MEGA 65

USER'S GUIDE

MUSEUM OF ELECTRONIC GAMES & ART

REGULATORY INFORMATION

The MEGA65 home computer and portable computer have not been subject to FCC, EC or other regulatory approvals as of the time of writing.

MEGA65 USER'S GUIDE

Published by
the Museum of Electronic Games and Art (M.E.G.A.) eV., Germany.
and
Flinders University, Australia.

WORK IN PROGRESS

Copyright ©2018 by Paul Gardner-Stephen, Flinders University, the Museum of Electronic Games and Art eV., and contributors.

This user-guide is made available under the GNU Free Documentation License v1.3, or later, if desired. This means that you are free to modify, reproduce and redistribute this user guide, subject to certain conditions. The full text of the GNU Free Documentation License v1.3 can be found at `https://www.gnu.org/licenses/fdl-1.3.en.html`.

Implicit in this copyright license, is the permission to duplicate and/or redistribute this document in whole or in part for use in education environments. We want to support the education of future generations, so if you have any worries or concerns, please contact us.

March 9, 2019

Contents

1 Introduction **v**

I GETTING TO KNOW YOUR MEGA65 **1**

2 SETUP **5**

- Unpacking and connecting the MEGA65 6
- Installation 6
- Optional Connections 6
- Operation 7
- Adjusting the Video Display 7

3 GETTING STARTED **9**

- Keyboard 10
- that 11

II FIRST STEPS IN CODING **13**

4 How Computers Work **17**

- Computers are just a pile of switches 18

III SOUND AND GRAPHICS **19**

A ACCESSORIES **25**

B BASIC 10 Command Reference **27**

- Commands 28
  - ABS (Absolute value function) 28

INDEX **31**

IV ELEMENT CATALOGUE **33**

- Keyboard keys 36
- Screen Output 36
- Sprite Grids 37
  - Original Commodore Balloon Demo 37
  - Wizball Demo Sprite 38

CHAPTER 1

Introduction

Congratulations on your purchase of one of the most long awaited computers in the history of computing! The **MEGA65** is a community designed computer, based on the never-released Commodore™ 65[1] computer, that was first designed in 1989, and intended for public release in 1990. Twenty eight years have passed since then, but the **simple**, **friendly** nature of the 1980s home computers is still something that has not been recreated. These were computers that were simple enough you could understand not just how your computer worked, but how computers themselves work.

Many of the people who grew up using the home computers of the 1980s have grown up to have exciting and rewarding jobs in many companies, in part because of what they learnt about computers in the comfort of their own home. We want to give you that same opportunity, so that you can experience the joy of learning how to use computers to solve all sorts of problems, whether that be writing a letter to a friend, working out how much tax you owe, inventing new things, or working out how the universe works. This is why we made the **MEGA65**.

The **MEGA65** team thinks that owning a computer should be like owning a house: You don't just use a house, you change things big and small to really make it your own, and maybe even renovate it or add on a room or two. In this guide we will show you how to more than just hang your own pictures on the wall, but instead how you can dream up new ways of using the powerful capabilities of computers by coding your own computer programmes, and even changing the computer itself!

To help you have fun with your **MEGA65**, we will show you how to use the exciting **graphics** and **sound** capabilities of the **MEGA65**. But the **MEGA65** isn't just about writing your own programmes. It can also run many of the thousands of games and other programmes that were created for the Commodore 64™[2] computer.

Welcome to the world of the **MEGA65**!

[1] Commodore is a trademark of C= Holdings
[2] Commodore 64 is a trademark of C= Holdings,

PART I

GETTING TO KNOW YOUR MEGA65

CHAPTER 2

SETUP

- Unpacking and connecting the MEGA65
- Installation
- Optional Connections
- Operation
- Adjusting the Video Display

UNPACKING AND CONNECTING THE MEGA65

The following instructions will show you all of the steps required to setup your MEGA65 home computer. The MEGA65 computer comes with the following:

- MEGA65 computer
- Power supply (black box with socket for mains supply)
- This book, the MEGA65 User's Guide

In addition, you will need the following things to be able to use your MEGA65 computer:

- A television set or computer monitor with a VGA input, that is capable of displaying an image with 800x600 pixel resolution at 60Hz, and preferably also at 50Hz.
- A VGA video cable.

You may also wish to use the following to get the most out of your MEGA65:

- 3.5" audio cable and suitable speakers or hifi system, so that you can enjoy the sound capabilities of your MEGA65.
- RJ45 ethernet cable ("normal network cable") and a network router or switch that it can connect to, so that you can use the high-speed networking capabilities of your MEGA65.

INSTALLATION

OPTIONAL CONNECTIONS

OPERATION

ADJUSTING THE VIDEO DISPLAY

CHAPTER 3

GETTING STARTED

- Keyboard
- that

KEYBOARD

Now that you have everything connected, it is time to get familiar with the Mega65 keyboard.

You will notice that the keyboard is a little different from the modern standard used on computers today. While most keys will be in familar positions, there are some specialised keys with special graphic symbols marked on the front.

What follows is a brief description of how some of these special keys function.

RETURN

The **RETURN** key tells the computer to process the information you typed.

SHIFT

The **SHIFT** key works just like on a typewriter or modern keyboard. It allows you to type uppercase letters when in lowercase mode, or to gain access to special graphic characters that are displayed on the right hand side of the front part of the key.

In the case of the function keys, pressing **SHIFT** will give you the function that is marked at the front of the key.

← ↑ → ↓ Cursor Keys

These keys move the cursor around the screen... etc etc.

RUN/STOP

Normally, pressing the **RUN/STOP** key will stop execution of a program. When holding **SHIFT** while pressing **RUN/STOP** will load the first program from disk.

RESTORE

etc etc.

THAT

PART II

FIRST STEPS IN CODING

CHAPTER 4

How Computers Work

- Computers are just a pile of switches

Computers can do amazing things, and you can make them do amazing things for you, too. But to do that, you need to understand how computers work. This can be hard to find out these days, because computers are now so complicated, that it isn't obvious how computers work anymore, just by looking at them and using them. The MEGA65 is designed to be simple enough that you can learn how computers work as you use it. But we don't want to leave you to have to work out everything for yourself. That is why we have written this chapter, so that you can learn how computers work, and then use that knowledge to help you make computers do what *you* want them to do.

COMPUTERS ARE JUST A PILE OF SWITCHES

What are computers *really*? Well, the answer to that question is quite simple, if a little surprising: Computers really are just made of lots of switches. These switches work very similar to the switches you use to turn a light on or off. Light switches connect or disconnect the power supply to a light. The switches in computers connect or disconnect circuits in the computer to power. But computers can do a lot more than just turn on and off, so something else must be going on. That something else is also a bit of a surprise: A computer can turn its own switches on and off by itself. Let's explore how this simple idea of switches that can turn themselves on and off makes a computer.

As we have just heard, computers are full of switches. Obviously those switches must be tiny, and they are. When you hear people talking about microns and nanometres with regard to computers, they are often talking about the size of the little switches that make up the computer chips. These switches are called transistors. The switches in the main chip of the MEGA65, for example, are 28 nanometres long. That's about 100,000 times skinnier than a single strand of hair. This is good, because a computer might need millions or billions of switches in its design.

PART III

SOUND AND GRAPHICS

APPENDICES

APPENDIX A

ACCESSORIES

APPENDIX B

BASIC 10 Command Reference

- **Commands**

ABS (Absolute value function)28

COMMANDS

ABS - Absolute value function

ABS(expression)

This function returns the absolute value of the numeric expression. That is, it ignores the sign. That is, if the value of the expression is positive, the result will be the same, but if the value is negative, then the result will be the positive number with the same magnitude, as the following examples show.

```
PRINT ABS(123)
123
PRINT ABS(-123)
123
PRINT ABS(4.5)
4.5
PRINT ABS(-4.5)
4.5
PRINT ABS(7-5)
2
PRINT ABS(5-7)
2
```

The expression must be numeric. If you give it a string, the computer will indicate a type mismatch error.

```
PRINT ABS("POTATO")

?TYPE MISMATCH ERROR

PRINT ABS("TWENTY")
```

```
?TYPE MISMATCH ERROR

PRINT ABS("12")

?TYPE MISMATCH ERROR
```

Bibliography

INDEX

copyright, ii

PART IV

ELEMENT CATALOGUE

KEYBOARD KEYS

RUN/STOP

Text to the left RUN/STOP and text to the right.

SHIFT CTRL 9 CLR/HOME RETURN

INST/DEL * RUN/STOP ← ↑ → ↓

SCREEN OUTPUT

```
10 INPUT A$
20 PRINT "YOU TYPED: ";A$
30 PRINT
40 GOTO 10
RUN
? MEGA 65
YOU TYPED: MEGA 65
```

```
10 OPEN 1,8,0,"$0:*,P,R
20 : IF DS THEN PRINT DS$: GOTO 100
30 GET#1,X$,X$
40 DO
50 : GET#1,X$,X$: IF ST THEN EXIT
60 : GET#1,BL$,BH$
70 : LINE INPUT#1, F$
80 : PRINT LEFT$(F$,18)
90 LOOP
100 CLOSE 1

RUN
```

SPRITE GRIDS

Original Commodore Balloon Demo

Wizball Demo Sprite