VICI

Valco Instruments Co. Inc.

Digital Valve Sequence Programmer Instruction Manual

MAN-DVSP
Rev. 1/93
Printed in USA

P. O. Box 55603, Houston, TX 77255
(713) 688-9345 • Sales toll-free (800) 367-8424
Fax (713) 688-8106

Table of Contents

1. GENERAL DESCRIPTION

The Digital Valve Sequence Programmer (DVSP) is an add-on or stand-alone timer/programmer available with either 2 or 4 intervals, settable in ranges of 0-99 seconds, 0-9.9 minutes, or 0-99 minutes. The DVSP is most commonly used for remote operation of electrical devices such as solenoid valves, Valco two position or multiposition electric actuators, and the Valco Digital Valve Interface (DVI), which converts contact closures into pneumatic pulses for switching Valco two position air actuators.

The DVSP has two operational modes: in the AUTO mode, the DVSP will return to the first interval and begin another sequence after the last interval is completed, and in the SINGLE CYCLE mode it stops after one sequence. During a cycle or sequence, simple controls allow the user to stop the cycle, reset it to Interval 1, switch to the AUTO mode, or advance to the next interval. The DVSP can also be wired for remote operation by contact closure from a data system or other control device.

Each interval has one DPDT (double pole, double throw) relay, which provides two sets of contacts with no connection from one side to the other. This means that a single interval can be used to perform two separate functions requiring differing voltage requirements. For example, one side of relay A (Interval 1) can be used to switch an electric actuator (contact closure) while the other side is connected to 110 VAC and switches a 110 VAC solenoid valve *at the same time as the electric actuator.* In addition, Relay E (functional only in the AUTO mode) supplies a two second contact. When solenoid valves are wired in series with this relay the result is "pulsed operation" of the air actuator, which avoids the potential valve and actuator problems associated with continuously-applied air pressure.

Both 12 VDC and 110 VAC power supplies are included within the DVSP, but the relays may be supplied from any external power source. For example, 24 VDC solenoid valves can be switched by the DVSP relays if the 24 volts is supplied to the relays from an external 24 VDC power supply.

SPECIFICATIONS

General

3-wire power cord (2 meters)
Externally accessible 2A fuse
95-130 VAC, 25-60 Hz
2 or 4 intervals; settable from 0 - 99 seconds, 0 - 0.9 minutes, or 0 - 99 minutes
DPDT relay contacts rated at 3 amps @120 VAC resistive load
Elapsed time display

Dimensions

30 cm (11.8") x 15 cm (6") x 6 cm (2.4")
Weight: 2 Kgm (4 lbs)

Accuracy

2.16 seconds/day maximum error

Temperature range

0 - 70°C

Power Consumption

110 VAC @ 50 mA
12 VDC @ 200 mA

2. IMPLEMENTATION

Before removing the top cover of the DVSP, make certain that the power cord is unplugged.

Remove the two screws on the upper rear panel which secure the top cover. Look at **Figure 1** to locate the two barrier terminal strips located near the center of the large printed circuit board. The terminals are grouped beside letters denoting relays **A**, **B**, **C**, and **D**, and are marked **C** for **Co**mmon, **NO** for **N**ormally **O**pen, and **NC** for **N**ormally **C**losed. For convenience, the power line (fused and switched) is connected to two of the terminals on the DVSP mother board, labelled **HOT** and **NEUT**. **HOT** is the high side of the line and **NEUT** is the low side.

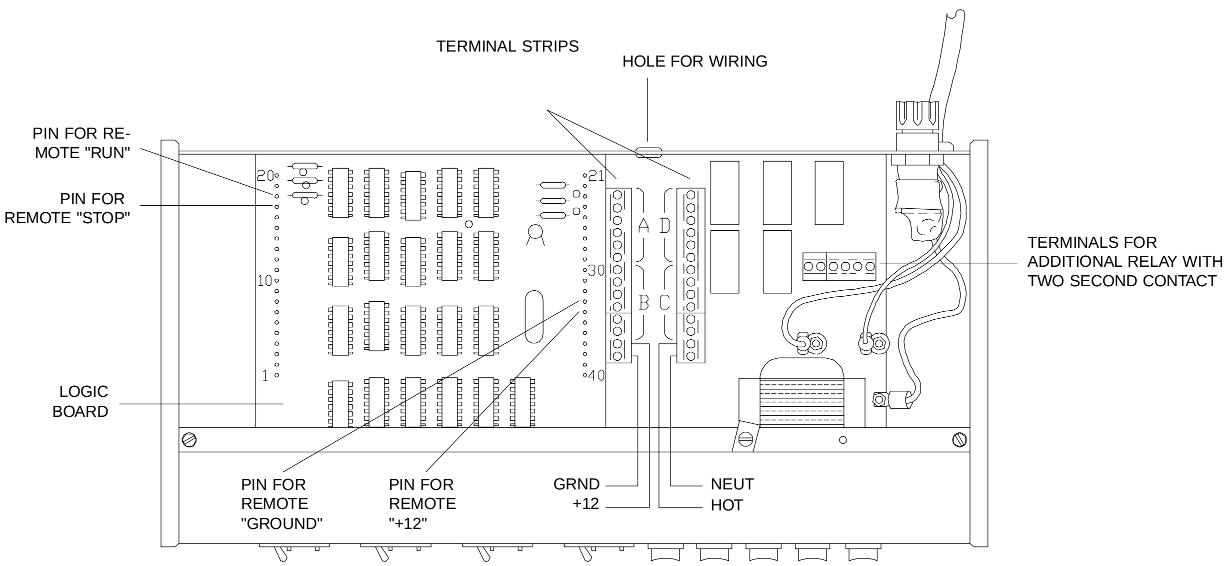


Figure 1: View of DVSP with cover removed

For operation of devices requiring line voltage (1 amp max), one side of the device is connected directly to the **NEUT** terminal and the **HOT** is switched by the output relays. For devices which operate on 12 VDC (300 mA max), voltage can be supplied to any of the relays with a simple jumper connection between the terminal marked **12** and the **C**ommon terminal of the target relay. (**Figure 2**) Any external power source can be connected to a **C**ommon in the same manner, with a hole provided in the rear panel to allow a passage for all the external wiring.

The DVSP output relays are double pole, double throw (DPDT), meaning that they have two separate sets of contacts with no connection from one set to the other. One contact of each set is the common (**C**), which is connected to the normally closed (**NC**) contact when the DVSP is *not* in the interval corresponding to that relay. As the DVSP enters each interval, the corresponding relay switches and connects the common (**C**) terminal to the normally open (**NO**) terminal, sending the current to the external device.

The table below indicates which group of terminals applies to each interval for the various DVSP models. In the drawings which illustrate the different wiring options, the terminal groupings are chosen purely for convenience: there is no intent in these drawings to convey any information about specific intervals.

DVSP-2	Interval 1	Relay A
	Interval 2	Relay C
DVSP-4	Interval 1	Relay A
	Interval 2	Relay B
	Interval 3	Relay C
	Interval 4	Relay D

2.1 Solenoid Valves

2.11 110 VAC

The steps described below are illustrated in **Figure 2.**

1. Supply 110 VAC by connecting the **HOT** terminal to **C** of the appropriate relay.
2. Connect one wire of the solenoid to the **NEUT** terminal.
3. Connect the other wire of the solenoid to the normally open (**NO**) terminal of the relay which corresponds to the **C** of Step 1.

2.12 12 VDC

The steps described below are illustrated in **Figure 2.**

1. Supply 12 VDC by connecting the **+12** terminal to **C** of the appropriate relay.
2. Connect one wire of the solenoid to the **GRND** terminal.
3. Connect the other wire of the solenoid to the normally open (**NO**) terminal of the relay which corresponds to the **C** of Step 1.

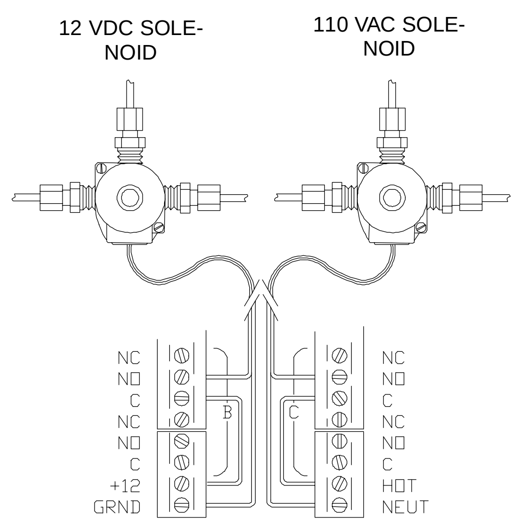


Figure 2: 12 VDC and 110 VAC solenoids

2.13 Valco MSVA

The MSVA is used with a two position air actuator, which requires one interval to switch to the inject position and another to switch to the load position. The steps described below are illustrated in **Figure 3**.

1. Supply the proper voltage (110 VAC in this example) by connecting the **HOT** terminal to **C** of the one of the groups of terminals to be used, and jumping it to **C** of the other.
2. Connect one wire of each solenoid to the **NEUT** terminal.
3. Connect the other wire of each solenoid to the **NO**s which correspond to the **C**s of Step 1, according to the desired switching sequence.

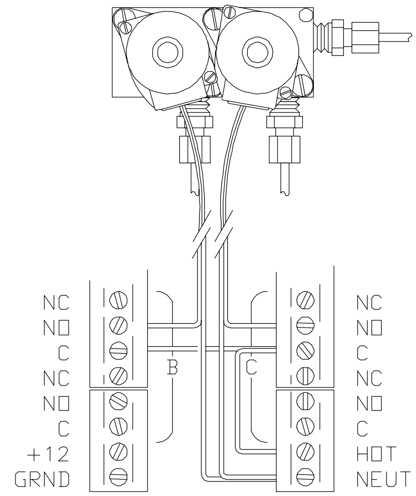


Figure 3: 110 VAC Valco MSVA

2.14 Pulsed Operation of Solenoids

The first three procedures demonstrate the simplest uses of the DVSP. This example will illustrate the use of the pulsed relay in conjunction with two devices on the same DPDT relay. The steps described below are illustrated in **Figure 4.**

1. Connect the two wires of the 12 VDC solenoid as described in Section 2.12.
2. Connect one wire of the 110 VAC sole-noid to **NEUT** as described in Section 2.11, but connect the other wire to the *second* **NO** terminal of the *same* relay to which the 12 VDC solenoid is con-nected.
3. Supply 12 VDC by connecting the **+12** terminal to one of the **NO** terminals on the pulsed relay (**Figure 1**) and connecting that **NO**'s related **C**ommon to the **C**ommon of the **NO** which has the 12 VDC solenoid connected to it.
4. Likewise, supply 110 VAC by connecting the **HOT** terminal to the remaining **NO** terminal on the pulsed relay and connecting that **NO**'s related Common to the Common of the **NO** which has the 110 VAC solenoid connected to it.

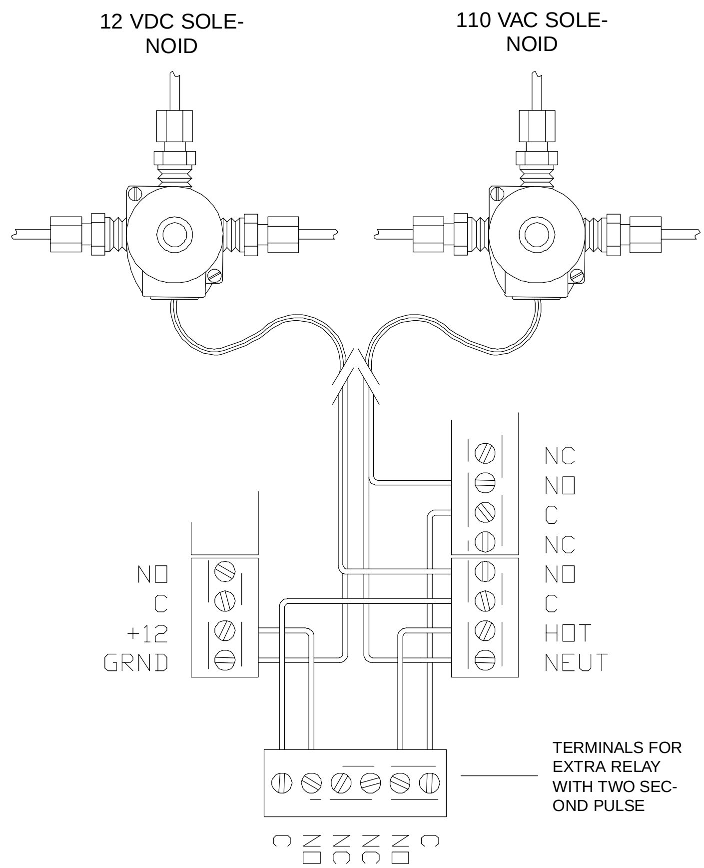


Figure 4: Use of the pulsed relay and two events on one relay

2.2 Valco Electric Actuators

Multiposition actuators require only one event to step the valve/actuator to its next position. However, the two position actuator requires two intervals: one to switch the two position valve to its inject position and another to switch it to its load position.

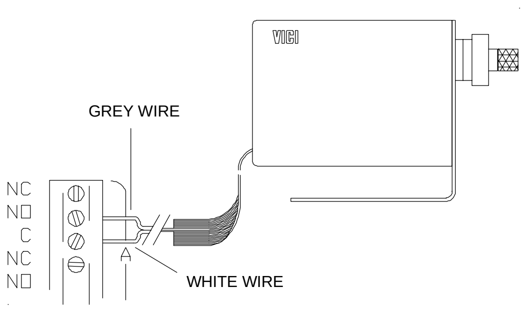


Figure 5:
Valco multiposition electric actuator

2.21 Multiposition

The steps below are illustrated in **Figure 5**.

1. Locate the two pairs of adjacent grey and white wires in the interface cable supplied with the actuator. The relevant pair for this application is the one near the center of the ribbon cable.
2. Connect the grey (STEP) wire to the **NO** terminal of the appropriate relay.
3. Connect the white (GRND) wire to **C** or the same relay.

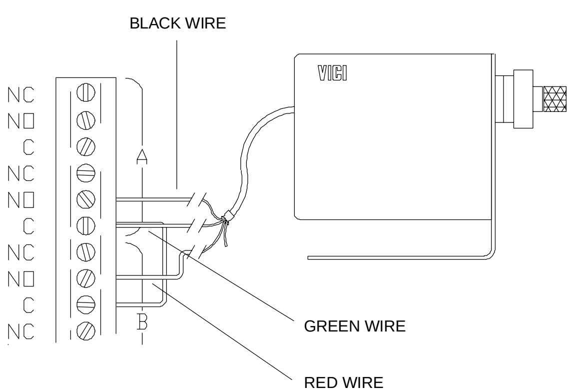


Figure 6:
Valco two position electric actuator

2.22 Two position

The steps below are illustrated in **Figure 6**.

1. Locate the black, red, and green wires in the remote switching cable extending from the cover of the actuator.
2. Connect the black (**I**NJECT) wire to the **NO** terminal of the appropriate relay for the desired interval.
3. Connect the red (LOAD) wire to the **NO** terminal of the relay corresponding to the interval where sample is to be loaded.
4. Connect the green (GRND) wire to the **C**ommon of one of the relays and use a jumper to connect it to the **C**ommon of the other relay.

2.3 Valco Digital Valve Interface (DVI)

Two intervals are required with the DVI: one to signal it to move the valve to the inject position, and one to signal it to return to the load position. The steps described below are illustrated in **Figure 7**.

1. Connect the air actuator to the DVI as described in the DVI literature.
2. Locate the blue, black, and red wires in the interface cable supplied with the DVI.
3. Connect the blue (INJECT) wire to the **NO** terminal of the appropriate relay for the desired interval.
4. Connect the black (LOAD) wire to the **NO** terminal of the relay corresponding to the interval where sample is to be loaded.
5. Connect the red (GRND) wire to the **C**ommon of one of the **NO**s used in Steps 3 and 4, and use a jumper to connect it to the **C**ommon of the other **NO**.

   In routine operation the DVSP will control the switching of the valves, so manual control through the DVI will not be an issue. However, it is possible to allow the option of manually overriding the positioning of valves switched by the DVI. To do this, the DVSP signal must be removed from the DVI remote cable by routing the DVI common (RED) through the pulsed relay, E. The signal from the DVSP is applied for only two seconds and then removed, permitting subsequent manual valve positioning with the switch on the front of the DVI.

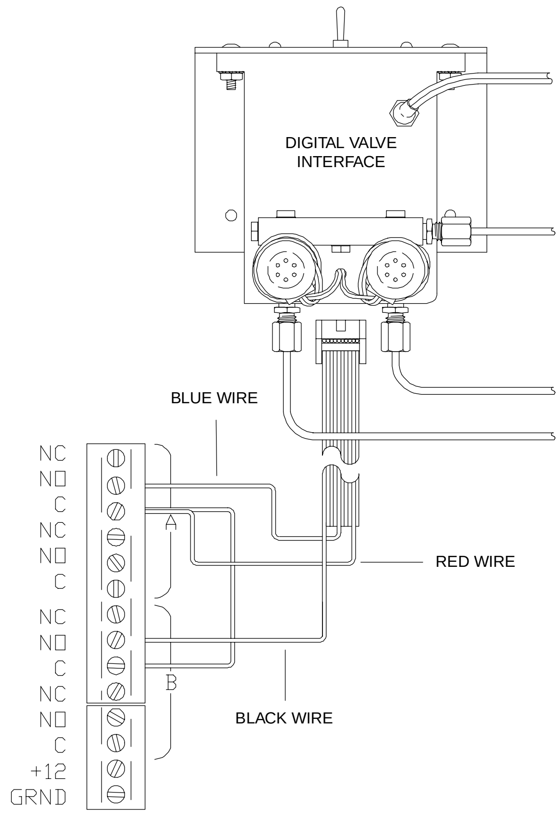


Figure 7: Valco Digital Valve Interface

3. SWITCH AND DISPLAY FUNCTIONS

1. **Power ON/OFF**: Turns the DVSP on and off.
2. **Interval duration** switches: Each interval has two thumbwheel switches for setting the the interval duration, in increments determined by the setting of the time unit switches.
3. **Time unit** switches: Under each pair of interval duration switches is a three-position switch which defines the units in which the duration is set. With this switch to the left the unit is minutes, so the two digits of the duration switches reflect a value from 00 to 99 minutes. In the middle position the unit is tenths of a minute, with a range of 0.0 to 9.9 minutes. (In this setting the elapsed time display shows a decimal point.) When the switch is to the right the thumbwheel duration switches are setting seconds, in a range from 00 to 99.
4. **ADV**ance button: This will advance the DVSP into the next non-zero interval. Everything functions as if the timer had reached its setting and advanced to the next interval on its own.
5. **AUTO** button: Pushing this button toggles the DVSP in and out of the AUTO mode. In the AUTO mode (AUTO LED on), when a cycle is completed the DVSP goes back to the first interval and starts another. In the SINGLE CYCLE mode (AUTO LED off), the timer stops at the end of the last interval.
6. **R**e**S**e**T** button: Pressing this button sets the DVSP to the state it's in when first turned on: the timer is stopped and the DVSP is in the SINGLE CYCLE mode. No interval is being addressed and no relays are energized.
7. **RUN** button: Pressing this button lights the RUN LED, starts the timer, and moves the DVSP to the first interval not set to "00".
8. **STOP** button: This stops the timer and resets it to zero, but the DVSP remains in the interval that was in progress and the output to the relays stays the same. The RUN LED goes off.
9. **Current interval** lights: Between each time unit switch and interval number is an LED which comes on when that interval is current.
10. **Elapsed time** readout: This digital display to the left of the VICI logo shows the elapsed time in the interval which is running, indicated by which current interval light is on. The display is in the value range selected by the three position time unit switch for that interval. Whenever the timer is counting minutes, the decimal light flashes at one second intervals.

3.1 Operating the DVSP by Remote Contact Closure

The DVSP can be wired so that the functions done by RUN, STOP, and AUTO buttons can be done by remote contact closure. This involves soldering wires from the control device to the appropriate pins on the logic board. (**Figure 1**) For the RUN function, establish *momentary* contact between pins 18 and 35 (+12). For the STOP function, momentarily connect pins 17 and 35. Connecting pin 22 to pin 34 (ground) will toggle the DVSP in and out of the AUTO mode.

4. DEMONSTRATION SEQUENCE

This example demonstrates use of the DVSP-4 to control the positioning of two Valco switching valves. Valve 1 (**V1**) is used for sample injection and Valve 2 (**V2**) is configured for column backflushing. Both valves are air actuated, but **V1** is controlled by a Valco Digital Valve Interface (DVI) while **V2** is controlled by a pair of 3-way solenoid valves (MSVA). Each valve requires two intervals of the DVSP; one for clockwise rotation and one for counterclockwise. (All references to directions are as seen from the actuator end of the valve.)

In the ready (rest) state, both valves are in the counterclockwise position. (**Figure 8**) After the process is begun by charging the sample to **V1**, **V1** will be switched clockwise to inject the sample. (**Figure 9**) After two seconds for sample injection, **V1** is returned to the counterclockwise position to load the next sample. In this example, fifteen minutes will elapse before **V2** is switched clockwise and the contents of the column are backflushed to the detector. (**Figure 10**) After nineteen minutes for desorbtion of the column contents into the detector, **V2** is switched counterclockwise for the next sample analysis. Four and a half minutes will be allowed for equilibration before the next cycle begins.

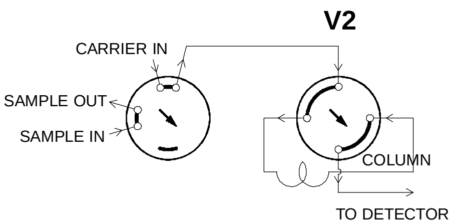


Figure 8: V1 and **V2** in counterclockwise position (Rest and Intervals 2, 4)

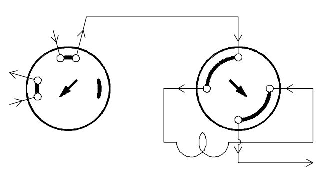


Figure 9: V1 in clockwise position (Interval 1)

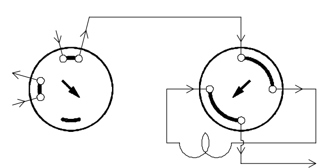


Figure 10: V2 in clockwise position (Interval 3)

Broken down into its component intervals, the process appears like this:

Interval 1 (2 seconds)
Relay A is energized, switching **V1** to its clockwise position and injecting the sample onto the column.

Interval 2 (15 minutes)
Relay B is energized, switching **V1** back to the counterclockwise position, ready for the next sample.

Interval 3 (19 minutes)
Relay C is energized for two seconds (through relay E), switching **V2** and backflushing the column to the detector.

Interval 4 (4.5 minutes)
Relay D is energized for two seconds (through relay E), switching **V2** to the column forward position, ready for the next run. If the DVSP is in the AUTO mode, the next cycle will begin after 4.5 minutes.

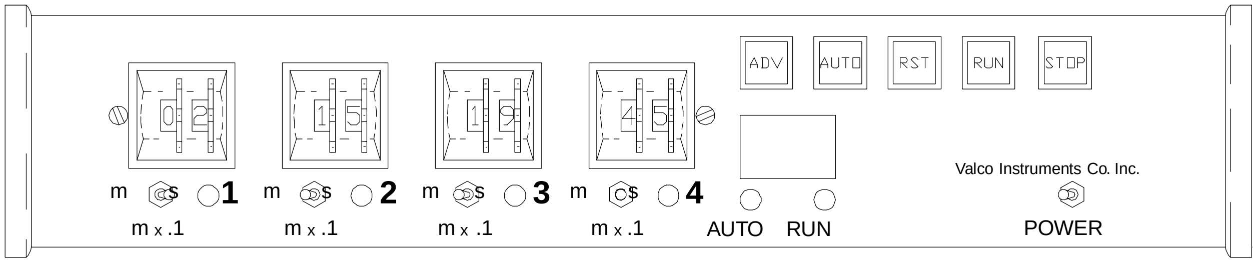


Figure 11: DVSP front panel
programmed for the demonstration process

Programming the DVSP is very simple now that the process has been broken into steps:

1. Set the switch beside the "**1**" to the right, for "seconds", and set the thumbwheel switch to **02**.
2. Set the switch beside the "**2**" to the left, for "minutes", and set the thumbwheel switch to **15**.
3. Set the switch beside the "**3**" to the left, for "minutes", and set the thumbwheel switch to **19**.
4. Set the switch beside the "**4**" in the middle, for "tenths of minutes", and set the thumbwheel switch to **45** (4.5 minutes).

The wiring connections for the demonstration sequence are illustrated in **Figure 12.** Since **V1** uses the DVI (with a built-in two-second relay) it is simply wired to DVSP relays A and B which correspond to **I**ntervals 1 and 2. (A jumper connects the **C**ommons.)

Since **V2** is switched by a *pair* of solenoid valves, it is important that the current which activates them is supplied only as long as it takes to switch the valve, even though the DVSP relay is energized for the entire length of the interval. To provide this pulsed current and avoid the problems associated with continuously-applied air pressure, the DVSP features a fifth relay (E) which is activated for two seconds at the beginning of each interval. When the "hot" leg of each solenoid is run through relay E, the power is applied to the solenoid only during the initial two seconds of its interval.

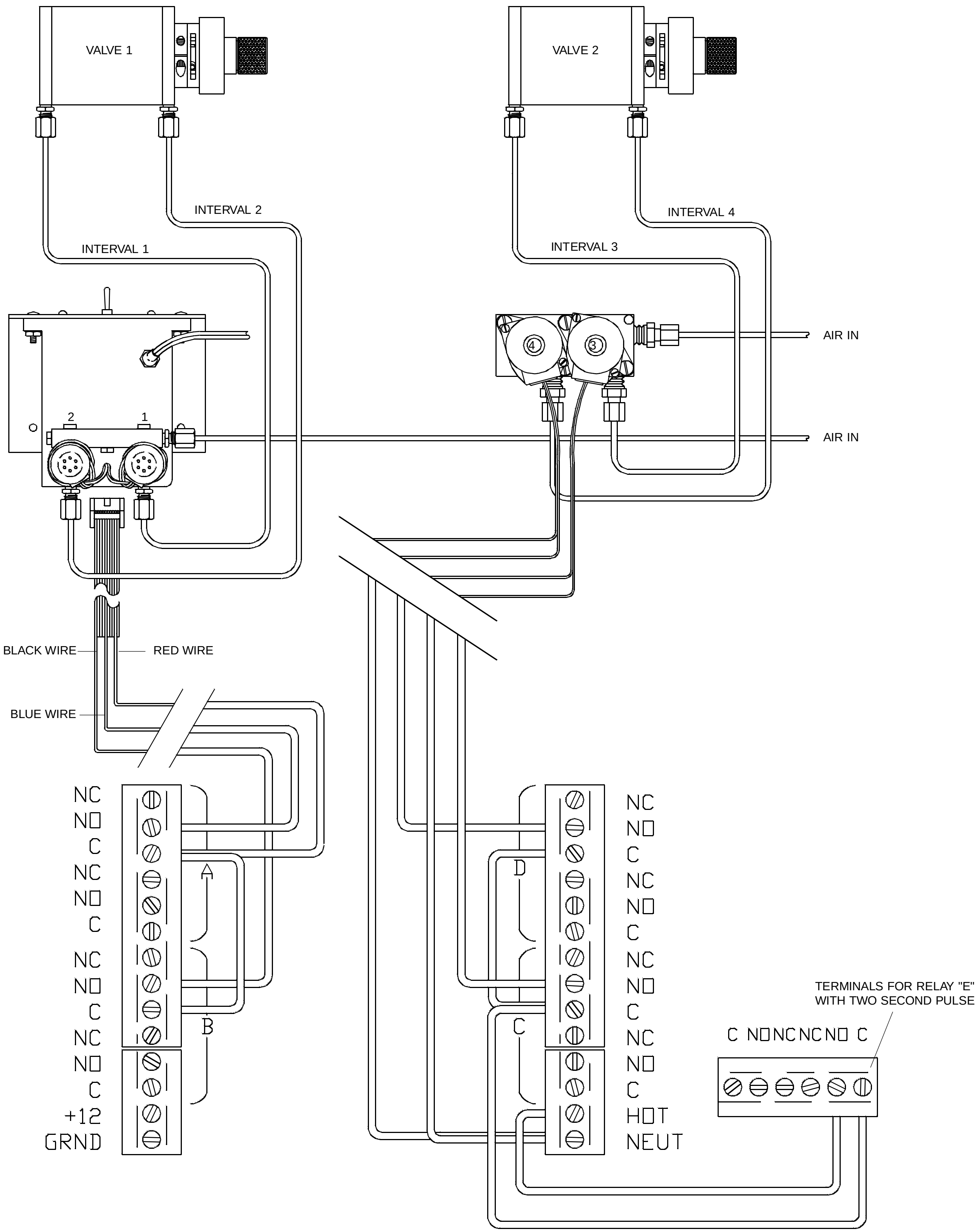
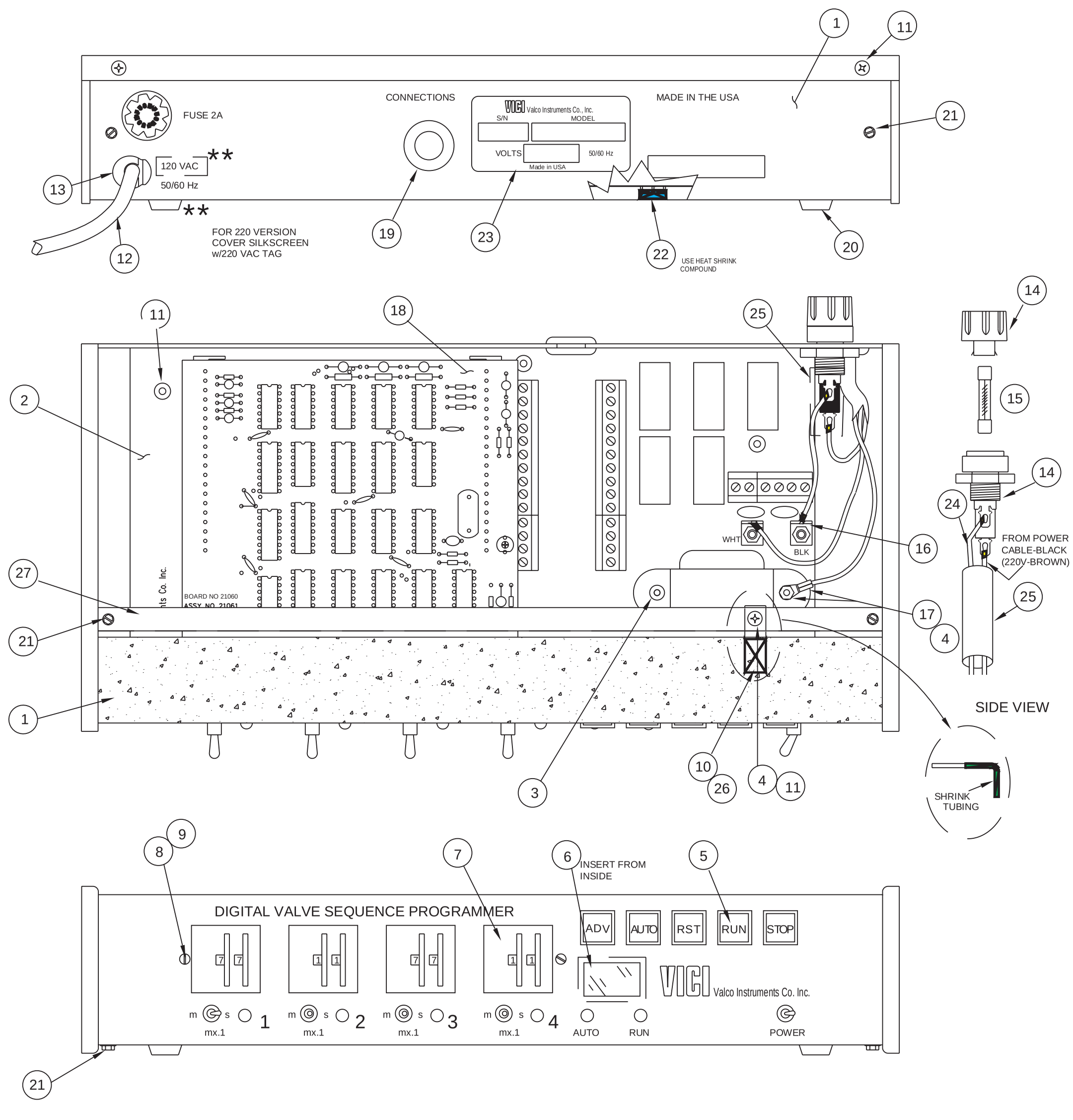


Figure 12: DVSP connections for the demonstration process

5. TECHNICAL DRAWINGS



REVISIONS

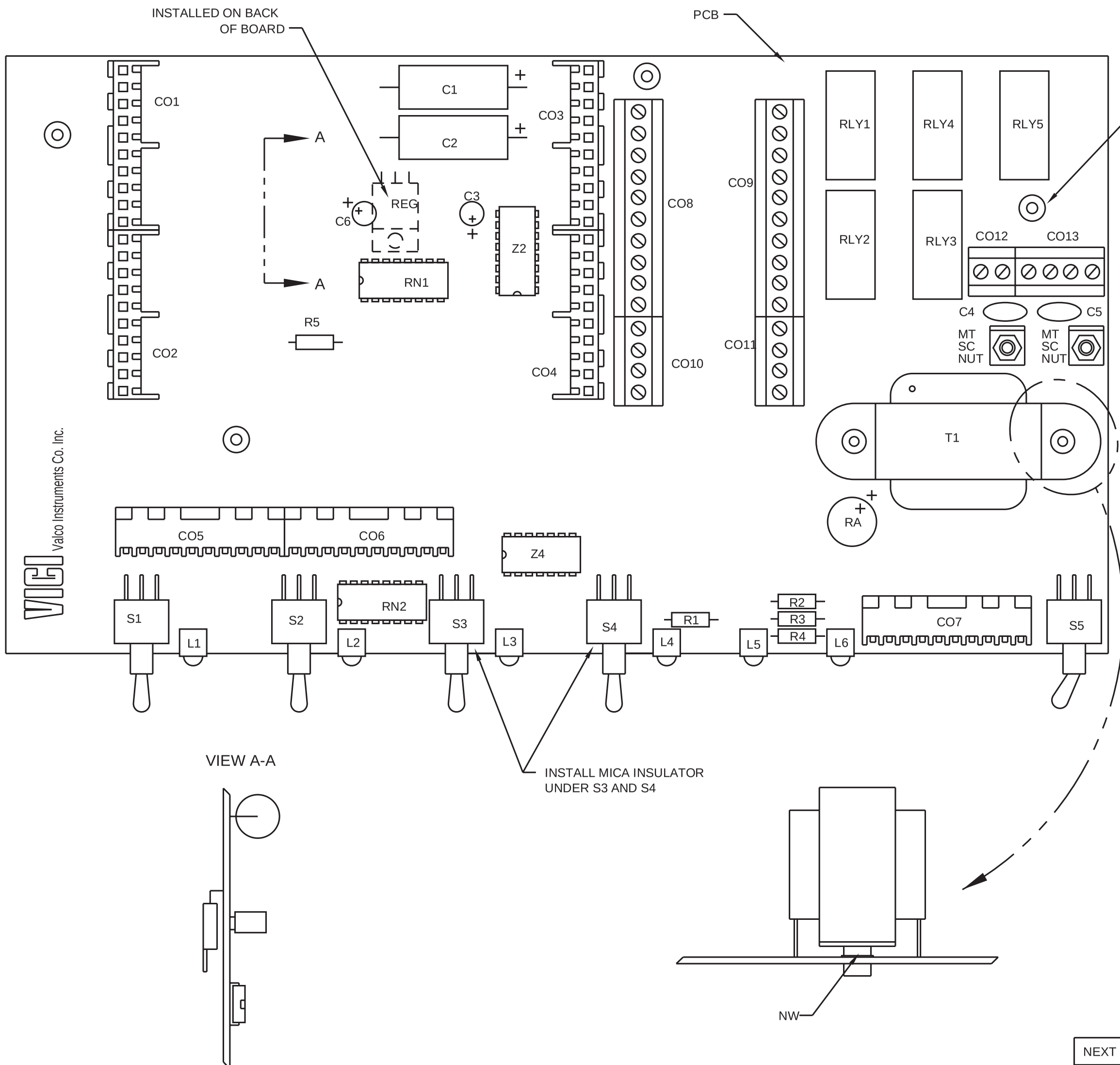
LTR	DESCRIPTION	DATE	INITIATED
A	ECN#:4821 BRING UP TO STANDARD, REDRAWN IN ACAD	04/21/99	J DURR

	ITEM	DESCRIPTION	VALCO #	QTY
	1	ENCLOSURE: DVSP-4 (TENEC E2231-J12)	I-21109	1
*	2	PCB ASSY: M/B, FOUR INTERVAL DVSP	I-21027	1
	3	SCREW,PLMS: 4-40 x 3/4 LG	HWSC-PL4-10	2
	4	NUT, HEX: #4-40 UNC, STAINLESS	HWNUT-HEX#4	3
	5	PCB ASSY: PUSH BUTTON BD,DVSP/TGA1K	I-21059	1
	6	LENS: DISPLAY, RED. INSTRUMENTS	I-21119	1
	7	PCB ASSY: T/W SWITCH, FOUR INTERVAL DVSP	I-21023	1
	8	SCREW, BMS: 2-56 x 1/2 LG	HWSC-BM2-8	2
	9	NUT, HEX: #2-56 UNC	HMNUT-HEX#2	2
	10	RETAINER ARM: DVSP PUSHBUTTON BD	I-21164	1
	11	SCREW, PLMS: 4-40 *1/4 Lg, PANHD	HWSC-PL4-4	7
*	12	POWER CORD: GREY 6' 18/3 SVT	I-W-CS-21	1
	13	STRAIN-RELIEF: SRR-10	HWSRR-10	1
	14	FUSE-HOLDER: 342014	HWFUSEHOLD-1	1
	15	FUSE: 2AMPS 3 AG	HWFUSE-2A	2
	16	LUG: FEMALE SLIP-ON, 16-14 AWG	HWLUG-4218B	2
	17	LUG: RING, HIGH TEMP. #6	HWLUG-1806-HT	1
	18	PCB ASSY: LOGIC BOARD, DVSP/TGA 1K	I-21061	1
	19	GROMMET: NEOPRENE, 5/8 x 1/16 x 7/16 ID	HWGR-2177	1
	20	FEET: RUBBER STICK-ON	HW-1658	4
	21	SCREW, SMS: #4*3/8 LG	HWSC-SM4-6	6
	22	MICA INSULATORS #4671	HW-MICA	1
	23	TAG: SERIAL, ALL ELEC. DEVICES	I-21988	1
	24	WIRE: 18 AWG TEFLON BLACK	I-W-18-BLACK	.500
	25	TUBING: HEAT SHRINK 1/2" ID	I-STUBE.500	.250
	26	TUBING: HEAT SHRINK 1/4" ID	I-STUBE.250	.041
	27	RETAINER: DVSP PUSHBUTTON BD	I-21110	1
	28	MANUAL: OPERATION, DVSP (NOT SHOWN)	MANUAL:DVSP	1

* 220 MODELS USE (2) I-21027-220
(12) I-W-17800

THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1 63		VICI Valco Instruments Co., Inc.
APPROVED	DATE	DIGITAL VALVE SEQ.
DRAWN DJM	12/16/82	PROGRAMMER ASSY. DVSP4
DESIGNED		DO NOT SCALE DRAWING SCALE --- / SIZE B / DRAWING NO. 21143
CHECKED		
FILE NAME 21143	SUB-DIR DVSP	USA PROJECTION / SHEET OF



SO1-6
INSTALL ON
BOTTOM OF PCB

REVISIONS			
LTR	DESCRIPTION	DATE	INITIATED
N	MOVE S1-S4 & Z3 ADD C4-6 MOVE INPUT POWER TERM.	11/16/82	-
P	ECN #4027 REDRAWN IN ACAD UPDATE BOM	01/07/98	J DURR

PARTS LIST

DES	DESCRIPTION	VALCO #	QTY
PCB	PCB: MOTHER BOARD DVSP AW108 REV M	I-PCB21024	1
RN1	RES NET: 10 K, 16 PIN DIP, COMMON	I-RN761-1-10K	1
RN2	RES NET: 220 K, 16 PIN DIP, COMMON	I-RN761-1-220K	1
Z4	IC: 4 INNPUT OR-GATE	I-IC4072	1
Z2	IC: 7 BUFFER/LINE DRIVER	I-IC2004	1
C1,2	CAP: ELECT, 220uF 35V, AXIAL LEAD	I-CE227-35AL	2
C3	CAP: TANTAL, 4.7MF 35V	I-CT475-35	1
C4,5	CAP: CERAMIC, .01uF 1000V	I-CC103-1K	2
C6	CAP: TANTAL, 1MF 35V	I-CT105-35	1
R1-4	RES: 1.2 K, 5%, 1/4W	I-R511201	4
R5	RES: 51 K, 5%, 1/4W	I-R515102	1
CO1-4	CONN: 10 PIN PCB MOLEX	I-T09523103	4
CO5-7	CONN: 10 PIN RT ANGLE MOLEX	I-T09523101	3
CO8,9	CONN: GS 5/10 WEIDMULLER #4596-6	I-T4596-6	2
CO10-12	CONN: GS 5/4 WEIDMULLER 4382-6	I-T4382-6	3
CO13	CONN: GS 5/2 WEIDMULLER #4109-6	I-T4109-6	1
REG	IC: VOLTAGE REGULATOR, 12V, T0220	I-IC7812	1
RA	RECTIFIER BRIDGE	I-D-VE28	1
S1-4	SWITCH: SPDT 7103MD9AB SPDT-RPC-C-P-S	I-SW-7103MD	4
S5	SWITCH: TOGGLE SPDT-RPC-N-P-S	I-SW-MTM106	1
L1-6	LED: RED, WITH MOUNT 550-0405 DIALIGHT	I-LED550-01	6
RLY1-5	RELAY: AROMAT 12V DC	I-RY-NC2DPDC12	5
T1	TRANSFORMER 16 VCT .6 AMP 120V	I-X-SSC-16-1	1
SO1-6	STANDOFF: #4-40 X .1875 SWAGE THREADED	HWSO-4639B	6
MT	MALE TABS	HW-607	2
SC	SCREW,PLMS: 4-40 X 1/4 LG PH,SS	HWSC-PL4-4	2
NUT	NUT, HEX: #4-40 UNC, STAINLESS	HWNUT-HEX#4	2
NW	WASHER: SHOULDER, #4 HHS-2661 NYLON	HWW-N#4	2
MICA	MICA INSULATORS #4671	HW-MICA	2

REF DWG (21212) SCHEMATIC

TOLERANCES UNLESS OTHERWISE SPECIFIED 63
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1

VICI Valco Instruments Co., Inc.

PCB ASSY: MOTHER BD

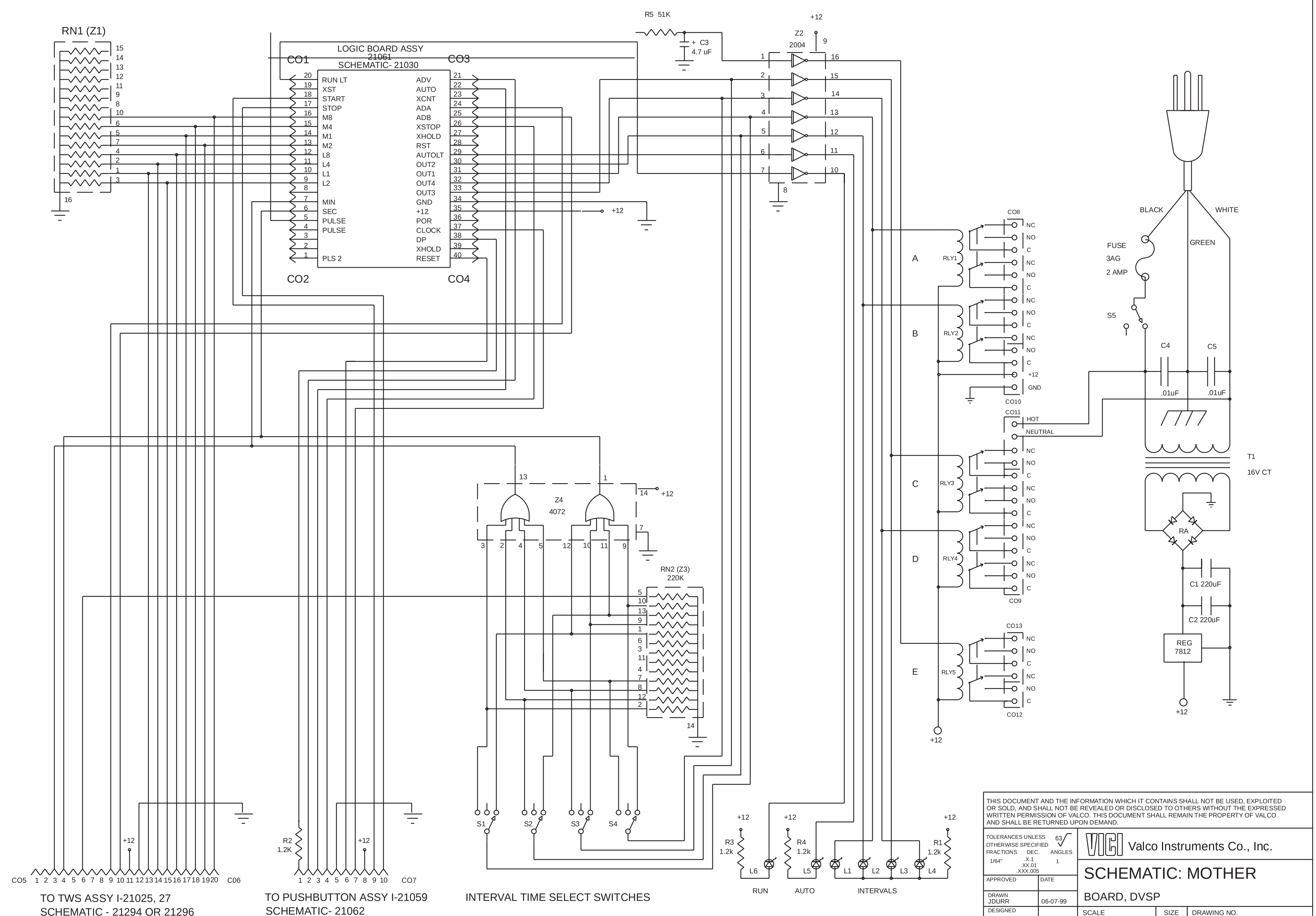
FOUR INTERVAL DVSP I-21027

APPROVED	DATE	
DRAWN R.B.D.	1/5/97	
DESIGNED		
NEXT ASSY	CHECKED	
B-21143	FILE NAME 21027	SUB-DIR \DVSP\

SCALE --- SIZE B DRAWING NO. 21027

USA PROJECTION SHEET OF

REVISIONS			
LTR	DESCRIPTION	DATE	INITIATED
A	CHANGE FROM HAND DWG TO CAD	7JUN99	JDURR



THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS 1/64"; DEC. .X .1, .XX .01, .XXX .005; ANGLES 1; 63

VICI Valco Instruments Co., Inc.

SCHEMATIC: MOTHER BOARD, DVSP

APPROVED	DATE
DRAWN JDURR	06-07-99
DESIGNED	
CHECKED	
FILE NAME 21212	SUB-DIR /DVSP/

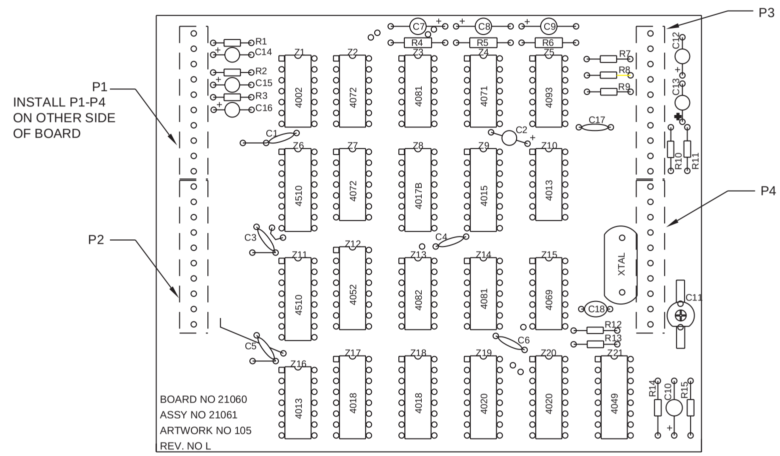
SCALE | SIZE C | DRAWING NO. 21212

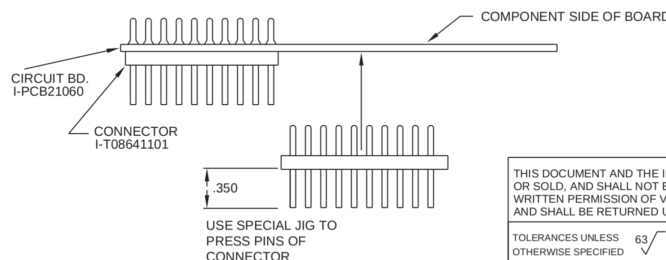
USA PROJECTION | SHEET | OF

REVISIONS			
LTR	DESCRIPTION	DATE	INITIATED
A	ECN #035 ADD C18 SEE		
B	ECN #1083 ADD ORIENTATION ON BOARD	3/2/93	J.D.

PARTS LIST

SYMB.	DESCRIPTION	VALCO #	QTY.
P.C.B.	PCB: LOGIC BOARD AW105 REV L	I-PCB21060	1 EA.
P1-4	PLUG: 10 PIN MOLEX	I-T09641101	4 EA.
R1-3;10,11	RES: 1 K, 5%, 1/4W	I-R511001	5 EA.
R4-6	RES: 220 K, 5%, 1/4W	I-R512203	3 EA.
R7-9	RES: 47K, 5%, 1/4W	I-R514702	3 EA.
R12	RES: 12 MEG, 5%, 1/4W	I-R51205	1 EA.
R13 & 15	RES: 10 K, 5%,1/4W	I-R511002	2 EA.
R14	RES: 100 K, 5%,1/4W	I-R511003	1 EA.
C1;3-6&17	CAP: CERAMIC,.022 uF,50V,.250 LEADS	I-CC223-50	6 EA.
C7-10	CAP: TANAL,.47 MF 35V	I-CE474-35	4 EA.
C11	CAP: CERAMIC VARIABLE, JFD-DV2PS120D	I-CV9410-4	1 EA.
C2;12-16	CAP:TANTAL, 47MF 35V	I-CT105-35	6 EA.
C18	CAP: CERAMIC 47pf 1000V	I-CC470-1K	1 EA.
XTAL	CRYSTAL: 2.097152 MHZ -MP2	I-XTAL-4	1 EA.
Z1	IC: DUAL 4-INPUT AND GATE	I-IC4002	1 EA.
Z2 & 7	IC: 4-INPUT OR GATE	I-IC4072	2 EA.
Z3 & 14	IC: QUAD 2-INPUT AND GATE	I-IC4081	2 EA.
Z4	IC: QUAD 2-INPUT OR GATE	I-IC4071	1 EA.
Z5	IC: QUAD 2-INPUT NAND GATE	I-IC4093	1 EA.
Z6 & 11	IC: BCD UP/DOWN COUNTER	I-IC4510	2 EA.
Z8	IC: DECIMAL CTR/DIVIDER, RCA OR MOT	I-IC4017	1 EA.
Z9	IC: DUAL 4-BIT STATIC SHIFT REGISTER	I-IC4015	1 EA.
Z10 & 16	IC: DUAL TYPE D FLIP-FLOP	I-IC4013	2 EA.
Z12	IC; ANALOG MUX/DEMUX	I-IC4052	1 EA.
Z13	IC: DUAL 4-INPUT AND GATE	I-IC4082	1 EA.
Z15	IC: HEX INVERTER	I-IC4069	1 EA.
Z17 & 18	IC: PRESET DIVIDE-BY-N COUNTER	I-IC4018	2 EA.
Z19 & 20	IC: 14 BIT BINARY COUNTER	I-IC4020	2 EA.
Z21	IC: INVERTING HEX BUFFER	I-IC4049	1 EA.
REF.	SCHEMATIC C-21030		





TOLERANCES UNLESS OTHERWISE SPECIFIED 63
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1

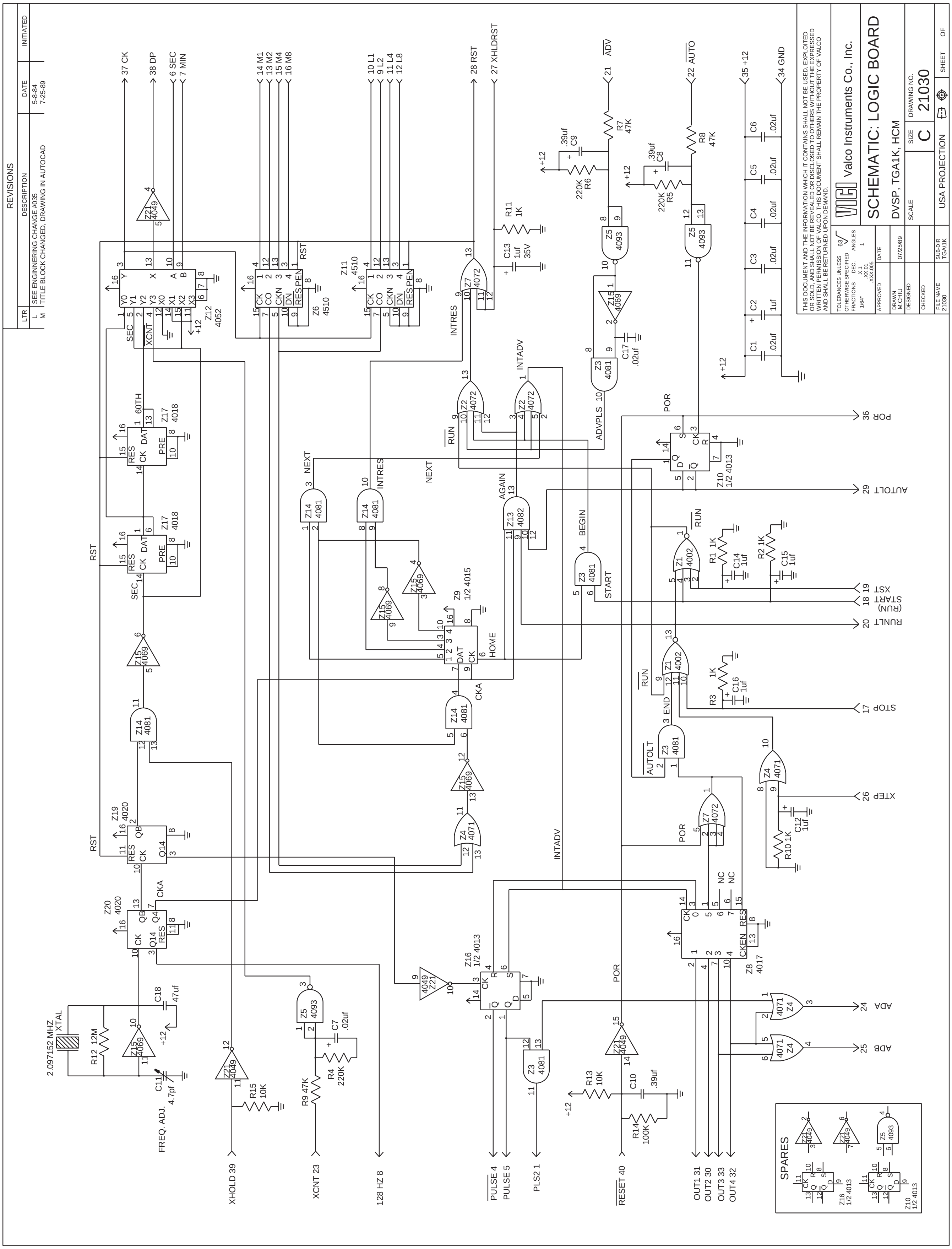
Valco Instruments Co., Inc.

PCB ASSY:LOGIC BOARD

DVSP/TGA1K I-21061

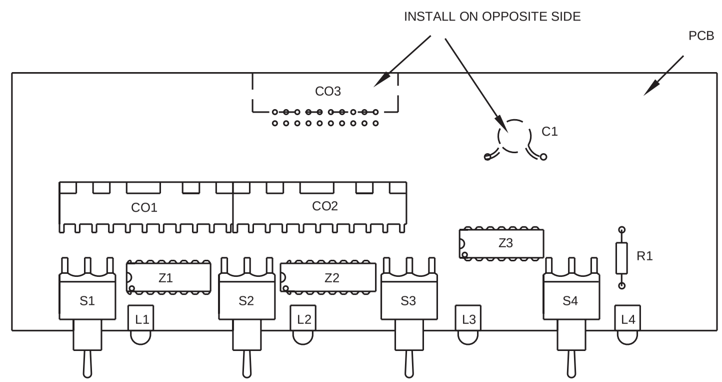
APPROVED	DATE
DRAWN D.K.W.	11/30/90
DESIGNED	
CHECKED	
FILE NAME 21061	SUB-DIR DVSP

DO NOT SCALE DRAWING
SCALE ---
SIZE B
DRAWING NO. 21061
USA PROJECTION
SHEET OF


REVISIONS
L SEE ENGINEERING CHANGE #035 5-8-84
M TITLE BLOCK CHANGED, DRAWING IN AUTOCAD 7-25-89
THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLE, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.
Valco Instruments Co., Inc.
SCHEMATIC: LOGIC BOARD
DVSP, TGA1K, HCM
DRAWN M.CHIU 07/25/89
SIZE C
DRAWING NO. 21030
FILE NAME 21030
SUB-DIR TGA1K
USA PROJECTION
SPARES

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	CHANGE FROM HAND DWG TO CAD	06/15/99	JDURR



PARTS LIST

DESC	DESCRIPTION	PART #	QTY
PCB	PCB: DIGISWITCH INTERFACE	I-PCB21087	1 EA
Z1	IC: INVERTING HEX BUFFER	I-IC4049	1 EA
Z2	RES NET: 220K, 16 PIN DIP, COMMON	I-RN761-1-220K	1 EA
Z3	IC: 4 INPUT OR GATE	I-IC4072	1 EA
L1-L4	LED: RED, W/MOUNT, 550-0405 DIALITE	I-LED550-01	4 EA
S1-S4	SWITCH: SPDT 7103MD9AB	I-SW-7103MD	4 EA
R1	RES: 1K, 5%, 1/4W	I-R511001	1 EA
C1	CAP: CERAMIC, .022uF 50V, .250 LEADS	I-CC223-50	1 EA
C01,2	CONN: 10 PIN RT ANGLE MOLEX	I-T09523101	2 EA
C03	CONN: 20 PIN HEADER, RT/ANGLE	I-T6092007	1 EA

APPLIES TO REV B PCB

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS 1/64" | DEC. .X.1 .XX.01 .XXX.005 | ANGLES 1 | 63

VICI Valco Instruments Co., Inc.

PCB ASSY: DIGISWITCH

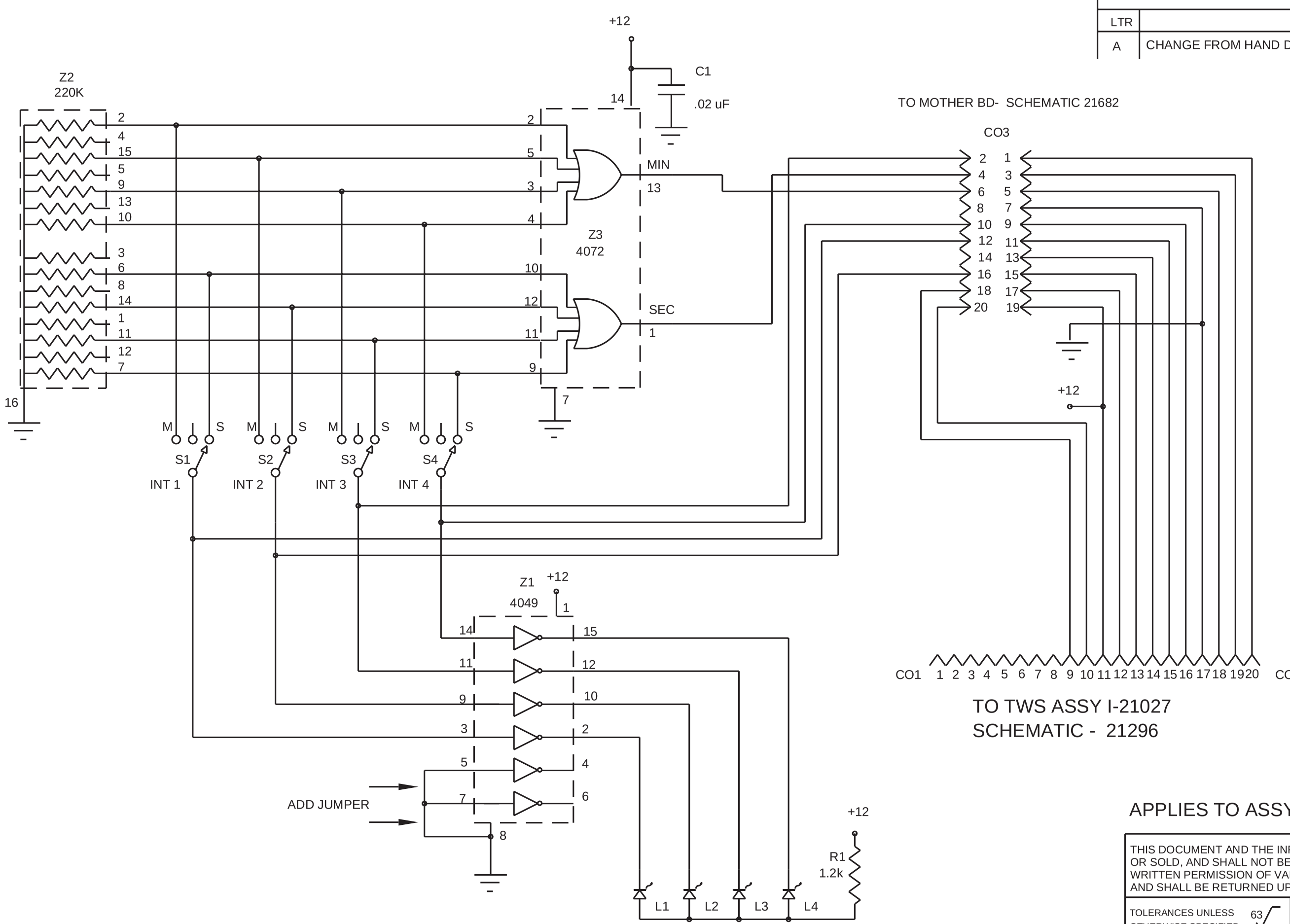
INTERFACE, TGA-1K I-21088

APPROVED	DATE
DRAWN JDURR	06/15/99
DESIGNED	
CHECKED	
FILE NAME 21088	SUB-DIR \TGA\

SCALE --- | SIZE B | DRAWING NO. 21088

USA PROJECTION | SHEET OF

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	CHANGE FROM HAND DWG TO CAD	06/15/99	JDURR



APPLIES TO ASSY 21088, REV B PCB

THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS 1/64" — DEC. .X.1 .XX.01 .XXX.005 — ANGLES 1 — 63

VICI Valco Instruments Co., Inc.

SCHEMATIC: DIGISWITCH

INTERFACE BD., TGA-1K

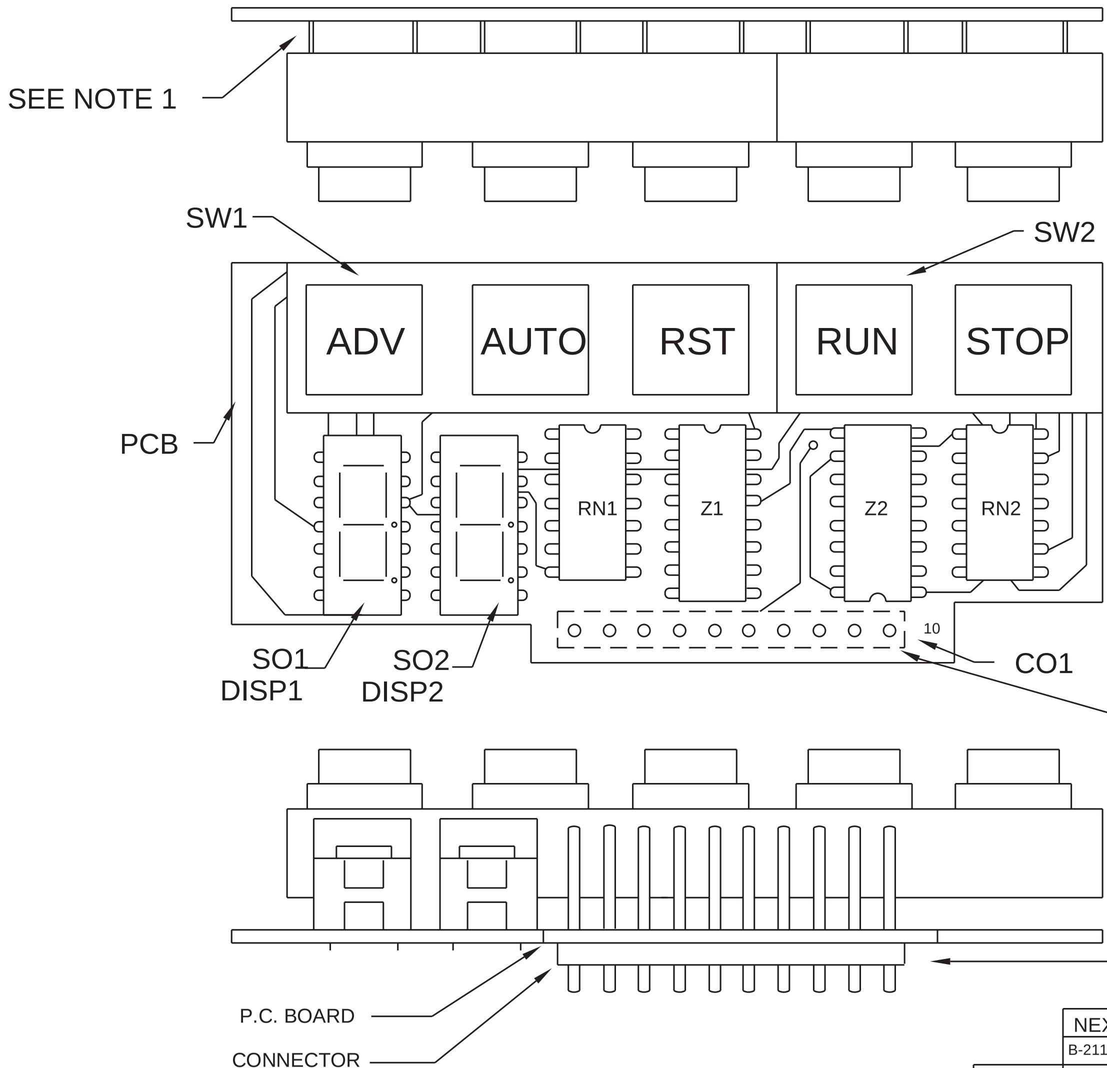
APPROVED	DATE
DRAWN JDURR	06/15/99
DESIGNED	
CHECKED	
FILE NAME 21188	SUB-DIR \TGA\

SCALE	SIZE	DRAWING NO.
---	B	21188

USA PROJECTION — SHEET — OF

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	LIFT SW1 AND SW2 OFF OF P.C. BOARD	8JUN83	
B	ECN #1790 REMOVE NOTE 2/UPDATE PL.	24MAR94	J DURR



PARTS LIST

SYMB	DESCRIPTION	VALCO #	QTY.
PCB	PCB: PUSH BUTTON BOARD DVSP	I-PCB21058	1 EA.
SO1,2	SOCKET: DIP, 14 PIN, STANDARD PROFILE	I-TDS-14-SP	2 EA.
DISP1,2	DISPLAY: LED, 7-SEGMENT .3"h	I-LEDMAN74	2 EA.
SW2	SWITCH: PUSHBUTTON, RUN/STOP	I-SW-21204	1 EA.
CO1	HEADER: 10 PIN MOLEX	I-T09641101	1 EA.
RN1-2	RES NET: 1 K, 14 PIN DIP, DISCRETE	I-RN760-3-1K	2 EA.
Z1-2	IC: DES. UP/DN CNTR W/ 7 SEG OUTPUT	I-IC40110	2 EA.
SW1	SWITCH: PUSHBUTTON, ADV-AUTO-RST	I-SW-21206	1 EA.
REF.	SCHEMATIC B-21062	——	——

NOTE 1: USE TEMPLATE TO SPACE SWITCHES PROPER DISTANCE OFF BOARD

INSERT CONNECTOR THRU REAR OF P.C. BOARD AND SOLDER FRONT SIDE OF BOARD

THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.

TOLERANCES UNLESS OTHERWISE SPECIFIED 63
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1

VICI Valco Instruments Co., Inc.

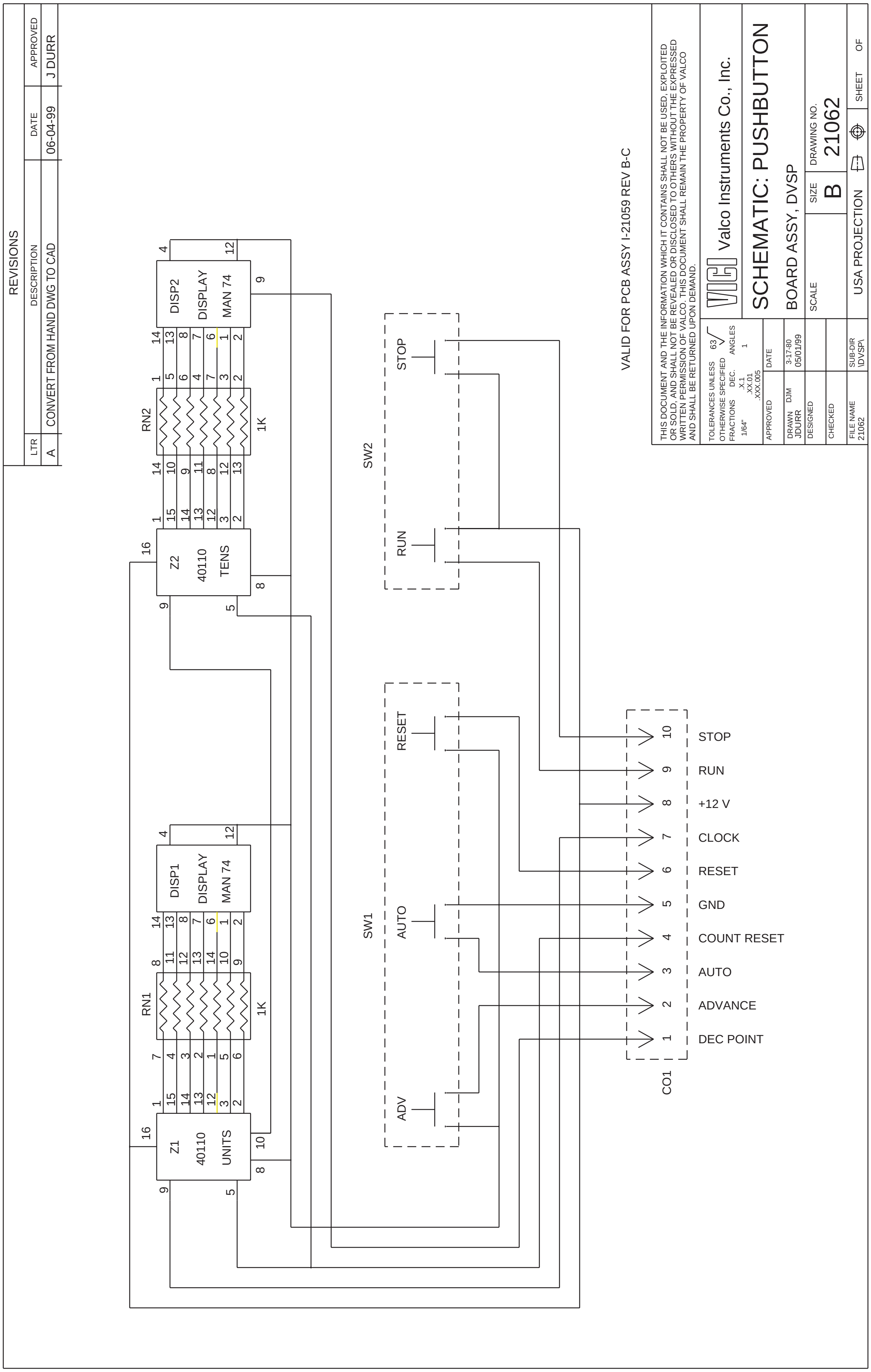
PCB ASSY: PUSH BUTTON

BD,DVSP/TGA 1K I-21059

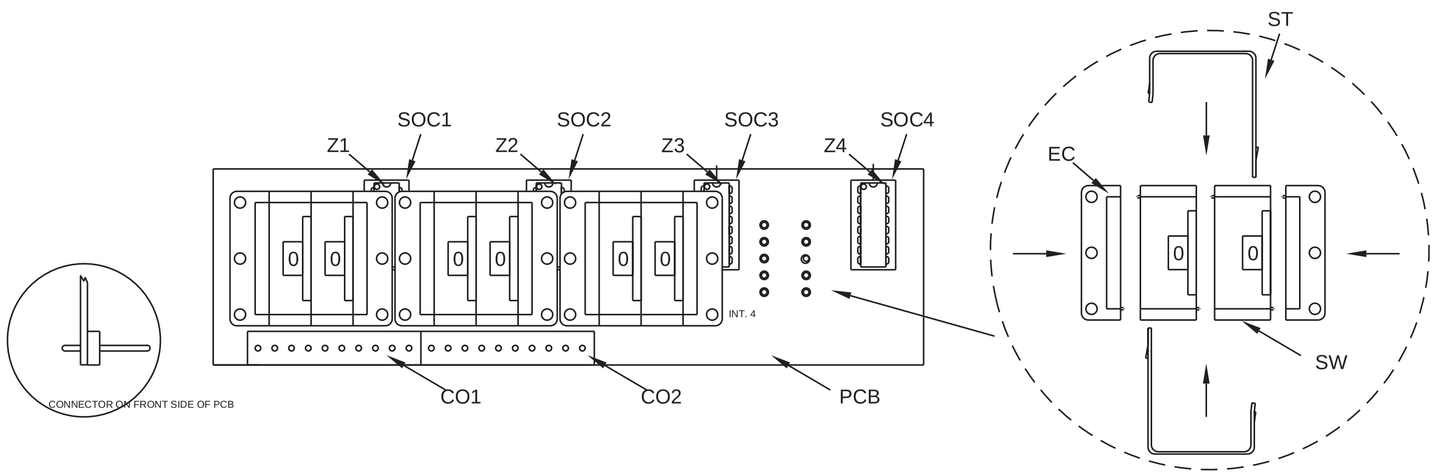
	NEXT ASSY.
	B-21142 ,C-21721
4 DVSP	B-21143
2 DVSP	B-21141

APPROVED	DATE
DRAWN J.H.	6/15/89
DESIGNED	
CHECKED	
FILE NAME 21059	SUB-DIR \DVSP\

SCALE	SIZE	DRAWING NO.
---	B	21059
USA PROJECTION		SHEET OF


REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
A
CONVERT FROM HAND DWG TO CAD
06-04-99
J DURR
VALID FOR PCB ASSY I-21059 REV B-C
THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS
1/64"
DEC.
.X.1
.XX.01
.XXX.005
ANGLES
1
63
APPROVED
DATE
DRAWN
JDURR
DJM
3-17-80
05/01/99
DESIGNED
CHECKED
FILE NAME
21062
SUB-DIR
\DVSP\
VICI Valco Instruments Co., Inc.
SCHEMATIC: PUSHBUTTON
BOARD ASSY, DVSP
SCALE
SIZE
B
DRAWING NO.
21062
USA PROJECTION
SHEET
OF
DISP2
DISPLAY
MAN 74
DISP1
DISPLAY
MAN 74
RN2
RN1
1K
Z2
40110
TENS
Z1
40110
UNITS
SW2
STOP
RUN
SW1
RESET
AUTO
ADV
CO1
10 STOP
9 RUN
8 +12 V
7 CLOCK
6 RESET
5 GND
4 COUNT RESET
3 AUTO
2 ADVANCE
1 DEC POINT

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
D	RESPACE T.W.S.'S AND MOVE IC'S	08-31-82	TLH
E	CHANGE FROM HAND DWG TO CAD	06/14/99	JDURR



NOTE 1 ASSEMBLE SWITCHES AS SHOWN AND INSTALL ON PCB

NOTE 2 USE CHASSIS TO HOLD SWITCHES IN POSITION FOR SOLDERING

PARTS LIST			
SYMB	DESCRIPTION	VALCO #	QTY.
PCB	PCB: THUMBWHEEL SWITCH, AW 107 REV E	I-PCB21020	1 EA.
SO1,4	SOCKET: DIP, 16 PIN, LOW PROFILE	I-TDS-16-LP	4 EA
Z1-Z4	IC: ANALOG MUX/DEMUX	I-IC4052	4 EA.
CO1, 2	HEADER: 10 PIN MOLEX	I-T09641101	2 EA.
ST	STRAP: 2 WIDE 29-57001-2	I-SW29ST2	8 EA
SW	SWITCH: THUMBWHEEL, BCD	I-SW29118P	8 EA.
EC	END CAP: SWITCH 29-06001-89	I-SW29CAP	8 EA
REF.	SCHEMATIC B-21294	———	——

TOLERANCES UNLESS OTHERWISE SPECIFIED 63
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1

VICI Valco Instruments Co., Inc.

PCB ASSY: THUMBWHEEL

SWITCH, 4 INT, DVSP I-21023

NEXT ASSY.
B-21142 ,C-21721
DVSP 4 B-21143

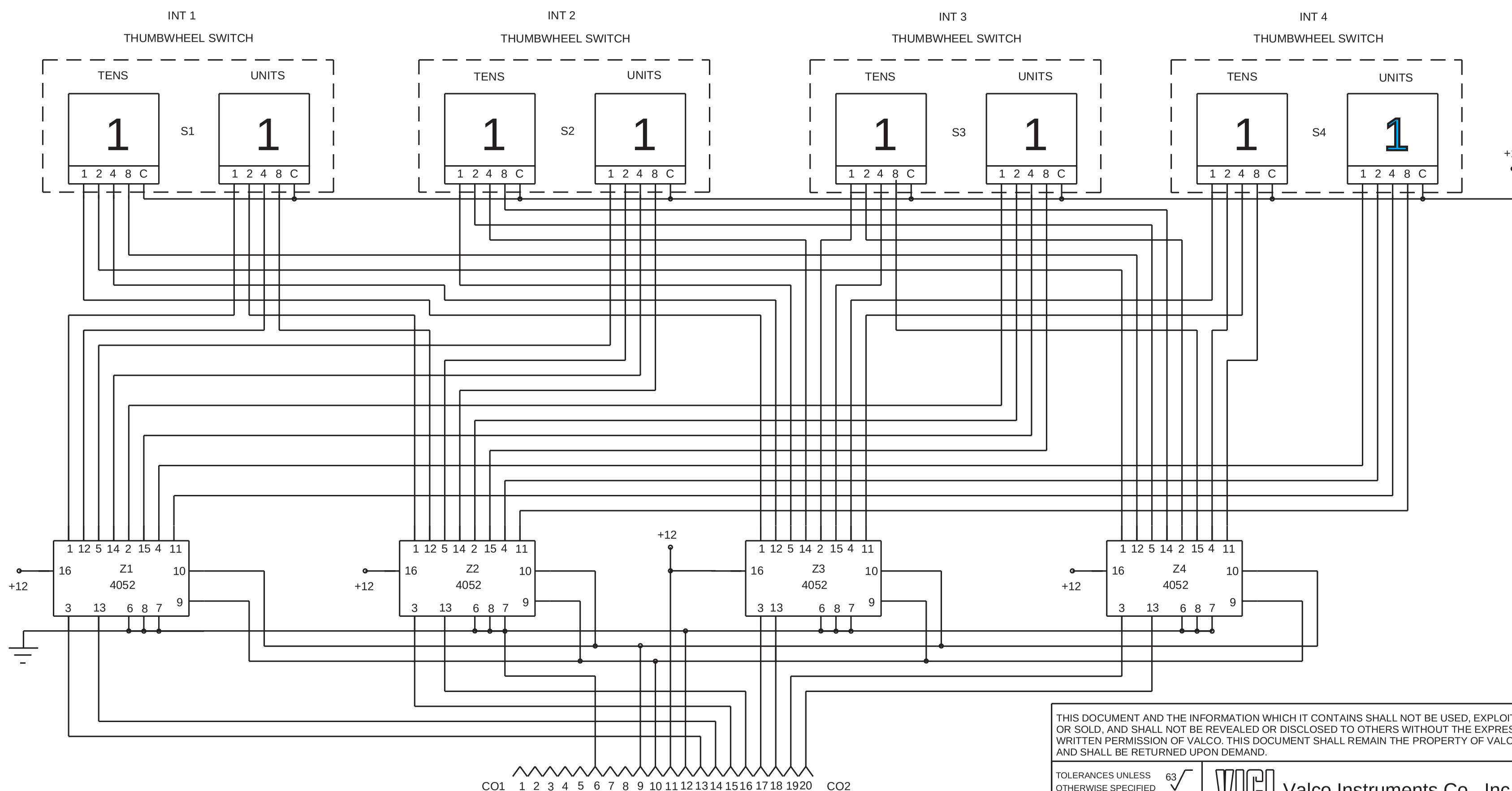
APPROVED | DATE
DRAWN JDURR | 06/14/99
DESIGNED
CHECKED
FILE NAME 21023 | SUB-DIR \DVSP\

SCALE — | SIZE B | DRAWING NO. 21023

USA PROJECTION | SHEET OF

LTR	DESCRIPTION	DATE	APPROVED
A	CHANGE FROM HAND DWG TO CAD	06/15/99	JDURR

REVISIONS



TWO INTERVAL MODELS- OMIT S2 AND S4

THREE INTERVAL MODELS- OMIT S4

TO MOTHER BOARD ASSY 21681 OR 21025
SCHEMATIC - 21268 OR 21212

APPLIES TO ASSY 21021, 21022, 21024, REV B PCB

THIS DOCUMENT AND THE INFORMATION WHICH IT CONTAINS SHALL NOT BE USED, EXPLOITED OR SOLD, AND SHALL NOT BE REVEALED OR DISCLOSED TO OTHERS WITHOUT THE EXPRESSED WRITTEN PERMISSION OF VALCO. THIS DOCUMENT SHALL REMAIN THE PROPERTY OF VALCO AND SHALL BE RETURNED UPON DEMAND.

TOLERANCES UNLESS OTHERWISE SPECIFIED 63

FRACTIONS	DEC.	ANGLES
1/64"	.X.1 .XX.01 .XXX.005	1

VICI Valco Instruments Co., Inc.

SCHEMATIC: THUMBWHEEL

SWITCH BOARD, DVSP, TGA-1K

	DATE
APPROVED	
DRAWN JDURR	06/16/99
DESIGNED	
CHECKED	
FILE NAME 21294	SUB-DIR \TGA\

SCALE	SIZE	DRAWING NO.
---	B	21294

USA PROJECTION SHEET OF

6. WARRANTY

This Limited Warranty gives the Buyer specific legal rights, and a Buyer may also have other rights that vary from state to state.

For a period of 365 calendar days from the date of shipment, Valco Instruments Company, Inc. (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

SELLER EXCLUDES AND DISCLAIMS ANY LIABILITY FOR LOST PROFITS, PERSONAL INJURY, INTERRUPTION OF SERVICE, OR FOR CONSEQUENTIAL INCIDENTAL OR SPECIAL DAMAGES ARISING OUT OF, RESULTING FROM, OR RELATING IN ANY MANNER TO THESE GOODS.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is VOID when repairs are performed by a nonauthorized service center or representative. For information about authorized service centers or representatives, call or write Customer Repairs, Valco Instruments Company, Inc, P.O. Box 55603, Houston, Texas 77255. ph(713) 688-9345 At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of the State of Texas.

THE WARRANTIES CONTAINED IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

This Limited Warranty supercedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.