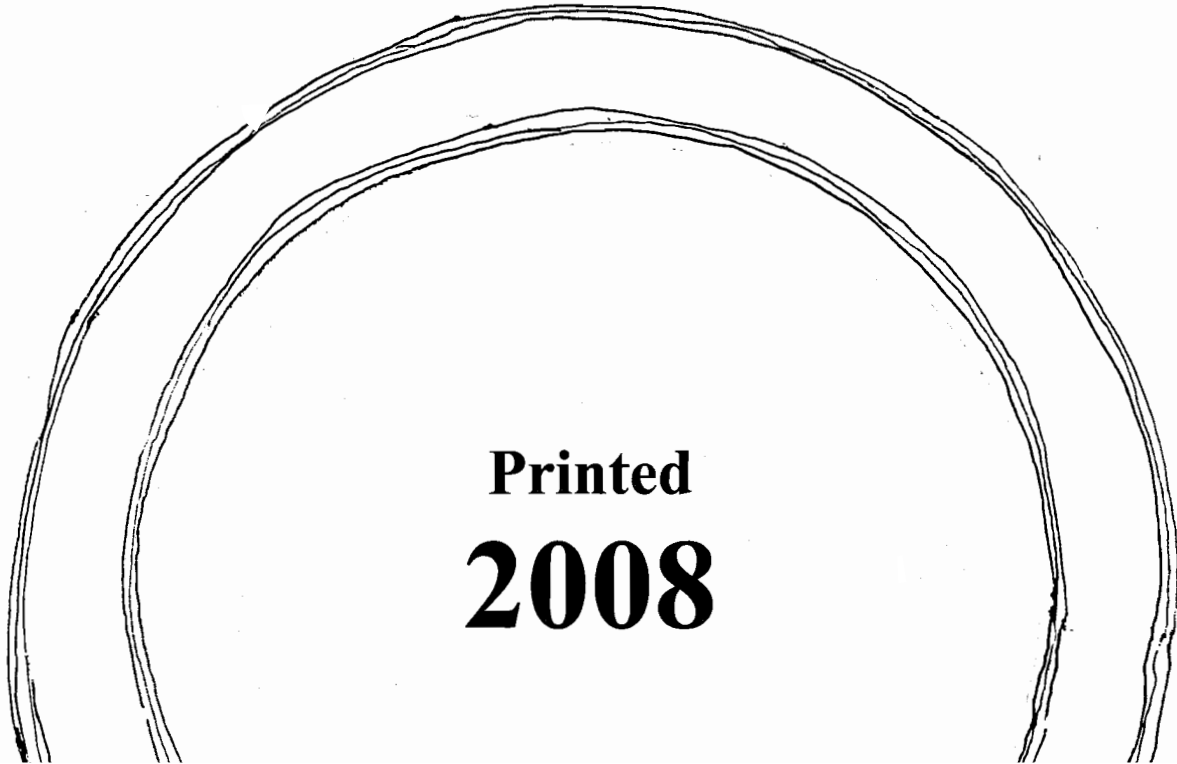
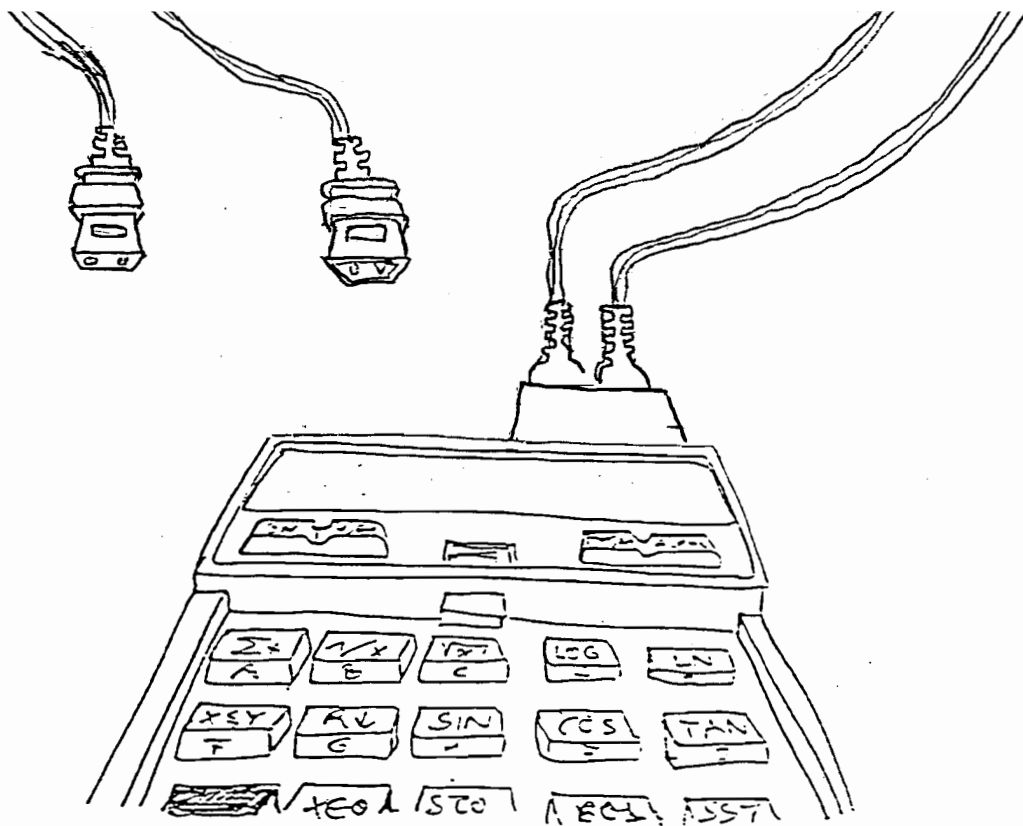


HP 82166 A 16 BIT INPUT / OUTPUT BOARD



Thraxus Verlag



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Christoph Klug (Hrsg.)

**HP-IL Input / Output Board
IL 2000 Interface System**

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Germany**

People and HP-41 Webpages :

HPCC Handheld Portable Computer Club Wlodek Mier-Jedrzejowicz
(United Kingdom) and a lot of other

<http://www.hpcc.org>

HP-Museum from David Hicks (USA)

<http://www.hpmuseum.org/>

HP-Collection from Matthias Wehrli (Switzerland)

<http://www.hp-collection.org/>

EMU41 Emulator with real HP-IL support from Jean-Francois Garnier (France)

<http://www.jeffcalc.hp41.eu>

HP41 Org / V41 Paper Collection and Emulator from Warren Furlow (USA)

<http://www.hp41.org/Intro.cfm>

MLDL2000 RAM Box system from Meindert Kuipers (The Netherlands)

<http://www.kuiprs.nl/hp41.htm>

Clonix / NoVRAM / NoV-64 Plug In Modules from Diego Diaz (Spain)

<http://www.clonix41.org/>

Printed 2008

The never ending fascination about the HP-41 handheld computer and HP-IL system – which keeps most of us on the jump – is the reason for publishing the actual reprint of the well known I/O-Board and IL2000 System manual. During the last years I deliver this manuals to HP-41 enthusiasts worldwide, to support and extend their HP-41 and HP-IL applications. Now I combine the former “only one side copied” manuals into a double side printed book which contains over 700 pages about advanced HP-41 knowledge.

As done with the earlier reprints of the I/O-Board and IL2000 System manual, again I extend some chapters (= I/O-Board manual) and add new parts (= IL2000 System manual). Some of the new pages are taken over from my actual papers for the HPCC, some more are composed completely new, include offering a modern version of the EXT-IL module.

This book is a voluminously reference for today HP-41 enthusiasts, who are looking for proven hardware circuit solutions for control interface-, data logging- and measurement applications. Besides describing some HP-41 hardware modifications, the book includes helpfully HP-41 software routines for operating HP-IL devices like IL-Converter, IL-Digital-Multimeter, IL-RS232-Interface, IL-Mass-Storage, IL-Plotter and IL-Video-Interface.

Furthermore advanced HP-41 applications with RAM-Box, Zeprom or Clonix and NoVRAM are included, based on the correct handling of ROM image files. Last not least the reader gets powerfully solutions for HP-41 ↔ PC-Interfacing, by using the HP-IL/PC Interface Card or IL-RS232-Interface in combination with EMU41.

This book is addressed to novices and beginners of the HP-41 and HP-IL system, to former HP-41 users, who come back to discover this nice machine again, and now want to reach a higher level. Also this book is addressed to handheld computer collectors, who want to operate their valuable devices in a much better way, and last not least to professional users and advanced forty one enthusiasts, who are looking for special and deeper knowledge, needed for realising advanced HP-41 applications, never seen before... connecting HP-41 and HP-IL to future

Christoph Klug
Körnerstrasse 47 B
Hildesheim / Germany
Summer 2008

PART XIV

People and HP-41 Webpages

HP 82166 A 16 BIT INPUT / OUTPUT BOARD

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CHAPTER II	HP-41 CONTROLLER
CHAPTER III	I/O-BOARD HARDWARE
CHAPTER IV	DC POWER SUPPLY
CHAPTER V	I/O-BOARD MODULES
CHAPTER VI	PRACTICAL TIPS
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CHAPTER IIX	REFERENCES
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CHAPTER X	HP-41 BARCODES
CHAPTER XI	ZEPROM-MODULE
CHAPTER XII	DOUBLE X-MEMORY MODULE
CHAPTER XIII	EXTERN HP-41 INTERRUPT
CHAPTER XIV	I/O-BOARD DATA TRANSFER
CHAPTER XV	HP-41↔PC DATA TRANSFER
CHAPTER XVI	AUDIO MEASUREMENT

Working with the Autostart Function :

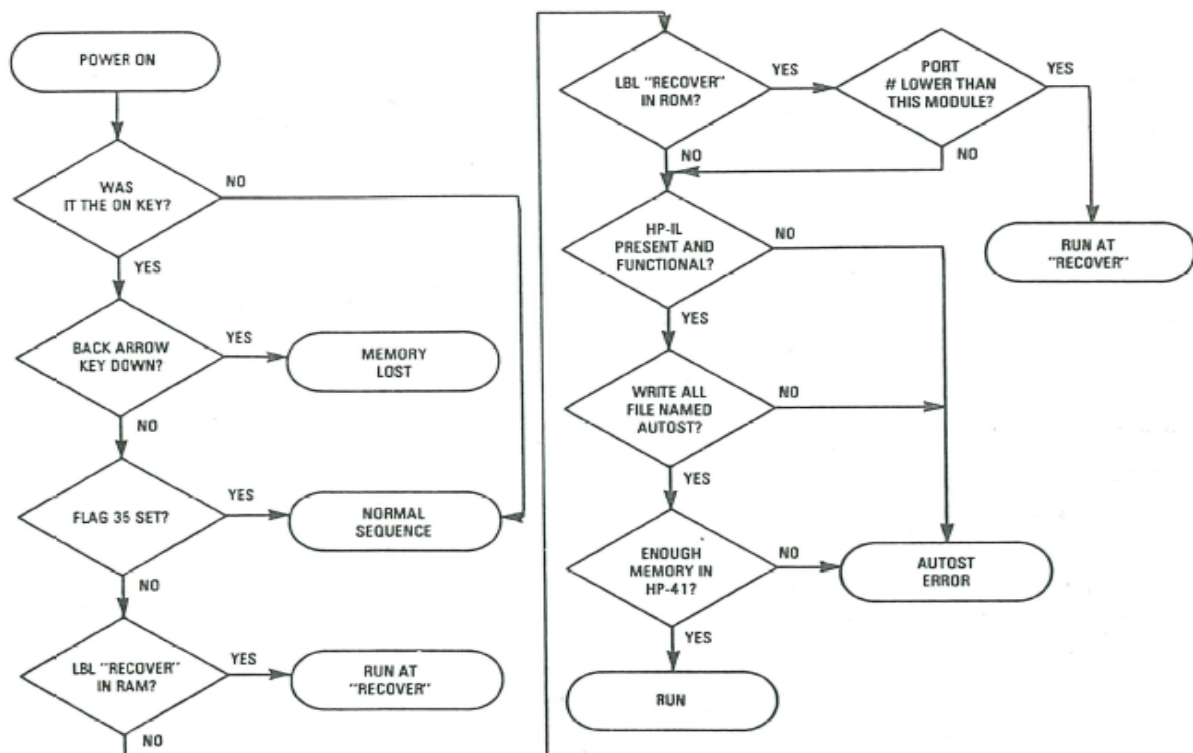
This function is taken from the Autostart – and Duplication Module. The automatic start feature provides a means of writing “fool-proof” HP-41 programs. With the Autostart or EXT-IL+ Module installed, the HP-41 goes through a special sequence when it is turned on. This sequence allows you to write programs which automatically set status, configure memory, access peripherals, or prompt the user. The automatic start feature looks for one of the following three conditions (in the order listed) in an attempt to start program execution when the HP-41 is turned on.

A program labelled RECOVER in HP-41 main memory.
Implement this as the default solution for Autostart and EXT-IL+.

A program labelled RECOVER in an HP-41 port with a lower port number than that of the port containing this module.

A “write-all” file named AUTOST on an HP-IL mass storage device.

If a program labelled RECOVER is found, the HP-41 will start running from RECOVER. If RECOVER is not found, the HP-41 will attempt to load the AUTOST file from a mass storage device in the HP-IL loop. The “write-all” file named AUTOST should be recorder with the program pointer for proper program execution. A detailed flow chart of the automatic start process follows :



Finally the automatic start feature is needed for the Extern HP-41 Interrupt and Wake Up application, described in I/O Board Manual Chapter XII.

M15Kb 25

HP 82166 A

HP82166A

Wkup 4

DAV0 5

GETO 26

VCC 31

VCI 9

RDI1 6

DACT 11

GND 33

ILGND 1

IL Converter

DAV1 20

DCLO 31

CS 32

DAV0 5

DB0 7

DB1 8

DB2 9

DB3 10

DB4 15

DB5 16

DB6 17

DB7 18

DA0 23

DA1 24

DA2 25

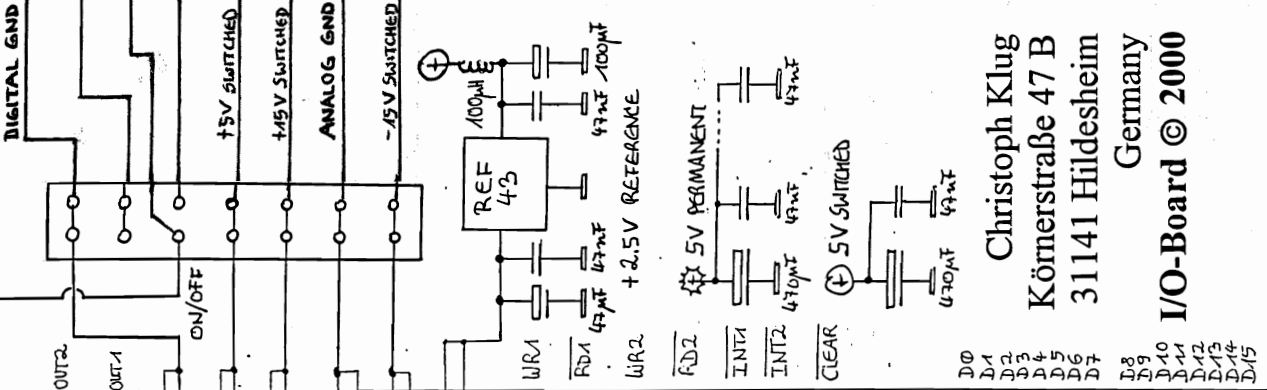
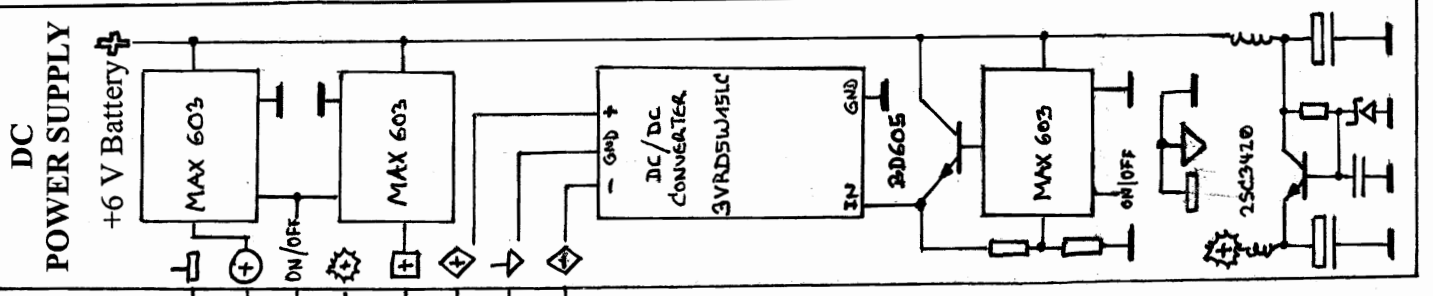
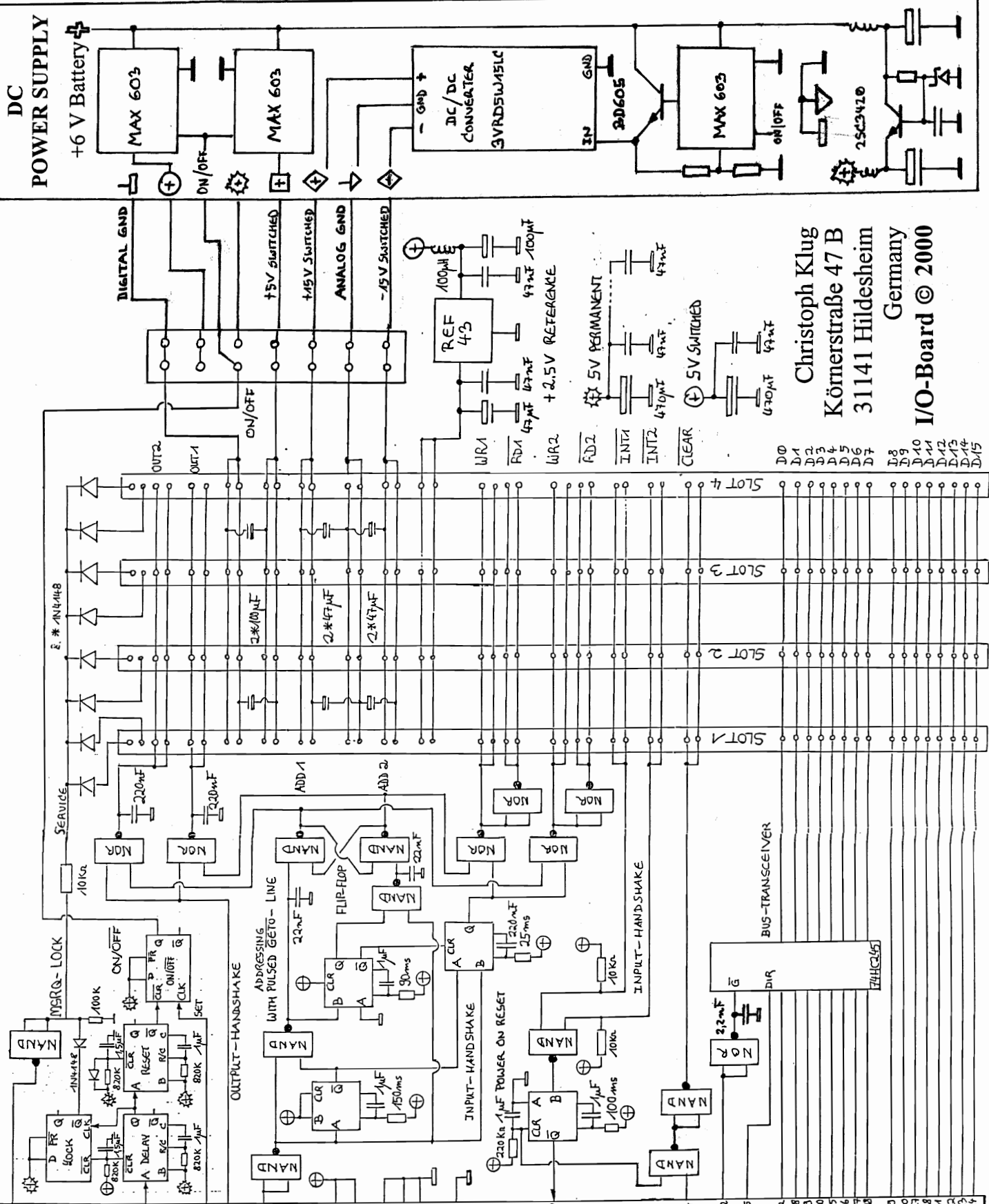
DA3 26

DA4 27

DA5 28

DA6 29

DA7 30



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 Germany
 I/O-Board © 2000

Working with NSTO and NRCL :

The two functions are extracted from the M2K Module for the MLDL2000 System from Meindert Kuipers. Both commands transfer Non Normalized Numbers = NNN's between X-Register and a Main Memory register by using a relative register address. As a main difference to this, the commands PEEKR and POKER from the CCD-Module working with absolute register addresses – which is more complex for a simple transfer of NNN's.

NSTO = Non Normalized Store

Stores Non Normalized Number in Y-Register to Main Memory register indicated in X-Register.

NRCL = Non Normalized Recall

Recalls a Main Memory register with the register number in X to X-Register as a Non Normalized Number. If register number in X < 0 the (negative) address is an absolute address.

HP 82166 A 16 BIT INPUT / OUTPUT BOARD

CHAPTER I INTRODUCTION

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Conclusion	I.05
I/O-Board Schematic Diagram	I.06
Port Addressing	I.07
Plug In Modules	I.08

The functions from this page are taken from the ZENROM, from "HP-41 Mcode For Beginners" and from "HP-41 Advanced Programming Tips" :

Working with CLMM and CLXM :

CLMM clears the HP-41 main memory and CLXM clears the HP-41 X-Memory.

Working with SFX, CLX and TFX :

This three commands allowing advanced flag manipulation by entering the flag number in the X-Register and executing SFX (set flag), CFX (clear flag) and TFX (toggle flag).

Working with FS?S and FC?S :

These functions are analogous to the FS?C and FC?C functions. They leave the specified flag set and check to see whether the test is true or not. If it is not true, one step is skipped in a running program. A YES or NO will appear in the display if they are executed from the keyboard.

Working with XTON and NTOX :

XTO converts a decimal value in X to a single nibble and append it to the right of Alpha. This shifts Alpha left one nibble. X may range from zero to fifteen. NTOX converts the rightmost nibble of Alpha to a decimal number. The contents of Alpha are shifted right one nibble. The normal stack lift scheme is observed, and the output in X will range from zero to fifteen.

Working with VA :

The VA routine is an Alpha View routine that will never stop a program. In difference the AVIEW function will stop a program for no apparent reason if flag 21 is set and there is no printer plugged into the calculator. Furthermore with AVIEW you get unwanted data output to the HP82166 IL-Converter when using this for hardware interfacing, data logging and measurement applications...

Working with X \geq Y ? :

This compare function "X greater or equal to Y ? " is missing in the HP41 operation system.

HP 82166 A 16 BIT INPUT / OUTPUT BOARD

General Information :

Most people use the HP 82166 A IL-Converter to adapt a standard parallel printer to HP Interface Loop. But you can use the powerful IL-Converter to connect electronic hardware to the Interface Loop, controlled by the HP-41 handheld computer. I developed an Input/Output Board for the HP 82166 A IL-Converter, designed as a mainboard with four 16 bit extension slots.

HP-41 Interface Loop Controller :

Best HP-41 IL-Controller is the powerful CX model with intern X-Functions, X-Memory and Time-Module. Additionally you need HP 82160 IL-Module and EXT I/O-Module to control the Interface Loop. Instead of you can use the Development-Module. For maximum performance you can complete the handheld with the German CCD-Module. Hard- and software of I/O-Board are developed to work optimal in combination with other Loop-Devices like Cassette Drive, Thermal Printer or Video Interface. For that reason you can configurate extensive IL-Systems.

EXT I/O-Module and Development-Module :

For controlling I/O-Board with HP-41 you must alter some internal status register of the HP 82166 A IL-Converter. Therefore you need the EXT I/O-Module or alternatively the Development-Module. For EXT I/O-Module 695 Bytes (= 100 Registers) of software are used by the HP-41 programmed to control I/O-Board, or 811 Bytes (= 116 Registers) of software for Development-Module.

I/O-Board Software for EXT I/O-Module :

Controlling the I/O-Board with HP-41 CX and EXT I/O-Module is easier and faster than with Development-Module ! The I/O-Module uses the ALPHA-Register to transfer data to IL-Converter. Avoiding problems with loss of leading null bytes in ALPHA-Register, I/O-Module generally works with leading dummy byte D. For controlling the I/O-Board with HP-41 CX and EXT I/O-Module, 24 commands are provided for power up/down, initialisation, addressing, manual service request, interrupt, clear, 16-bit I/O-transfer by ALPHA-Register and by X-Register and 8 bit I/O-transfer by X-Register. For 8 bit I/O-transfer the software provided needs the X-Memory Module for storage.

I/O-Board Software for Development-Module :

Controlling I/O-Board with HP-41 CX and Development-Module is more complex and slower than with I/O-Module ! The Development-Module generates