
Computer Systems Laboratory, Washington University

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Computer Systems Laboratory
Washington University
St. Louis, Missouri
ABSTRACT

The assembly procedure for the Parameter Switch, Mini Console, and LED Data Indicator is given here along with the parts lists and description of special tools required for proper assembly.
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PAGES 351-1 thru 351-35

MINI-CONSOLE
PAGES 354-1 thru 354-24

TAP BOX
PAGES 355-1 thru 355-9

L.E.D. DATA INDICATOR
PAGES 356-1 thru 356-25
## PARAMETER SWITCH

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MACROMODULAR SYSTEMS PROJECT
## PARAMETER PLUG
### PARTS LIST

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<td>Amphenol</td>
<td>Astro 348 Rear Nut</td>
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<td>1</td>
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<td>Astro 348 Shell &amp; Insert Assembly (Modified)</td>
<td>351-28</td>
</tr>
<tr>
<td>1</td>
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<td>Astro 348 Membrane Seal</td>
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<td>Amphenol</td>
<td>Astro 348 Contact Retention Disc</td>
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<td>2</td>
<td>Amphenol Cadre</td>
<td>Case Half</td>
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<tr>
<td>1</td>
<td></td>
<td>Connector Bracket</td>
<td>351-30</td>
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<td>1</td>
<td></td>
<td>Lock Nut</td>
<td>351-31</td>
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<td>4</td>
<td>Interswitch</td>
<td>MB031/A07 Thumbwheel Switch</td>
<td>351-32</td>
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<td>Interswitch</td>
<td>M2x40 Threaded Rods</td>
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<td>M2 Slotted Nuts</td>
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<td>4</td>
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<td>LTN-3 Resistor Capacitor Networks</td>
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<td>1</td>
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<td>Diode Type 013-694 Selected by Ampex</td>
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<td>1</td>
<td>ITT</td>
<td>Type 1N270 Diode (Selected)</td>
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<tr>
<td></td>
<td>Brand Rex</td>
<td>#26 AWG Kynar Insulated wire wrap wire</td>
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<tr>
<td></td>
<td></td>
<td>white and gray</td>
<td></td>
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<tr>
<td></td>
<td>Belden</td>
<td>#22 AWG Solid Tinned Bare Bus Wire</td>
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<td>37</td>
<td>Amphenol</td>
<td>348 Female Contacts, ASTRO-348-100-500S-02</td>
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<td>1</td>
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<td>2-56 x 1/4 S.S.F.H. Socket Screws Special Tools</td>
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<td>1</td>
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<td>Slotted Screwdriver</td>
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<td>Turret Wrench</td>
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<td>Assembly Fixture and dummy blocks</td>
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### Change Log

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</table>
PARAMETER PLUG

ASSEMBLY SPECIFICATION

I. INTRODUCTION

The Parameter Plug is used as a static 12 bit input device. The desired data value is set into a bank of four thumbwheel switches mounted in a plug-in case. See page 351-4 for an overall view. The ASTRO-348 connector on the rear of the case allows communication with any data input port in a Macromodular computer.

This specification will describe the internal components and the assembly sequence.

II. COMPONENTS

The ASTRO-348 Connector is made up of a subset of parts from a 348-40E14-37S1 connector. The parts are named on the parts list, and the entire subset may be purchased from Amphenol by special negotiation. Note that the front shell assembly has a groove, and the locking ring flange has been removed. See 351-28 for parts identification.

The plastic case is made from two identical halves. The case half is detailed on drawing 351-29 which shows decorative detail suitable for machining. The molded case halves from Amphenol Cadre have a copy of the decorative framing found on Interswitch Division Plates.
The Connector Support Bracket (351-30) and the Lock Nut (351-31) serve to align and capture the ASTRO-348 connector. The tapped holes in the bracket also serve to retain the case halves.

The Interswitch MB031/A07 thumbwheel switch is a standard binary output switch with mechanical stops at 0 and 7.

The Sprague LTN-3 resistor-capacitor networks are fully detailed in Document 010. The case outline is shown on 351-32 for reference.

The Ampex diode (part #013-694) is selected by the manufacturer. The forward drop shall be between 0.85 and 0.94 volts at a current of 0.350 amperes. The type 1N270 germanium diode shall be selected for forward voltage drop. The forward drop shall be between 0.245 and 0.275 volts at a current of 0.001 amperes. See 351-6 for sketch of diode selection procedure.
PARAMETER SWITCH
1N270 DIODE

SELECTION PROCEDURE

The forward drop (V) shall be between 0.245 and 0.275 volts at a current of 0.001 amperes.
SOLDERING

All soldering shall be performed with a temperature controlled iron. The Weller W-TCP with a 700°F tip is acceptable. Resistance and SCR controlled irons are not acceptable.

The solder used shall be nominally 60% tin and 40% lead with a non-corrosive rosin core. A small diameter (#22 wire gauge) solder is preferable. (Ersin Multicore)

WIRE STRIPPING

The #26 wire wrap wires shall be stripped on both ends with a modified NO NIK stripper. (Blue Handle 0.021 inch NO-NIK Stripper. CLAUSS Cutlery Co., Fremont, Ohio.) The modification consists of a machined wire stop which gives a strip length of .150+.025 inches.

CRIMPING

Crimping standards and tooling are covered in the 370 document. Adjust the crimping tool to accommodate the #26 wire used for the Parameter devices.

ASSEMBLY SEQUENCE

Prepare wires from #26 AWG White and Gray wire wrap wire.

2 short gray wires 1.5 ± .062 inches
13 Gray wires 2.5 ± .062 inches
13 White wires 2.5 ± .062 inches
Strip both ends of all wires using modified NO-NIK stripper.

Reserve one 2.5 inch gray wire, and crimp ASTRO-348 female contacts on one end of all remaining wires.

Insert crimped contacts and empty-uncrimped contacts into the contact retention disc as follows:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ASTRO-348 Contact Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK PINS</td>
<td>1, 2, 3, 4, 6, 7, 18, 19, 34, 35</td>
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<tr>
<td>WHITE WIRES</td>
<td>5, 9, 11, 13, 15, 17, 21, 24, 26, 28, 31, 33, 37</td>
</tr>
<tr>
<td>GRAY WIRES</td>
<td>8, 10, 12, 14, 16, 20, 23, 25, 27, 30, 32, 36</td>
</tr>
<tr>
<td>SHORT GRAY WIRES</td>
<td>22, 29</td>
</tr>
</tbody>
</table>

Place membrane seal over contacts.

Assemble an ASTRO-348 Shell into a Connector Support Bracket with a Lock Nut. (351-9) Securely tighten the Lock Nut using the special turret wrench (351-10). Hold the bracket in a vise for this operation - the nut must be tight. The only correct orientation is shown on 351-9.

Insert the contact retention disc and associated wires into the connector shell with a rear nut, and tighten the rear nut securely with channel lock pliers. Dress the two short gray wires and one end of the reserved long gray wire against the lip of the rear nut and solder all three.

Insert connector assembly into socket of the electrical ring-out box. (351-33 and 35)
Numbers are upright in only one of three possible rotational positions.

Note relative position of slot and U-shaped bracket.
ASSEMBLY FIXTURE

SLOTTED SCREWDRIVER

SPACING JIG

DUMMY BLOCKS

TURRET WRENCH

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT
SPECIAL TOOLS

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ISSUE 1-7-72

CHANGE NO. DATE DESCRIPTION

SLOTTED SCREWDRIVER

SPACING JIG

DUMMY BLOCKS

TURRET WRENCH
Prepare 4 thumbwheel switches (MB031/A07) by removing the contact from pin 6 and the alignment pins from the leftmost switch. Use diagonal cutting pliers and cut as shown on 351-12. WARNING - Do not touch the remaining contacts of the thumbwheel switches. All operations shall be performed in a manner which protects the contacts from mechanical damage.

Prepare 4 LTN-3 networks by bending the leads as shown on 351-13. Three of the networks are bent toward the printed pin numbers, and one is bent in the opposite direction. During assembly, these will be designated (TOWARD: LTN-3) and (AWAY: LTN-3).

The distance between body and bend is determined by the spacer tool as illustrated (351-10 and 13).

Place two thumbwheel switches and two dummy blocks into the assembly fixture - 351-14 apply light pressure. Position 4 #22 AWG bare wires (2.250 long) into holes 3, 4, 5 and 6 nearest the body of the switches. Solder the wires to the lower switch, and trim the upper ends to about 1/16 inch above the upper switch board. Do not trim the lower ends until the LTN-3 has been installed.

Remove upper switch and replace with dummy block. Position one (TOWARD: LTN-3) network with the bend in the leads 1/8 inch above the surface of the board of the lower switch. (Lead 1 of

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<td>-</td>
<td>1-5-72</td>
<td>90J</td>
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351-11
CLIP CONTACT HERE
(ALL 4 SWITCHES)

REMOVE ALIGNMENT PINS ON THIS (LEFTMOST) SWITCH ONLY
LOWER SWITCH SCHEMATIC

TOP VIEW

TO PINS 12 14
TO GROUND
WHITE WIRES

LTN-3

NUMBERS ON LOWER SIDE BEFORE FOLDING

DIODE IS SELECTED 1N270

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MACROMODULAR PROJECT

TITLE
LOWER SWITCH SCHEMATIC

ISSUE 1-7-72

CHANGE NO. DATE DESCRIPTION

APPROVED ENQ DRAWING NO.
BY FOR DATE
GCJ PLL 351-15
PROD. 1-8-72 DRAWN BY
GCJ
CHECKED GCJ
DATE 1-4-72
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**COMPUTER SYSTEMS LABORATORY**
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

**TITLE**
LOWER SWITCH CLOSE UP

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<td>GCJ</td>
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**DATE**
1-8-72

**DESCRIPTION**

**PROD**
1-8-72
the network goes into hole 1 of the switch. (351-15). Refer to 351-16 for a completed view of the next few assembly steps.

Solder the network to the switch, and trim the leads flush with the lower side of the switch printed circuit board. Trim the 4 #22 Bus leads at this point.

A 1N270 diode is connected to Hole 5 of the circuit board and the anode lead is soldered to lead 5 of the LTN-3 (Lead 5 of the LTN-3 is already connected to hole 4 of the circuit board. The body of the diode shall be dressed parallel to the leads of the LTN-3 network. (351-16 and 18)

Using the electrical ring-out box, find the following three gray wires and solder them in holes 1, 2, and 7 of the switch circuit board. These, and the following wires are dressed under the LTN-3 network (351-18).

<table>
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<th>Binary Bit</th>
<th>Astro 348 Pin</th>
<th>Lower Switch Hole</th>
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<tbody>
<tr>
<td>9</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>7</td>
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Find the long gray wire soldered to the rear nut, and solder the free end to lead 4 of the LTN-3 network. (Ground)

Find the white wire from pin 5 of the ASTRO-348 connector and solder to lead 8 of the LTN-3 (-5.2 volts).

Take any three of the remaining white wires and solder them to lead 5 of the LTN-3. (The cathode end of the 1N270 is already soldered to this lead) (LOW BUS) Gently fold LTN-3 network over wiring as shown on side view picture 351-22 and bottom view picture 351-18. Refer to lower switch schematic 351-15 and pictures for views of the completed lower switch assembly.
Note that the connector support bracket will slide through the opening in the assembly fixture.

Slide LOWER SWITCH ASSEMBLY back on assembly fixture, remove dummy blocks and position SECOND SWITCH on the four bus wires. Add two dummy blocks and slide the collection into the fixture; apply light pressure.

Solder the four bus leads, and position one (TOWARD: LTN-3) network as for LOWER SWITCH. Trim LTN-3 leads to 1/8" from bend and solder the network leads.

Take Ampex 013-694 diode and solder cathode end to Hole 5. Insulate anode lead with teflon sleeving and solder to lead 4 of the LTN-3. Dress the diode body parallel as before.

![AMPEX 013-694 Diode Connection Identification]

Find the following three gray wires and solder to holes 1, 2 and 7 of the switch printed circuit board

<table>
<thead>
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<th>Astro 348 Pin</th>
<th>Second Switch Hole</th>
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<tbody>
<tr>
<td>6</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
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351-20
SECOND SWITCH SCHEMATIC

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

DIODE IS AMPLEX
013-694

MACROMODULAR PROJECT
TITLE
SECOND SWITCH SCHEMATIC

ISSUE 1-7-72  
CHANGE NO. DATE DESCRIPTION

APPROVED  ENG  DRAWING NO.
GCJ  351-21

ST. FOR DATE DRAWN BY
PROD 1-8-72 PLL

CHECKED DATE
PROD 1-5-72
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<td>GCJ</td>
<td>1-8-72</td>
<td>DLS</td>
<td>351-22</td>
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**Title:** TOP SWITCH ALIGNMENT, SLID BACK

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ST. LOUIS, MISSOURI

**MACROMODULAR PROJECT**

**ISSUE:** 1-8-72

**DATE:** 1-8-72

**DRAWING NO.:** 351-22

**DRAWN:** DLS

**DATE:** 1-8-72
Solder any three white wires to lead 5 of the LTN-3.
Note that 3 white wires are soldered on each switch level.
Gently fold the LTN-3 over the wiring.

Slide the two switch assembly out of the fixture and remove
the dummy blocks. Position the THIRD SWITCH on the four bus
wires, add one dummy block and slide the collection into the
fixture - apply pressure.

Solder the four bus wires to the circuit board. Position
one (TOWARD: LTN-3) as before and solder and trim the leads.

Find the following gray wires and solder.

<table>
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<th>Bit</th>
<th>Pin</th>
<th>Hole</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>27</td>
<td>7</td>
</tr>
</tbody>
</table>

Gently fold the LTN-3 over the wiring.

Slide the collection out of the fixture, remove dummy block
and position TOP SWITCH on the bus wires. (351-22) Return
collection to pressure in fixture.

Solder the four bus wires. Position the (AWAY: LTN-3)
network with the bend in the leads flush with the lower surface
of the top switch circuit board. Solder the leads. (NOTE: all
four LTN-3 networks have lead 1 in hole 1 and lead 10 in hole 7)

Find the remaining three gray wires and solder.
<table>
<thead>
<tr>
<th>Binary Bit</th>
<th>Astro 348 Pin</th>
<th>Top Switch Hole</th>
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<td>0</td>
<td>36</td>
<td>1</td>
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<tr>
<td>1</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>7</td>
</tr>
</tbody>
</table>

Solder the three remaining white wires to lead 5 of the LTN-3 network and gently fold the network over the wiring.

Disconnect ring-out box connector and slide the switch and connector assembly through the fixture - Picture 351-26 shows the device at this stage.

Assemble a case half to the lower side of the device. (exposed circuit board side). Place two M2x40 threaded rods with nuts through the switches and case half and secure with 2 M2 slotted nuts.

NOTE: prepare one end of each threaded rod by masking gently with pliers. Then back thread a nut onto the end.

This will freeze the nut on one end and make assembly of the top end easier. See picture 351-27.

Push the connector assembly toward the switches - taking care to tuck-in any wiring or components that impede travel.
Do not allow LTN-3 leads to touch metal of connector support bracket. When the connector bracket is aligned with the case holes - insert two 2-56 flat head screws and tighten.

Remove the slotted nuts from the top switch and position the upper case half. Install the slotted nuts and two more 2-56 screws to complete the assembly.

TESTING

The completed assembly will be tested by the Computer Systems Laboratory. The Parameter switch shall be tested for all eight numbers on each switch. In addition the following patterns shall be verified.

\[
\begin{align*}
0000 \\
7777 \\
2525 \\
5252 \\
0707 \\
7070 \\
\end{align*}
\]

\[
\{ \text{Worst case patterns} \}
\]

The Parameter Switch under test shall be plugged into an adapter which has 15K resistors from each DATA BIT LOW line to pin 5 (-5.2v). This asserts DATA ZERO in the absence of an input.
NOTES:
1. CENTERS OF TABS ARE 110 DEGREES APART AND TABS 14 DEGREES WIDE. THIS IS WIDTH OF 0.300 MEASURED AT THE INNER RADIUS.
2. CUT WITH 1/8 DIAMETER END MILL. STOCK MUST BE HELD IN FIXTURE TO PREVENT DEFLECTION OF SIDE WALLS. DEPTH OF CUT MUST BE REFERENCED TO BACK WALL IN ORDER TO PRESERVE 0.093 DIMENSION.

DIMENSIONS: 5 0.005 O.D.N.
STOCK: 1.250 X 0.750 X 0.125
EXTRUDED CHANNEL: 6061-T6
FINISH: BLACK ANODIZE
SCALE: APPROX. 4X
DO NOT SCALE.

DRILL & TAP 2-56
4 PLACES
CLASS 2 THREAD

- SEE NOTE 1
- SEE NOTE 2

0.93
1.203
1.250
0.880
0.162
0.437
0.750

- 120°
- 240°
- 0°
- 7°
-
MATERIAL: 2011-T3 ALUM
ALL DIMENSIONS ± 0.005
FINISH: NATURAL

\[ \frac{7}{8} - 28 \text{ UN2B THREAD} \]

0.062 TYP

1.062 D

0.250

0.100 TYP
LEADS MISSING IN POSITIONS 3, 6, 7, & 9.
NUMBERS REFER TO PINS IN THE ASTRO-348 CONNECTOR

TEST PROBE

FLEXIBLE LEAD

S1 13 POSITION ROTARY SWITCH
R3 = 130 ohm line termination resistor in host macromodule.

Each S1 is \( \frac{1}{2} \) of an interswitch octal digit.
DIMENSION A EQUAL TO FLANGE DIMENSIONS (1.125) OF ASTRO 348 BULKHEAD CONNECTOR.
## MINICONSOLE

<table>
<thead>
<tr>
<th>PAGE</th>
<th>TITLE</th>
<th>CHANGE</th>
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<tbody>
<tr>
<td>354-1</td>
<td>TITLE PAGE</td>
<td>ISSUE</td>
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<tr>
<td>354-2</td>
<td>PARTS LIST</td>
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<tr>
<td>354-3</td>
<td>GENERAL DESCRIPTION</td>
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<td>354-4</td>
<td>ASSEMBLY PROCEDURE</td>
<td></td>
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<td>thru 354-10</td>
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<td>354-11</td>
<td>OVERALL VIEW</td>
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<td>354-12</td>
<td>SWITCH AND LED DRIVER CIRCUITS</td>
<td></td>
</tr>
<tr>
<td>354-13</td>
<td>TURRET WRENCH</td>
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</tr>
<tr>
<td>354-14</td>
<td>ASTRO 348 PARTS IDENTIFICATION</td>
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<td>354-15</td>
<td>MINI-CONSOLE CASE DESIGN</td>
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<td>354-16</td>
<td>CONNECTOR MOUNTING BRACKET</td>
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<td>354-17</td>
<td>LOCK NUT</td>
<td></td>
</tr>
<tr>
<td>354-18</td>
<td>CONNECTOR TO BRACKET ORIENTATION</td>
<td></td>
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<tr>
<td>354-19</td>
<td>MINICONSOLE FACEPLATE</td>
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<tr>
<td>354-20</td>
<td>FACEPLATE-REAR VIEW</td>
<td></td>
</tr>
<tr>
<td>354-21</td>
<td>PRINTED CIRCUIT BOARD ASSEMBLY AND CONNECTIONS</td>
<td></td>
</tr>
<tr>
<td>354-22</td>
<td>REAR SECTION, PC BOARD, FACEPLATE ORIENTATION</td>
<td></td>
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<tr>
<td>354-23</td>
<td>COAXICON CONNECTOR</td>
<td></td>
</tr>
<tr>
<td>354-24</td>
<td>CASE HALF ASSEMBLY</td>
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MACROMODULAR SYSTEMS PROJECT
## MINI CONSOLE PARTS LIST

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Mechanical Parts</th>
<th>Quantity</th>
<th>PT# or Refer to</th>
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</thead>
<tbody>
<tr>
<td>CSL</td>
<td>Faceplate</td>
<td>1</td>
<td>354-19</td>
</tr>
<tr>
<td>Amphenol Cadre</td>
<td>Rear Connector Mounting Bracket</td>
<td>1</td>
<td>354-16</td>
</tr>
<tr>
<td>&quot;</td>
<td>Case Half</td>
<td>2</td>
<td>354-15</td>
</tr>
<tr>
<td>&quot;</td>
<td>Lock Nut</td>
<td>1</td>
<td>354-17</td>
</tr>
<tr>
<td>Amphenol</td>
<td>Astro 348 Rear Nut</td>
<td>1</td>
<td>354-14</td>
</tr>
<tr>
<td>&quot;</td>
<td>Astro 348 Shell &amp; Insert Assembly</td>
<td>1</td>
<td>354-14</td>
</tr>
<tr>
<td>&quot;</td>
<td>(Modified)</td>
<td>1</td>
<td>354-14</td>
</tr>
<tr>
<td>&quot;</td>
<td>Astro 348 Membrane Seal</td>
<td>1</td>
<td>354-14</td>
</tr>
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<td>&quot;</td>
<td>Astro 348 Contact Retention Disc</td>
<td>1</td>
<td>354-14</td>
</tr>
<tr>
<td>&quot;</td>
<td>Female Contacts, ASTRO 348-100</td>
<td>37</td>
<td>354-14</td>
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<tr>
<td>&quot;</td>
<td>5000S-02</td>
<td>37</td>
<td>354-14</td>
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<tr>
<td>AMP</td>
<td>Female Coaxicon #329055</td>
<td>2</td>
<td>354-14</td>
</tr>
<tr>
<td>C&amp;K Comp</td>
<td>#7101 PB Switch</td>
<td>1</td>
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<tr>
<td>&quot;</td>
<td>2-56 x 1/4&quot; S.S.F.H. Socket Screws</td>
<td>8</td>
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**Electronic**

<table>
<thead>
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<th>Manufacturer</th>
<th>Part Description</th>
<th>Quantity</th>
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<tr>
<td>Monsanto</td>
<td>MV5023 Light Emitting Diode</td>
<td>2</td>
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<tr>
<td>CSL</td>
<td>WCL 0146-1 PC Board</td>
<td>1</td>
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</tr>
<tr>
<td>Motorola</td>
<td>MC1235L MECL IC</td>
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<td>&quot;</td>
<td>MPS3640 Transistor</td>
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<tr>
<td>Hewlitt-Packard</td>
<td>82-2900 Diode</td>
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<tr>
<td>Mallory</td>
<td>4.7 μF 10 WVDC Tantalum Capacitors</td>
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<td>TAC 475 M010P02</td>
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<tr>
<td>OHMITE</td>
<td>5.1 K Ohm 1/8 W. 5% Carbon</td>
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<tr>
<td>&quot;</td>
<td>1.5 K Ohm &quot; &quot; &quot;</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>1 K Ohm &quot; &quot; &quot;</td>
<td>2</td>
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</tr>
<tr>
<td>&quot;</td>
<td>750 Ohm &quot; &quot; &quot;</td>
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</tr>
<tr>
<td>&quot;</td>
<td>510 Ohm &quot; &quot; &quot;</td>
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<td>390 Ohm &quot; &quot; &quot;</td>
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<td>&quot;</td>
<td>150 Ohm &quot; &quot; &quot;</td>
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<tr>
<td>Electra Midland</td>
<td>57.6 Ohm 1/8 W. 1% film</td>
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<tr>
<td>Brand Rex</td>
<td>#30 AWG Kynar Insulated Wire Wrap Wire</td>
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</tr>
<tr>
<td>&quot;</td>
<td>Blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>Green/White Twisted Pair (optional)</td>
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<td></td>
</tr>
</tbody>
</table>

**Special Tools**

| Turret Wrench | 1 | 354-13 |
NUMBERS REFER TO PINS IN THE ASTRO-348 CONNECTOR

S1 13 POSITION ROTARY SWITCH

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

SCHEMATIC OF RINGOUT BOX

ISSUE 1-7-72

ENG GCJ
DRAWING NO. 351-33

BY GCJ
FOR PROD
DATE 1-2-72
DRAWN BY GCJ
CHECKED GCJ
DATE 1-4-72
MINI-CONSOLE GENERAL DESCRIPTION

The mini-console allows an operator to monitor and control the state of macromodule control signals. Each mini-console, as shown in Dwg. #354-11, consists of two independent sections. On top is a control cable input and a pair of indicators. The lower indicator is on when the input control signal is in the preset state and the upper indicator is on when the control signal is in the non-preset state. Neither indicator will be on if there is no input cable connected or if the module that the cable comes from is not powered or has blown a fuse. Both indicators will be on if the control signal is switching rapidly enough or if the mini-console input is connected to a macromodule input instead of an output.

The lower half of the mini-console has a control output connector and a toggle switch. The control output is in the preset state when the toggle switch is down and is in the non-preset state when the toggle switch is up. A switch filter is included so that a single "clean" transition is produced each time the toggle switch is operated.

The mini-console is plugged into any otherwise unused data input or output to provide mechanical support and to supply its power. A quick check of mini-console operation can be made by connecting its input and output together and checking that the indicators follow the switch position.
COMPONENTS

The ASTRO-348 Connector is made up of a subset of parts from a 348-40E14-37S1 connector. The parts are named on the parts list, and the entire subset may be purchased from Amphenol by special negotiation. Note that the front shell assembly has a groove, and the locking ring flange has been removed. See 354-14 for parts identification.

The plastic case is made from two identical halves. The case half is detailed on drawing 354-15 which shows decorative detail suitable for machining.

The Connector Mounting Bracket (354-16) and the Lock Nut (354-17) serve to align and capture the ASTRO-348 connector. The tapped holes in the bracket sides serve to retain the case halves.

SOLDERING

All soldering shall be performed with a temperature controlled iron. The Weller W-TCP with a 700°F tip is acceptable. Resistance and SCP controlled irons are not acceptable.

The solder used shall be nominally 60% tin and 40% lead with a non-corrosive rosin core. A small diameter (#22 wire gauge) solder is preferable. (Ersin Multicore)

WIRE STRIPPING AND CRIMPING

The #30 crimped wires shall be stripped on one end with a modified NO NIK stripper. (Green Handle 0.014 inch NO-NIK Stripper. CLAUSS Cutlery Co., Fremont, Ohio.) The modification consists of a machined wire stop which gives a strip length of 0.125--0.150 inches.
Crimping standards and tooling are covered in the 370 document. Adjust the crimping tool to accommodate the #30 ga. wire used for the FPB-3_8 devices.

Wires for these connectors shall be stripped 0.125--0.150 inches. The tight stripping tolerance is necessary to insure that the insulation will tuck into the rear sleeve of the contact for mechanical support. The wires are crimped into the ASTRO-348 contacts using Buchanan hand tool 612-596 with contact locator 613-381. Equivalent automatic tooling is preferable. Crimp settings of (4) have proved satisfactory with two hand tools, but tool variability requires that some tests be made before a production setting is adopted. The test criterion is that the crimped joint shall have 70% of the tensile strength of the wire being crimped.

Wire wrapped wires shall be stripped to a length of 0.875 on one end. The ends of all wires to be soldered should be stripped a minimum of 0.250 inches and soldered with the insulation as close as possible to the P.C. board. Final clipping of finished wires should be as close to the solder joint as possible.

**REAR SECTION ASSEMBLY**

Cut one red and one blue piece of #30 AWG Kynar wire three inches in length. Strip one end of each wire using the tool referred to in "Wire Stripping and Crimping."

Crimp the stripped ends into ASTRO 348 female pins.

Strip the free ends of the two wires you have just crimped 0.250 inches. These ends will later be soldered to the P.C. board.

Insert wired crimped contacts and empty uncrimped contacts into the contact retention disc as follows:
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ASTRO-348 Contact Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK PINS</td>
<td>1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37</td>
</tr>
<tr>
<td>RED WIRE</td>
<td>5</td>
</tr>
<tr>
<td>BLUE WIRE</td>
<td>22</td>
</tr>
</tbody>
</table>

Place membrane seal over contacts.

Assemble an ASTRO-348 Shell into a Connector Support Bracket with a Lock Nut. (354-18). Tighten the Lock Nut securely using the special current wrench (354-13). Hold the bracket in a vise for this operation - the nut must be tight. The only correct orientation is shown on 354-18.

Insert the wired contact retention disc into the connector shell and tighten securely with lock pliers. Set the completed rear section aside until called for.

ASSEMBLE FACEPLATE

The Faceplate should be assembled as shown on page 354-20.

The two LED retention flanges should be pressed by hand, into the specified holes with the flanges to the front. The two LED's shall then be inserted into the retention flanges from the rear until they snap securely into place, with their negative and positive leads aligned horizontally. (The negative or double shouldered lead shall be placed on the left side of the Faceplate as viewed from the front.) The next step is to snap on the rear locking ring. This is done by placing it equally over the rear of the retention flange and pressing straight down until the ring touches the metal surface. (You will notice the locking ring is tapered. The ring must be
installed with the narrow end down toward the metal.) The two negative leads of the LED's shall then be wire wrapped together with a section of red wire as noted in reference #354-20. Two 3" blue wires should be prepared for wire wrapping. They will now be wrapped to the positive LED leads. The free ends will be soldered to the P.C. board later.

The toggle switch CK7101PB shall be installed next. The switch shall have either N.O. contact in the down position. The lower locking nut of the switch shall be raised approximately 1/16" above the switch base. This is to allow the threaded extension to be flush with the outside nut when the lock-washer and nut is in the tightened position. Using a short piece of stripped 30 ga. red wire; wire wrap one end to the lower negative LED (double shoulder). The other end shall be soldered to the center pole of the switch. To the lower N.O. contact solder a blue wire as referred to on page 354-20. The other end shall be attached to the P.C. board later.

ASSEMBLY of COAXICONS

All wires for this connector are stripped 0.250 ± .031 inches. The wires are crimped using AMP crimp die 69231-2 in hand tool 45707-2 or pneumatic tool 69356-2. The wires must be carefully held during the crimp cycle to prevent slippage. These connectors are press fitted with an arbor press, after crimping, into the faceplate. The orientation of these connectors is important. They must be installed as shown in Dwg# 354-11 and #354-20.

ASSEMBLY of P.C. BOARD WCL0146-1

The lined or printed side of the board shall be interpreted as the signal side. The other side shall be considered the component side.

The package P1 (M1235) shall be placed on the component side of the P.C. board with pin 1 inserted in the appropriate hole. (On the signal side a small 1 is printed to assure proper alignment of the MECL package). It
shall then be soldered into position using the soldering procedure as outlined on page 2.

The installation of the other components shall be as shown in drawing #354-21, observing the related positions and polarities of the diodes and capacitors. Any vertical components shall not have two bare leads facing each other to prevent accidental circuit failure.

**FINAL CONNECTION**

The three separate sections shall be placed in the positions indicated by dwg. #354-22. Note the position of the P.C. board.

The loose ends of the wires from the front and rear sections shall now be attached to the P.C. board. They shall be brought directly to the board and soldered on the signal side. All precautions must be taken to assure no cold joints or pits result from soldering. These wires shall be attached to the board as shown in drawing #354-21.

**FINAL ASSEMBLY**

The rear section shall then be placed in the left shell half and secured with 2, 2-56 x 1/4" SS.F.H. socket screws. The board shall then be placed, angled, in the housing and the faceplate set in position. The board shall be allowed to lie loosely between the rear section and the faceplate. The faceplate shall then be fastened into position with 2, 2-56 x 1/4" SS.F.H. socket head screws as shown in dwg. #354-23.

The right shell half may then be fastened into position with the required screws.

**TESTING**

The mini-console may be tested by applying - 5.2 VDC to pin #5 and ground to pin #22 of the ASTRO 348 connector.
A macromodule control cable may then be connected from the lower coaxicon to the upper coaxicon.

If the mini-console is working properly the LED illuminated will follow the switch position as indicated in the table.

Table #

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>LED ON</th>
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<tbody>
<tr>
<td>UP</td>
<td>TOP</td>
</tr>
<tr>
<td>DOWN</td>
<td>BOTTOM</td>
</tr>
</tbody>
</table>
FRONT VIEW

REAR VIEW

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

MINI CONSOLE
OVERALL VIEW

ISSUE 8-11-72

CHANGE NO. DATE DESCRIPTION

ENG. DRAWING NO.
FUR 354-11

BY FOR DATE DRAWN BY
FUR PROD 8-11-72 GWP

CHECKED DATE

8-8-72
NOTE:
57.6Ω RESISTORS ARE 1/8 W 1%.
ALL OTHERS 1/8 W 5% "LITTLE DEVIL"

MINI-CONSOLE SWITCH CIRCUIT

MINI CONSOLE LED DRIVER CIRCUIT

SW. C & K NO. 7101PB
350Ω
4.7ufd
1KΩ
1.5KΩ
1KΩ
3
6
5
10
13
12
57.6Ω
57.6Ω
AMP NO. 323055
HIGH
LOW
COAX CONNECTOR
MINI-CONSOLE SWITCH CIRCUIT

UPPER COAXICON CONNECTOR
AMP NO. 323055

SMALL PORT (LOGIC HIGH)

LARGE PORT (LOGIC LOW)

BOTTOM MV5023 LED

TOP MV5023 LED

HPB2-2900

MPS3640

51Ω
5.1KΩ

510Ω

MINI CONSOLE LED DRIVER CIRCUIT

BOTTOM MV5023 LED
<table>
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<tr>
<td>CHANGE NO.</td>
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<td>DESCRIPTION</td>
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**Title:**

**MINI CONSOLE TURRET WRENCH**

**Drawing Information:**

- **Drawing No.:** 354-13
- **Approved:** GCJ 8-11-72
- **Drawn By:** PLL 8-7-72

**Computer Systems Laboratory**

Washington University

St. Louis, Missouri
MATERIAL: BLACK CYCOLAC (ABS)
DIMENSIONS: ± 0.005 U.O.N.

SECTION AA

DRILL NO. 43
COUNTERBORE OUTSIDE NO. 18 .066 DEEP
COUNTERBORE INSIDE NO. 30 .050 DEEP
(2 PLACES)

CHAMFER 0.100 X 45°

DRILL NO. 43
SINK 0.25 FACE DIAMETER
FOR A-23 SOCKET FLAT HEAD STAINLESS SCREW
-56-8
(2 PLACES)

CUT .080 DEEP
WITH 90° INCLUDED ANGLE 2 X .080
DOUBLE ANGLE MILLING CUTTER

1.600
0.080
0.031 SHELF

2.500
0.880

0.437
0.327
0.214
0.880

ISSUE DATE:

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
B. KIDD, M. KIDD

MACROMODULAR PROJECT
MINI-CONSOLE:
CASE DESIGN

354-15
B-9-72
NOTES:
1. Center of tab are 120 degrees
   apart and tabs 14 degrees wide.
   This is a width of 0.030 measured
   at the inner radius.
2. Cut with 1/4 diameter end mill.
   Stock must be held in fixture to
   prevent deflection of side walls.
   Depth of cut must be referenced
   to back wall in order to preserve
   0.093 dimension.

DIMENSIONS:
- ±0.005 U.O.
- Stock: 1.250 x 0.750 x 0.125
- Extruded Channel: 6061-T6
- Finish: Black Anodize
- Scale: Approx. 4x
- Do not scale.

STOCK:
- 1.250 x 0.750 x 0.125
- Extruded Channel: 6061-T6
- Finish: Black Anodize
- Scale: Approx. 4x
- Do not scale.
MATERIAL: 2011-T3 ALUM
ALL DIMENSIONS ± 0.005
FINISH: NATURAL

\[ \frac{7}{8} - 28 \text{ UN2B THREAD} \]

1.062 D

0.062 TYP

0.100 TYP

0.250

ISSUE 8-11-72

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

MINI-CONSOLE: LOCK NUT

APPROVED

GCJ

DRAWING NO.

354-17

CHECKED

DATE

E-8-72
NUMBERS ARE UPRIGHT IN ONLY ONE OF THREE POSSIBLE ROTATIONAL POSITIONS

NOTE RELATIVE POSITION OF SLOT AND U-SHAPED BRACKET
DRILL \( \frac{1}{4} D \)
CSINK \( \frac{3}{8} \times 82'' \times 0.020 \) DEEP
2 PLCS

REAM .275 D \( \pm 0.001 \)
C'BORE .343D \( \times 0.020 \)
CSINK 82'' FROM BOTTOM OF C'BORE
2 PLCS

MAT'L: \( 1 \frac{1}{4} \times \frac{1}{4} \times \frac{1}{8} \) EXTRUDED ALUM CHANNEL
FINISH: CLEAR ANODIZE
DIMENSIONS: \( \pm 0.005 \) U.O.N.

TAP 2-56 2 PLCS (BOTH SIDES)
GROUND WIRE (TO PC BOARD) (SEE NOTE)

Wire to P.C. board as indicated. (Ref. drawing No. 354-21)

NOTE: WIRE IS 30 AWG BLUE KYNAR. STRIP 5/8" ON THIS END AND SOLDER ONTO COAXICON CASES.

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

MINI CONSOLE
FACEPLATE - REAR VIEW

ISSUE 8-10-72
CHANGE NO. 
DATE 
DESCRIPTION 

DRAWING NO. 354-20
DATE 7/17/72
## TAP BOX

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<td>ASSEMBLY PROCEDURE</td>
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355-2
INTRODUCTION

The tap box is assembled from a basic predrilled Pomona Utility Box. The top has been drilled and reamed to accept 4 female coaxicon connectors and 2 Tektronix probe receptacles on each end. These connectors are jumpered within to provide a continuous control path for macromodule computer control signals. At the same time this control path is tapped by two Tektronix probe connectors at each end. The probe connectors allow access to the high and low levels during system operation. With one box a person is able to observe two control signals at a time by inserting a probe of the appropriate size into the desired HIGH or LOW taps.
ASSEMBLY PROCEDURE

Using #30 AWG Kynar Insulated Wire prepare 8 pieces (4 white - 4 green) in the following manner.

Cut 4 pieces of each color approximately 2 1/4 inches in length. Strip both ends of each wire (using a NO NIK .014 dark green handled stripping tool which may be acquired from Clauss Cutlery Co., Freemont, Ohio) approximately 0.250± .031 inches. The green and white wires are inserted into their respective connector positions (see dwg. #355-7 & wiring chart pg. #355-5) and crimped using die #69231-2 in AMP hand tool #45707-2 or pneumatic tool 36365-2. The wire must be carefully held during the crimp cycle to prevent slippage. The connectors may now be set aside until called for later.

Insert the 4 Tektronix probe connectors in the holes provided for them in the Pomona Utility Box. Using the nuts provided, tighten them securely in place.

With an arbor press, insert the 4 coaxicon connectors into the top of the utility box paying strict attention to the orientation in DWG #355-7. The appropriate wires for high and low shall be attached to their respective Tektronix probe receptacles. Two wires of the same color shall go to the indicated probe.

A single 2 inch piece of #24 AWG Buss Wire shall electrically connect the outside of each coaxicon connector and the fastening nut at the rear of the Tektronix probe connectors for grounding purposes. (See dwg. #355-7) This wire must be soldered to the coaxicon cases, and fastening nuts. This operation must be done to both tap halves.

<table>
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355-4
## WIRING CHART

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<tr>
<th>Wire Color</th>
<th>AMP Pin #</th>
<th>Tektronix Probe</th>
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<tr>
<td>GREEN</td>
<td>2 (Large Port)</td>
<td>LOW</td>
</tr>
<tr>
<td>WHITE</td>
<td>1 (Small Port)</td>
<td>HIGH</td>
</tr>
<tr>
<td>BUSS WIRE</td>
<td>CASE</td>
<td>CASE NUT</td>
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**TESTING PROCEDURE**

Using an ohm meter or light circuit check for continuity between the 3 high connections, 3 low connections and the grounds on each ckt. side. (None of the three should indicate short between each other but common between themselves.)

If the circuit checks, fasten the bottom plate to the box with the 4 screws provided.
**Dimensions:** ±0.005

**Diagram:**
- **REAM .2750**
- **4 HOLES**

- **DRILL .2500 D 2 HOLES**
  - (both sides)

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**Title:**
- **TAP BOX**
- **DRILLING DIMENSIONS**

**Company:**
- **COMPUTER SYSTEMS LABORATORY**
  - **WASHINGTON UNIVERSITY**
  - **ST. LOUIS, MISSOURI**

**Project:**
- **MACROMODULAR PROJECT**

**Approved:**
- **ENG. GLB**

**Drawing No.:**
- **355-9**

**Date:**
- **5-2-72**
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<td>INTRODUCTION</td>
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<td>356-5</td>
<td>OVERALL VIEW</td>
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<td>356-6</td>
<td>L.E.D. DATA INDICATOR ASSEMBLY PROCEDURE</td>
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<td>356-7</td>
<td><strong>L.E.D. DATA INDICATOR ASSEMBLY PROCEDURE</strong></td>
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<td>356-8</td>
<td>L.E.D. PRINTED CIRCUIT BOARD AND ASSEMBLY JIG ORIENTATION</td>
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<td>356-9</td>
<td>COMPONENT IDENTIFICATION L.E.D. DRIVER BOARD</td>
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<td>356-10</td>
<td>COMPONENT IDENTIFICATION L.E.D. CURRENT REGULATOR BOARD</td>
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<td>L.E.D. SANDWICH ASSEMBLY</td>
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<td>REAR SECTION - SANDWICH AND FACEPLATE ORIENTATION</td>
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<td>356-14</td>
<td>ASTRO 348 PARTS IDENTIFICATION</td>
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<td>356-18</td>
<td>CASE DESIGN</td>
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<td>356-19</td>
<td>L.E.D. CASE HALF ASSEMBLY</td>
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## L.E.D. DATA INDICATOR

### Parts List

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<td>1K Ohm 1/8 Watt Carbon 5% Resistor</td>
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356-2
L. E. D. ASSEMBLY JIG (CSL)

TURRENT WRENCH (CSL)
INTRODUCTION

12 Bit Light Emitting Diode Data Indicator

The 12 Bit "L.E.D." Data Indicator is a compact instant reading data indicator that may be plugged into any data output to indicate the value of each of the output bits.

The "L.E.D.'s" are grouped by threes to facilitate conversion by the user to OCTAL; with the most significant OCTAL digit on top. Thus a four digit OCTAL number may be read from top to bottom.
L.E.D. FACEPLATE ASSEMBLY

Insert 12 Light Emitting Diodes into P.C. Board WCL-0148-2 as shown in Drawing No. 356-14. Align the leads vertically with the double shouldered lead inserted in the negative common path.

Insert the PC board with the diodes in the assembly jig as shown in Drawing No. 356-14. Turn in the jig screws carefully to capture the assembled pieces. (Do not touch the common path line with the left jig screw). Solder* the negative (-) leads to the common path and the leads connected to the (+) terminals to the PC board.

Prepare 12 Blue wires (No. 30 AWG Kynar) 3” in length. Strip 0.875 from each wire and wrap one wire to each single shouldered (+) L.E.D. terminal. Strip the loose ends 0.187 for future soldering to the L.E.D. sandwich. Clip the L.E.D. ends, after the wiring and soldering so as not to exceed 0.250 inches in length.

Remove the completed mounting board from the jig and place it in a black finished faceplate exactly as it was in the assembly jig as shown in Drawing No. 356-14. Insert the mounting board in the faceplate bracket until the L.E.D. shoulders touch the metal. Install the two 2-56 x 3/16 S.S.F.H. screws so that they hold the L.E.D. mounting board in place from behind.

---

*Soldering

All soldering shall be performed with a temperature controlled iron. The Weller W-TCP with a 700°F tip is acceptable. Resistance and SCR controlled irons are not acceptable.

The solder used shall be nominally 60% tin and 40% lead with a noncorrosive rosin core. A small diameter (No. 22 wire gauge) solder is preferable. (Ersin Multi-core)
Remaining Wires

At this point it is best to make up the rest of the wires necessary to complete the L.E.D. Data Indicator Assembly.

Prepare 13 blue and 1 red No. 30 AWG Kynar wires 3.000 inches in length. These wires for Astro 348 connector pins, shall be stripped 0.125 - 0.150 inch on one end. For this procedure a NO-NIK -- .014 -- dark green handled stripping tool should be acquired from Clauss Cutlery Co.

Crimp the Astro 348 connector pins to the stripped ends of the wires. The crimp should be made using Buchanan hand tool No. 612-596; with contact locator No. 613-381. (Crimp settings of 4 have proved satisfactory but tool variability requires some test be made before a policy is adopted. The test criterion is that the crimped joint shall have 70% of the tensile strength of the wire being used.)

The free end of each wire should be stripped 0.187 with the same type NO-NIK tool. This end will later be soldered to the L.E.D. sandwich.

Also at this time another single red wire No. 30 AWG Kynar, 3.000 inches long, should be prepared. Strip one end 0.187 and the other end 0.875. This wire shall be used for wire wrapping the connection to the faceplate common path.
ASSEMBLY PROCEDURE FOR L.E.D. SANDWICH

Solder 12 MPS3640 Transistors into place on WCL0089-2. The necessary orientation is shown in Drawing No. 356-15. These transistors must not exceed 5/16 inch in height as measured from the component side of the P.C. Board.

Next solder the jumper required to WCL0089-2. Leave the free end unclipped until later.

Solder the 510 ohm resistors to WCL0089-2. Allow 1/32 inch space between the board and the end to be soldered.

Trim the free ends of the 510 ohm resistors so they represent a stair case to ease the stacking of the two P.C. boards as shown in Drawing No. 356-15.

Set this board aside until later.

Solder the Motorola MD8001 to the component side of WCL0088-2. Orientation of pin No. 1 should be noted as in Assembly Drawing No. 356-16.

Solder the 2N4402 to the component side of WCL0088-2. Note the emitter orientation.

Insert the Mallory 1 µfd Tantex capacitor into the proper holes indicated on Assembly Drawing No. 356-16. Attention to polarity of the capacitor is imperative.

Solder the rest of the resistors to WCL0088-2 as indicated in Assembly Drawing No. 356-16.

Locate the following wires:

1. One red 3.000 inch 30 ga. Kynar wire with a crimped AStro 348 contact and the free end stripped 0.187.

2. One blue 3.00 inch 30 ga. Kynar wire with a crimped Astro 348 contact and the free end stripped 0.187.
3. one red 3.00 inch 30 ga. Kynar wire with one end stripped 0.187 inch and the other end stripped 0.875 inch.

The next step is to take both red wires and solder their 0.187 bare ends into the -5.2 pad on WCL0088-2. The Astro 348 crimped pin will later be inserted into the rear connector and the 0.875 end of the 3.00 inch red wire will be wrapped to the L.E.D. Mounting board.

The blue wire should now be soldered to its ground pad on WCL0088-2. Its Astro 348 pin will later be inserted in the rear connector.

Place WCL0088-2 above WCL0089-2 and align the 510 ohm resistors with the inside row of the double pads on WCL0088-2. The jumper must be aligned with its hole on WCL0088-2 at this time as shown in Drawing No. 356-17.

Ease WCL0088-2 down over WCL0089-2 with its component side up. Compress the boards until the inside distance is 3/8 inch. Check to see that each resistor is aligned properly.

Solder the resistors to the top and bottom sides of WCL0088-1. Care must be taken to prevent the filling of the outside holes with solder. They will be used later for attaching the L.E.D. and bit connections. Solder the jumper to complete the final operation.

Set the sandwich aside until called for later.
REAR ASSEMBLY PROCEDURE

Components

The Astro 348 connector is made up of a subset of parts from a 348-40E14-37S1 connector. Note that the front shell assembly has a groove, and the locking ring flange has been removed. (See Drawing No. 356-20) for parts identification.

The plastic case is made from two identical halves. The case is detailed on Drawing No. 356-24.

The connector mounting bracket (Drawing No. 356-22) and the Lock Nut (Drawing No. 356-23) serve to align and capture the Astro 348 connector. The tapped holes in the bracket also serve to retain the case halves.

Assembly

Assemble an Astro 348 shell into a connector mounting bracket with a lock nut. (See Drawing No. 356-21. Securely tighten the Lock Nut using the special turret wrench (Drawing No. 356-3). Hold the bracket in a vise for this operation - the nut must be tight. The only correct orientation is shown in Drawing No. 356-21.

Insertion in Connector

Insert 12 crimped contacts with blue wires and empty uncrimped contacts into the Astro 348 retention disc as indicated on page 356-11.

One red and one blue have been soldered to the L.E.D. sandwich already - they will be inserted when the final assembly is made.
### REAR SECTION "348" PIN CONNECTIONS

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<tr>
<td>Red Wire</td>
<td>5 (power)*</td>
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<tr>
<td>Blue Wires</td>
<td>9, 11, 13, 15, 17, 21, 22* (ground), 24, 26, 28, 31, 33, 37</td>
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* will be inserted when final assembly is started
ADJOINMENT OF REAR SECTION, SANDWICH AND FACEPLATE

1. Set the three sections as illustrated in Drawing No. 356-18.
   A. Notice that when viewed from the rear the Bit 0 L.E.D. is in the lower left corner of the mounting board and the part No. of the board is upright. (refer to page 356-6 and 356-14).
   B. The sandwich should be setting on the short side with the MD8001 at the top facing front.
   C. The rear section should be setting on its 1/8 inch walls and the large boss position to the right. (The numbers on the connector should be upright at this time.)

2. Insert the pin crimped to the red wire on the sandwich in the No. 5 position of the rear connector.

3. Insert the pin crimped to the blue wire in the No. 22 position of the rear connector.

4. Wire wrap the other red wire to the Bit No. 9 (-) negative lead to complete the common path.

5. Turn to assembly drawing No. 356-16 and note the L.E.D. and Pin connections and 356-4 for L.E.D. Bit positions.

6. Beginning with the blue wire connected to the L.E.D. in the Bit No. 11 position, bring the wire directly to board No. WCL0088-2. Insert the wire from the component side and solder to the pad on the other side.

7. Locate the blue wire attached to pin No. 9 of the Astro 348 connector. Bring this wire forward and around P.C. board WCL0089-2. Insert the wire directly into WCL0088-2 from the other side and solder the bare end to the pad on the component side.
8. For greatest ease in making the rest of the connections it is suggested the assembler work down and across the bottom finishing with the Bit No. 5 connection. This will prevent the accidental burning of another wire's insulation.

9. After final wiring and inspection the assembly should be placed in the plastic shell as shown in Drawing No. 356-25 and the 8 - 2 - 56 x 1/4” S.S.F.H. screws installed.

Check Out

The best method for testing the completed L.E.D. indication unit is to insert it in to a Macro Module data output port or interface port that may be controlled by a computer, switches or parameter plug. The lights should follow the input pattern as it is varied.
ASSEMBLY JIG

NOTE
PART NO. WCL-0148 ORIENTATION

NOTE
L.E.D. LEAD ORIENTATION

COMMON PATH

COMPUTER SYSTEMS LABORATORY
WASHINGTON UNIVERSITY
ST. LOUIS, MISSOURI

MACROMODULAR PROJECT

L.E.D. P.C. BOARD AND
ASSEMBLY JIG ORIENTATION

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>CHANGE NO.</th>
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<th>DESCRIPTION</th>
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<tr>
<td>10-12-71</td>
<td>356-14</td>
<td>10-12-72</td>
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</table>
JUMPER

ALL OTHER HOLES FOR 510Ω RESISTORS (24 PLACES)

P. C. BOARD WCL0085-2

MPS-3640 (12 PLACES)

NOTE COMPONENT ORIENTATION

COMPONENT IDENTIFICATION

L.E.D. DRIVER BOARD

MACROMODULAR PROJECT
NOTE COMPONENT INSTALLATION

RED

BLUE
<table>
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<td>G.W.</td>
<td>B. F.</td>
<td>356-17</td>
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<tbody>
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<td>J.B.</td>
<td>10-24-72</td>
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</tbody>
</table>
MAT'L: 1 \frac{1}{4} \times 1 \frac{1}{4} \times \frac{1}{8} ALUM CHAN
FINISH: BLACK ANODIZE
DIMS: \pm .005 U.O.N.
NUMBERS ARE UPRIGHT IN ONLY ONE OF THREE POSSIBLE ROTATIONAL POSITIONS

NOTE RELATIVE POSITION OF SLOT 'AND U-SHAPED BRACKET
NOTES:

1. CENTERS OF TAB ARE 100 DEGREES APART AND TABS ARE DEGREES RUDE.

2. CUT WITH 1-4 DIAMETER END MILL.

3. STOCK MUST BE HELD IN FIXTURE TO PREVENT DEFLECTION OF SIDE WALLS.

4. DEPTH OF CUT MUST BE REFERENCED TO BACK WALL IN ORDER TO PRESERVE 0.001 DIMENSION.

DIMENSIONS: ± 0.005 G.O.N.

STOCK: 1.250 X 0.750 X 0.125

EXTRUDED CHANNEL: 6061-T6

FINISH: BLACK ANODIZE

SCALE: APPROX. 4X

DO NOT SCALE

TCB OUTLINES NOT SHOWN IN THIS VIEW

1.250 STOCK

0.125 TYP STOCK

DRILL & TAP 2-56

4 PLACES CLASS 2 THREAD

SEE NOTE 2

0.093

SEE NOTE 2

1.20

0*

240*

SEE NOTE 1

437*

I.I.03 O

1/2" STOCK

750 STOCK

MACROMODULAR PROJECT

CONNECTOR MOUNTING BRACKET

ENGINEERED: GCJ

DATE: 07/28/72

PROJECT: ISS-72

MACROMODULAR PROJECT

CONNECTOR MOUNTING BRACKET

ENGINEERED: GCJ

DATE: 07/28/72

PROJECT: ISS-72
MATERIAL: 2011-T3 ALUM
ALL DIMENSIONS ± 0.005
FINISH: NATURAL

.062 TYP

\( \frac{7}{8} \) - 28 UN2B THREAD

.100 TYP

.250

1.062 D
END MILL

0.062 R

0.005 0.060

0.0025 ± 0.005

SECTION AA

MATERIAL: BLACK CYCOLAC (A85)
DIMENSIONS: ± .005 U.N.

DRILL NO. 43
(CORE OUTSIDE NO. 18, 0.065 DEEP
CORE INSIDE NO. 30, 0.050 DEEP
(2 PLACES))

CHAMFER 0.100 24°

DRILL NO. 43
(CORE 88° 180 FACE DIA.
FOR 2-56 SOCKET FLAT HEAD
STAINLESS SCREW
2-56-4)

(2 PLACES)

CUT 0.080 DEEP
WITH 90° INCLUDED
ANGLE 2 1/2 DIA
DOUBLE ANGLE
MILLING CUTTER

0.031 SHELF

0.0160

0.080

0.150

0.867

1.513

2.500

0.880

0.880

0.327

0.414

2-5/8

0.050

0.025

2-5/8

0.050

0.025

2-5/8

0.050

MACROMODULAR PROJECT

CASE DESIGN

COMPUTER SYSTEMS LABORATORY
PURDUE UNIVERSITY

JACK HODGSON

ISSUANCE

SHEET

REV

NO

DATE

SIGNATURE

1968-24

S-G-72
The assembly procedure for the Parameter Switch, Mini Console, and LED Data Indicator is given here along with the parts lists and description of special tools required for proper assembly.
<table>
<thead>
<tr>
<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
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<tbody>
<tr>
<td>Macromodule Parameter Switch</td>
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<tr>
<td>Macromodule Mini-console</td>
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<tr>
<td>Macromodule Data Indicator</td>
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