

Basis Weight Control SKF Actuator with PEAB IC2000 Stepmotor Interface

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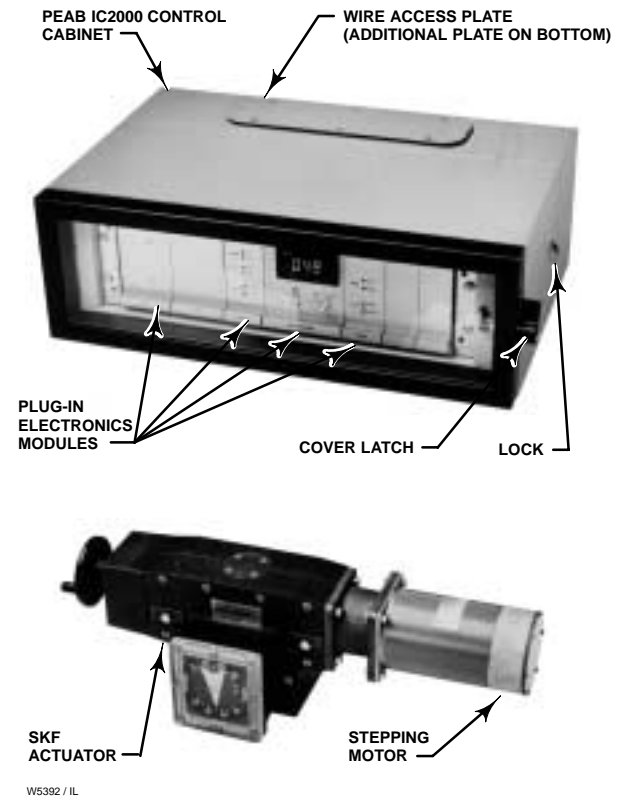


Figure 1. Basis Weight System with Vee-Ball Valve, SKF Actuator and IC2000 Stepmotor Interface

Introduction

Scope of Manual

This instruction manual provides instructions for application and use of the SKF actuator and PEAB (Process Instrument and Electro AB) IC2000 Stepmotor Interface in a basis weight system. Refer to the separate instruction manual for valve instructions.



Basis Weight Actuator

Table 1. Specifications

Actuator Sizes

■ 20HT ■ 30HT or ■ 40HT
HT denotes High Torque

Enclosure Protection

Actuator/Motor: IP54
IC2000: IP55
Remote Station: IP40

Resolution (for 90 Degrees of Valve Rotation)⁽²⁾

Size 20HT: 5600 steps
Size 30HT: 8800 steps
Size 40HT: 11300 steps

Actuator Torque

0% Backlash Rating

Size 20HT: 180 N•m (1590 lbf•in)
Size 30HT: 380N•m (3360 lbf•in)
Size 40HT: 580N•m (5130 lbf•in)

Motor Torque Required

Size 20HT: 4.3 N•m (38 lbf•in)
Size 30HT: 5.7 N•m (50 lbf•in)
Size 40HT: 7.0 N•m (62 lbf•in)

Stroking Time⁽²⁾

Size 20HT: 20 to 1120 seconds
Size 30HT: 20 to 1760 seconds
Size 40HT: 20 to 2260 seconds

Stepping Speeds (programmable)

Slow: 5–1000 steps/sec
Fast : 600–1000 steps/sec

Gear Ratio⁽²⁾

Size 20HT: 1:56
Size 30HT: 1:88
Size 40HT: 1:113

Actuator Rotation

0 to 90 degrees

Motor Drive

Type: Bipolar, 20 KHz chopper
For Stepmotor Types: 2-phase, hybrid or permanent

magnet, 1mH to 10mH per phase, in 4, 6 or 8 wire configuration
Current Adjustment: 2.1 to 3.0 A per phase, in 0.3 A increments
Operation Modes: Half-step (default, for highest resolution) or full-step
Short Circuit Protection: Logic automatically interrupts motor currents when a phase-to-phase or across-phase fault occurs. Power must be cycled to reset the fault.

Maximum Distance from IC2000 to Actuator

40 m (132 ft) with 1.5 mm² conductor
100 m (320 ft) with 2.5 mm² conductor

Control Signal (Customer Supplied)⁽³⁾

Increase: Opens valve
Decrease: Closes valve
Slow Speed: Switches to the slow step speed

Temperature Range

Actuator: -20 to 60°C (-4 to 140°F)
IC2000: -20 to 50°C (-4 to 122°F)
Stepmotor: -20 to 40°C (-4 to 104°F)⁽⁵⁾

Power Requirements

IC2000: 117, 220, or 240 Vac at 50–60 Hz, 225 VA
Remote Station: 24Vdc⁽⁴⁾

Position Feedback

Transmitter Type: 4–20 mA, 2 wire transmitter, max load 1 K ohm
Input Potentiometer: 1 K ohm over 320° rotation, Independent linearity +/- 0.5% of 320° (+/-1.8% of 90°), Repeatability 0.1% over 90°

Approximate Weight

IC2000: 21 kg (47 lbs)
Size 20HT: 16 kg (35 lbs)
Size 30HT: 36 kg (80 lbs)
Size 40HT: 61 kg (135 lbs)
Remote Station: 1.4 kg (3.2 lbs)

Dimensions

See figure 2 and *Bulletin 51.3:V150 (S1)*

1. The pressure/temperature limits in this manual, and any applicable code or standard limitation, should not be exceeded.

2. SKF Crab Actuators using 50 tooth step motors in half-stepping mode have these characteristics for 0–90° travel. The fastest stroking speeds are approximate. The torque falls off as speed increases, and the motor may stall before the theoretical highest speed is reached.

3. Each control signal is normally asserted by pulling the input low through external relay contacts. The increase/decrease signals are optically isolated. The speed control input closes a 24 volt relay coil circuit. A factory option is available for Open-Collector logic supplied by 24 Vdc/8 mA from an external power supply.

4. When factory supplied, a bridge rectifier is mounted in the IC2000 to develop this from one of the power transformer windings. If field mounted, customer supplies the 24 Vdc power.

5. Free air ating at max current. Based on still air in motor without air sinks.

Basis Weight Actuator

Only personnel qualified through training or experience should install, operate, or maintain this equipment.

Do not attempt to install, operate, or maintain this product without this instruction manual and the valve instruction manual. If you have any questions concerning these instructions, contact your Fisher Controls sales office or sales representative before proceeding.

Specifications

Valve

Refer to the appropriate valve instruction manual for specifications.

Actuator and IC2000

See the Specifications table.

Driver Card

Description of Terminal Functions

Motor Phases 1A, 1B, 2A, 2B (pins 2, 4, 6, and 8 on both rows). Connect one phase of the motor to 1A and 1B, and the other phase to 2A and 2B. To reverse the direction of rotation relative to the direction input, interchange the connections to 1A and 1B.

+24 DC Out (pin 10, both rows). Use this output to supply an external control module such as an indexer card. The maximum current which may be drawn is 250 mA.

Logic Supply Inputs 1 and 2 (pins 12a and 14a). When the drive is AC-powered, these two inputs are connected to a center-tapped secondary on the power transformer rated at 18-0-18 volts RMS. The center tap is connected to power common (pins 16 & 18, both rows).

Motor Supply Inputs (pins 12c and 14c). For operation at a motor supply of 24v, these inputs may be driven from the same transformer secondary as the logic supply. An extended secondary rated at 26-18-0-18-26 volts RMS is required for operation at 36v, with the motor supply inputs fed from the 26-volt taps.

Fast Input (pin 20a). Connect to 0v to run the internal oscillator at the fast rate.

Slow Input (pin 22a). Connect to 0v to run the internal oscillator at the slow rate.

Rate Adjust Inputs (pins 24a, 24c, and 26a). The speed of the internal oscillator is determined by external potentiometers connected across the appropriate inputs. The normal values are 100K for the fast control and 500K for the slow control, and these will give the specified speed ranges. Higher values may be fitted to reduce the minimum speed in each range.

Direction Input (pin 26c). Connect to 0v to reverse the direction of motor rotation. This input should not be changed when the "clock" input is low or while the motor is running above its start/stop speed.

Internal Clock Output (pin 28a). This is the output of the internal oscillator which will normally be connected to the clock input of the drive (pin 28c). The output consists of low-going pulses approximately 25 μ S wide.

Clock Input (pin 28c). The motor will step following a low-going pulse on this input, the step occurring on the rising edge of the pulse. The input should remain low for at least 10 μ S. It may be driven from an external oscillator card or the internal oscillator in the drive. The latter method is used in the IC2000

Energize Input (pin 30c). The motor will be energized with this input connected to 0v. Link 4 may be fitted as an alternative to making an external connection to 0v. Note that the drive should not be de-energized when the motor is running at speed.

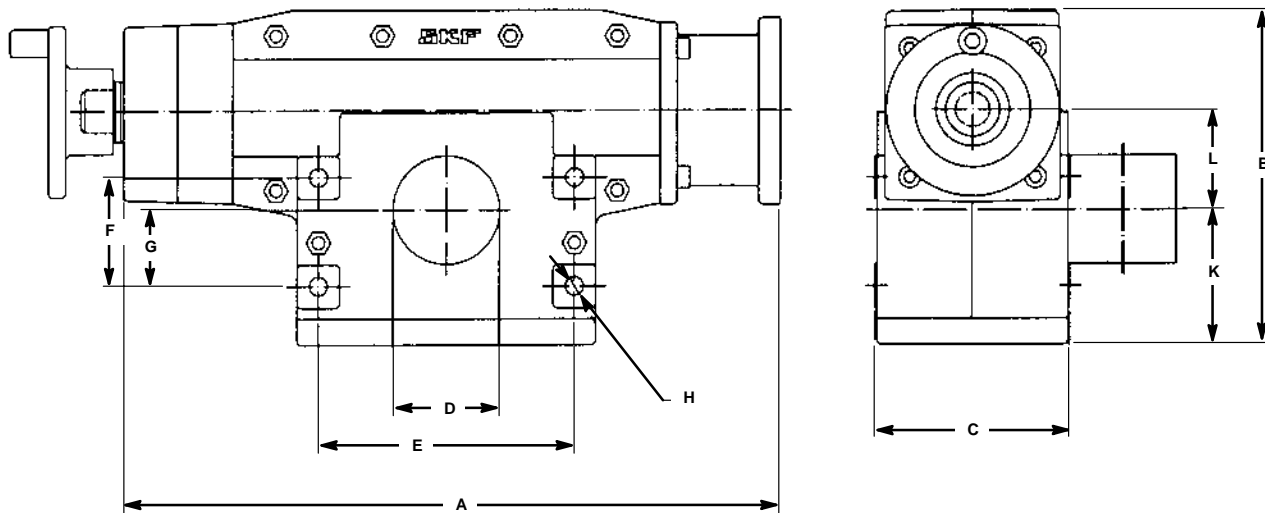
External Reference Input (pin 32a). The motor current may be programmed by means of an external resistor connected between this input and signal 0v (32c). A 1K resistor will give approximately half the rated current. This input is used to control the standby or "braking" current in the IC2000.

Signal 0V (pin 32c). Use this pin as a return connection for the current programming resistor.

Two internal fuses are fitted to the drive power supply circuits. These are 20 mm quick-blow types and are rated in the specifications table.

Basis Weight Actuator

Dimension	20HT	30HT	40HT
mm			
A	306	455	565
B	155	228	286
C	90	122	134
D	50	80	100
E	120	176	230
F	50	85	115
G	35	60	80
H	8.5	10.5	12.5
K	63	92	116
L	46	72	92
Inches			
A	12.0	17.9	22.2
B	6.10	8.98	11.22
C	3.54	4.80	5.28
D	1.97	3.15	3.94
E	4.72	6.93	9.06
F	1.97	3.35	4.53
G	1.38	2.36	3.15
H	0.33	0.41	0.49
K	2.48	3.62	4.57
L	1.81	2.83	3.62



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Figure 2. Actuator Dimensions

System Description

The SKF actuator, IC2000 Stepmotor Interface, and Vee-Ball valve is a control system intended for basis weight control. The system requires a 117, 220, or 240 Vac power supply and a control signal (provided by the customer) that consists of a contact closure for increase in valve position and a contact closure for decrease. The system consists of the following standard and optional components.

The Vee-Ball Valve, a Design V150 or V200, is the final control device that controls the amount of process flow.

The SKF electrically operated actuator provides rotary motion to open and close the valve. A stepping motor in the actuator drives a ball screw. The linear motion of the ball screw nut is transmitted to the valve shaft through a rack and pinion arrangement and a clamped, splined actuator-to-valve connection. Also included in the actuator are a potentiometer (used to provide a valve position feedback signal), limit switches to shut off motor control signal when the travel limit is reached, a handwheel for manual operation of the valve, and a valve rotation indicator. The handwheel can be operated only when no power is applied to the actuator and Stepmotor Interface. The hand-

Basis Weight Actuator

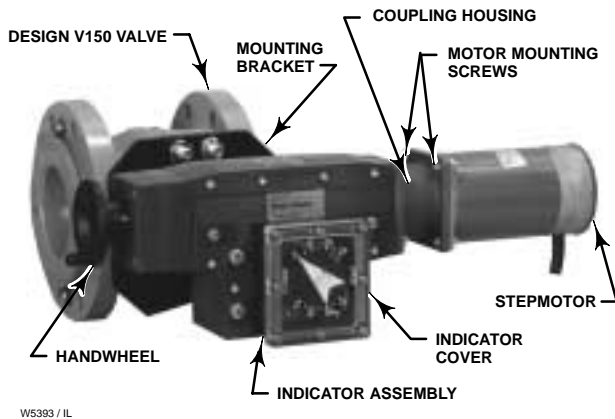


Figure 3. SKF Actuator with Design V150 Valve

wheel is intended for use during power outages or when ac power has been removed at the external circuit breaker box.

The PEAB IC2000 Stepmotor Interface contains the circuit cards necessary to operate the actuator. The Stepmotor Interface is provided with a lock to discourage unauthorized access. Keep the key in a secure location where only authorized people can get it.

All of the circuit components are plug-in modules. Each component is mounted to a faceplate that is visible from the front of the Stepmotor Interface. Use the faceplate handle to pull the plug-in module (component) out of the cabinet. Connections between the modules and the Stepmotor Interface are gold-plated edge connectors.

Table 5 describes how each card within the IC2000 is connected to the other cards. Each card has two columns of pins labeled 2a, 4a, and up to 32a (also 2c, 4c, and up to 32c). The table indicates that 2ca is 24 V and 32ca is ground, which is connected to power common (terminal 10 on terminal block TB1).

See figure 14 for information in the *Input Signal Wiring* section. Also see the External Control Signal portion of the *Wiring* section.

Included as standard in the Stepmotor Interface are:

SD13 Driver Card—This card (key 1, figure 5) sends pulses to operate the stepping motor. See the *Driver Card* section.

Power Transformer— This 225 VA toroidal transformer, mounted on the power supply backplane (see figure 7), supplies internal power.

Terminal Blocks—All field connections including control signals are made to terminal block TB1, TB2 or optional TB3 (see figure 9).

IC500 Interface Card—This card (key 3, figure 5) receives the control signal, which is sent from a customer-supplied control device, from the manual station (key 4, figure 5), or from the optional remote station (see figure 6).

The inputs are optically isolated. The card has four direct inputs, two for manual operation of the actuator, and two for computer operation of the actuator. The IC500 gates the internal oscillator to the driver card when input is low. If there is no low input, a transistor sets the current to the motor at the standby “braking” value to provide stiffness (holds the valve in position).

See figure 5. The IC500 card includes screwdriver adjustments on the lower half of the front panel for actuator motor speed for both manual (MAN) and computer (COMP) operation. Normally, a low speed is used for computer operation, and a high speed is used for manual operation.

The faceplate also has four LEDs on the interface card. The LEDs allow you to verify that signals are reaching the card. Different LEDs are provided for signals intended to open (INC) or close (DEC) the valve in both manual (MAN) or computer (COMP) operation.

FT100 Motion Feedback Transmitter—This transmitter (key 5, figure 5) senses actuator feedback potentiometer resistance and provides a proportional 1 to 5 volt signal for internal use (valve position indicator) and a proportional 4 to 20 mA dc signal for external use (extra valve position indicator or input to a remote computer).

Manual Station—This module (key 4, figure 4) allows selection between manual and computer operation of the actuator and valve. It also provides the means to open or close the valve from the Stepmotor Interface. It includes the digital valve position indicator (0–100%) which is driven by the FT100 0–1 V output line.

For manual operation, press and release the local control button. Then, rotate the DEC–INC knob toward DEC (decrease) to close the valve or toward INC (increase) to open the valve. If you turn the knob the way to DEC or INC, the knob will remain engaged, and the valve will open or close until a limit switch stops motor operation.

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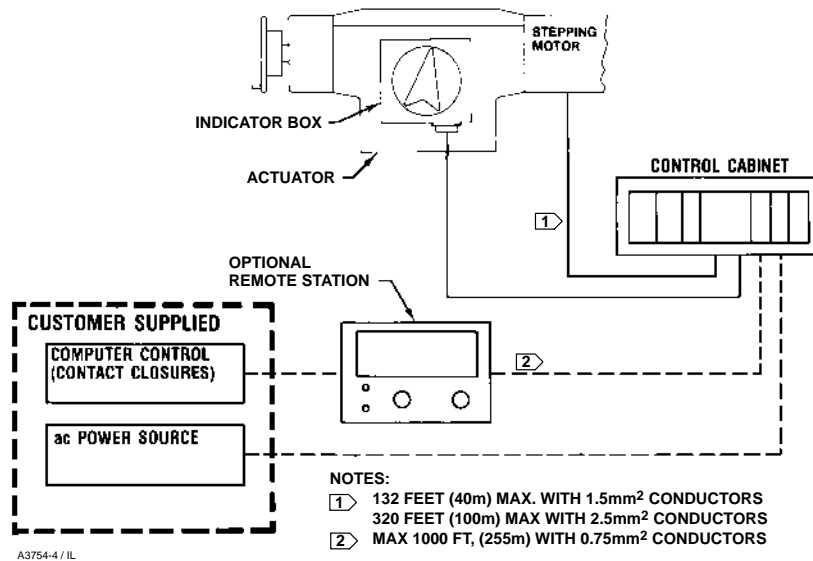


Figure 4. Actuator and Controls

Note

For additional information on use of the manual station when there is no remote station, see the External Control Signal portion of the *Wiring* section.

The Valve Position Indicator is a LED panel meter that displays valve position from 0 to 100 percent. It is mounted in the manual station.

The two additional options for remote position indication are the remote station described below and a customer-supplied, remote indicator that can be connected to the control box. See figure 6 and the Optional Remote Position Indication portion of the *Wiring* section of Installation.

Remote Station (Optional)—This station (figure 6) allows manual control of the actuator and valve from a location up to 1000 feet (305 meters) from the Stepmotor Interface. Maximum allowable distance between the Stepmotor Interface and the remote station depends on wire size. The limit is 1000 feet (305 meters) for a wire size of 0.75 mm² (approximately 18 AWG).

Operation of the remote station overrides operation of the manual station located in the Stepmotor Interface.

When the system is equipped with this remote station and is under computer control, the manual station in the Stepmotor Interface cannot gain control of the system, until you first switch the remote station to MAN (manual).

For manual operation of the valve from the remote station, turn the MAN–COMP knob to MAN (manual). Then, press and release the remote control button. Now you can rotate the DEC–INC knob toward DEC (decrease) to close the valve or toward INC (increase) to open the valve. If you turn the knob all the way to DEC or INC, the knob will remain engaged, and the valve will open or close until a limit switch stops motor operation. If you wish to operate the valve in slow speed from the remote station, press the remote control button and continue to press it while using the DEC–INC knob.

Installation

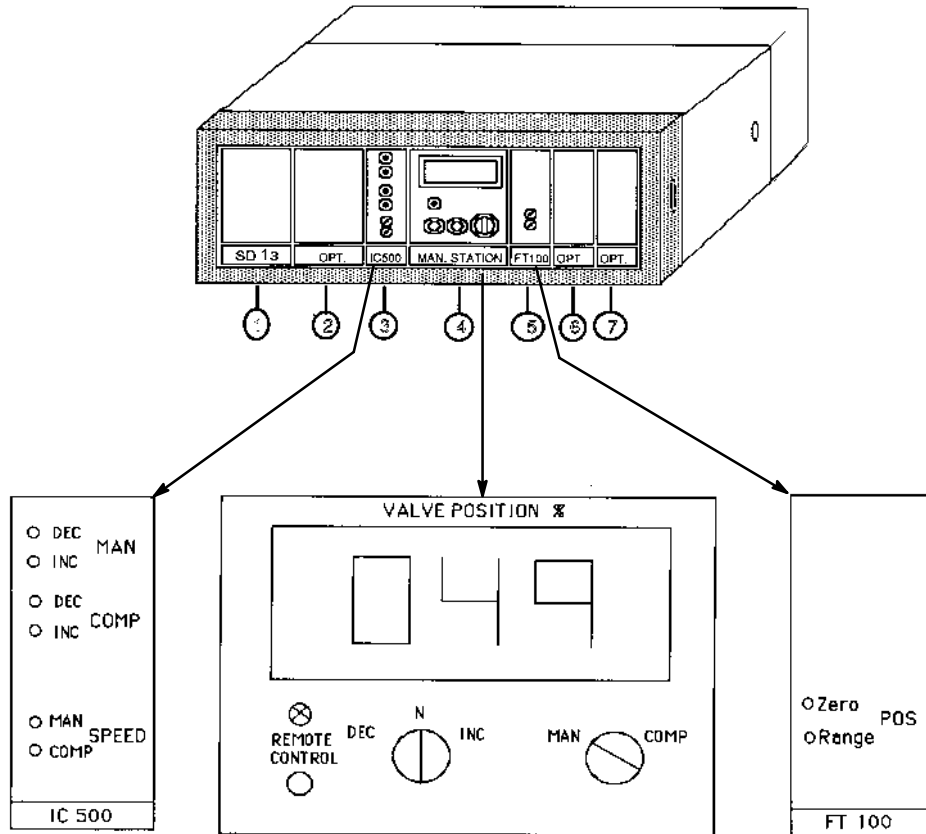
Valve and Actuator

Normally, the actuator is shipped mounted on the valve body. After you have wired the actuator, install the valve in the pipeline by following instructions in the separate valve instruction manual.

It is easier to determine the fully open and closed position of a valve when the valve is out of the pipeline. If possible, check the operation of the actuator limit switches and of the valve position indicator before installing the valve in the line. Refer to the *Adjustment* section to check the operation of the limit switches and indicator.

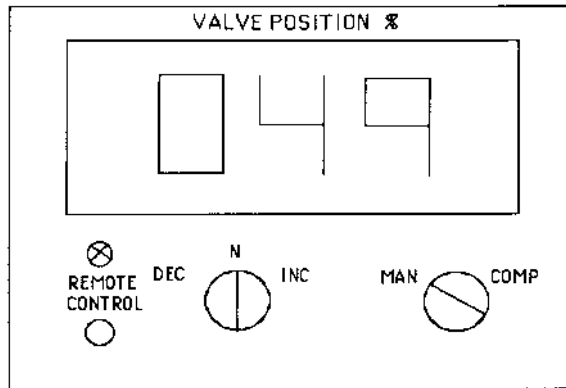
If the actuator and valve have been purchased separately or if the actuator has been removed for maintenance, mount the actuator on the valve by following the Mounting the Actuator instructions in the *Maintenance* section.

Basis Weight Actuator



E0011 / IL

Figure 5. IC2000 Control Cabinet Components



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Figure 6. Remote Station

Required valve shaft rotation is not the same for all valves. Design V150 and V200 valves require clockwise valve shaft rotation to open the valve; valves in the 8500 Series require counterclockwise rotation to open the valve. Before mounting the valve, check to see that the actuator will provide the correct rotation to open and close the valve. If the rotation is not correct, change the rotation direction by changing the switch Settings and jumper locations on the control cards. Refer to the *Settings* section.

Always use the standard mounting position shown in figure 17 and check for proper rotation before installing the actuator on the valve. Other mounting positions might provide incorrect valve rotation.

CAUTION

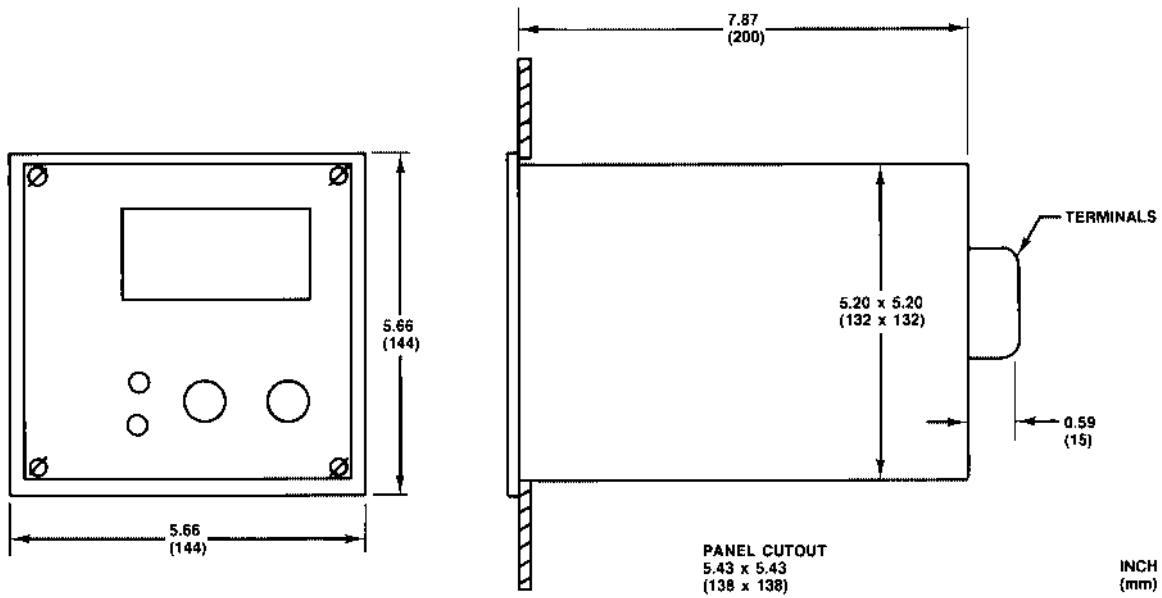
Incorrect valve shaft rotation can damage internal valve parts. To avoid such damage, be certain that the actuator will provide the correct rotation direction for the valve you are using.

Wiring

WARNING

Never make adjustments to the drive current or terminal connections while power is applied. Personal injury or property damage might result.

Basis Weight Actuator



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Figure 7. Remote Station Dimensions

For assistance in wiring, refer first to the overall schematic in figure 8 which includes references to more detailed wiring schematics that show specific sections of the system. Also refer to figure 9 for a schematic of the power transformer connections.

Wire sizes are shown in the schematics in square millimeters (mm²). Approximate equivalents in AWG sizes are:

mm ²	AWG
0.50	20
0.75	18
1.5	16
2.5	12

Schematics for some special inputs (for example, input from a Rolm computer) are not included in this instruction manual. If the schematics in this manual do not appear to cover your equipment, determine the serial number of the unit, and contact your Fisher Controls sales office or sales representative.

Motor, limit switch, and feedback potentiometer wiring is connected to the actuator before the unit is shipped. The limit switch and feedback potentiometer wires are provided with an appropriate connector at the actuator. It is necessary to connect the other ends of these wires to the Stepmotor Interface, as well as the alternating current power and connecting wires from your computer or other controlling device to the Stepmotor Interface.

The Stepmotor Interface has a wire access plate on top and bottom. Connect all wires through one of those plates.

Note

It is necessary to drill holes in one of the wire-access plates and provide connectors for the power supply wires and the control wires from your computer or controlling device.

WARNING

To avoid personal injury from electrical shock, keep hands and tools out of the Stepmotor Interface and away from the terminal connections on the actuator whenever power is applied to the control box or actuator. Always disconnect power before making or checking electrical connections.

Remove the screws and the appropriate wire access plates. Drill the required size holes and install connectors that are appropriate for the installation location. Replace the wire-access plate. Be sure to tighten the connector and access plate securely.

Unlock the cabinet and open it. Then proceed to the following instructions.

Basis Weight Actuator

Motor

Refer to figure 10. Use the wire color codes and terminal numbers as shown in figures 9 and 10 when connecting motor wires to terminal block TB1.

Note

The wire color codes are subject to change per availability of cable. The connections should be verified at both ends.

Limit Switches

Limit switch LS1 and LS2 (figures 11 and 12) interrupt the input commands when the valve reaches the fully open (LS1) and fully closed (LS2) positions. Use the wire color codes and terminal numbers in figures 10, 11 or 12 when connecting the wires to terminal block TB1.

Valve Position Potentiometer

A potentiometer located behind the valve rotation arrow on the actuator is used to operate the FT100 and the digital meter on the manual station (key 4, figure 4). Use the wire color codes and terminal numbers in figure 15 when connecting the wires to terminal block TB1.

Power Supply

Connect an ac power supply of the correct voltage (117, 220, or 240 Vac as specified on your order) to terminal block TB2 (figure 9). The terminal block has different terminal connections for different supply voltages. Fuses F1, F2, and F3 are provided in a bag with the actuator. Determine the correct fuse from figure 9.

1. Locate the correct fuse and install it in the correct terminal.
2. Connect ground to the terminal block.
3. Connect the neutral wire (ACC or ac common) to terminal 4 and then connect the line to the appropriate terminal (1, 2, or 3).
4. Be sure that terminal 7 on terminal block TB2 is connected to ground (GND—yellow—green) on TB2.
5. Provide 24 Vdc power to the remote station.

External Control Signal

Manual Station Input Wiring

4 basic command signals are sent to the IC2000 (3 external and 1 internal) when using the Manual Station module between the user's signals and the IC500 interface module. See table 2.

Note

At power up the Manual Station is in Remote Control mode, but will pass the remote INC/DEC signals to the IC500 MAN (fast) inputs. (This provides a means to drive the MAN (fast) from a Remote Station option.)

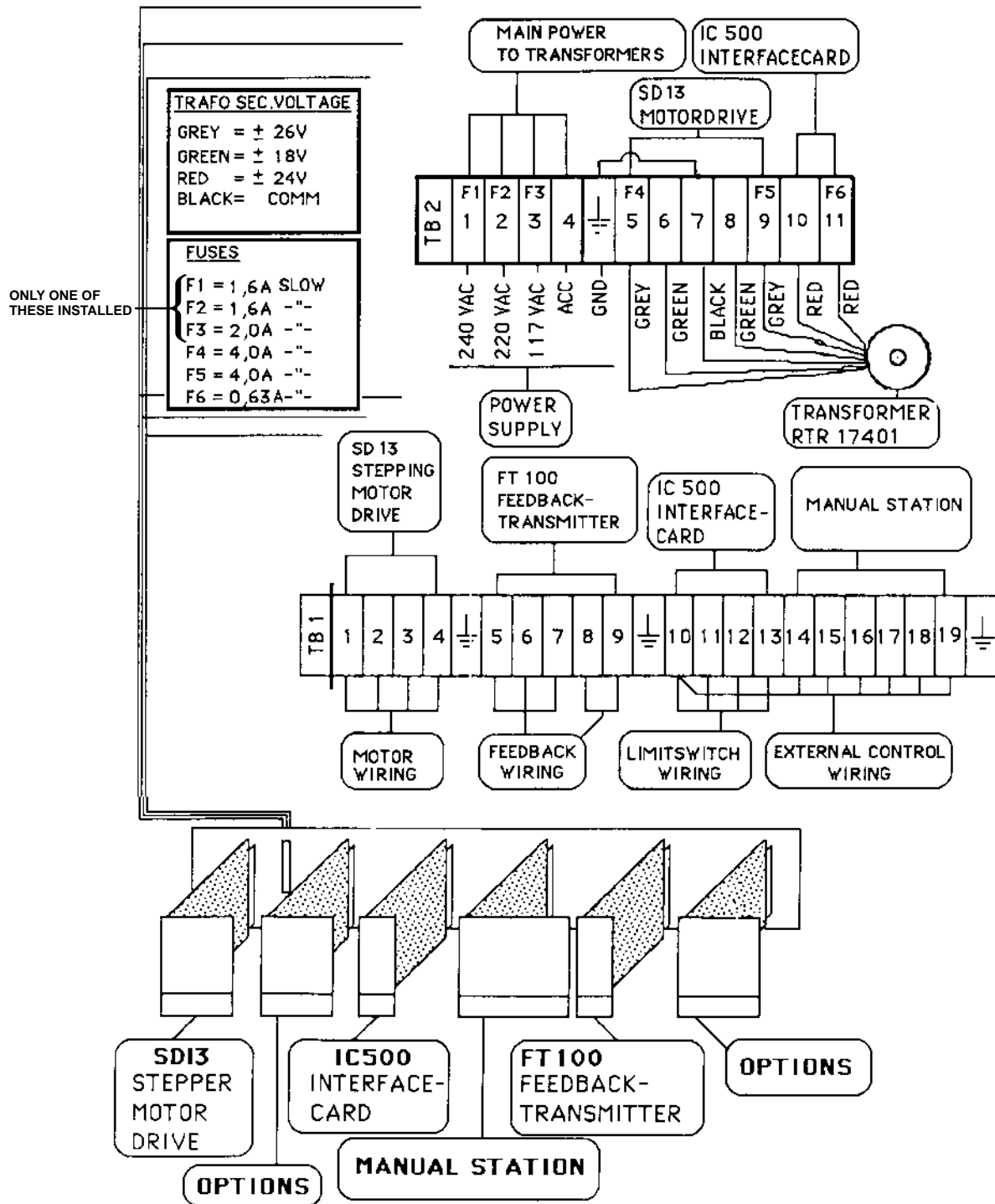
To select the slow preset speed, the COMP/MAN input (TB1–14) must be held low. However, when TB1–14 is low, the remote device always overrides any local attempt to gain control. (The local INC/DEC switch is locked out.) If the Remote Station option is not being used, TB1–14 can be controlled in several ways.

1. Remote Lockout: The COMP/MAN input may be controlled by a third set of relay contacts on the remote device that are configured to close whenever the remote device desires to be in command of the valve. To provide a means of locking out the remote commands while operating the valve from the Manual Station, install a switch at the IC2000 cabinet (e.g. in one of the blank front panels), to open this line to TB1–14. Label this switch "Remote Lockout" at its open position, and open it before pushing the LOCAL request button on the Manual Station front panel. When finished using the Manual Station, set the "Remote Lockout" switch back to the closed position. The next request for control by the remote device will then switch the Manual Station back into remote mode.
2. Local Lockout: The COMP/MAN input may be controlled solely by a switch installed by the user at the IC2000 cabinet. The switch should be wired to connect TB1–14 to TB1–10 when closed. Label it "Local Lockout" at this position. When manual control is desired, open this switch and press the LOCAL request button on the Manual Station front panel. When finished using the Manual Station, set the "Local Lockout" switch back in the closed position, and the Manual Station will immediately revert to remote mode.
3. "Dead Man" Switch: The COMP/MAN input may be controlled by wiring the TB1–14 input to the normally closed contact of the LOCAL request switch on the Manual Station front panel. When the LOCAL request button is released, the Manual Station will always be in remote mode. The user will have to press and hold the LOCAL request button with one hand and operate the Manual Station INC/DEC switch with the other to move the valve from the Manual Station.
4. If you have specified the optional remote station, refer to figure 18 for a wiring schematic.

IC500 Inputs

The IC500 may be driven directly by remote INC/DEC signals, bypassing the Manual Station. However, only the slow input terminals of the IC500 are brought out to the terminal block. Therefore, if local manual control

Basis Weight Actuator



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Figure 8. System Schematic (Contact Closure Input)

Basis Weight Actuator

Table 2. Manual Station Inputs

Manual Station Input	Terminal	Type of Circuit	Assert By	Effect While Asserted
INC	TB1-15	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to open the valve, provided "max. open" limit switch is not tripped.
DEC	TB1-16	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to close the valve, provided "max. closed" limit switch is not tripped.
COMP/MAN	TB1-14	24V relay coil	grounding to TB1-10	Selects remote control of the IC2000 and the slow preset speed. Locks out local requests for manual operation. (When not asserted, the fast preset is selected.)
LOCAL	Normally open, momentary panel switch	24V relay coil	Push and release	Latches the IC2000 in Local Mode and fast preset speed. Can be released only by asserting the COMP/MAN input.

Table 3. IC500 Inputs

Manual Station Input	Terminal	Type of Circuit	Assert By	Effect While Asserted
SLOW/INC	TB1-18	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to open the valve, at the preset slow speed, provided "max. open" limit switch is not tripped.
SLOW/DEC	TB1-19	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to close the valve, at the preset slow speed, provided "max. closed" limit switch is not tripped.
FAST/INC ⁽¹⁾	IC500-14a rack slot K28	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to open the valve, at the preset fast speed, provided "max. open" limit switch is not tripped.
FAST/DEC ⁽¹⁾	IC500-16a rack slot K28	24V opto-isolated	grounding to TB1-10	Commands the actuator to run in the direction to close the valve, at the preset fast speed, provided "max. closed" limit switch is not tripped.

1. Non-field accessible.

is desired at the IC2000 cabinet, the Manual Station or a customer-supplied interface card will be required.

The user is responsible for selecting the COMP (slow) INC/DEC inputs, or the MAN (fast) INC/DEC inputs, and insuring that only one set is used at a time. Asserting more than one of the IC500 inputs simultaneously may have unpredictable results. See table 3.

Input Signal Options

You can use relay contacts or open collector transistor outputs to control the standard IC500 interface module.

To assert the inputs by applying a positive voltage signal from the controlling computer, you can request the "ROLM OPTION" as a special build, and the additional circuitry will be mounted in the IC500 card to accept the positive signals. However, if using the Manual Station, the COMP/MAN signal must still be asserted by pulling it low, since it closes a relay coil circuit.

A special construction is available to accommodate a 4–20 mA position command signal from a user system. This requires an input signal isolator, a positioner

to generate INC/DEC signals by comparing the position command to the valve position feedback, and an

additional terminal block to accommodate the new signal interface. A small reduction in resolution may occur with this system, since some hysteresis must be built in to the comparator to prevent "hunting" behavior. Contact the factory for help with this option.

Optional Remote Position Indication

If you desire, use terminals 8 (positive) and 9 (negative) to supply a 4 to 20 mA dc signal for remote indication of valve position. Other indicators may be connected in series. Total load is 1000 ohm. See figure 18. At these terminals, a 4 to 20 mA dc signal represents 0 to 90 degree valve position.

Completing the Wiring

After completing the wiring, tighten the wire access plate screws and connectors where they connect to the access plate.

Complete the steps in the *Settings* section before proceeding.

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Table 4. SD13 Card Functions

Link	Position	Function	Comments	Default Setting
1	A-B	STANDBY OUT	No standby (braking) current selected	
	B-C	STANDBY IN	50% standby (braking) current selected	*
2	D-E	HALF	Half-stepping mode selected (maximum resolution)	*
	E-F	FULL	Full-stepping mode selected	
3	G-H	ENERGIZE	Motor permanently energized	*
	H-I	DE-ENERGIZE	Motor energized via control signal	

Settings

Before starting the actuator, use the following steps to check to be sure that all switch and jumper selections are correct for the desired action of your system.

1. Unlock and open the cover. Loosen the appropriate captive screws.
2. Unplug the motor drive (key 1, figure 5). Locate the jumpers on the card.

The programming links on the SD13 drive card allow the user to tailor the operating mode to the application. Table 4 describes the usage of the first 3 links in brief.

3. Make sure that the current limit jumpers are properly set. For size 20HT (2.4A), link 4 should be set to short pins L-M; and for sizes 30HT and 40HT(2.7A), link 4 should be set to short pins K-L.
4. Plug the motor drive back into the IC2000.
5. Unplug the IC500 module. On the side of the card are two rows of jumper packages labeled A4 through A7 and A1 through B3. A4 through A7 are set at the factory; do not change these jumpers. The table in figure 16 indicates the correct jumpers that are to be used on IC500 and FT100.
6. Look at the top of each jumper set. You can see a strip of metal where there is a jumper and no metal where there is no jumper. If the jumper location does not match that required by figure 16, pull the jumper assembly out of the card, invert the assembly, and reinsert it in into the card.

For example, for the standard mounting position and standard rotation, there should be a jumper at B1, A2, and A3, and there should be no jumper at A1, B2, and B3.

Note

Jumpers A4, A5, A6, and A7 are set at the factory and are not field selectable.

7. Plug the IC500 module back into the cabinet.
8. Unplug the FT100 module. For the FT100 card, the jumper should be at A for reversed rotation (increasing signal rotates valve shaft counterclockwise) and at B for standard rotation (increasing signal rotates valve shaft clockwise).
9. Plug the FT100 module back into the cabinet. Tighten the captive screws, close and latch the cover.

Start Up

1. Be sure you have completed the *Wiring* section and that you have set all switches and jumpers as described in the *Settings* section.
2. Check to be sure that the correct power supplies and logic signal have been supplied.

WARNING

If the valve is out of the pipeline, keep hands and tools away from the valve when adjusting or stroking the valve. The valve disk or ball opens and closes with a shearing action that can injure hands or damage tools.

3. Remove ac power at the external circuit breaker box before using the handwheel. Use the handwheel to carefully rotate the valve to the fully closed position. Be careful to avoid rotating the valve ball or disk too far into its seat. (If necessary, refer to the valve body instruction manual to determine the fully closed position.):
 - a. As the valve reaches the fully closed position, listen carefully to be sure the limit switch activates when the valve reaches the fully closed position. (The limit switches are located under the indicator cover. You can hear a click as the limit switch is activated.) If adjustment is required, refer to the *Adjustment* section.
 - b. Repeat the process to check the limit switch at the fully open position.

Note

Check the limit switch when you release, or close, it. If the mounting screws are

Basis Weight Actuator

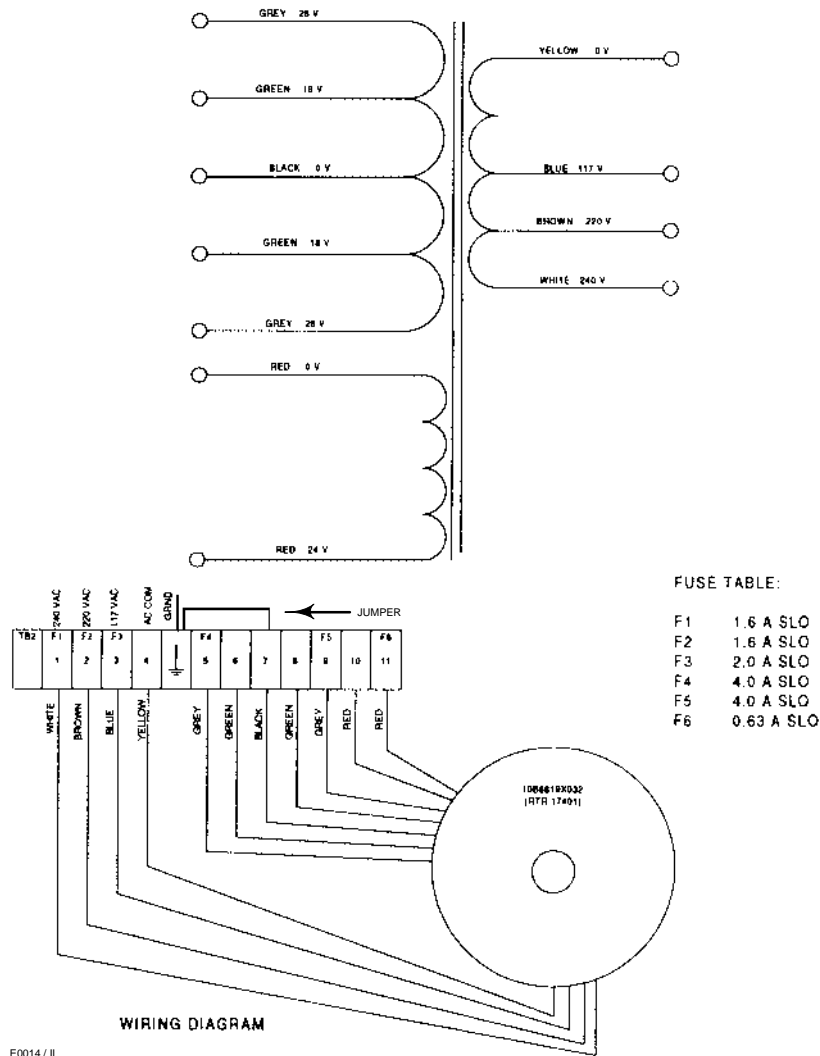


Figure 9. Transformer Schematic

over-tightened, the switch action may not allow the switch to close after it has been tripped.

4. Turn on power to the Stepmotor Interface.
5. Check to be sure the valve rotation indicator in the Stepmotor Interface and in the optional remote station show zero percent for 0 degrees of valve rotation (fully closed) and 100 percent for 90 degrees of valve rotation (fully open). Refer to the Adjustment section for adjustment instructions.
6. Adjust the stroking speed with the adjustments on the IC500 card faceplate (key 3, figure 4). Clockwise rotation of the adjustment increases the speed. If the

speed increases too much, the the torque will drop off and cause the motor to stall.

With no pressure applied to the valve, apply a signal to operate the valve in both directions (opening and closing) and in both the manual (MAN) and computer (COMP) operating modes. As the valve ball or disk is rotating, adjust speed until the motor operates smoothly and as quietly as possible. If the valve moves with a jerky motion, continue to adjust the speed. Refer to the *Stroking Speed* section for more information.

After the valve is in service, you can adjust the speed again. If it appears that motor torque is too low, decrease stroking speed.

Basis Weight Actuator

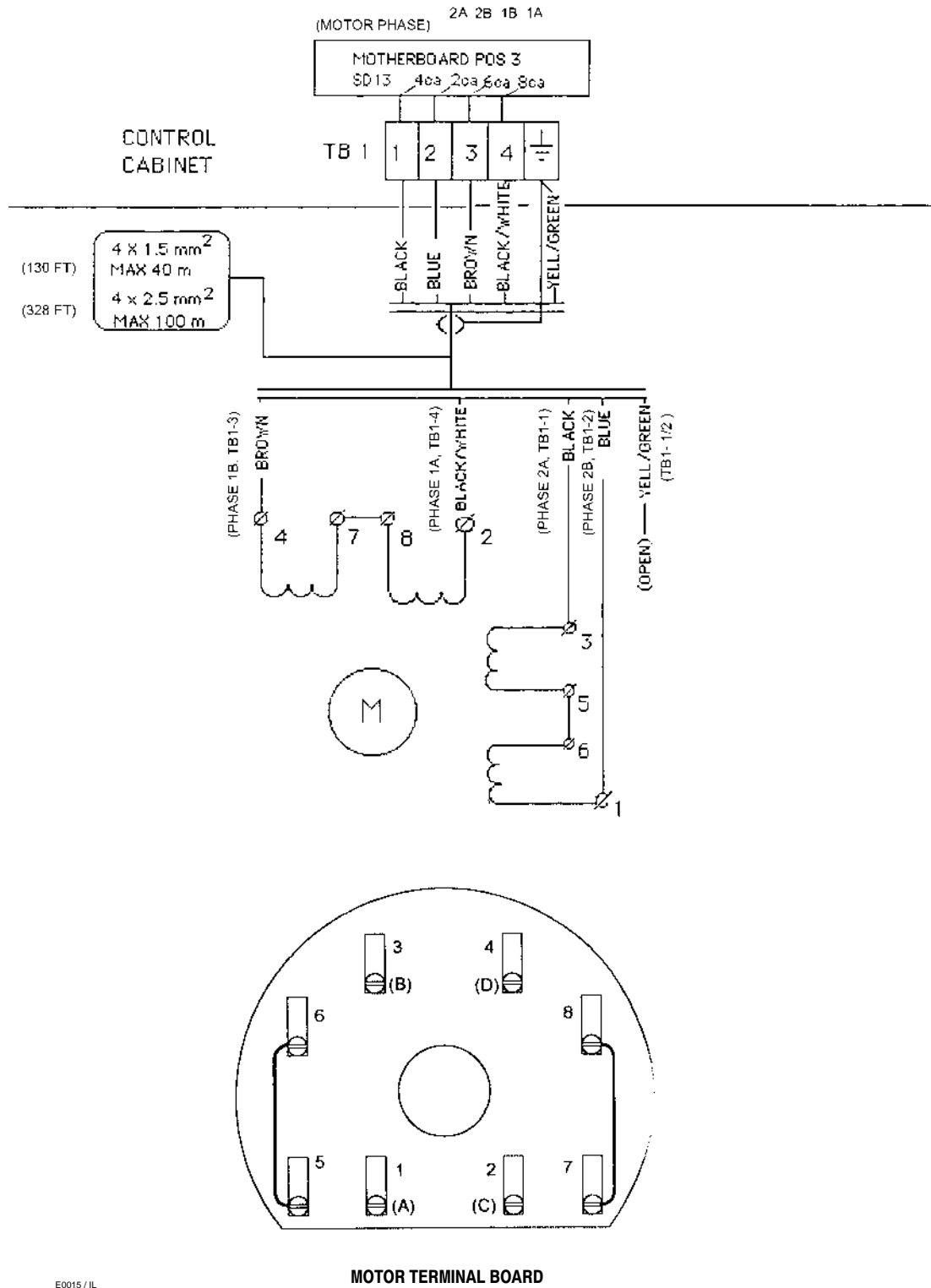
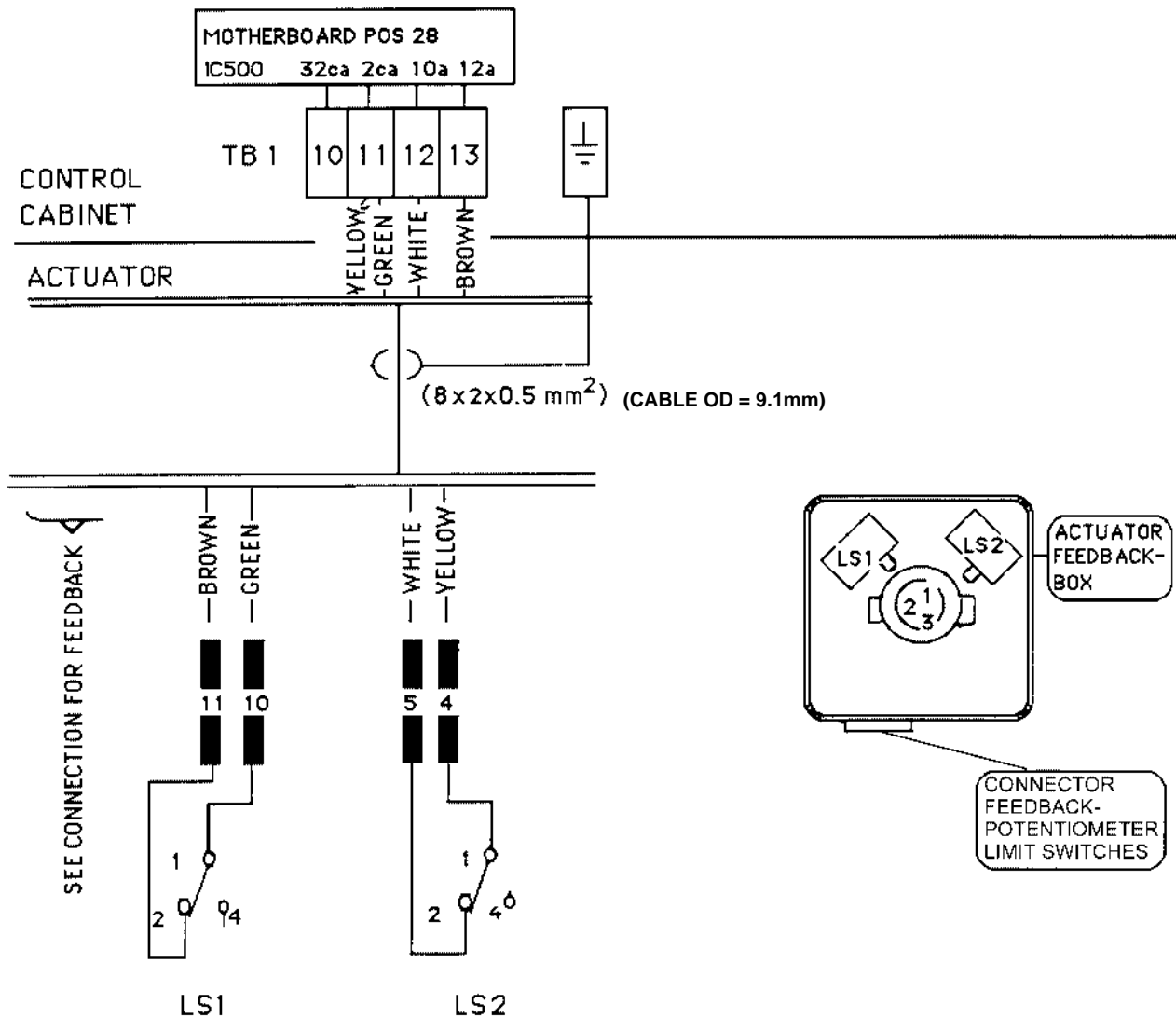


Figure 10. Motor Connection Schematic

Basis Weight Actuator



NOTE:
LS1 & LS2 OPEN THE COMMAND CIRCUITS TO STOP THE ACTUATOR AT THE LIMIT CONDITIONS.

E0016 / IL

Figure 11. Limit Switch Connection Schematic, 2 Limit Switches (Standard)

Adjustment

Limit Switches

The Basis Weight Assembly is standardly shipped with 2 limit switches. 4 limit switches can be wired by the customer.

1. Mark the position of the actuator travel indicator cover (figure 2) so that you can return it to the same position after adjustment. Loosen the screws and remove the actuator position indicator.

2. Use the handwheel to position the actuator to 0 degrees rotation (fully closed). If necessary, refer to the valve body instruction manual to determine the fully closed position.

3. Loosen (slightly) the two screws on the limit switch for 0 degrees rotation (LS2). Move the switch until you can hear a click, which indicates that the switch has been actuated.

4. Tighten the limit switch screws.

Note

Check the limit switch when you release, or close, it. If the mounting screws are

Basis Weight Actuator

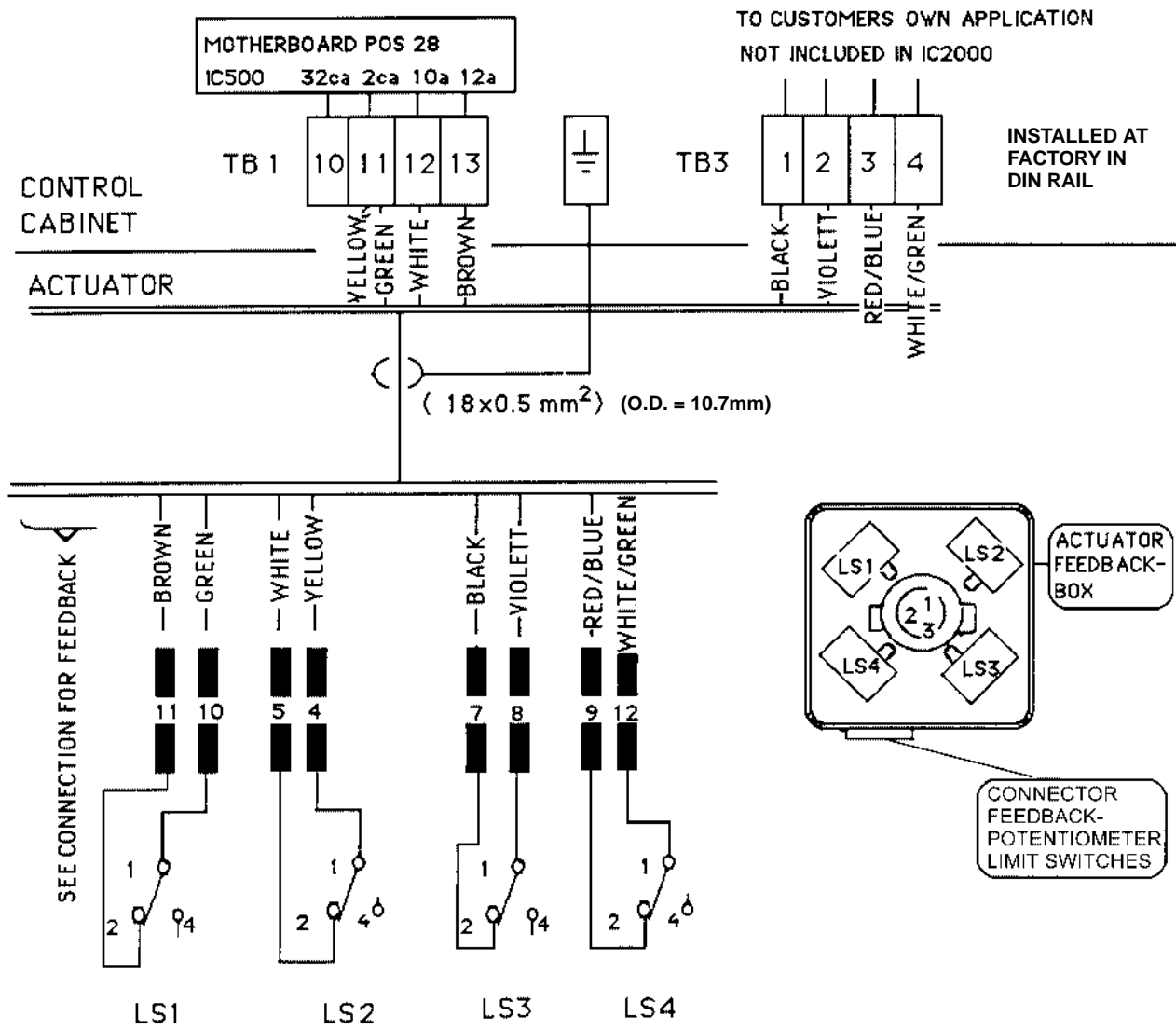


Figure 12. Limit Switch Connection Schematic, 4 Limit Switches (Optional)

over-tightened, the switch action may not allow the switch to close after it has been tripped.

IC500 card (key 3, figure 4). If it appears that motor torque is too low, decrease stroking speed.

5. Use the handwheel to position the actuator to 90 degrees rotation (fully open).
6. Repeat steps 3 and 4 for the limit switch for 90 degrees rotation (LS1).
7. Replace the travel indicator cover and screws.

Note

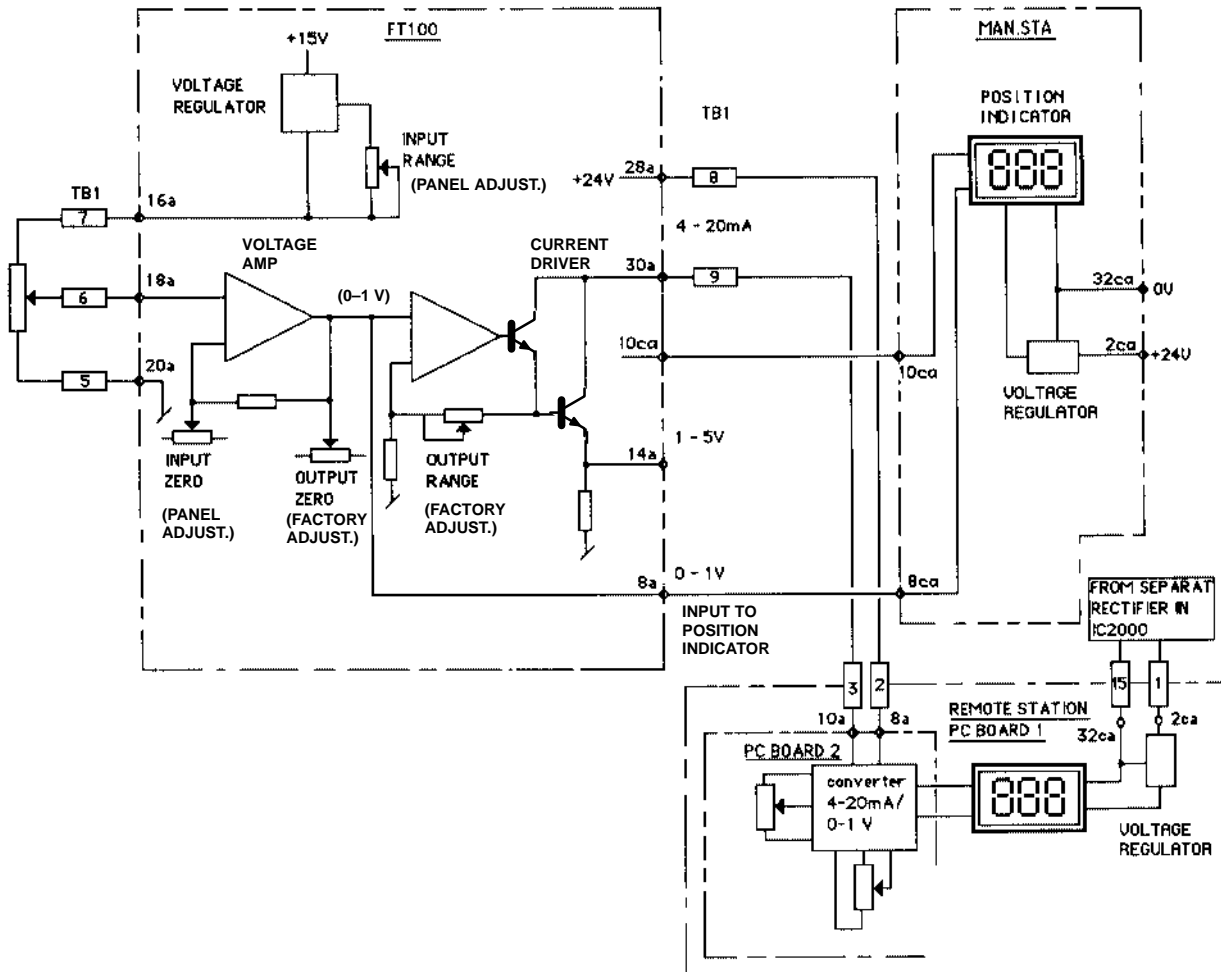
In this manual, the default half-step increment is referred to as a step.

Stroking Speed

Stroking speed adjustments for the manual (MAN) and automatic (COMP) modes are on the faceplate of the

The two trim potentiometers (screwdriver adjustments) on the front panel of the IC2000 are for setting each of the selectable preset speeds. The slowest speed is approx. 600 steps/second in Manual mode and approx. 5 steps/second in Computer mode; this speed is governed by trim potentiometer resistance. The Fastest speed is about 20 seconds for full stroke in

Basis Weight Actuator



E0019 / IL

Figure 13. Valve Position Indicator Block Diagram

both modes, and is governed by the torque dropping off enough that the motor stalls.

The stroking time is controlled by the frequency of the internal oscillator. The oscillator triggers the stepper motor drive card to provide properly phased currents to the various windings of the stepper motor. The sequence of energization of the windings is designed to move the rotor one motor step per oscillator pulse. In this stepping mode, 400 positions are available per motor revolution. The gear ratio of the specific actuator then determines how many motor revolutions are required to produce 90 degrees of output shaft rotation, providing the multiplier to determine the resolution of the valve travel.

The shortest contact closure to which the IC2000/SKF will respond depends on the setting of the computer mode speed potentiometer and the time skew between the user's gating signal and the IC2000's internal oscillator.

The output of the oscillator is an asymmetric pulse signal which is low for about 25 microseconds of the period. The stepper motor is guaranteed to move one step if the signal to the driver card has been low for at least 10 microseconds prior to going high again. However, there is no way to synchronize the DCS contact closures with the internal oscillator. So, the external contacts must be held closed for 10 microseconds longer than the period of the oscillator to guarantee at least one step movement of the motor. On occasion, this length of contact closure will result in 2 steps movement (specifically when the contact closure happens to occur simultaneously with the beginning of the oscillator low phase).

Therefore, if you had an oscillator set up for 10.1 steps per second (99msec/step) and sent an Increment command that lasted 200 milliseconds, you would move the valve 2 steps in the open direction.

Basis Weight Actuator

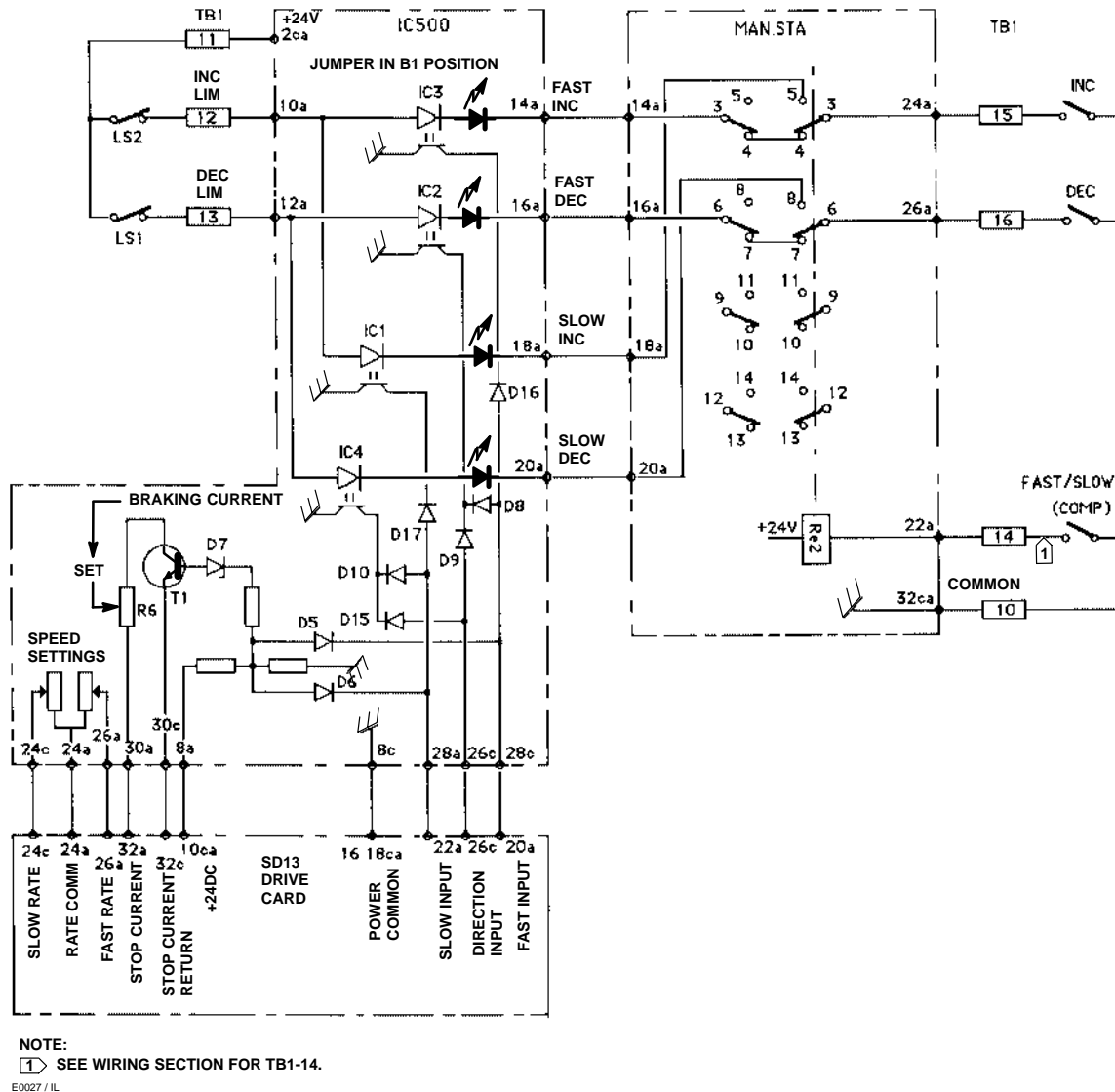


Figure 14. Overall Connection Schematic for IC500/Manual Station/SD13

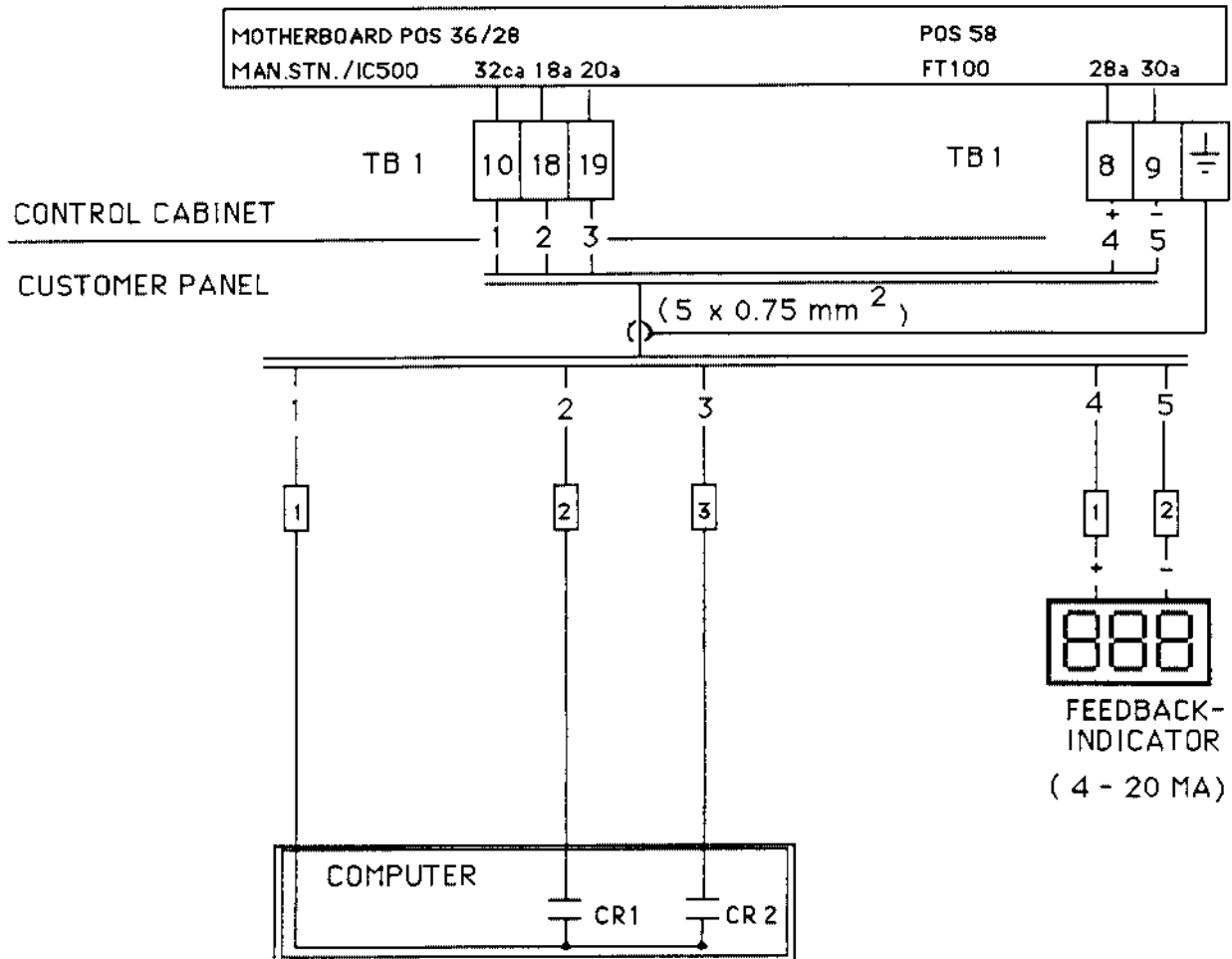
Valve Position Indicator

The indicator is located on the manual station (key 4, figure 4), and it shows 0 to 100 percent of valve travel as the valve travels from 0 to 90 degrees rotation. Another indicator is located on the optional remote station (figure 5).

To adjust the indicator (key 4, figure 4), proceed as follows:

1. Position the valve at 0 degrees rotation (fully closed).
2. The meter should now show zero percent. If it does not show zero, rotate the zero screw on the FT100 station faceplate.
3. Position the valve at 90 degrees rotation (fully open).
4. The meter should now show 100 percent. If it does not show 100 percent, rotate the span screw.

Basis Weight Actuator



WITH THIS CONNECTION TO COMPUTER THE ACTUATOR CAN ONLY RUN WITH SLOW SPEED.
 CR1=INCREASE
 CR2=DECREASE
 NOTE:
 IF THE MANUAL STATION IS INSTALLED, CONTROL CONFLICTS MAY OCCUR, SEE WIRING SECTION.
 E0021 / IL

Figure 15. Control Connection Schematic without Remote Station and without Manual Station

5. Check the meter again at 0 degrees rotation to be sure zero has not changed.

Maintenance

WARNING

Avoid personal injury from sudden release of process pressure. Before performing any maintenance operations:

- Shut off any line providing, electrical power or a control signal to the actuator and Stepmotor Interface. Be sure the actuator cannot suddenly open the valve.

- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve. Drain the process media from both sides of the valve.

- Keep power off when working in the Stepmotor Interface.

A brief troubleshooting guide is provided below. Following the troubleshooting guide are maintenance procedures that can be completed in the field. For other maintenance, return the actuator to Fisher Controls.

Due to the care Fisher Controls takes in meeting all manufacturing requirements (heat treating, dimensional tolerances, etc.), use only replacement parts supplied by Fisher Controls.

Basis Weight Actuator

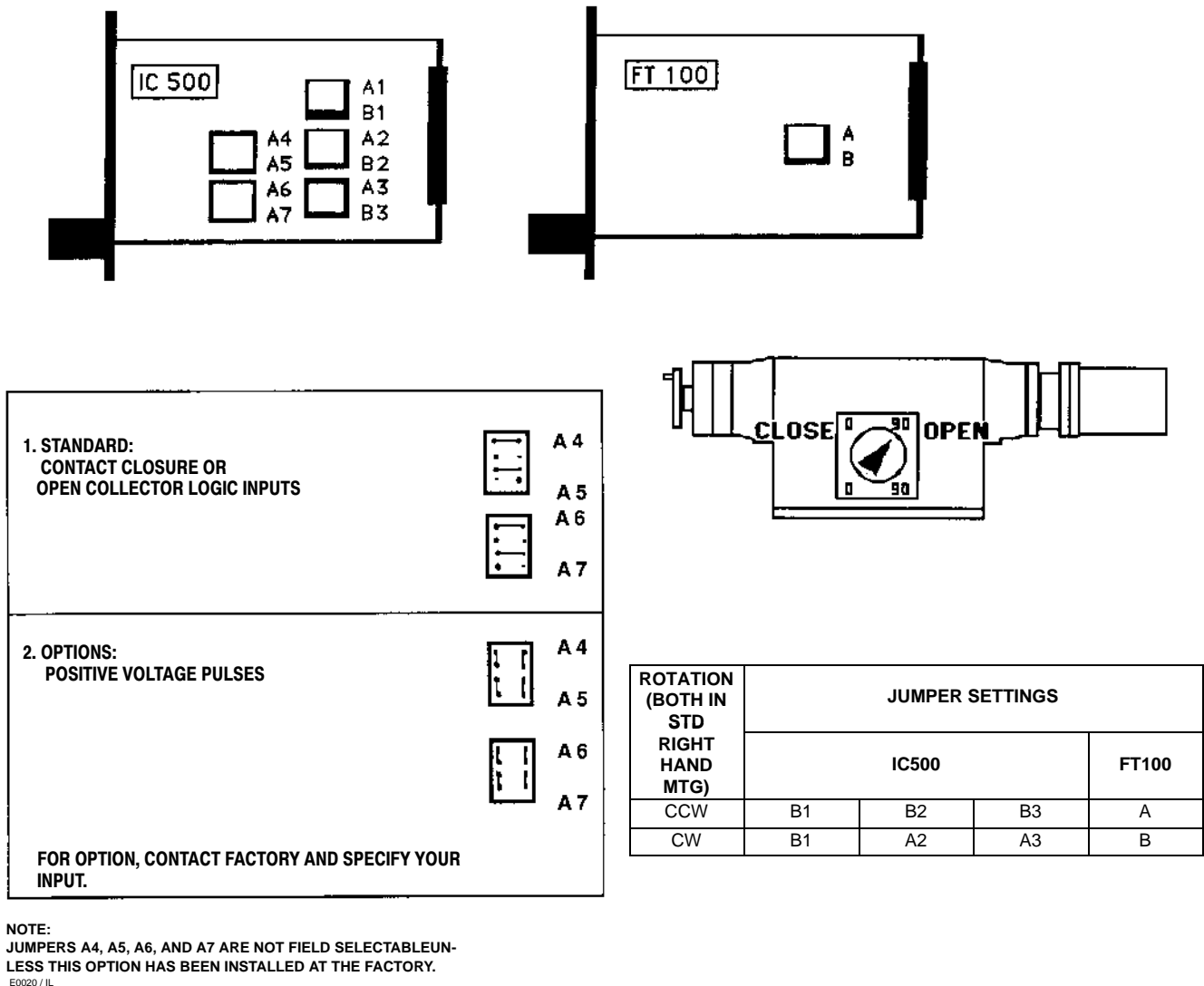


Figure 16. Jumper Configurations

Troubleshooting

Table 5 describes how each card within the IC2000 is connected to the other cards. Each card has two columns of pins labeled 2a, 4a, and up to 32a (also 2c, 4c, and up to 32c). The table indicates that 2ca is 24 V and 32ca is ground, which is connected with power common terminal 10 on terminal block TB1. See the *Wiring* section for more information on the correct connections.

If the actuator will not operate,

1. Check to be sure that the power of the correct voltage is reaching the terminal block in the Stepmotor Interface. Also check to be sure that the power supply is connected to the appropriate terminal.

2. Check the fuses on terminal block TB2 and check fuses FS1 and FS2 on the SD13 card. Replace fuses if necessary.

3. Check the LEDs (light-emitting diodes) on interface card IC500 light when a signal is applied to the control box. The LEDs should turn on in response to an applied signal. If the LEDs do not turn on, no signal is reaching the card. The limit switch may be open and needing adjustment, the limit switches may be connected incorrectly on TB1, or jumpers A1–A3 and B1–B3 may be in the wrong position. See figure 13.

4. Check to see if power is reaching the actuator. If power is reaching the actuator, the handwheel will be difficult to turn. If power is not reaching the actuator, the handwheel will be easy to turn.

Basis Weight Actuator

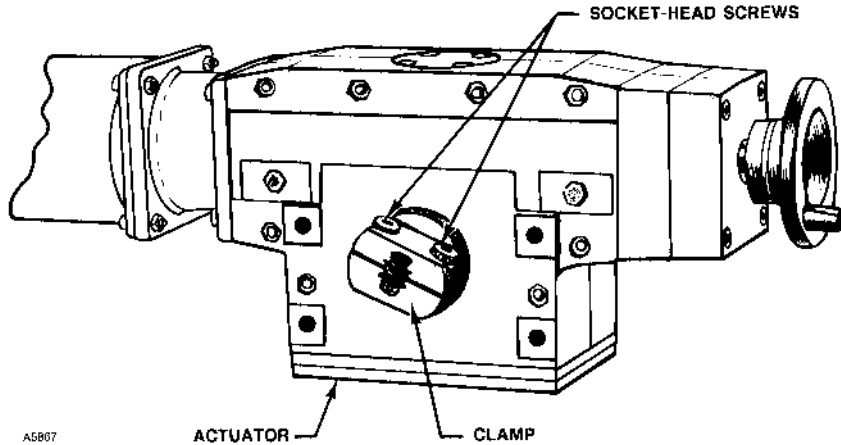


Figure 17. Actuator/Valve Connection

Test Procedures

Required equipment for these procedures are an extender card (see the parts list) and volt-ohm-millimeter or similar voltage-measuring device.

Checking the SD13 Card

1. Remove the SD13 module (refer to the *Replacing Modules* section).
2. Install the extender card in place of the SD13 module. Plug the SD13 module into the extender card.
3. Install fuses. Use table 5 and the *Driver Card* section.
4. Be sure that terminal 7 on terminal block TB2 is connected to ground (GND—yellow-green) on TB2.
5. Check the ac voltages on the SD13 card. There should be approximately 8 Vac between 12a and 12c and approximately 8 Vac between 14a and 14c.
6. Also check the following voltages:

Voltage Between	Should Be
16a and 12a	18 Vac
16a and 14a	18 Vac
16a and 12c	26 Vac
16a and 14c	26 Vac

Note

Contact your Fisher Controls sales office or sales representative if the measured voltages are not approximately the values shown in steps 5 and 6.

7. Remove all power. Remove the extender card and SD13 card. Re-install the SD13 module and correct fuses.

Checking the IC500 Card

1. Remove the IC500 module (refer to the *Replacing Modules* section).
2. Install the extender card in place of the IC500 module. Plug the IC500 module into the extender card.
3. Check the dc voltage between 8c (PCOM) and 30a (Ref.) at 2.7 A current limiting. (Be sure DIP switch 4 on the SD13 card is “on.” See the *Settings* section.)
4. Voltage between 8c and 30a should be 0.75 Vdc with the motor not running and 1.50 Vdc with the motor running.
5. Contact your Fisher Controls sales office or sales representative if the measured voltages are not approximately the values shown above.
6. Remove all power. Remove the extender card and IC500 card. Re-install IC500 module.

Valve Maintenance

Refer to the appropriate valve body instruction manual for information on valve maintenance. If it is necessary to remove the actuator from the valve, refer to the *Removing the Actuator* instructions below.

Removing the Actuator

1. Remove alternating current power at the external circuit breaker box. If necessary, disconnect conduit connections and disconnect wiring from the actuator. Then, proceed as follows.
2. Due to the need to determine the closed position of the valve before re-connecting the actuator and valve, remove the valve and attached actuator from the pipeline.

Basis Weight Actuator

WARNING

The valve ball or disk closes and opens with a shearing, cutting motion. Avoid personal injury from this motion by keeping hands, tools, and other objects away from the valve ball or disk.

3. Loosen the socket-head screws in the valve shaft clamp (see figure 17). The valve shaft clamp is located on the actuator where the valve shaft is connected to the actuator.
4. Remove the cap screws that attach the valve body to the actuator mounting yoke. If it is desired to remove the yoke from the actuator, remove the cap screws and nuts that attach the mounting yoke to the actuator.

Mounting the Actuator on the Valve

1. When maintenance is complete, attach the mounting yoke to the actuator if it was removed.
2. Refer to the valve body instruction manual for instructions on determining the fully closed position. Fully close the valve and keep it in that position until this procedure is complete.

CAUTION

Incorrect valve shaft rotation can damage internal valve parts. To avoid such damage, be certain that the actuator will provide the correct rotation direction for the valve you are using.

Required valve shaft rotation is not the same for all valves. Design V150 valves require clockwise valve shaft rotation to open the valve. Before mounting the valve, check to see that the actuator will provide the correct rotation to open and close the valve. If the rotation is not correct, change the rotation direction by changing the switch settings and jumper locations on the control cards. Refer to the *Settings* section.

Always use the standard mounting position shown in figure 17 and check for proper rotation before installing the actuator on the valve. Other mounting positions might provide incorrect valve rotation.

3. Use the actuator handwheel to rotate the actuator mechanism to the closed end of its travel (to the position it is to be in when the valve is fully closed).
4. While guiding the valve shaft clamp over the valve shaft, place the actuator and mounting yoke on the valve.

5. Check to be sure that the valve is still fully closed. Then, tighten the socket head cap screws in the valve shaft clamp. If the valve ball or disk has moved from the fully closed position, remove the actuator from the valve, fully close the valve and repeat steps 4 and 5.
6. Attach the mounting yoke to the valve with cap screws.

Replacing Fuses

1. Remove alternating current power at the external circuit breaker box.
2. Unlock and open the Stepmotor Interface.
3. Locate fuses. Fuses are in terminal block TB2 and on the SD13 card.
4. Test the fuses and replace them if needed.

Replacing the Actuator Motor

1. Remove alternating current power at the external circuit breaker box.
2. Remove the cover plate from the motor. The cable was sealed to the motor with silicone rubber at the factory. Remove the seal. Note the wire-terminal connections so you can re-wire the new motor correctly. Disconnect and remove the wires from the motor.
3. Unscrew the four screws and nuts that attach the motor to the actuator (figure 2). Remove the motor by separating the two halves of the zero backlash coupler. Inspect the elastomer spider in the coupler; replace it if worn or damaged. Keep the coupler as you may need to use it again during re-assembly.
4. Install the new motor. Make sure the coupling engages both the actuator and the motor output shaft. Secure the motor with the four screws and nuts.
5. Connect the motor wires to the correct terminals as you noted in step 2. Re-seal the cable to the motor or provide another suitable cable connector.

Replacing Modules

1. Remove alternating current power at the external circuit breaker box.
2. Unlock and open the cover of the Stepmotor Interface.
3. Unlock and open the Stepmotor Interface.
4. Loosen the four captive screws that secure the module you wish to replace. Pull the module out of the cabinet.
5. If you are replacing the IC500 or FT100 card, make the appropriate switch and jumper settings on the replacement card. Refer to the *Settings* section.

Replacing the Transformer

1. If it is necessary to replace the transformer, remove alternating current power at the external circuit breaker box. Unlock and open the cabinet.

Basis Weight Actuator

- Record the location of the wire connections on the terminal block. Remove the transformer wires from the terminal block.
- Unscrew the mounting screw from the center of the transformer and remove the transformer from the back of the cabinet.
- Be sure to remove insulation from the ends of the transformer wires.
- Attach the new transformer and connect the transformer wires to the terminal block (see figure 9). Make sure the jumper between TB2-7 and TB2-Ground is installed.
- Close the cabinet, turn on power, and check operation of the system before returning it to service.

Field Installation of the Remote Station

Follow these steps to install a Remote Station to an already existing IC2000 unit. See figure 18.

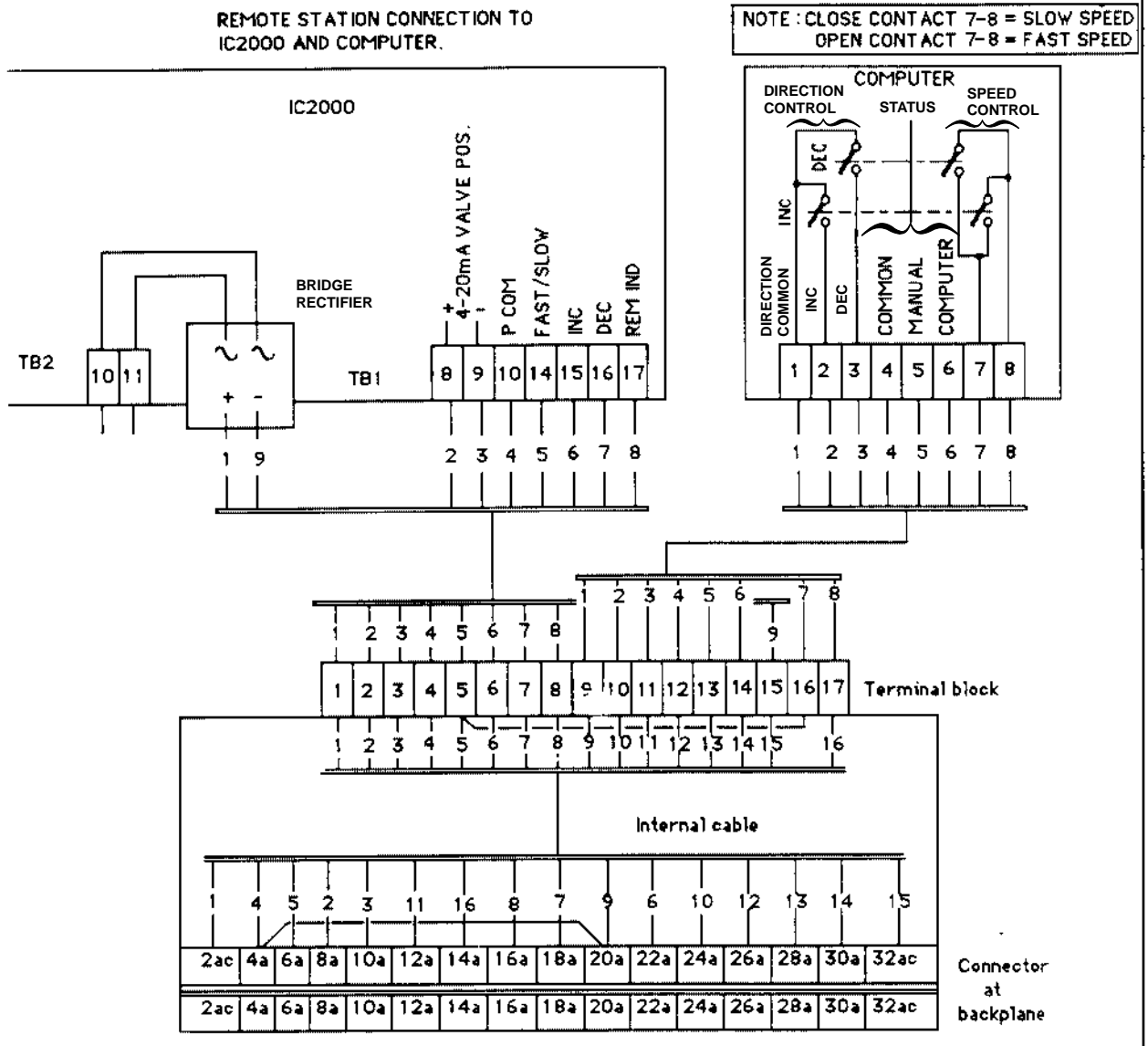
- The IC2000 has no 24Vdc for external units, but a power outlet is included. So, a Rectifier Bridge is included with the Remote Station.
- Drill a 4.2 mm (0.165 inch) hole to the left of TB1. Make a thread of 5mm and mount the Rectifier Bridge, see figure 18.
- Connect AC power input to the Rectifier from terminals 10 and 11 on TB2. Be sure to connect on the upper side of the terminal after the terminal fuse.
- Install the Remote Station. Install a junction box close to the Remote Station.
- Install a multi-wire cable with a screen, having at least 9 wires between the IC2000 and the junction box. Connect the wires as shown in figure 18.
- Connect wires 1 and 9 without terminals directly to the Rectifier. Use the end connectors provided.
- Install a multi-wire cable with a screen between the computer and the junction box (see figure 18). If the status information is fed to the computer, the cable must have at least 6 wires. Otherwise, 3 are needed.

Parts List

A Fisher Controls serial number is assigned to each basis weight control system. This serial number can be found on a nameplate attached to the actuator mounting yoke. Refer to this serial number whenever corresponding with your Fisher Controls sales office or sales representative about this equipment. When ordering replacement parts, also include the part number from the *Parts List* section.

Description	Part Number
IC2000 Control Cabinet	12B0720X012
IC500 Module	12B0723X012
FT100 module	12B0726X012
SD13 Card	12B0721X022
Limit Switch	11B9830X012
Transformer RTR 17401	10B6819X032
14 Pin female connector	11B9828X012
14 Pin male connector	11B9829X012
Terminal Block TB3	17B5977X012
Terminal Block TB4	17B5977X022
Remote Station	12B0725X012
Manual Station Module	12B0724X012
Extender Card	12B9361X012
Motor	
Size 20HT	10B6807X032
Size 30HT & 40HT	10B6807X042
Handwheel	
Size 20HT	13B7129X032
Size 30HT	13B7129X022
Size 40HT	13B7129X012
Housing Kit for Motor Coupling	
Size 20HT	13B7129X062
Size 30HT	13B7129X052
Size 40HT	13B7129X042
Valve Position Indicator Assembly	
2 Limit Switch	13B7130X012
4 Limit Switch	13B7130X022
Elastomer Spider for Motor Coupling	
Size 20HT	17B7755X012
Size 30HT & 40HT	17B7755X022

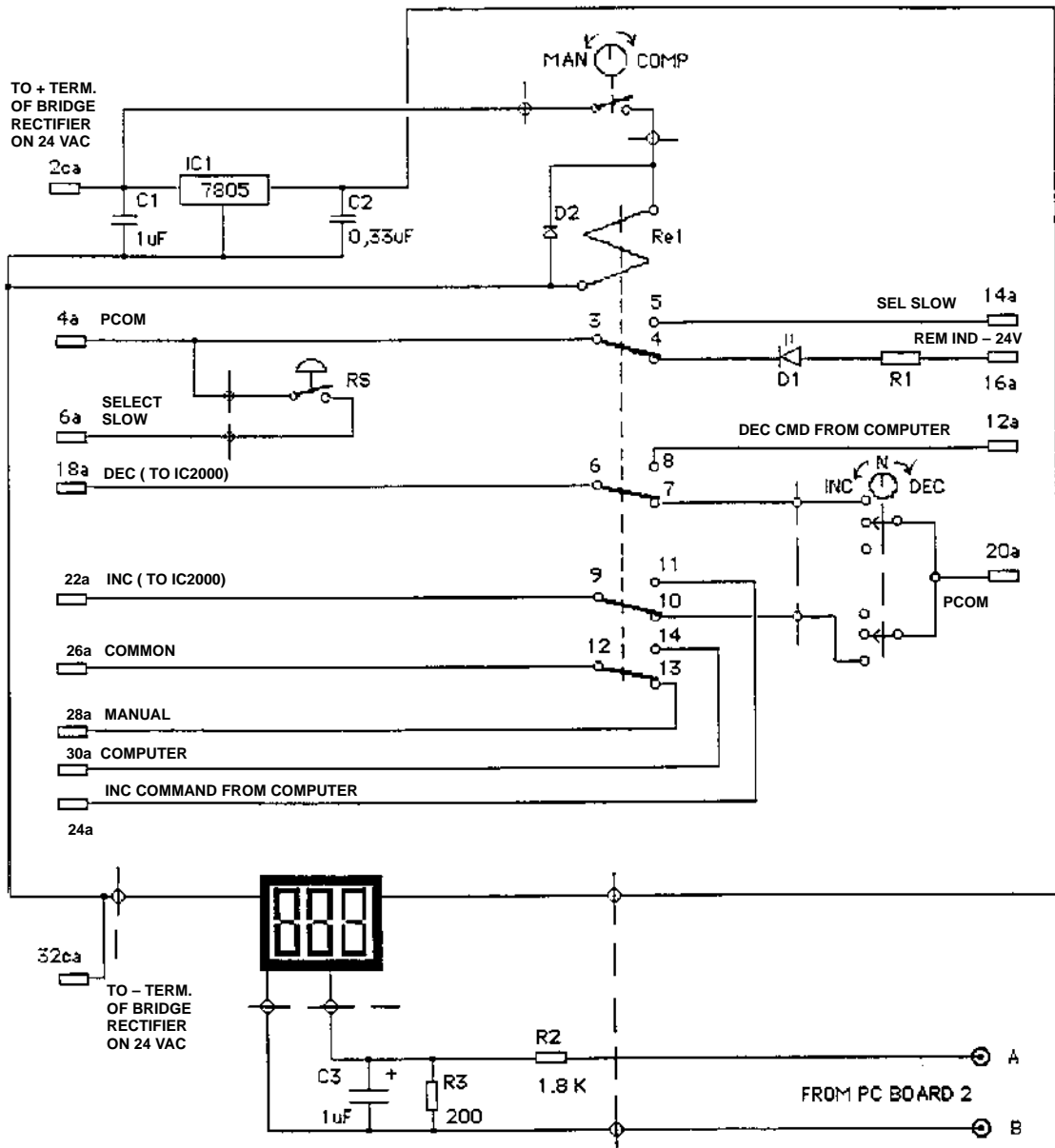
Basis Weight Actuator



E0023 / IL

Figure 18. Control Connection Schematic with Remote Station

Basis Weight Actuator



E0024 / IL

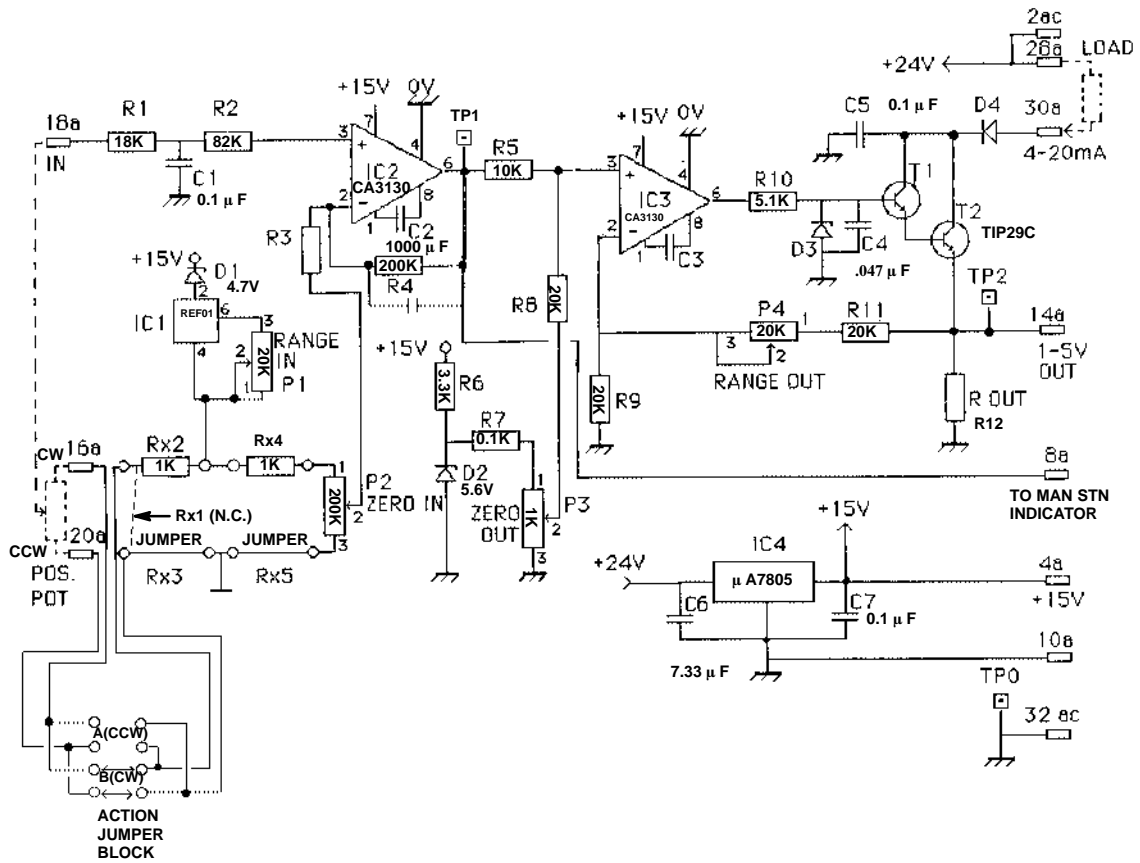
Figure 18. Control Connection Schematic with Remote Station Cont'd (Card 1 Schematic)

Basis Weight Actuator

Table 5. Control Cabinet Connection Table

FT100 Rack K58	MAN Rack K36	IC500 Rack K28	SD13 Rack K3	DESIGNATION	TERMINAL
Edge Connector Pins					
2ca	2ca	2ca		+24 VDC BUS	TB1/11
			2ca	MOTOR PHASE 2A	TB1/2
			4ca	MOTOR PHASE 2B	TB1/1
4a				+15 VDC BUS	
		4ca		TRANSFORMER 24 VAC TO IC500	TB2/11
		6ca		TRANSFORMER 24 VAC TO IC500 RET	TB2/10
			6ca	MOTOR PHASE 1B	TB1/1
			8ca	MOTOR PHASE 1A	TB1/1
8a	8ca			POSITION SIGNAL TO MAN STN	FT100/TP1
		8a	10ca	+ 24 VDC FROM SD13 TO IC500	TB1/3
10a	10ca			0-1V, 1-5V POSITION SIGNAL RET	
		10a		LIM SW CW (LS2)	TB1/12
			12a	TRANSFORMER SEC 18 VAC	TB2/6
			12c	TRANSFORMER SEC 26 VAC	TB2/5
		12a		LIM SW CCW (LS1)	TB1/13
14a				1-5V POSITION SIGNAL (local)	
			14a	TRANSFORMER SEC 18 VAC (1)	TB2/8
			14c	TRANSFORMER SEC 26 VAC (1)	TB2/9
	14a	14a		FAST INC MAN TO IC500	
		8c	16,18ca	TRANSFORMER SEC 18, 26 VAC CT	TB2/7
16a				FB POT CW	TB1/7
	16a	16a		FAST DEC MAN TO IC500	
18a				FB POT WIPER	TB1/6
	18a	18a		SLOW INC COMP TO IC500	TB1/18
20a				FB POT CCW	TB1/5
	20a	20a		SLOW DEC COMP TO IC500	TB1/19
		28c	20a	FAST CMD INPUT TO SD13	
		28a	22a	SLOW CMD INPUT TO SD13	
	22a			SLOW SPEED CMD TO MAN STN	TB1/14
	24a			INC CMD INPUT TO MAN STN	TB1/15
		24a	24a	RATE ADJ COMMON TO SD13	
		24c	24c	SLOW RATE ADJ TO SD13	
	26a			DEC CMD INPUT TO MAN STN	TB1/16
		26a	26a	FAST RATE ADJ TO SD13	
		26c	26c	DIR CMD INPUT TO SD13	
28a				4-20mA POSITION OUTPUT +	TB1/8
	28a			REM MODE INDICATOR	TB1/17
30a				4-20mA POSITION OUTPUT -	TB1/9
		30a	30a	STBY CURRENT SET SIGNAL TO SD13	
		30c	32c	STBY CURRENT SET RET TO SD13	
32ca	32ca	32ca		POWER COMMON	TB1/10, FT100/TP0

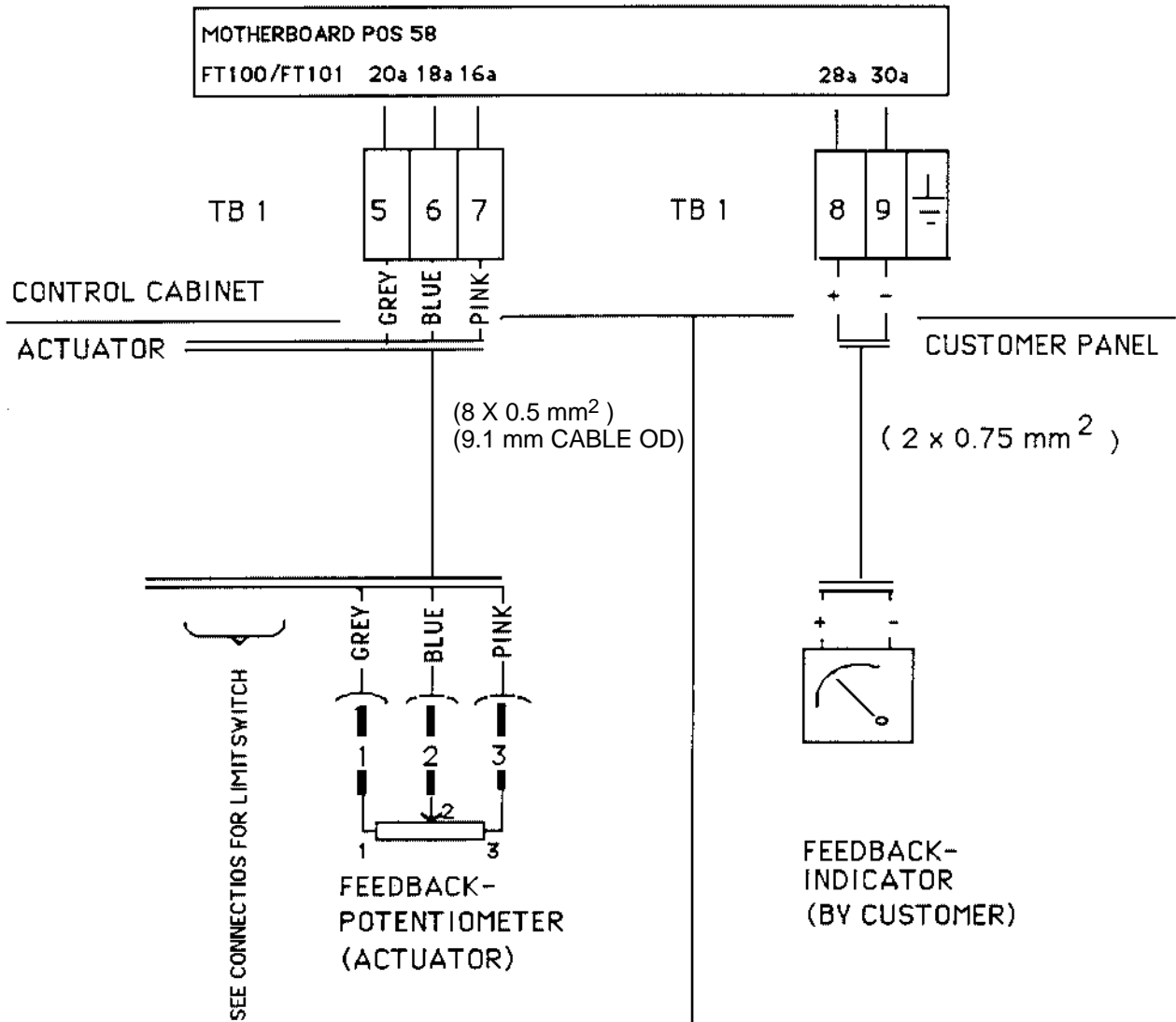
Basis Weight Actuator



E0025 / IL

Figure 19. Feedback Transmitter Schematic

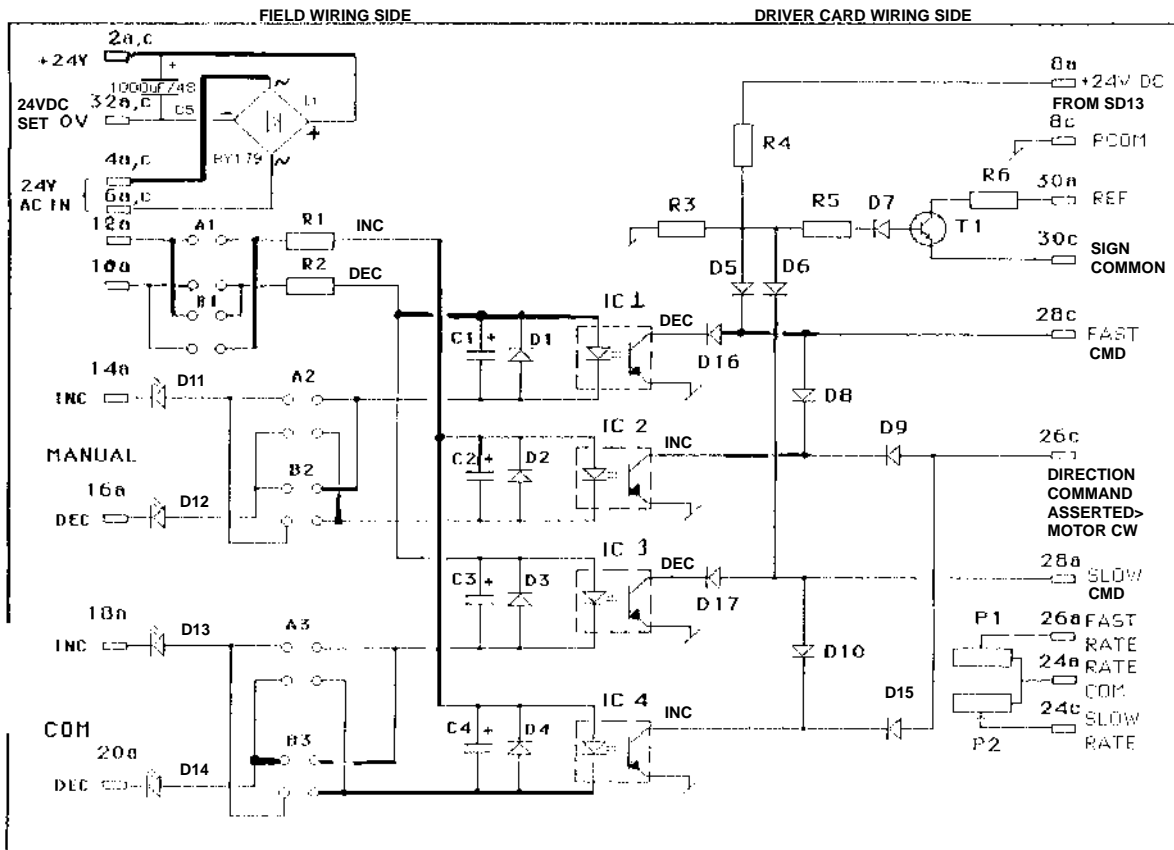
Basis Weight Actuator



E0022 / IL

Figure 20. Feedback Potentiometer Connection Schematic

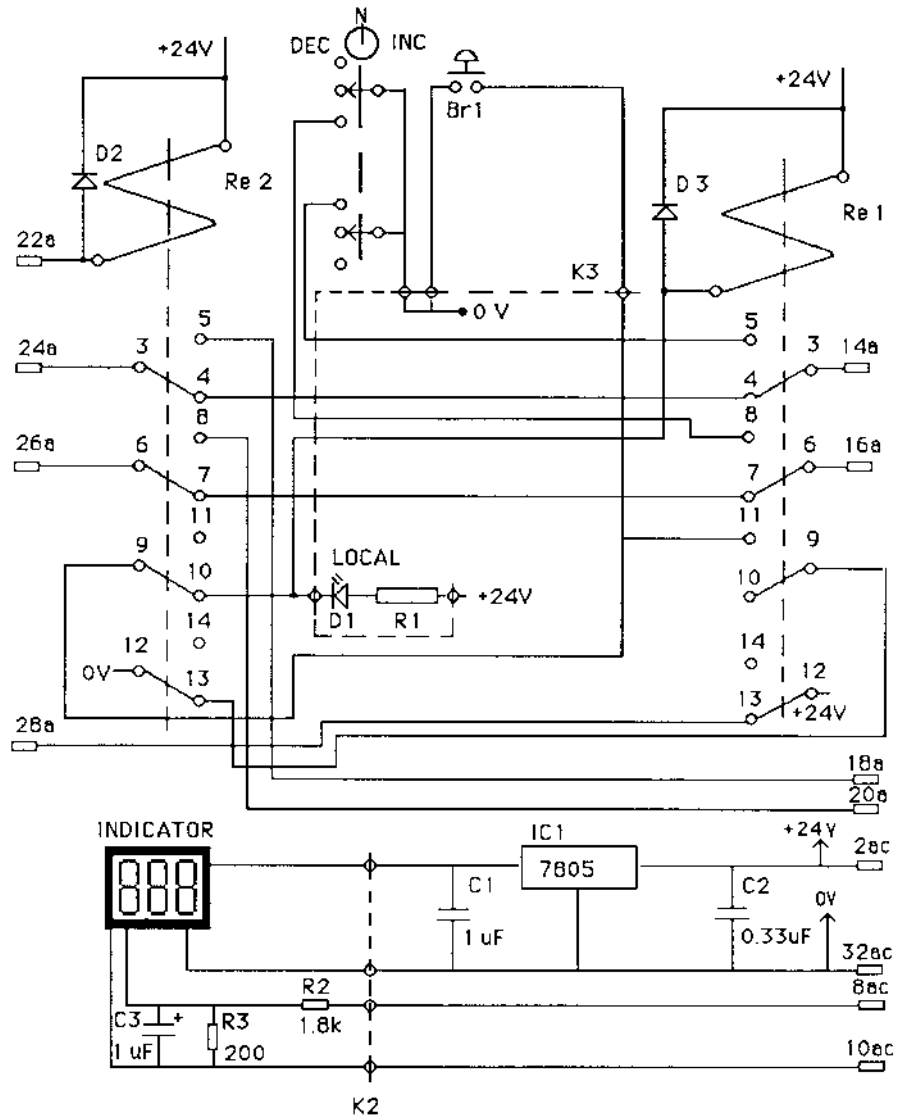
Basis Weight Actuator



E0026 / IL

Figure 21. IC500 Schematic

Basis Weight Actuator



E0018 / IL

Figure 22. Manual Station Schematic

Basis Weight Actuator

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For information, contact Fisher Controls:
Marshalltown, Iowa 50158 USA
Cernay 68700 France
Sao Paulo 05424 Brazil
Singapore 128461

