

INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS FOR

FAIRCHILD 24CS() M/P CONVERTERS (STEPPER MOTOR IN COMMERCIAL ENCLOSURE)

GENERAL INFORMATION

The 24CS() M/P Converters allow incremental adjustment of regulator setpoint and provide for various adjustment times for full range operation.

Specifications Model 24CS
Stepper Motor 24CS 5
ENVIRONMENTAL

Stepper Motor Operating Temp. Range . . . 0°-120°F

ELECTRICAL

Stepper Motor Voltage to 23-26vDC@800mA
Translator Board
Power Consumption 21 max. (watts)

PERFORMANCE

Stepper Motor

Reg. Model	Pressure Range							Motor RPM
	2	5	10	20	30	60	100	
30	.000342		.00131		.00444	.00702	.0139	PSI/STEP PULSE CNT FR ADJ TIME
	5850		7650		6750	8550	7200	
	11.7		15.3		13.6	17.1	14.4	
80				.00444		.0136	.0214	PSI/STEP PULSE CNT FR ADJ TIME
				4500		4410	4580	
				9.0		8.8	9.4	
81	.000427	.000896		.00444		.0136	.0214	PSI/STEP PULSE CNT FR ADJ TIME
	4680	5580		4500		4410	4580	
	9.4	11.2		9.0		8.8	9.4	

DEG/STEP of range screw all models, all pressures 0.4°/Step
PULSE COUNT (PULSE CNT) to Full Range
FULL RANGE ADJUSTMENT TIME (FR ADJ TIME) is measured @ 500 PPS

INPUTS

Stepper Motor

Input Signal Voltage (High) 2-5v
Input Signal Voltage (Low) 0-.8v max.
Input Signal Current (High) 0
Input Signal Current (Low) 0.9mA (Sink)
Enable Input Voltage (Low) 0v-1.5v
Enable Input Voltage (High) 2v-5v
Clock Time Duration 0.5us Min
Clock Setup 1us Min
Clock Freq. Range (Low) 0-60 Hz
Clock Freq. Range (High) 300-800 Hz
Resonant Frequency 80-200 Hz

Regulator Characteristics

Regulator	Regulator Characteristics		
	Pressure Ranges (psig)	Flow SCFM ¹	Exhaust SCFM ²
30	All Ranges	30	2.0
80	All Ranges	14	2.5
81	All Ranges	50	5.5

¹100 psig pressure 20 psi set

²Downstream pressure 5 psig above setpoint of 20 psig

PRINCIPLES OF OPERATION

Stepper Motor

The Model 24CS M/P Converter is a digital pulse controlled pressure regulator which has been configured with an integral translator. Electronic circuits in the translator convert the digital pulse input signals into control logic that operates a 20C step per revolution stepper Motor. The stepper motor in turn controls the output of a pressure regulator by driving its range screw through a 4.5:1 reduction gear. The translator consists of a control/logic section and a power output section.

The Control/Logic section contains the logic sequence that determines the proper switching of the stepper motor windings to accomplish rotation. This section accepts the input signal that controls the direction of the motor and the type of switching sequence which is transmitted to the motor windings. This section also contains a pulse width modulated chopper circuit that controls the current in the motor windings.

The power output section uses a dual full bridge power transistor array to handle the power switching of the motor windings in a bi-polar circuit configuration.

For simple manual control in Full Step mode, a 24 volt power supply is required, together with a pulse generator to supply step pulses, a switch to control direction of rotation, and a wire jumper to select Full Step mode (See Figure 1). In this case, each pulse present at the clock input of the Translator will result in one motor step or 1/200th of a shaft rotation. The stepper motor can be started and stopped by turning the pulse generator ON and OFF.

All inputs have pull up resistors to place them in a high logic state. As a result, all inputs can be changed by switch closures.

This simplifies manual control circuits, and as a result, the controlling device does not have to supply input current to the translator inputs.

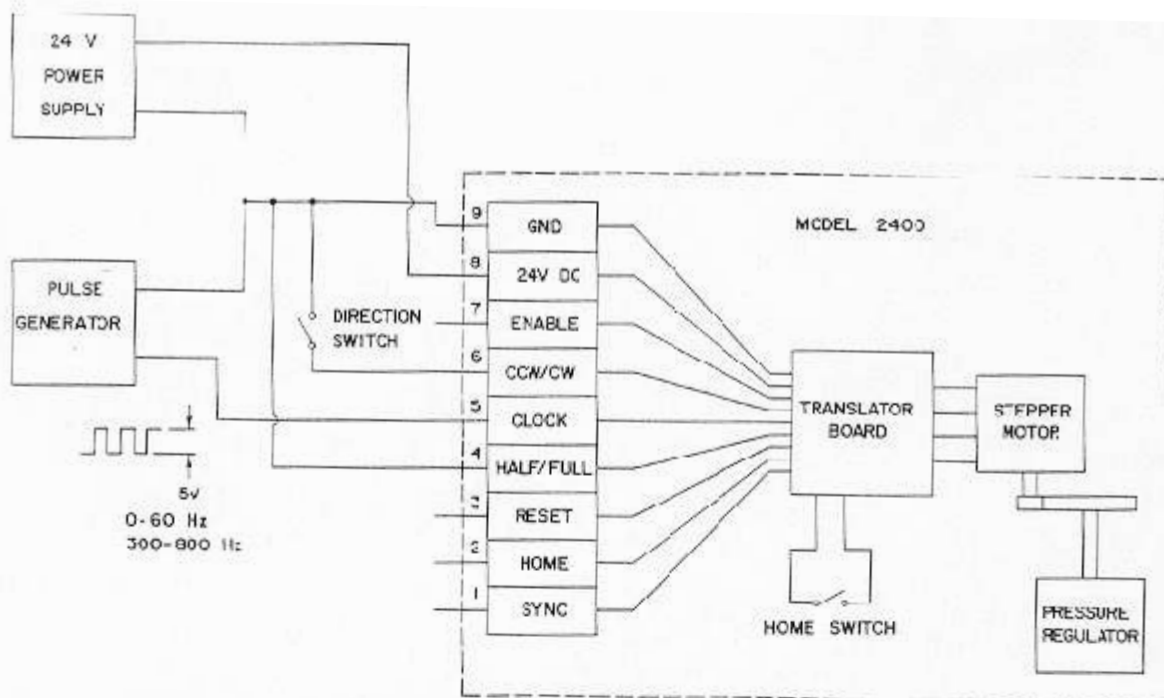


Figure 1
Terminal Block Connection and Block Diagram

Reset, Enable, and Half/Full Step inputs, Sync and Home outputs are all optional connections to the unit. These enable connection of the unit to a computer for control. When the Reset input is pulled LOW, the Translators four motor outputs are placed in an 0101 state. The state is considered the "HOME" or first logic state of a basic eight step sequence. Wave drive mode is also cancelled.

When the Enable input is pulled LOW, all inputs and outputs are disabled and power to the stepper motor is turned OFF. This condition conserves input/output power.

The Model 2400 Stepper unit will hold its last set position when disabled and will not need rereferencing when enabled.

The Half/Full step input is a selectable step mode input (See Figure 2).

Half step mode

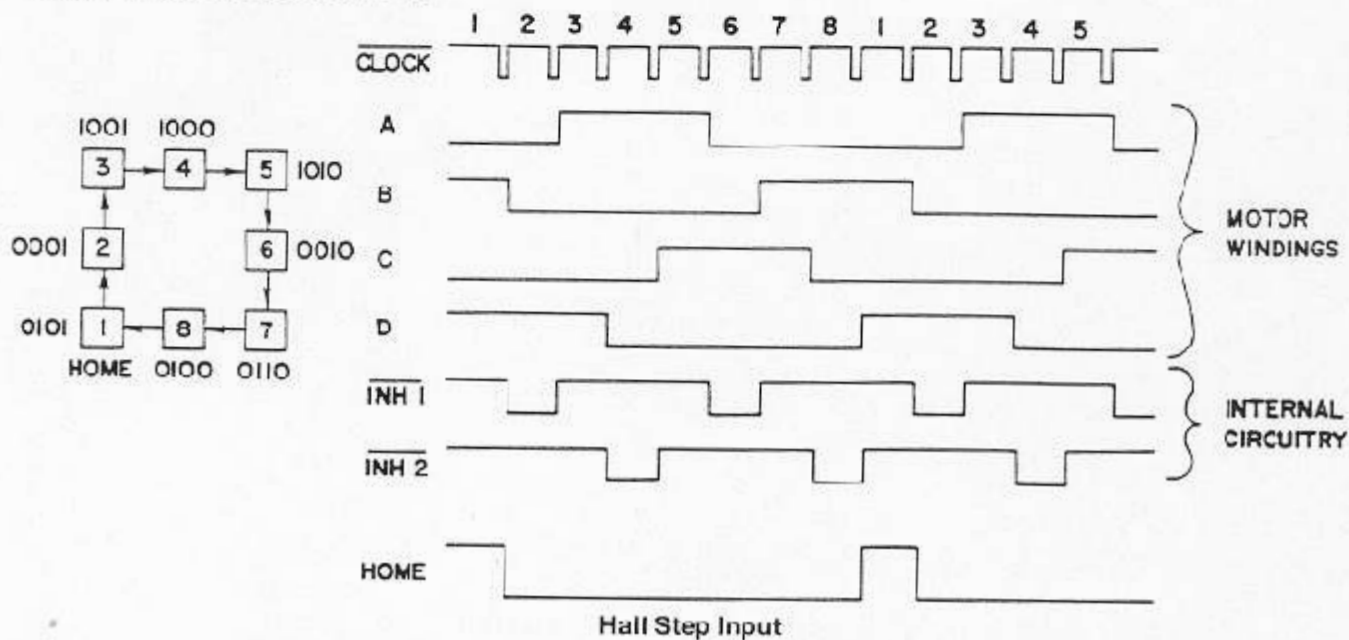
Half step mode is selected by a high level on the HALF/FULL input.

When Half/Full input to the Translator Board is held Low, the Translator is in Full Step mode. When input is High, the Translator operates in Half Step mode. This condition effectively doubles the step resolution of the unit.

Wave drive mode on one phase of Full Step mode is obtained by selecting Full Step Mode when the Translator is operating in an even numbered state (See Figure 3).

The Sync connection is used only with multiple unit installations and is an optional feature. Sync connection is an input or output of the chopper oscillator circuit which depends on the position of switch S1. The chopper oscillators of multiple unit installations may be synchronized by connecting all SYNC connections of the translators together.

IN SINGLE UNIT INSTALLATIONS, SWITCH S1 SHOULD BE PLACED IN THE OPEN POSITION.



Normal drive mode (Full Step)

Normal drive mode (also called "two-phase-on" drive) is selected by a low level on the HALF/FULL input when the translator is at an odd numbered state (1, 3, 5 or 7). In this mode the INH1 and INH2 outputs remain high throughout.

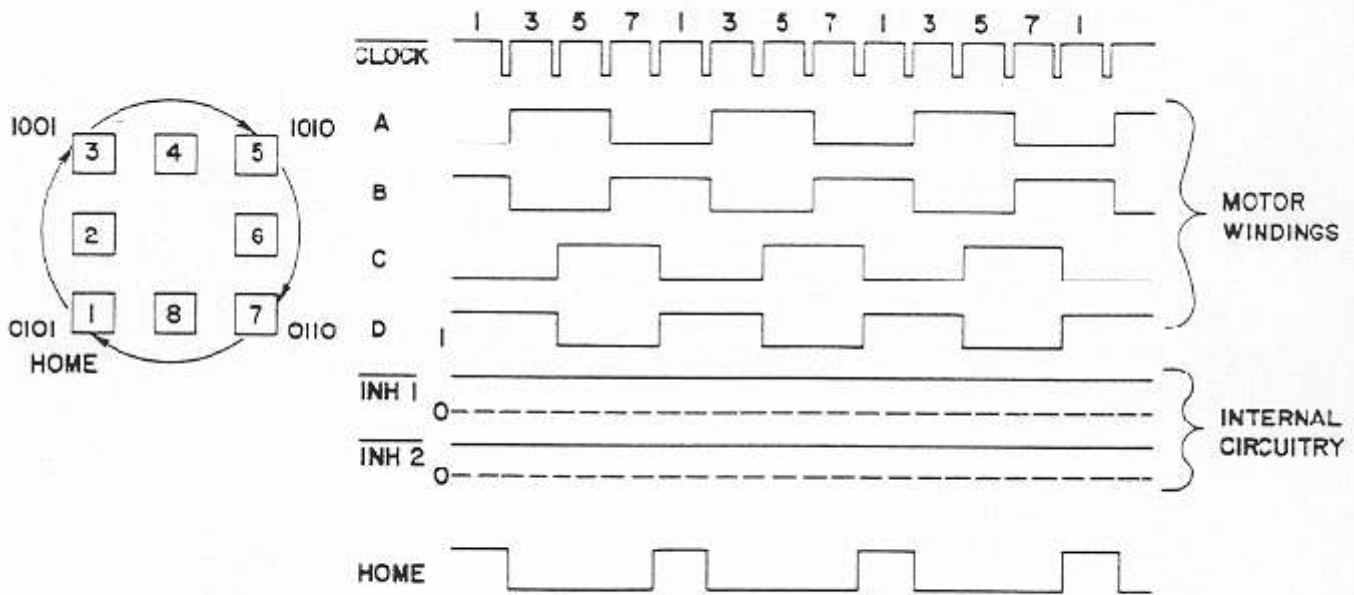
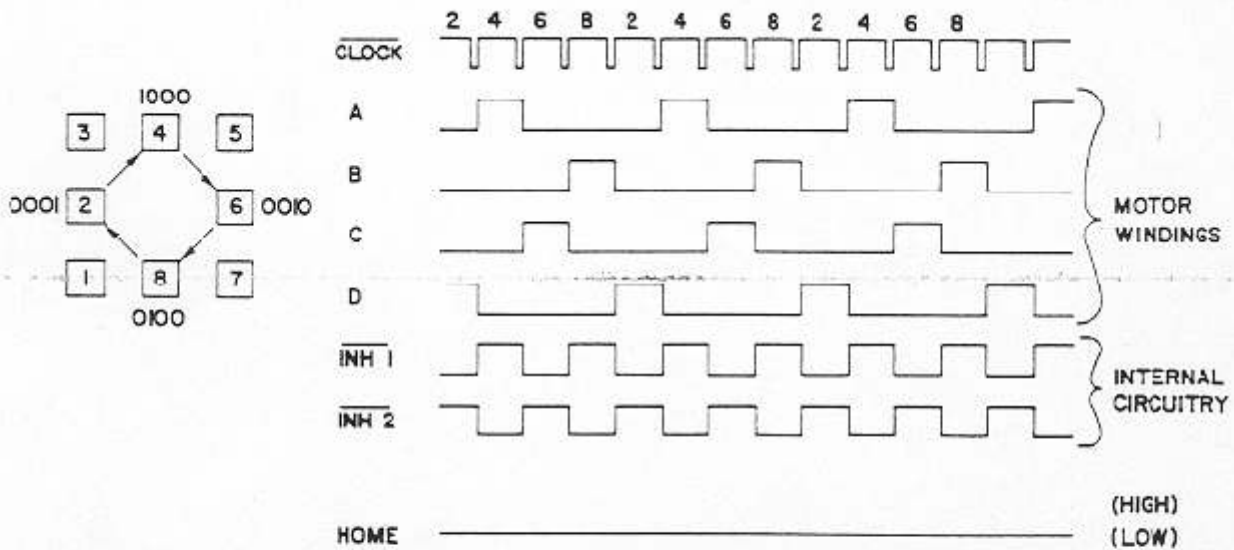


Figure 2
Full Step Input

Wave drive mode

Wave drive mode (also called one-phase-on drive) is selected by a low level on the HALF/FULL input when the translator is at an even numbered state (2, 4, 6 or 8).

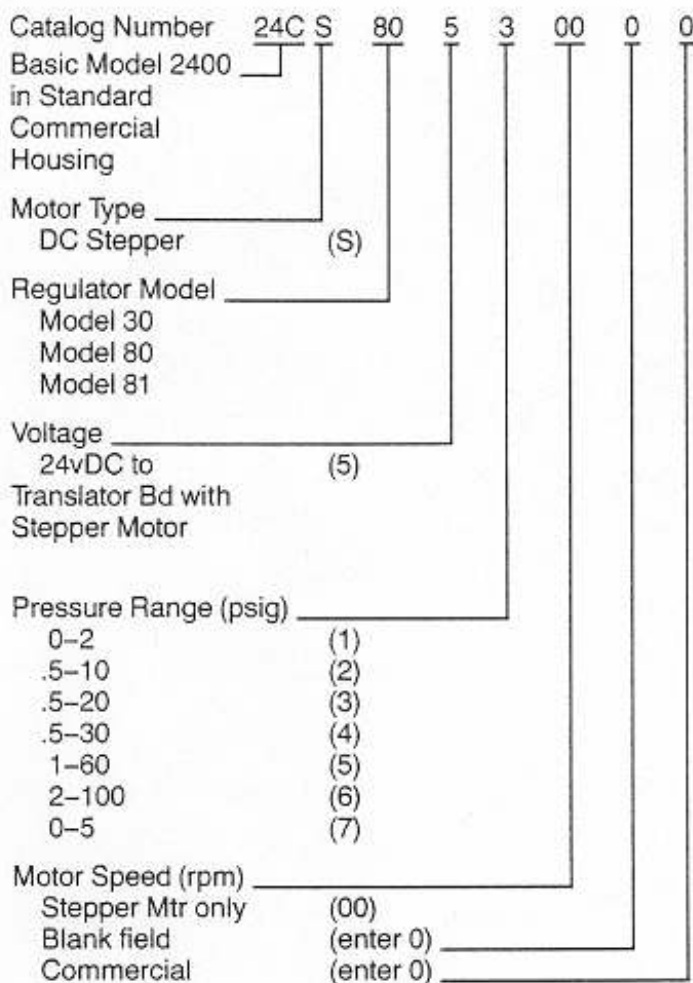


The L297's translator generates phase sequences for normal drive, wave drive and half step modes. The state sequences and output waveforms for these three modes are shown below. In all cases the translator advances on the low to high transition of CLOCK.

Clockwise rotation is indicated for anticlockwise rotation the sequences are simply reversed. RESET restores the translator to state 1, where ABCD = 0101.

Figure 3
Motor Driving Phase Sequences

The Model 24CS Series M/P Converters with Stepper Motors are identified with the following description and variations.



Installation

The 24CS Model 2400 may be wall mounted or pipe mounted (2" pipe clamp) by means of the integral bracket containing two mounting holes. The unit should be mounted vertically for drip proof operation.

Pneumatic Connections

Clean all pipe lines to remove dirt and scale before installation is made. When installing pipe or tube fittings into the regulator it is preferable to use teflon dope as a sealant if pipe compound is used.

Apply minimum amount of pipe compound to male threads of the air line only. Start with third thread back and work away from the end of the line to avoid possibility of getting compound into the regulator. Install regulator in air line; body is fitted with a 1/4 NPT for the inlet and outlet connections of the Model 81; 1/4 NPT for the Model 30 and 1/8 NPT for the Model 81.

Inlet and outlet connections are labeled (look for arrows denoting direction of flow on the underside of the unit) and should be tightened securely. Avoid undersized fittings that will limit flow through the regulator and cause pressure drop downstream.

NOTE: Oil free air only, must be applied to the regulator. The use of a filter to remove dirt and entrained liquid in the air line ahead of the regulator is required for correct performance. If an air line lubricator is used, it must be located downstream beyond the regulator in order to avoid interference with regulator performance. Instrument air is NOT required for the Model 30 regulator.

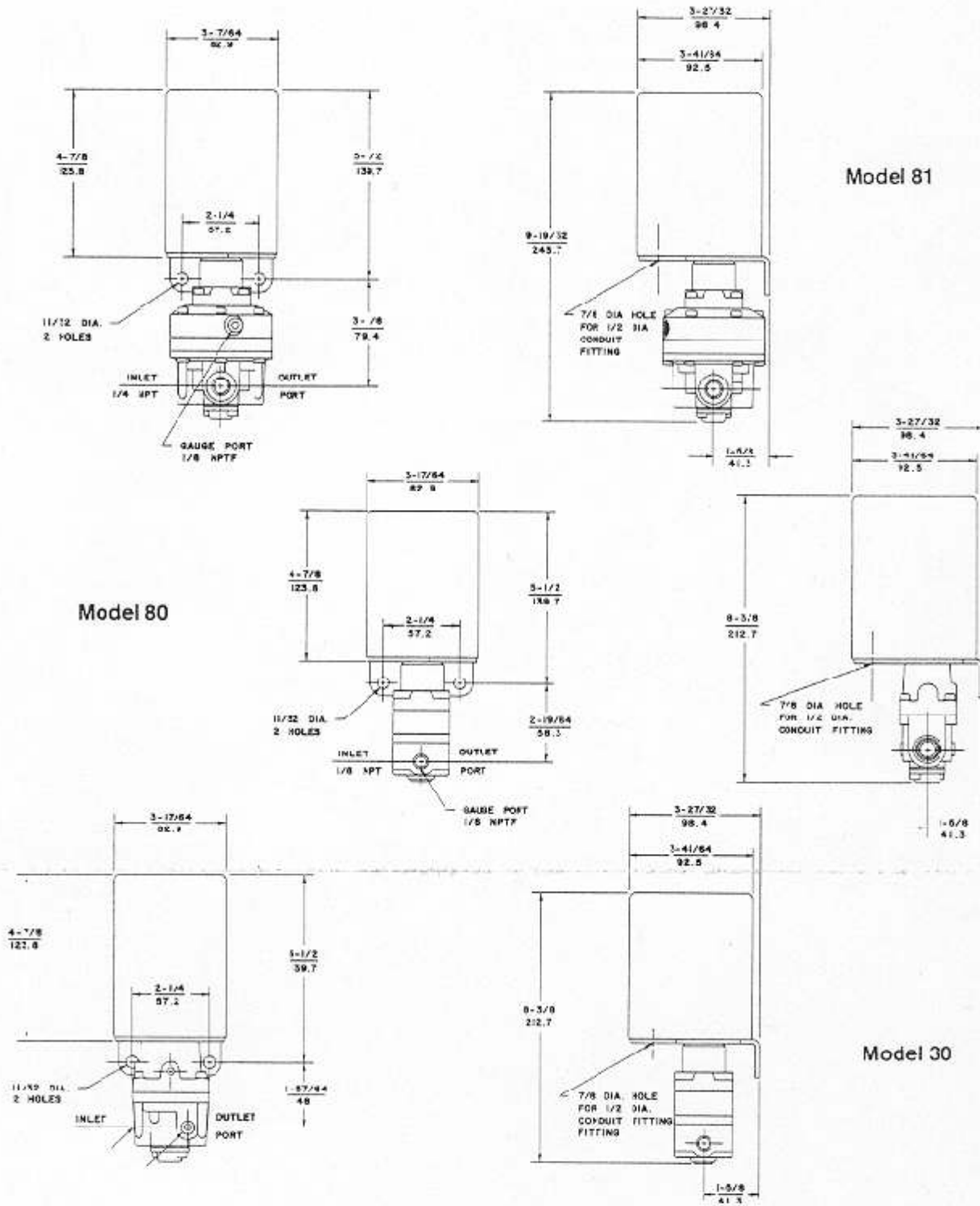


Figure 4
24CS Outline Dimensions

Electrical Connections - Stepper Motor

For the 24CS unit, connections are made through the 1/2 inch conduit hole in the base plate after the cover is removed. Wires should be routed inside the unit so that they will not become entangled in the actuating mechanism. (See Figure 5 for proper routing.) For data runs of six feet or less, 22 gage wire may be used. For longer data runs, use 13 gage wire. Shielded cable should be used to achieve noise immunity for long data lines.

DO NOT run power leads within the same shield as the data lines. In order to keep power wiring as short as possible, locate the power supply close to the 24CS unit. Terminal block connections are as follows:

- Terminal number
- 1 Sync
 - 2 Home
 - 3 Reset
 - 4 Half/Full
 - 5 Clock
 - 6 CW/CCW
 - 7 Enable
 - 8 +24vDC*
 - 9 Ground

*Power Supply must have a minimum capability of 1.5 amps @ 23-26 volts.

In multiple unit installations it may be desirable to synchronize the chopper oscillators of all Translators to minimize ground noise problems and the high frequency sound emitted by the stepper motor. Connect Sync terminals of all Translator boards together. Switch S1 on ONLY one of the translator boards must be placed in the OPEN position. All other S1 switches must be in the CLOSED position. This disables the RC oscillator networks and boards so configured will accept Sync terminal input for the oscillator. This input comes from the Translator board whose S1 switch is in the open position. (See Figure 6 for proper connections.)

The table below shows the functional parameters which are applied to the Translator board terminal block (Figure 7).

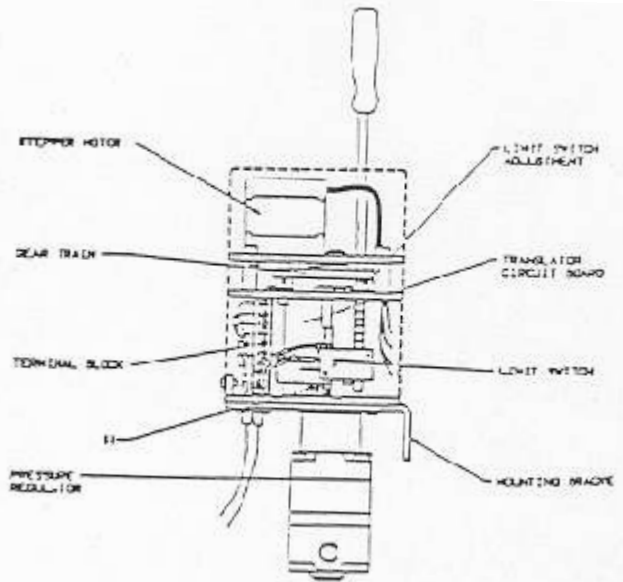


Figure 5

Term.	Function	Type
1	Sync	input/output
2	Home Position	output
3	Reset	input
4	Half/Full Step	input
5	Clock	input
6	CW/CCW	input
7	Direction Contr.	
8	Enable	input
9	+24vDC Power	input
	Ground	

When SW-1 is set for Internal Sync (Open), an output of the chopper oscillator is available for synchronizing the chopper circuits of other units with which the Translator board is interfaced. These units must be set up for External Synchronization.

SW-1 MUST BE IN THE OPEN POSITION FOR OPERATION OF THE MODEL 2400 A3 A SINGLE UNIT (NO SYNCHRONIZATION).

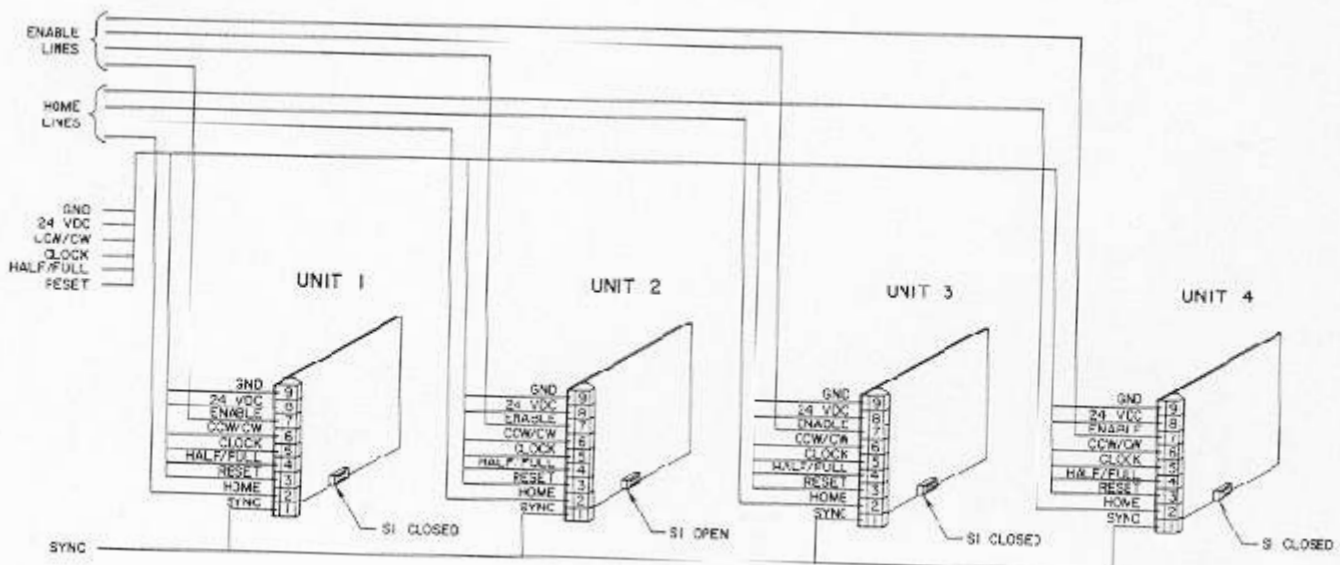
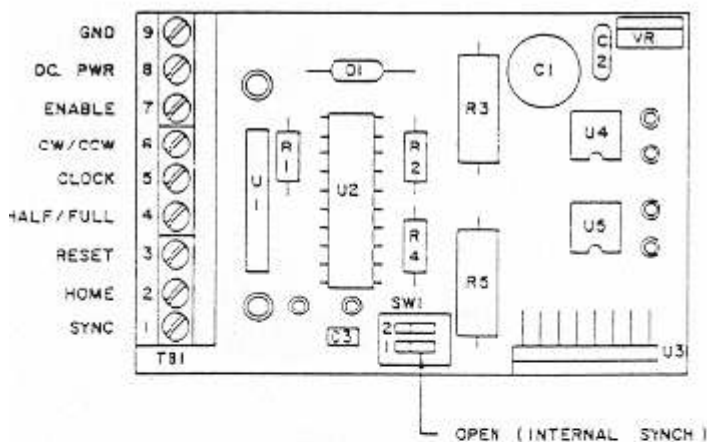


Figure 6
Multiple Unit Operation



**Figure 7
Translator Board**

If the Model 2400 is to be synchronized to an external unit, SW-1 must be set for external synch (CLOSED) to accept a synch signal.

When the Translator board Controller output is in an 0101 state, this state is "anded" with the Home position limit switch state to establish a home position reference signal, available on Terminal 2. Under these conditions the output signal is LOW.

When the external circuit connected to terminal 3 is in a LOW state, the Translator board Controller is reset to an 0101 state. In addition, if the wave drive mode has been set, it will be cancelled and the operational mode will return to the mode selected initially.

When the input to Terminal 4 is LOW, the Controller operates in Full Step mode (200 steps per revolution of the motor shaft). When the input to Terminal 4 is HIGH, the Controller operates in Half Step mode (400 steps per revolution of motor shaft).

To obtain operation in wave drive mode (one phase in Full Step mode), the Controller is first set to Half Step mode, reset to zero, and then advanced one step so that the Controller is in an even numbered state. (See clock function for advance one step procedure.)

A LOW input to Terminal 4 will place the Controller in the wave drive mode. Wave drive mode may be used on some occasions where it is necessary to reduce power (approximately 50%) to drive the motor. In this case the motor is driven at 200 steps per revolution, but with lower torque than in Full Step mode.

A LOW input (pulse) on Terminal 5 advances the motor one increment. This motor step occurs on the rising edge of the pulse.

When the input to Terminal 6 is HIGH, the motor will be driven to decrease regulator output pressure. When the input is LOW, the motor will be driven to increase regulator output pressure.

When the input to Terminal 7 is LCW the Translator circuit is disabled. In this case power to the stepper motor is turned off and input signals to the board have no effect on the motor drive circuits. The Model 2400 will hold the last position to which it was driven and does not need to be re-oriented when the Translator circuits are again enabled. This allows parallel operation of two or more Model 2400 units, any of which may be selected for repositioning by applying an enable signal.

The positive side of the 24vDC power supply is applied to Terminal 8. The Model 2400 will operate with an input voltage between 23-26 volts.

Function

Terminal	State	
	High	Low
3		Controller in 0101 (Home). Wave Drive Cancelled
4	Half Step	Full Step When Translator Is In Odd State. (1,3,5,7) Wave Drive In Even State
5		Advance One Increment
6	Decrease	Increase
7	Translator Enabled	Inputs And Outputs Enabled

Adjustment

The HOME reference microswitch is adjusted at the factory to produce a signal at 0 psi output. To adjust to this value in the field, use the following procedure:

Remove the cover and locate the microswitch adjustment screw (See Figure 5). Insert a Phillips head screwdriver into the adjusting screw, through the access hole in the motor plate. Turn the screw clockwise to decrease the pressure, or counterclockwise to increase the pressure.

Operation Manual

Figure 1 shows the configuration of Stepper Motor, Power Supply and Pulse Generator to achieve manual motor control of the Model 2400. Turning the pulse generator ON and OFF will drive the Stepper motor in a direction dependent on the position of the direction switch. Rotation of the motor will be dependent on the number of pulses applied by the generator during the time it is ON.

**Model 2400 Stepper Motor Set Regulator
Translator Board Timing Chart**

Parameter		Min.	Max.	Unit
T Ck	Clock Time	0.5		μs
T s	Set Up Time	1		μs
T h	Hold Time	1		μs
T r	Reset Time	1		μs
Tr Clk	Reset To Clock Delay	1		μs

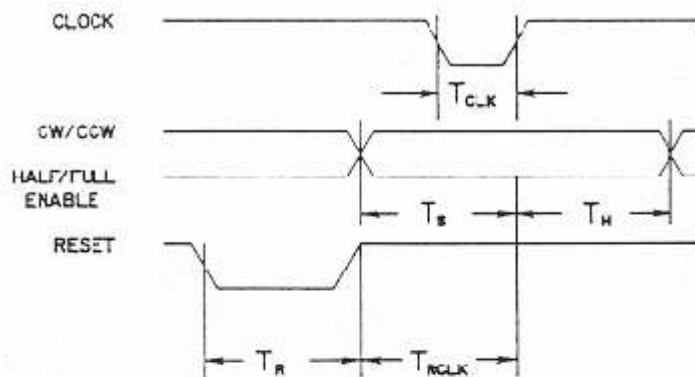


Figure 8
Timing Diagram

Computer Control

The table shows minimum time relationships between translator board input signals. Computer output current rise or decay would be required to meet these limitations.

Maintenance

The Model 30 and 81 regulator is easily disassembled for the occasional cleaning or removal of foreign matter. Before this is done however, shut off the valve upstream of the regulator to prevent the escape of air when the regulator is disassembled. There is no need to remove the regulator from the pipe line; remove the two screws on the bottom of the unit and pull out the inner valve assembly. Wash the inner valve assembly with solvent, exercising care to avoid damaging the diaphragm and valve facings. Replace the assembly carefully. The vent hole in the bonnet should be kept clear. A slight flow of air through this hole is necessary for the proper operation of the regulator. The adjusting screw should be lubricated with Molycote type "G" grease.

CAUTION: Avoid such solvents as acetone, carbon tetrachloride and trichlorethylene.

Motor Drive Disassembly for Model 24CS stepper motor.

(Figure 12)

1. Remove Cover Retaining Screw (2) and Cover (1). Mark Adapter Plate (22) and regulator body so that all parts can be realigned during assembly.
2. Remove four leads from Translator Board Assembly (17) and pull leads through holes in the Motor Assembly Plate (3) and Top Plate (10).
3. Remove three Screws (4) from Motor Plate (3) and lift off Top Plate (10).
4. Remove Gear Hub Assembly (5) by pulling it straight up.
5. Remove two leads from Switch Assembly (15A,B).
6. Remove three Screws (9) holding down Top Plate (10). Remove Clip (19) from Top Plate (10).
7. Lift off Top Plate (10) including Switch Assembly (15A,B).
8. Using an Allen wrench, loosen set screw on Coupling Shaft Assembly (11) and slide the assembly off the Regulator Range Screw.
9. Remove Spring Washer (13) and Guide Bar Assembly (16).

10. Remove two Screws (18) holding Translator Board Assembly (17) to Bottom Plate Assembly (14) and remove the Translator Board Assembly (17).

11. Remove Screw (9) holding Translator Board assembly (14B) to Bottom Plate Assembly (14).

12. Remove Nut or Screws holding Regulator to Adapter Plate (22).

13. Proceed to service kit installation instructions for the specific Regulator.

Motor Drive Assembly for Model CS stepper motor.

1. Place the Adapter Plate (22) and Bottom Plate Assembly (14) on the Regulator. Use Nut or Screws to secure the Adapter Plate (22) to the Regulator.

2. Using two Screws (18), fasten Translator Board Assembly (17) to Bottom Plate Assembly (14B) square post.

3. Fasten L298 on Translator Board Assembly (17) to Bottom Plate Assembly (14B) using Screw (8).

4. Place Guide Bar Assembly (16) on Regulator Range Screw so that cutout is engaged in guide on Bottom Plate Assembly (14) and Limit Switch Actuator is closest to the Bottom Plate Assembly (14).

5. Place Spring Washer (13) concave side down over the Range Screw.

6. Place Coupling Shaft Assembly (11) on Regulator Range Screw and on top of Spring Washer (13). Position the lower coupling hub of the Coupling Shaft Assembly (11) on the Range Screw so that it compresses the Spring Washer (13) to approximately 1/2 of its free height. Tighten the set screw securely against the flat on the shaft.

NOTE: Apply Loctite to set Screw before tightening.

7. Position Top Plate Assembly (10) including Limit Switch Assembly (15A, B) on the Bottom Plate Assembly (14A) posts, and slide the Switch Assembly (15A, B) over the post located above the Regulator Inlet port.

8. Using three Screws (9) fasten Top Plate Assembly (10) to posts of the Bottom Plate Assembly (14).

9. Fasten left hand lead from Translator Board Assembly (17) to the middle terminal of the microswitch. Fasten right hand lead from Translator Board Assembly (17) to the top terminal of the microswitch.

10. Place Clip (19) over Top Plate Assembly (10) and component heat sink. Apply Silicone heat sink compound to pack before securing.

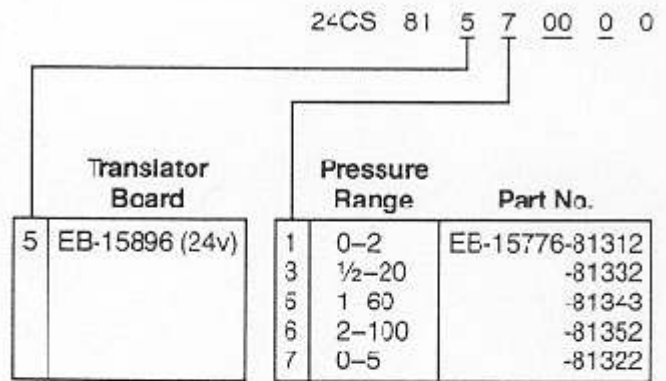
11. Place Gear Assembly (5) over Coupling Shaft Assembly (11) and rotate so that slots in Gear Assembly (5) engage the pins on Coupling Shaft Assembly (11). Press the assembly down flat against the bearing on Top Plate Assembly (10).

12. Turn the assembly so that the mounting holes in Adapter Plate (22) are directly in view and the INLET port of the regulator is on the left.

13. Position Motor Plate Assembly (3) so that the bearing on Motor Plate Assembly (3) is directly over the Gear Assembly (5) and the stepper motor pinion engages the large gear. Fasten the Motor Plate Assembly (3) to the Top Plate Assembly (10) using three Screws (4).

14. Thread four leads from the motor through holes in the Motor Plate Assembly (3) and Top Plate Assembly (10).

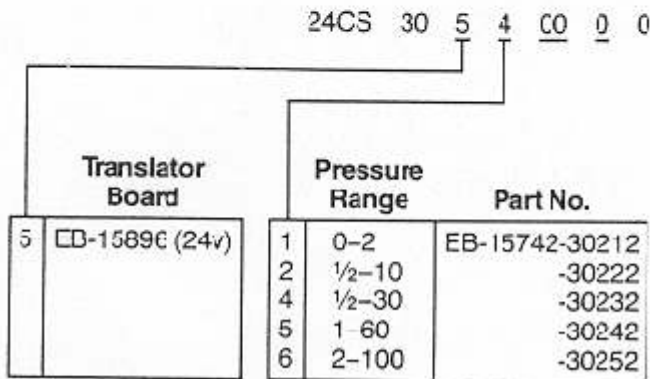
15. Connect leads to the Translator Board Assembly (17) as follows:
- 1st term. from bottom plate
Black
 - 2nd term. from bottom plate
Green
 - 3rd term. from bottom plate
Blue
 - 4th term. from bottom plate
Red
- Adjust the limit switch for the specific application.
16. Place Cover (1) on the unit and fasten with Retaining Screw (2).



Identifies an M/P Controller with the following characteristics:

Model 81 Voltage 24vDC to Translator Board
Regulator Range 0-5 psig
 Regulator EB-15776-81322

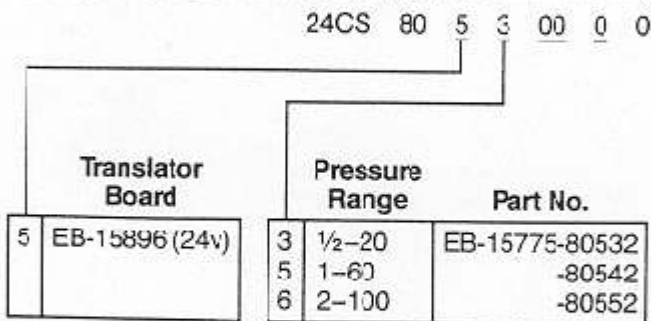
Figure 11
24CS 81 Characteristics



Identifies an M/P Controller with the following characteristics:

Model 30 Voltage 24vDC to Translator Board
Regulator Range 1/2-30 psig
 Regulator EB-15742-30232

Figure 9
24CS 30 Characteristics



Identifies an M/P Controller with the following characteristics:

Model 80 Voltage 24vDC to Translator Board
Regulator Range 1/2-20 psig
 Regulator EB-15775-80532

Figure 10
24CS 80 Characteristics

Index	Part No.	Description
1	EB-15557-2	Cover
2	EB-11182-2	Screw
3	EB-15897-1	Motor Plate
3A	EB-15909	Motor
3B	EB-13291	Screw
3C	EB-15905	Bearing
3D	EB-15995	Gear
4	EB-1C32-6	Screw
5	EB-16025-1	Gear Hub Assy
6	EB-1C32-32	Screw
7	EB-15996-1	Washer
8	EB-8223-4	FH Screw
9	EB-11182-3	Screw
10	EB-15898-1	Top Plate
10A	EB-15990-10	Spacer
11	EB-16026-1	Coupling
		Shaft Assy
12	EB-15569	Spring
13	EB-15566	Spring Washer
14	EB-15899	Bottom Plate
14A	EB-15553	Standoff
14B	EB-15908	Bar
15	EB-14489-7	Screw
15A,B	EB-15988-1	Switch Assy
16	EB 15907 1	Guide Bar
16A	EB-15906-1	Spring
16B	EB-14489-4	Screw
16C	FR-15564	Bar
17	EB-15896	Translator
		Board Assy
18	EB-14989-7	Screw
19	EB-15992-1	Clip
20	EB-5204	Nut
21	EB-5205	Washer
22	EB-15900-1	Adapter Plate

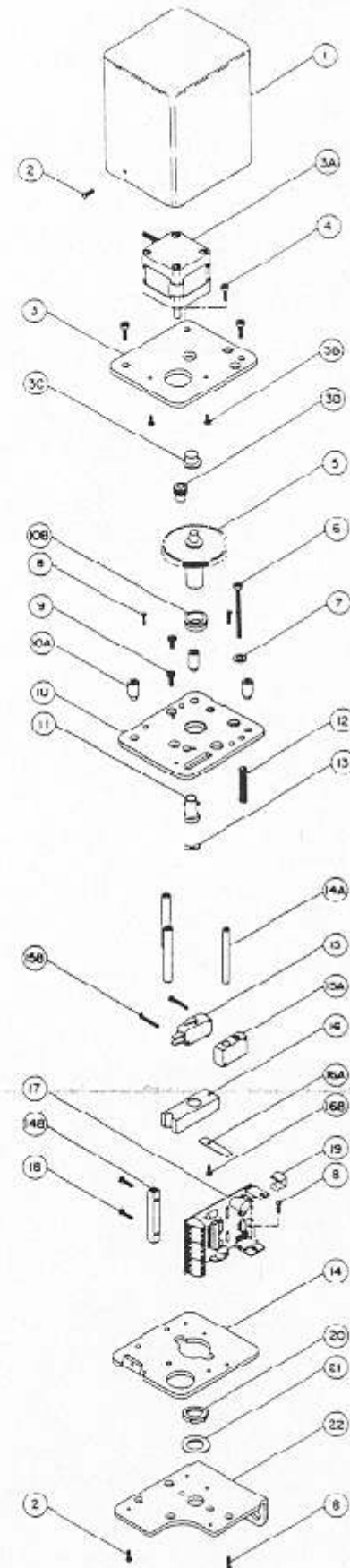


Figure 12
Stepper Motor Exploded View

Service Kit Installation

Model 30 Service Kit

1. Check parts in the EA-15703 service kit against the parts marked with an asterisk in the exploded view and the associated table.

2. Remove two Screws (20) holding the Regulator to Adapter Plate (18) and remove the Adapter Plate from Regulator.

3. Remove four Screws (3) holding Bonnet (2) to Body (10). Mark Bonnet (2) and Body (10) so they can be reassembled properly.

4. Set aside Bonnet (2), Range Spring Washer (4) and Range Spring (5).

5. Remove Diaphragm Assembly (6) and discard.

6. Remove four Screws (7) holding Seal Plate (8) to Body (10).

7. Remove two Screws (16) holding Retainer Plate (14) and Cup (15) to Body (10).

8. Remove Retainer Plate (14), Cup (15), Inner Valve Assembly (13) and Screen (12).

9. Remove Seal Plate Assembly (8) from Body (10).

NOTE: It will be necessary to lift and twist the plate in order to remove it. Make sure that the aspirator is not damaged in the process of removal.

10. Remove Seal Plate Gasket (9) from Body (10) and discard.

11. Using a suitable dowel rod, tap out the Seat Ring Assembly (11) from Body (10) and discard.

12. Obtain Seat Ring Assembly (1*) from service kit and drop into the bottom hole in the Body (10), brass end first. Insure that it is seated against the shoulder in Body (10).

13. Obtain Seal Plate Gasket (9) from service kit and place in Body (10), narrow end of hole over the port in the

Body (10) marked with an arrow and going out of the Body.

14. Using four Screws (7) secure new Seal Plate (3) to Body (10) with aspirator extending into port identified in Step 13.

15. Place Filter Screen (12) from service kit in the groove in Inner Valve Assembly (13) from service kit. Insert the assembly into the hole in the bottom of the Body (10), aligning Pintle of the Inner Valve Assembly (13) so that it drops in to Seal Plate (8) center tube.

16. Tap Inner Valve Assembly (13) so that the brass shoulder is flush with the bottom of the Body (10). Place Retainer Plate (14) over the Inner Valve Assembly (13) aligning it with holes in the Body (10).

17. Place retainer Cap (15) over the Retainer Plate (14) and secure to Body (10) with two Screws (16).

18. Obtain Diaphragm Assembly (6) from service kit and place on Body (10) so that the oval Cup faces up and the four holes in the Diaphragm Assembly (6) are aligned with holes in the Body (10).

CAUTION: Make sure that the hole in the center of Diaphragm Assembly (6) is directly over the Inner Valve Assembly (13) Pintle.

19. Set Range Spring (5) over the Nut on top of Diaphragm Assembly (6) and set Spring Cup (4) on top of the Range Spring (5), Range Screw recess facing up. Place some Molykote grease in the recess.

20. Place Bonnet (2) over Body (10) making sure that marks from Step 3 are aligned.

21. Using four Screws (3), secure Bonnet (2) to Body (10).

22. Using two Screws EB-1032-6 (not shown), attach Regulator to Adapter Plate (22).

23. Proceed to instructions for Motor Drive Assembly.

Index	Part No.	Description
1	EB-15550	Range Screw
2	EB-1835	Bonnet
3	EB-1032-12	Screw
4	EB-15780-1	Spring Seat
5	EB-7141-()	Spring
*6	See Table	Control Diaphragm Assy**
*6A	EB-16122-1	Gasket
7	EB-1032-5	Screw
8	See Table	Seal Plate Assembly**
*9	See Table	Gasket**
10	See Table	Body**
*11	EB-6070	Seat
*12	EB-6017	Screen Filter
*13	EB-1820	Inner Valve Assembly
14	EB-6027	Retainer Plate
15	EB-7136	Retainer Cap
16	EB-1032-5	Screw

*EA-15703 Service Kit Components

**Number depends on Range

PORT SIZE	BCDY
1/4 NPT	EB 15614-1
3/8 NPT	EB 15614-2
1/4 BSPT	EB 15614-3
3/8 BSPT	EB 15614-4

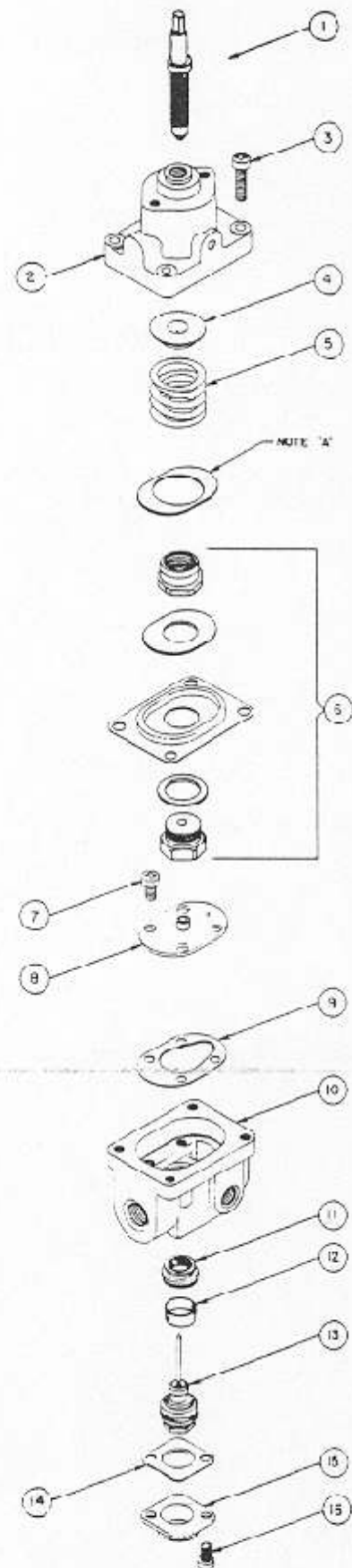


Figure 13
Model 30 Exploded View

2 PSIG RANGE														(F) 10, 30, 60 & 100 PSIG RANGES													
EB-16116-1 STD. MODEL 30 & OPTIONAL 1, 1.5, 2 N. OPTION														EB-16116-1 STD. MODEL 30 & OPTIONAL 1, 1.5, 2 N. OPTION													
EB-16116-1	EB-16116-2	EB-16116-3	EB-16116-4	EB-16116-5	EB-16116-6	EB-16116-7	EB-16116-8	EB-16116-9	EB-16116-10	EB-16116-11	EB-16116-12	EB-16116-13	EB-16116-14	EB-16116-15	EB-16116-16	EB-16116-17	EB-16116-18	EB-16116-19	EB-16116-20	EB-16116-21	EB-16116-22	EB-16116-23	EB-16116-24				
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	EE-16122-1	GASKETS		
																								EE-15858-1	DIAPHRAGM ASS'Y		
																								EE-15858-4	DIAPHRAGM ASS'Y		
																								EE-15858-2	DIAPHRAGM ASS'Y		
																								EB-15818-1	DIAPHRAGM ASS'Y		
																								EA-15913-1	DIAPHRAGM ASS'Y		
																								EA-15913-2	DIAPHRAGM ASS'Y		
																								EA-15913-4	DIAPHRAGM ASS'Y		
																								EA-15913-3	DIAPHRAGM ASS'Y		
																								EA-15917-1	DIAPHRAGM ASS'Y		
																								EA-15917-2	DIAPHRAGM ASS'Y		
																								EA-15917-4	DIAPHRAGM ASS'Y		
																								EA-15917-3	DIAPHRAGM ASS'Y		
																								EB-15884-1	SEAL PLATE ASS'Y (LOW)		
																								EB-15841-1	SEAL PLATE ASS'Y (HIGH)		
																								EB-15844-1	SEAL PLATE GASKET		
																								EB-6070	SEAT RING ASSEMBLY		
																								CD 0101	SEAT RING ASSEMBLY		
																								EB-9937	SEAT RING ASSEMBLY		
																								EB-6017	SCREEN FILTER		
																								EB-1820	INNER VALVE ASS'Y		
																								EB-11947	INNER VALVE ASS'Y		
																								EB-11948	INNER VALVE ASS'Y		

- OPTIONS:
A - SILICONE
B - LOW BLEED
G - GAUGE
J - VITON
L - LOW FLOW
N - NON-RELIEVING
P - PINTLE OPERATED
T - TAMPER PROOF

NOTE A:
Gasket to be applied (if req'd) to piston at top of diaphragm assembly. Use only when replacing old style diaphragm assembly which has a formed piston.

Service Kit Installation

Model 80 Service Kit

1. Check parts in the EA-15704 service kit against the parts marked with an asterisk in the exploded view and the associated table.
 2. Remove Nut (17) and Washer (17A) holding Regulator to Adapter Plate (18) and remove Adapter Plate from Regulator.
 3. Turn out Fange Screw Assembly (1) to relieve tension on spring.
 4. Remove four Bonnet Screws (15). Set aside Range Spring and Spring Cap.
- CAUTION:** Spring (13) is in compression. Screws should be removed carefully, allowing the spring to expand.
- Set aside Spring (13), after removing Bonnet Assembly (2), Diaphragm Assembly (4), Pilot Body Assembly (7), Diaphragm (12), Spacer Ring (9) and Diaphragm Assembly (8) from Body and Valve Assembly (10). Remove any pipe fittings in Body ports.
 5. Remove Orifice Assembly (11) and Gasket (21) from Body and Valve Assembly (10).
 6. Unscrew Plug (23) from Body (10). Remove and discard Pintle (19) and retain Conical Spring (22).
 7. Replace O Ring (20) on Plug (23) with O Ring from kit. Lubricate with silicone grease. Place Conical Spring (22) wide end down, into Cup of Plug (23). Clear Body Assemblies (10) and (7) with a suitable solvent. Blow dry with compressed air.

8. Turn Body (10) over, so that plug end faces up.
9. Place Pintle (19) from kit into plug end of Body (10), valve end up. Hold the Pintle securely which extends from the opposite end of Body (10) and insert Conical Spring (22) and Plug (20) into the plug end of Body (10). Screw the Plug (23) into body (10) until it is tight.

CAUTION: Insure that short end of Pintle (19) fits into top of Conical Spring (22).

10. Secure Orifice Assembly (11) and Gasket (21) from kit. Place Gasket (21) over threaded portion of Orifice Assembly (11) and screw the Assembly into the port on Body (10) opposite port marked GAUGE.
11. Place Spacer Ring (9) on Body (10) making sure that six holes in the Spacer Ring match the six holes in Body (10).
12. Obtain Diaphragm (12) from kit and place it on top of Spacer Ring (9), making sure that six holes in the Diaphragm (12) match the six holes in Spacer Ring (9).
13. Place the Pilot Body Assembly (7) on top of Diaphragm (12), making sure that the six holes on the bottom of Pilot Body Assembly (7) match the holes in Diaphragm (12). Check that Anvil (6) is seated in the center hole of the Spring Plate.
14. Obtain Diaphragm Assembly (4) from kit and place it in the recess of the Pilot Body Assembly (7). Place Range Spring and Spring Cap on top of Diaphragm Assembly (4).

15. Position Bonnet Assembly (2) over the Pilot Body Assembly (7) so that the signal port in the Bonnet Assembly (2) is over the port marked with the arrow pointing into the unit.

NOTE: Output ports on the side opposite Spacer Ring (9) which has the vent hole.

16. Grasp the Spacer Ring (9) firmly, and lift up, being careful that all parts above it remain in alignment. Set the stacked parts aside.

17. Obtain Spring (13) from the kit and place it in the cup on Body (10), directly over the Pintle (19).

18. Obtain Diaphragm Assembly (8) from the kit and place it on top of Spring (13), making sure that holes in the Diaphragm match the six holes in Body (10), when the Spring (13) is compressed.

19. Carefully place the assembled stack set aside in Step 18 or top of the Diaphragm Assembly (8), making sure large piston is on top and that six holes in the Spacer Ring (9) match the holes in Diaphragm Assembly. Place Screws (15) into the Bonnet Assembly (2), until several threads are engaged on each Screw.

20. Carefully tighten opposite Screws until Spring (13) is compressed.

CAUTION: Insure that the Screws do not cut the Diaphragm as they are being tightened.

21. Complete tightening of the Screws (15).

22. Insert Regulator into Adapter Plate (22) and fasten with Washer (21) and Nut (20) (page 10).

23. Proceed to instructions for Motor Drive Assembly

Index	Part No.	Description
1	EB-15559	Range Screw
2	EB-9536-4	Bonnet Assembly
*4	EB-12191	Diaphragm Assembly
6	EB-9547	Anvil
7	EB-9530-3	Pilot Body Assembly
*8	EB-13681	Diaphragm Assembly
9	EB-13679-1	Spacer Ring
10	EB-13680-1	Body and Valve Assembly
*11	EB-9348-3	Orifice Assembly
*12	EB-12926-1	Diaphragm
13	EB-9917	Spring
15	EB-1032-28	Screw
18	EB-1120	Nut
*19	EB-13674	Pintle
*20	EB-130-C12-1-70	O Ring
*21	EB-9346	Gasket
22	EB-9212	Conical Spring
23	EB-13676	Plug

*EA-15704 Kit Components

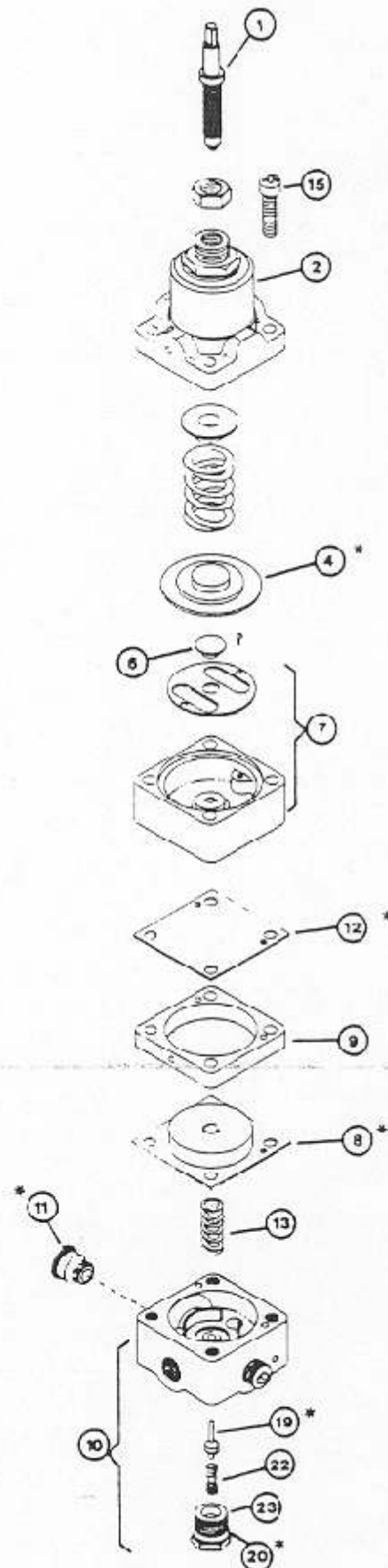


Figure 14
Model 80 Exploded View

Service Kit Installation

Model 81 Service Kit

1. Check parts in the EA-12922 Service Kit against the parts marked with an asterisk in the exploded view and the associated table.

2. Remove Nut (17) and Washer (17A) holding Regulator to Adapter Plate (18) and remove Adapter Plate from Regulator. Mark all parts of the Regulator, starting from the IN port and working up to the Bonnet (1) to facilitate reassembly. Remove any inserts in the IN and OUT ports.

3. Back off Range Screw Assembly (3) to remove compression on Range Screw.

4. Remove four Screws (2) securing Bonnet (1) to Pilot Body Assembly.

5. Remove Diaphragm Assembly (4).

6. Loosen six Screws (5) holding Pilot Body Assembly (5) to Body Assembly (12).

WARNING: Spring (9) is under compression. Loosen Screws (6) carefully so that Pilot Body (5) separates from Body Assembly (12).

7. Lift Diaphragm and Piston Assembly (8) together with Spacer Ring Assembly (7) away from Body Assembly (12) and set aside.

8. Remove Spring (9) and set aside.

9. Remove four Screws (19) holding Seal Plate Assembly (10) to Body Assembly (12).

10. Remove Gasket (11) from Body Assembly (12).

11. Remove two Screws (18) holding Retainer Cap (17) and Retainer Plate (16) to Body Assembly (12) and set aside Retainer Cap (17) and Retainer Plate (16).

12. Tap out the Inner Valve Assembly (14) and Screen (15) from Body Assembly (12).

13. Using a dowel rod, tap out Ring Seat (13) from Body Assembly (12).

14. Obtain Ring Seat (13) from the service kit and insert in the bottom hole of Body Assembly (12), brass end first. Tap with a dowel rod to assure that Ring Seat (13) is seated against the shoulder in Body Assembly (12).

15. Insert Screen (15) from the service kit into the groove in the Inner Valve Assembly (14) obtained from the service kit. Insert the assembly Pintle first into the bottom hole of the Body Assembly (12). Press until brass shoulder is flush with the bottom of Body Assembly (12).

16. Align the holes in the Retainer Plate (16) with the two holes in the bottom of the Body Assembly (12). Align the holes in Retainer Cap (17) with the holes in the Retainer

Plate (16) and secure both to the Body Assembly (12) with two Screws (18).

17. Obtain Gasket (11) from the service kit and place in Body Assembly (12), aligning four holes in Gasket (11) with holes in Body Assembly (12).

18. Place Seal Plate (10) over Gasket (11), brass seal tube facing up, aligning four holes in Seal Plate (10) with holes in Gasket (11). Pintle on the Inner Valve Assembly (14) extends through the seal plate tube and the ball bearing in the Seal Plate is over the OUT port.

19. Fasten Seal Plate (10) to Body Assembly (12) with four Screws (19).

20. Obtain Diaphragm Assembly (8) and Ring Assembly (7) from service kit. Place Diaphragm Assembly (8) into Ring Assembly (7) (hexagonal Nut on Orifice side of the ring) so that the Diaphragms overlap top and bottom of Ring Assembly (7). Align six Screw holes and two passage holes in Diaphragm Assembly (8) with holes in Ring Assembly (7).

21. Place Spring (9) over the seal tube on Seal Plate (10).

22. Place Pilot Body Assembly (5) over the assembly in Step 21, so that six holes in Pilot Assembly (5) are aligned with the six holes of assembly in Step 21 and the passage hole in Diaphragm Assembly (8) which is next to the drilled passage in the bottom well of Assembly (5) is directly over the Orifice in the Ring Assembly (7).

CAUTION: Make sure that the Anvil (4A) is not lost while manipulating Assembly (5).

23. Drop six Screws (6) into the holes in Pilot Body Assembly (5).

24. Place assembly of step 24 over Spring (9), aligning marks placed on Pilot Body Assembly (5) and Body Assembly (12) in Step 2.

25. Tighten six Screws (6) alternately so that Diaphragms are not damaged by the Screws.

26. Place Diaphragm Assembly (4) into well in Pilot Body Assembly (5).

27. Place Bonnet Assembly (1) on Pilot Body Assembly (5), aligning marks placed on the Regulator in Step 2, and aligning four holes in Assembly (1) with the four holes in Assembly (5). Secure Bonnet Assembly (1) to Pilot Body Assembly (5) using four Screws (2). Insert regulator into Adapter Plate (22) and fasten with Washer (21) and Nut (20) (page 10).

28. Proceed to instructions for Motor Drive Assembly.

Index	Part No.	Description
1	EB-9536-4	Bonnet Assembly
2	EB-1032-12	Screw
3	CB-15559	Range Screw
*4	EB-12191	Diaphragm Assembly
4A	EB-9547	Anvil
5	EB-12224	Pilot Body Assembly
6	EB-1032-24	Screw
*7	EB-16014-1	Spacer Ring Assembly
*8	FB-15869-1**	Control Diaphragm Assy (20, 60, 100 PSI)
9	EB-12227	Spring
10	EB-15739-1	Seal Plate Assembly
*11	EB-6053	Gasket
12	CD-14960-1	Body Assembly
*13	EB-15074-1	Seat Assembly
*14	EB-15578-1	Inner Valve Assembly
*15	EB-6017	Screen
16	EB-6027	Retainer Plate
17	EB-7136	Retainer Cap
18	FB-1032-6	Screw
19	EB-1032-5	Screw

*EA-15705-1 Kit Components

For EA-15705-2, Control Diaphragm Assembly is EB-15869-2

**EB-15869-2 for 2.5 FSI

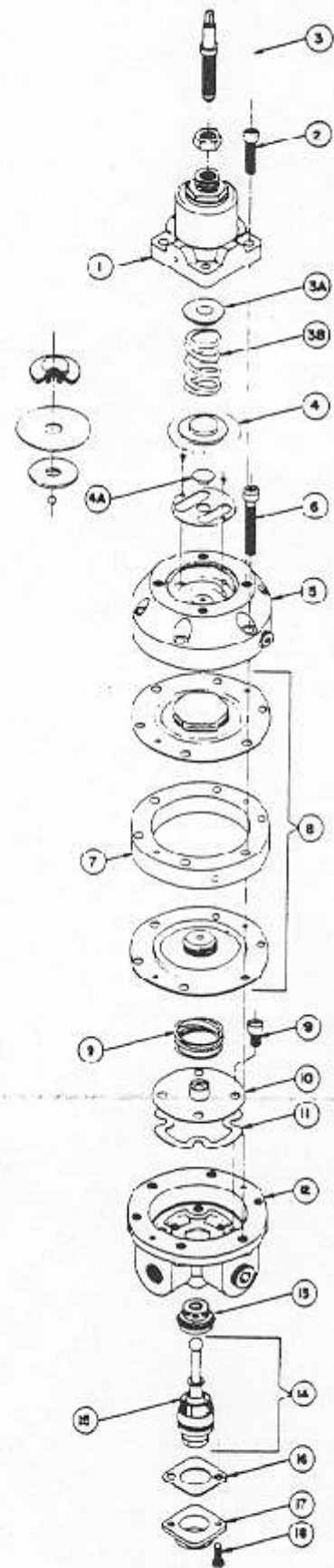


Figure 15
Model 81 Exploded View

TROUBLE SHOOTING

PROBLEM	CHECK
Leakage	Body screw tightness Diaphragm
High Bleed	Relief pintle and relief seat for damage or contaminat on
Difficult to adjust	Acjusing screw, seal ring lubrication

REPAIR PARTS LIST

Service kits are available for repair of regulators as follows:

EA-15703	Model 30
EA-16037-1	Model 30, 100 PSI Fange
EA-15704	Model 80
EA-15705	Model 81

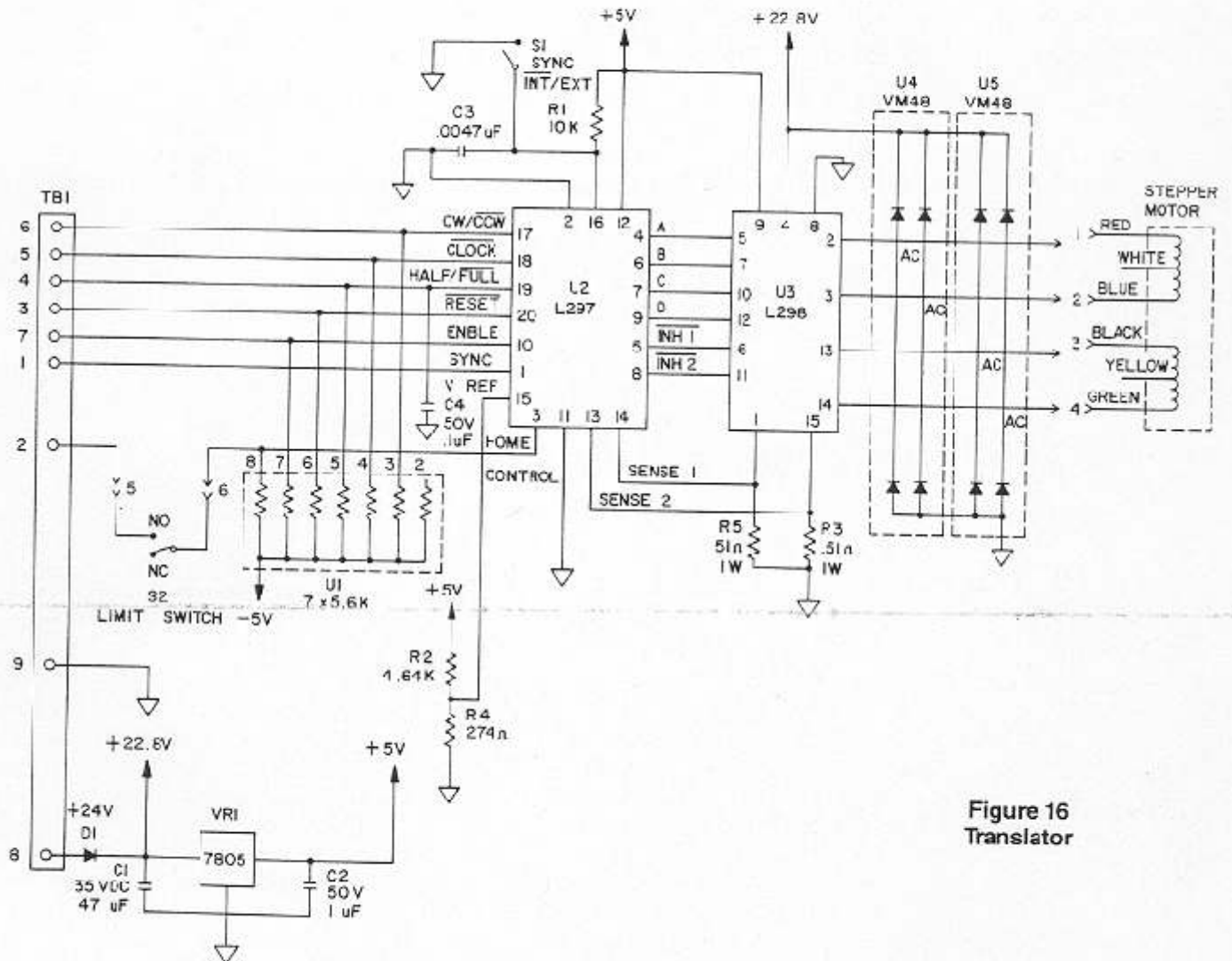


Figure 16
Translator

LEGAL NOTICE:

The information set forth in the foregoing Installation, Operation and Maintenance Instructions shall not be modified or amended in any respect without prior written consent of Fairchild Industrial Products Company. In addition, the information set forth herein shall be furnished with each product sold incorporating Fairchild's unit as a component thereof.



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