Washington University School of Medicine
Digital Commons@Becker

Technical Reports | Institute for Biomedical Computing

2-1974

Macromodular Computer Design, Part 2, Volume 11, Cables

Computer Systems Laboratory, Washington University

Follow this and additional works at: http://digitalcommons.wustl.edu/bcl_techreports

Recommended Citation
Computer Systems Laboratory, Washington University, "Macromodular Computer Design, Part 2, Volume 11, Cables" (1974). *Technical Reports*. Paper 16.
http://digitalcommons.wustl.edu/bcl_techreports/16

This Technical Report is brought to you for free and open access by the Institute for Biomedical Computing at Digital Commons@Becker. It has been accepted for inclusion in Technical Reports by an authorized administrator of Digital Commons@Becker. For more information, please contact engeszer@wustl.edu.

MACROMODULAR COMPUTER DESIGN PART 2 MANUFACTURING DESCRIPTION

VOLUME XI

CABLES

Technical Report No. 40

FINAL REPORT - FEBRUARY, 1974
CONTRACT SD-302 (ARPA)

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR COMPUTER DESIGN

FINAL REPORT - CONTRACT SD-302

FEBRUARY, 1974

Technical Report No. 40

PART 2 - MANUFACTURING DESCRIPTION

VOL. XI-CABLES

This work has been supported by the Advanced Research Projects Agency of the Department of Defense under Contract SD-302 and by the Division of Research Facilities and Resources of the National Institutes of Health under Grant RR-00396.
The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Advanced Research Projects Agency or the U.S. Government.

Computer Systems Laboratory
Washington University
St. Louis, Missouri

ABSTRACT

Manufacturing information for the construction and testing of macromodular cables is given. Included are the DATA CABLE, CONTROL CABLE, PEDESTAL DAISY CHAIN CABLE, and FUNCTION CALLER CABLE.

INDEX

MACROMODULAR CONTROL CABLE

CHG.	E.C.O.	DATE	APPR	CHG	E.C.O.	DATE	APPR	CHG.	E.C.O.	DATE	APPR.
ISSUE	–	1-7-71	RCJ								
A	0245	1-11-72	RCJ								

CONTROL CABLE
PARTS LIST

QTY.	C.S.L. DOC.	PART
2	–	AMP 329054 TWIN STANDARD COAXICON
2	–	AMP 329056 SHIELD FERRULE
VAR.	010–2	CAS–7 CONTROL CABLE

CHG	E C O	DATE	APPR	CHG	E C O	DATE	APPR	CHG	E C O	DATE	APPR
ISSUE	–	1–7–71	DCJ								
A	0245	1–11–72	DCJ								

ASSEMBLY SPECIFICATION
MACROMODULAR CONTROL CABLE
September 11, 1968
Revised December 28, 1970

Introduction:

This specification describes a cable and connector assembly which will carry high-speed digital control signals in a restructurable computer system. The cable assemblies are to be manufactured from lengths of a special 120 ohm twisted pair shielded cable with an AMP connector on each end.

Cable:

The cable was manufactured by the Brand Rex Division of the American Enka Co. Complete details of the cable construction may be found in Macromodular Project Specification CAS-4 and CAS-7 in Document 010. New cables are to be made from CAS-7 material.

Connector:

Each end of the cable is terminated by a single AMP twin Standard Coaxicon Connector. The connector consists of an AMP 329054 plug and and AMP 329056 shield ferrule.

Wire Preparation:

The length of a completed cable assembly is defined by dimension L on drawing 360-7. The actual wire length is about 7/8 inches shorter than the completed assembly. Table 1, in a later section, defines the assembly and cable lengths to be manufactured.

ISSUE	–	1-7-71	
A	0245	1-11-72	

Cut the cable to proper length and slip a 329056 ferrule, small end first, onto the cable. Strip the outer PVC jacket back one inch, taking care not to nick or break any of the shield wires. The braided shield provides both a ground connection and mechanical support to the cable.

The cable jacket may be stripped with a tool such as the one shown on 360-11. This is a standard Hunter strip tool which has been modified for a circular aperture of 0.110 inches. This primary stripping operation may not be done with a knife.

The braided shield is to be combed out and formed into two equal pigtails (Dwg. 360-8) and pushed back over the unstripped portion of the cable. Do not twist the pigtails, simply group the individual wire strands into two bundles. The two internal conductors are than cut to a length of .438 inches and stripped back 1/4 inch. Stripping dimensions for jacket and inner conductors are shown on drawing 360-7.

The cable must be constrained during the stripping process as the internal components will easily slip out of the outer jacket; a vise with plastic jaws is suggested (Pana-Vise). Techniques of wire stripping must be disclosed prior to manufacture, and the method is subject to final approval by the Computer Systems Laboratory.

Crimping:

The crimp die is AMP 69231-2 which may be used in hand tools 45707-2 or 69710. The die may also be used in AMP production tools 69365 or 69365-2.

Insert yellow wire into hole I of 329054 plug, and clear wire into hole II. Hole I has the small oval crimping port, and hole II has the large crimping port. Refer to drawing 360-7 for illustration of plug polarity.

Pull shield pigtails over rear of plug, and seat ferrule in place over shield. Orient pigtails as shown on Dwg. 360-8 in order to avoid interference with the crimp dies.

ISSUE	-	1-7-71	DCJ

Insert connector, wire, and ferrule into crimp tool. Close crimp tool slowly while observing seating of wire-barrel crimping dies. These dies must be aligned with the oval ports of the 320954 plug. When alignment is assured, close tool until dies bottom; then open and remove completed connector.

The connector assembly must be supported during the crimping procedure to prevent the wires or shield from slipping away from the plug. Any shield wire which protrudes from the ferrule after crimping shall be trimmed away. The final plug must have a smooth feel.

A secondary crimp operation is now performed to capture the cable jacket. CSL will supply a crimp die (Dwg. 360-9) suitable for mounting in an arbor press.

Place the crimped connector and cable assembly into the die as shown on page 360-10. Operate the arbor press until the dies bottom out. Then open the die and remove the completed cable end.

Lengths:

The cable assemblies shall be manufactured in the following lengths:

ASSEMBLY LENGTH	CABLE LENGTH
4 Inches	3-1/8 Inches
5 "	4-1/8 "
6 "	5-1/8 "
7 "	6-1/8 "
8 "	7-1/8 "
9 "	8-1/8 "
12 "	11-1/8 "
18 "	17-1/8 "
24 "	23-1/8 "
36 "	35-1/8 "

ISSUE - 1-7-71 RCJ

ASSEMBLY LENGTH	CABLE LENGTH
48 Inches	47-1/8 Inches
60 "	59-1/8 "
120 "	119-1/8 "

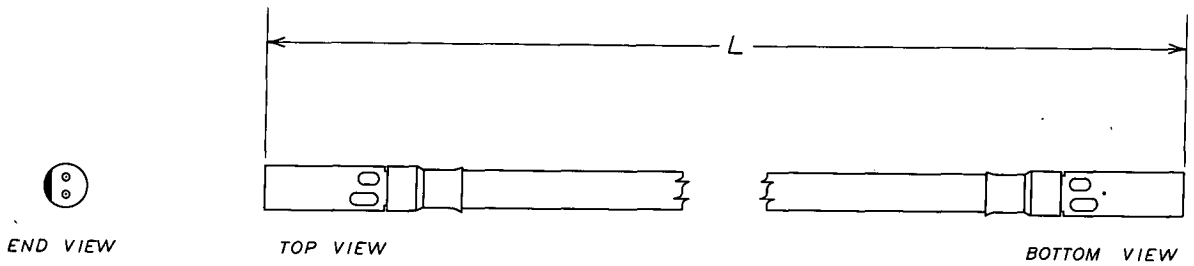
Inspection:

The completed cable assemblies shall be tested for end-to-end continuity and leakage to the shield. The end-to-end resistance shall be less than 0.5 ohm per foot of cable for each of the two conductors and the shield. The leakage resistance between either inner conductor and the other conductor or shield shall be greater than one megohm.

Quality:

The completed cables shall reflect the workmanship standards of the best commercial practice.

ISSUE	-	1-7-71	RCJ



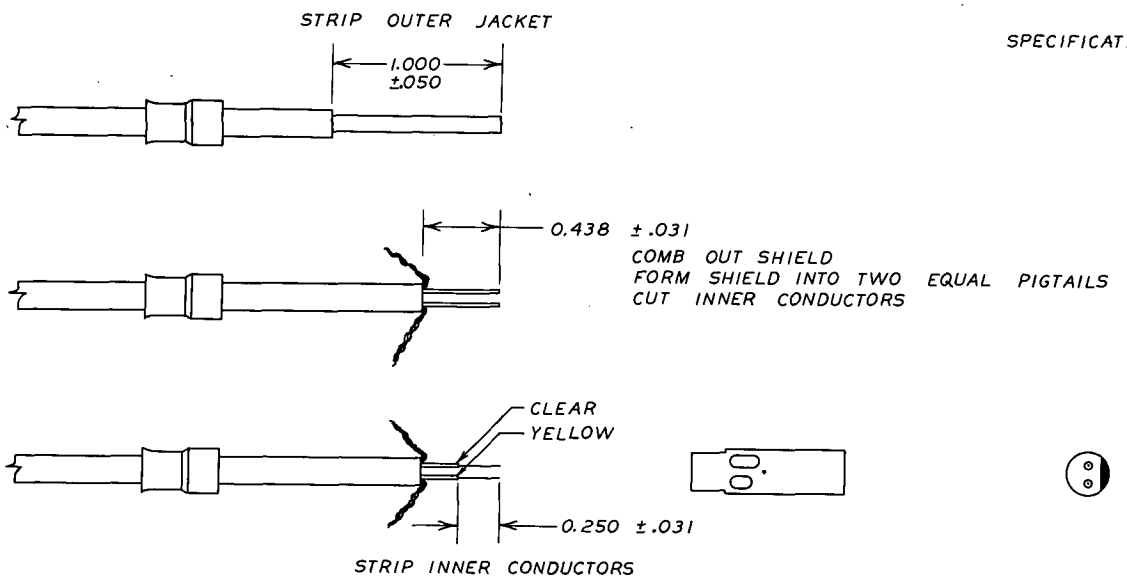
CONNECTOR

AMP TWIN STANDARD COAXICON
PLUG: AMP 329054
FERRULE: AMP 329056

CABLE

SPECIFICATION CAS-4 120 OHM CABLE

STRIPPING DIMENSIONS



POLARITY

YELLOW - HOLE I - SMALL PORT (LOGIC HIGH)
CLEAR - HOLE II - LARGE PORT (LOGIC LOW)

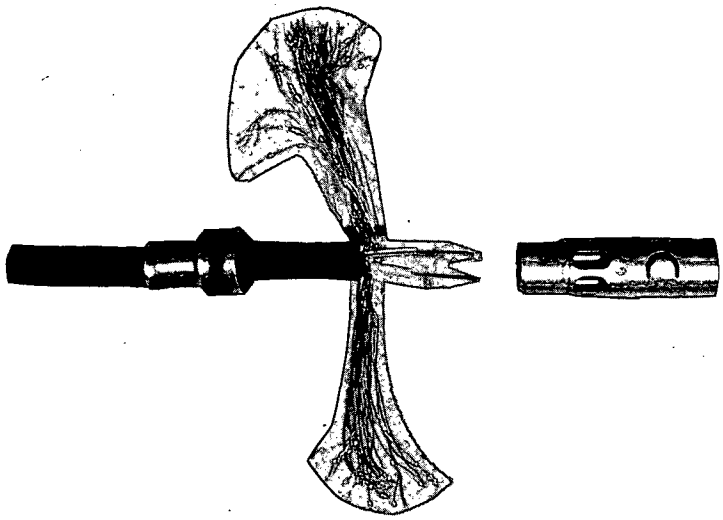
CHANGE NO.	DATE	DESCRIPTION
ISSUE	1-7-71	GCJ

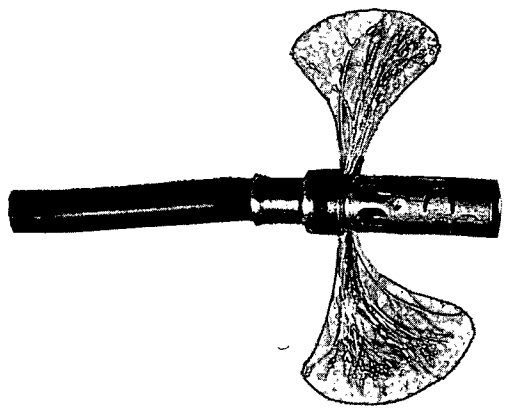
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
CONTROL CABLE ASSEMBLY
STRIPPING - POLARITY

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
GCJ	PROD	12-30-70	GCJ	360-7
			DRAWN BY PLL	
			CHECKED GCJ	DATE 12-29-70





COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE

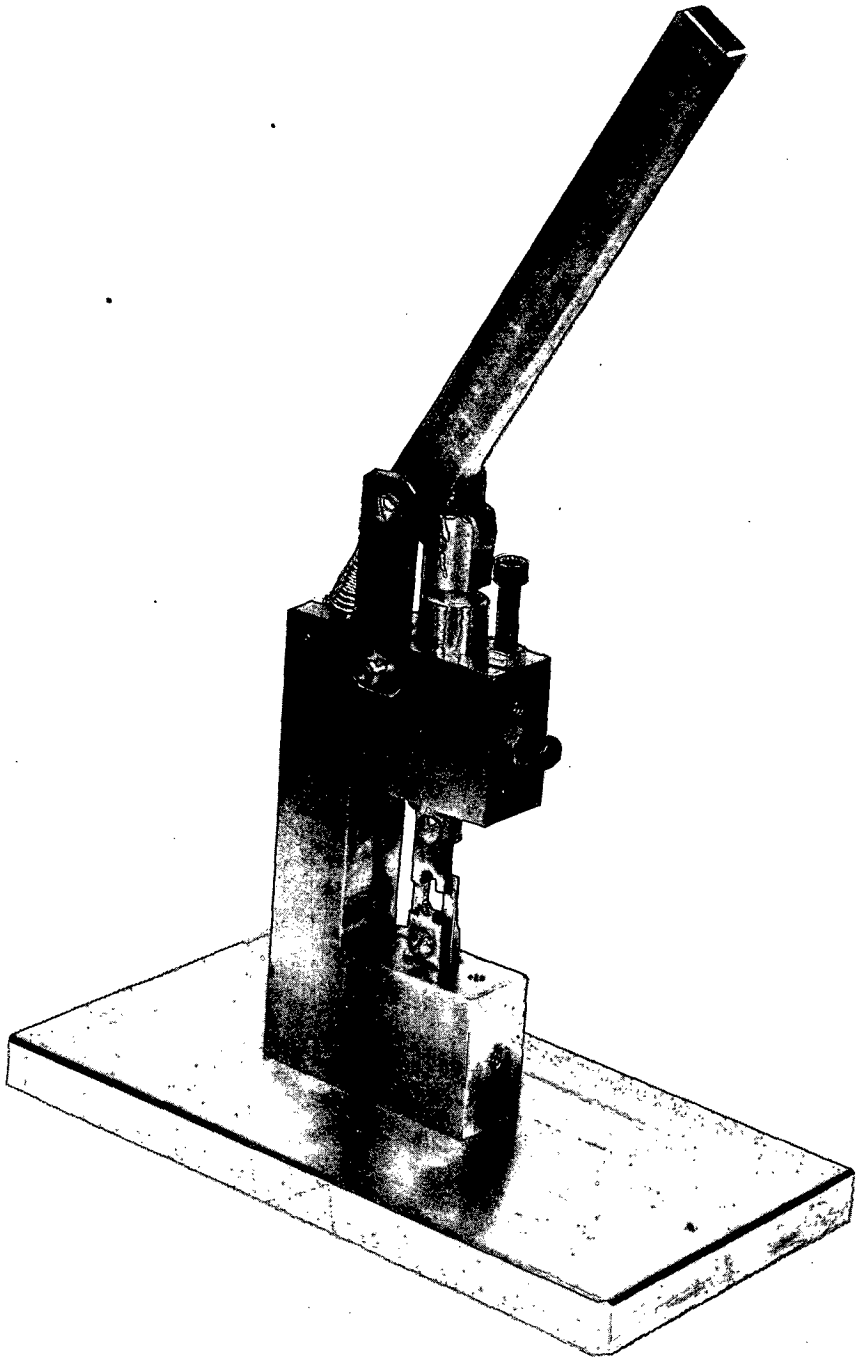
ASSEMBLY ORIENTATION

CHANGE NO.	DATE	DESCRIPTION
ISSUE	1-7-71	GCJ

APPROVED BY	FOR	DATE
GCJ	PROD.	1-7-71

ENG GCJ
DRAWN BY DHO
CHECKED GCJ

DRAWING NO. 360-8
DATE 1-7-71



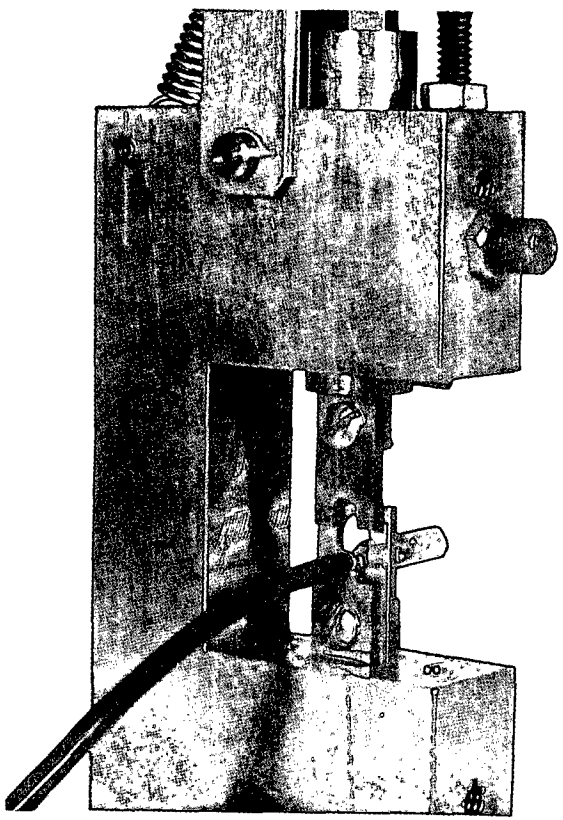
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

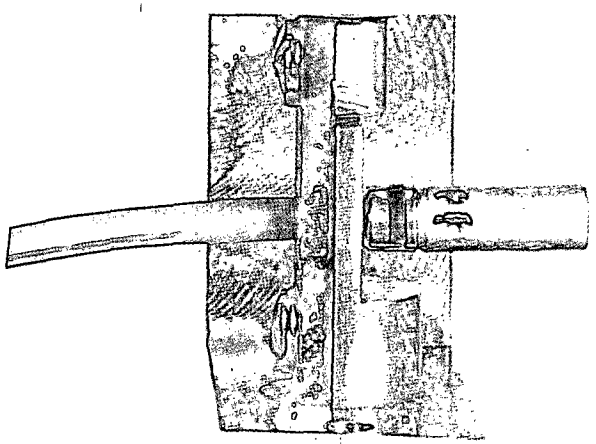
MACROMODULAR PROJECT

TITLE
SECONDARY CRIMP DIE

CHANGE NO.	DATE	DESCRIPTION
ISSUE	1-29-71	DCJ

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	GCJ	360-9
DCJ	ASSBY	1-29-71	DRAWN BY GWP	
			CHECKED DCJ	DATE 1-29-71





CHANGE NO.	DATE	DESCRIPTION
ISSUE	1-29-71	GCJ

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: SECONDARY CRIMP ORIENTATION

APPROVED BY	FOR	DATE
GCJ	ASSBY	1-29-71

ENG. GCJ
DRAWN BY GWP
CHECKED GCJ

DRAWING NO. 360-10
DATE 1-29-71

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
MODIFIED STRIP TOOL

CHANGE NO.	DATE	DESCRIPTION
ISSUE	1-11-71	GCJ

APPROVED BY	FOR	DATE
GCJ	PROD.	1-11-71

ENG GCJ
DRAWN BY DHO
CHECKED GCJ

DRAWING NO. 360-11
DATE 1-11-71

PEDESTAL DAISY CHAIN CABLE

CHG.	E.C.O.	DATE	APPR	CHG	E.C.O.	DATE	APPR	CHG.	E.C.O.	DATE	APPR.
ISSUE	——	12-7-70	RCJ								
A	0137	12-29-70	RCJ								
B	0270	10-17-72	RCJ								
C	0277	12-7-72	RCJ								
D	0304	2-5-74	RCJ								

ASSEMBLY SPECIFICATION:

PEDESTAL DAISY CHAIN CABLE

I. Introduction

This specification describes a cable and connector assembly which will carry power sequence and alarm signals between elements of a modular computer system. The Daisy Chain Cable consists of a length of multiconductor, jacketed cable terminated by identical connectors at each end.

II. Cable Stock

The jacketed cable, National number S10-1445, was produced by National Wire and Cable Corporation, 136 San Fernando Road, Los Angeles, California 90031 to the following specification:

The cable consists of 10 #24 AWG, 19 strand conductors insulated with a 0.010 inch PVC wall and a 0.003 inch nylon wall, and 2 #22 AWG, 7 strand drain wires. The 10 insulated conductors are color coded the following solid colors: black, brown, red, orange, yellow, green, blue, violet, gray, and white. Each conductor is individually shielded with aluminum/mylar tape with the aluminum on the outside. The cable is planetary cabled with the 2 drain wires approximately 90° apart in the outer layer and has an aluminum/mylar tape shield,

CHG.	E.C.O.	DATE	APPR.
ISSUE	-	12-7-70	

with the aluminum on the inside, over all covered with a 0.035 inch wall black PVC jacket. The finished cable has a 0.290 inch nominal, 0.310 inch maximum, O. D.

III. Connectors

The connector on each of the two ends of the cable consists of an Amphenol ASTRO 348-46E10-12S1 connector, an Amphenol 348-470-14000-02 Rear Shell Assembly, and an Adapter described by CSL drawing 361-8.

IV. Variations

All cables shall be indentical except in length. The length is defined as the measurement from end to end of the cable stock before stripping and termination. The tolerance on length shall be ± 1/2 inch.

The cables shall be constructed in the following lengths:

1. 4 1/2 feet
2. 10 feet
3. 25 feet

V. Assembly Sequence

1. Cut cable to length as defined above.
2. Solder a piece of 22 AWG bare tinned wire to 2 Adapters per Dwg. 361-6.
3. Slide on 2 Compression Nuts, 2 Tined Ferrules, 2 Outer Housings, and 2 Adapters per Dwg. 361-6.

Do These Operations to Both Ends of Cable

4. Cut back outer jacket 1 3/4 inches.
5. Cut away the exposed aluminum/mylar tape jacket. (Do not cut the two stranded bare tinned copper leads.)

CHG.	E.C.O.	DATE	APPR.
B	0270	10-17-72	RCJ

6. Remove the exposed aluminum/mylar tape from each of the 10 insulated conductors.

7. Trim the ends of all 12 wires 1/8 inch to eliminate damage from the cable cutting operation.

8. Strip the 10 insulated individual conductor (0.188 to 0.219 inches.)

9. All wires shall be crimped with acceptable tooling as shown in the tooling chart, or equivalent automatic tooling. The settings of the tools shall be determined by a simple pull test. The wire shall break consistently at, or near the crimp after noticeable elongation. An optimum crimped termination has 70% of the tensile strength of the wire.

TOOLING CHART

MANUFACTURER	TOOL
BUCHANAN	612596 CRIMP TOOL
BUCHANAN	613381 LOCATOR

10. Insert the contacts into the connector per Amphenol's ASTRO 348 technical manual and the following wiring list:

WIRE COLOR	PIN
Bare tinned lead	1
White	2
Gray	3
Red	4
Black	5
Brown	6
Violet	7
Orange	8
Yellow	9
Blue	10
Green	11
Bare tinned lead	12

CHG.	F.C.O.	DATE	APPR.
B	0270	10-17-72	DCJ
C	0277	12-7-72	DCJ

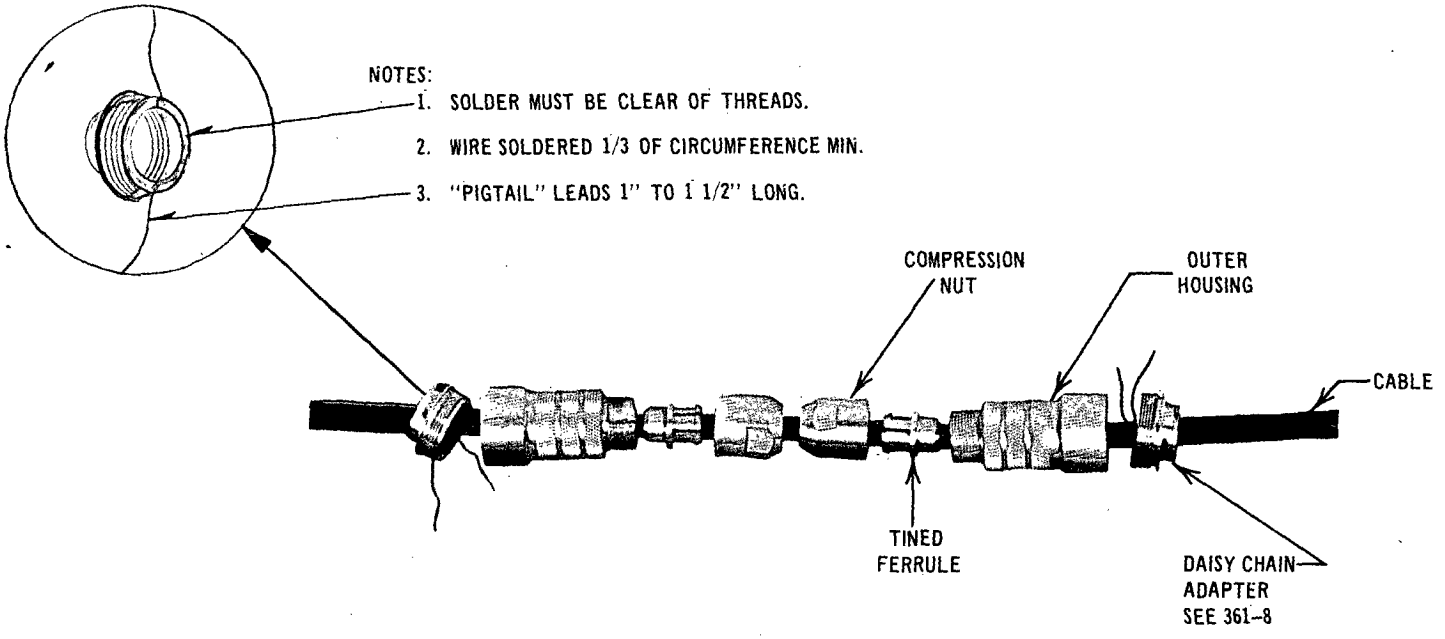
11. Complete assembly by screwing the rear nut into the Connector Shell--tighten carefully with channelock pliers.
12. Slide the Adapter forward and screw into the Connector Shell.
13. Wrap a "pigtail" wire from the Adapter around each of the bare tinned cable leads and solder both connections. Care must be taken to not damage the wire insulation of the other conductors.
14. Slide the Outer Housing forward and screw into the Adapter and tighten Outer Housing-Adapter Assembly.
15. Slide the Tined Ferrule forward, then slide the Compression Nut forward, pull on cable to remove the wire slack inside the back shell, and then screw on the Compression Nut and tighten with a wrench. The cable and Connector Shell must be carefully constrained to prevent rotation of the cable. (A fixture should be designed to capture the cable during this operation. The cable cannot be held properly by hand.)

VI. Testing

The cable shall be tested for continuity and shorts as follows:

1. Each pin shall be connected to the pin of the same number on the opposite end with a resistance of less than one ohm.
2. Pins 1 through 11 shall be isolated from each other by a resistance greater than one megohm.
3. The resistance between pins 1 and 12, measured at both ends of the cable, shall be less than 1 ohm.

CHG.	E.C.O.	DATE	APPR.
B	0270	10-17-72	RCJ



CHANGE NO.	DATE	DESCRIPTION
B	10-17-72	E.C.O. 0270 GCJ
ISSUE	12-7-70	GCJ

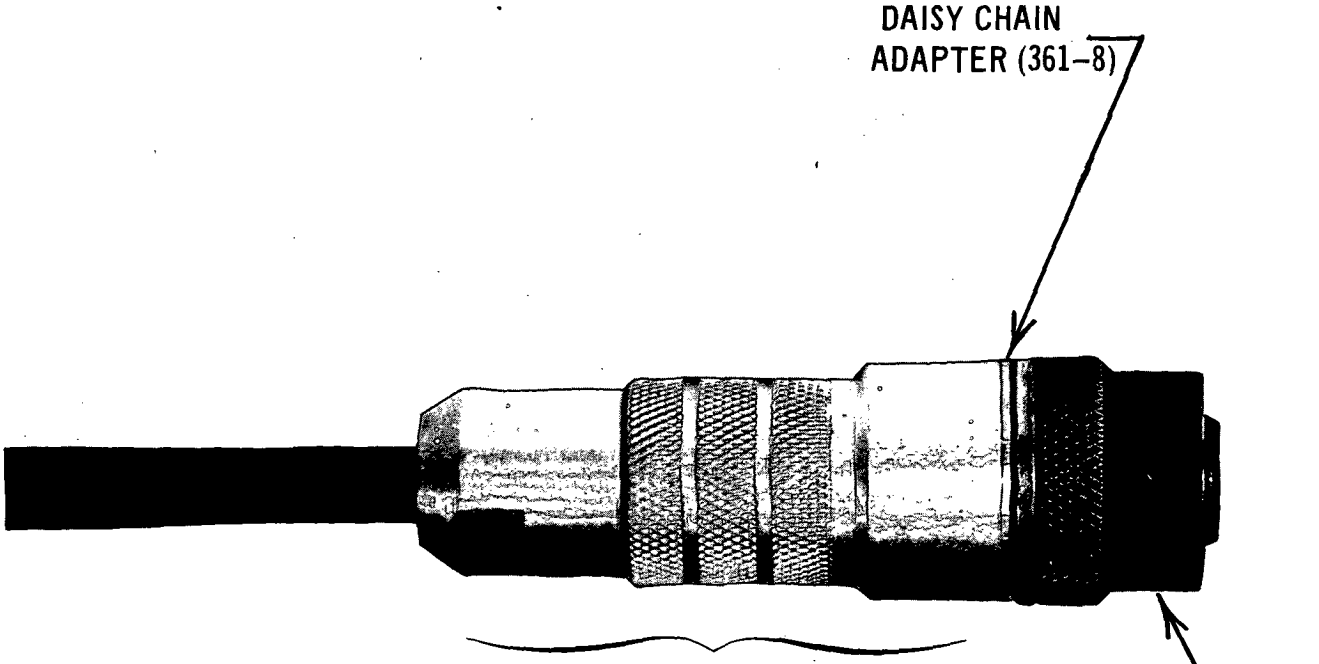
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
DAISY CHAIN CABLE ASSEMBLY SEQUENCE PICTORIAL

APPROVED BY	FOR	DATE
GCJ	PROD.	12-7-70

ENG.	GCJ
DRAWN BY	DLS
CHECKED	GCJ
DRAWING NO.	361-6
DATE	12-7-70



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

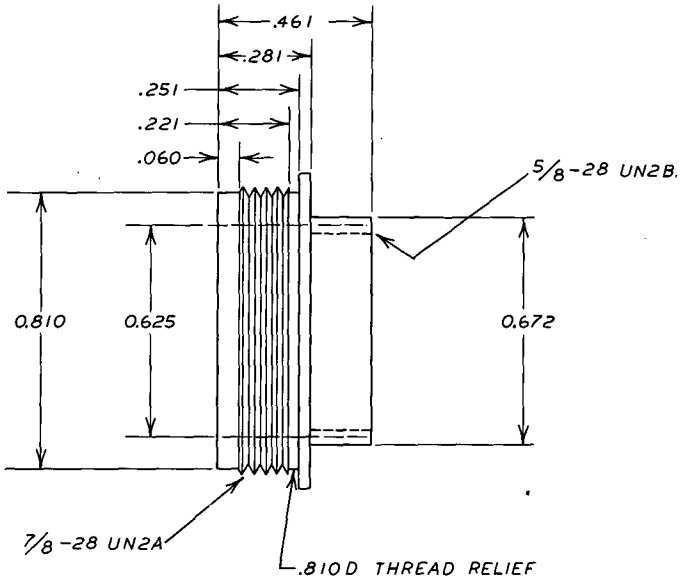
MACROMODULAR PROJECT

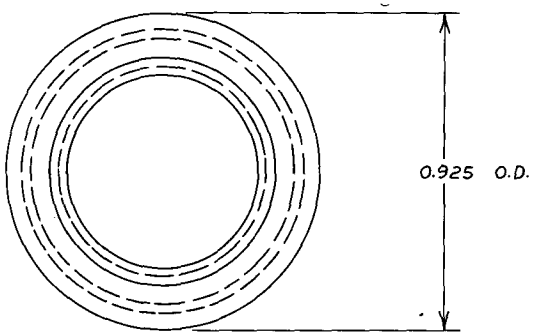
TITLE: DAISY CHAIN CABLE HEAD

CHANGE NO	DATE	DESCRIPTION
ISSUE	12-7-70	GCJ

APPROVED BY	APPROVED FOR	APPROVED DATE
GCJ	PROD.	12-7-70

ENG: GCJ
DRAWN BY: DLS
CHECKED: GCJ
DRAWING NO: 361–7
DATE: 12–7–70





MATERIAL: 6061-T6 ALUMINUM
DIMENSIONS: ± 0.005

MACHINED PARTS SHALL BE GIVEN THE FOLLOWING FINISH:

CADIUM PLATE (0.0002-0.0004 INCHES THICK) OVER NICKEL PLATE (0.0001-0.0002 INCHES THICK) FOLLOWED BY CLEAR CHROMATE CONVERSION.

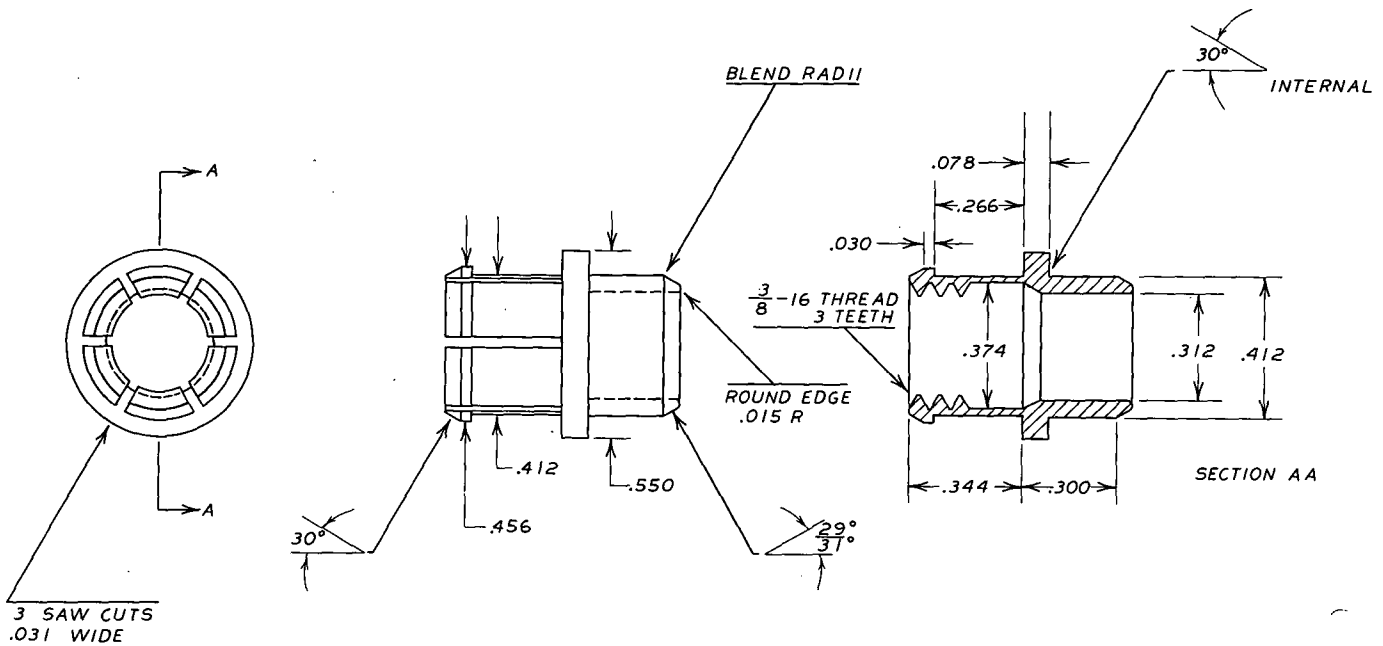
CHANGE NO.	DATE	DESCRIPTION	
A	12-29-70	E.C.O. 0137	RCJ
ISSUE	12-7-70	E.C.O. 0124	RCJ

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
CABLE HEAD ADAPTER
BASE PEDESTAL DAISY CHAIN

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
RCJ	PROD.	12-7-70	GCJ	361-8
			DRAWN BY PLL	
			CHECKED RCJ	DATE 12-7-70



DEBURR, BREAK SHARP EDGES 0.010
ALL DIMENSIONS ± .005
MATERIAL: 6061-T6 ALUM
ALL ANGLES ± 2 DEGREES EXCEPT AS NOTED

DO NOT SCALE

CHANGE NO.	DATE	DESCRIPTION
D	2-5-74	ECO 0304 GCJ

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
CABLE HEAD
TINED FERRULE

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
GCJ	PROD	11-1-70	GCJ	361-9
			DRAWN BY PLL	
			CHECKED GCJ	DATE 9-15-70

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY

FUNCTION CALLER CABLE
MECHANICAL PARTS

CHG.	E.C.O.	DATE	APPR.
		10-4-73	RJA

MACROMODULAR SYSTEMS PROJECT

FUNCTION CALLER CABLE
MANUFACTURE AND SPECIFICATIONS

The intent of this document (363) is to set forth manufacturing specifications for mechanical parts relating to the function caller cable head. To this end the following pages are a complete set of mechanical drawings fully describing all aspects of the individual cable head components. Strict adherence to component tolerance and finish specifications by the manufacturer must be excercised to produce acceptable assemblies. The manufacturer must assure himself that his facility can meet these specifications by analysis of component and assembly documentation, his tooling and characteristics of his production processes.

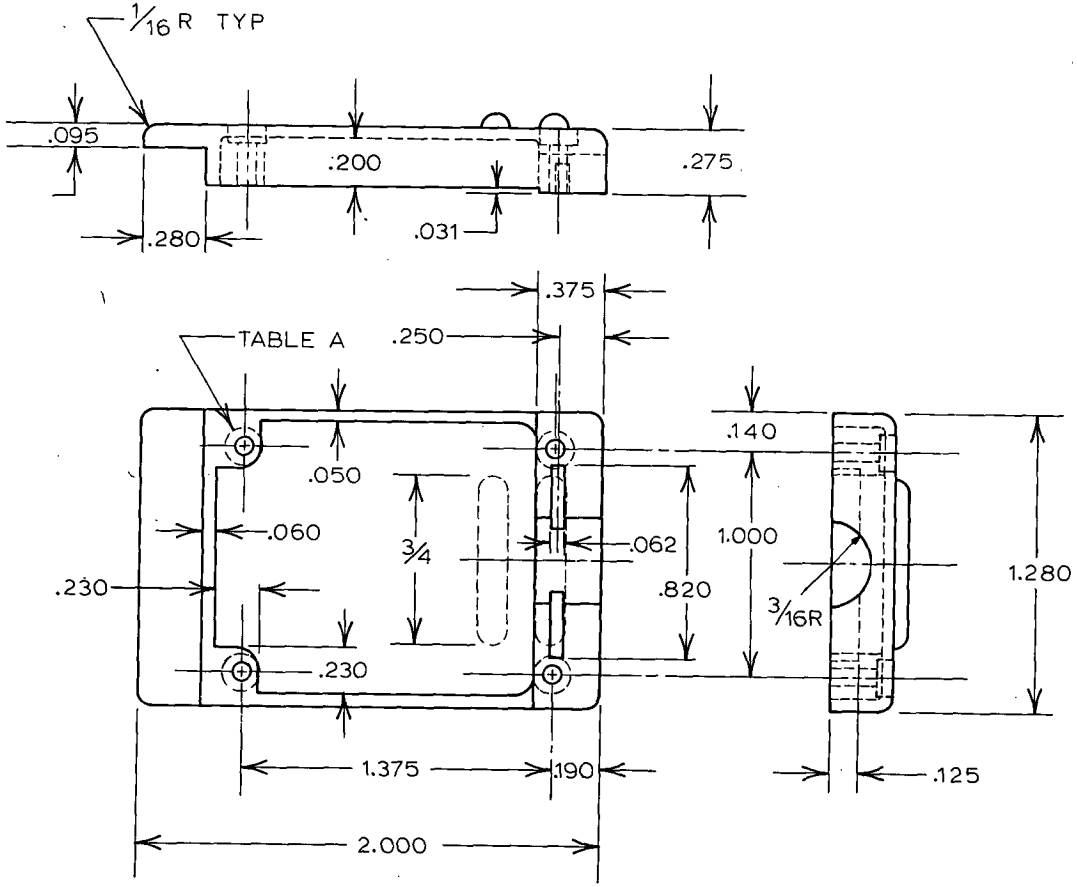


TABLE A

PART NO. 1 .070 DIA x .200 DEEP AS MOLDED 4 PLACES FROM SIDE SHOWN.

PART NO. 2 DRILL NO. 43 C'BORE .170 x .100 DEEP 4 PLACES AS SHOWN.

ONE PART NO. 1 AND ONE PART NO. 2 REQ'D. PER ASSEMBLY.

MAT'L: INJECTION MOLDED ABS
COLOR: BLACK

DIMENSIONS SHOWN ARE MOLD DIMENSIONS
TOLERANCES UON:
.XXX ±.005
.XX ±.010
$\frac{X}{X} \pm \frac{1}{64}$

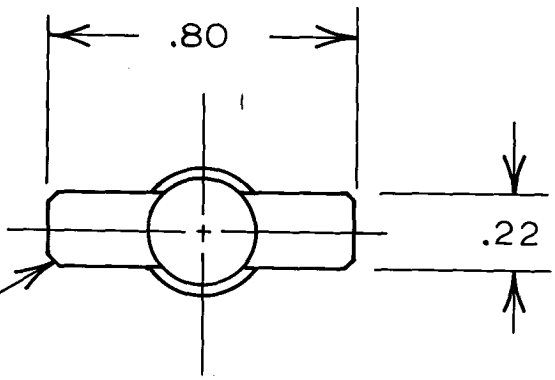
ISSUE		
CHANGE NO.	DATE	DESCRIPTION

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

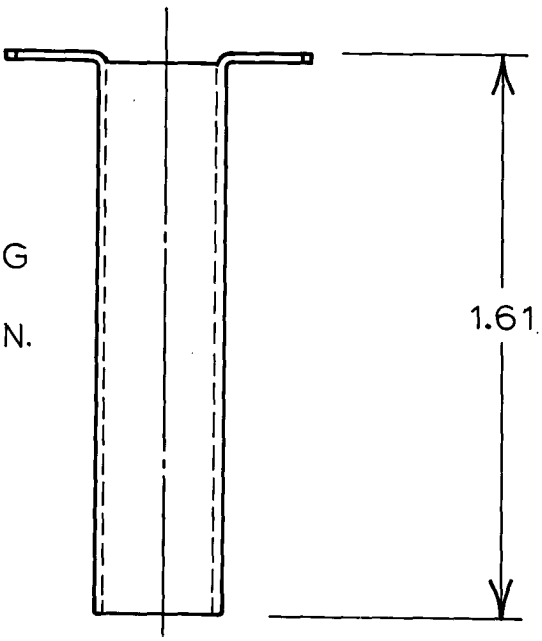
MACROMODULAR PROJECT

TITLE
FUNCTION CALLER CABLE HEAD COVER

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
RJA	PROD	10-4-73	GCM	363-3
			DRAWN BY PLL	
			CHECKED GM	DATE 9-12-73



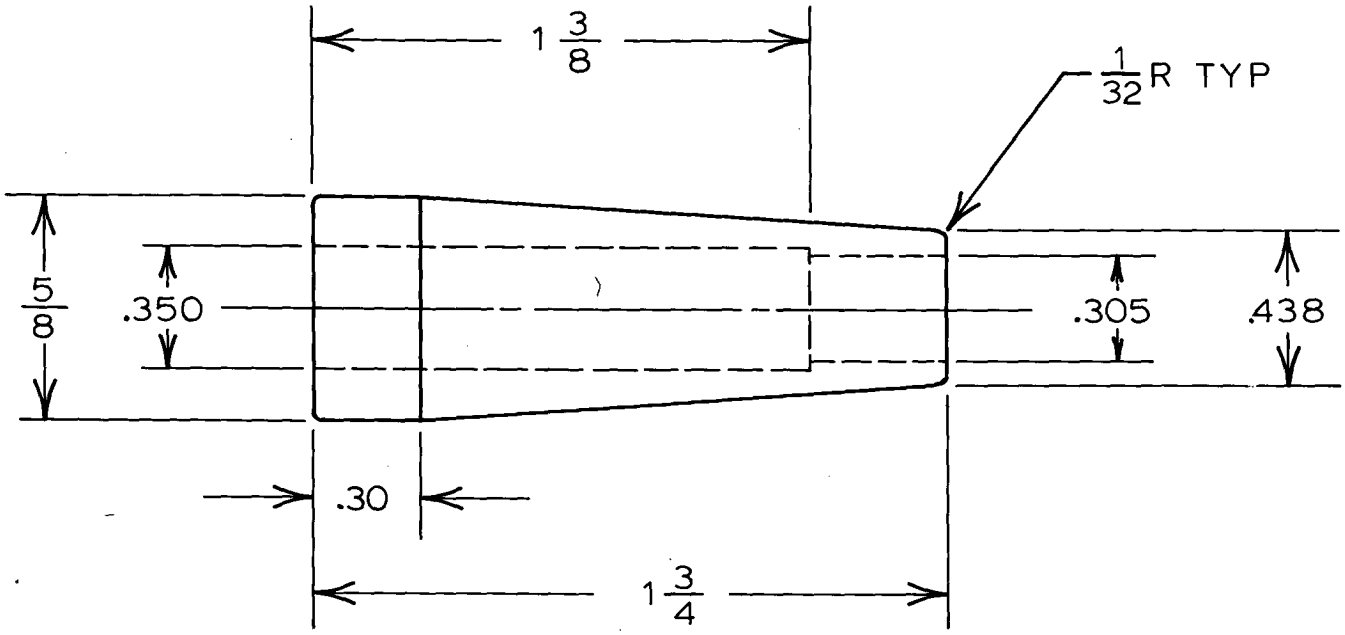
BREAK
CORNERS .02 × 45°



MAT'L: .375 ±.005
FLEXIBLE
COPPER TUBING

DIMENSIONS: ±.010 U.O.N.

COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT		
			TITLE: COPPER STRAIN RELIEF		
			APPROVED BY: RJA	FOR: PROD	DATE: 10-4-73
ISSUE			ENG: RJA	DRAWN BY: PLL	DRAWING NO.: 363-4
CHANGE NO.	DATE	DESCRIPTION	CHECKED: GM	DATE: 9-12-73	

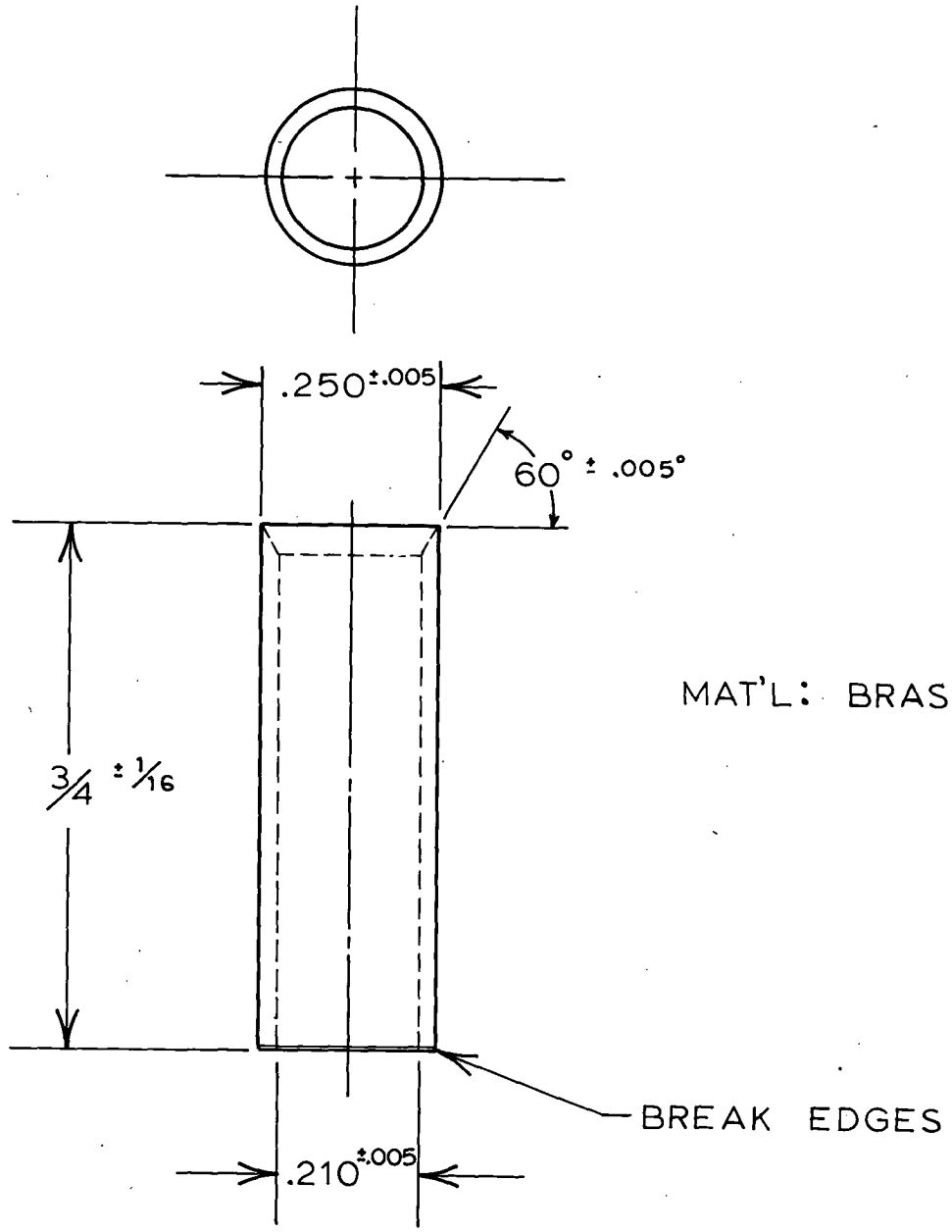


MAT'L: MOLDED VINYL
PART A COLOR - BLACK
PART B COLOR - GREEN

DIMENSIONS U.O.N.

.XXX ±.005
.XX ±.010
X/X ± 1/64

COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE: STRAIN RELIEF HANDLE GRIP				
			APPROVED			ENG RJA	DRAWING NO. 363-5
			BY	FOR	DATE	DRAWN BY PLL	
ISS			RJA	PROD	10-4-73		
CHANGE NO.	DATE	DESCRIPTION				CHECKED GM	DATE 9-12-73



COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT		
			TITLE: BRASS SLEEVE		
			APPROVED BY: RJA	FOR: PROD	DATE: 10-4-73
ISS			ENG: RJA	DRAWN BY: PLL	CHECKED: GM
			DRAWING NO.: 363-6	DATE: 9-12-73	
CHANGE NO.	DATE	DESCRIPTION			

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY

FUNCTION CALLER CABLE
CIRCUIT BOARD SUB-SUBASSEMBLY

CHG.	E.C.O.	DATE	APPR.
Iss.		10-4-73	MTR
A	0298	10-24-73	MLP

MACROMODULAR SYSTEMS PROJECT

ASSEMBLY SPECIFICATIONS

I. P.C. Board Assembly

A. Two printed circuit boards are used - one for each end of the cable. The boards - WCL0211 and WCL0213 - have plated-through holes and gold plated fingers conforming to specifications in PC-1. (See Document 010.)

B. All of the Corning 1% resistors are mounted on .4 inch centers. The leads should be bent so that the value may be easily read.

C. WCL-0211-2

1. Refer to pages 364-4 and 364-5 for component orientation.
2. Insert MECL package from B side and solder on A side.
3. Insert R1 to R8 from A side and solder on B side. Note that one lead of R6 is very close to the MECL package. Solder this lead very carefully on the B side or solder from the A side letting solder flow through the hole.
4. Insert C1 from A side and solder on B side. This capacitor lies on top of R3 and R4.
5. Insert the LTN-2 from the A side. Bend the leads so that the top and bottom edges of the LTN-2 are just clear of the MECL pins, and solder on the B side.

D. WCL0213-2

1. Refer to pages 364-9 and 364-10 for component orientation.
2. Insert the MECL packages from the B side and solder on the A side.
3. Insert R1, R2 and R3 from the A side and solder on the B side.
4. Insert C1 from the A side, bending it over so that it just clears the MECL pins. Solder on the B side.

INTEGRATED CIRCUIT

P1 = M20

RESISTORS

N01 = LTN2

R01 thru R04 = 121 Ohm 1% Corning RN55D
R05 thru R08 = 1.1K 5% 1/8 W Carbon Comp.

CAPACITOR

C01 = .018 MF Sprague 262C067183X0500B
(192C substitute)

PRINTED CIRCUIT BOARD

WCL0211-2

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

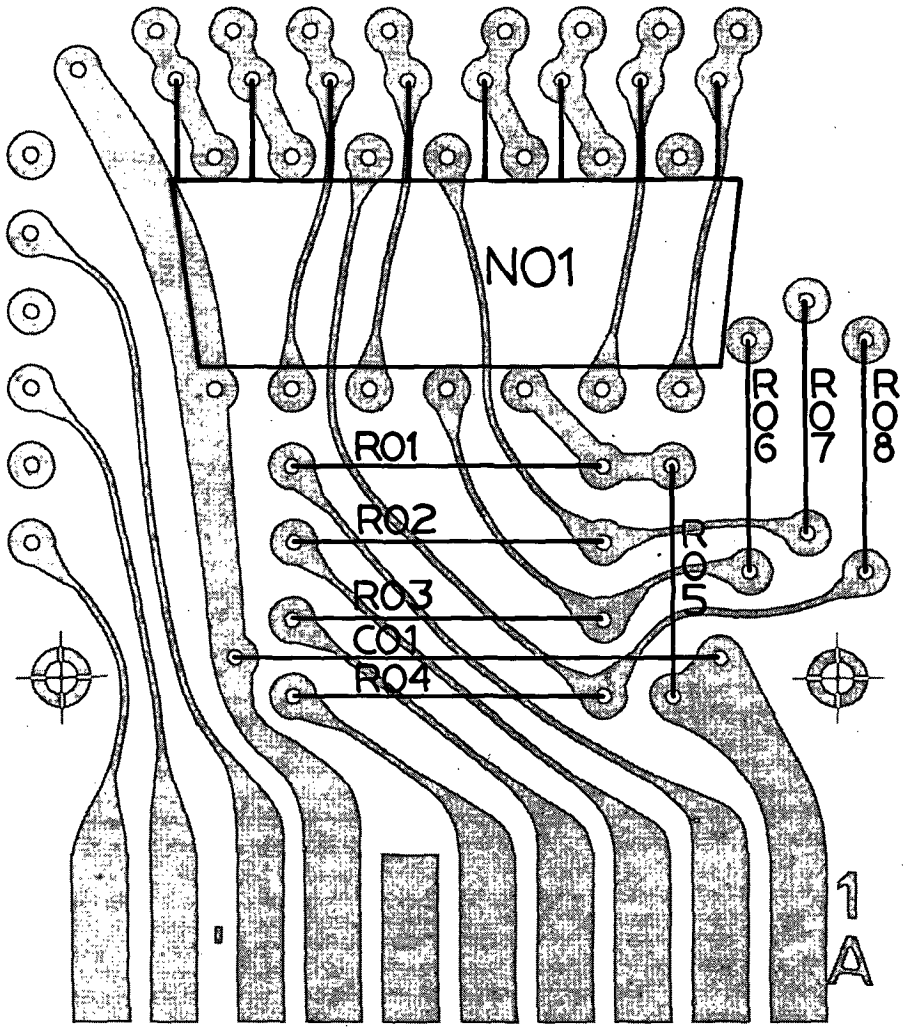
TITLE: Parts List
Receiving End

CHANGE NO.	DATE	DESCRIPTION
Issue	9-12-73	

APPROVED BY	FOR	DATE
MK	PROD	10-4-73

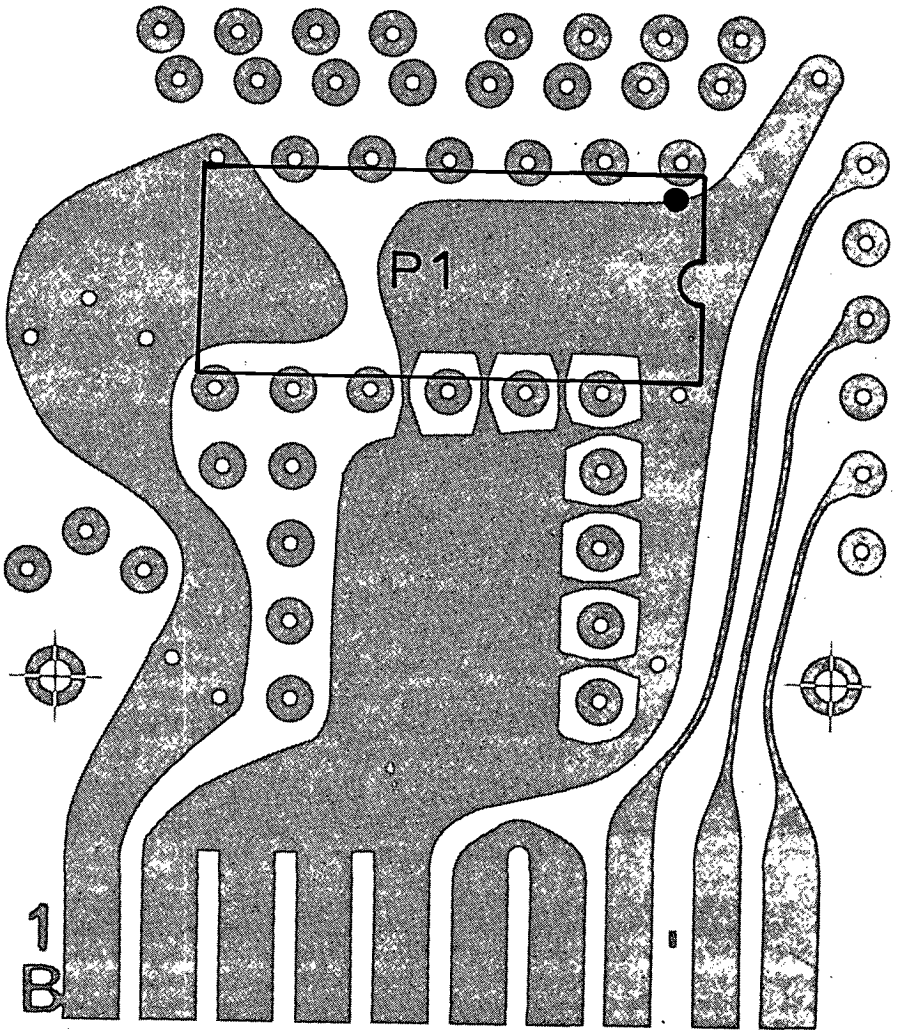
ENG. MLP
DRAWN BY CAH
CHECKED MLP
DRAWING NO. 364-3
DATE 9-12-73

WCL 0211-2



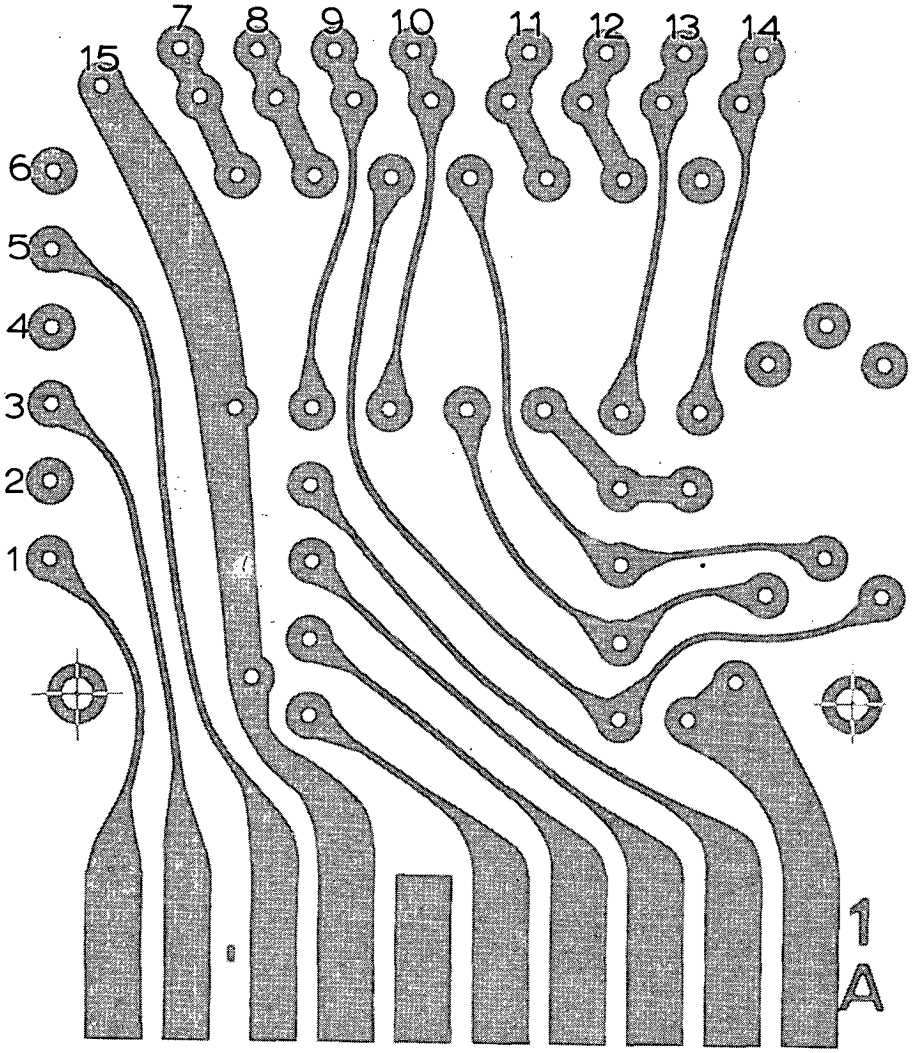
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT		
			TITLE Component Identification A Side Receiving End		
			APPROVED	ENG MLP	DRAWING NO. 364-4
			BY: MTK / FOR: PROD / DATE: 10-9-73	DRAWN BY CAH	
Issue	9-12-73			CHECKED MLP	DATE 9-12-73
CHANGE NO.	DATE	DESCRIPTION			

WCL 0211-2

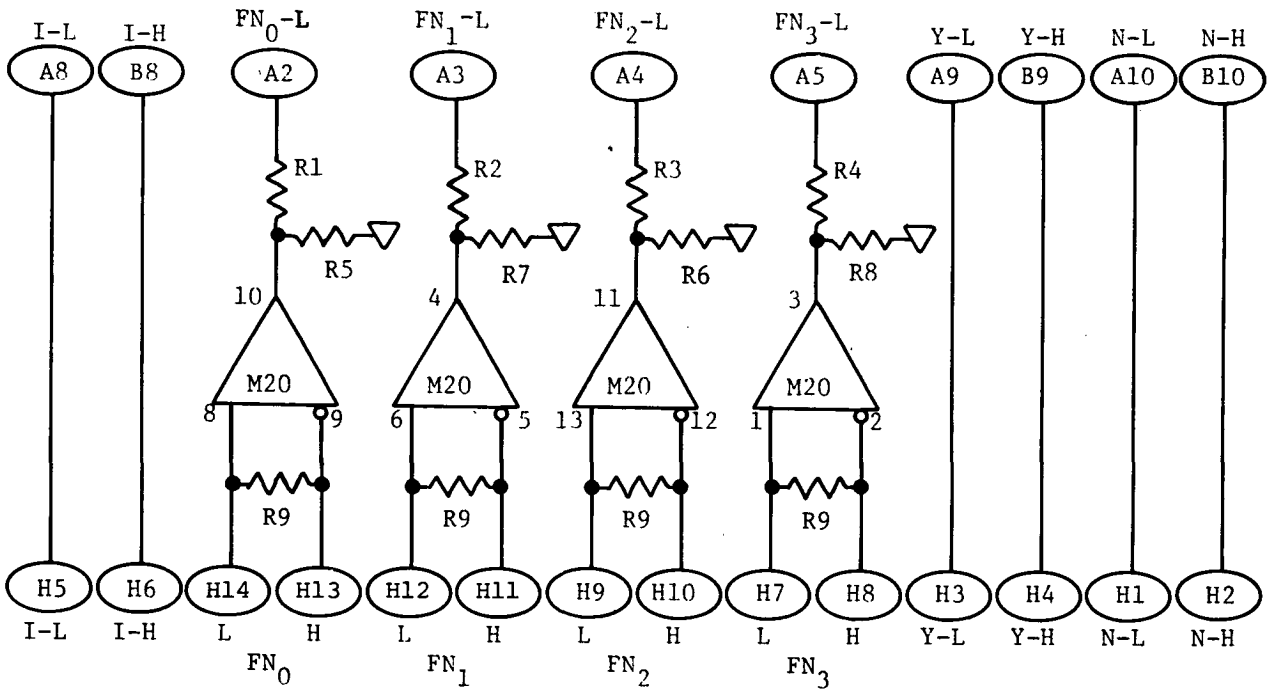


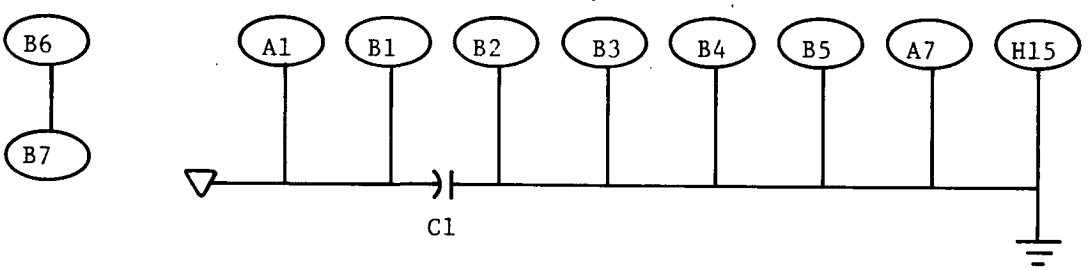
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE Component Identification B Side Receiving End				
			APPROVED			ENG MLP	DRAWING NO. 364-5
			BY	FOR	DATE		
Issue	9-12-73		MTR	PROD	10-4-73	DRAWN BY CAH	
						CHECKED MLP	DATE 9-12-73
CHANGE NO.	DATE	DESCRIPTION					

WCL 0211-2



COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE: HOLE LOCATIONS RECEIVING END				
			APPROVED			ENG: MLP	DRAWING NO.: 364-6
			BY	FOR	DATE	DRAWN BY: DLS	
ISS			[illegible]	PROD	10-4-73		
CHANGE NO.	DATE	DESCRIPTION				CHECKED: MLP	DATE: 9-12-73





C1 = .018 MF

R5 - R8 = 1.1 K 1/8 W 5% carbon comp.

R1 - R4 = 121 Ω 1/8 W 1% RN55D

R9 = LTN-2

Printed Circuit Board
WCL0211-2

COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT	
			TITLE: Logic Drawing - Receiving End	
			APPROVED BY: MK; FOR: PROD; DATE: 10-4-73	ENG: MLP; DRAWN BY: PLL; CHECKED: MLP; DATE: 9-12-73
				DRAWING NO.: 364-7
CHANGE NO.	DATE	DESCRIPTION		
A	10-24-73	E.C.O. 0298		

INTEGRATED CIRCUIT

P1 = M35

RESISTORS

R01 = 130 Ohms 1% Corning RN55D
R02, R03 = 57.6 Ohms 1% Corning RN55D

CAPACITOR

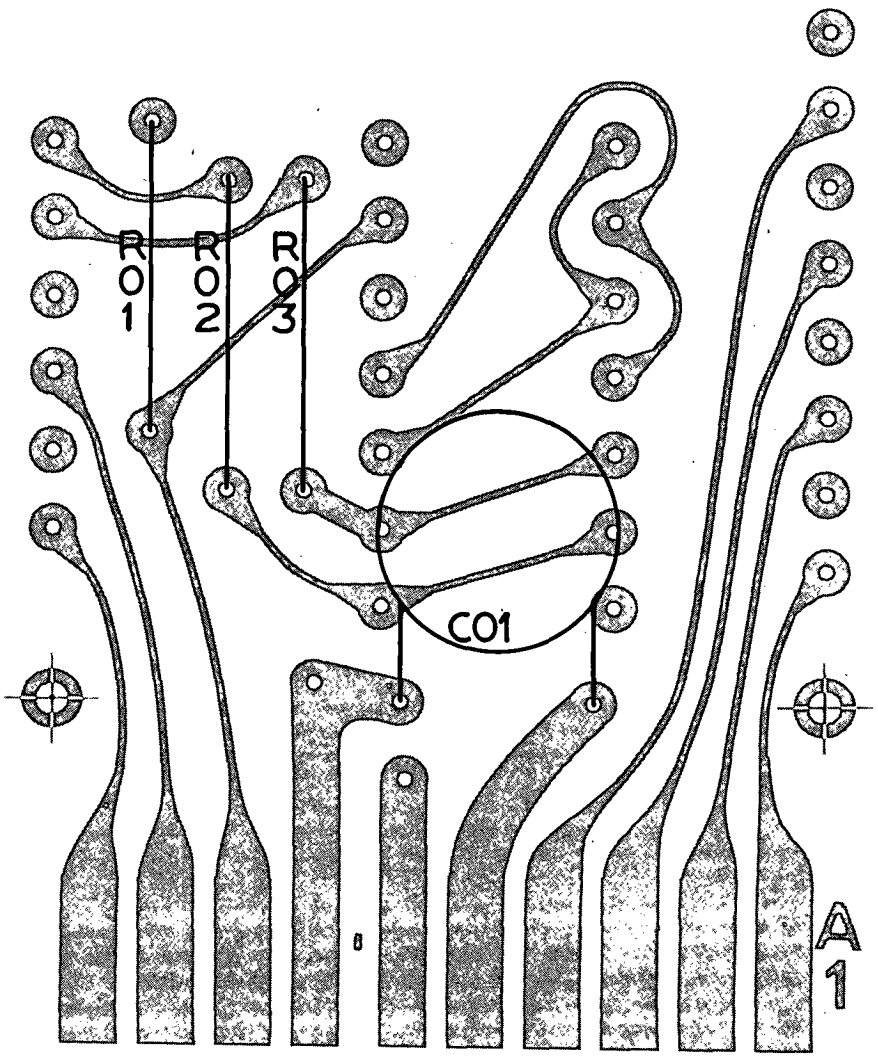
C01 = .01 uf Sprague

PRINTED CIRCUIT BOARD

WCL0213-2

COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI		**MACROMODULAR PROJECT**
		TITLE: Parts List Transmitting End
Issue	9-12-73	APPROVED BY: MR; FOR: PROD; DATE: 10-4-73 ENG: MLP DRAWN BY: CAH CHECKED: MLP DRAWING NO.: 364-8 DATE: 9-12-73
CHANGE NO.	DATE / DESCRIPTION	

WCL 0213-2



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

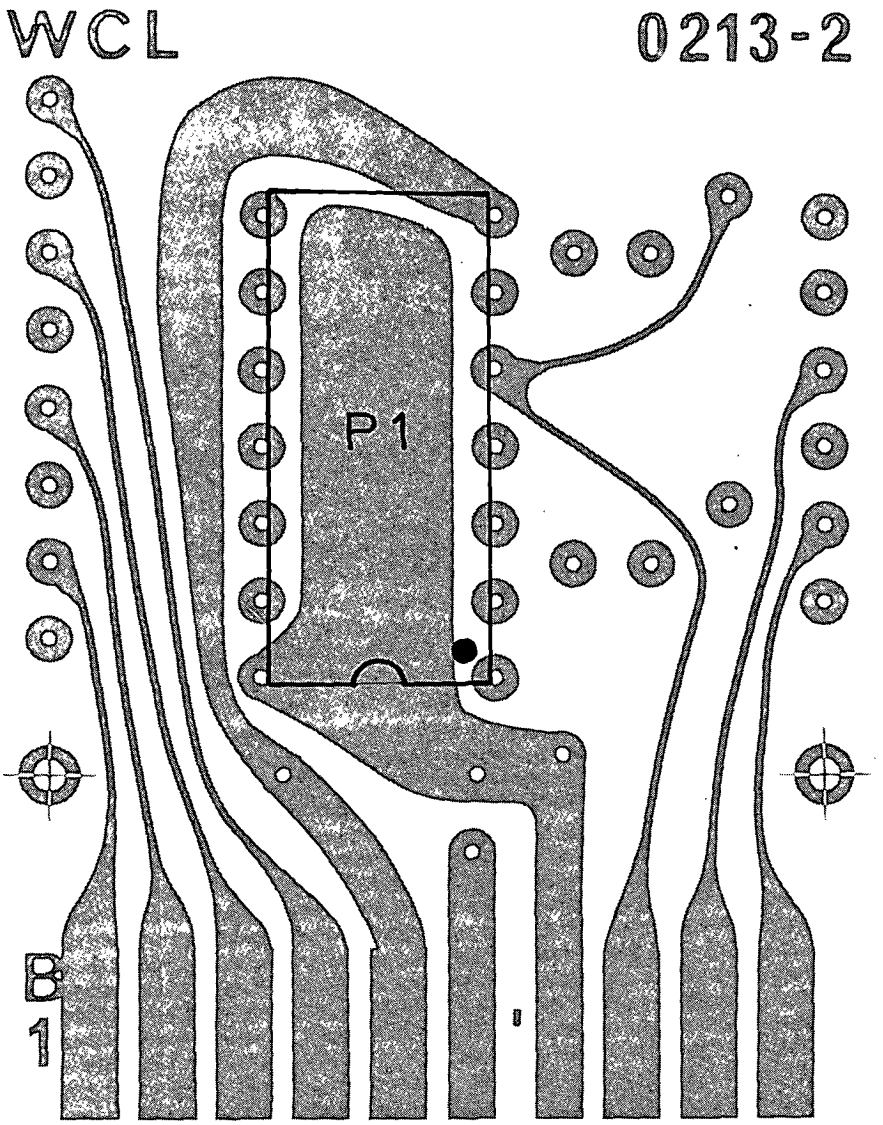
TITLE
Component Identification
A Side Transmitting End

CHANGE NO.	DATE	DESCRIPTION
Issue	9-12-73	

APPROVED BY	APPROVED FOR	APPROVED DATE
MR	PROD	10-4-73

ENG MLP
DRAWN BY CAH
CHECKED MLP

DRAWING NO. 364-9
DATE 9-12-73



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

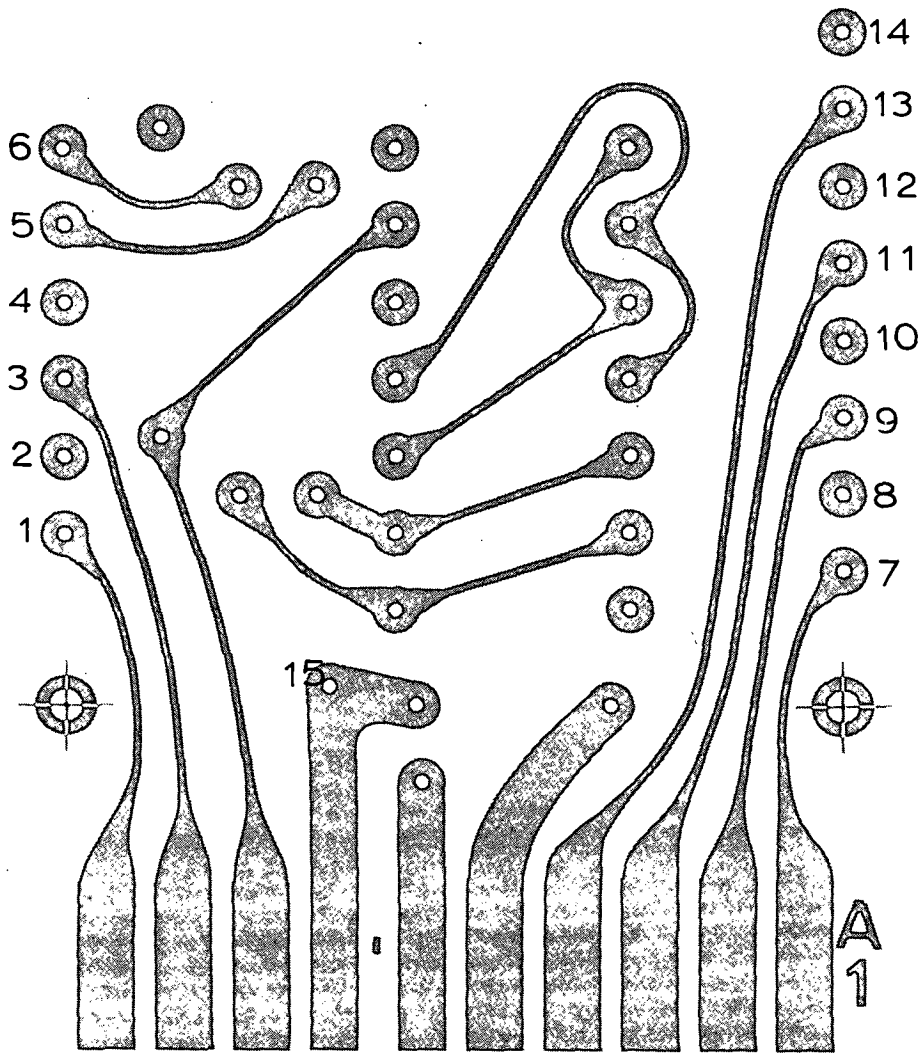
MACROMODULAR PROJECT

TITLE
Component Identification
B Side Transmitting End

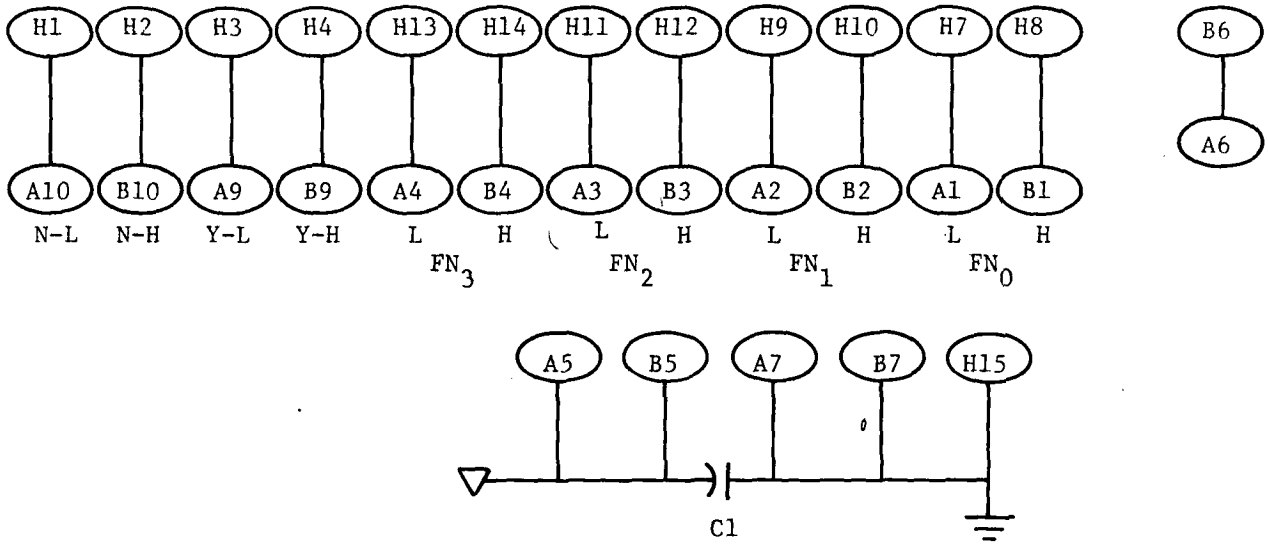
APPROVED			ENG MLP	DRAWING NO.
BY	FOR	DATE		
ZTR	PROD	10-4-73	DRAWN BY CAH	364-10
			CHECKED MLP	DATE 9-12-73

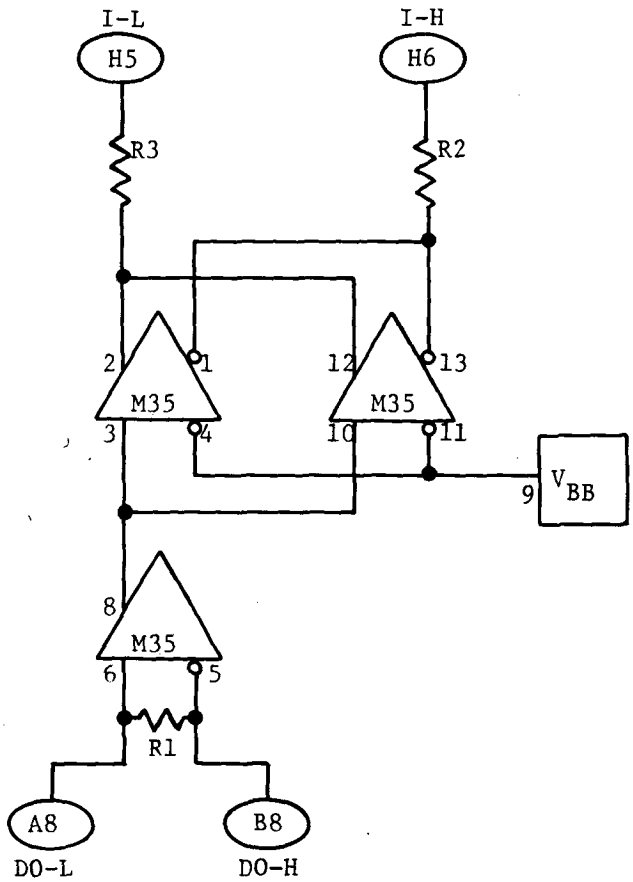
CHANGE NO.	DATE	DESCRIPTION
Issue	9-12-73	

WCL 0213-2



COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE: HOLE LOCATIONS TRANSMITTING END				
			APPROVED			ENG: MLP	DRAWING NO.: 364-11
			BY: UTK	FOR: PROD	DATE: 10-4-73	DRAWN BY: PLL	
ISS						CHECKED: MLP	DATE: 9-12-73
CHANGE NO.	DATE	DESCRIPTION					





C1 = .01 MF

R1 = 130 Ω

R2, R3 = 57.6 Ω

} 1/8 W 1% RN55D

Printed Circuit Board
WCL0213-2

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: Logic Drawing - Transmitting End

APPROVED BY	FOR	DATE	ENG	DRAWING NO.
MK	PROD	10-4-73	MLP	364-12
			DRAWN BY: PLL	
			CHECKED: MLP	DATE: 9-12-73

CHANGE NO.	DATE	DESCRIPTION

365

COMPUTER SYSTEMS LABORATORY

WASHINGTON UNIVERSITY

FUNCTION CALLER CABLE ASSEMBLY

PAGE	TITLE	CHANGE
365-1	TITLE PAGE	A
365-2	PARTS LIST	
365-3 thru 365-5	INTRODUCTION AND ASSEMBLY PROCEDURES	
365-6	CABLE ASSEMBLY	
365-7	WIRING CHART - RECEIVING END	A
365-8	WIRING CHART - TRANSMITTING END	
365-9	COPPER STRAIN RELIEF VICE	
365-10	SWAGING TOOL	
365-11	WINDOW & SHORT HEAD COVER ASSEMBLY JIG	

CHG.	E.C.O.	DATE	APPR.
Issue		9-4-73	RJA
A	0298	10-24-73	MSP

MACROMODULAR SYSTEMS PROJECT

PARTS LIST

QTY	C.S.L. DOC.	PART
1	364	PRINTED CIRCUIT BOARD WCL-0211-2
1	364	PRINTED CIRCUIT BOARD WCL-0213-2
2	363-3	HEAD COVER PART NO. 1
2	363-3	HEAD COVER PART NO. 2
2	363-4	COPPER STRAIN RELIEF
1	363-5	STRAIN RELIEF HANDLE GRIP TYPE A
1	363-5	STRAIN RELIEF HANDLE GRIP TYPE B
2	363-6	BRASS SLEEVE
8	-----	2-56 SELF THREADING FILLISTER HEAD SCREWS 3/8"LONG
	-----	DATA CABLE (SEE PAGE 365-3, SECTION II)
1	365-11	WINDOW COVER ASSEMBLY JIG
1	365-11	SHORT COVER ASSEMBLY JIG

CHG.	E.C.O.	DATE	APPR.
Issue		9-4-73	RJA

MACROMODULAR SYSTEMS PROJECT

ASSEMBLY PROCEDURE

FUNCTION CALLER CABLE

I. Introduction

This document describes the procedure for assembling the Function Caller Cable. This cable carries seven twisted pairs of high speed digital data in a length of multiconductor, jacketed cable terminated by active cable head connectors at each end. The cable heads each contain one digital integrated circuit; they are of similar mechanical design, but each is distinct electrically.

II. Cable Stock

Macromodular Data Cable is used for the Function Caller Cable. The cable is described by CAS-5 (refer to Document 010).

III. Wiring P.C. Board to Cable

A. Cable Nomenclature (See page 365-6.)

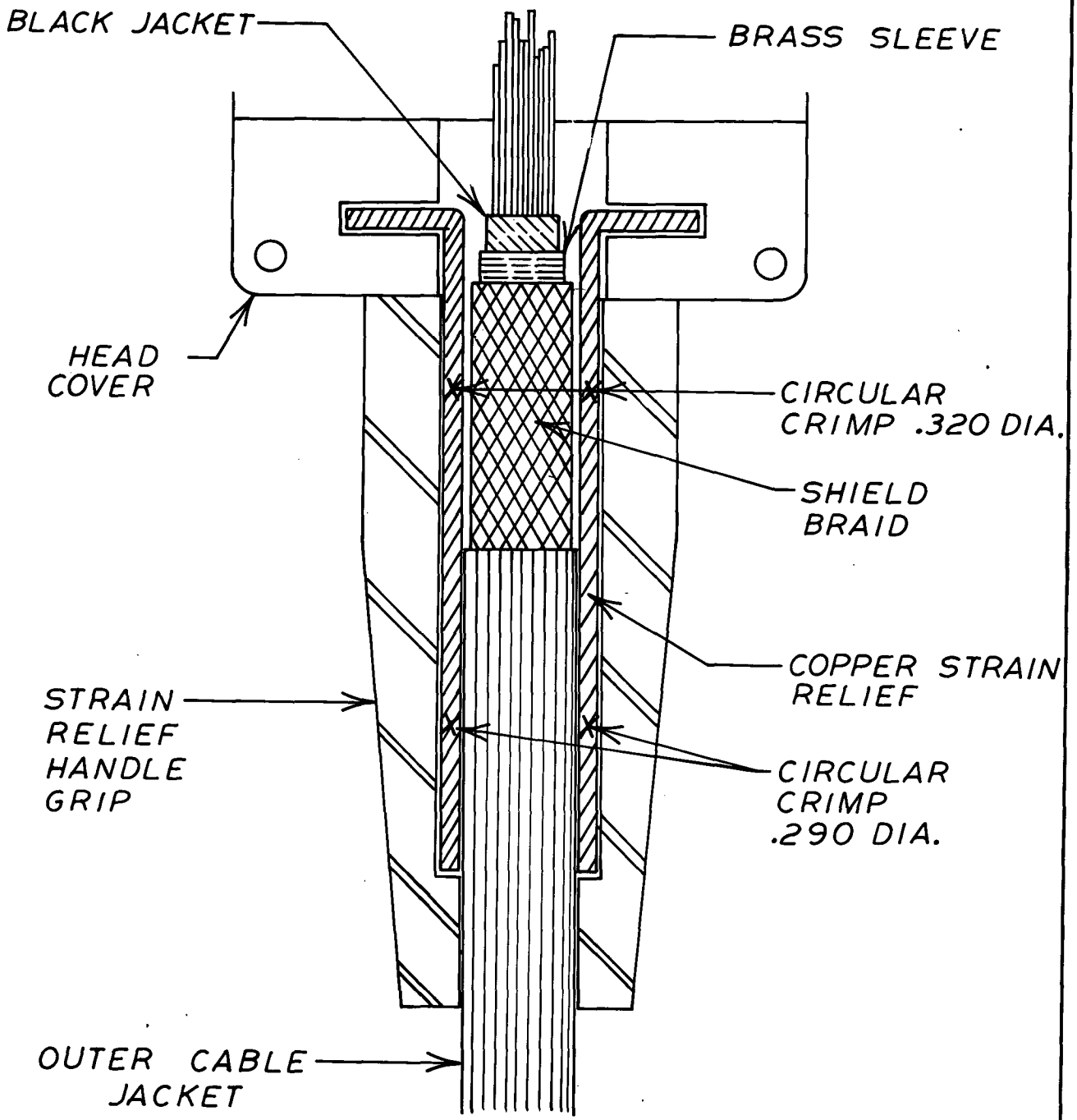
1. The outer jacket made of gray PVC will be called the gray jacket.
2. The inner jacket made of black polyethylene will be called the black jacket.
3. The braided copper shield will be called the braid.

B. Assembly

1. Cut cable stock to specified length. Make sure the cut is clean and square.
2. Slide on Strain Relief Handle Grip. (See pages 365-7 and 365-8 for designated color.)

3. Slide on copper Strain Relief.
4. Strip back gray jacket 2.5".
5. Cut braid back to .75".
6. Uncomb braid enough to insert the Brass Sleeve, chamferred end first, under the braid all the way to the gray jacket. Trim braid flush with end of Brass Sleeve.
7. Insert a 2.5" #26 AWG tinned copper wire between the braid and brass sleeve. Slide the Copper Strain Relief up flush with end of Brass Sleeve and braid, and clamp the assembly using the strain relief vice (modified Vise Grip).
8. Place the A side of the swaging tool (modified tube cutter) against the vice and gently touch the roller to the copper Strain Relief. Gradually reduce the tube diameter with this tool until the proper diameter is achieved.
9. Move the swaging tool so that the side of the roller is within 1/4" of the end of the copper Strain Relief and reduce the copper Strain Relief to the proper diameter.
10. Remove the swaged strain relief from the vice.
11. Strip back black jacket and mylar film to 1/16" from end of brass sleeve.
12. Separate wire pairs, and using the charts on page 365-7 and 365-8 cut off the unused pairs flush with the end of the black jacket.
13. Cut the wires to length using the charts on pages 365-7 and 365-8.
14. Strip the wires 1/8" using extreme care not to nick the wires. This is similar to preparation of the Data Cable - see 370-2 and 370-3.

15. Place the cable in the window cover (see page 365-11), the P.C. board (A side toward the window) then goes over that, and the short cover is then screwed to the window cover. Two screws hold the P.C. board in place.
16. Insert the wires into the proper holes from the A side using the charts on pages 365-7 and 365-8. The insulation should just touch the board. The bare wire should be covered with a teflon sleeve. There is adequate clearance that the wires may run over the components, but they must not run farther to the side of the board than the pads.
17. Solder on the B side.
18. Remove the assembly covers and replace with a set of plastic covers so that the 2-56 screws enter from the A side of the P.C. board.



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: CABLE ASSEMBLY

CHANGE NO.	DATE	DESCRIPTION
ISS		

APPROVED BY	FOR	DATE
RJA	PROD	10-4-73

ENG: RJA
DRAWN BY: PLL
CHECKED: GM
DRAWING NO.: 365-6
DATE: 9-11-73

FUNCTION CALLER CABLE

RECEIVING END - WCL0211-2

HOLE #	COLOR PAIR	WIRE LENGTH	NAME
1	Blue	1.4	N-L
2	Yellow	1.3	N-H
3	Blue	1.2	Y-L
4	Violet	1.1	Y-H
5	Orange	1.0	I-L
6	Violet	.9	I-H
7	Orange	.7	FN_3-L
8	Red	.7	FN_3-H
9	Blue	.7	FN_2-L
10	Red	.7	FN_2-H
11	Yellow	.7	FN_1-H
12	Slate	.7	FN_1-L
13	Yellow	.7	FN_0-H
14	Orange	.7	FN_0-L
15	Bare	.8	Gnd.

HANDLE GRIP COLOR - BLACK

SEE DRAWING NO. 364-6 FOR HOLE LOCATIONS

CHG.	E.C.O.	DATE	APPR
A	0298	10-24-73	MLP

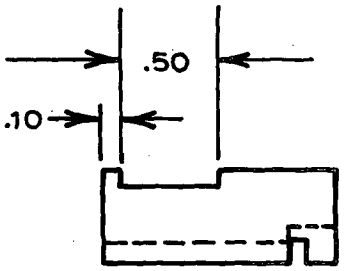
FUNCTION CALLER CABLE

TRANSMITTING END - WCL0213-2

HOLE #	COLOR PAIR	WIRE LENGTH	NAME
1	Blue	1.4	N-L
2	Yellow	1.3	N-H
3	Blue	1.2	Y-L
4	Violet	1.1	Y-H
5	Orange	1.0	I-L
6	Violet	.9	I-H
7	Orange	1.4	FN_0-L
8	Yellow	1.3	FN_0-H
9	Slate	1.2	FN_1-L
10	Yellow	1.1	FN_1-H
11	Blue	1.0	FN_2-L
12	Red	1.0	FN_2-H
13	Orange	.9	FN_3-L
14	Red	.8	FN_3-H
15	Bare	1.5	Gnd.

HANDLE GRIP COLOR - GREEN

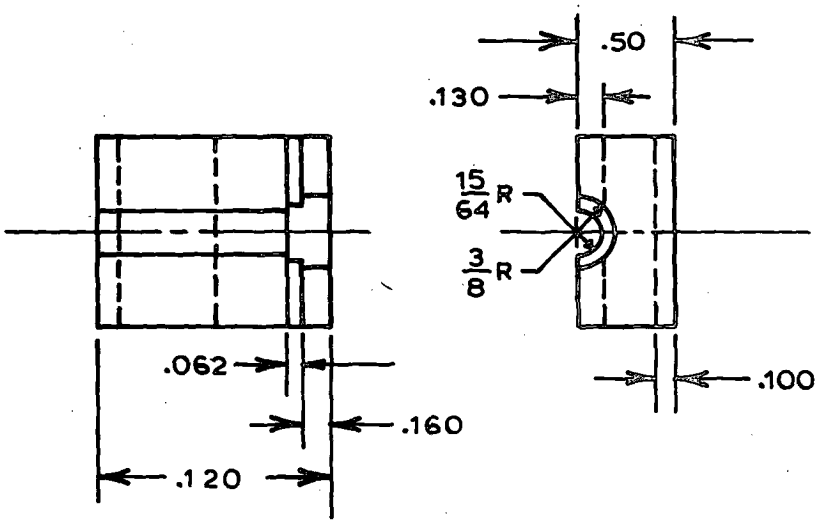
SEE DRAWING NO. 364-11 FOR HOLE LOCATIONS

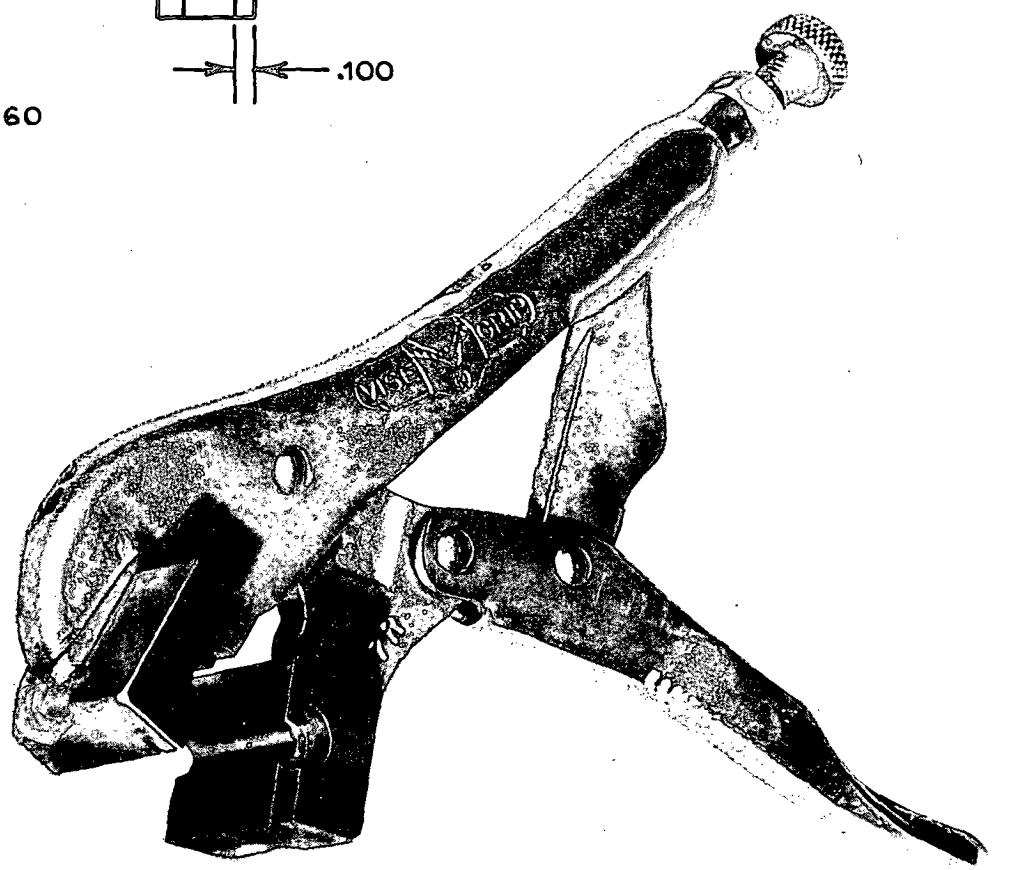


COPPER STRAIN RELIEF VICE JAW
2 REQ'D.
MAT'L. CRS

DIMENSIONS U.O.N.

.XXX ±.005
.XX ±.010
$\frac{X}{X} \pm \frac{1}{64}$



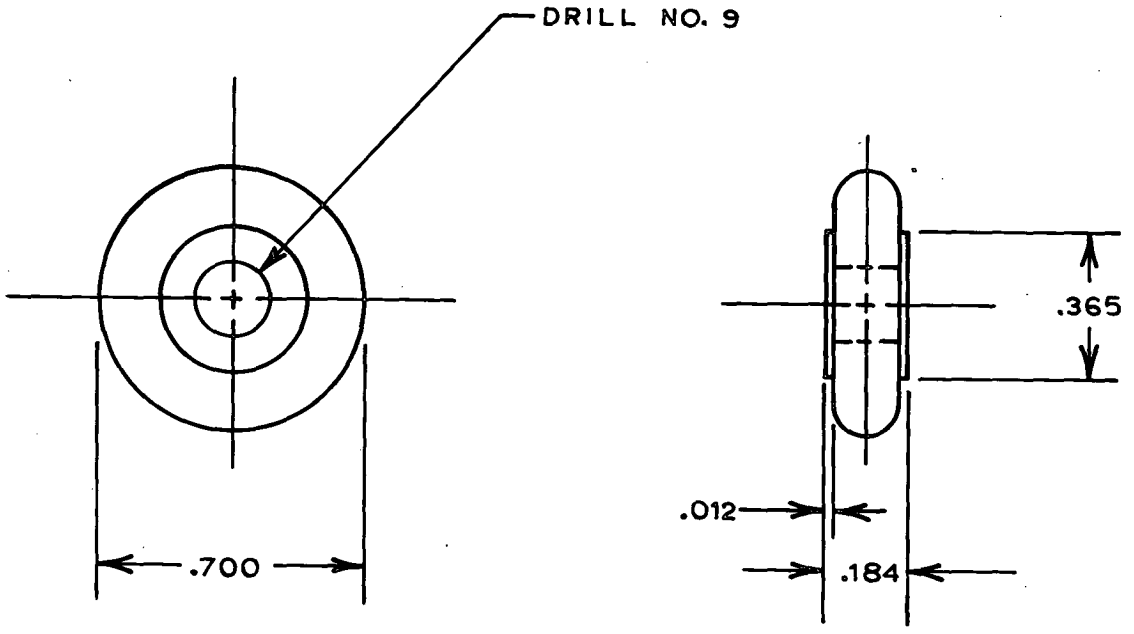


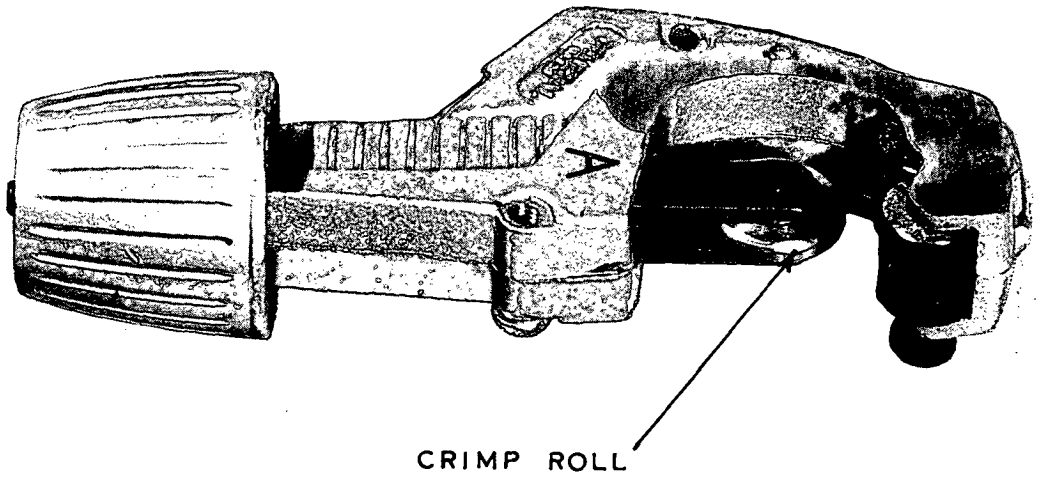
COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE COPPER STRAIN RELIEF VICE				
			APPROVED			ENG RJA	DRAWING NO. 365-9
			BY RJA	FOR PROD	DATE 10-4-73	DRAWN BY PLL	
ISSUE						CHECKED GM	DATE 9-17-73
CHANGE NO.	DATE	DESCRIPTION					

CRIMP ROLL

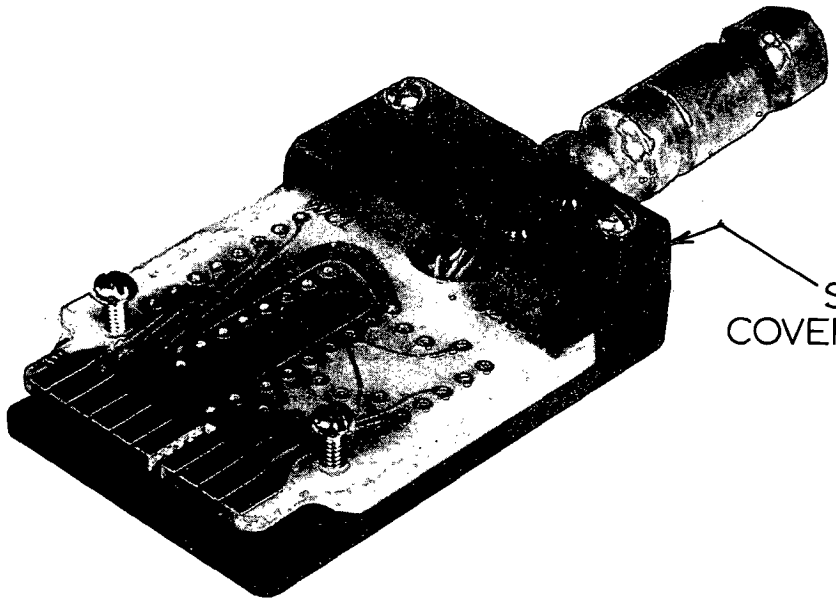
MAT'L: HEAT TREATED AND TEMPERED DRILL ROD

DIMENSIONS ±.005 U.O.N.

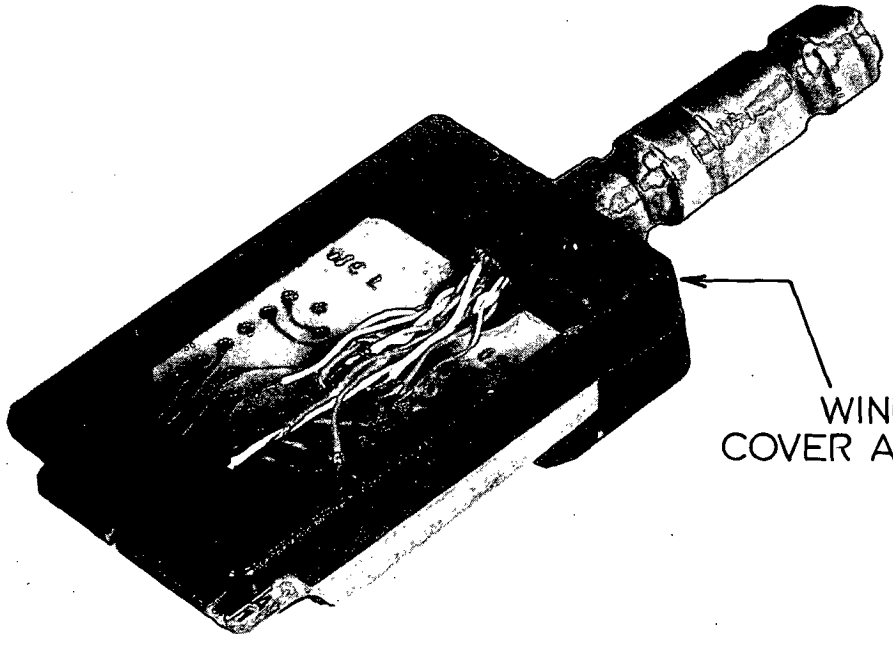




COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT		
			TITLE: SWAGING TOOL		
			APPROVED BY: RJA	FOR: PROD	DATE: 10-1-73
			ENG: RJA	DRAWN BY: PLL	CHECKED: [signature]
			DRAWING NO.: 365-10	DATE: 9-17-73	
ISSUE					
CHANGE NO.	DATE	DESCRIPTION			



SHORT HEAD
COVER ASSEMBLY JIG



WINDOW HEAD
COVER ASSEMBLY JIG

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
WINDOW AND SHORT HEAD COVER ASSEMBLY JIGS

APPROVED			ENG	DRAWING NO
BY	FOR	DATE	RJA	
RJA	PROD	10-4-73	DRAWN BY GWP	365-11
			CHECKED GM	DATE 9-26-73

CHANGE NO	DATE	DESCRIPTION
ISS		

PEDESTAL AC POWER CABLE

CHG.	E.C.O.	DATE	APPR	CHG	E.C.O.	DATE	APPR	CHG.	E.C.O.	DATE	APPR.
ISS		10-3-72									

PARTS LIST

QTY.	C.S.L. DOC.	PART
1	—	RECEPTACLE, AMPHENOL 60-F
1	—	SHELL, AMPHENOL 3-858
1	—	CABLE, BELDEN 14629S (9 ft.) or 17635S (15 ft.)

ASSEMBLY

1. Screw the two halves of an Amphenol shell together and ream the small end to a 17/32 inch diameter. Then tap the hole with 9/16-12 threads.

2. Strip the black insulation on a Belden cable back one inch. Strip the insulation on each of the three conductors back 0.5 inch.

3. Solder the three cable conductors to an Amphenol receptacle as follows:

   Black wire - Pin 1
   White wire - Pin 2
   Green wire - Pin 3G

4. Mount the shell on the receptacle. Note indexing slot on receptacle.

MACROMODULAR DATA CABLE

CHG.	E.C.O.	DATE	APPR	CHG.	E.C.O.	DATE	APPR	CHG.	E.C.O.	DATE	APPR.
re-issue	0179	5–12–71	DCJ								
A	0193	5–28–71	DCJ								
B	0244	1–6–72	DCJ								
C	0277	12-7-72	DCJ								

ASSEMBLY SPECIFICATION

MACROMODULAR DATA CABLE

I. Introduction

This specification describes a cable and connector assembly which will carry high speed digital data in a modular computer system. This "Data Cable" consists in general of a length of multiconductor, jacketed cable terminated by identical connectors on each end.

II. Cable Stock

The jacketed cable was produced by Brand Rex Division of Akzona Corporation, Willimantic, Connecticut, to meet CSL Specification CAS-5 (Model C Data Cable). The cable is completely described by CAS-5. (Refer to Document 010).

III. Stripping and Crimping

The stripping specification of 0.125--0.150 inches is very critical to the long term reliability of the Data Cable. Failures in early assemblies were traced to cases in which the wire insulation entered the crimp portion of the contact barrel. These failures were position sensitive, and the assemblies were initially able to pass the electrical specification.

The second requirement on strip length is that the insulation shall tuck into the rear of the contact barrel, in order to support the tiny #30 AWG. wire during the assembly operation.

CHG.	E.C.O.	DATE	APPR.
Re-Iss	0179	5-13-71	RCJ

The manufacturer of the data cable assemblies shall demonstrate a technique for wire stripping which will consistently meet the stripping tolerance, and samples shall be supplied to CSL for approval before any production is undertaken. While the manufacturer is free to devise any technique applicable to his particular circumstances, the following comments may prove helpful.

The Clauss Cutlery Company makes a small hand operated stripping tool which gives good results on #30 wire when properly sized. The .014 No-Nik tool consistently strips the insulation without deforming the wire. A small wire stop jig has been designed which can be riveted to the No-Nik tool, and in the hands of a careful operator, the required stripping tolerance has been met.

All wires shall be crimped with acceptable tooling as shown in the tooling chart, or equivalent automatic tooling. The settings of the tools shall be determined by a simple pull test. The wire shall break consistently at, or near the crimp; after noticeable elongation. An optimum crimped termination has 70% of the tensile strength of the wire.

TOOLING CHART

MANUFACTURER	TOOL
BUCHANAN	612596 CRIMP TOOL
BUCHANAN	613381 LOCATOR

CHG.	E.C.O.	DATE	APPR.
C	0277	12-7-72	

CONNECTORS AND VARIATIONS

Connectors

The connectors on each of the two ends of the cable are special versions of an Amphenol ASTRO-348 with a 14-37 insert. The entire connector is available under Amphenol part number 348-7011-1 and is shown on the drawing 370-6.

Reference drawings of the connector parts are included here to facilitate the engineering of special purpose cables. The drawings are not intended, but may be used, to manufacture the parts shown.

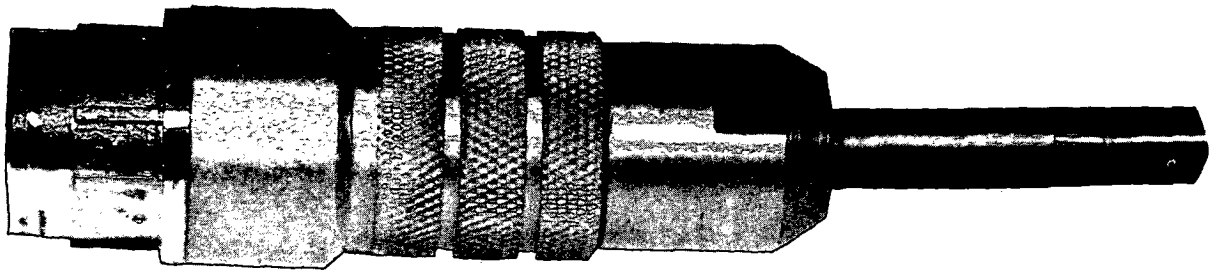
Variations

All cables shall be identical except in length. The length is defined as the measurement from end to end of the cable stock, before stripping and termination. The tolerance on length shall be ± 1/2 inch.

The cables shall be constructed in the following lengths:

1. 16 inches
2. 26 inches
3. 36 inches
4. 46 inches
5. 66 inches
6. 96 inches
7. 126 inches
8. 246 inches

CHG.	E.C.O.	DATE	APPR.
Re-Iss	0179	5-13-71	RCJ



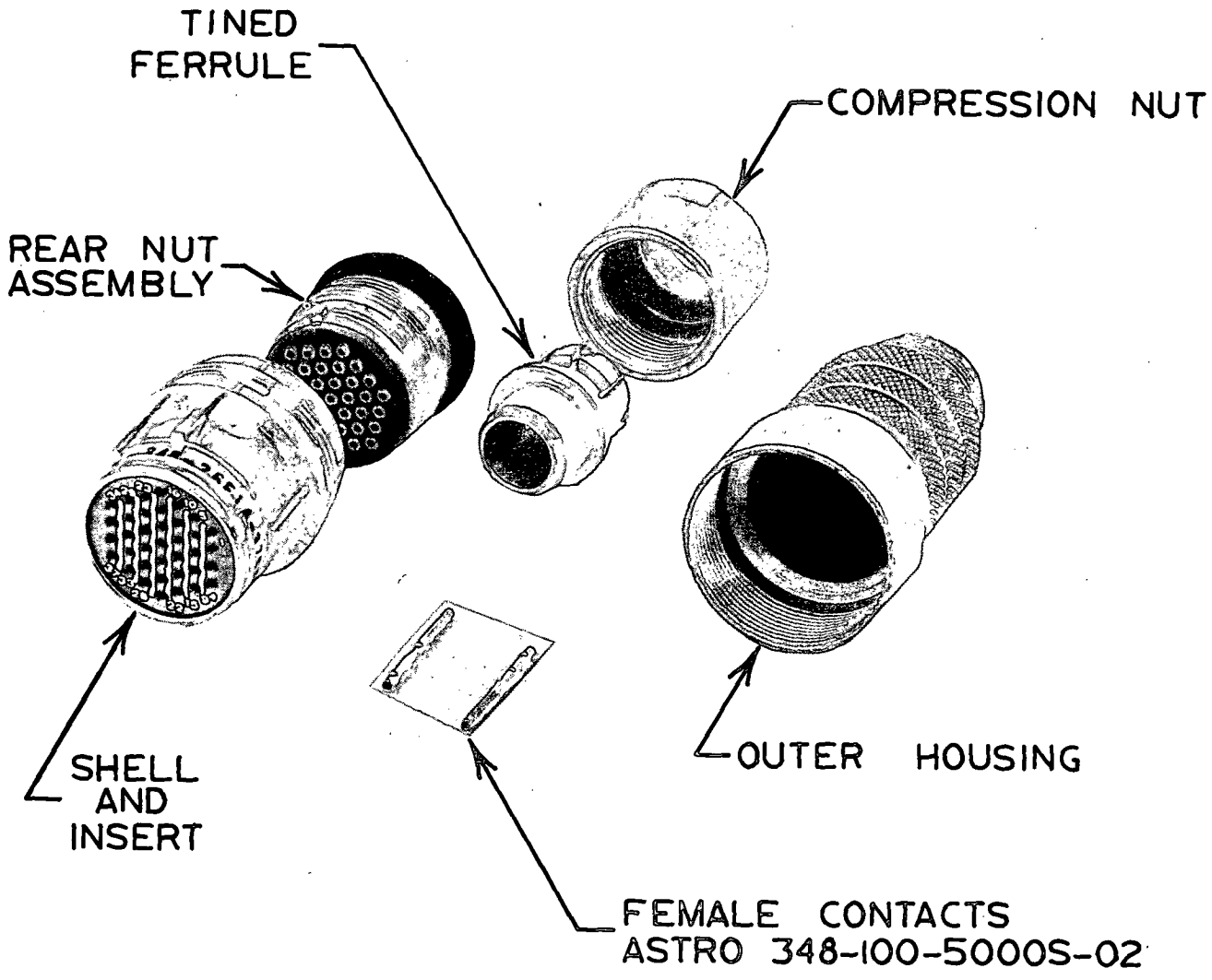
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
DATA CABLE HEAD

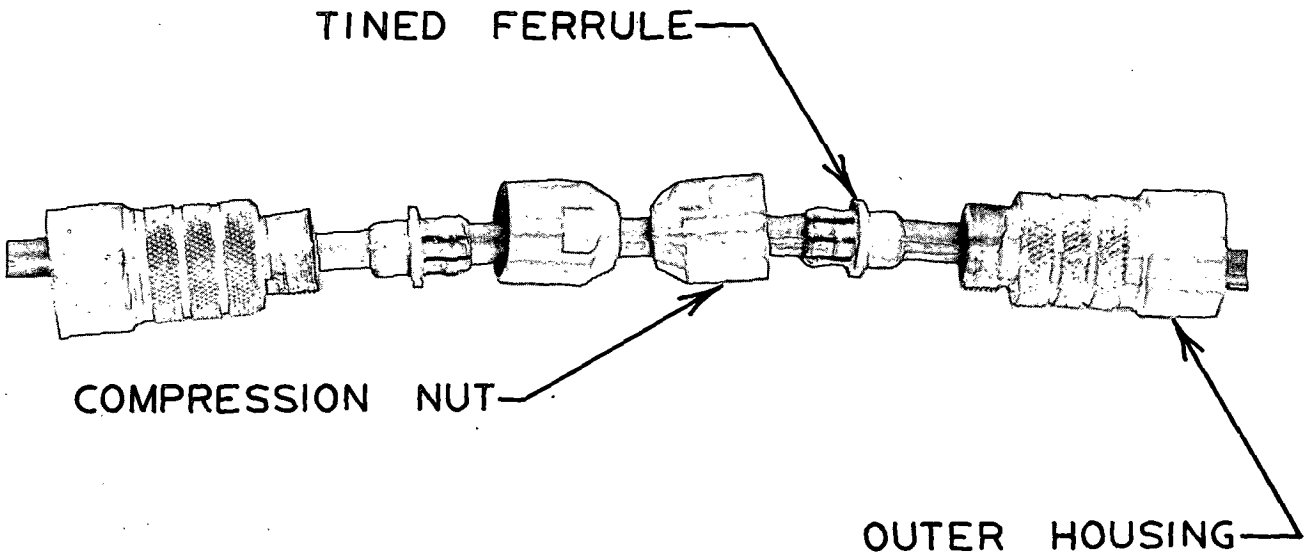
CHANGE NO.	DATE	DESCRIPTION
RE-155	5-13-71	E.C.O. 0179 GCJ

APPROVED			ENG	DRAWING NO.
BY	FOR	DATE	GCJ	370-5
GCJ	PROD.	12-7-70	DRAWN BY DLS	
			CHECKED GCJ	DATE 12-7-70



AMPHENOL ASTRO 348-7011-1

COMPUTER SYSTEMS LABORATORY WASHINGTON UNIVERSITY ST. LOUIS, MISSOURI			MACROMODULAR PROJECT				
			TITLE: ASTRO 348 PARTS				
			APPROVED			ENG GCJ	DRAWING NO. 370-6
			BY	FOR	DATE		
RE-ISS	5-13-71	E.C.O. 0179 gcj	gcj	PROD.	5-13-71	DRAWN BY GWP	
CHANGE NO.	DATE	DESCRIPTION				CHECKED gcj	DATE 5-13-71



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: ASSEMBLY SEQUENCE PICTORIAL

CHANGE NO.	DATE	DESCRIPTION
RE-155	5-13-71	E.C.O. 0179 DCJ

APPROVED BY	FOR	DATE
DCJ	PROD.	5-13-71

ENG GCJ
DRAWN BY GWP
CHECKED DCJ

DRAWING NO. 370-7
DATE 5-13-71

Assembly Sequence

1. Cut cable to length as defined above.
2. Slide on 2 Compression Nuts.
3. Slide on 2 Tined Ferrules. Spread tines if necessary to prevent scoring of outer jacket. Be tender, the tines are easily broken.
4. Slide on 2 Outer Housings. Drawing 370-7 shows assembly at this stage.

Do These Operations To Both Ends of Cable

5. Cut back outer jacket 2 1/4 inches.
6. Cut away all but 1/2 inch of shield.
7. Comb out shield, using a dull instrument such as a lead pencil, fold back and tape.
8. Remove all but 1/2 inch of black polyethylene inner jacket.
9. Remove mylar tape. Dwg. 370-11.
10. Carefully isolate individual twisted pairs. Dwg. 370-12.
11. Untwist pairs to obtain 1 1/2 inch of free wire for stripping.
12. Trim ends of wires 1/8 inch to eliminate damage from cable cutting operation.
13. Strip individual conductors (.125--.150 inches). (This strip length is critical.)

CHG.	E.C.O.	DATE	APPR.
Re-Iss	0179	5-13-71	DCJ

14. Crimp contacts onto wires. Inspect to assure that all wires are visible in the crimp inspection port.
15. Insert contacts into rear nut-retention disc assembly per wiring list. Place uncrimped contact into location 5.
16. Place completed disc assembly into modified ASTRO-348 connector Shell.
17. Complete assembly by screwing rear nut into the Connector Shell--tighten until nut bottoms with channelock pliers.
18. After the assembly of the rear nut, bend the two bare wires into the recess between the rear nut and the Connector Shell. Solder the wires. Take care that the wires are dressed as close as possible to the outer diameter of the nut.
19. Slide Outer Housing forward, and screw onto Connector Shells and tighten with special thin wrench.
20. Remove tape from shield wire.

Final Operations - do to each end in sequence.

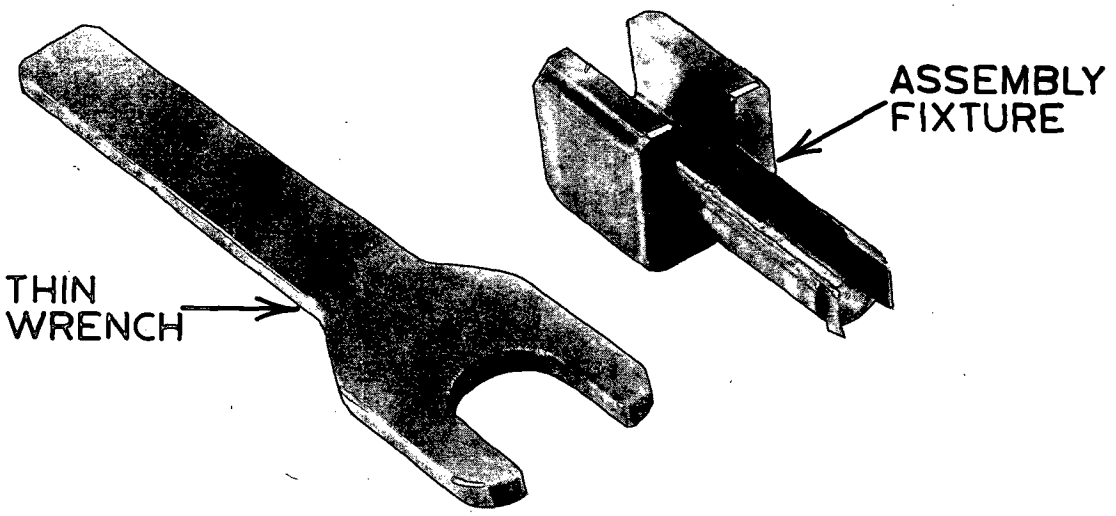
Slide the Tined Ferrule forward (Picture 370-13) until the front end is flush with the cut surface of the cable jacket. Using a preset pair of VISE-GRIP pliers, compress the side tines carefully. - Picture 370-14. Move the Compression Nut forward and insert Assembly Fixture into Nut. Mate Fixture with slots in Ferrule. Use finger pressure or pliers to achieve mating.

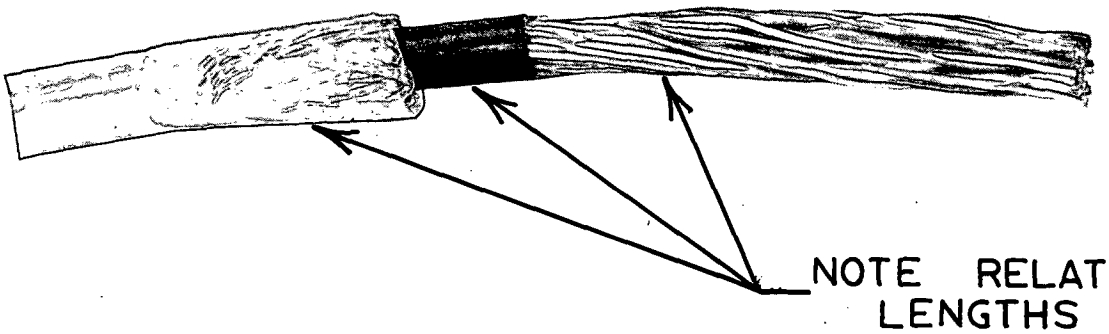
Fold shield wires back symmetrically, and trim wires short of shoulder. Push Ferrule and Fixture into contact with the Outer

Housing. Apply axial pressure to the assembly, and support with a vise or special fixture - Picture 370-15.

Move Compression Nut along barrel of Assembly Fixture and tighten nut with wrench.

The Assembly Fixture must remain mated until the Compression Nut is fully tightened. The Ferrule must not be allowed to rotate at any time during assembly. If the Fixture does slip - more axial force must be applied in the preceding assembly step.





COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

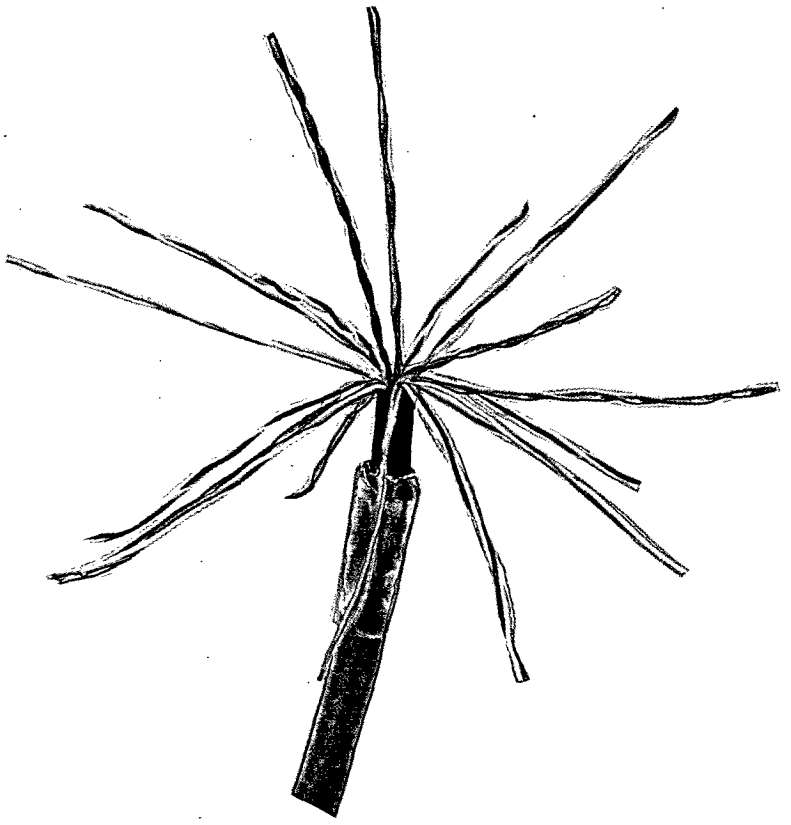
TITLE
TOOLS AND PREPARED CABLE

CHANGE NO.	DATE	DESCRIPTION
RE-155	5-13-71	E.C.O. 0179 RCJ

APPROVED BY	APPROVED FOR	APPROVED DATE
RCJ	PROD.	5-13-71

ENG GCJ
DRAWN BY GWP
CHECKED RCJ

DRAWING NO. 370-11
DATE 5-13-71



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE

PAIR ISOLATION

CHANGE NO.	DATE	DESCRIPTION
RE-ISS	5-13-71	E.C.O. 0179 rcf

APPROVED BY	APPROVED FOR	APPROVED DATE
rcf	PROD.	5-13-71

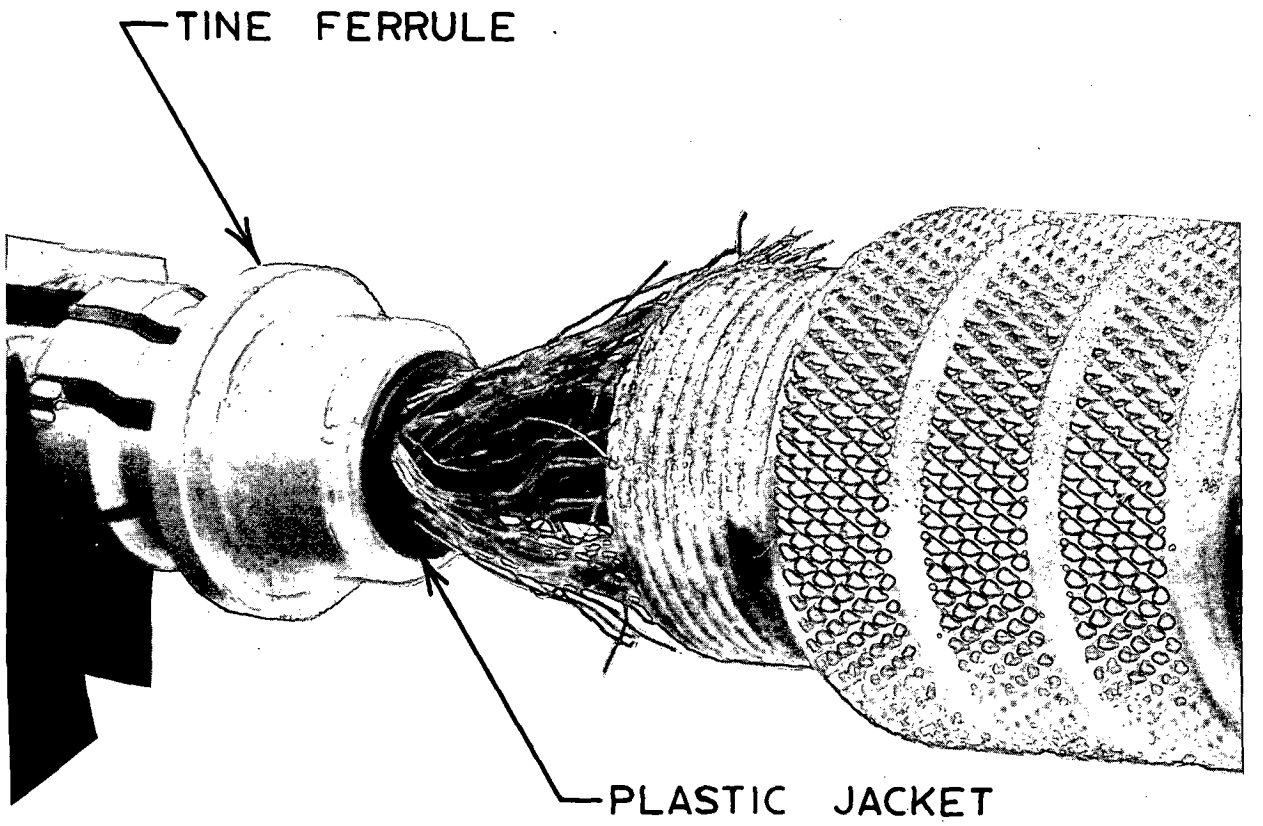
ENG GCJ

DRAWN BY GWP

CHECKED rcf

DRAWING NO. 370-12

DATE 5-13-71



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

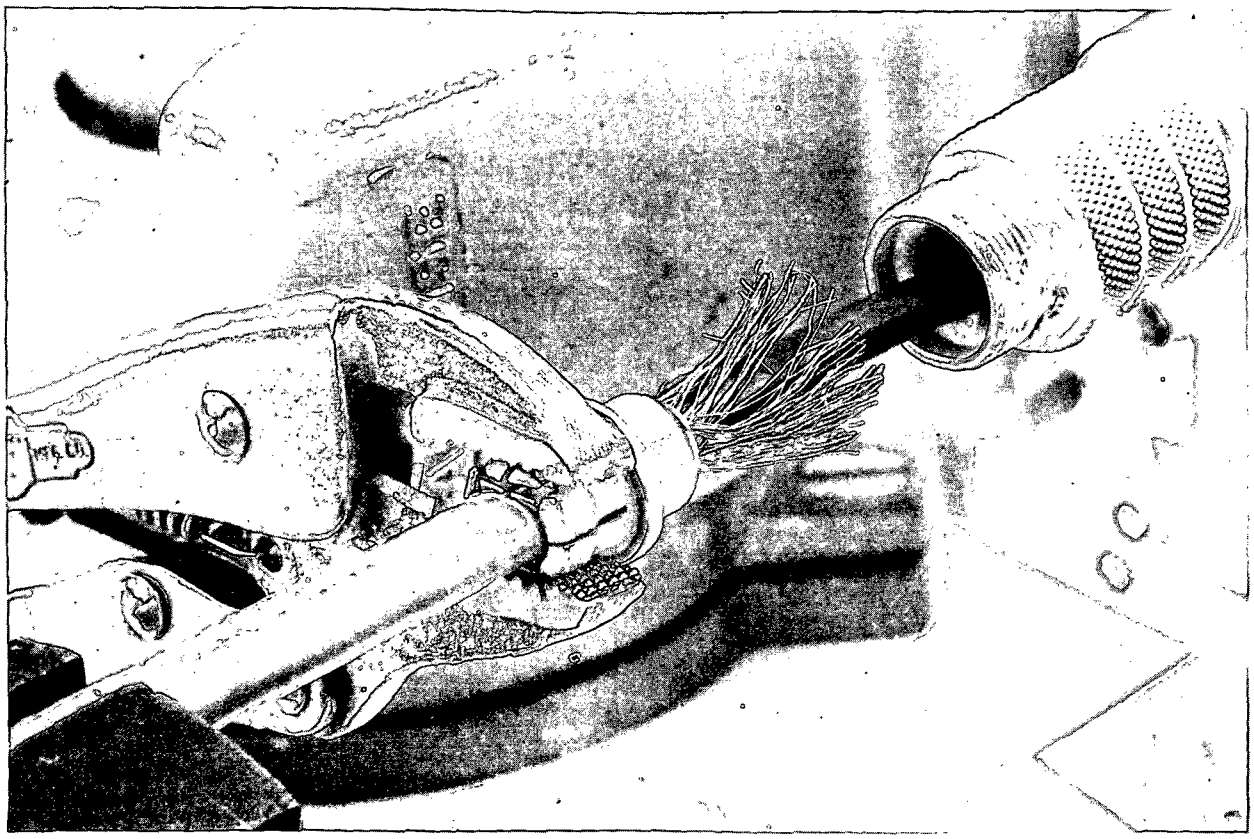
MACROMODULAR PROJECT

TITLE: POSITION OF FERRULE AND CABLE

CHANGE NO.	DATE	DESCRIPTION
RE-155	5-13-71	E.C.O. 0179 gcj

APPROVED BY	FOR	DATE
gcj	PROD.	5-13-71

ENG: GCJ
DRAWN BY: GWP
CHECKED: gcj
DRAWING NO.: 370-13
DATE: 5-13-71



COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

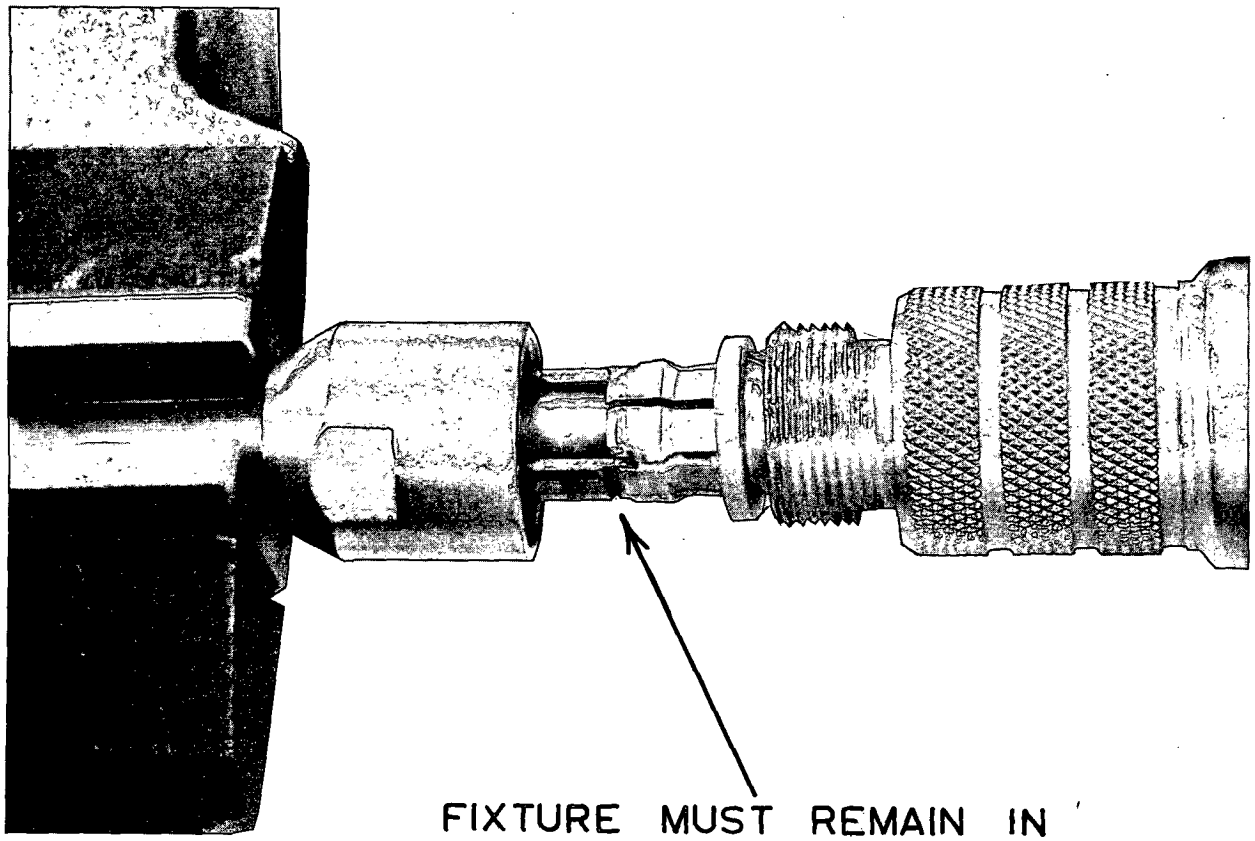
TITLE
TINE COMPRESSION

CHANGE NO.	DATE	DESCRIPTION
RE-ISS	5-13-71	E.C.O. 0179 GCJ

APPROVED BY	APPROVED FOR	APPROVED DATE
GCJ	PROD.	5-13-71

ENG GCJ
DRAWN BY GWP
CHECKED GCJ

DRAWING NO. 370-14
DATE 5-13-71



FIXTURE MUST REMAIN IN CONTACT WITH FERRULE UNTIL NUT IS FULLY TIGHTENED.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE
MATED ASSEMBLY FIXTURE

CHANGE NO.	DATE	DESCRIPTION
RE-ISS	5-13-71	E.C.O. 0179 GCJ

APPROVED BY	APPROVED FOR	APPROVED DATE
GCJ	PROD.	5-13-71

ENG GCJ
DRAWN BY GWP
CHECKED GCJ

DRAWING NO. 370-15
DATE 5-13-71

Testing

The cable shall be tested for continuity and shorts as follows:

1. Each pin shall be connected to the pin of the same number on the opposite end with a resistance of less than one ohm. Exception--Pin 5 shall be open.
2. Each pin shall be isolated from all other pins by a resistance greater than one megohm.
3. The Outer Housing shall be connected to pins 29 and 22 by a resistance of less than 0.5 ohm.

CHG.	E.C.O.	DATE	APPR.
Re-Iss	0179	5-13-71	RCJ

DCBP,1 LN=1

DATA CONNECTOR BY PIN

PIN NUMBERS ARE THOSE PRINTED ON THE FACE OF THE ASTRO 348 CONNECTOR

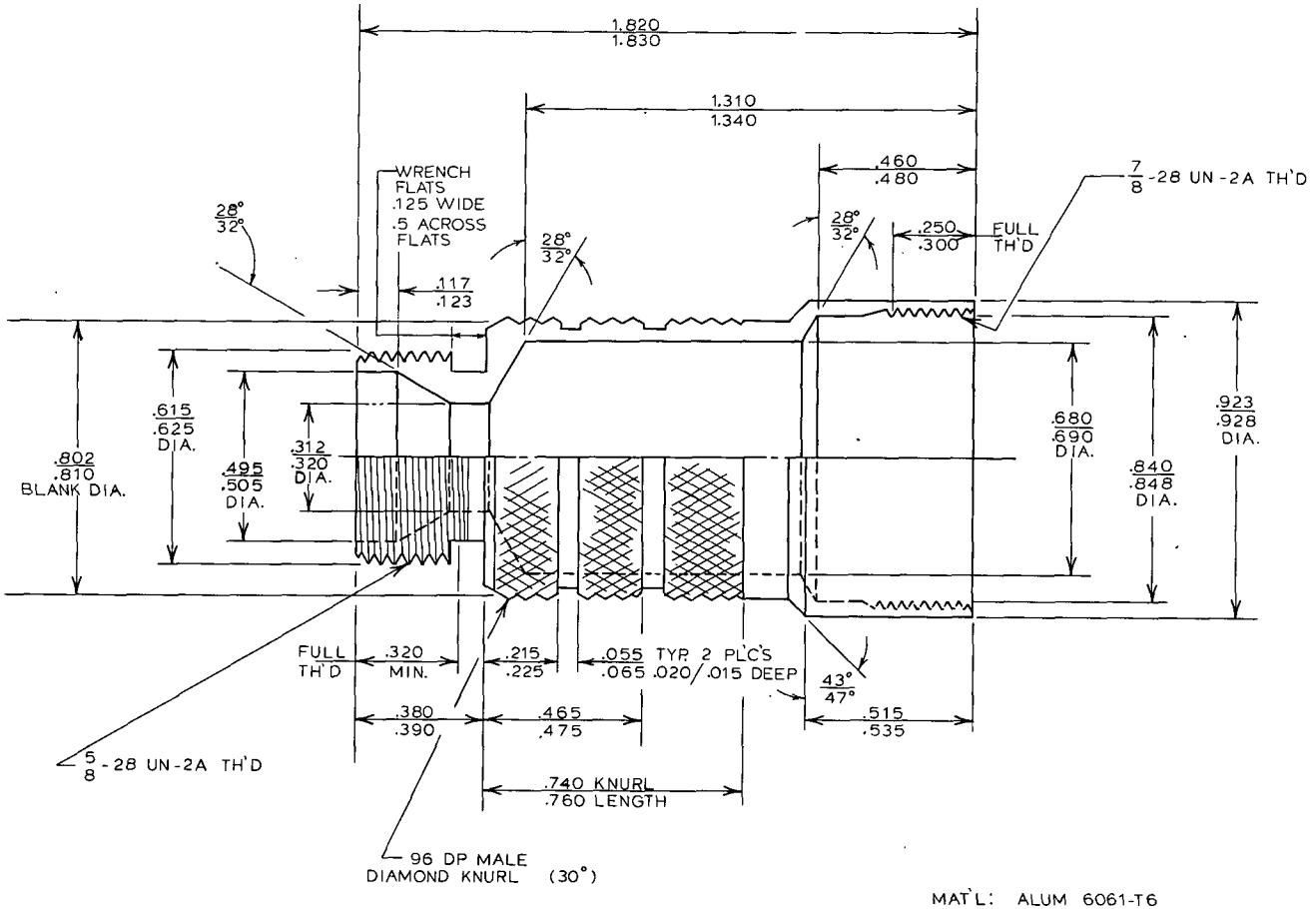
PIN	NAME	COLOR
1	SPARE 1	RED
2	SPARE 2	SLATE
3	SPARE 3	YELLOW
4	SPARE 4	BLUE
5	BLANK PIN	
6	D DELIVER H	VIOLET
7	D DELIVER L	ORANGE
8	BIT 11 H	WHITE
9	BIT 11 L	ORANGE
10	BIT 8 H	WHITE
11	BIT 8 L	BROWN
12	BIT 9 H	WHITE
13	BIT 9 L	GREEN
14	BIT 10 H	RED
15	BIT 10 L	GREEN
16	BIT 6 H	YELLOW
17	BIT 6 L	GREEN
18	DD RETURN H	VIOLET
19	DD RETURN L	BLUE
20	BIT 7 H	YELLOW
21	BIT 7 L	BROWN
22	#28 AWG BARE WIRE 3 INCHES LONG	
23	BIT 3 H	RED
24	BIT 3 L	ORANGE
25	BIT 4 H	RED
26	BIT 4 L	BROWN
27	BIT 5 H	WHITE
28	BIT 5 L	SLATE
29	#28 AWG BARE WIRE 3 INCHES LONG	
30	BIT 1 H	YELLOW

CHG.	E.C.O.	DATE	APPR.
Re-Iss	0179	5-13-71	JCJ

```
DCBP,2  LN=71


     31     BIT 1 L    SLATE
     >>>>>>>>>>>>>>>>
     32     BIT 2 H    RED
     33     BIT 2 L    BLUE
     >>>>>>>>>>>>>>>>
     34     SPARE 5    WHITE
     35     SPARE 6    BLUE
     >>>>>>>>>>>>>>>>
     36     BIT 0 H    YELLOW
     37     BIT 0 L    ORANGE
     >>>>>>>>>>>>>>>>
     END OF LIST

[DCBP
[GERALD C JOHNS
[8 DECEMBER 1970
```



MAT'L: ALUM 6061-T6

PARTS SHALL BE FINISHED AS FOLLOWS:
CADMIUM PLATE (0.0002–0.0004 INCHES THICK)
OVER NICKEL PLATE (0.0001–0.0002 INCHES THICK)
FOLLOWED BY CLEAR CHROMATE CONVERSION.

CHANGE NO.	DATE	DESCRIPTION
A	5-28-71	E.C.O. 0193
RE-ISS	5-13-71	E.C.O. 0179

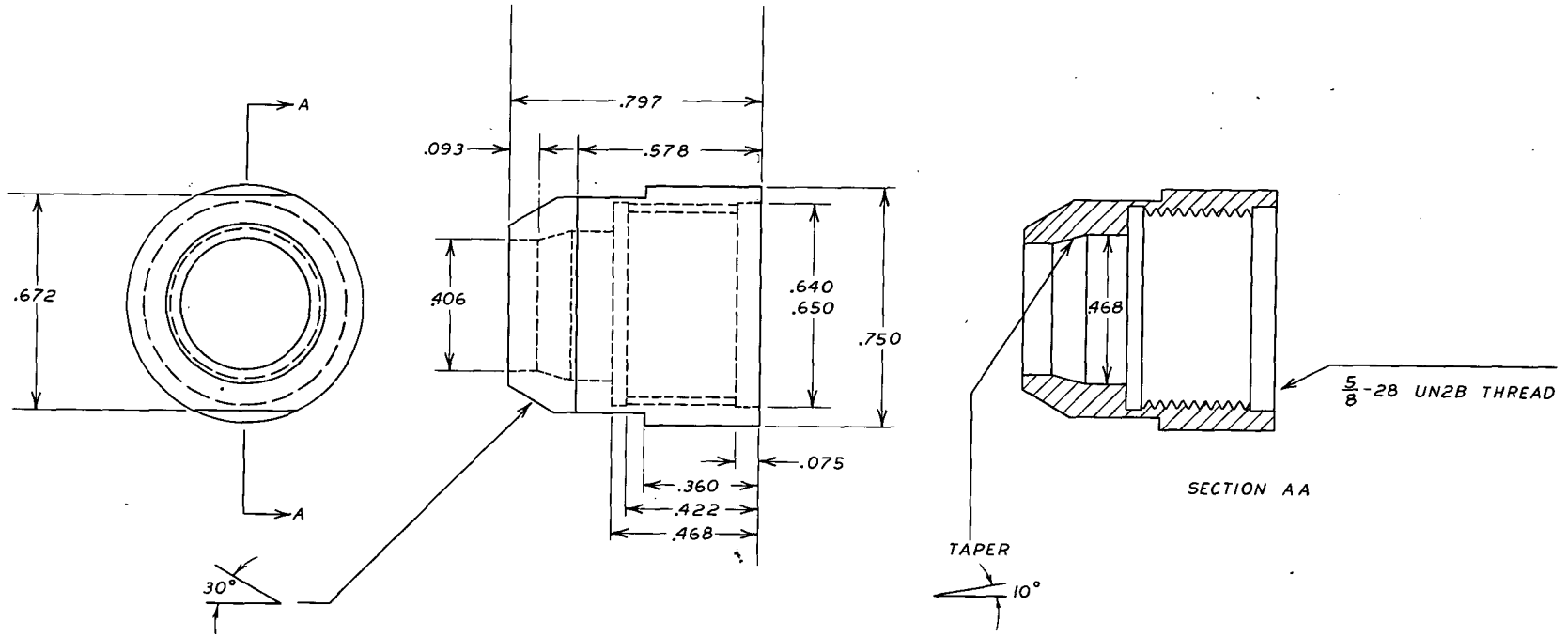
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: OUTER HOUSING

APPROVED BY	FOR	DATE
	PROD.	11-1-70

ENG. GCJ
DRAWN BY PLL
CHECKED
DRAWING NO. 370-19
DATE 10-27-70



DEBURR BREAK ALL CORNERS .010
DIMENSIONS: ±.005 U.O.N.
MAT'L: 6061-T6 ALUM

TAPERS ± 2°

PARTS SHALL BE FINISHED AS FOLLOWS:
CADMIUM PLATE (0.0002–0.0004 INCHES THICK)
OVER NICKEL PLATE (0.0001–0.0002 INCHES THICK)
FOLLOWED BY CLEAR CHROMATE CONVERSION.

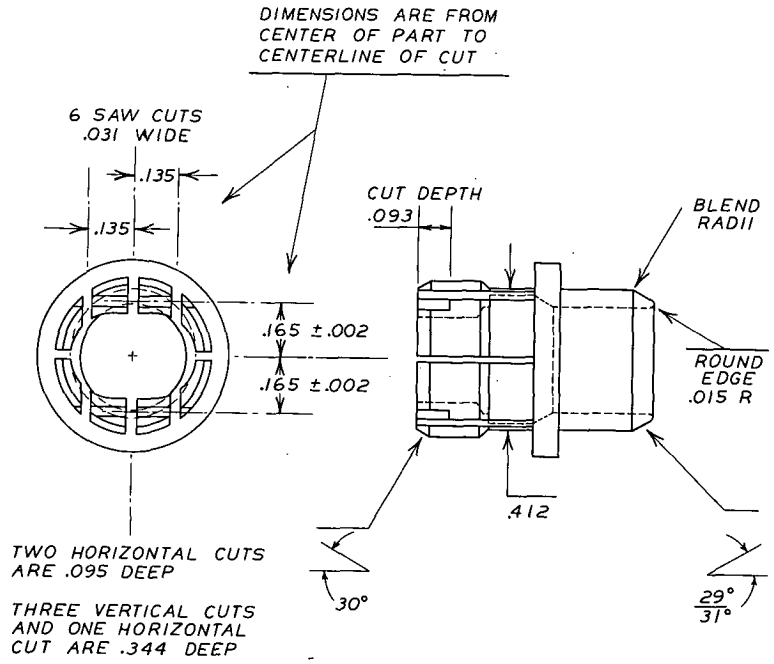
CHANGE NO.	DATE	DESCRIPTION
A	5-28-71	E.C.O. 0193 GCJ
RE-155	5-13-71	E.C.O. 0179 GCJ

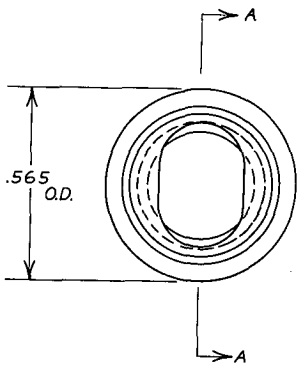
COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

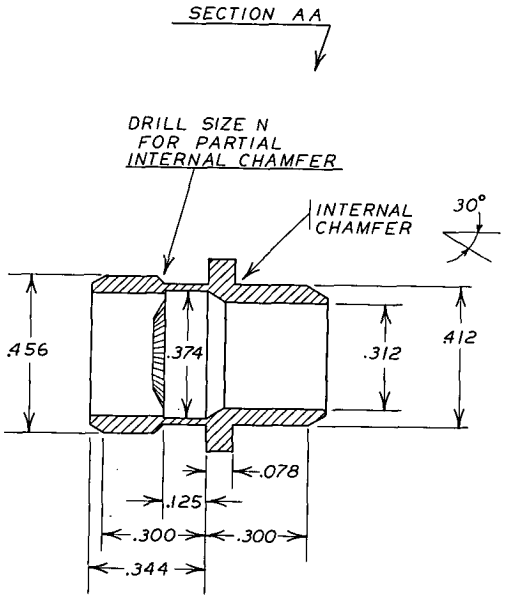
MACROMODULAR PROJECT

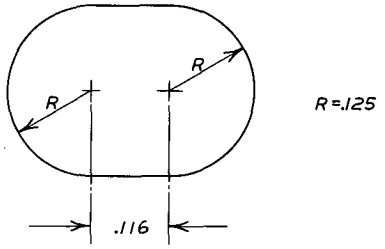
TITLE
COMPRESSION NUT

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
GCJ	PROD	11-1-70	GCJ	370-20
			DRAWN BY PLL	
			CHECKED GCJ	DATE 9-15-70









DEBURR, BREAK EDGES 0.010
DIMENSIONS: ± .005 U.O.N.
ALL ANGLES: ± 2 DEGREES
EXCEPT AS NOTED
MATERIAL: 6061-T6 ALUM

PARTS SHALL BE FINISHED AS FOLLOWS:
CADMIUM PLATE (0.0002–0.0004 INCHES THICK)
OVER NICKEL PLATE (0.0001–0.0002 INCHES THICK)
FOLLOWED BY CLEAR CHROMATE CONVERSION.

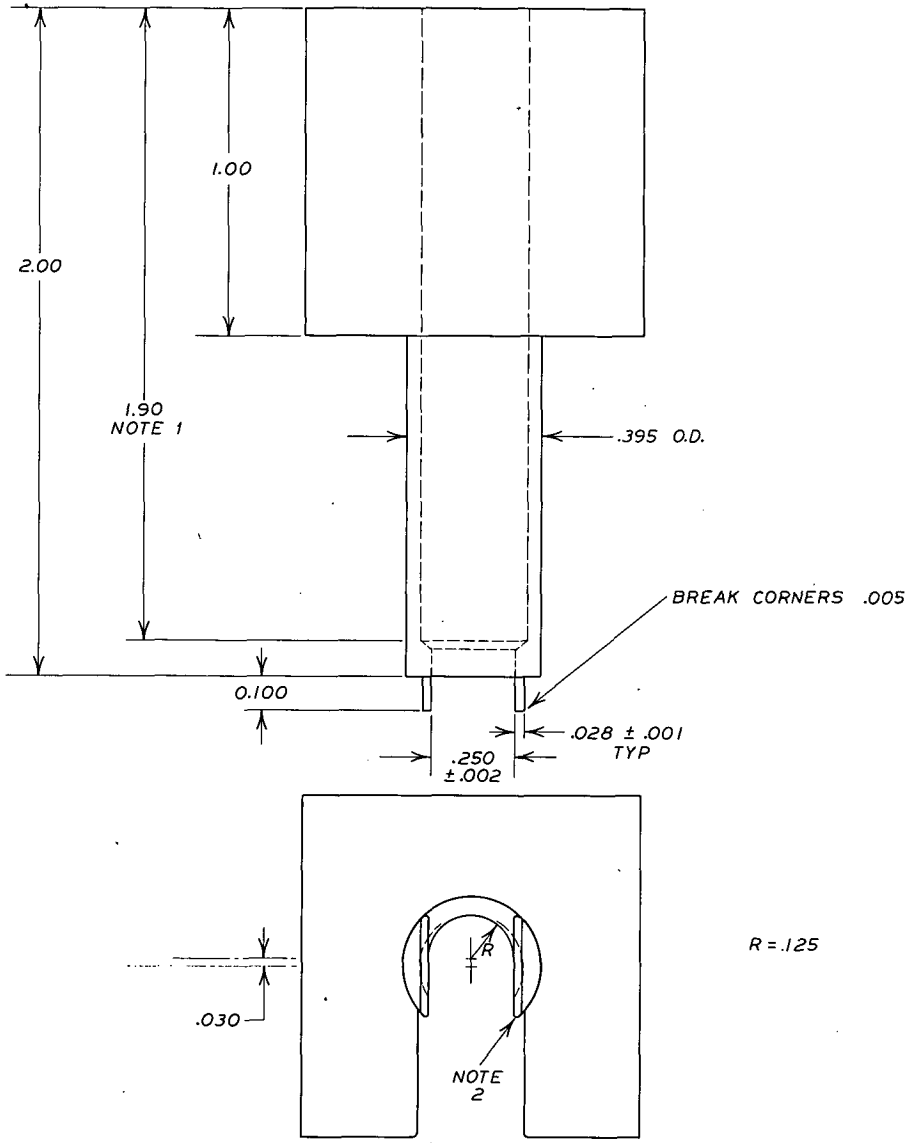
CHANGE NO.	DATE	DESCRIPTION
B	1-6-72	E.C.O. 0244 GCJ
A	5-28-71	E.C.O. 0193 GCJ
RE-ISS	5-12-71	E.C.O. 0179 GCJ

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: TINED FERRULE

APPROVED BY	APPROVED FOR	APPROVED DATE	ENG.	DRAWING NO.
GCJ	PROD	5-17-71	GCJ	370-21
			DRAWN BY PLL	
			CHECKED GCJ	DATE 5-14-71



R = .125

NOTE 1: DRILL .312 TO DEPTH SHOWN, THEN OPEN SLOT IN BLOCK.

NOTE 2: ROUND THESE CORNERS (4 INSIDE) APPROX .015 R

MAT'L: 1 INCH SQUARE BAR TOOL STEEL

DIMENSIONS ± .005 U.O.N.

CHANGE NO.	DATE	DESCRIPTION
RE-ISS	5-12-71	E.C.O. 0179 GCJ

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

TITLE: ASSEMBLY FIXTURE

APPROVED BY	FOR	DATE
GCJ	PROD.	5-17-71

ENG. GCJ
DRAWN BY PLL
CHECKED GCJ
DRAWING NO. 370-22
DATE 5-14-71

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Computer Systems Laboratory Washington University St. Louis, MO	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

CABLES

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report 4/1/65 through 12/31/73

5. AUTHOR(S) *(First name, middle initial, last name)*

Gerald C. Johns, Editor

6. REPORT DATE February, 1974	7a. TOTAL NO. OF PAGES 74	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. DOD (ARPA) Contract SD-302 b. PROJECT NO. ARPA Project Code No. 655 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) Volume XI of Part 2 9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)* Technical Report No. 40	

10. DISTRIBUTION STATEMENT

Distribution of this document is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY ARPA - Information Processing Techniques, Washington, D.C.

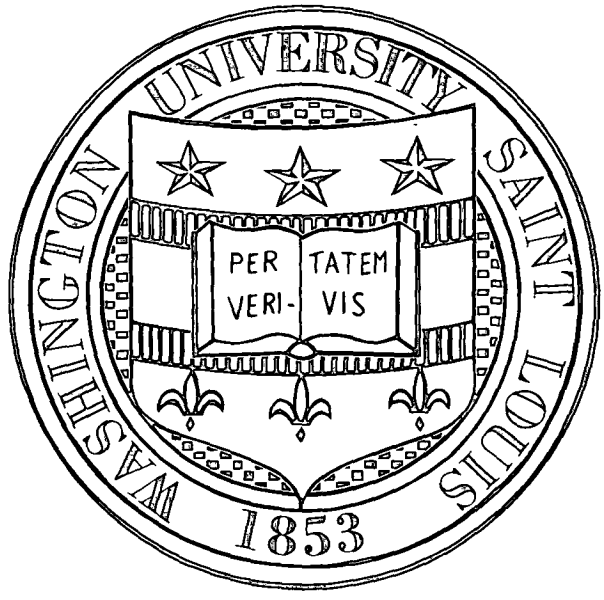
13. ABSTRACT

Manufacturing information for the construction and testing of macro-modular cables is given. Included are the DATA CABLE, CONTROL CABLE, PEDESTAL DAISY CHAIN CABLE, and FUNCTION CALLER CABLE.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Macromodule Data Cable						
Macromodule Control Cable						
Macromodule Daisy Chain Cable						
Macromodule Function Call						
Macromodule Cables						


WASHINGTON UNIVERSITY SAINT LOUIS
PER TATEM
VERI- VIS
1853