DYNA Power Control Manual For Plus 1, Plus 2, Plus 4 and Plus 6 Ft. Lb. Systems

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GENERAL INFORMATION

1. SCOPE. This manual provides information for the installation, calibration, operation, and maintenance of the DYNA system. One +1, +2, +4 or + 6 actuator and one electronic control box comprise the DYNA system.

This system is manufactured by the Power Controls Division of the Barber-Colman Company which is headquartered at 1354 Clifford Avenue, P.O. Box 2940, Loves Park, Illinois 61132-2940

2. INTRODUCTION. This manual describes the basic operation and installation of the DYNA plus 1, plus 2, plus 4, and plus 6 all-electric governor systems. The basic governor assembly consists of an actuator and controller. The units are electrically coupled together to make a complete governor system offering optimum engine control.

A typical system would also have an on-off switch, a magnetic pickup and a remote speed potentiometer. The magnetic pickup detects engine speed (RPM) from gear teeth on the prime mover. This signal along with the remote speed signal and the D C power are brought into the controller for processing to allow for optimum engine control.

No special mounting requirements are needed for the DYNA actuator mounted on the engine and it can be located at any convenient position since there are no requirements for a mechanical drive or oil connections.

3. ELECTRONIC CONTROL BOX. The electronic control box is a rugged container which houses the electrical components used in controlling the actuator output and finally the engine. The components and container are designed to withstand 20 G's of mechanical vibration through 500 Hz. This control box is mounted directly on the actuator and is electrically connected to the actuator through a 5 pin connector

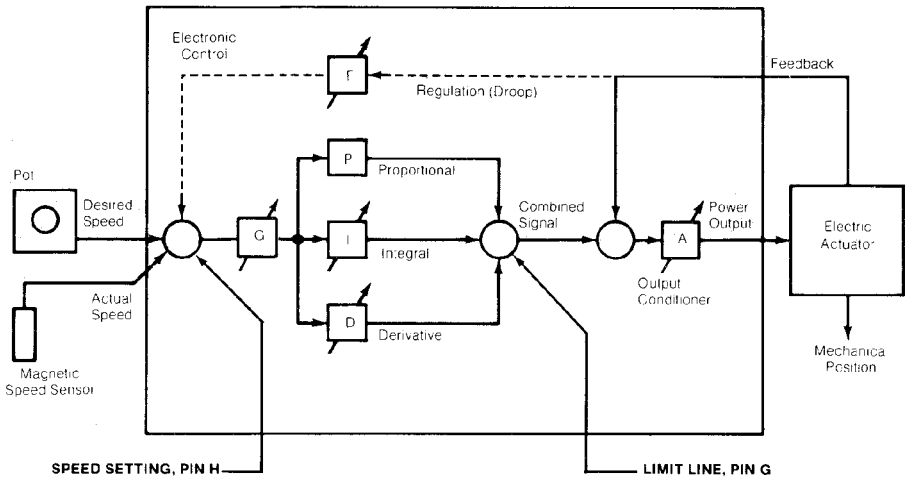
The electronic control box receives electrical input signals from both the magnetic speed sensor and the reference speed pot. These signals are processed and compared, resulting in an error signal that is amplified and sent to the actuator in a proportional, integral and derivative summation. When the actuator receives the desired output shaft electrical signal, the output shaft rotates and a feedback is sent back and compared to the desired signal and any difference is transmitted to the power amplifier which sends corrective action to the output shaft position.

4. JUNCTION BOX. An optional junction box can be used to house the reference speed potentiometer and the power switch. It is mounted so that it can be conveniently connected to the electronic control box, power source, and magnetic speed sensor.

5. MAGNETIC SPEED SENSOR. The magnetic speed sensor is mounted in a convenient location, i.e.: flywheel housing, such as to generate electrical pulses proportional to speed by sensing magnetic material, i.e.: teeth on the engine ring gear passing the sensor.

6. ACTUATORS. The actuators are electrically connected to the electronic control box and their mechanical output is connected to the engine's fuel system. Actuators are electrically powered and have output work capacities of 1, 2, 4, and 6 ft-lbs. The actuators convert an electrical input to an angular mechanical output at the output shaft which has a maximum rotation of 45°.

DYNA Controller Inputs



Modify speed with respect to:
Remote Speed Setting
Time (Ramp Generator)
Electrical Load Change (Load Pulse)
Electrical Load (Isochronous Load Sharing)
Electrical Phase Angle (Synchronizer)

On Pump Applications:
Output Pressure
Output Temperature
Liquid Level
(Controller Recorder Output)

Limit fuel (rack or throttle position) with respect to:
Maximum Fuel Permitted (Load Limit)
Temperature (Exhaust)
Manifold Pressure (Smoke Limit)
Oil Pressure
Time (Some ramp generator applications)
Requested Speed (Torque Limit)
Actual Speed (Torque Limit)

INSTALLATION INFORMATION

1. ACTUATOR AND ELECTRONIC ASSEMBLY. The actuator and electronic assembly can be installed in any position by using a simple steel bracket or mounting pad. Be sure that the mechanical linkage has sufficient physical clearance to freely move from minimum to maximum fuel. The length of this linkage rod connecting the actuator output shaft to the engine fuel control should not be excessively long. Use 4" to 10" except in special cases.

NOTE

The plus 4 actuators have through output shafts that rotate CW or CCW to increase fuel. The direction of rotation is determined when the output shaft is pointed toward the observer. The minimum fuel position is obtained when power is not applied to the actuator coil.

2. MOUNTING THE ACTUATOR AND LINKAGE. Adjust the linkage rod to allow at least 40° rotation of the actuator output shaft for full travel of the fuel control. Use lock nuts on the linkage rod. See Figure 1 for typical linkage arrangements.

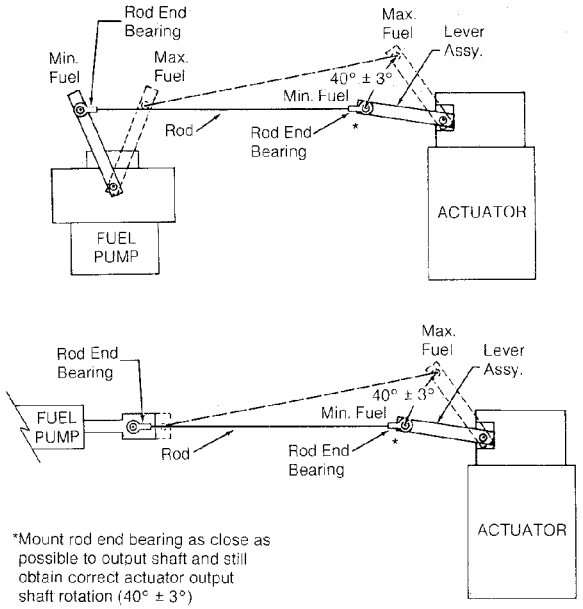


Figure 1. Typical Non-Linear Linkage Arramgements

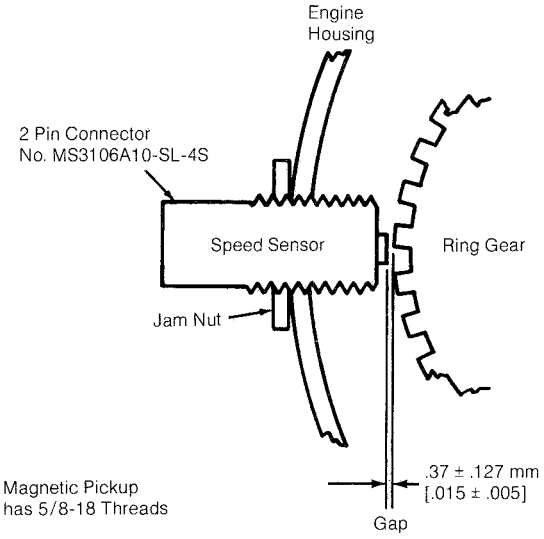
3. INSTALLATION OF SPEED SENSOR (MAGNETIC PICKUP). Remove the inspection cover over the ring gear teeth. The teeth should be free of burrs, excessive grease or dirt.

The magnetic pickup should not be installed in inspection covers. Inspect the ring gear housing and pick a location where a 37/64" hole can be drilled such that the ring gear teeth will pass in front of the pickup pole face. After the 37/ 64" hole is drilled, use a 5/8-18 starting tap to cut threads for the magnetic pickup, then run a bottom tap through the hole.

NOTE

The hole should be drilled as nearly perpendicular as possible over the ring gear teeth, as illustrated in Figure 2

Manually rotate the ring gear until a tooth face is directly in the center of the tapped hole. Gently turn the magnetic pickup clockwise into the hole until it bottoms on the tooth, and back off 1/4 turn. Tighten the jam nut firmly.



Turn in until pole face of pickup bottoms out on ring gear tooth and back out 1/4 turn and tighten jam nut.

Figure 2. Installation of Magnetic Pickup

4. INSTALLATION AND WIRING. Barber-Colman has installation kits available for many engines.These include the mounting bracket and wiring harness (Consult the Barber-Colman DYNA distributor or dealer for installation kit information.)

See the typical wiring for +1, +2, +4, or +6 DYNA governor systems shown on pages 10 through 15 of this manual

Important things to follow when making an installation.

a. Do not connect the control box connector to the wiring until proper voltage and polarity have been established.

b. Wiring.

(1) Use the recommended wiring cables shown in this manual (see pages 10 through 15).

(2) Make sure the wire insulation will withstand the temperatures around the engine.

(3) Twist power leads.

(4) Make sure the end of shield not used is taped to prevent touching other components

c. Ground Shield Installation Precautions

(1) Engines with positive ground systems. With positive ground systems the shield lead on the two- and three-lead shielded cables must not be allowed to touch the engine frame or any part of the power system which is at the same potential as the engine frame. *Allowing the shield lead to touch any of these exposed parts will cause a short across the D-C supply and could damage the control.*

(2) Engines with negative ground systems. With negative ground systems the shield of the two- and three-lead shielded cables must not touch the engine frame. Letting the shield touch the engine frame or associated parts will not damage the control, but it may generate undesirable electrical signals that may cause unstable engine performance.

d. Observe the proper power supply polarity. The proper polarity to Pins A and C of the controller connector must be observed or the unit will not operate. Pin A must be connected to the positive terminal and Pin C to the negative terminal of the battery or power supply.

5. CHECKING OUT WIRING INSTALLATION.

a. After the wiring is mounted on the engine, connect the power wires; the red wire to the positive terminal, and the black wire to the negative terminal. (Do not connect power wiring to the engine frame — connect directly to the battery terminals.)

b. A voltmeter must be used at this time to check voltage at the electronic control box connector. Turn the power switch “ON” at the junction box. Connect the meter leads to Pins A and C of the connector. Pin A must be positive and Pin C negative. The meter should read rated battery voltage.

c. Place the power switch in the “OFF” position and connect the connector to the control box.

d. Remove top cover from control box.

e. Place a jumper between TP1 and TP2 (this overrides the failsafe feature).

f. Place the power switch in the “ON” position. The actuator should move to the full fuel position

g. Remove jumper between TP1 and TP2. (Actuator must return to minimum fuel position.)

h. Engine is ready to start.

CAUTION

As a safety measure, the engine should be equipped with an independent overspeed shutdown device in the event of failure which may render the governor inoperative.

6. REQUIRED TOOLS.

a. Drill Bit — 37/64" diameter for magnetic pickup.

b. Thread Tap — 5/8-18 starting tap for magnetic pick-up.

c. Thread Tap — 5/8-18 bottom tap for magnetic pick-up.

d. Soldering Iron — 50 Watt and Rosin Core Solder

e. Various — pliers, wrenches, screwdrivers, wire strippers

CALIBRATION AND ADJUSTMENTS
FOR
DYN1-10002-002, DYN1-10003-002, DYN1-10004-002, DYN1-10006-002 CONTROLLERS

DYN1-10502-001, DYN1-10503-001, DYN1-10504-001, DYN1-10506-001 CONTROLLERS

*DYN1-10502-004, *DYN1-10503-004, *DYN1-10505-004, *DYN1-10506-004 CONTROLLERS

* CE

Reference Potentiometer
Potentiometer shown in
the 9 o'clock position

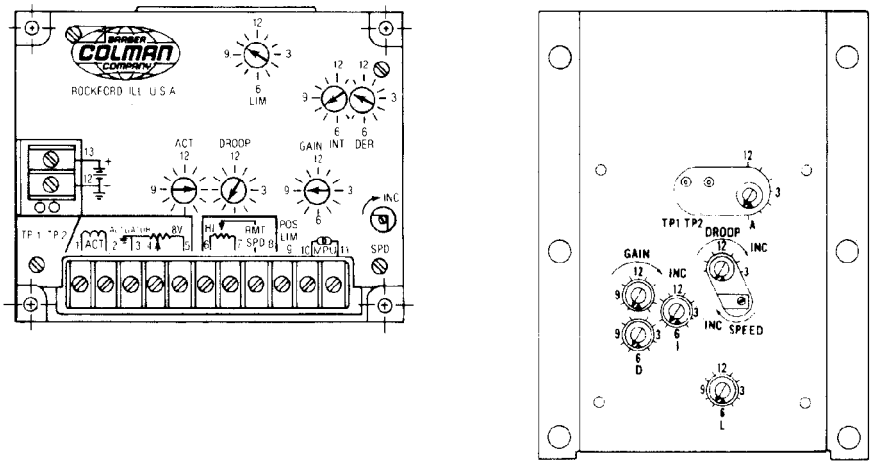


Figure 1. Electronic Control Box Adjustments Configurations

NOTE 1

See Figure 1 for a reference guide before making any adjustments of "A (ACT)", " D (DER)" "DROOP'', "GAIN", "I (INT)" or "L (LIM)" potentiometers

1. Power "OFF" — engine not operating

   a. Easier adjusting is possible by connecting an extension cable (Part No DYNZ-126) between control box and actuator.
   b. Remove top cover from control box.

CAUTION

As a safety measure, the engine should be equipped with an independent overspeed shutdown device in the event of failure which may render the governor inoperative.

2. Set potentiometers as indicated below:
   a. Set "A (ACT)" at 3 o'clock.
   b. Set "GAIN" at 9 o'clock
   c. Set "D (DER)" at 10 o'clock
   d. Set "I (INT)" at 8 o'clock.
   e. **"L (LIM)" is factory adjusted** and should be about 10 o'clock. (See Note 4.)

3. For isochronous operation, set "DROOP" potentiometer fully counterclockwise (zero droop) and proceed to Step 4. **For droop operation, set "DROOP" potentiometer to desired droop.** Refer to Note 2

NOTE 2

The amount of droop for a given setting depends on pick-up frequency and no load to full load actuator shaft rotation. A "DROOP" potentiometer setting of 9 o'clock will give about 3% droop, no load to full load, when the pick-up frequency is 4260 Hz and actuator shaft rotation is 13° from no load to full load. Lower pick-up frequency or smaller shaft rotation results in less droop.

4. If a remote speed potentiometer is used, set it to mid-range.

5. **Start engine.** Then adjust controller "SPEED (SPD)" potentiometer until engine is operating at the desired speed (RPM). (**Clockwise** increases engine speed)

6. Adjust the "A (ACT)'' potentiometer with engine **running** unloaded

   a. Turn the "A (ACT)" potentiometer **slowly clockwise** until the actuator lever oscillates (jiggles) rapidly. Turn the "A (ACT)'' potentiometer **slowly counterclockwise** until the rapid oscillation just stops.

   b. Upset governor by tapping actuator lever. If the actuator lever oscillates rapidly, turn the "A (ACT)" potentiometer **slowly counterclockwise** until the rapid oscillation just stops.

7. If governor is unstable (hunting), turn "GAIN" potentiometer **slowly counterclockwise** until it is stable. (Moving actuator lever and constant engine speed means unit is governing and not hunting.) If governor is stable, turn “GAIN” potentiometer **slowly clockwise** until governor starts to hunt, then turn “GAIN” **slowly counterclockwise** until governor is stable. Upset governor by tapping actuator lever. Engine should return quickly to its commanded speed without hunting.

8. Turn “D (DER)” **clockwise** until actuator lever begins to hunt. One may have to upset governor by tapping actuator lever, then turn “D (DER)” **slowly counterclockwise** until engine is stable. [“D (DER)” setting may be fully clockwise on some engines which have large mass in the linkage.]

NOTE 3

Step 9 must be done when engine is unloaded.

9. After "GAIN”, “A (ACT)” and “D (DER)” potentiometers are set, turn power switch “OFF”. Let engine speed slow down to about half speed, and then turn power switch "ON”. Watch or listen to engine speed. If engine speed overshoots commanded speed, turn “I (INT)” potentiometer a **small amount** counterclockwise. Keep repeating above until engine no longer overshoots its commanded speed. [If “L (LIM)” potentiometer is set too far clockwise, engine may also overshoot commanded speed.]

10. Changing the adjustments “A (ACT)”, "D (DER)”, "DROOP” and "GAIN’’ may cause a slight engine speed change which will require resetting the “SPEED” (SPD) adjustment.

11. **Changing droop potentiometer setting** adjustment of the “DROOP” potentiometer after the controller is calibrated [“A (ACT)” and “GAIN” settings set] may result in some instability when **large loads** are shed. Therefore, turning the “DROOP” potentiometer (clockwise) from a previous setting may cause system instability which can be improved (regained) by turning “A (ACT)” potentiometer (counterclockwise) slightly and turning “GAIN” potentiometer (clockwise) slightly.

12. If unit has a cover, place cover back onto controller to keep out dirt and moisture.

NOTE 4

Field Adjustment of “L (LIM)”: “L (LIM)” is factory adjusted and is sufficient for most installations. The following method can be used for setting the “L (LIM)” potentiometer to match the governor to the linkage on installations where the engine can be fully loaded (100%).

I. After “A (ACT)”, "GAIN”, “D (DER)” and “I (INT)” are adjusted, load engine to 100% (full load)

   a. While observing frequency or RPM meter, turn “L (LIM)” potentiometer **slowly counterclockwise** until the frequency or RPM starts to decrease.

   b. Turn “L (LIM)” potentiometer slowly clockwise until the frequency or RPM returns to the original value before “L (LIM)’’ was adjusted in Step (a) above

Table 1. Calibration and Adjustment Tips

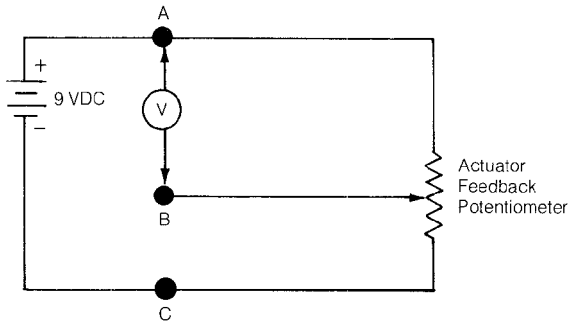
If any of the following adjustments are tried and they are not successful, the potentiometer should be reset to its original position before going on with the calibration.

Symptom	Possible Cause	Corrective Action
Actuator lever oscillating (jiggling) at a 10 to 15 Hz rate.	“A (ACT)’’ potentiometer set too far clockwise.	Turn A (ACT)” **slowly** counterclockwise.
Actuator lever oscillating (hunting) at a 4 to 10 Hz rate.	“D (DER)” potentiometer set too far clockwise.	Turn “D (DER)” **slowly** counterclockwise.
Actuator lever oscillating (hunting) at a 2 to 3 Hz rate.	“GAIN” potentiometer set too far clockwise.	Turn "GAIN” **slowly** counterclockwise.
Actuator lever has a small amplitude oscillation of less than 1 Hz rate with no quick changes in position.	“I (INT)” potentiometer set too far clockwise.	Turn “I (INT)” **slowly** counterclockwise.

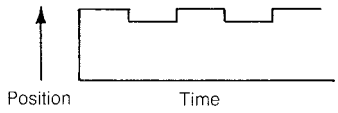
GENERAL
DYNA GOVERNOR TROUBLESHOOTING

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
I	1. No DC power.	1. Measure battery or power supply voltage.	1. Change battery or replace power supply.
		2. Disconnect 10 Pin connector from controller and measure DC voltage between Pin A & Pin C on cable connector with power switch "ON". Read battery voltage. (Pin A is positive with respect to Pin C) (Not applicable on 125 VDC system)	1. Check wiring. a. Open lead to Pin A. b. Open lead to Pin C. c. Faulty power switch. d. Power leads not connected to power supply.
		3. Disconnect 3 Pin connector from actuator and measure DC voltage between Pin A & B on cable connector with power switch "ON". (This test is for the +6 actuators only)	1. Check wiring a. Open lead to Pin A. b. Open lead to Pin B. c. Faulty power switch.
	2. Sticking linkage.	1. Manually operate linkage to make sure it is not sticking.	1. Free up linkage.
	3. Indadequate power supply voltage.	1. Remove cover from the controller. Place a jumper between TP1 & TP2. Turn power switch "ON" and measure the DC voltage between Pins A & C on the 10 Pin connector. (For +6 DYNA actuators measure the DC voltage between Pins A & B on the actuator 3 Pin connector). Voltage should be 80% of nominal supply voltage for correct operation. Examples: 24 VDC SYSTEM: 24V x 0.80 = 19.2V 12 VDC SYSTEM: 12V x 0.80 = 9.6V 32 VDC SYSTEM: 32V x 0.80 = 25.6V	1. Larger supply. 2. Larger leads from supply to controller. 3. Check for poor or loose sulpply connections.
	4. No signal or a weak signal from magnetic pickup.	1. Disconnect 10 Pin connector from controller. Measure the AC voltage between Pin I & J on cable connector while cranking engine. Meter must read 2.5 volts or greater during cranking. (AC input impedance of meter must be 5000 ohms / volt or greater.) 2. Check the following: • Pickup resistance (200 ohms) • Magnetic pickup leads (Pins A & B) must be isolated from case • Loose connector • Mechanical integrity (May be damaged pole piece. Flywheel may have run out) • Water in connector • Broken leads • Shorted leads • Shield drain wire (isolated from ground) • Gap — .015 ± .005" (0.37 ± 0.127 mm) NOTE: One complete turn of the pickup is approximately 0.055".	1. Check leads I & J from 10 Pin cable connector to magnetic pickup for continuity. (See step 5 below for a short C to J on the 10 Pin connector that will cause loss of pickup signal.) 2. Check for correct installation of magnetic pickup. 3. Replace magnetic pickup if unable to obtain an output signal from unit.
	5. Short in either male or female member (10 Pin connector between Pins: C to D C to H C to E C to J C to G	1. Turn "OFF" power switch. Disconnect 10 Pin connector. a) Check cable connector for short(s) between C & D, C & E, C & G, C & H and C & J.	1. Check connector and leads for cause of short(s). Repair or replace.
		b) Check box connector for short(s) between C & D, C L& E, C & G, C & H and C & J.	1. Replace controller.
	6. Actuator failure.	1. Try different actuator.	1. Replace actuator.
		2. Remove controller from actuator. a) Measure resistance between actuator case and pins on the actuator connectors. These measurements will all indicate an open circuit on a good actuator.	1. If a short or resistance path is indicated, replace actuator.
		b) Measure the resistance between Pins D & E on actuator connector. If an open circuit is indicated, it means the actuator coil is open and the unit is faulty. (This test is for the +1 actuator only)	1. Replace actuator.
		c) Measure for shorts between Pins A to C or B to C on actuator 5 Pin connector. (A good actuator should not indicate a short circuit A to C or B to C.	1. Replace actuator.
	(CONTROLLER SHOULD BE CHECKED AT THIS TIME BECAUSE IT IS DISCONNECTED FROM ACTUATOR.)	d) Measure for open between Pins A to C on the actuator 5 Pin connector. (A good actuator will measure 4,000 to 20,000 ohms). Open lead to Pin A on actuator connector will cause unit to go to minimum fuel position.	1. Replace actuator.
		e) Measure for shorts between Pins A to C or B to C on the controller 5 Pin connector. (A good controller should not indicate a short circuit A to C or B to C).	1. Replace controller.
	7. Controller failure.	1. With power switch "ON", measure DC voltage between Pin C (-) and Pin D (+) at the controller 10 Pin connector. This voltage should be +8.0V ± 0.5 volts.	1. Replace controller.
		2. Remove cover from controller and place a jumper between TP1 & TP2. Make sure correct power is available to controller. If controller is good and correct voltage is available, the actuator output lever will go to full fuel position and remain there until jumper TP1 to TP2 is removed.	1. Replace controller if actuator checked O.K. in Step 6.

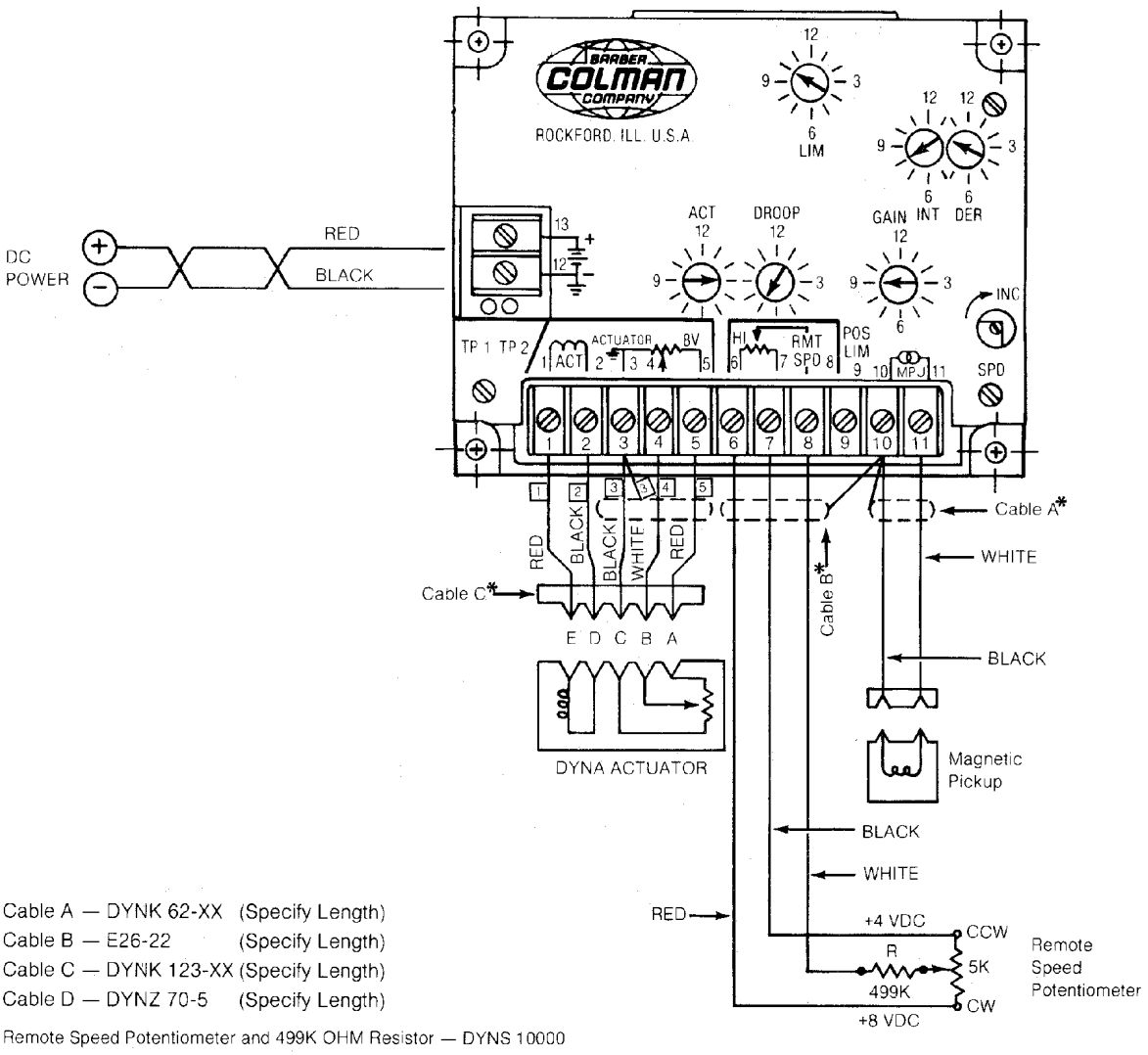
GENERAL
DYNA GOVERNOR TROUBLESHOOTING (Cont.)

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
II. Actuator lever to full fuel position each time power switch is turned "ON". (Engine not operating.)	1. Magnetic pickup leads not properly shielded.	1. Check for open shield lead on magnetic pickup. See wiring diagrams on Pages 10 - 15 for correct shielding.	1. Correct the wiring. The magnetic pickup shield must be tied to the controller Pin C. The other end of shield must not be tied to anything.
	2. Short between Pins B & C or C & F in either male or female member (10 Pin connector).	1. Turn "OFF" power switch. Disconnect 10 Pin connector. a. Check cable connector for short(s) between C & B or C & F. b. Check box connector for short(s) between C & B or C & F.	1. Check connector and leads for cause of short(s). Repair or replace. 1. Replace controller.
	3. Actuator failure.	1. Try another actuator.	1. Replace actuator.
		2. Measure for open between Pins A to C on the actuator 5 Pin connector. (A good actuator will measure 4,000 ohms to 20,000 ohms. Open lead to Pin C on actuator will cause unit to go to maximum fuel position.	1. Replace actuator.
	4. Controller failure.	1. Try another controller.	1. Replace controller.
		2. Make resistance check between Pins E and C on the controller 5 Pin connector. Controller must be removed from actuator. A good controller will measure approximately 360 ohms ± 20% when the plus lead of meter is connected to Pin C and minus lead is connected to Pin E. Reversing the meter leads, minus to Pin C and plus to Pin E will measure (infinity) open circuit.	1. Replace controller if a short circuit was detected between Pins E and C. 2. Replace controller if an open circuit was detected between Pins E and C with meter leads connected in both directions.
	5. Amplifier module failure. (Used on explosive proof actuator.)	1. Try another amplifier module.	1. Replace amplifier module.
II. Erratic governor operation.	1. Poor electrical connection between supply voltage and controller.	1. Measure voltage Pin A and C on the 10 Pin connector while engine is operational. Read nominal battery voltage.	1. Correct wiring.
	2. Poor electrical connection between supply voltage and the +6 actuator.	1. Measure voltage Pin A and B on the 3 Pin connector.	1. Correct wiring.
	3. Low battery supply voltage at controller.	1. Same as above.	1. Charge battery.
	4. Electrical noise (RFI) pickup due to poor shielding.	1. Observe output shaft (lever) on actuator. It will make a quick correction of fuel throttle position without a change in load.	1. Check for correct shielding.
	5. Electrical noise (RFI) fed through power supply.	1. Observe output shaft (lever) on actuator. It will make a quick correction of fuel throttle position without a change in load.	1. Check all wiring connections in system.
	6. Defective feedback potentiometer in actuator.	Check the feedback potentiometer with a 9 VDC transistor battery. Pins A, B and C of actuator 5 Pin connector.  A, B and C of 5 Pin Actuator Connector	Remove control box from actuator. 1. Connect the plus of the 9 VDC battery to Pin A, and the minus to Pin C of the 5 Pin connector. Refer to drawing. 2. Connect the plus lead of the volt meter to Pin A, and the minus lead to Pin B. 3. Using a standard lever, slowly rotate the actuator output shaft to maximum while observing the volt meter. NOTE: The voltage will be at approximately 4.0 VDC initially and will increase to approximately 4.5 VDC at full stroke of the actuator. (If the voltage change is not evident or it is erratic, replace the actuator.)

GENERAL
DYNA GOVERNOR TROUBLESHOOTING (Cont.)

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
IV. Slow small amplitude hunting of engine RPM or generator frequency.	1. Sticking linkage or very loose linkage.	1. Fairly regular but quick changes in position of fuel rack and then it rests and moves back to original position. 	1. Correct linkage arrangement.
	2. Sticking injector(s) in fuel system pump.	1. Same as 1 above.	1. Correct fuel system.
	3. DYNA actuator (internal) problem.	1. Change actuator.	1. Replace actuator.
V. Actuator lever oscillating (hunting). (If any of these adjustments are tried and they are not successful, reset the potentiometer to its original position before going on with the troubleshooting.)	1. "A" pot set too far clockwise.	1. Actuator lever oscillating (jiggling) at a 10 to 15 Hz rate.	1. Turn "A" slowly counterclockwise.
	2. "D" pot set too far clockwise.	1. Actuator lever oscillating (hunting) at a 4 to 10 Hz rate.	1. Turn "D" slowly counterclockwise.
	3. "GAIN" pot set too far clockwise.	1. Actuator lever oscillating (hunting) at a 2 to 3 Hz rate.	1. Turn "GAIN" slowly counterclockwise.
	4. "I" pot set too far clockwise.	1. Actuator lever has a small amplitude oscillation of approximately 1 Hz with no quick changes in position.	1. Turn "I" slowly counterclockwise.
VI. Remote potentiometer adjustment has no effect on setting engine RPM.	1. Open circuit to Pins D, F or H in either male or female member of controller 10 Pin connector.	1. Turn "OFF" power switch. Disconnect 10 Pin connector. a. Check cable connector for open circuit between Pins D & F, Pins D & H, and Pins F & H.	1. Check connector, remote potentiometer and leads for cause of open circuit(s). Repair or replace faulty components.
		b. If external wiring and remote potentiometer checks out correctly, change controller.	1. Replace controller.
		2. Check the following points at the remote potentiometer. • Mechanical check • Resistance check • Wiring • Speed range resistor • Drain shield (Cut off and isolate from ground and other leads.) • Voltage check for the 4 and 8 VDC at the remote potentiometer.	1. Repair or replace faulty components.
VII. Engine operates above set speed (May overspeed.)	1. Faulty actuator. a. Short between Pins A and B of the 5 Pin actuator connector.	1. Remote controller from actuator. a. Measure for short(s) between Pin A and B on the actuator 5 Pin connector.	1. Replace actuator.
	b. Open lead to Pin C of 5 Pin connector on actuator.	b. Measure for open circuit by measuring between Pins B and C on the 5 Pin connector.	1. Replace actuator.
VIII. Engine won't start. (Actuator lever goes to full fuel position each time engine is cranked.)	1. Fuel not getting to engine.	1. Try to operate engine manually.	1. Check fuel line. 2. Check safety shutdowns.

TYPICAL WIRING DIAGRAM FOR DYN1 10504 SERIES PANEL MOUNTED CONTROLLERS



Cable A — DYNK 62-XX (Specify Length)
Cable B — E26-22 (Specify Length)
Cable C — DYNK 123-XX (Specify Length)
Cable D — DYNZ 70-5 (Specify Length)

Remote Speed Potentiometer and 499K OHM Resistor — DYNS 10000

* Shielded Cable — should be purchased from Barber-Colman or customer should purchase a cable with a wrapped mylar supported aluminum foil shield with a drain wire.

AVAILABLE PANEL MOUNTED DYNA CONTROLLER PART NUMBERS

Specify voltage 12 or 24 volts d-c when ordering.

SPEED CONTROLLERS

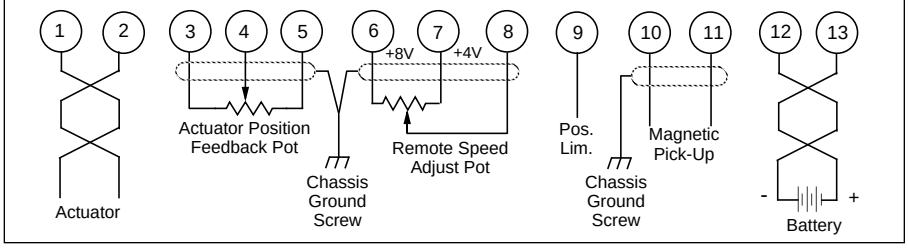
Part Number	Input Signal Frequency
DYN1 10502-001	250 to 1200 Hz
DYN1 10503-001	1200 to 2500 Hz
DYN1 10504-001	2500 to 5000 Hz
DYN1 10506-001	5000 to 9500 Hz

CE

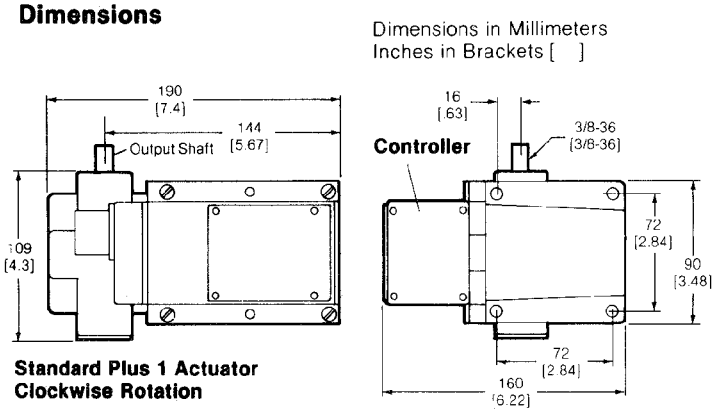
Part Number	Input Signal Frequency
DYN1 10502-004	250 to 1200 Hz
DYN1 10503-004	1200 to 2500 Hz
DYN1 10504-004	2500 to 5000 Hz
DYN1 10506-004	5000 to 9500 Hz

Adjustments available: ACT, GAIN, DER, INT, LIM, DROOP and SPEED (SPD).

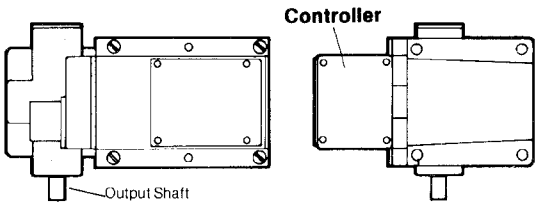
Wiring for CE Controllers



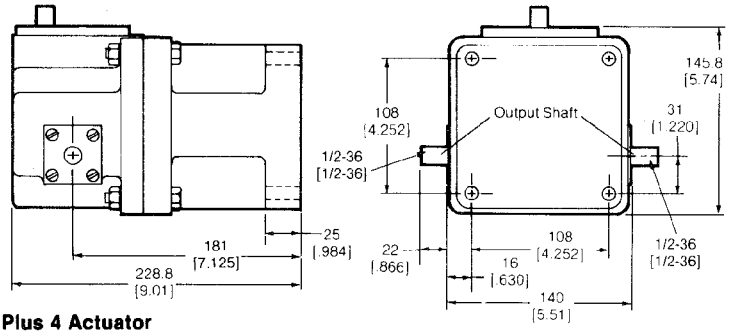
Dimensions



Standard Plus 1 Actuator
Clockwise Rotation

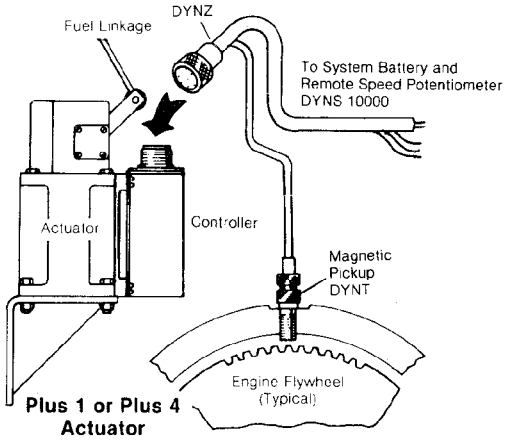


Standard Plus 1 Actuator
Counterclockwise Rotation



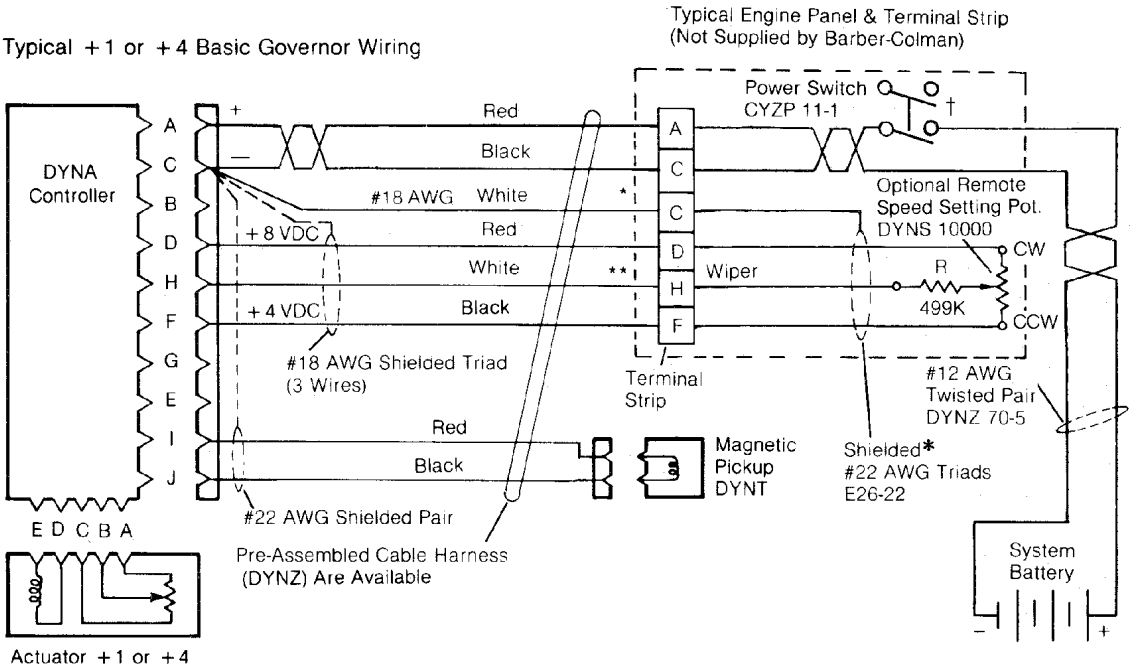
Plus 4 Actuator

Typical Installation Diagram



Plus 1 or Plus 4 Actuator

Typical +1 or +4 Basic Governor Wiring



* The white wire from Pin C must not be connected to the same terminal as the black wire from Pin C.

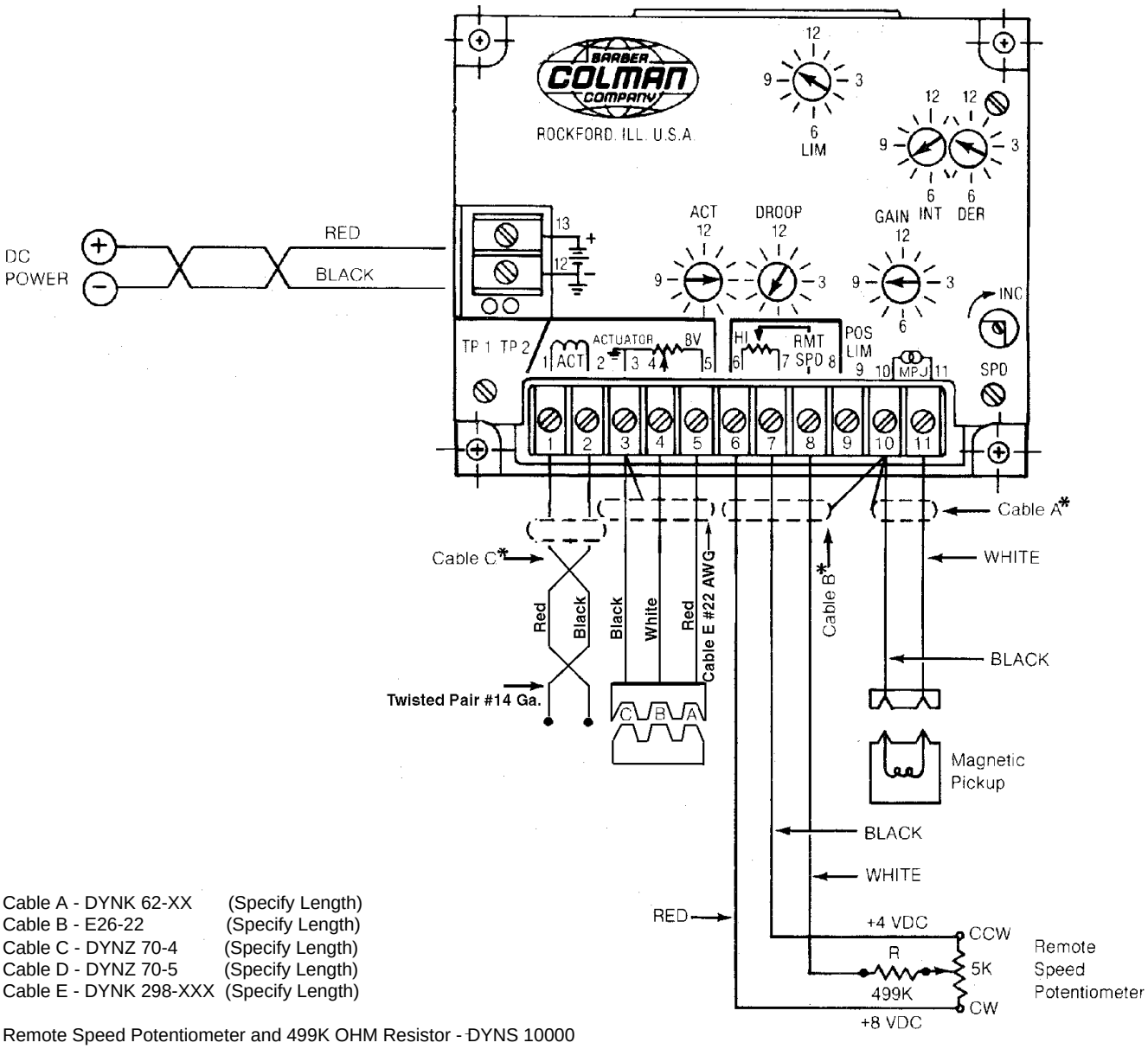
† Power switch wiring is shown for a negative ground system. When a positive ground system is being wired, the installer should switch (break) both the positive and negative leads.

** Wiring procedure when a remote speed setting potentiometer is not used.
1. If a terminal strip is not used, then isolate and tape the ends of the wires from Pin D, F and H to keep them from touching each other or other leads.

*** Shielded Cable** — should be purchased from Barber-Colman or customer should purchase a cable with a wrapped mylar supported aluminum foil shield with a drain wire.

TABLE OF WIRE SIZES	
Size — AWG	**Nominal mm**
10	6
12	4
14	2.5
18	1.5
22	1.0

TYPICAL PLUS 2 WIRING DIAGRAM FOR DYN1 1050X SERIES PANEL MOUNTED CONTROLLERS



Cable A - DYNK 62-XX (Specify Length)
Cable B - E26-22 (Specify Length)
Cable C - DYNZ 70-4 (Specify Length)
Cable D - DYNZ 70-5 (Specify Length)
Cable E - DYNK 298-XXX (Specify Length)

Remote Speed Potentiometer and 499K OHM Resistor - DYNS 10000

* Shielded Cable — should be purchased from Barber-Colman or customer should purchase a cable with a wrapped mylar supported aluminum foil shield with a drain wire.

AVAILABLE PANEL MOUNTED DYNA CONTROLLER PART NUMBERS

Specify voltage 12 or 24 volts when ordering.

Speed Controllers

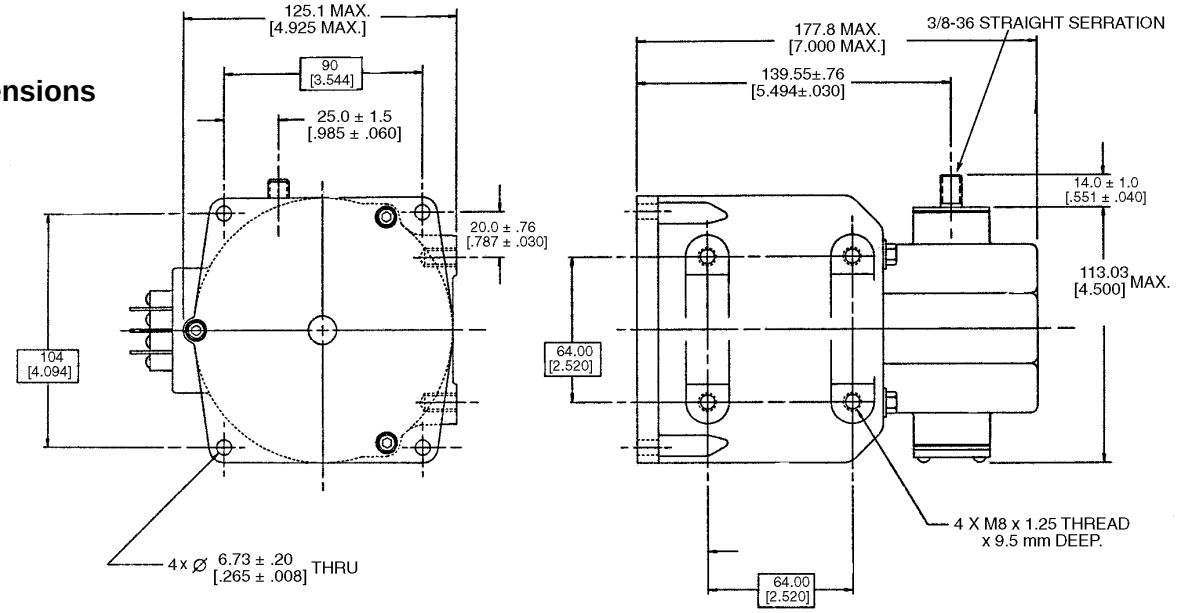
Part Number	Input Signal Frequency
DYN1 10502-001	250 to 1200 Hz
DYN1 10503-001	1200 to 2500 Hz
DYN1 10504-001	2500 to 5000 Hz
DYN1 10506-001	5000 to 9500 Hz

Adjustments available: ACT, GAIN, DER, INT, LIM, DROOP and SPEED (SPD).

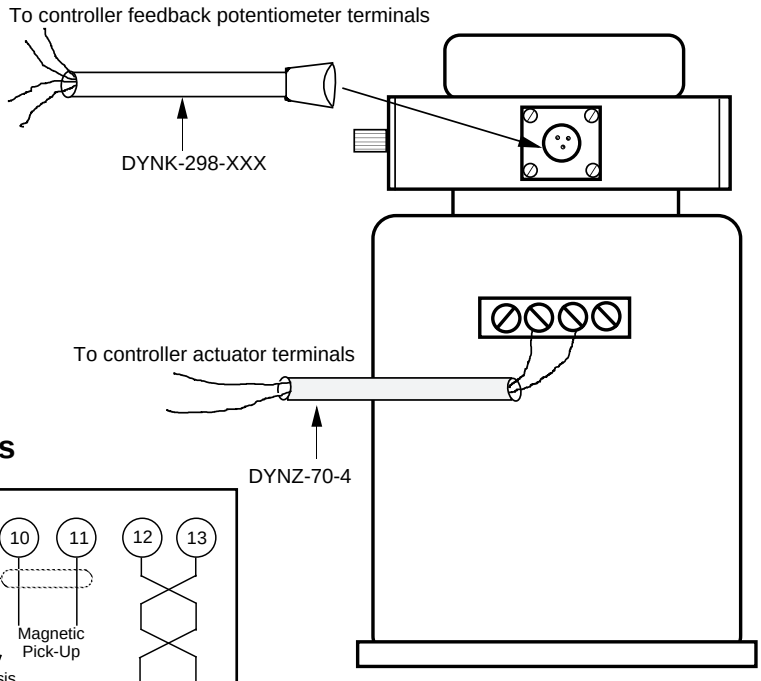
CE

Part Number	Input Signal Frequency
DYN1 10502-004	250 to 1200 Hz
DYN1 10503-004	1200 to 2500 Hz
DYN1 10504-004	2500 to 5000 Hz
DYN1 10506-004	5000 to 9500 Hz

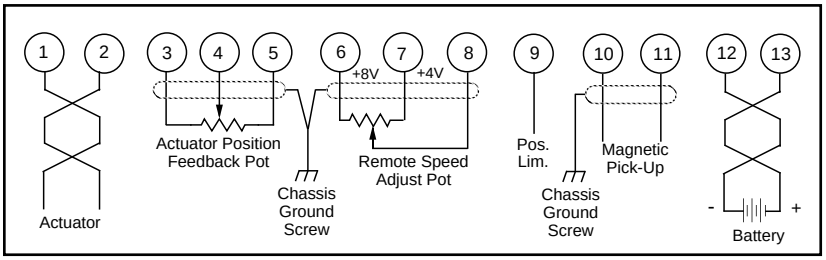
Dimensions



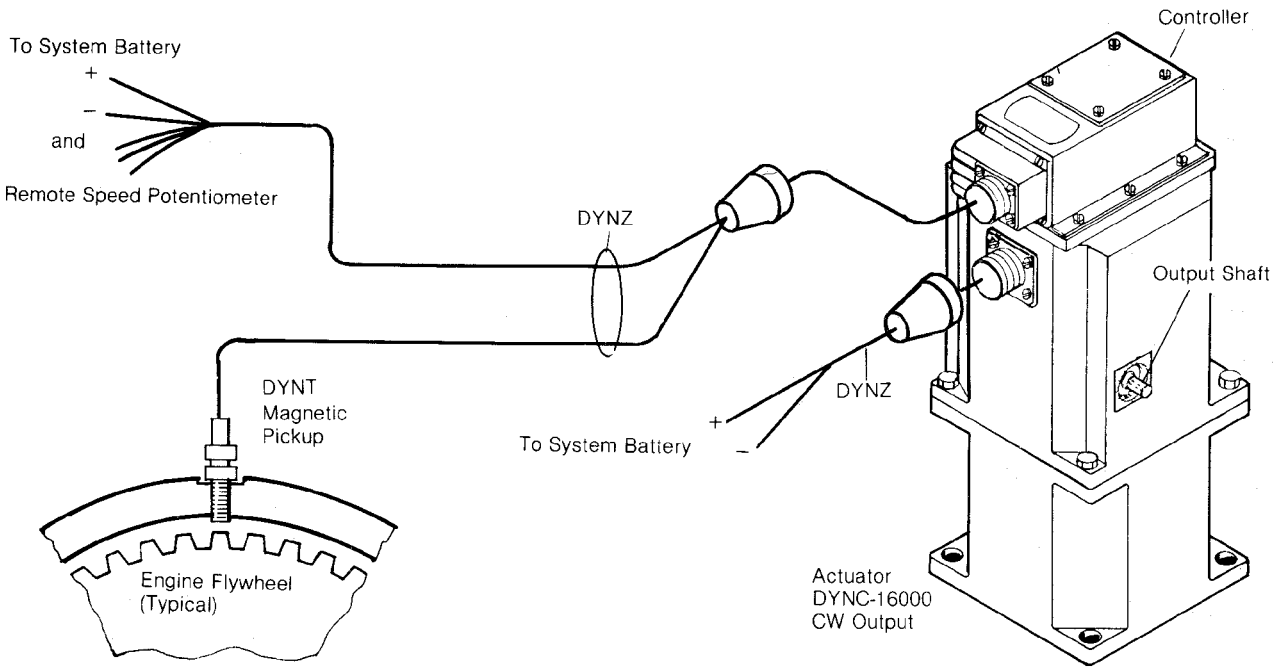
Typical Plus 2 Actuator Wiring



Wiring for CE Controllers



Typical Plus 6 Governor Wiring

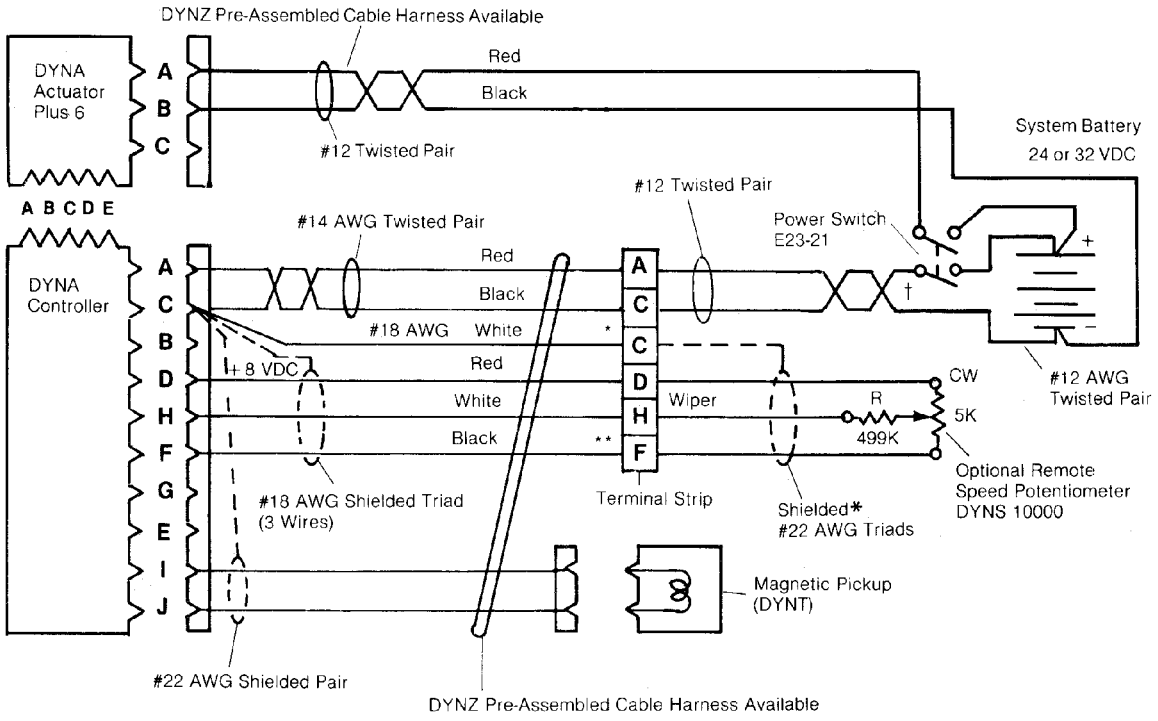


Available Actuator Models

- **Standard Actuator**

  DYNC 16000 Plus 6 with clockwise output shaft rotation
  DYNC 16001 Plus 6 with counterclockwise output shaft rotation

Typical Panel and Terminal Strip Wiring



* The white wire from Pin C must not be connected to the same terminal as the black wire from Pin C.

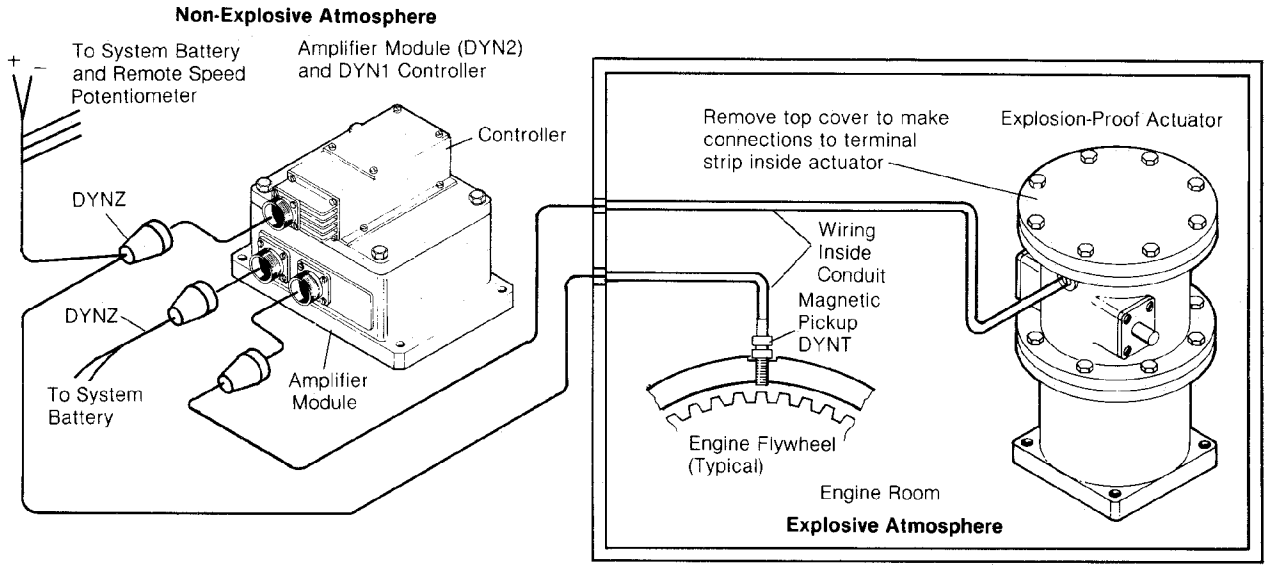
† Power switch wiring is shown for a negative ground system. When a positive ground system is being wired, the installer should switch (break) both the positive and negative leads.

** Wiring procedure when a remote speed setting potentiometer is not used.

1. If a terminal strip is not used, then isolate and tape the ends of the wires from Pin D, F and H to keep them from touching each other or other leads.

***** **Shielded Cable** — should be purchased from Barber-Colman or customer should purchase a cable with a wrapped mylar supported aluminum foil shield with a drain wire.

Typical Plus 6 Explosion Proof Governor Wiring



Typical Panel and Terminal Strip Wiring

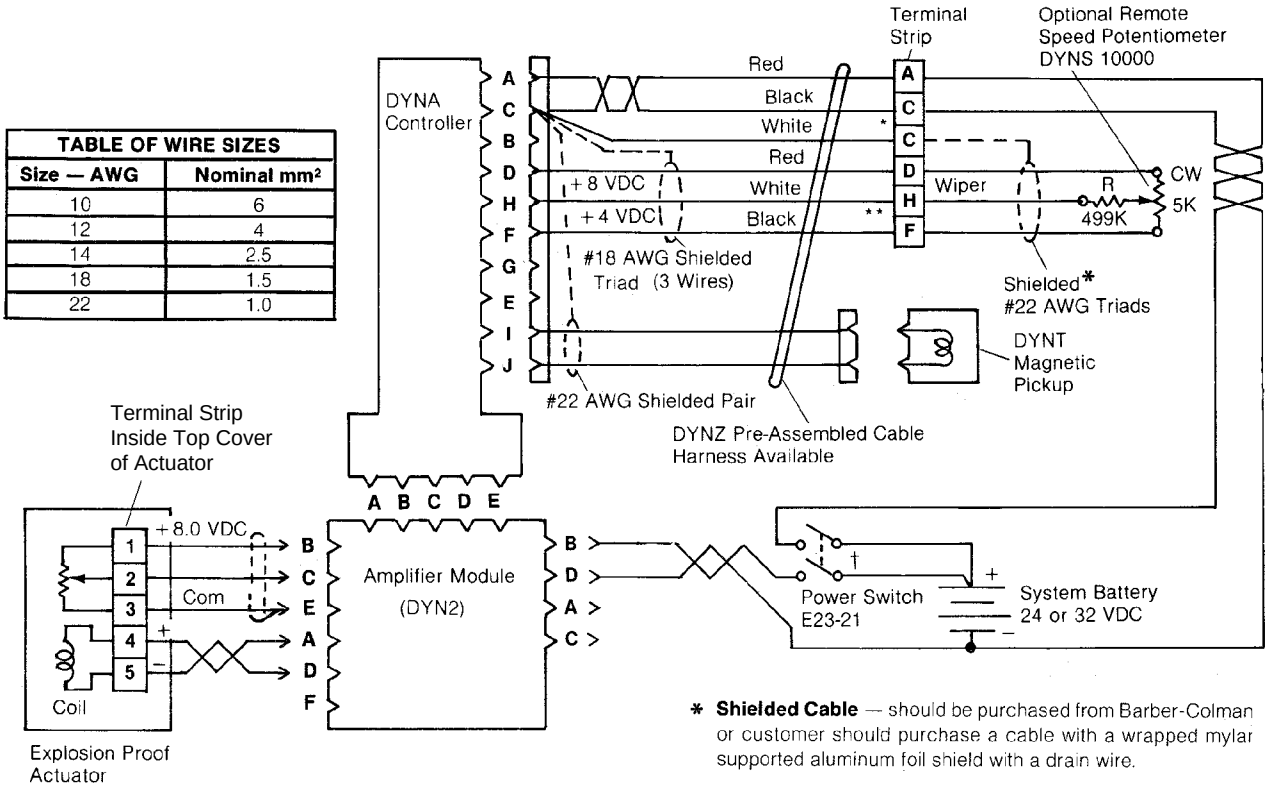


TABLE OF WIRE SIZES	
Size — AWG	Nominal mm²
10	6
12	4
14	2.5
18	1.5
22	1.0

* The white wire from Pin C must not be connected to the same terminal as the black wire from Pin C.

† Power switch wiring is shown for a negative ground system. When a positive ground system is being wired, the installer should switch (break) both the positive and negative leads.

** Wiring procedure when a remote speed setting potentiometer is not used.

1. If a terminal strip is not used, then isolate and tape the ends of the wires from Pin D, F and H to keep them from touching each other or other leads.

Specifications

Available Operating Voltages 12, 24 or 32 volts, ±20%. Other voltages on special request.

Input Signal Frequency

$$\text{Input Signal Frequency in Hertz} = \frac{\text{Engine RPM x Number of Gear Teeth on Flywheel}}{\text{60 Seconds}}$$

Select your controller for the correct input signal frequency range generated by the magnetic pickup at the maximum engine operated (RPM) speed.

Steady State Speed Band
±0.2 percent, isochronous control.

Ambient Operating Temperature
-65°F (-55°C) to +200°F (+95°C).

Temperature Stability Better than ±0.5 percent over a temperature range of -55° to 95°C (-65° to 200°F).

Speed Regulation (Droop) Adjustable from 0 to 15 percent. Remote adjustment optional.

Mechanical Vibration Tested 5 to 500 Hz @ 25 G's (peak level on the governor).

Output Signal Pulse width modulated current to DYNA actuator. Maximum output current is 14 amperes.

Circuit Boards Boards are covered with a heavy conformal coating for moisture and vibration protection.

Enclosure Aluminum extrusion.

Weight 635 grams (1.4 lbs.).

Speed Governing
DYNA controllers are available for engine governing for speed and power control of piston and gas turbine engines where the fuel is controlled by the governor's output shaft. The controllers are also applicable for controlling steam and water turbines.

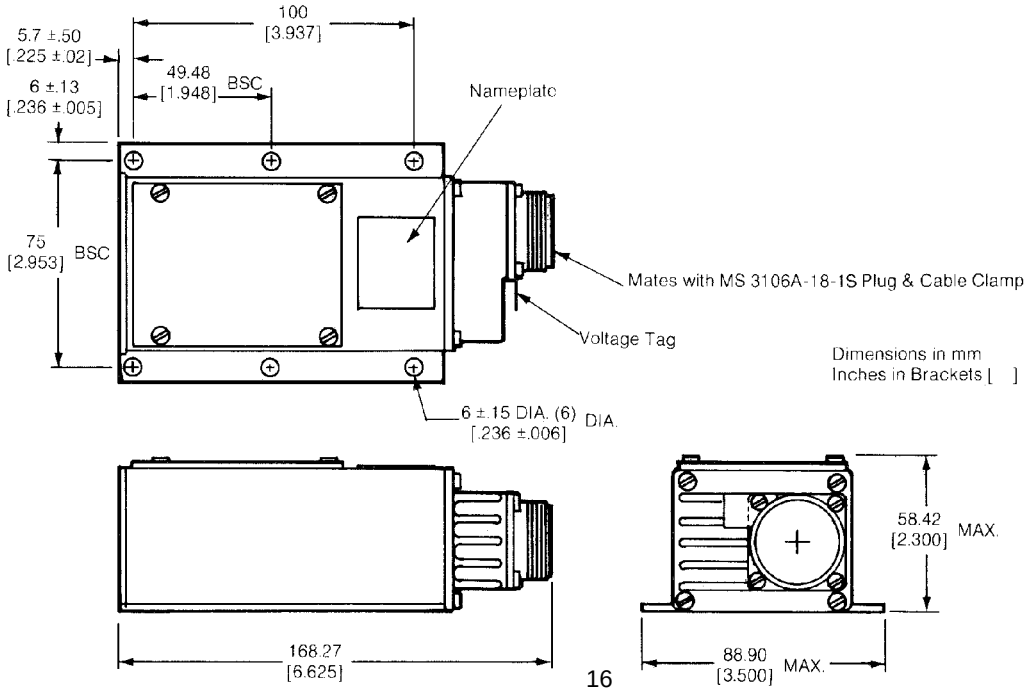
Tandem Engine Governing
DYNA controllers are available for tandem engine operation. The controller provides the precise positioning required for accurate tracking of two governor actuators used for controlling tandem-coupled engines.

No-Break Engine Governing
DYNA controllers are available for no-break operation. The controller is designed to provide dual-mode operation. The controller functions with fixed gain when the engine is declutched and with an adjustable high gain when the engine is coupled to the load.

Propulsion Governing
DYNA controllers are available for engine governing of propulsion engine applications. The control has an adjustable low limit feature which is required to maintain correct engine operation due to the loading characteristics of the propeller. The same controller should be used on tandem-coupled propulsion engine applications.

Wide Speed Range Governing
DYNA controllers are available for wide speed range governing for speed and power control of piston and gas turbine engines where the fuel is controlled by the governor's output shaft. The controller is designed to provide improved governor performance and control over a wider speed range than the standard speed governor.

Dimensions



Available DYNA Controller Part Numbers

Specify voltage 12, 24 or 32 volt d-c when ordering.

SPEED CONTROLLERS CONFIGURATION A

Part Number	Input Signal Frequency
DYN1 10002-2	250 to 1200 Hz
DYN1 10003-2	1200 to 2500 Hz
DYN1 10004-2	2500 to 5000 Hz
DYN1 10006-2	5000 to 9500 Hz

Adjustments available: A, Gain, D, I, L, Droop and Speed (under controller cover).

TANDEM CONTROLLER CONFIGURATION A

Part Number	Input Signal Frequency
DYN1 10008-2	2500 to 5000 Hz

NO-BREAK CONTROLLER CONFIGURATION A

Part Number	Input Signal Frequency
DYN1 10010	2500 to 5000 Hz

PROPULSION CONTROLLERS CONFIGURATION B

Part Number	Input Signal Frequency
DYN1 10024-2	250 to 1200 Hz
DYN1 10025-2	1200 to 2500 Hz
DYN1 10026-2	2500 to 5000 Hz

Adjustments available: A, Gain, D, I, Droop, High Limit, Low Limit and Speed (under controller cover).

Note: The following is for reference only; these controllers are no longer manufactured.

SPEED CONTROLLERS CONFIGURATION C

Part Number	Input Signal Frequency
DYN1 10112-0	250 to 1500 Hz
DYN1 10113-0	1200 to 3000 Hz
DYN1 10114-0	2500 to 6000 Hz
DYN1 10116-0	5000 to 10000 Hz

Adjustments available: I, Droop and Speed (under controller cover); Stability and Speed Trim (on side of controller).

SPEED CONTROLLERS CONFIGURATION D

Part Number	Input Signal Frequency
DYN1 10212-0	250 to 1500 Hz
DYN1 10213-0	1200 to 3000 Hz
DYN1 10214-0	2500 to 6000 Hz
DYN1 10216-0	5000 to 10000 Hz

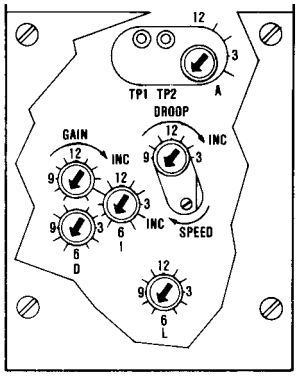
Adjustments available:Gain, I, Droop & Speed (under controller cover).

WIDE SPEED RANGE CONTROLLERS CONFIGURATION E

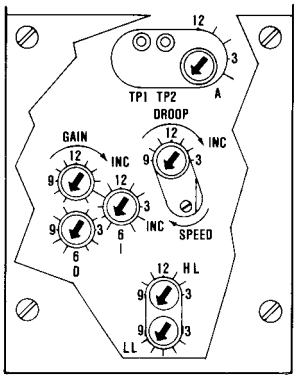
Part Number	Input Signal Frequency
DYN1 10312-0	250 to 1500 Hz
DYN1 10313-0	500 to 3000 Hz
DYN1 10314-0	1000 to 6000 Hz
DYN1 10316-0	2000 to 12000 Hz

Adjustments available: Gain, D, I, Droop & Speed (under controller cover).

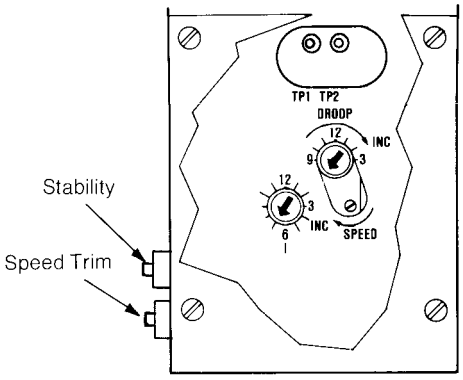
Adjustment Configurations



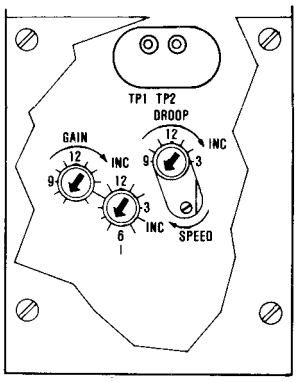
Configuration A



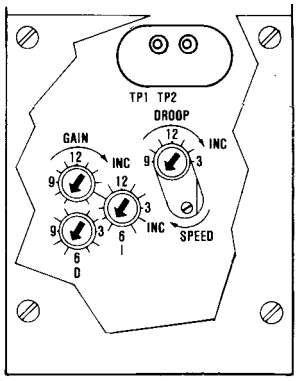
Configuration B



Configuration C

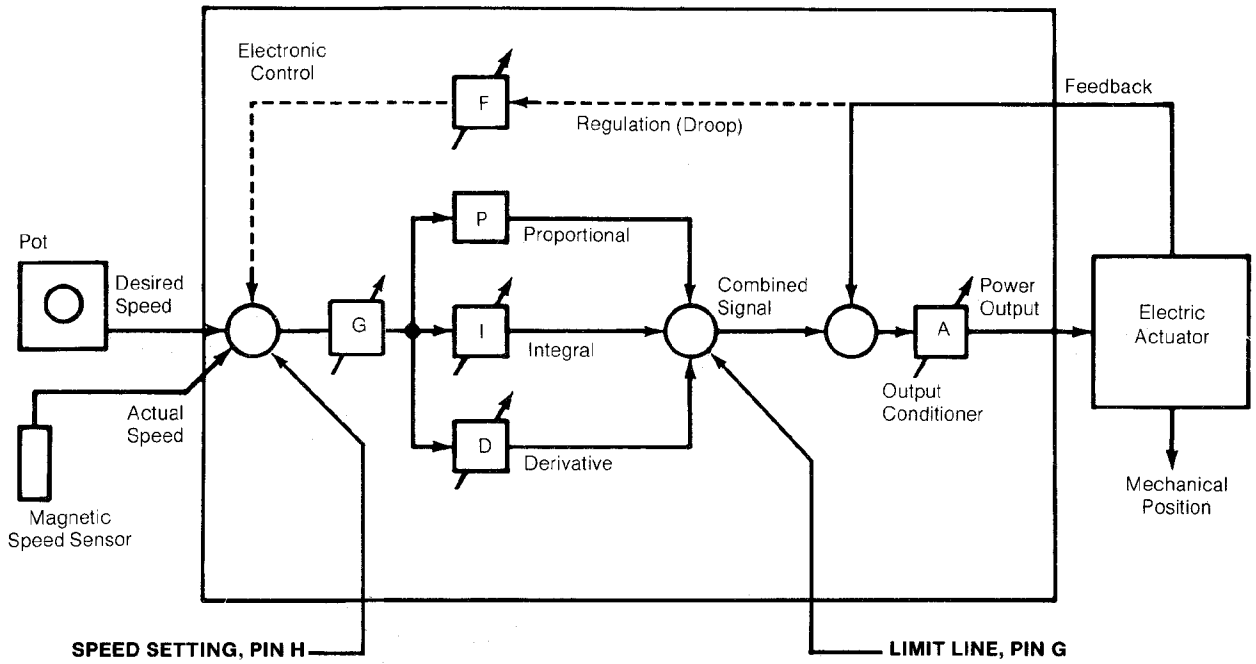


Configuration D



Configuration E

DYNA Controller Inputs



Modify speed with respect to:
Remote Speed Setting
Time (Ramp Generator)
Electrical Load Change (Load Pulse)
Electrical Load (Isochronous Load Sharing)
Electrical Phase Angle (Synchronizer)

On Pump Applications:
Output Pressure
Output Temperature
Liquid Level
(Controller/Recorder Output)

Limit fuel (rack or throttle position) with respect to:
Maximum Fuel Permitted (Load Limit)
Temperature (Exhaust)
Manifold Pressure (Smoke Limit)
Oil Pressure
Time (some ramp generator applications)
Requested Speed (Torque Limit)
Actual Speed (Torque Limit)

FEATURES ARE EASY TO ADD

It is easy to add features to the electric governor to provide benefits the customer needs. Remote speed setting, isochronous load sharing, automatic synchronizing, ramp generator, single phase load pulse and KW limits can be added at the time of initial governor installation or, just as easily, added later when the need arises. No modification to the basic governor is required when these features are added. In fact, if the prewired harness is used, the wires necessary to add these features are often already provided, so it is indeed easy to add features.

AUXILIARY CONTROL MODULES

Four auxiliary control modules are available: Isochronous Load Sharing Control, Auto-Synchronizer, Ramp Generator, and Single Phase Load Pulse Control. These and other auxiliary functions can be installed at the time of the initial governor installation or, just as easily, added later when the need arises. No modification is required to the basic governor when these modules are added.

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In Japan contact: Ranco Japan Ltd.
Shiozaki Bldg. 7-1, 2-chome, Hirakawa-Cho, Chiyoda-Ku
Tokyo 102, Japan
Telephone (81) 3 3261 4293, Facsimile (81) 3 3264 4691

CAUTION
As a safety measure, the engine should be equipped with an independent overspeed shutdown device in the event of failure which may render the governor inoperative.