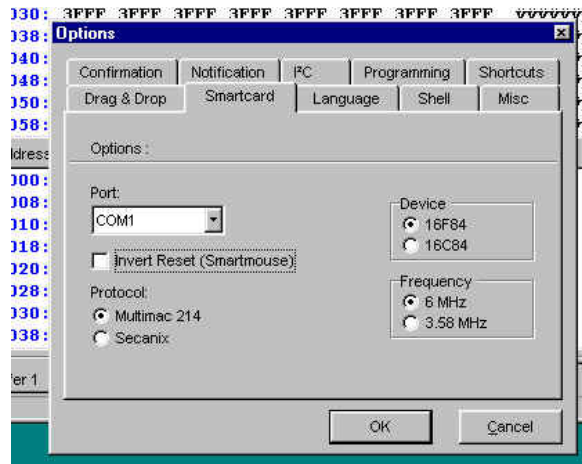


The Option menu enables you to customize many settings.

#### 4.2.2.1 Language

This submenu let you select your preferred language. You can select between a variety of 11 European and east European languages.

# MASTERA-IV

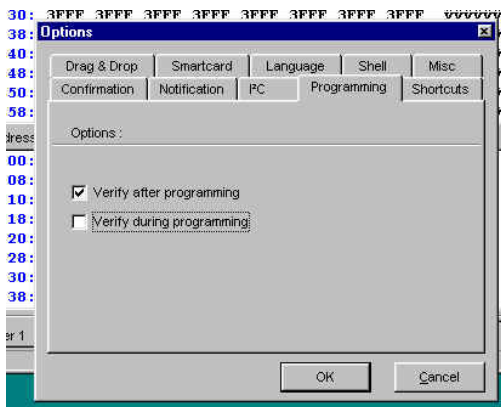


## 4.2.2.2 Smartcard Option

You can program embedded EEPROMs indirectly with this software, MODE #0 or #1 from the MASTERA-IV. You have to make the necessary programmer settings first in this submenu.

- The COM port where the MASTERA-IV is connected.
- The Device is the type of the embedded processor in the card. (Most modern GOLD cards are 16F84. 16C84 will be found on older type of GOLDCards)

- Frequency: Select 6MHz for MASTERA-IV Mode #0 / 3.58 MHz for Mode #1
- Multimac or Secanix is the type of LOADER program used.

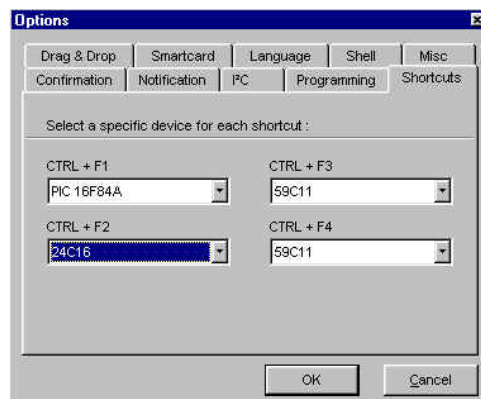


## 4.2.2.3 Program verification

The programmed device is verified during or after programming. The default setting is “*Verify after programming*”. This means that the complete device is programmed and then verified. This is a good practice but it has one drawback: most PIC devices having a security bit. This bit prevents program readout when set. So, when this bit set that it is impossible to verify the programming process. For these devices it is better to change the setting to “*Verify during programming*”

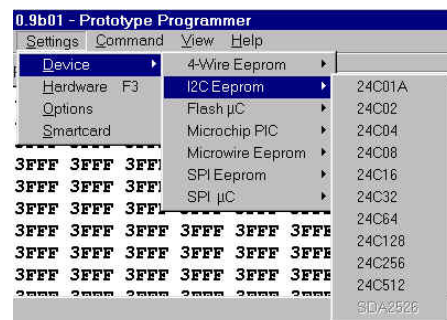
## 4.2.2.4 Shortcut setting.

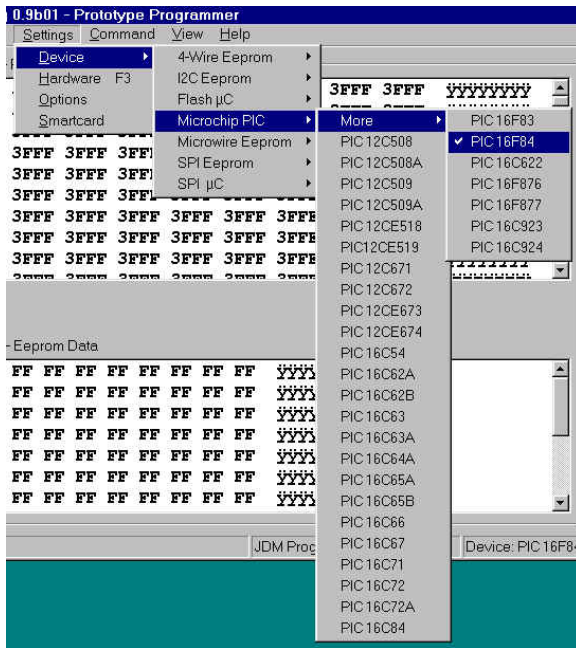
You can call device settings very fast without going through the separate setup menus by pre-setting them to a shortcut key sequence. You can create 4 Shortcuts (CTRL + F1 to F4).



## 4.2.3: Device selection:

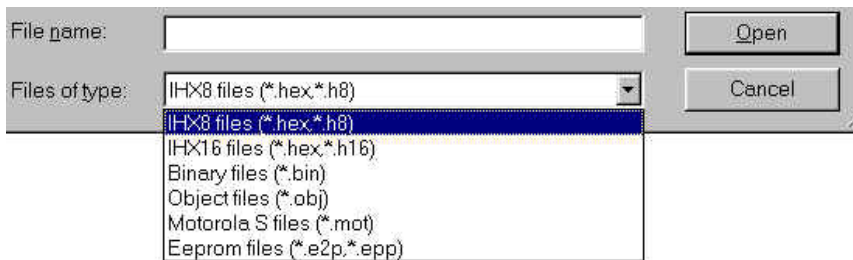
The device can be selected out of an extensive list. The devices that can be programmed directly in the sockets can be found in the “Microchip PIC” list ⇒ and the “I2C EEprom” list. ↓





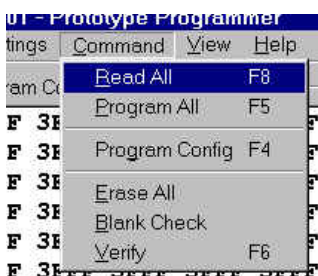
## 4.2.4: Loading and saving data files:

Program files can be loaded or saved in any directory and in many data formats ↓.



**A word of warning about the data formats:** Reading in, e.g. a HEX file in .H16 format when it is a .H8 will be detected by the software and results in an error message. However, the software is not capable of detecting errors in .BIN files because this file type is not using a CRC check or any other control check. Also the format of Binary files can differ depending on the source that created the .BIN file. Always check a BIN file on its contents before using this file type for programming a device.

## 4.2.5: The Command Menu:



The command menu is the final menu where you can select the required action. The device is verified automatically after programming. You have to remember that it is not possible to verify a device when the security bit is set. You could program a device without the security bit and verify the program integrity after programming. Next you set the security bit and perform the "Program Config" (F4) action.

Command ICON's Most commands can be activated directly by clicking on one of the command ICON's.



# MASTERA-IV

## 4.2.6: Editing a Data field:



You can directly edit a location in the Data or Code field. Place the cursor at the start of the data and click the right mouse button. You can now choose to fill the whole buffer or just edit the selected location ⇒



## 4.2.7: Special:



There is one special setting in the programming software. "Smartcard", This setting is intended for Trough PIC programming using a Phoenix or SmartMouse card interface (Mode #0 and #1). This option is to be switched of in MASTERA-IV Mode #2 and #3.

### Trough PIC Programming sequence.

Programming ISO Cards with a buried EEPROM is done in tree steps. The EEPROM device is not directly accessible by the programmer as shown in the figure above. The EEPROM is accessible in Phoenix Mode (#0 or #1). The buried PIC has to contain a **LOADER** program to enable the serial communication. The data is transferred by a serial protocol to or from the PIC. The PIC relays the data to the EEPROM and vice versa.

Some Smartcard PIC software having this serial protocol build in. So as soon as the PIC is programmed you can access the EEprom date in Phoenix mode. This kind of PIC software is ideal; you can change the EEprom data over and over without re-programming the PIC.

Most PIC software however is not prepared for "trough Pic programming" or the are using a different protocol. So to access the EEprom you have to place a loader program in the PIC first. ***This means that you have to know the original code from the PIC to re-program the PIC's original code when you are finished programming the EEprom!***

The loader program "**LOADER.hex**" is compatible with the IC-Prog software from Bonny Gijzen.

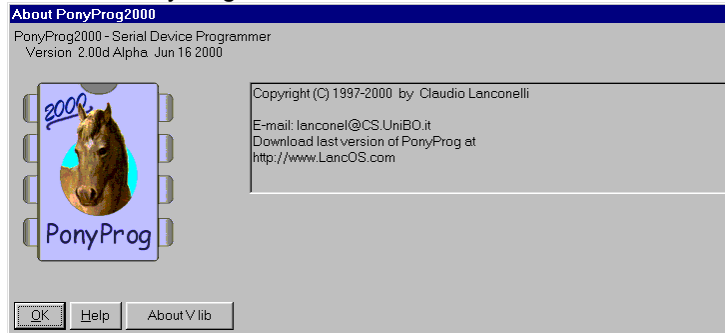
### PROCEDURE:

1. Select MASTERA Mode #2 and program the PIC on the card with **LOADER.hex**
2. Select MASTERA Mode #0 or #1
3. Select the SMARTCARD option in the ICprog settings menu
4. Select the correct I2C EEPROM type (usually 24C16)
5. Program the EEPROM
6. Select MASTERA Mode #2 again and program the PIC with the final code.

## 4.3: PonyProg Software Setup:

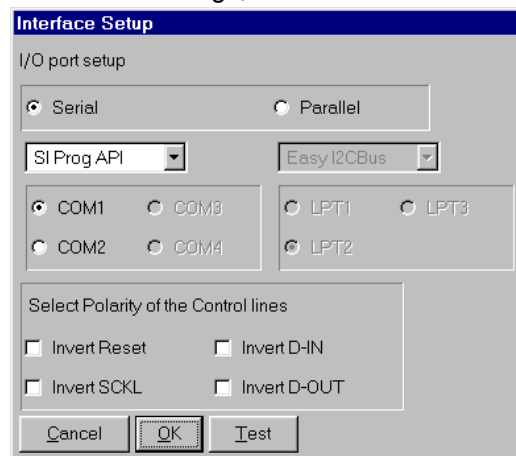
The software description in this chapter refers to the “PONYProg” program from Claudio Lanconelli. (Download at <http://www.lancos.com/ppwin95.html> )

- Install and start PonyProg2000 under Windows 95/98 or NT.

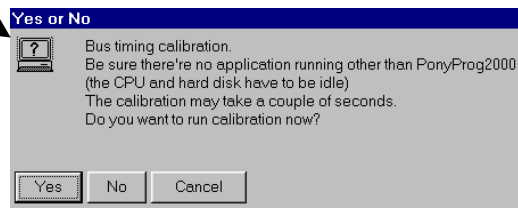


Open **SETTINGS**, Open **HARDWARE**, now select *Si Prog API* programmer and the correct COM port for your PC connection. →

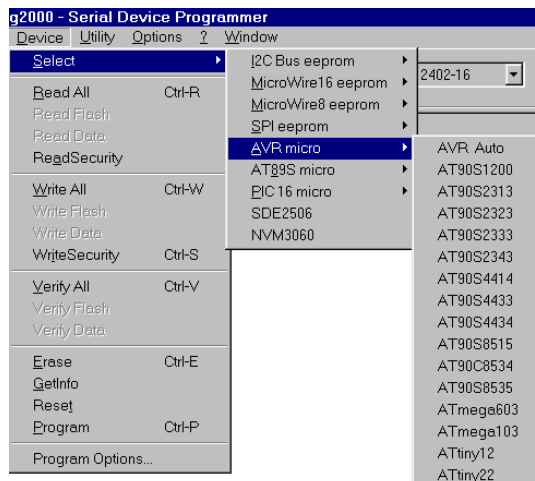
- The first time you have to make the correct Hardware settings,:



- Run Calibration



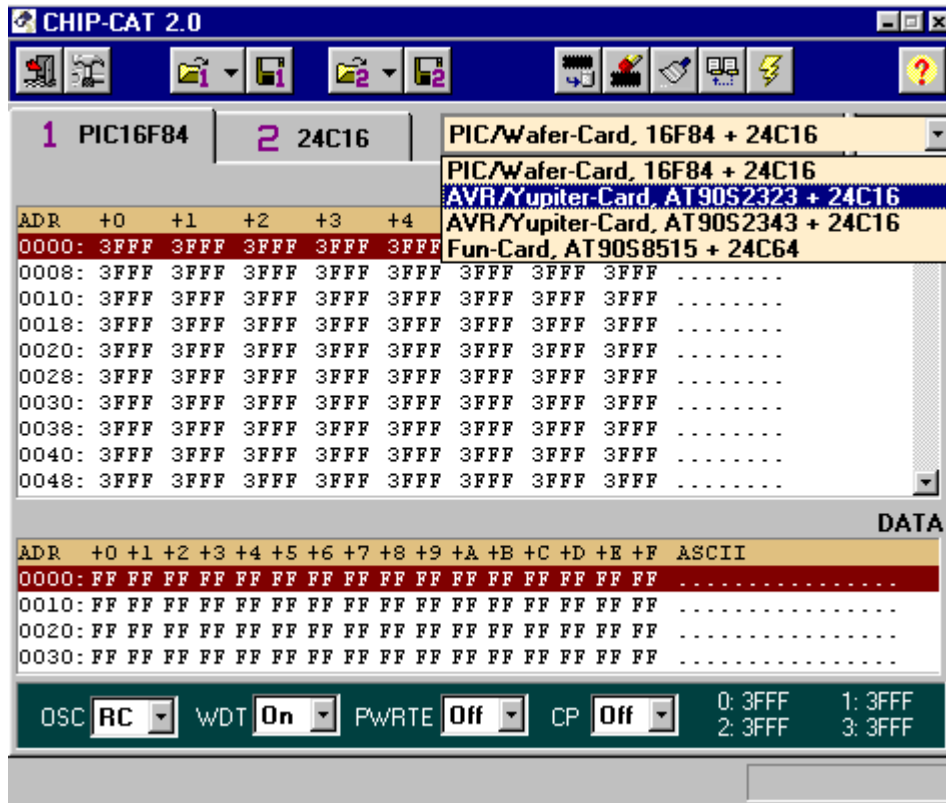
- The programmer and the software is now ready to program. Select the AVR microprocessor type or I2C Bus eeprom



# MASTERA-IV

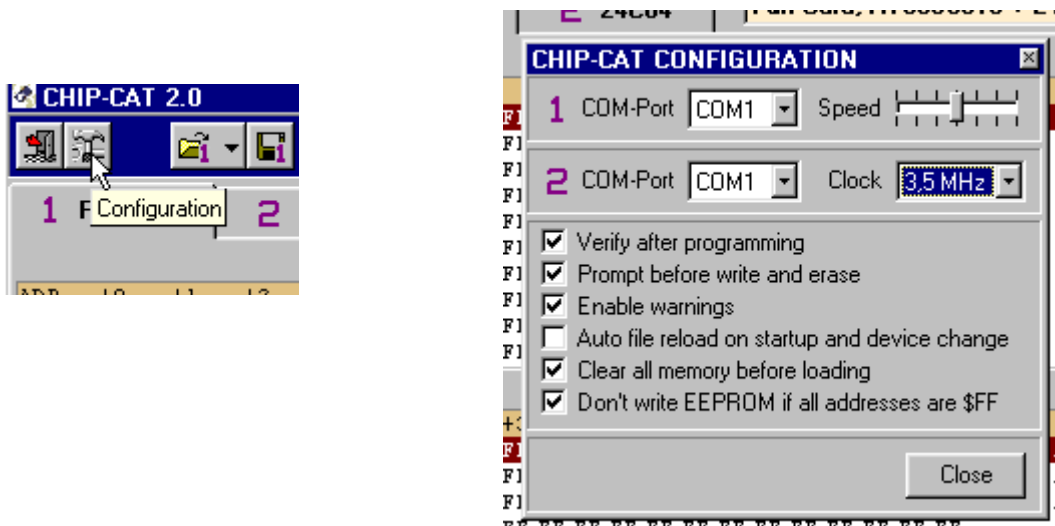
## 4.4: CHIP-CAT Software Set-up:

The CHIP-CAT rev 2.0 is a new program that works splendid with the MASTERA programmer family in mode 0 to 5. This program also enables you to program a complete GOLD or ATMEL card. The program also writes the correct loader for the different chip types and requests you to change the programmer mode when required.

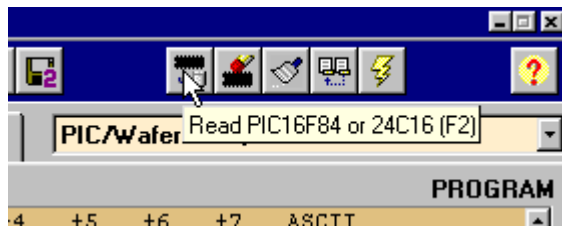


The operation is strait forward, select the card type (as displayed above) and select the correct mode on the MASTERA programmer always start with the EEPROM when programming a card and always start with the processor when reading a card (see also GOLD140 description).

The Software should be configured first to recognize the connected MASTERA programmer.

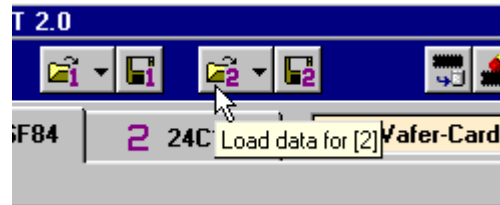


## MASTERA-IV



You can now READ, WRITE, ERASE and Verify the card by clicking the different ICON's .

You can Load and Save data to and from the PC with the 4 file icon's. The two on the left (identified by "1") are used for the processor part. The two on the right (identified by "2") are used for the EEPROM part of the card.



Also with this programmer you can manipulate the different typical processor setting as, e.g. the Oscillator setting or Code Protect bit.



# MASTERA-IV

## 5: CARD Information

ISO Cards are sold under different names and colors, they are called SmartCards, Gold Wafer Cards, Platinum, Galaxy or Gold card, MM2 Gold Wafer Cards and so on. Also variants build on a small thin PCB containing a discrete PIC and EEPROM can be found. The CARD contact function is standardized except for the contacts C4 and C8 (see below)

### 5.1: The internal circuit of the popular cards:

#### GOLDCARD:

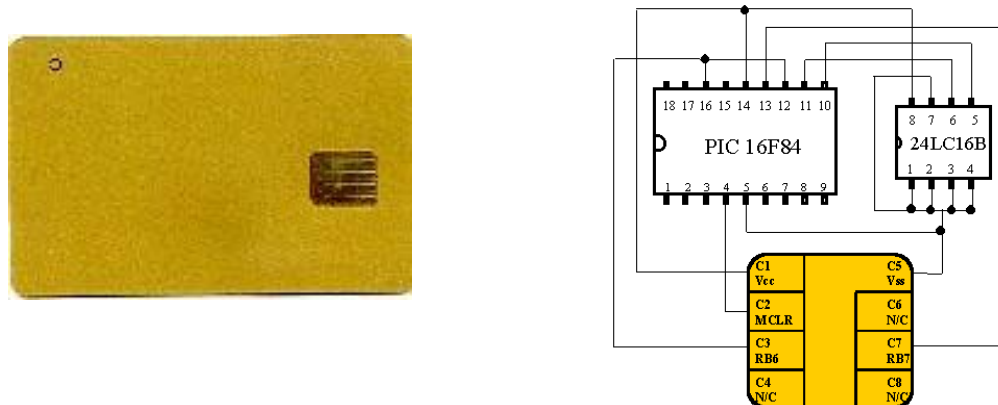


Figure 1: GOLD Card layout (Mode #0 , #1 and #2)

#### GOLDCARD CONTACT DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	RB6/Osc1	Clock Input	C7	RB7	Data I/O
C4	N/C	No Connect (or SDA)	C8	N/C	No Connect (or SCL)

# MASTERA-IV

## SILVERCARD:

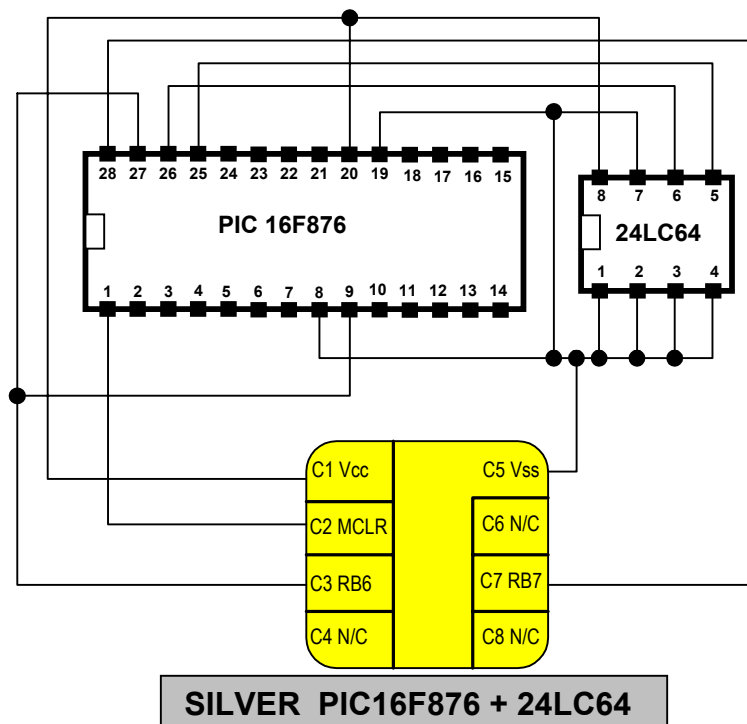


Figure 2: SILVER Card layout (Mode #0 , #1 and #2)

### SILVERCARD CONTACT DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	RB6/Osc1	Clock Input	C7	RB7	Data I/O
C4	N/C	No Connect	C8	N/C	No Connect



## JUPITERCARD:

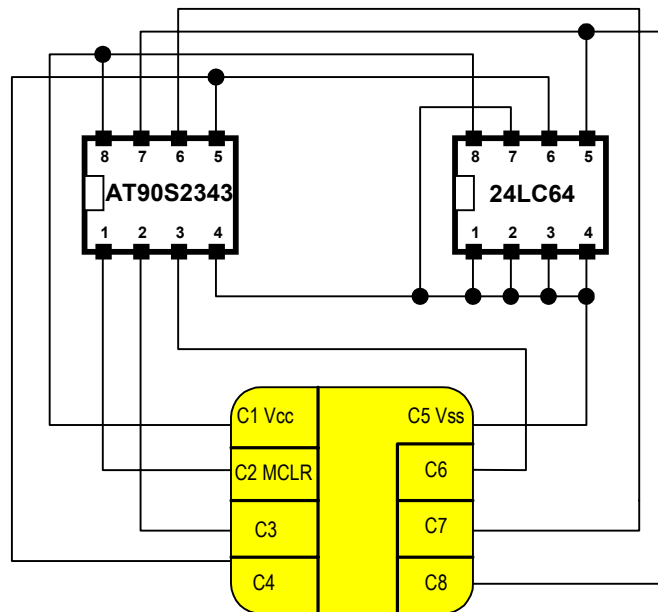


Figure 3: ATMEL –Jupiter I card (Mode #0, #1 & #4)

## JUPITERCARD CONTACT DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	Osc1	Clock Input	C7	MISO	Data I/O
C4	MOSI	Only used for programming	C8	SCK	Only used for programming

# MASTERA-IV

## FUNCARD:

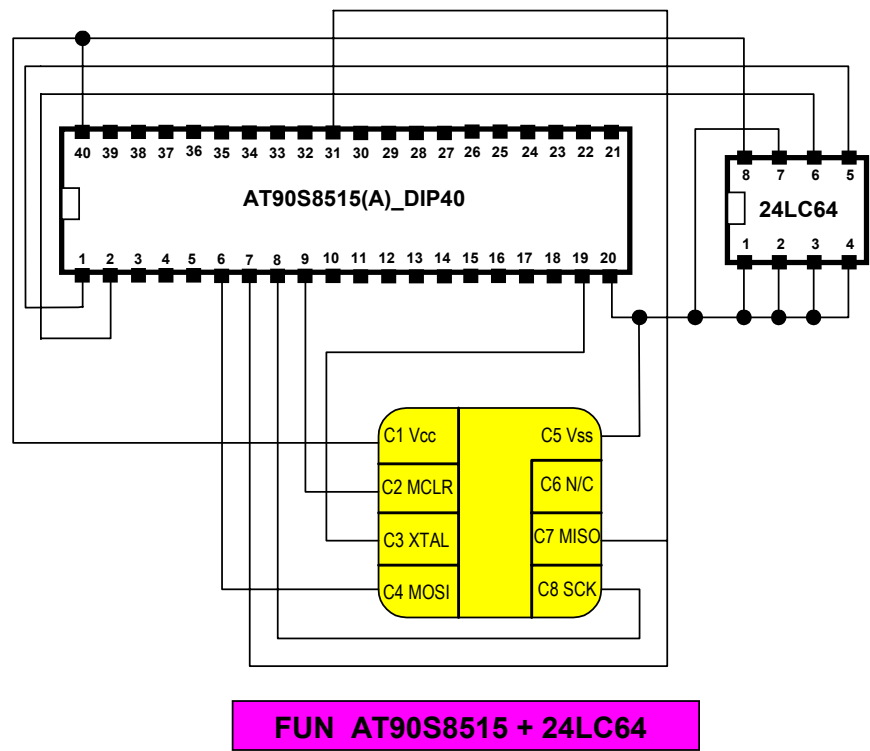


Figure 4: ATMEL – FUN card (Mode #4 , # 0 and #1)

## FUNCARD CONTACT DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	Osc1	Clock Input	C7	MISO	Data I/O
C4	MOSI	Only used for programming	C8	SCK	Only used for programming



## 5.2: The internal circuit of some replica cards:

The replica cards are using discrete chips but having basically the same pinlayout and functionality than the plastic cards. Some of the replica cards are using the extra card contacts (C4 and C8) to give direct access to the EEPROM on the card. The card can be programmed just like a plastic card but the EEPROM can also be programmed directly trough the extra card contacts. MASTERA III supports both mode of programming.

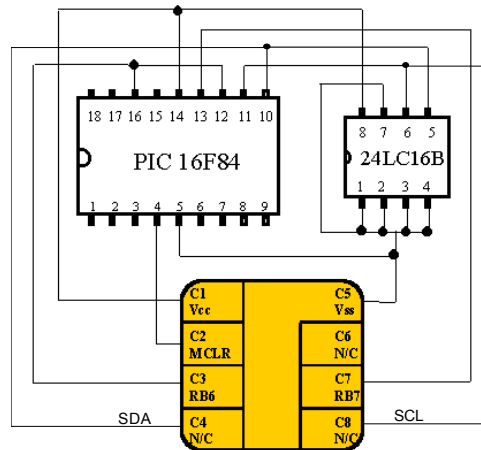


Figure 5: GOLD card replica with separate contacts for EEPROM (Mode #2 and #3)

### GOLDCARD replica Contact DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	RB6/Osc1	Clock Input	C7	RB7	Data I/O
C4	SDA	No Connect (or SDA)	C8	SCL	No Connect (or SCL)

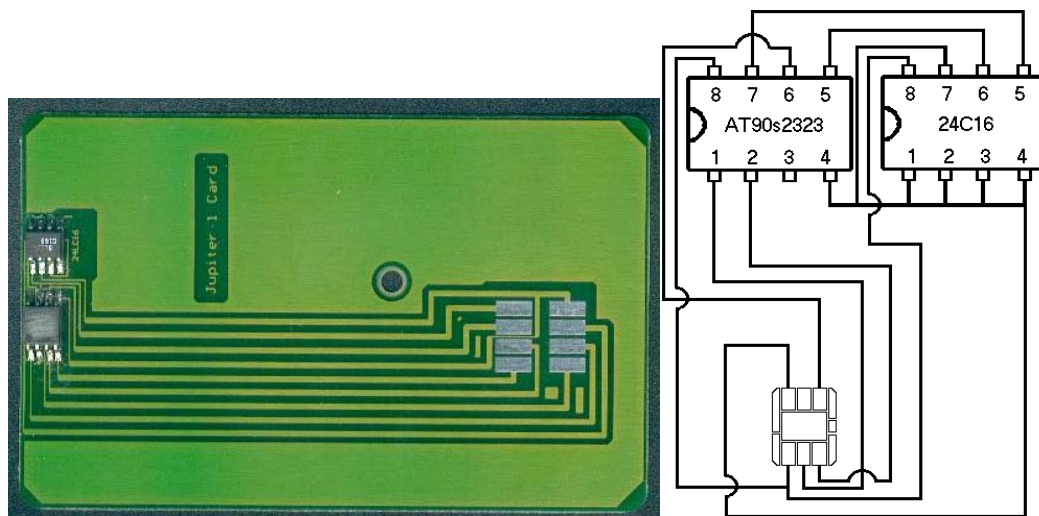


Figure 6: ATMEL – Jupiter card (Mode #4 & #5)

# MASTERA-IV

## JUPITERCARD replica Contact DESCRIPTION

Pin	Name	Function	Pin	Name	Function
C1	Vcc	Power Supply	C5	Vss	Ground
C2	MCLR	Master Clear	C6	N/C	No Connect
C3	Osc1	Clock Input	C7	MISO	Data I/O
C4	MOSI / SCL	SCL	C8	SCL /SDA	SCL and SDA

## **6: Programming Discrete Devices**

Discrete PIC or ATMEL processors and I2C EEprom's can also be programmed by placing them on an adapter card. This adapter card is usually a GOLD card replica as e.g. the "Two Stone Card". The chips are placed in IC sockets. The JUPITER and FUN card types can be used for ATMEL devices or I2C EEprom's.

Empty adapter cards are sold separately.

GSM SIM cards are normally sold in the standard card size with a break-out area. You can use this standard card to change the MINI SIM's back to the original card size (use a small piece of tape on the back). You can also find an adapter in your local telecom shop.