Digital Laboratories

3R

UNIVERSAL VOLTAGE (RS232C) AND CURRENT LOOP JUNCTION

The "3R" is a compact connection unit that allows serial communication devices and terminal equipment such as Teletypes, high speed printing terminals, video displays, computers and modems to be combined in a common system. More than one 3R can be used, expanding indefinitely the number of devices that can be connected.

Specifications

32° - 122° F (Operating)

Humidity to 95% non-condensing

Width	Height	Length
5.3"	2.3"	7"

Weight: 3.5 lbs.

Power: 90-125 VAC 60 Hz 5 Watts

Transmission Speeds
Any, up to 9600 baud

Circuit/Connector
RS-232C compatible (Connectors are Amphenol #17-10250-1, or equivalent)
20 ma current loop via RS232 undefined pins

Communications Connections
The 3R contains six switches that implement any combination of connections between the input and output of the three plugs. The six switches implement the following connections:
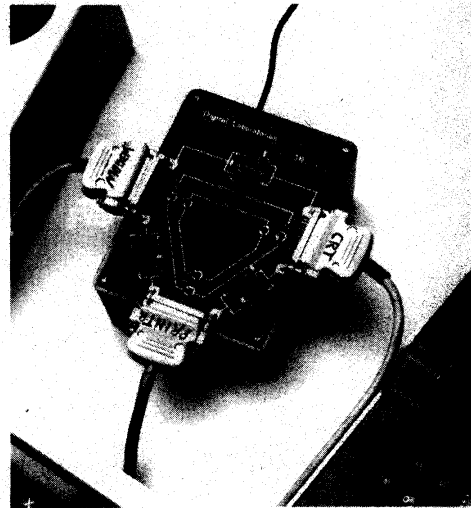
(1) Transmitted Data, Device A to Received Data, Device B
(2) Transmitted Data, Device A to Received Data, Device C
(3) Transmitted Data, Device B to Received Data, Device A
(4) Transmitted Data, Device B to Received Data, Device C
(5) Transmitted Data, Device C to Received Data, Device A
(6) Transmitted Data, Device C to Received Data, Device B

Circuit Configuration Controls
Six switches, two for each of the three device ports are provided for each device. One sets up operation in either the voltage or current-loop mode, and the other interchanges the transmit and receive signals.

C2-076

A 3R CASE HISTORY:

COMPUTER TO COMPUTER

It was desired to transmit data from in-house Computer A to B without starting a new software project. Both computers had Teletype paper tape oriented editors, but it was desirable to bypass the paper and connect the computers directly. A direct connection between the computers would not work because each thought the other was a Teletype. But more significantly, the existing software in both machines required commands from a terminal and there was only one port per machine.

The solution was to make one of the computers ("A") think it was punching tape on the Teletype and the other computer ("B") think it was reading tape from the Teletype, with the output of the punching computer providing the input for the reading compu-ter. Computer A, B, and the Teletype were each connected to one of the three ports on the 3R. Commands to the two computers (using the Teletype keyboard through the 3R) were given in the following way:

First, the Teletype keyboard was switched to B and the Com-mand "Read Tape" was given. This put B in a state where any character received would enter memory. Then, with a flip of the 3R switches, the Teletype keyboard was disconnected from B and connected to A. Furthermore, A's output was connected to B's input (rather than the Teletype). Then, a "Punch Tape" command was issued to A.

"A" responded, sending its data to the 3R but the data was routed (due to the 3R switch connection) to B rather than the Teletype. Thus B accepted the data from A just as if paper tape had been read to it through the Teletype, accomplishing the des-ired data transfer.

3R-018

Digital Laboratories

3R UNIVERSAL VOLTAGE AND CURRENT LOOP JUNCTION

OPERATION INSTRUCTIONS

General

Each of the three connectors on the unit correspond to an independant data port and each can operate with an active or passive 20 mA current loop or EIA and TTL voltage levels. Six switches on the two inner circles labeled "CURRENT SOURCE" and "TERM/COMP" are associated in pairs with each port, independantly. These switches do not affect the device interconnections, but configure the setting of each port to the desired circuit.

Once a port's CURRENT SOURCE and TERM/COMP switches have been set, then these switches are not changed. If another device is plugged into one of the ports, then these switches provide a very fast and easy way to reconfigure the circuit consistent with the cabling procedures used by many manufactures.

The remaining six switches control the data flow between devices with an LED (Light Emitting Diode) indicating the circuit state as explained in the section on operation below.

Set-up

Each of the three devices that are to be switched or operated through the 3R are connected in accordance with the "hook-up" information in Figure 1. For most RS-232C devices such as modems, serial computer ports, video terminals, and printers, a standard one-to-one cable is all that is necessaary.

Control signals such as CLEAR TO SEND are activated on the 3R plug so that most devices will operate with a one-to-one plug. For these devices, and any others that are RS-232C compatible, the current source switch associated with the port is set to the off position. The current source switch that is associated with each port is next to the associated connector, and on the outer ring. The ring is used to label the three current source switches and does not imply any interconnection relationship between ports.

Similarly, the inner circle TERM/COMP three switches operate with its associated port independantly and has nothing to do with the interconnection of the ports. This switch reverses the Data Transmitted and Data Received signals (RS-232C pins 2 and 3) which allows one-to-one cables to work with both Data Terminal Equip-

ment (DTE) and Data Communications Equipment (DCE). It further allows use of cables that themselves reverse these signal wires.

Operation

Once two or three devices' are plugged into the 3R, and the proper circuit configuration is set by the CURRENT SOURCE and TERM/COMP switch, then the data flow switches will establish any desired connection between the three devices.

The six swithces are located between the three ports and the arrow head indicates the data direction. To establish a data path, the swich handle is set in the direction that the arrow points.

A data indicator is associated with each switch. Unless the data path is turned on, the light will stay unlit. If the data path is established, then it will light for the mark condition (Negative RS-232 Voltage) and go off for the space condition. If no device is plugged in, the lights from the open port to the other ports will light indicating the mark state for open circuit that is required by RS-232C. Thus when data is being transmitted, the lights will flash for low and moderate data rates, and dim for high data rates.

There is no restriction on the combination of the six data flow selector switches. The Computer to Computer Case History is an example of the versitility. Only when two devices are sending to the same device is there need for any caution. In this case if both devices try to simultaneously transmit, then the data bits are superimposed. There is no problem however with this connection so long as one device is in the mark condition while the other is transmitting.

3R-.ᵕ

A 3R CASE HISTORY:

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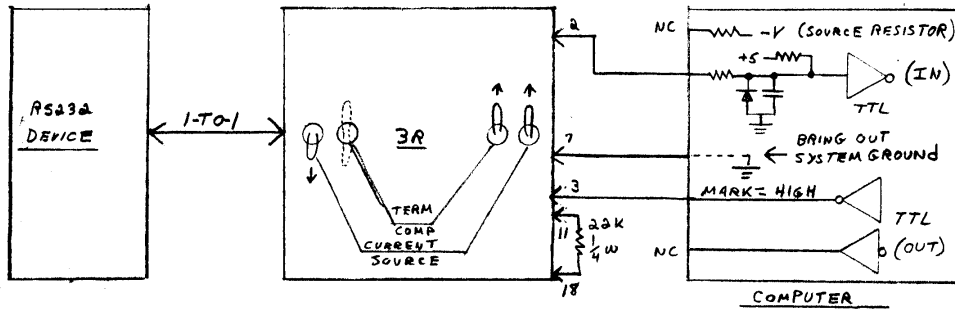terminal and there was only one port per machine.

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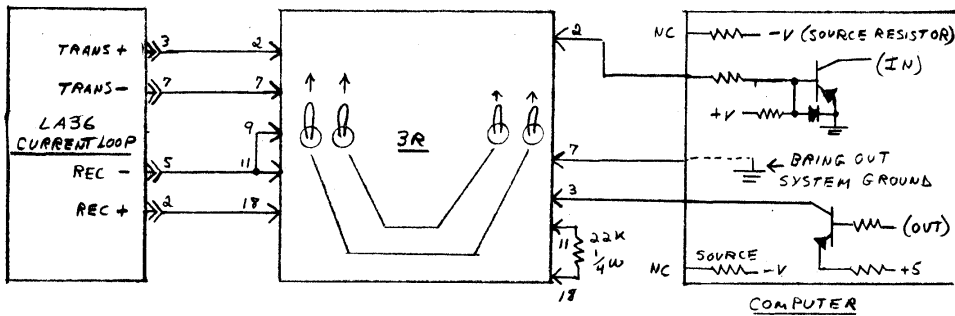was issued to A.

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3R-018

20mA CURRENT LOOP COMPUTER ←→ RS232 DEVICE

RS232 DEVICE

1-TO-1

3R

TERM COMP CURRENT SOURCE

NC   -V (SOURCE RESISTOR)

+5

TTL (IN)

2

7   BRING OUT SYSTEM GROUND

3   MARK = HIGH   TTL (OUT)

11   22K 1/4W

18   NC

COMPUTER

20 mA CURRENT LOOP COMPUTER ←→ LA36

TRANS +   3   2
TRANS -   7   7
LA36 CURRENT LOOP
REC -   5   11
REC +   2   18

3R

2   NC   -V (SOURCE RESISTOR)

(IN)

+V

7   BRING OUT SYSTEM GROUND

3

(OUT)

11   22K 1/4W

18   SOURCE   -V   NC   +5

COMPUTER

20mA CURRENT LOOP COMPUTER ←→ TTY ←→ MODEM (SYSTEM GND NOT ACCESSIBLE)
OR (MARK CONDITION INVERTED)

MODEM 103

2   2
3   3
7   7
20   9

3R

2   2 4 5   GE P/N H11B255   -V   +5   (IN)

7

9

11   5 3 1 4 2   GE P/N H11B255   +   +5   (OUT)

18

COMPUTER

2   7   9   11   18

P2 --- 7   8   6   5 --- P2

→ DIST +   + KBRD -

TTY
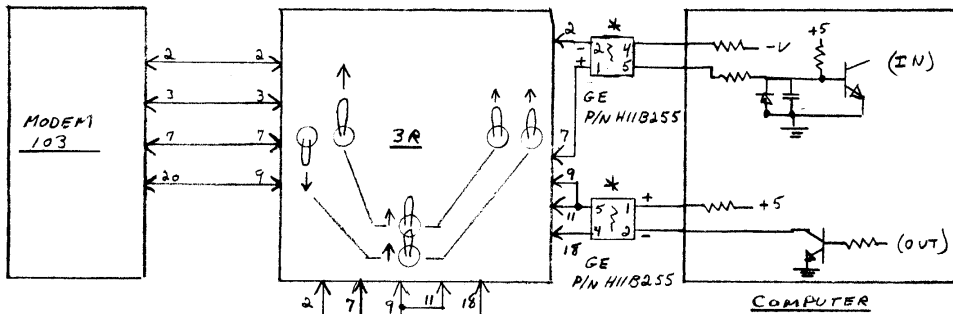
* NOTE: THESE PHOTON COUPLED ISOLATORS CAN BE MOUNTED IN THE CABLE

MAX: 950V 60 mA   1   5   MAX: 55V 100 mA   2   4

GENERAL ELECTRIC # H11B255
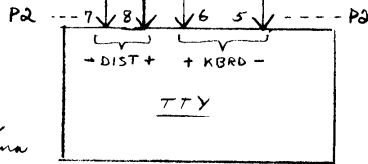
DIGITAL LABORATORIES		
TYPICAL 3R APPLICATIONS	D. STONE	
	28 MAR 77	
	REV A	
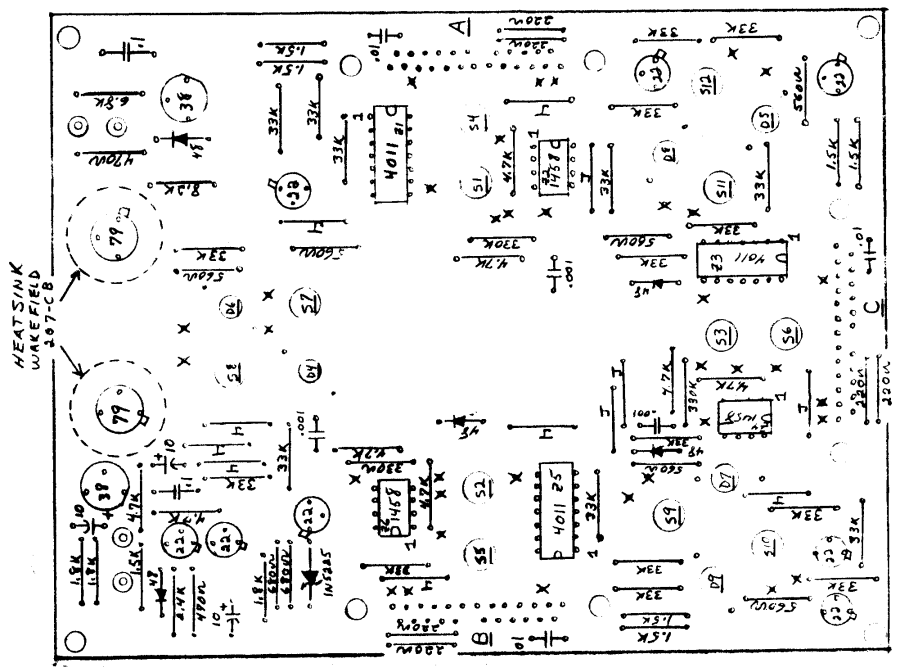
1.) INSERT & SOLDER FROM CIRCUIT SIDE
   (S1-S12, D1-D6, & A, B, C; INSTALLED ASSY-2)
2.) TRIM LEADS
3.) FILE
4.) CLEAN (BOTH SIDES)
5.) PUT ON LABEL
6.) CUT OUT HOLES IN LABEL
7.) PUT ON HEAT SINKS (2)- 207-CB

NOTES:
22= 2N2222
38= 2N3638
48= 1N4148
79= 2N5779
⊙= TERMINAL LUGS (4 TOTAL)
X= WIRE TO SWITCHES (36 TOTAL) #26 GA STRANDED 2.5" LONG
J= JUMPER, INSULATED (12 TOTAL)
   USE a) #22-#26 GA. BUSS WIRE
   OR b) RESISTOR LEADS

HEATSINK WAKEFIELD 207-CB

20 ma CURRENT LOOP OUT

RS232 IN/OUT

GROUND

20 ma CURRENT LOOP IN
(JUMPER PIN 9 to 11)

(-)   (+)
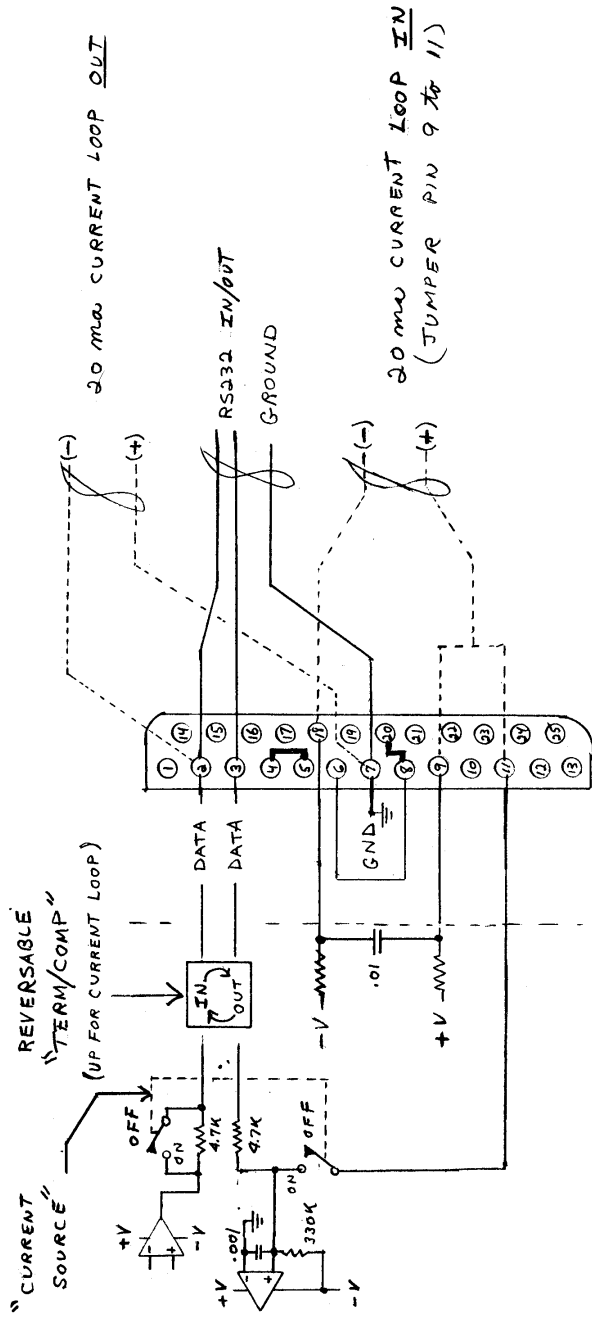
MATING CONNECTOR

CONN. "AMPHENOL" #17-305-01 (PLUG)
PINS " " #17-766-2 (MALE)
HOOD "CINCH" #DB51226-1

DATA
DATA
GND
-V
.01
+V

REVERSABLE
"TERM/COMP"
(UP FOR CURRENT LOOP)

IN
OUT

"CURRENT SOURCE"

OFF   OFF
ON   ON

4.7K   4.7K
330K
.001
+V -V
+V -V
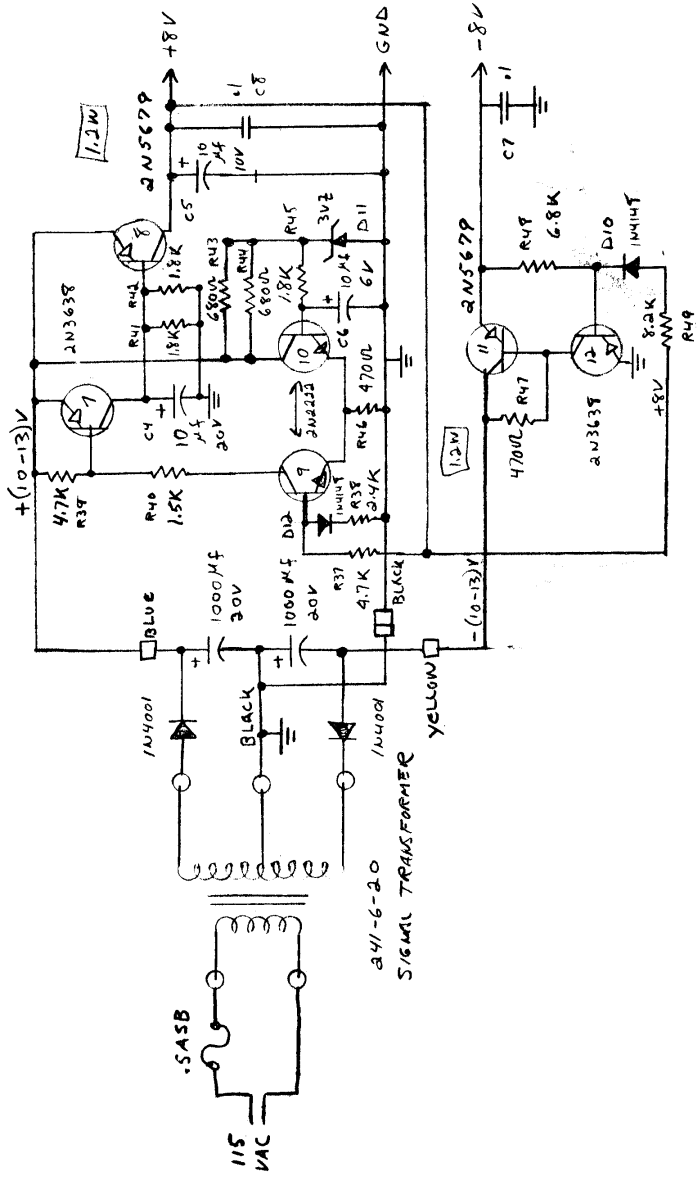
DIGITAL LABORATORIES

3-R
Power
SUPPLY

1458   +V 7   4 -V

LED

4011   OR

2N2222

1N4148

S4 & OFF   S1 &   3   2
R31   4.7K   A

S5 & OFF   S2 &   3   2
R32   4.7K   B

S6 & OFF   S3 &   3   2
R33   4.7K   C

22   1 2 3   10
21   7 8 9
21   11   13 12

26   1 2 3   10
25   7 8 9
25   11   12 13

24   1 2 3   10
23   7 8 9
23   11   13 12

R10 33K   R11 33K   R12 33K
R9 560Ω   D4   R13 560Ω   D5
R7 33K   S7   R14 33K   S12
+V   ↓ON   +V   ↓ON

R15 33K   R22 33K
R16 560Ω   D6   D7
R5 33K   S8   R17 33K   S9
+V   ↓ON   +V   ↓ON

R26 33K   R30 33K
R28 560Ω   D8   R29 560Ω   D9
R25 33K   S11   R27 33K   S10
+V   ↓ON   +V   ↓ON

21   1 2 3   21   6 5 4
25   1 2 3   25   6 5 4
23   1 2 3   23   6 5 4

S4,S5,S6   13   25   11   9

S1,S2,S3   14   1

1.5K   +V   1.5K
A   .01
390Ω   13 GΩ   -V

R34 33K   7   22   6 5   A   D1
C1 .001   R1 4.7K   S1a   S4a   OFF
330K R2   -V

R35 33K   7   26   6 5   B   D2
C2 .001   R3 4.7K   S2a   S5a   OFF
330K R4   -V

R36 33K   7   24   6 5   C   D3
C3 .001   R5 4.7K   S3a   S6a   OFF
330K R6   -V

ITEM	MANF.	PART NO	DESCRIPTION	QTY	QTY IN STOCK	LEAD TIME	PRICE	REMARKS
1	KEYSTONE	701	INSTRUMENT BOX	1				
2	ALTRON	3R	PC BOARD "3R"	1				
3	SIGNAL	241-6-20	TRANSFORMER	1				
4	LITTLEFUSE	342D38A	FUSE HOLDER (3AG)	1				
5	BELDEN	17106S	LINE CORD (BROWN)	1				
6	BUSS	MLD-1/2	.5A FUSE	1				
7	MALLORY	MTA-1000-625	1000 MFD > 20V PC	2				
8	MULTI	IN4001	DIODES RECTIFIER	2				
9	LAURENCE HARRISON		STICK ON LABEL	1				
10	Centralab	IN4372	3V ZENER DIODE 400MW	1				
11	MULTI	IN4148	GENERAL PURPOSE SILICONE	5				
12	H.H. Smith	9402	GROMMET 9/32 x 13/32 5/32	1				
13	KEYSTONE / H.H Smith	1518 / 2322	.5" SPACER 6x32	2				

BOARD ITEMS

ITEM	MANF.	PART NO	DESCRIPTION	QTY	QTY IN STOCK	LEAD TIME	PRICE	REMARKS
1	AMPH	17-3-04-01 / 17-1203	25 PIN CONNECTOR FEMALE	3				
2	AMPH	17-1209	CONNECTOR PINS 90° 5-33					
3	J&T	JMT 223	DPDT SWITCH	4				
4	J&T	LFH123	SPDT SWITCH	1				
5	TI	TIL220	LED	6				
6	MULTI	4011	CMOS IC	3				
7	MULTI	1458	LINEAR OP AMP	3				
8	MULTI	2N5679	PNP MED POWER TRANSISTOR	2				
9	MULTI	2N3638	PNP MED POWER TRANSISTOR	2				
10	MULTI	2N2222	NPN SIGNAL TRANSISTOR	8				
11	WAKEFIELD	207-CB	HEAT SINK FOR TO-5	2				
12	MULTI	220Ω	RESISTOR .25W ±10%	6				
13	MULTI	470Ω	" "	2				
14	MULTI	560Ω	" "	6				

ITEM	MANF.	PART NO	DESCRIPTION	QTY	QTY STOCK	LEAD TIME	PRICE	REMARKS.
			BOARD ITEMS (CONT.)					
15	Multi	68Ω	Resistor, .25W ±10%	2				
16	Multi	1.5K	"	7				
17	Multi	1.8K	"	3				
18	Multi	2.4K	"	1				
19	Multi	4.7K.	"	8				
20	Multi	6.8K	"	1				
21	Multi	8.2K	"	1				
22	Multi	33K	"	21				
23	Multi	330K	"	3				
24	Sprague	CCD-102	Capacitor, .25V ±20% .001	3				
25	Centralab	UK-25-103	" " .01	3				
	Sprague	TG-S10	"					
26	Centralab	UK-25-104	" " .1	2				
	Sprague	TG-P10						
27	ITT	TAG-F-30-MFD50	" 50V	3				
	Sprague	TVA1220 EX65MFD	" 50V " 10MFD	3				
28	Cinch	D-2048-2	STUDS + NUTS	6				
29	H.H.Smith	9181	3/16 x 3/16 NYLON SPACERS	6				
30	H.H.Smith	2160	FIBRE WASHER, FLAT	11				
31	KEYSTONE	614	BRACKETS, 1/4 x 1/4 "	6				
32	H.4.Smith	1426	SCREWS 6x32 x 3/8" BINDING HEAD	4				
33			SCREWS 6x36 x 1/4" BINDING HEAD	2				
34			SCREWS 6x32 x 3/8 " FLAT HEAD	2				
35	H.H.Smith	1000	SCREWS 6x32 x 1/4" ROUND HEAD	6				
36	H.H.Smith	1140	WASHER STAR #6	2				
			STICK-ON CLAMPS	2				
	Cambion	#2089-2	TERMINAL LUGS					STEEL, CADMIUM PLATED
	APL	#226-5003	CLEAR TUBING 20"					"
	ALPHA	JET 2.00	22					"
			18gauge WIRE 30"	12"				"
			24gauge WIRE 28" TWISTED 14"					"
			26 gauge WIRE Switchwire 9"					