

FROM
WHAT SPEED?
TO WHAT
SPEED?

1. INTRODUCTION

The Solenoid Controller (ScanCo Part Number CTLR 2/S2-S6) is designed to increase the stepping speed of the Ledex solenoid driven Scanivalves. Other fringe benefits are reduced solenoid heating and simplicity of Scanivalve control.

This remotely controllable unit is packaged in a (4-1/8 x 8 x 5-3/8) metal box containing isolated power supply, solenoid drive circuit, homing circuit, home indicator relay and manual control.

Two power settings are provided for flexible operations.

The maximum stepping rates vary with the size solenoid being used and the load being driven.

Unit includes all silicon construction for increased reliability and heat tolerance.

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2. GENERAL SPECIFICATIONS

Power Requirements 115 V.A.C., 50-400 Hz.
(Units can also be furnished for operation on 230 V.A.C., 50-400 Hz.)

Maximum Stepping Rate (at "Low" Power Setting)

S4 size solenoid 20 steps per second

Higher stepping rates are possible for certain applications.
Duty cycle of the Ledex solenoid should be observed in all cases.

Commands: Remote Contact Closures, Transistor (PNP) Switches (see Drawing Number 8454, Sheet 1), or Manual Push Buttons (S3 and S4) for "Step" and "Home".

Command Contact Protection: None required

Command Input: Command 5 milliseconds minimum
Recovery 5 milliseconds minimum

3. WIRING INSTALLATION

An eleven point solderless screw terminal board (TB1) is provided on the back panel of the Controller for all signal connections (see Figure A, Drawing Numbers 8472, 8474, and 8454, Sheet 1).

The Scanivalve Ledex solenoid drive normally requires five separate connections between it and the Controller (see Drawing Number 8472). If the homing function is not needed, only four wires are required. If double step control is used, a total of six wires are needed (see Drawing Number 8474).

3.
(cont'd)


Control wire resistance should not exceed 5 ohms per wire or 10 ohms total in series with the contact closure. Recommended wire size is #20 or larger at lengths of 10 feet or less. For lengths greater than 10 feet, the wiring resistance should be low enough to maintain 24 volts at the solenoid at the end of each stepping pulse. This is best assured, with an oscilloscope, at the Scanivalve solenoid.

WARNING: No arc suppression of any type should be used across a Ledex solenoid when used with a Controller.

Three wires are needed for normal remote command of the Controller (see Drawing Number 8472). Additional wires may be desired for use with the "home" indicator output (2), ground wire (1), or double step control wire (1) (when used as a slewing command) (see Drawing Number 8474) forming a total of seven wires.

4. A built-in pulser kit is available changing the catalog number to CTRL2P/S2-S6. The pulser kit enables the user to preset an established pulse rate to the solenoid. The pulse rate is field adjustable from 50 min./pulse to .04 sec./pulse (25 pulses/sec).

When the pulser is switched off the CTRL2P becomes electrically the same as CTRL2.

		SCANIVALVE CORP.	
		OUTLINE DRAWING CTR2/S2-S6 & CTR2P/S2-S6	
DWN BY AA	DATE 77/3/29	CKD BY	8972 SHT. of
A ERCA-811 HSH JAN 83			

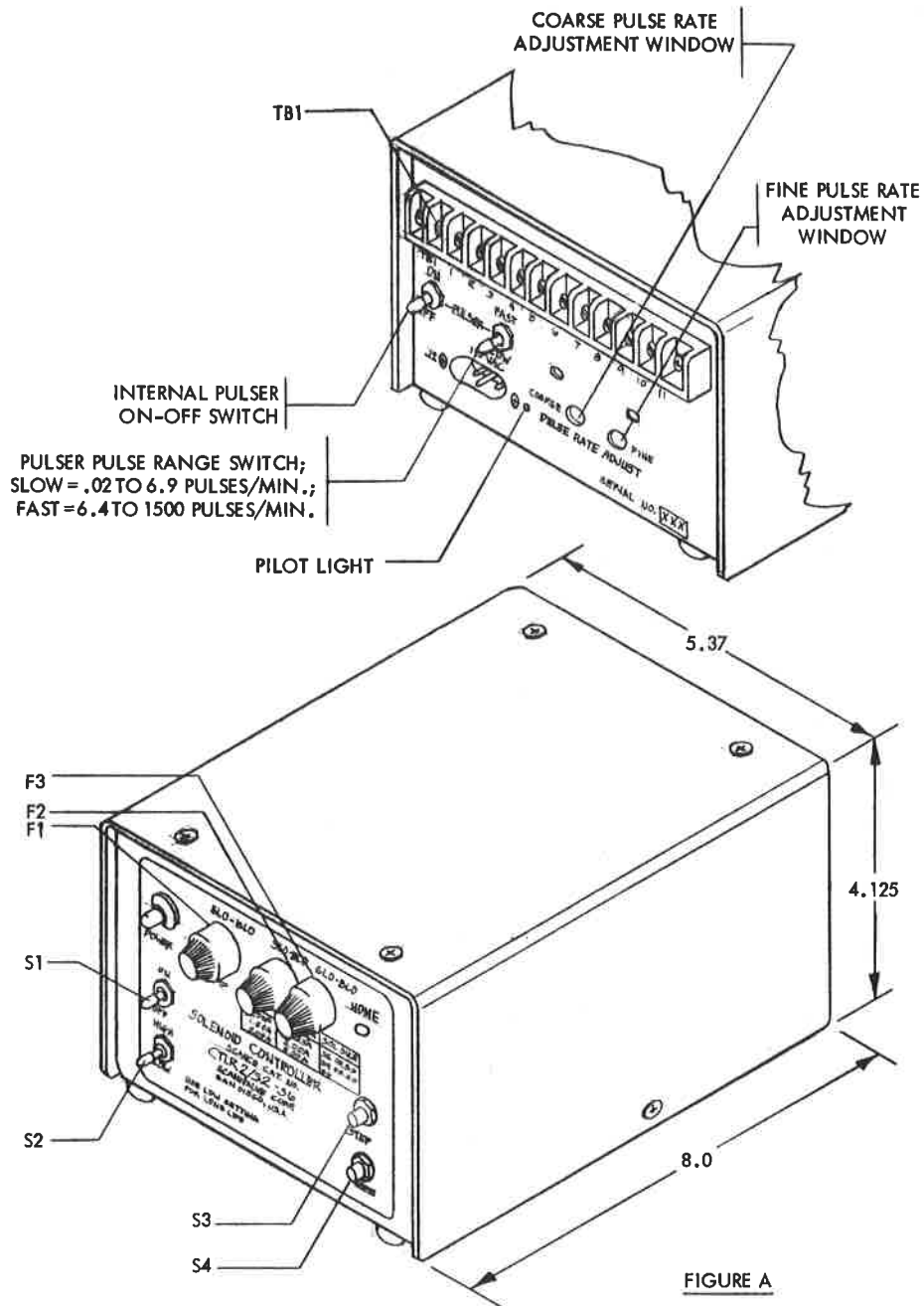


FIGURE A

4. CONTROLS

- a) The Controller is turned on by switch S1 (See Figure A).
- b) Switch S2 provides high and low output pulses to the Ledex solenoid. The high power setting should be used only where there is high wire resistance to the Ledex solenoid or extreme stepping rates are desired.

5. COMMAND INPUTS

Two basic commands and one special command can be received by the Controller. The "step" command can be given manually by depressing push button S3 or by a remote contact closure between TB1-5 and TB1-8. This command will pulse the Ledex solenoid once, causing the Scanivalve to advance one port. After the valve advances, the solenoid is automatically turned off and allowed to cool until the command is released and reapplied.

The "home" command is given manually by depressing push button S4 or remotely by a contact closure between TB1-5 and TB1-9. When this command is given and the Scanivalve is not at "home" port, the Controller will slew the Scanivalve at its optimum stepping rate until "home" port is reached. If this command is released before "home" port is reached, a latching relay (K1) will hold the command. As long as this command is held, the Scanivalve will slew one revolution each time it is stepped.

WHAT IS THE
HOLD TIME?

5ms

SEC. 2

6. THEORY OF OPERATION

A. Basic Drive Circuit (See Drawing 8454)

The Ledex solenoid shown in the upper right hand portion of the schematic drawing is driven by the power switch circuit consisting of transistors Q3 and Q4. The power switch circuit is in turn driven by the step logic switch Q2. All transistors used in this device are always fully on or fully off. Circuit operation is as follows: With the power switch circuit on, the solenoid armature is energized with approximately 28 or 36 volts causing it to rotate. Near the end of the solenoid travel, the interrupter switch operates, thus interrupting current I-3 through transistor Q2. The interrupter switch is normally closed and does not operate until near the completion of the solenoid stroke. $I-3 \approx$ collector current of Q2.

A normal stepping cycle consists of the following:

Condition one: The power switch circuit is turned on, but the solenoid armature has not yet reached the end of its stroke. Under this condition, current I-3 plus I-2 are of the same polarity and greater than I-1. This causes the power switch circuit to act as a flip-flop and remain in the "on" condition.

6. A. Condition two: The power switch circuit is "on" but with the interrupter contact open. Under this condition I-3 is zero and I-1 is greater than I-2, thus turning off the power switch circuit.

Condition three: The solenoid returns to its rest position. The interrupter switch is again closed and current I-1 and I-2 combined are greater than current I-3 which is trying to turn the power switch circuit on. The result is that the power switch circuit is held off. I-2 reverses polarity when Q4 turns off.

To initiate a new step, the circuit is activated by depressing the "step" switch S-3. This causes a positive pulse to be coupled to the base of Q3 through C-4 and the normal cycle is repeated. S3 can be depressed as long as desired and still only cause a single step. A subsequent step cycle can not be activated until the switch S3 is released for about (5) milliseconds to allow capacitor C-4 to discharge.

B. Homing Circuit

I-3 is the current that flows through transistor Q2. When the homing circuit is not being used, the latching contact of K2 is open. Operation of switch S4 operates the relay coil K2 which latches through the position switch contacts that are wired together. Current also flows through CR11 into R4 forming a slew command to the step logic circuit.

With the power applied to R4, the current of Q2 is increased. This increased current overrides the off-bias normally on the power switch circuit and causes it to turn on. As soon as the interrupter contact opens, it removes the base drive from Q2 thus removing both I-4 and I-3. This allows the circuit to shut itself off as in the normal step operation. However, as soon as the interrupter contact closes again, Q2 is again "on" which allows this current to flow through transistor Q2 thus repeating the stepping cycle. The Controller is paced by the Ledex solenoids self-interrupting rate, which depends on the supply voltage, until it reaches an open contact on the position switch.

C. Double Step Circuit

To permit selection of 24 positions with a 48 position drive, it is possible to wire alternate position contacts between TB1-5 and TB1-10. The Controller will then step the solenoid drive over these positions and stop on the next open contact. During the time that double step contact is closed, the latching action of the position contacts is maintained on K2 through CR15. This allows both double step and the normal homing operations to be carried out on the same wafer switch when desired.

D. Home Indicator

When the home position is reached, the circuit through CR7 is opened and the current through R2 turns on transistor Q1. This operates K1 which provides isolated contact closure for remote indication of the home condition. When double step control is used, CR6 clamps the base of Q1. This prevents the operation of relay K1 until home position is reached.

6. D. In applications where a number of Scanivalves and controllers are used together, it is possible to indicate when all Scanivalves have reached a home position. This can be done by simply wiring the isolated contact closure from each controller in series. The isolated contact is a dry reed switch which should be operated at below 1/4 watt (up to 24 volts) or 1/10 watt (up to 100 volts).

E. Driver Transistor Protection Circuit

In order to obtain maximum stepping rates and to protect the driver transistor Q4 from the inductive voltage of the Ledex solenoid, a circuit consisting of transistors Q5 and Q6 called the slave switch and two clamp diodes are employed. Normally the slave switch is "on". However, when the step switch turns off, the inductive current through the solenoid develops a negative voltage across CR21. This negative voltage turns off the slave switch. This forces the inductive current to flow through CR21 and CR20 making the solenoid dissipate its energy into C2. When viewed through an oscilloscope across the solenoid leads, this will appear as a momentary voltage reversal at the end of each step.

To further protect Q4 and Q6 against switching transients, C5 is employed across the solenoid leads.

F. Power Supply

The power supply consists of transformer T1 and a ^{How?} modified bridge rectifier circuit. This provides plus and minus 20 volts with respect to the transformer center tap. As far as external connections to the unit are concerned, the common is actually the plus 20 volts supply available on pin 5 of TB-1. All input commands are with respect to this point. In addition, capacitor C1 and C2 are employed for ripple filtering and energy storage. R1 is employed across C1 as a bleeder to provide proper power supply biasing to the step logic circuit as the power is being turned off to the unit. This technique prevents spurious stepping of the solenoid in case of power failure. With S-2 in the "low" power position, the power supply voltage is reduced. This will result in an increased reliability and longer life of the overall system. This switch can also be used in the "high" power position to compensate for high wire resistance in the Ledex solenoid supply wires.

Power fusing is provided by Fuse F1 (1.25 amp). Fuse F2 is for Ledex solenoid protection. This fuse varies with different solenoid sizes.

8. REPLACEABLE PARTS

- | | |
|-------------------|-----------------------------------------------------------------------|
| 1. Fuse (F2 only) | Little fuse 3AG313 (F2 Solenoid size S2 & S3)
(1.00 amp) Slo Blo |
| 2. Fuse (F2 only) | Little fuse 3AG313 (Solenoid size S4 & S5)
(1.50 amp) Slo Blo |
| 3. Fuse (F2 only) | Little fuse 3AG313 (Solenoid size S6)
(2.00 amp) Slo Blo |
| 4. Fuse (F3 only) | Little fuse 3AG313 (F2 Solenoid size S2 & S3)
(1.25 amp) Slo Blo |
| 5. Fuse (F3 only) | Little fuse 3AG313 (Solenoid size S4, S5, & S6)
(2.00 amp) Slo Blo |

NOTE: Unit is supplied with 2.00 amp. Fuses. Replace Fuses for your requirement as per above.

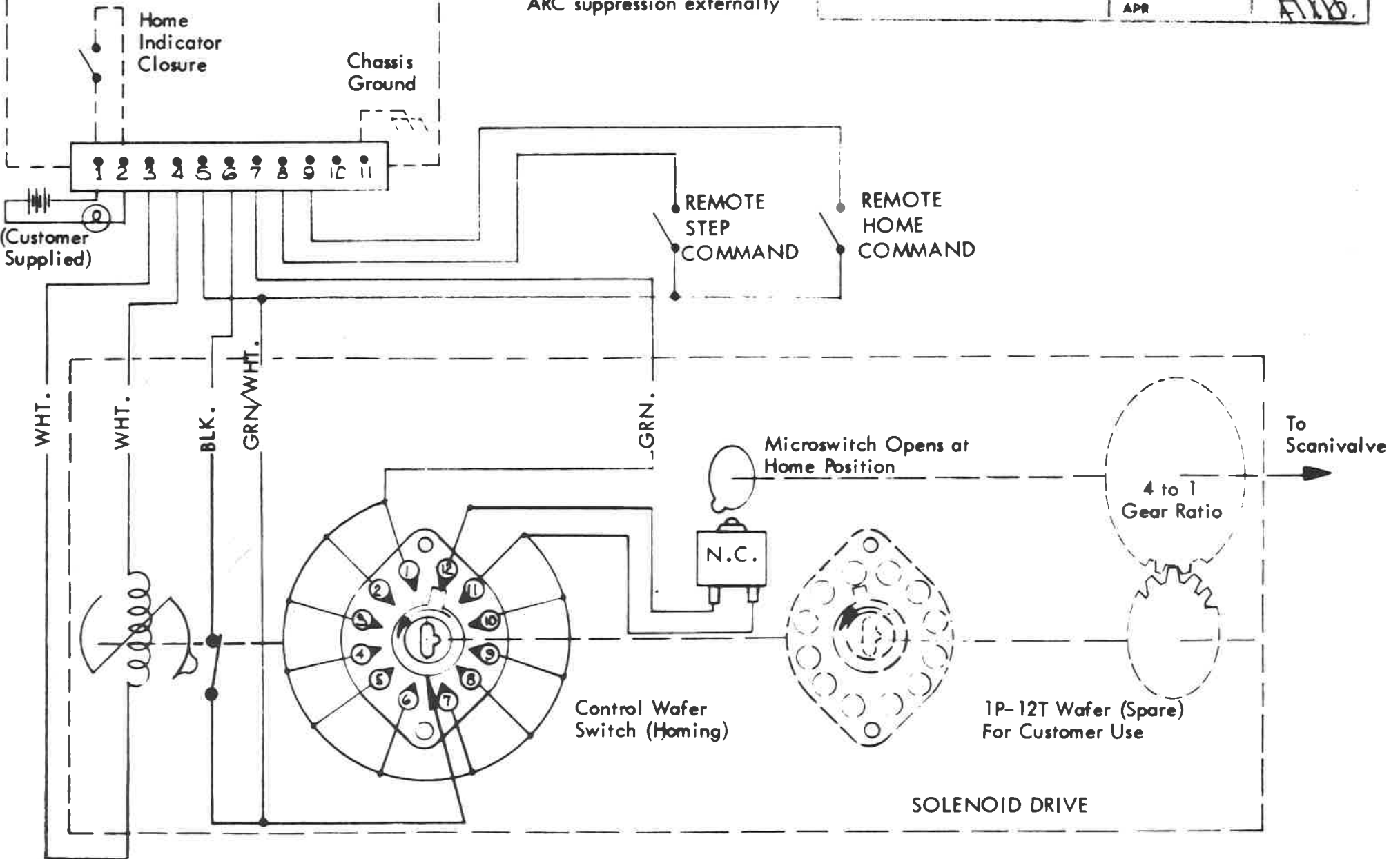
THE END

SOLENOID CONTROLLER

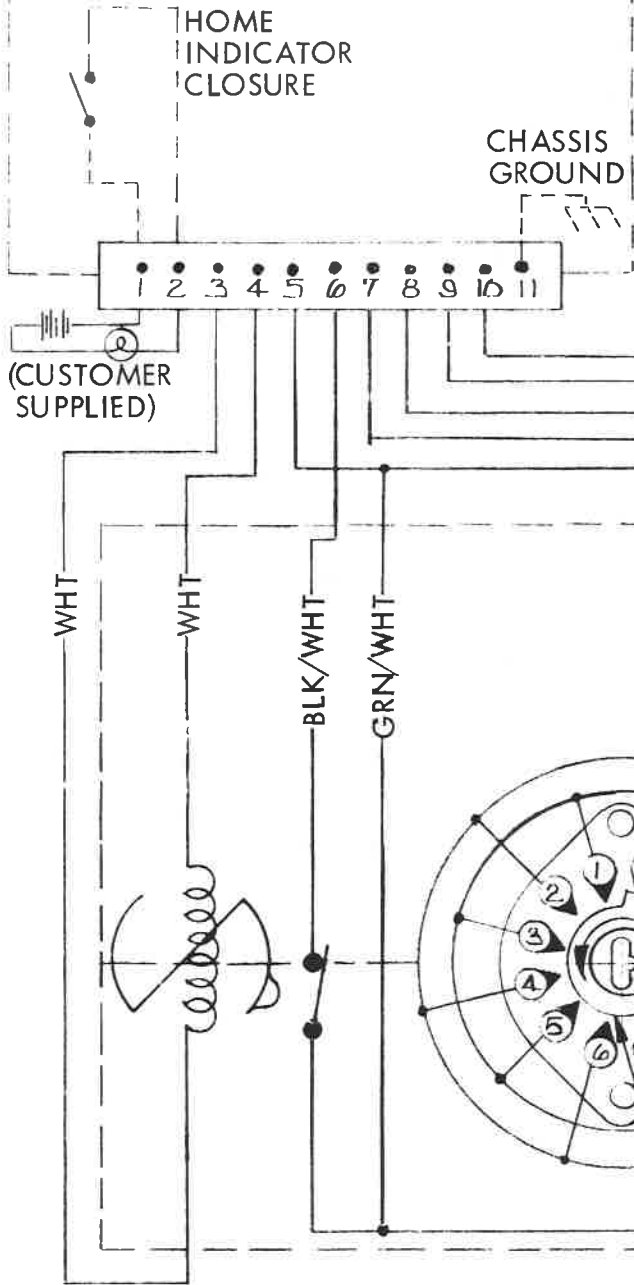
ScanCo No. CTLR 2/S2-S6

- Note: Unless otherwise specified
1. Solenoid ARC suppression contained in controller. Do not add additional ARC suppression externally

WIRING DIAGRAM-ScanCo# CTLR 2/S2-S6 to Solenoid	
SCANIVALVE [®] DIV.	
8472	
DWN MRD FEB 68	CH. A
CRD	
APR	AKB.



SOLENOID CONTROLLER
SCANCO NO. CTLR 2/S2-S6

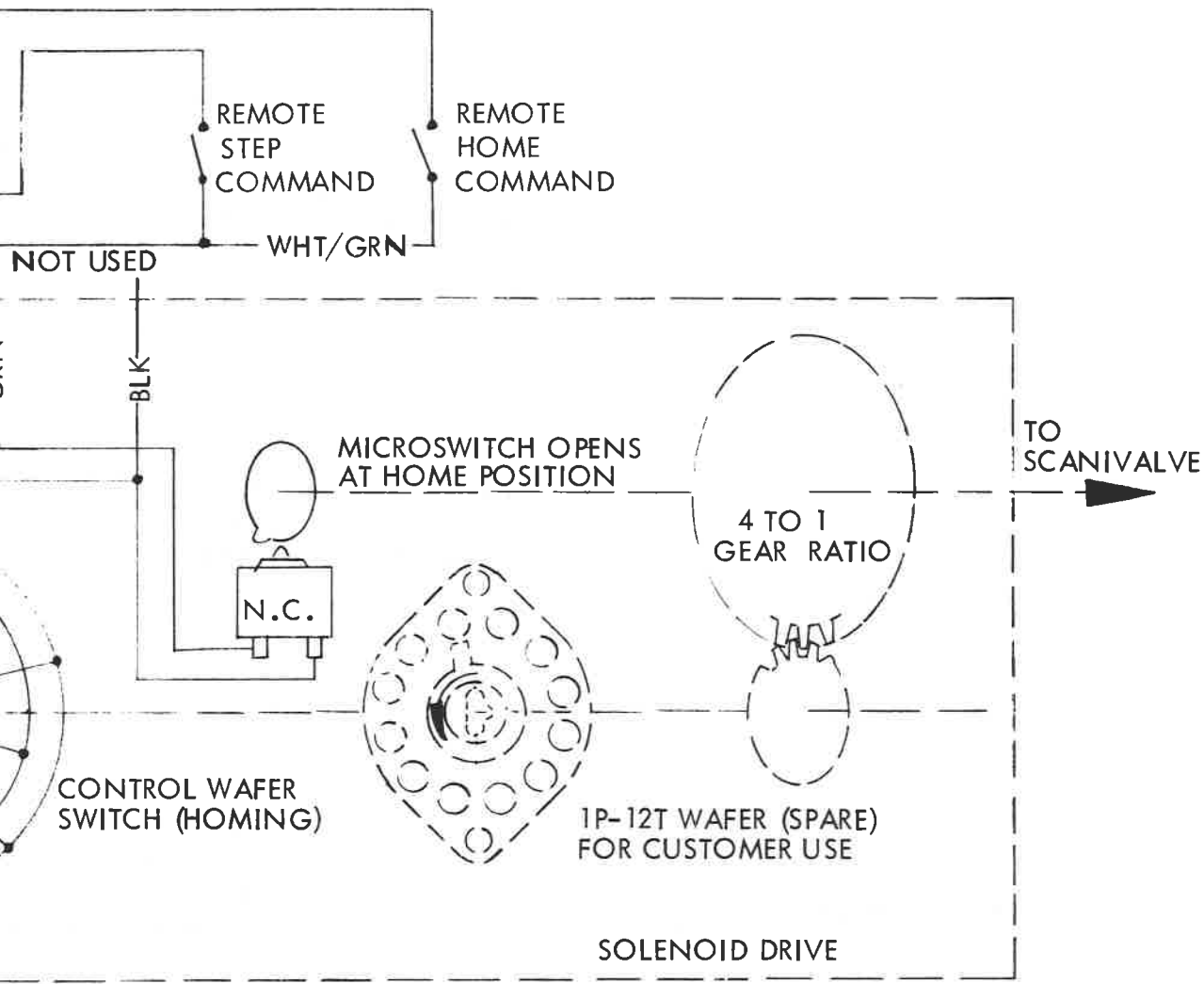


Note: Unless otherwise specified


1. Solenoid ARC suppression contained in controller. Do not add additional ARC suppression externally

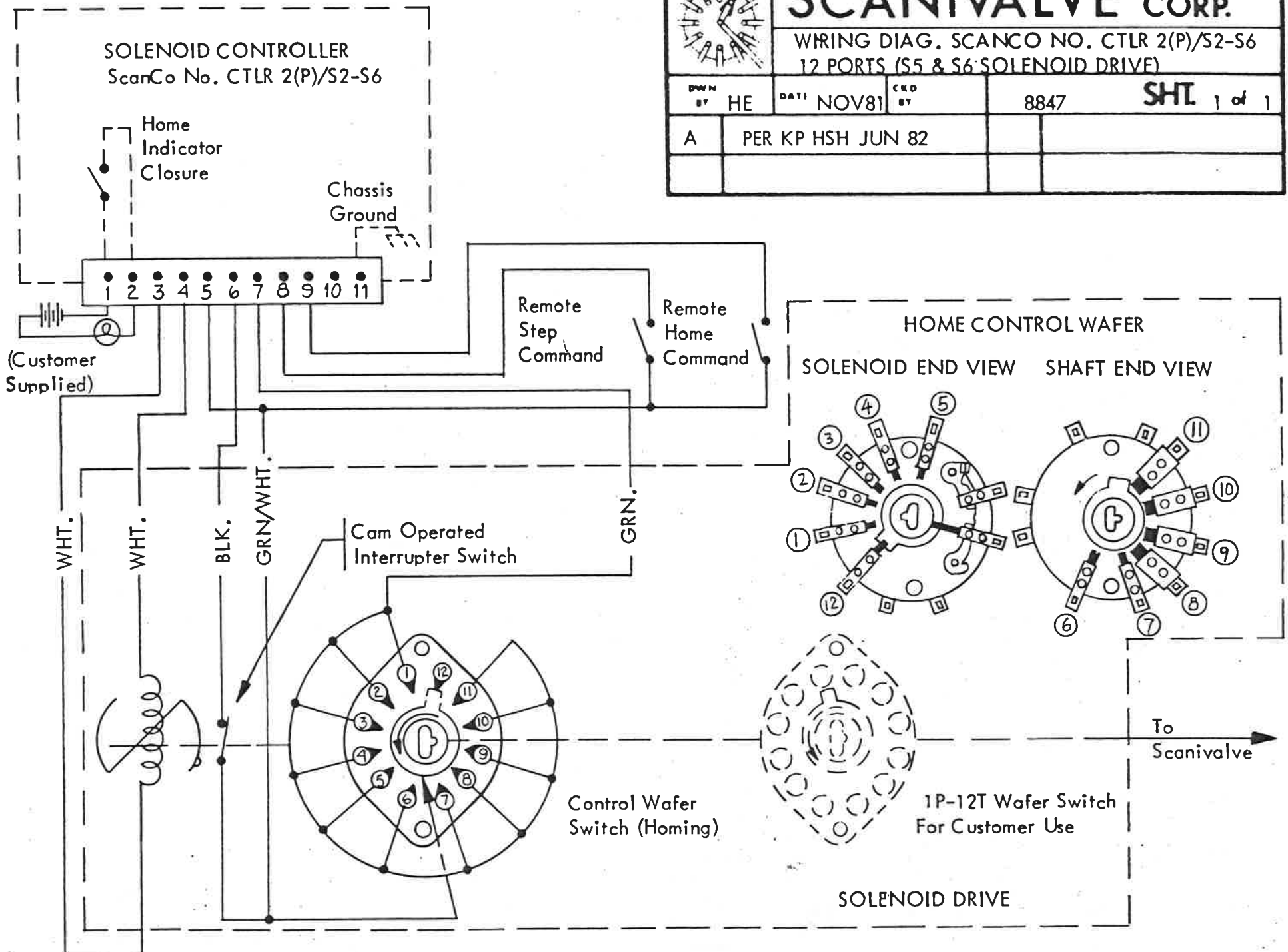
WIRING SCANCO # CTLR 2/S2-S6 FOR DOUBLE STEP

SCANIVALVE [®] DIV.		8474	
DWN. MRD	FEB/68	CH. A	
CKD.			
APR.			F.V.D.



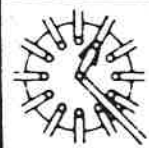
NOTES: UNLESS OTHERWISE SPECIFIED

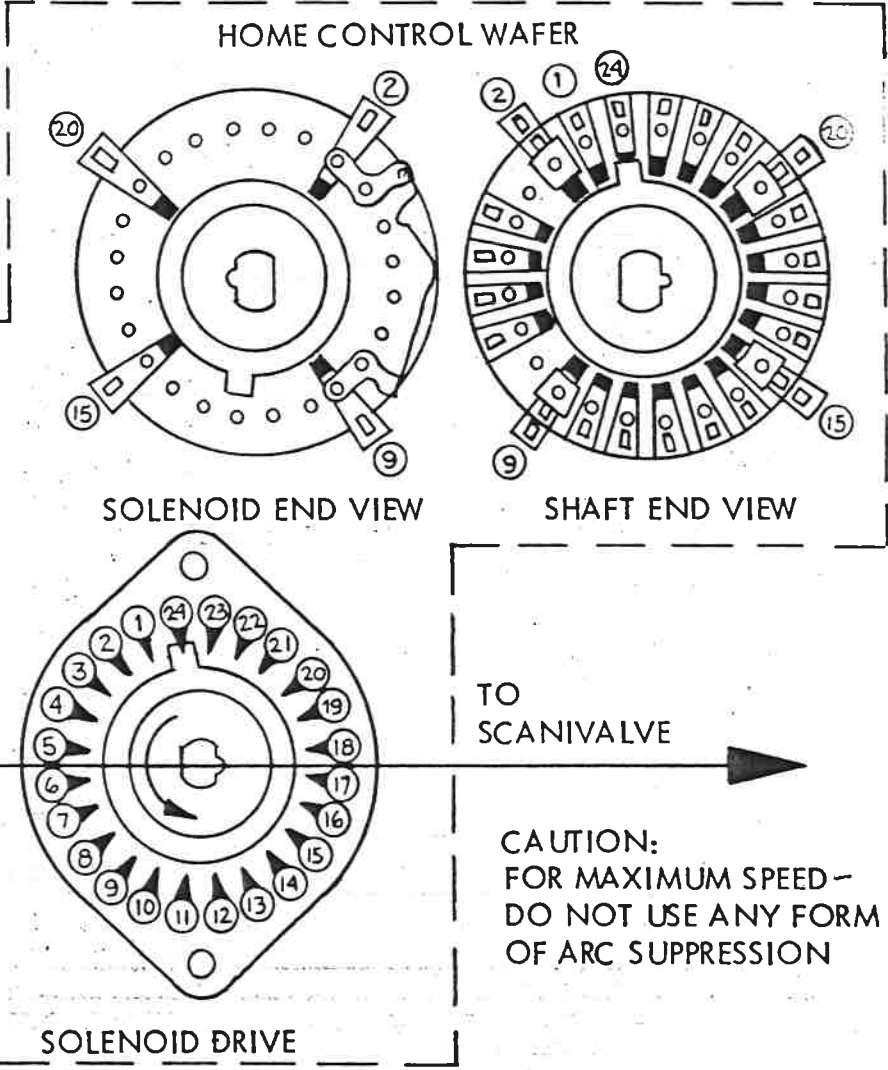
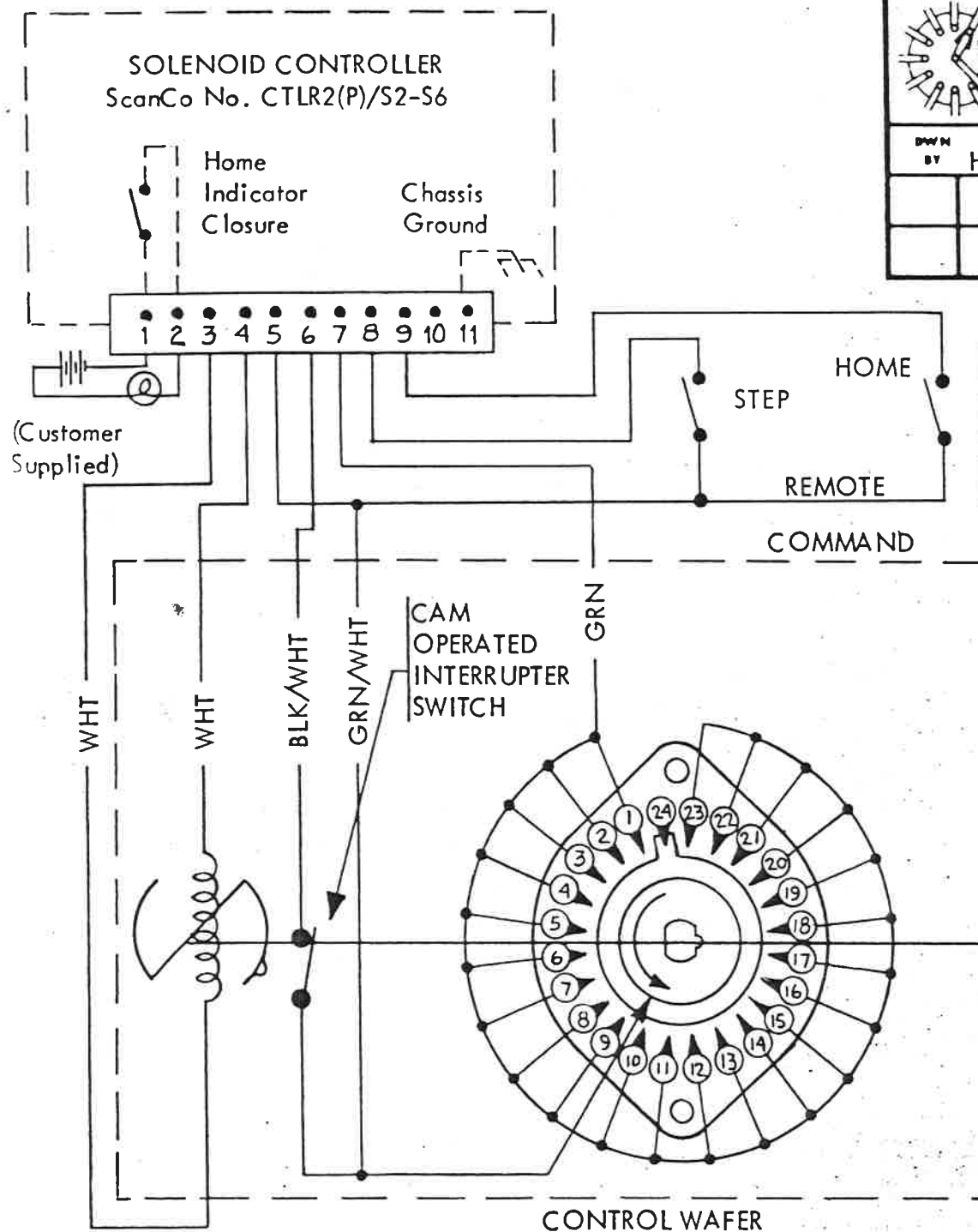
		<h1>SCANIVALVE® CORP.</h1>		
		WRING DIAG. SCANCO NO. CTLR 2(P)/S2-S6 12 PORTS (S5 & S6 SOLENOID DRIVE)		
DWN BY HE	DATE NOV81	CRO BY	8847	SHT 1 of 1
A PER KP HSH JUN 82				



CAUTION: FOR MAXIMUM SPEED DO NOT USE ANY FORM OF ARC SUPPRESSION

NOTES: UNLESS OTHERWISE SPECIFIED

		SCANIVALVE® CORP.			
		WIRING DIAG. SCANCO NO. CTRL2(P)/S2-S6 FOR 24 PORTS (S5 & S6 SOLENOID DRIVES)			
DWN BY HE	DATE NOV81	CKD BY	8848	SHT. 1 of 1	



SOLENOID DRIVE
1P-24T
WAFFER SWITCH FOR
CUSTOMER USE

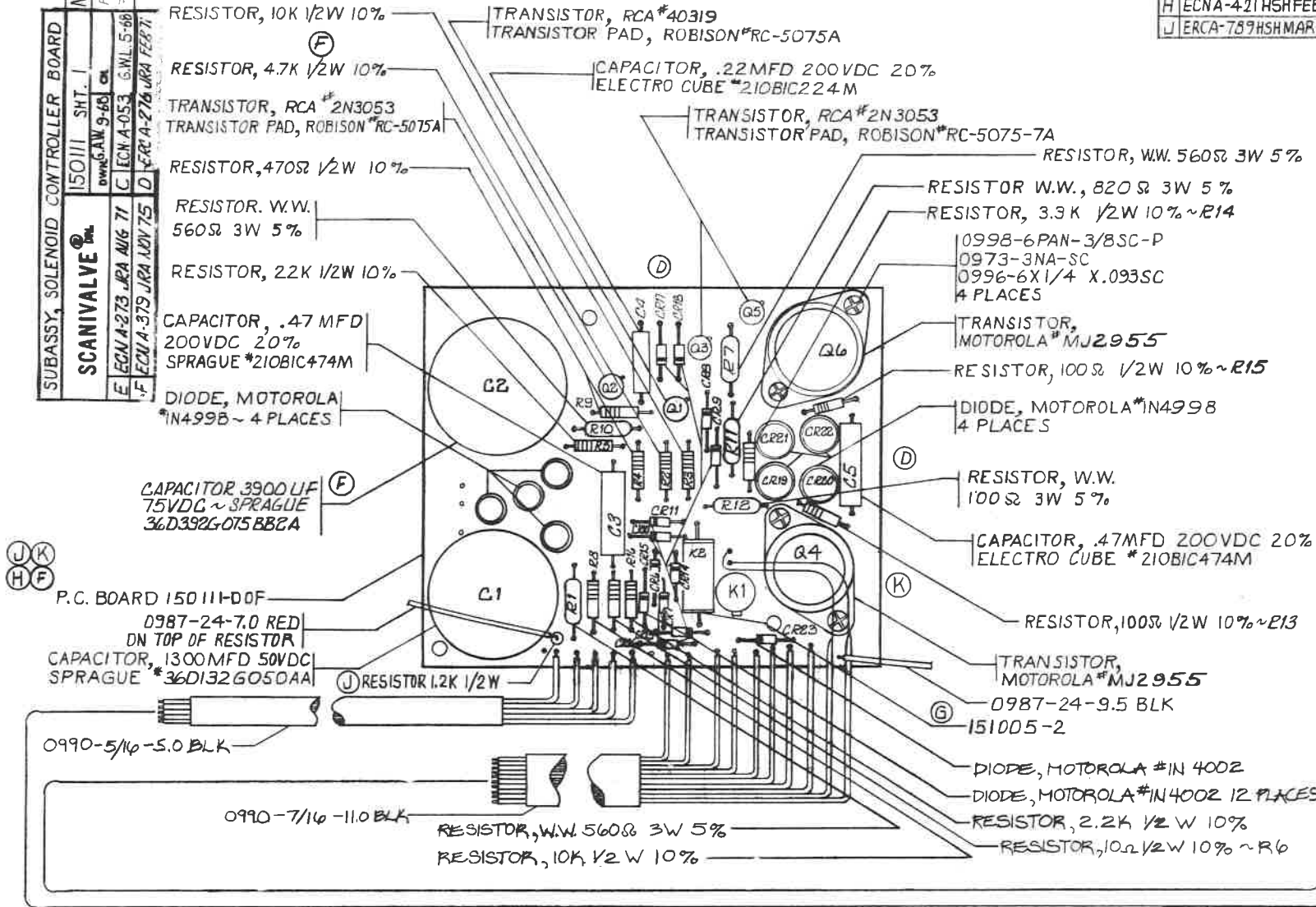
TO
SCANIVALVE

CAUTION:
FOR MAXIMUM SPEED -
DO NOT USE ANY FORM
OF ARC SUPPRESSION

SUBASSY, SOLENOID CONTROLLER BOARD	150111	SHT. I	MAP
	dwg. GAW 9-66	cl	P/L
	E. ECNA-273 JRA AUG 71	C. ECNA-053 G.W.L. 5-68	SHT. 2
	F. ECNA-379 JRA JUN 75	D. ECNA-276 JRA FEB 71	

1. RUBBER STAMP SUBASSY NUMBER TO SOLDERED SIDE OF COMPLETED BOARD.

G	ERCA-603 JRAMAR 76	K	ECNA-464 HSH JUL 82
H	ECNA-421 HSH FEB 78		
J	ERCA-789 HSH MAR 82		



B.N. W-102
9404 RIBBON CABLE
PCI-1 TO TBI-1 BRN
PCI-2 TO TBI-2 RED
PCI-3 TO TBI-3 ORG
PCI-4 TO TBI-4 YEL
PCI-5 TO TBI-5 GRN
PCI-6 TO TBI-6 BLU
PCI-7 TO TBI-7 VIO
PCI-8 TO TBI-8 GRY
PCI-9 TO TBI-9 WHT
PCI-10 TO TBI-10 BLK
STRIP FROM (12)
CONDUCTORS TO (10)
CONDUCTORS AS SHOWN
LENGTH 21.0

B.N. W-102
9404 RIBBON CABLE
PCI-11 TO S4-1 GRN
PCI-12 TO S3-1 BLU
PCI-13 TO S3-2 VIO
PCI-14 TO S2-2 GRY
PCI-15 TO F2-2 WHT
STRIP FROM (12)
CONDUCTORS TO (5)
CONDUCTORS AS
SHOWN
LENGTH 14.0

(K)(J)(H)(G)(F)(E)(D)(C) - IF SUBASSY, SOLENOID CONTROLLER BOARD

- NOTE: 1. MAXIMUM CURRENT NON-INDUCTIVE 100 MA. MAXIMUM VOLTAGE 300; 5 VA MAXIMUM. DO NOT DRIVE LAMPS DIRECTLY WITHOUT SERIES RESISTOR.
 2. ALTERNATE VALUES FOR C1 & C2 = 2700 & 6000 MFD. RESPECTIVELY. MUST BE USED TOGETHER. I.E.: 1300/3900 OR 2700/6000.
 3. EXTERNAL TRANSISTORS QA & QB MAY BE SUBSTITUTED FOR EXTERNAL SWITCHES SA & SB RESPECTIVELY. BOTH TRANSISTORS & SWITCHES SHOULD BE CAPABLE OF SWITCHING 30 VOLTS AT 50 MA. PEAK.
 4. CUSTOMER FURNISHES EXTERNAL (REMOTE) CONTROLS.
 5. CONTROL VOLTAGE PRESENT WHEN UNIT IS ENERGIZED.
 6. UNLESS OTHERWISE SPECIFIED:
 ALL TRANSISTORS - 2N3053 ALL WIRES - #22 AWG. (REF.)
 ALL RESISTORS - 1/2 W 10% ALLEN BRADLEY
 ALL DIODES - 1N4002.
 7. DELETE PHANTOMED COMPONENTS FOR 12 & 24 POSITION PNEUMATIC WAFER DRIVES.
 8. SCHEMATIC DESIGNATORS NOT USED: CR12
 9. FOR 230VAC OPERATION SEE VIEW A FOR WIRING TRANSFORMER PRIMARIES.
 10. SHTS 2, 3 & 4 OBS PER ECA A-388.
 11. OPTIONAL CIRCUIT BOARD FOR PULSER CIRCUIT.

