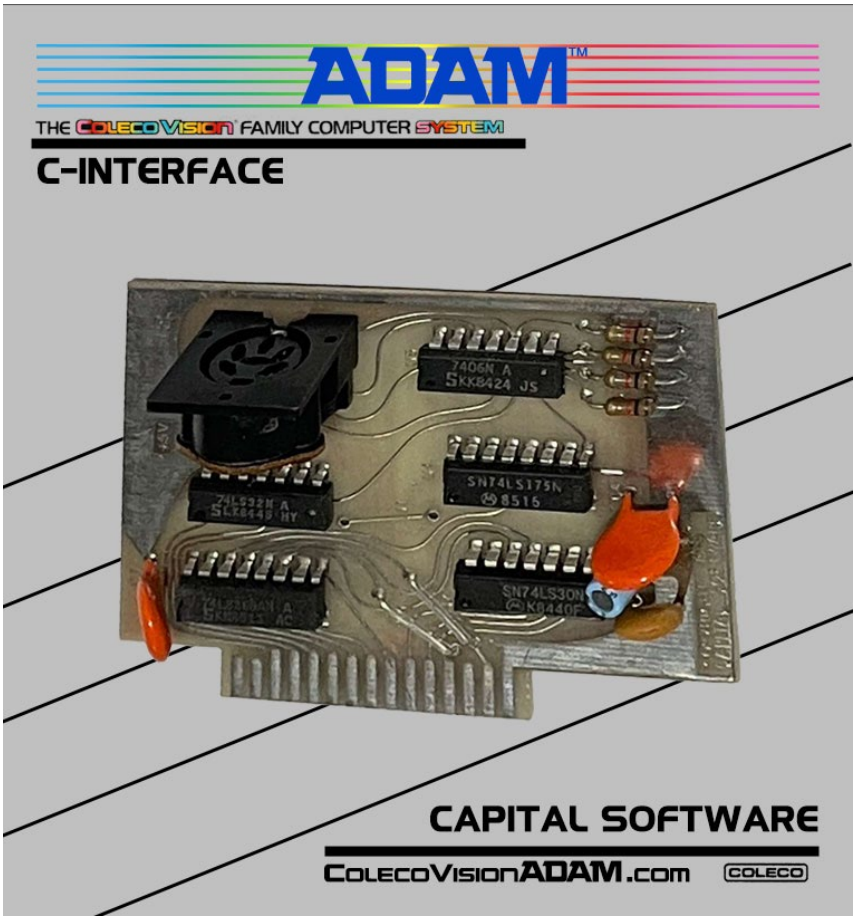
Capital Software C-Interface

Third-Party Printer Interface for the Coleco ADAM

Technical Documentation and Hardware Analysis



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1. Executive Summary

The Capital Software C-Interface (1985) is a third-party expansion card that enabled the Coleco ADAM computer to print to standard dot-matrix printers via either the Commodore Serial Bus or Centronics Parallel interface. Designed by Thomas J. Golab as a one-man operation in St. Louis, Missouri, it is among the rarest documented ADAM peripherals.

The card connects to the ADAM's internal Expansion Slot #1 via a 30-pin card-edge connector. A 6-pin DIN cable routes through a user-drilled hole in the expansion cover to an external printer or adapter. The design uses five standard TTL ICs with no dedicated protocol chip — all communication protocols are implemented in Z80 software (bit-banging) through the CDRIVER binary (1,481 bytes loaded at address 27986).

Two board variants were designed: one outputting Commodore Serial Bus protocol (for Commodore-compatible printers and the MW-302C Centronics adapter), and one outputting Centronics Parallel directly. Both share the same PCB layout and differ only in output-stage ICs and connector.

This archive contains the most complete documentation of any third-party ADAM hardware peripheral in existence: original hand-drawn schematics (both variants), production PCB artwork (both sides), fabrication specifications, the complete 34-page manual, a 1986 software update letter, retail sales flyers, photographs of the actual board (both sides and installed in an ADAM), the MW-302C Centronics adapter with retail box, three disk images with checksum-verified CDRIVER binary and all BASIC programs, and the designer's own development tools.

2. Board Architecture & IC Identification

The C-Interface is a compact, single-sided PCB approximately 2⅝" × 3½" designed to fit the ADAM's internal expansion slot connectors. The board carries five ICs, a DIN or cable connector, passive components, and a 30-pin card-edge connector. The designer specified tight dimensional constraints: max 1⅛" height below slot and 1⅜" above slot.

2.1 Commodore Serial Bus Variant — Photo-Verified ICs

Ref	Schematic	Actual IC	Mfr	Date	Function
U1	74LS06	**7406N**	Signetics	8516	Hex inverting open-collector buffer — drives serial bus. Standard TTL (40mA sink).
U2	74LS32	**74LS32N A**	Signetics	8444	Quad 2-input OR gate — address decode + control logic.
U3	(custom)	**SN74LS175N**	Motorola	8515	Quad D flip-flop — 4-bit output latch for serial bus signals.
U4	74LS368	**74LS368AN A**	Signetics	8511	Hex inverting tri-state buffer — input buffer for serial bus.
U5	74LS30	**SN74LS30N**	Motorola	8451	8-input NAND gate — I/O address decode.

Schematic vs. Actual Discrepancies

> **Engineering Note:** U1 specified as 74LS06 but actual is 7406 (standard TTL). The 7406 provides 40mA sink current vs 24mA on the LS variant — better for driving serial bus pull-ups over cable lengths. U3 specified as 74LS75 (transparent latch) but actual is 74LS175 (edge-triggered D flip-flop) — prevents data bus glitches from corrupting latched output during I/O write cycles. Both substitutions are deliberate engineering improvements.

2.2 Original Hand-Drawn Schematics

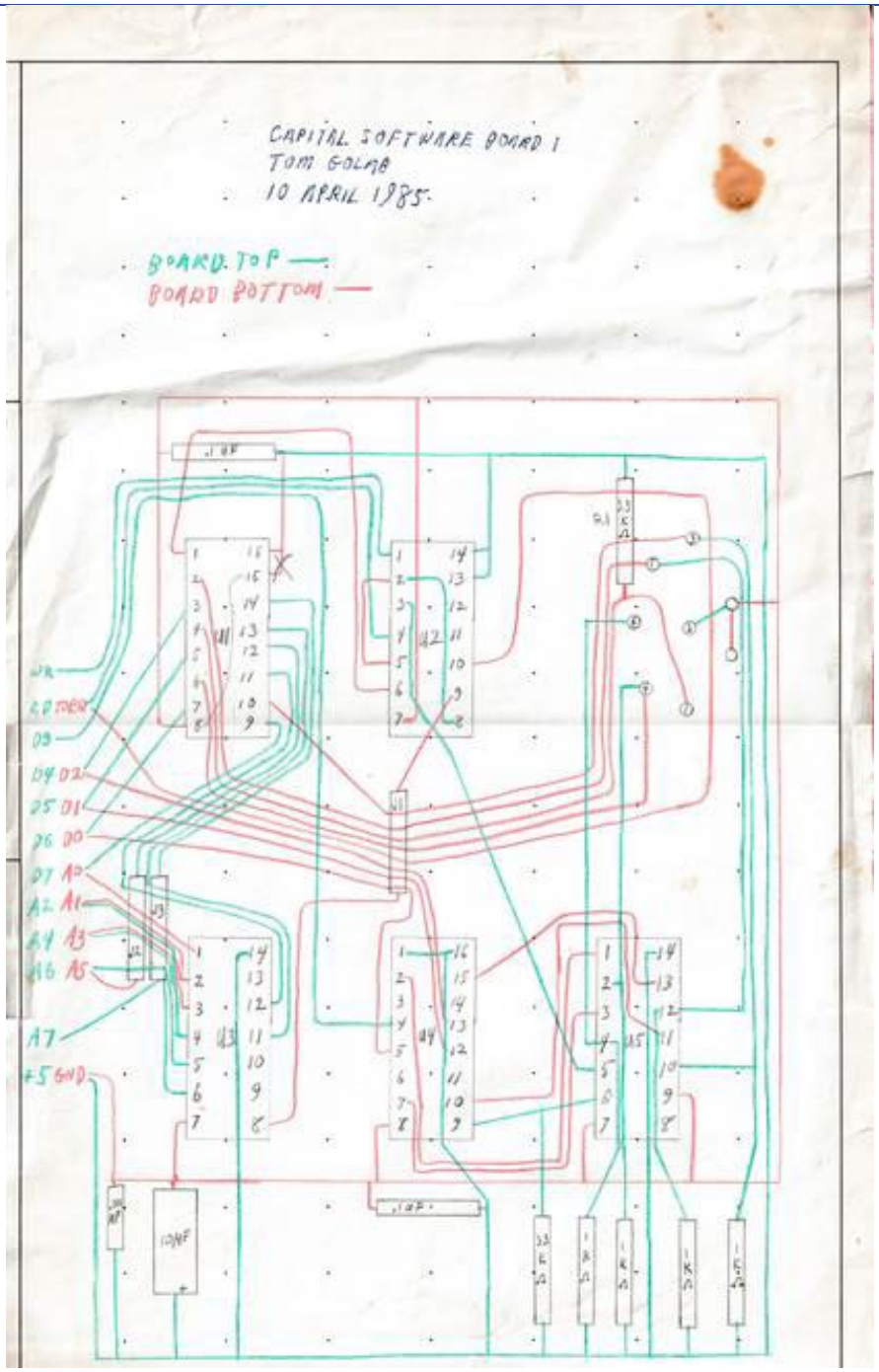


Figure 2-1: Commodore Serial Bus Variant — Tom Golab, 10 April 1985

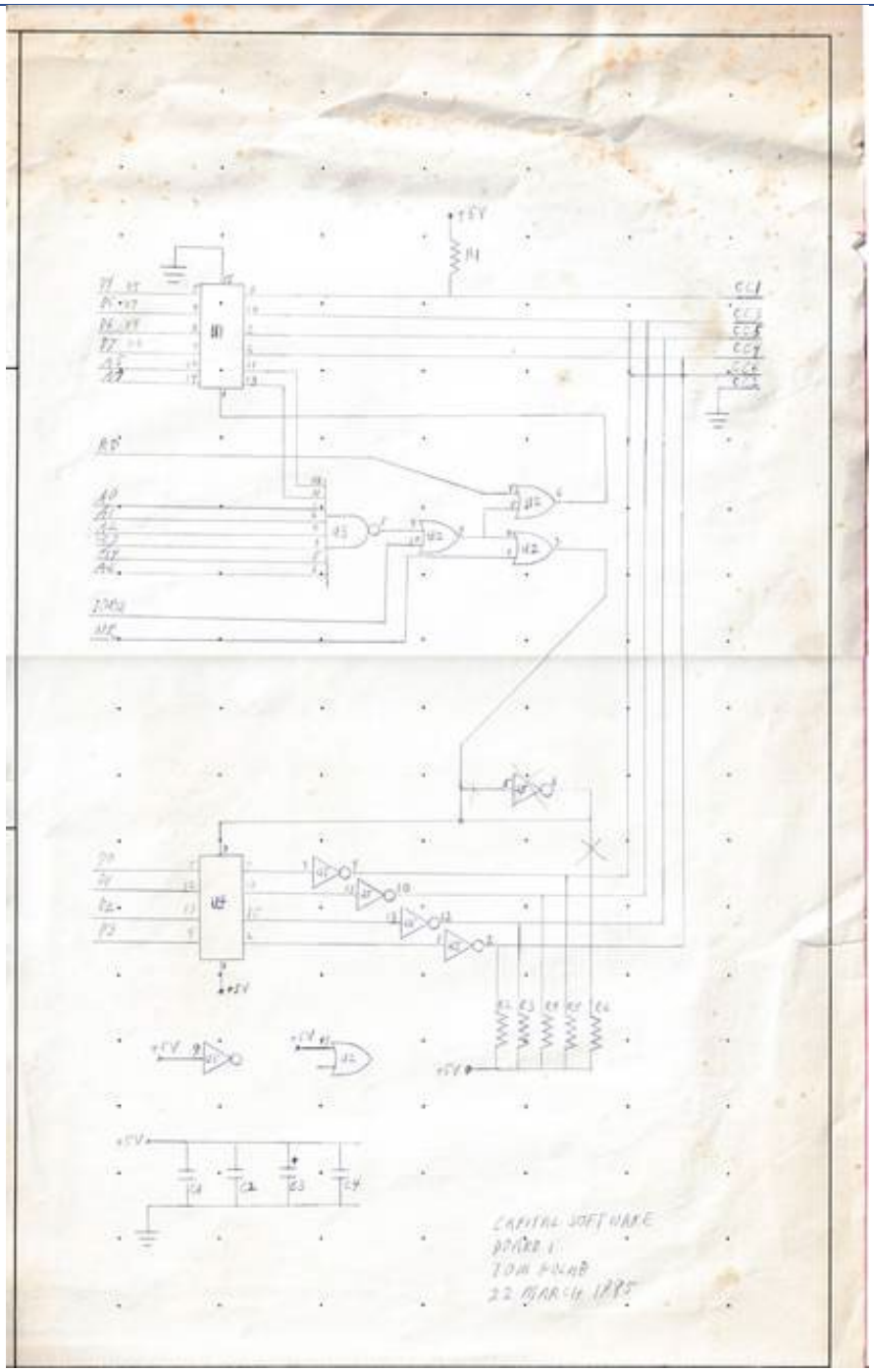


Figure 2-2: Centronics Parallel Variant — Tom Golab, 22 March 1985

2.3 Physical Board — Component & Solder Side

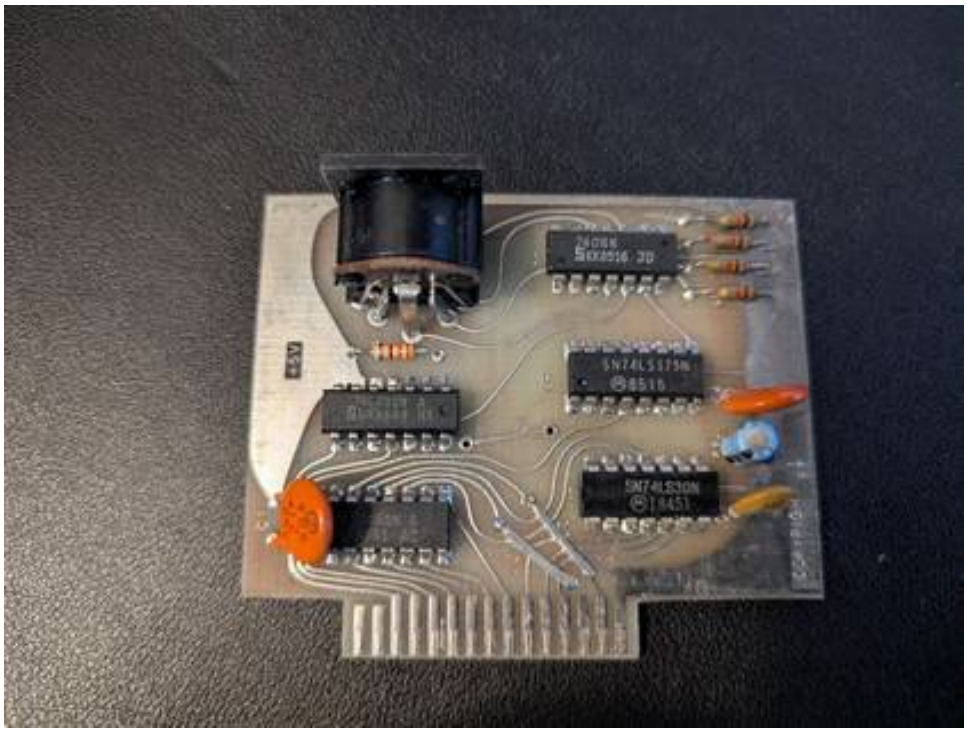


Figure 2-3: Component side — all 5 ICs readable (7406N, 74LS32N, SN74LS175N, 74LS368AN, SN74LS30N)

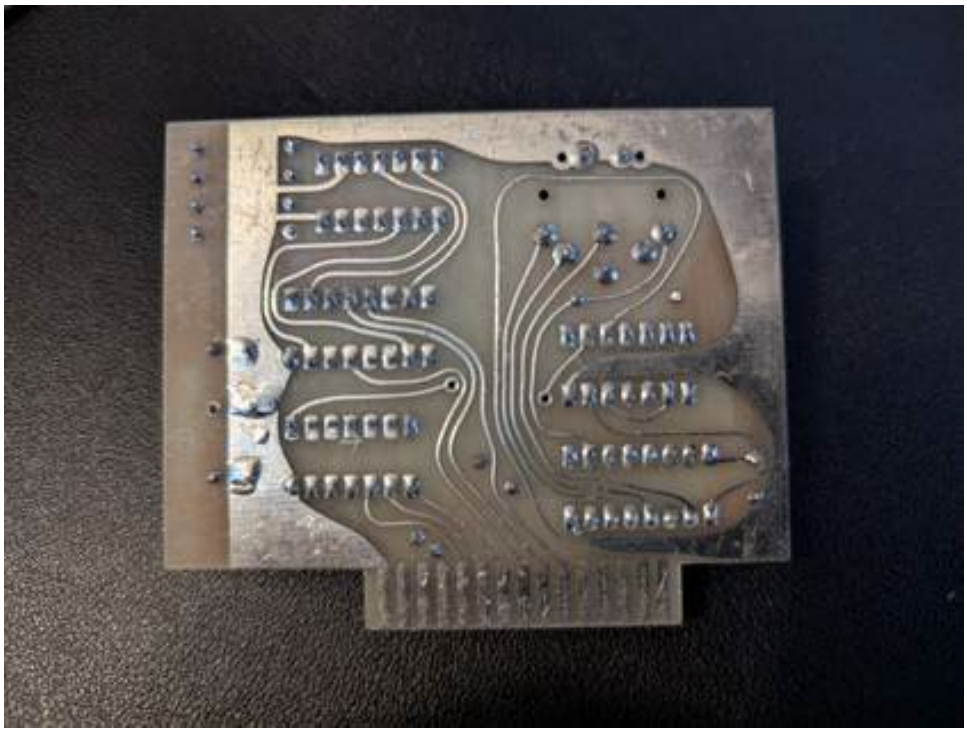


Figure 2-4: Solder side — single-sided traces, wire jumpers, bare copper

2.4 Installed in ADAM — Expansion Slot #1

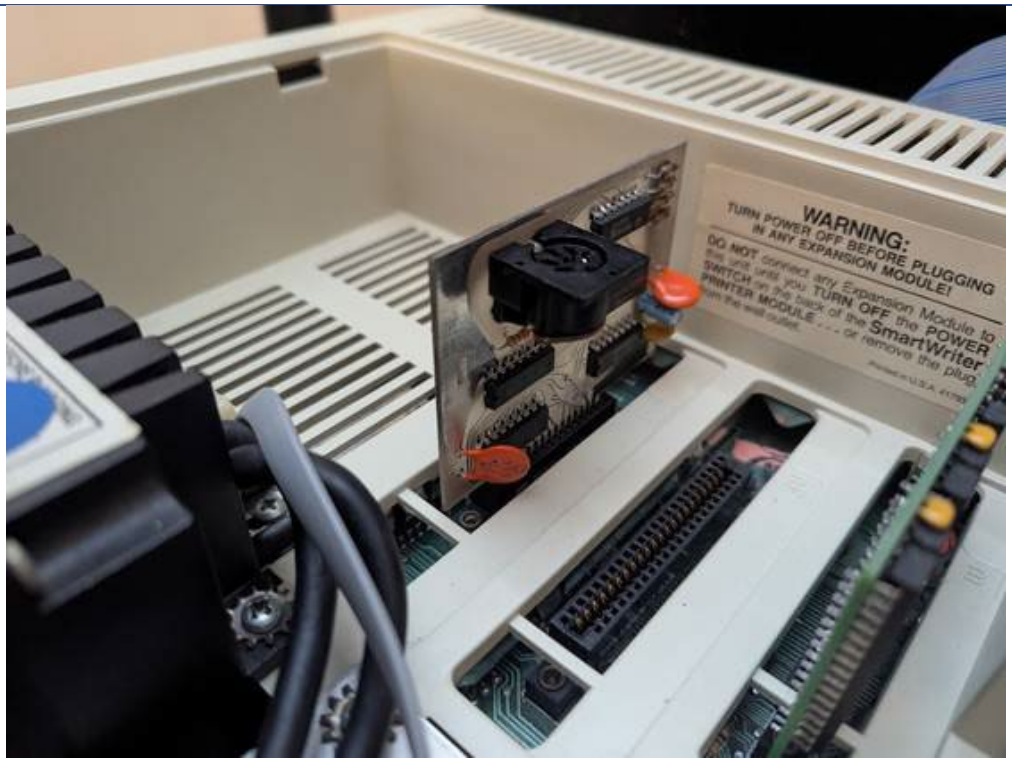


Figure 2-5: C-Interface seated in Expansion Slot #1, DIN cable routing through drilled cover

2.5 Passive Components

C1: Orange ceramic disc capacitor (~0.1µF bypass) near 74LS368AN. C2: Blue tubular ceramic capacitor (bypass) near 74LS175N. R1–R6: Pull-up resistors (1KΩ and 3.3KΩ per schematic) — visible as standing resistors at right edge of board. 6-pin DIN connector: Panel-mount Switchcraft 61PC6F, soldered directly to board top.

2.6 PCB Construction

Single-sided FR-4 with traces on solder side only. No solder mask, no silkscreen — bare copper traces with “+5V” and “COPYRIGHT... CAPITAL...” etched in copper. Hand-soldered through-hole components with wire jumpers on component side for trace crossovers. Non-plated through-holes per fabrication constraint #6. Card-edge fingers: bare tin/lead on copper (no gold plating). Notch at bottom-left for ADAM slot center rib clearance.

3. ADAM Expansion Slot #1 — Pin Mapping

Pin	Signal	Function / C-Interface Connection
1	**+5V**	Power supply — VCC for all ICs
2	**GND**	Ground reference
3	**D7**	Data bit 7 — to U3 (74LS175) D input for serial ATN line
4	**D6**	Data bit 6 — to U3 D input for serial CLK line
5	**D5**	Data bit 5 — to U3 D input for serial DATA line
6	**D4**	Data bit 4 — to U3 D input (directly directly directly directly directly directly reserved)
7–10	**D3–D0**	Data bus bits 3–0 — directly to U4 (74LS368AN) inputs for serial bus read-back
11	**A7**	Address bit 7 — to U5 (74LS30) for I/O decode
12–15	**A6–A3**	Address bits — to U5 for I/O decode (port $60–$67)
19	**/IORQ**	I/O Request — directly to U2 (74LS32) for qualified I/O select
20	**/RD**	Read strobe — to U2 for read-enable gating
21	**/WR**	Write strobe — to U2 for write-clock generation
30	**GND**	Second ground pin

4. C-DRIVER & BASIC Software Architecture

4.1 Memory Map

Address Range	Size	Contents
27440–27951	512 bytes	Print buffer (character accumulation before transmission)
27952–27985	34 bytes	File I/O workspace (filename storage, status bytes)
27986–28463	478 bytes	CDRIVER communications section (serial bus protocol, init, device addressing). Checksum: 55594 ✓ VERIFIED
28464–28552	89 bytes	Configuration gap (user-POKEable parameters, excluded from checksum)
28553–29466	914 bytes	CDRIVER graphics section. Expected checksum: 81181 (not verified from available disk images)
29467–29722	256 bytes	PET ASCII translation table (built by subroutine 45600 in adampr1a)

4.2 Key Entry Points

CALL Address	Function
CALL 28325	Initialize C-Interface electronics — required before any printing
CALL 28345	Open file for reading (filename at 27957+)
CALL 28647	Print B&W graphics (HGR screen dump, POKE 28673 sets line count)
CALL 28690	Print color graphics for Okimate 10 (POKE 28740 sets line count)

4.3 BASIC Programs (Master Disk)

Filename	Lines	Size	Function
graphprint	26	997	Graphics printing setup — LOMEM:38172, BLOADs CDRIVER, configures 54 lines
comprint	172	5,805	Full text print for Commodore printers — BASIC & SmartWriter files, PET ASCII
cenprint	163	5,121	Text print for Centronics printers — similar to comprint without PET translation
cdiagnosis	168	4,097	Diagnostic utility — BASIC version check, board test, CDRIVER checksum verify
comtext	87	3,073	Example direct-printing program for Commodore printers
centext	116	3,073	Example direct-printing program for Centronics printers
bwtest	87	2,048	B&W graphics print test — draws pattern in HGR, dumps via CALL 28647
colortest	68	1,411	Color graphics print test for Okimate 10

5. Software Extraction & Binary Verification

Three ADAM disk images were recovered: the Master C-Drivers distribution disk (volume label “C-INTRFACE”), a Production C-Driver development disk containing Golab’s development tools, and a C-Interface Basic user backup disk. The CDRIVER binary and all BASIC programs were successfully extracted and verified.

5.1 CDRIVER Checksum Verification

Section	Address Range	Bytes	Expected	Actual	Status
Communications	27986–28463	478	55594	55594	✓ VERIFIED
Config Gap	28464–28552	89	(excluded)	—	User-POKEable
Graphics	28553–29466	914	81181	45000 / 160260	See note

> **Graphics Section:** The Master disk’s graphics section is partially uninitialized (53% zeros) — the BSAVE was performed before graphics routines were fully loaded. The Basic backup has the graphics populated but with user-applied POKEs. The communications section is identical and verified across all three disk images.

5.2 ADAM Disk File Format

CDRIVER uses a 5-byte file header on disk: 01 00 02 52 6D — type byte (0x01), parameter word (0x0200 = 512 = buffer size), and load address (0x6D52 = 27986). The file spans two 1024-byte blocks: 1019 data bytes from block 2, plus 462 bytes from block 3, totaling exactly 1,481 bytes.

5.3 Production Disk — Development Files

The Production disk contains Thomas Golab’s development and debugging tools alongside the distribution files:

Filename	Type	Blocks	Significance
prdrv	Binary	18	Earlier/larger CDRIVER version — loads at 0x6CC0 (27840). Graphics fully populated. Development build.
adampr	BASIC	2	PR#2/PR#3 patch program — earlier version (66 bytes, addr 27886–27951, cksum 8408 ✓).
adampr1a	BASIC	3	Alternate PR#2/PR#3 patch with PET ASCII table initialization and interactive PR#2/PR#3 selection.
disasmtA	Hybrid	9	Z80 disassembler — loads CDRIVER first, then provides disassembly tools.
basbug	BASIC	3	Hex dump/debug utility with hex-to-ASCII conversion tables.

6. December 1986 Software Update — PR#2/PR#3 Patch

In December 1986, Golab mailed a one-page update letter to registered owners. The patch added PR#2 (Commodore) and PR#3 (Centronics) support to SmartBASIC, allowing transparent printing from any BASIC program without calling CDRIVER subroutines directly.

Patch Mechanism

The patch writes 81 bytes of Z80 machine code to addresses 27871–27951 (inside the print buffer area, before CDRIVER) with checksum 9740. It then modifies three bytes in CDRIVER at address 28044: POKE 28044,195 : POKE 28045,38 : POKE 28046,109 — which inserts a JP 0x6D26 instruction to redirect execution into the new patch code.

The patch code performs PET ASCII translation via a lookup table at address 29467, manages the print buffer pointer, handles carriage returns specially, and saves/restores the IX, IY registers and stack pointer across EOS calls.

> **Version Discovery:** The adampr program on the Production disk contains a 66-byte earlier version of this patch (addresses 27886–27951, checksum 8408 ✓). The published letter version added 15 bytes of prologue at 27871–27885. The core functionality is identical.

7. Supported Printers & Pricing

7.1 Printer Comparison (from flyers)

Printer	Speed	Matrix	Features	Chars/Line
Okidata 120	120 CPS	9×9	Sub/superscript, underline	40–137
Okimate 10	60 CPS	9×9	COLOR graphics	40–136
Comrex CR220	50 CPS	5×7	80 chars/line	80

7.2 Retail Pricing Evolution

Package	Original Price	Enhanced Price
C-Interface only	$69.95	$49.95
With Centronics Port	$119.95	$99.95
With Comrex CR220	$174.95	$149.95
With Okimate 10	$259.95	$219.95
With Okidata 120	$319.95	$299.95

8. MW-302C Centronics Port Adapter

Attribute	Detail
Manufacturer	Micro World Electronix Inc., 3333 S. Wadsworth Blvd. #C 105, Lakewood, CO 80227
Fabricator	Manufactured by Micro R & D, Inc.
Model	MW-302 C
Original Purpose	Commodore VIC-20 & C-64 Printer Interface — converts Commodore serial bus to Centronics parallel
Phone	(303) 987-9531
Cables	6-pin DIN connector (to C-Interface) + Centronics 36-pin parallel connector (blue, to printer)
Power	Draws power from C-Interface via DIN cable — no separate power cord needed

> **Design Insight:** Rather than designing a second board variant for Centronics, Golab bundled an off-the-shelf Commodore-to-Centronics adapter. The C-Interface outputs Commodore serial bus protocol; the MW-302C converts that to Centronics parallel. Two products in series — elegant, cost-effective, and avoided designing a completely different PCB.

9. PCB Artwork & Engineering Documents

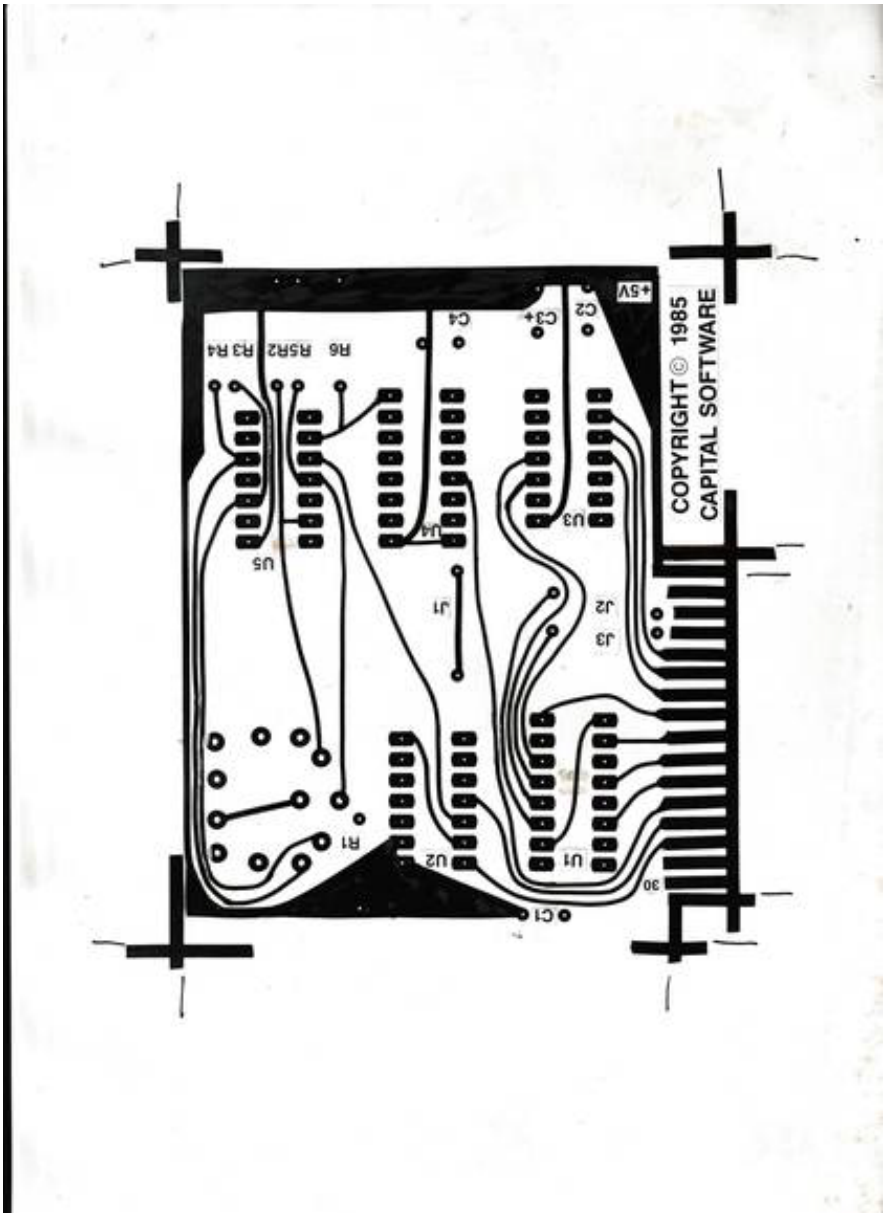


Figure 9-1: Production PCB Artwork — Solder Side (© 1985 Capital Software)

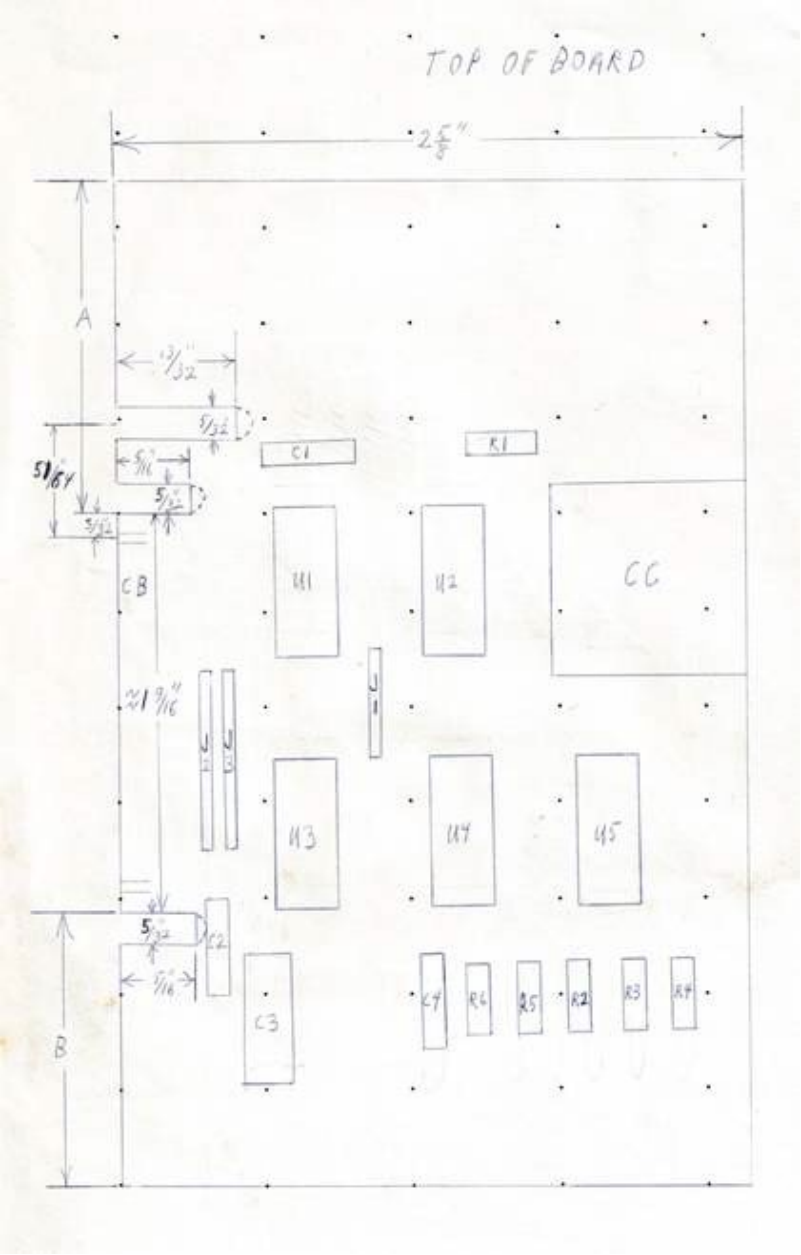


Figure 9-2: Component Placement / Dimensional Drawing — "Top of Board"

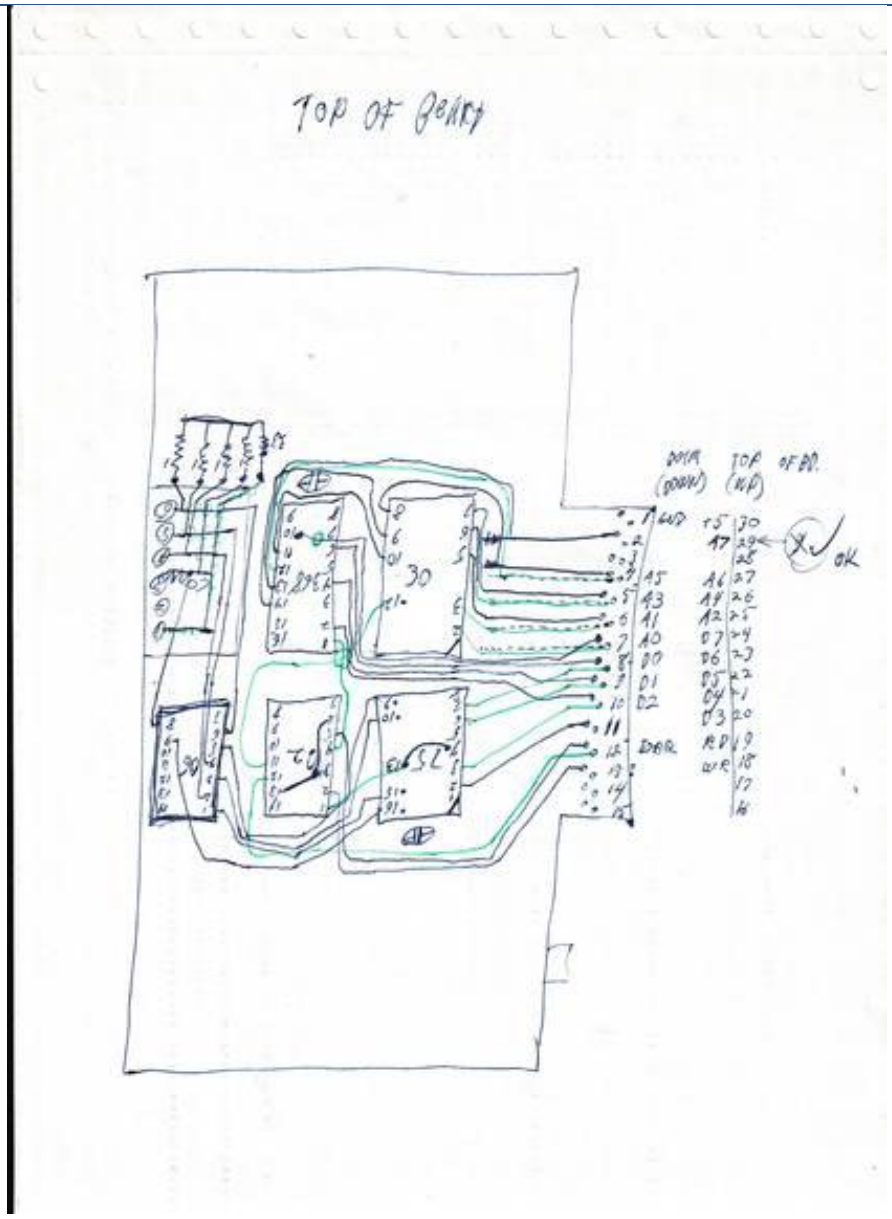
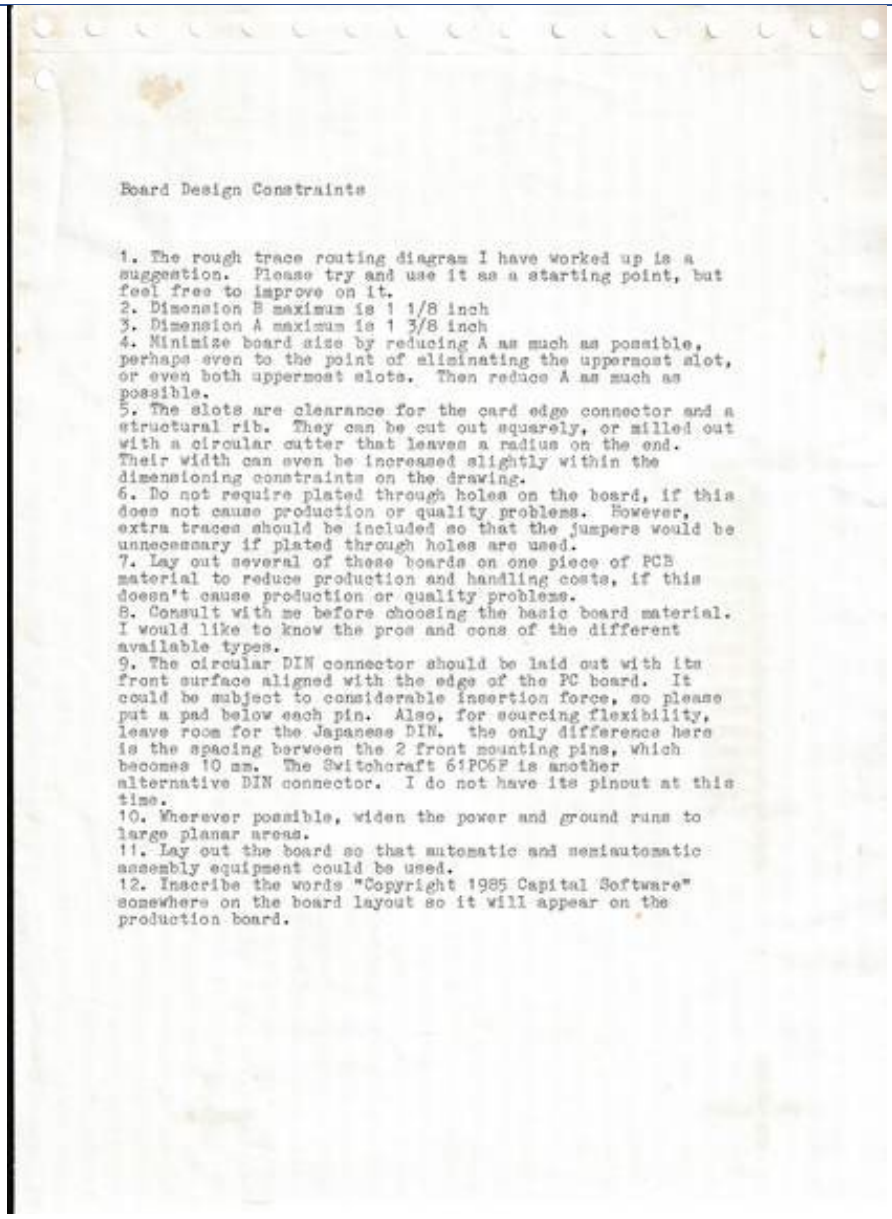


Figure 9-3: Component-Side Wiring Sketch with Expansion Slot Pinout



Board Design Constraints

1. The rough trace routing diagram I have worked up is a suggestion. Please try and use it as a starting point, but feel free to improve on it.
2. Dimension B maximum is 1 1/8 inch
3. Dimension A maximum is 1 3/8 inch
4. Minimize board size by reducing A as much as possible, perhaps even to the point of eliminating the uppermost slot, or even both uppermost slots. Then reduce A as much as possible.
5. The slots are clearance for the card edge connector and a structural rib. They can be cut out squarely, or milled out with a circular cutter that leaves a radius on the end. Their width can even be increased slightly within the dimensioning constraints on the drawing.
6. Do not require plated through holes on the board, if this does not cause production or quality problems. However, extra traces should be included so that the jumpers would be unnecessary if plated through holes are used.
7. Lay out several of these boards on one piece of PCB material to reduce production and handling costs, if this doesn't cause production or quality problems.
8. Consult with me before choosing the basic board material. I would like to know the pros and cons of the different available types.
9. The circular DIN connector should be laid out with its front surface aligned with the edge of the PC board. It could be subject to considerable insertion force, so please put a pad below each pin. Also, for sourcing flexibility, leave room for the Japanese DIN. the only difference here is the spacing between the 2 front mounting pins, which becomes 10 mm. The Switchcraft 61PC6F is another alternative DIN connector. I do not have its pinout at this time.
10. Wherever possible, widen the power and ground runs to large planar areas.
11. Lay out the board so that automatic and semiautomatic assembly equipment could be used.
12. Inscribe the words "Copyright 1985 Capital Software" somewhere on the board layout so it will appear on the production board.

Figure 9-4: Board Design Constraints — 12-Point Fabrication Specification

10. Physical Installation

Installation required the user to drill a ⅝” hole in the ADAM’s plastic expansion cover (positioned 2 9/16” from center edge, 5” from notch edge) to route the DIN cable from the internal expansion slot to the external printer. The board seats in Expansion Slot #1 (leftmost) with the DIN connector protruding above the board level.

This has been photographically confirmed: the C-Interface installed in an actual ADAM memory console shows correct fitment in Slot #1, proper DIN connector orientation, cable routing through the drilled cover, and board dimensions matching the fabrication constraints.

11. Thomas J. Golab — Capital Software

Capital Software was a one-man operation run by Thomas J. Golab from St. Louis, Missouri. The company sold exclusively via mail order through P.O. Box addresses (Box 576 for the manual, Box 370 for later flyers). Payment accepted via VISA/Mastercard (+3% surcharge), check, or money order. Missouri residents paid 5.725% sales tax. Bulk rate postage via Permit 657, Erie PA (national mail house).

IC date codes (week 44 of 1984 through week 16 of 1985) place component sourcing from October 1984 to April 1985. The PCB artwork is copyrighted 1985. The schematics are dated March–April 1985. The manual references the 1985 copyright. The December 1986 update letter demonstrates ongoing support over a year after initial release.

12. Development & Release Chronology

Date	Event
Oct 1984	Earliest IC date code (74LS32N, week 44/1984) — component sourcing begins
Mar–Apr 1985	Schematics dated. PCB artwork copyrighted 1985.
Apr 1985	Latest IC date code (7406N, week 16/1985) — board assembly window
© 1985	34-page manual produced. Original flyer printed. P.O. Box 576.
Dec 1986	Software update letter mailed — PR#2/PR#3 patch (81 bytes, cksum 9740). P.O. Box 370.
~1987	Enhanced flyer with reduced prices ($49.95 card only, down from $69.95). PaintMASTER integration advertised.
2026	Board photos, disk images dumped, CDRIVER extracted and verified. Production disk development tools recovered.

13. Preservation & Rarity Assessment

13.1 Archive Contents

✓	Complete 34-page manual with schematics for both variants
✓	Hand-drawn schematics (Commodore Serial Bus + Centronics Parallel)
✓	Production PCB artwork — both sides (solder + component)
✓	12-point fabrication specification + dimensional mechanical drawing
✓	Board photographs (component side, solder side, installed in ADAM)
✓	Verified IC markings with manufacturers and date codes
✓	CDRIVER binary — communications section checksum verified (55594)
✓	All 8 BASIC programs extracted from Master distribution disk
✓	PR#2/PR#3 patch code recovered (66-byte early version, cksum 8408)
✓	Development tools recovered (prdrv, disassembler, basbug)
✓	MW-302C Centronics adapter identified with original retail box
✓	Three disk images preserved (Master, Production/dev, user backup)
✓	Two retail sales flyers with full pricing evolution
✓	1986 update letter with PR#2/PR#3 patch code
✓	Host ADAM system photographed — complete configuration
✓	Installed photo — C-Interface in Slot #1 with drilled cover visible

13.2 Remaining Items

✗	CDRIVER graphics section with verified checksum (81181)
✗	Original Capital Software Digital Data Pack (retail label/packaging)
✗	Original retail box / packaging
✗	Production quantity / sales figures

Rarity: EXTREMELY RARE. One-man operation selling via mail order to a discontinued platform's user base. This archive represents the most complete documentation of any third-party ADAM hardware peripheral in existence.

Reproduction Potential: VERY HIGH. This archive contains everything needed to reproduce the C-Interface hardware and most of the software. Both PCB artwork sides, schematics, board photos with verified ICs (all common 74LS-series), and fabrication specs provide a complete manufacturing package.

14. Contributors

Contributor	Role
Richard DiRocco	Board acquisition, photography, disk imaging, pin verification, live testing, ColecoVision ADAM Archive
Thomas J. Golab	Original designer, Capital Software (St. Louis, MO)