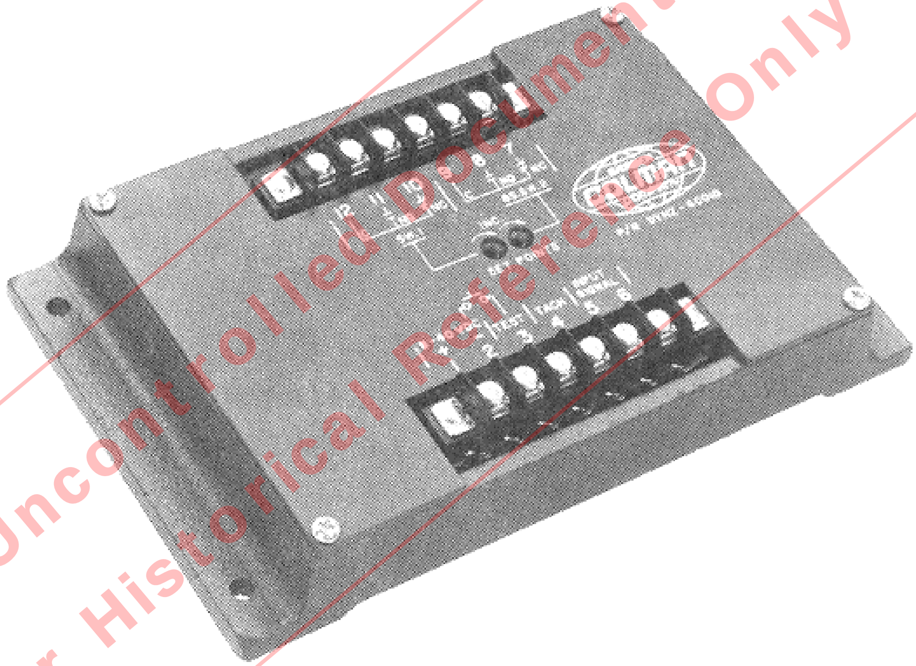
Technical Manual

Electronic Speed Switch

Models
DYNZ-60010- 8 to 40 Vdc
DYNZ-60012- 59 to 88 Vdc
DYNZ-60013- 8 to 40 Vdc



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1.0 INTRODUCTION

The Barber-Colman two setpoint speed switch normally obtains its input signal from a magnetic pickup which is positioned in proximity to the teeth of a gear on a rotating shaft. The pickup generates an AC signal voltage whose frequency is directly proportional to the rate at which the gear teeth pass by the pole piece. The speed switch converts the input signal voltage into a DC signal which is compared to the preset levels (setpoints) and actuate the relays when the input signal frequency exceeds the preset values.

Note

Barber-Colman believes that all information provided herein is correct and reliable and reserves the right to update at any time. Barber0Colman does not assume any responsibility for its use unless otherwise expressly undertaken.

1.1 APPLICATION

- Overspeed Protection Signal
- Underspeed Protection Signal
- Crank Termination Signal
- Generator Field Flashing Signal
- Ignition Signal
- Sequencing Signal
- Tach Signal for Driving Model 40 Tachometer

Caution

As a safety measure, Barber-Colman Company recommends that all engines and turbines be equipped with an independent overspeed shutdown devise.

1.2 RELAY LOGIC TABLE FOR SPEED SWITCHES

Switch	Power to Unit and Input Signal Frequency below Trip Point	Power to Unit and Input Signal Frequency above Trip Point
DYNZ-60010 SWI Relay Contacts	De-energized 10 to 12 closed 11 to 12 open	Energized (non-latching) 10 to 12 open 11 to 12 closed
DYNZ-60010 OS-SW2 Relay Contacts	Energized 7 to 9 open 8 to 9 closed	De-energized (latched) 7 to 9 closed 8 to 9 open
DYNZ-60012 SW1 Relay Contacts	De-energized 10 to 12 closed 11 to 12 open	Energized (non-latching) 10 to 12 open 11 to 12 closed
DYNZ-60012 OS-SW2 Relay Contacts	De-energized 7 to 9 closed 8 to 9 open	Energized (non-latching) 7 to 9 open 8 to 9 closed
DYNZ-60013 SW1 Relay Contacts	De-energized 10 to 12 closed 11 to 12 open	Energized (non-latching) 10 to 12 open 11 to 12 closed
DYNZ-60013 OS-SW2 Relay Contacts	De-energized 7 to 9 closed 8 to 9 open	Energized (non-latching) 7 to 9 open 8 to 9 closed

2.0 SPECIFICATIONS

2.1 ELECTRICAL

2.1.1 COMMON ELECTRICAL SPECIFICATIONS FOR DYNZ-60010, DYNZ-60012 AND DYNZ-60013

Ambient Operating Temperature: -40 to +185°F (-40 to +85°C).
Maximum Operating Current: 0.20 amperes.
Input Signal Voltage: 0 7 Vrms minimum into 33 k ohm load.
Trip Setpoint: Adjustable 325 to 10,000 Hz.
SW1: Factory set at 1100 Hz.
SW2: Factory set at 3600 Hz.
Repeatability: ±5 Hz or ±1%, whichever is greater.

2.1.2 ELECTRICAL SPECIFICATIONS FOR DYNZ-60010

Power Input: 8 to 40 Vdc.
Voltage Transients: Withstand 200 volts forward and reverse peaks of 10 milliseconds duration at 5 ohms source input impedance. Withstand 80 volts forward and reverse peaks of 50 milliseconds duration at 50 ohms source input impedance.
Hysteresis:
SW1: Crank dropout, non-latching; nominal 165 Hz
SW2: Overspeed, latching; 100% of setpoint.
Relay Contact Rating: 10 amperes at 30 Vdc resistive.
Overspeed Response Time: With the overspeed set at 4140 Hz and a steady input frequency of 3600 Hz, then switching the input frequency to 5000 Hz must result in the overspeed relay operating in 90 milliseconds or less.

2.1.3 ELECTRICAL SPECIFICATIONS FOR DYNZ-60012

Power Input: 59 to 88 Vdc.
Voltage Transients: Withstand 200 volts forward and reverse peaks of 10 milliseconds duration at 50 ohms source input impedance. Withstand 80 volts forward and reverse peaks of 50 milliseconds duration at 50 ohms source input impedance.
Hysteresis:
SW1: Crank dropout, non-latching; nominal 165 Hz
SW2: Overspeed, non-latching; 0% of setpoint.
Relay Contact Rating: 0.75 amperes at 88 Vdc resistive.
Overspeed Response Time: With the overspeed set at 4140 Hz and a steady input frequency of 3600 Hz, then switching the input frequency to 5000 Hz must result in the overspeed relay operating in 75 milliseconds or less.

2.1.4 ELECTRICAL SPECIFICATIONS FOR DYNZ-60013

Power Input: 8 to 40 Vdc.
Voltage Transients: Withstand 200 volts forward and reverse peaks of 10 milliseconds duration at 50 ohms source input impedance. Withstand 80 volts forward and reverse peaks of 50 milliseconds duration at 50 ohms source input impedance.
Hysteresis:
SW1: Crank dropout, non-latching; nominal 165 Hz
SW2: Overspeed, non-latching; 0% of setpoint.

Relay Contact Rating: 10.0 amperes at 30 Vdc resistive.
Overspeed Response Time: With the overspeed set at 4140 Hz and a steady input frequency of 3600 Hz, then switching the input frequency to 5000 Hz must result in the overspeed relay operating in 75 milliseconds or less.

2.2 MECHANICAL / ENVIRONMENTAL

Case: Has nickel plated terminals. Humidity and salt spray resistant. Potted for water protection.
Vibration: 5.0 G's from 20 to 500 Hz.
Shock: 4 foot drop test.

2.3 MOUNTING INSTRUCTIONS

Four mounting holes are provided on the case as shown in Figure 1. Although the unit can withstand the normal vibration levels and temperature excursions encountered, it is a good practice to mount the unit in a location where these effects are minimized. The unit should be attached to the mounting plate with 10-32 screws.

Figure 1. Installation Drawing

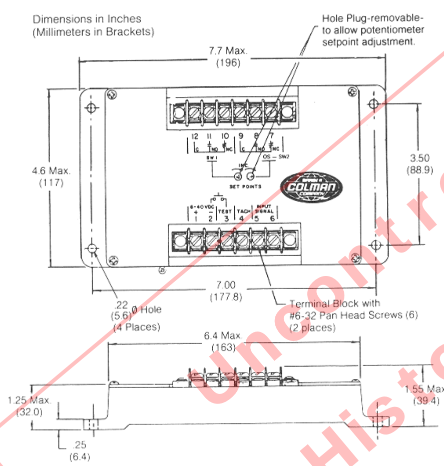

Figure 1. Installation Drawing

3.0 ADDITIONAL FEATURES

3.1 OVERSPEED TRIP TESTING

Overspeed trip testing while the engine is running at its normal speed can be accomplished by temporarily connecting terminal 2 to terminal 3. This lowers the overspeed setpoint of OS-SW2 to 67% of its set/calibrated value.

3.2 TACHOMETER READOUT

Tachometer readout can be obtained by connecting a Synchro-Start Model 40 tachometer to terminals 1, 2 and 4 as shown in Figure 3.

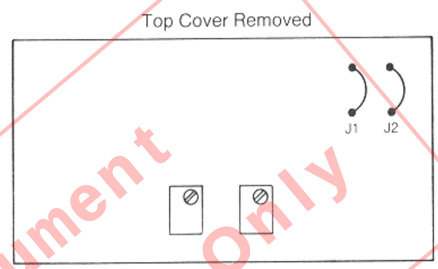

Figure 2

3.3 SW1 & OS-SW2 ADJUSTMENT AND ADJUSTMENT RANGE

- There are two speed trip setpoint adjustments, SW1 and OS-SW2, located on top of the unit. Turning the 20 turn potentiometer adjustment clockwise increases the RPM setting.

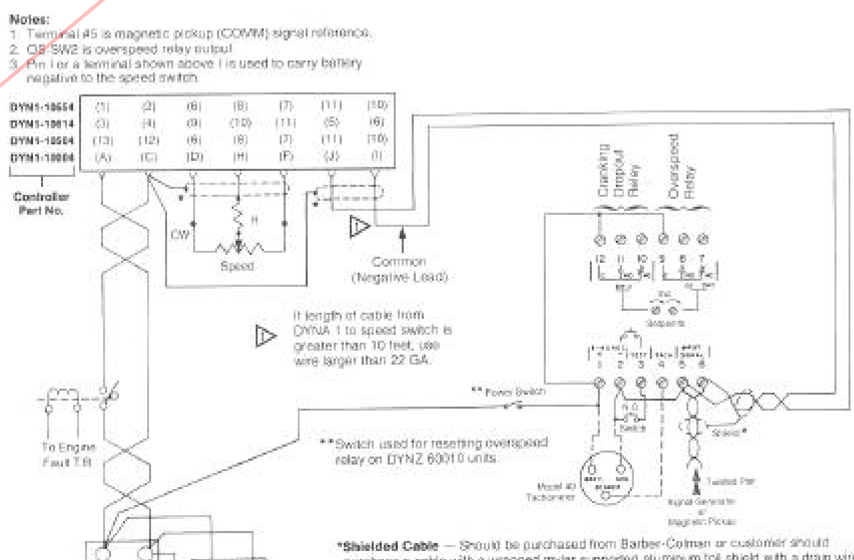

Figure 3. Typical Wiring Diagram When Using a DYN1-10004, DYN1-10504, DYN1-10614 or DYN1-10654 Series Controller

- Barber-Colman sets the units to operate over the adjustment range of 325 to 10,000 Hz by cutting jumper J2 only. The sensitivity of the adjustment potentiometer is approximately 480 Hz per turn.
- SW1 is factory set at 1100 Hz unless specified in purchase order.
- OS-SW2 is factory set at 3600 Hz unless specified in purchase order.
- The unit can be operated at a lower frequency adjustment range (80 to 2500 Hz instead of 325 to 10,000 Hz) by reconnecting jumper J2 and cutting out jumper J1 (see Figure 2).

4.0 WIRING INSTRUCTIONS

The typical wiring diagram shows the wiring required to properly connect the unit to the DYNA governor. All the wiring for the test, tach and input power terminals should be either 18 or 20 AWG wire. The wiring to the relay contacts should be 16 AWG wire if the current requirement is less than 5 amperes and 14 AWG if the current through the contacts is between 5 and 10 amperes. The current load and wiring to the relay should be checked thoroughly.

CAUTION

If the 10 ampere relay contact rating is exceeded, the foil on the printed circuit board from the relay contacts to the terminals can be damaged.

As shown in Figure 3, a two-conductor shielded cable must be used for mounting the speed sensor (MPU) to the unit. The shield should only be connected as shown. It is good practice to isolate the power wiring from the relay contacts and associated relays from the input signal wiring. The input signal is normally from a magnetic pickup (MPU) mounted on the flywheel housing which senses the ring gear speed.

5.0 OPERATION AND CALIBRATION OF DYNZ-60010 SPEED SWITCH

5.1 OPERATING PROCEDURE

Once the system has been wired, the SPEED SWITCH functions in the following manner.

5.1.1 No power applied to unit.

- SW1 and OS-SW2 relays are de-energized; therefore, contacts are in position as shown on top of unit.

5.1.2 Power is applied to unit when POWER SWITCH is turned on and no input signal to speed switch.

- SW1 relay remains de-energized; therefore, its contacts remain in same position as those shown on top of unit.
- OS-SW2 relay energizes; therefore, its contacts change states from those shown on top of unit.

5.1.3 When the engine is cranked and the engine starts, SW1 energizes at its crank-dropout setting which is normally adjusted midway between the cranking RPM and idle RPM of the engine.

5.1.4 When an overspeed condition occurs, OS-SW2 relay deenergizes and latches up and will remain latched up until the POWER SWITCH is turned off or power is somehow removed from the unit. The engine overspeed setpoint is normally adjusted to trip at 10 to 20% above the engine operating speed.

5.2 CALIBRATION PROCEDURE

Equipment Required: Signal generator Frequency counter Ohmmeter

5.2.1 Determine the desired trip points for your unit when using a magnetic pickup (MPU).

$$\text{Trip Point in Hz} = \frac{\text{No. of Gear Teeth} \times \underline{\text{Engine RPM Trip Point}}}{60}$$

5.2.2 Connect the signal generator and counter to terminals 5 and 6 with terminal 5 being the ground terminal. Set the signal generator frequency 100 Hz below the SW1 or OS-SW2 trip point you are trying to calibrate/set or check. Then adjust the out signal from the signal generator to 1 volt rms or greater.

NOTE

Omit/skip step 5.2.3 if you are only checking the calibration points of the unit.

5.2.3 If you are calibrating unit, turn the desired trip point potentiometer adjustment 10 or 15 turns clockwise.

5.3 CALIBRATION OR CHECKING PROCEDURE FOR SW1 TRIP POINT

5.3.1 With no power applied to unit, connect an ohmmeter to terminals 10 and 12 (no other wires attached). The ohmmeter should indicate zero resistance (short circuit). This is the normally closed contact on relay SW1.

5.3.2 Apply correct DC power to terminals 1 and 2 of speed switch. The ohmmeter connected to terminals 10 to 12 should still indicate zero resistance, because you should be below the setpoint for SW1 and it should not change states when power is applied to the unit.

NOTE

If you are only checking calibration point, omit steps 5.3.3 and 5.3.4 and go to step 5.3.5

5.3.3 Adjust the signal generator frequency to the desired SW1 set/trip point as specified or calculated in step 5.2.1.

5.3.4 Slowly adjust SW1 setpoint potentiometer counterclock-wise until the ohmmeter indicates an open circuit. This is now the set/trip point for SW1.

5.3.5 Slowly increase the signal generator frequency until the ohmmeter connected to terminals 10 to 12 indicates an open circuit. Note the frequency and verify that it is correct for your SW1 set/trip point requirements. If set/trip point of SW1 is correct it is properly calibrated. If set/trip point is incorrect, go to step 5.3.2, 5.3.3 and 5.3.4 and calibrate unit.

5.4 CALIBRATION OR CHECKING PROCEDURE FOR OS-SW2 TRIP POINT

5.4.1 With no power applied to unit, connect an ohmmeter to terminals 7 and 9 (no other wires attached). The ohmmeter should indicate zero resistance (short circuit). This is the normally closed contact on relay OS-SW2.

5.4.2 Apply correct DC power to terminals 1 and 2 of speed switch.

The ohmmeter connected to terminals 7 to 9 should now indicate infinite resistance (open circuit). Originally the signal generator frequency was set below the units set/trip point (see step 5.2.2); therefore, it must change states when power is applied.

NOTE

If you are only checking calibration point, omit steps 5.4.3 and 5.4.4 and go to step 5.4.5.

5.4.3 Adjust the signal generator frequency to the desired OS-SW2 set/trip point as specified or calculated in step 5.2.1.

5.4.4 Slowly turn the OS-SW2 potentiometer adjustment counterclockwise until the ohmmeter indicates an open circuit. This gives you the correct setpoint for OS-SW2. Remember OS-SW2 latches.

5.4.5 Slowly increase the signal generator frequency until the ohmmeter connected to terminals 7 to 9 indicates an open circuit. Note the frequency and verify that it is correct for your OS-SW2 set/trip point requirements. If set/trip point of OS-SW2 is correct it is properly calibrated. If set/trip point is incorrect, go to step 5.4.2, 5.4.3 and 5.4.4 and calibrate unit.

6.0 OPERATION AND CALIBRATION OF DYNZ-60012 AND DYNZ-60013 SPEED SWITCH

6.1 OPERATING PROCEDURE

Once the system has been wired, the SPEED SWITCH functions in the following manner.

6.1.1 No power applied to unit.

- SW1 and OS-SW2 relays are de-energized; therefore, contacts are in position as shown on top of unit.

6.1.2 Power is applied to unit when POWER SWITCH is turned on and no input signal to speed switch.

- SW1 relay remains de-energized; therefore, its contacts remain in same position as those shown on top of unit.
- OS-SW2 relay remains de-energized; therefore, its contacts remain in the same position as shown on top of unit.

6.1.3 When the engine is cranked and the engine starts, SW1 energizes (non-latching) at its crank-dropout trip point setting which is normally set to trip midway between the cranking RPM and idle RPM of the engine.

6.1.4 When an overspeed condition occurs, OS-SW2 relay energizes and it will remain energized until the frequency falls below the trip point at which time the relay will de-energize (relay is non-latching with no hysteresis). The engine over-speed setpoint is normally adjusted to trip at 10 to 20% above the engine operating speed.

6.2 CALIBRATION PROCEDURE

Equipment Required: Signal generator Frequency counter Ohmmeter

6.2.1 Determine the desired trip points for your unit when using a magnetic pickup (MPU).

$$\text{Trip Point in Hz} = \frac{\text{No. of Gear Teeth x Engine RPM Trip Point}}{60}$$

6.2.2 Connect the signal generator and counter to terminals 5 and 6 with terminal 5 being the ground terminal. Set the signal generator frequency 100 Hz below the SW1 or OS-SW2 trip point you are trying to calibrate/set or check. Then adjust the out signal from the signal generator to 1 volt rms or greater.

NOTE

Omit/skip step 6.2.3 if you are only checking the calibration points of the unit.

6.2.3 If you are calibrating unit, turn the desired trip point potentiometer adjustment 4 or 5 turns clockwise.

6.3 CALIBRATION OR CHECKING PROCEDURE FOR SW1 TRIP POINT

6.3.1 With no power applied to unit, connect an ohmmeter to terminals 10 and 12 (no other wires attached). The ohmmeter should indicate zero resistance (short circuit). This is the normally closed contact on relay SW1.

6.3.2 Apply correct DC power to terminals 1 and 2 of speed switch. The ohmmeter connected to terminals 10 to 12 should still indicate zero resistance, because you should be below the trip point for SW1 and it should not change states when power is applied to the unit.

NOTE

If you are only checking calibration point, omit steps 6.3.3 and 6.3.4 and go to step 6.3.5.

6.3.3 Adjust the signal generator frequency to the desired SW1 set/trip point as specified or calculated in step 6.2.1.

6.3.4 Slowly turn the SW1 setpoint potentiometer adjustment counterclockwise until the ohmmeter indicates an open circuit. This gives you the correct setpoint for SW1.

6.3.5 Slowly increase the signal generator frequency until the ohmmeter connected to terminals 10 to 12 indicates an open circuit. Note the frequency and verify that it is correct for your SW1 set/trip point requirements. If set/trip point of SW1 is correct it is properly calibrated. If set/trip point is incorrect, go to step 6.2.3, 6.3.3 and 6.3.4 and calibrate unit.

6.4 CALIBRATION OR CHECKING PROCEDURE FOR OS-SW2 TRIP POINT

6.4.1 With no power applied to unit, connect an ohmmeter to terminals 7 and 9 (no other wires attached). The ohmmeter should indicate zero resistance (short circuit). This is the normally closed contact on relay OS-SW2.

6.4.2 Apply correct DC power to terminals 1 and 2 of speed switch. The ohmmeter should indicate zero resistance (short circuit) with the signal generator frequency set below the OS-SW2 set/trip point; therefore, it must not change states when power is applied.

NOTE

If you are only checking calibration point, omit steps 6.4.3 and 6.4.4 and go to step 6.4.5.

6.4.3 Adjust the signal generator frequency to the desired OSSW2 set/trip point as specified or calculated in step 6.2.1.

6.4.4 Slowly turn the OS-SW2 potentiometer counterclockwise until the ohmmeter indicates an open circuit. This gives you the correct setpoint for OS-SW2.

6.4.5 Slowly increase the signal generator frequency until the ohmmeter connected to terminals 7 to 9 indicates zero resistance. Note the frequency and verify that it is correct for your OS-SW2 set/trip point requirements. If set/trip point of OS-SW2 is correct, it is properly calibrated. If set/trip point is incorrect, go to step 6.2.3, 6.4.3 and 6.4.4 and calibrate unit.

7.0 TROUBLESHOOTING PROCEDURE

The unit is potted and, therefore, non-repairable, but the following checkpoints can be used to determine if there is an internal fault.

7.1 UNIT DOES NOT FUNCTION

7.1.1 Check battery voltage on terminals 1 and 2.
DYNZ-60010-000-0-40 — 8 to 40 Vdc
DYNZ-60012-000-0-74 — 58 to 88 Vdc
DYNZ-60013-000-0-40 — 8 to 40 Vdc

7.1.2 Check input signal from MPU on terminals 5 and 6 with an AC voltmeter — must be greater than 0.7 volts rms.

7.1.3 Check wiring to speed switch.

7.2 TRIPPING AT WRONG RPM

7.2.1 Check for proper trip point settings.

7.2.2 See calibration section.

7.3 RELAY DOES NOT FUNCTION

7.3.1 Check wiring to relays.

7.3.2 Check relay contacts for proper operation.

– 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.

- NOTE -

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