Technical Manual

DYNA II
Digital Isochronous Load Sharing Module

Models:

DYN2 80108*

DYN2 80109*

DYN2 80110*

*CE

Table of Contents

1.0 INTRODUCTION

1.1 FUNCTION

The Barber-Colman DYNA II Digital Isochronous Load Sharing Control operates with any of the DYNA all-electric precision governors. This combination permits proportional division of a common load between multiple engine-generator sets while maintaining a fixed frequency on an isolated bus.

1.2 MULTI-GEN SET CAPABILITY

The ILS Control will enable a common load to be proportionately shared among any number of engine generators in a system. The generators need not have the same kilowatt ratings. All generators in the system will assume equal percentages of their full load capacity.

1.3 THREE BASIC MODELS

Three models of the isochronous load sharing control are available.

1. 115 to 230 Volts AC, 50 to 60 Hz — DYN2-80108.
2. 240 to 480 Volts AC, 50 to 60 Hz — DYN2-80109.
3. 240 to 480 Volts AC, 400 Hz — DYN2-80110.

1.4 LOAD PULSE

The load pulse feature senses generator load changes and signals the governor to increase or decrease engine fuel before there is an actual change in engine speed. Depending upon the engine being controlled, offspeed transient performance may be improved by up to 25-30 percent. The amount of load pulse is adjustable.

1.5 SAFETY

The module's cover protects all adjustments and covers the terminal strip when in place.

1.6 DROOP MODE

In addition to isochronous operation, a droop mode may be selected for applications when generators are paralleled with an infinite bus.* The maximum amount of droop is adjustable from 0 to 10 percent at full load.

1.7 HIGH RELIABILITY

The DYNA II Digital ILS Module employs all solid state circuitry for high reliability. After assembly, each unit is subjected to thorough functional testing under operating conditions.

1.8 ENCLOSURE

The Digital ILS Module is one compact assembly. No separate burden resistor box is required. The module cover is a sturdy non-conductive plastic that is secured to the module by two knurled nuts. The module is designed for behind-the-panel mounting.

*Infinite bus is defined as a bus so large that an engine being placed in parallel with this bus will not be able to affect the bus frequency.

2.0 PARALLEL OPERATION USING DIGITAL ILS MODULE

2.1 ISOCHRONOUS CONFIGURATION

The object of isochronous load sensing is to proportionally divide a common load between two or more engine generator sets while maintaining a fixed frequency on an isolated bus. Each DYN2 Digital ILS Control compares the load of its generator unit with the load applied to all other units in operation, through the paralleling lines, and either decreases or increases the engine fuel to maintain its proportional share of the total load.

Figure 4, in the Installation section, shows a *typical* DYN2 Digital ILS wiring diagram for parallel isochronous operation of two generators.

2.2 DROOP CONFIGURATION

The droop configuration is necessary to limit the load carried by the engine generator sets when paralleled with an infinite bus. The infinite bus frequency is fixed; therefore, operating isochronously will either overload the engine/ generator or cause shutdown on reverse current, depending upon whether the reference speed for the engine/generator is below or above the bus frequency.

All engine/generators should be set to the same droop when connected to the bus. Once the engine/generators are paralleled in droop on an infinite bus, load is picked up by increasing the fuel on each engine/generator.

The droop mode is obtained when terminal 11 is connected to terminal 12. The amount of droop is adjustable over the range of 0 to 10% by setting the "droop" potentiometer.

2.3 LOAD PULSE

The load pulse feature senses generator load changes and signals the governor to increase or decrease engine fuel before there is an actual change in engine speed. Depending upon the engine being controlled, offspeed transient performance may be improved by up to 25-30%. The amount of load pulse is adjustable.

2.4 THE ILS MODULE CAN PROVIDE GOVERNOR CONTROL IN FOUR MODES

- Single unit isochronous
- Single unit droop
- Parallel unit isochronous
- Parallel unit droop

3.0 SPECIFICATIONS

AC Voltage Inputs

Model with Line to Line Voltage of 115 to 230 ±20% Vac Input (50 or 60Hz ±5%): Digital ILS Module — Part No. DYN2 80108.

Model with Line to Line Voltage of 230 to 480 ±20% Vac Input (50 or 60Hz ±5%): Digital ILS Module — Part No. DYN2 80109.

Model with Line to Line Voltage of 230 to 480 ±20% Vac Input (400 Hz ±5%): Digital ILS Module — Part No. DYN2 80110.

DC Voltage Input 9 to 30 Vdc.

Current Input 3 phase.
2.5 to 5.0 Amperes per phase at maximum generator load.

0.32 VA burden per phase on each current transformer at 2.5 Amperes.

1.25 VA burden per phase on each current transformer at 5.0 Amperes.

Load Sharing Setability (Accuracy)
Adjustable to ±0.5% between sets of equal size at full load.

Outputs (Dependent on Load Gain Adjustment)

Test Jacks: TP1 to TP2 — 6.0 Vdc typical at full load.

Paralleling Line: 3.0 Vdc typical at full load.

Speed Correcting Signal: Compatible with standard DYN1 controllers.

Reverse Power Relay Contacts: Normally closed
10 Amperes resistive at 115 Vac (UL Approved)
5 Amperes resistive at 230 Vac (UL Approved)

Forward Power Relay Contacts: Normally open
10 Amperes resistive at 115 Vac (UL Approved)
5 Amperes resistive at 230 Vac (UL Approved)

Forward Power Monitor: 0 to 5 Vdc or 0 to 5 mAdc analog signal with full scale accuracy of 1%. Minimum meter movement of 10,000 ohms.

4.0 ADJUSTMENTS

Current Transformer Calibration
"CT Cal"— calibration to correct for variation in current obtained from the current transformers. Clockwise increases the output signal obtained at the test points.

Load Sharing Gain
"LS Gain"— test point signal — clockwise increases signal voltage at test points, TP1 to TP2. Clockwise will decrease percentage of load carried by the generator.

Droop 0 to 10% — clockwise increases droop setting.

Load Pulse Clockwise increases load pulse output.

Reverse Power Relay Trip Point
"RPLVL" — clockwise increases trip point. Trip point is adjustable with a range of 0 to 40% of full load. The trip point has an inverse time constant which decreases relay trip time on larger reverse power levels.

Examples:

- Trip time with a reverse power of 5% over setpoint is approximately 20 seconds.
- Trip time with a reverse power of 40% over setpoint is approximately 5 seconds.

Forward Power Relay Trip Points

On Point: "FP On" — clockwise to increase, independent of "Off" point, adjustable with a range of 20 to 120% of full load.

Off Point: "FP Off" — clockwise to increase, independent of "On" point, adjustable with a range of 10 to 100% of full load.

Forward Power Monitor Gain
"PM Gain" — clockwise to increase analog output signal, adjustable range of 5.0 Vdc or to 5 mAdc minimum at full load.

5.0 ENVIRONMENTAL

Ambient Operating Temperature
-40° to 85°C (-40° to 185° F).

Enclosure
The Digital ILS Module is one compact assembly. The module cover is a sturdy nonconductive plastic that is secured to the module by two knurled nuts. The module is designed for behind-the panel mounting.

Mounting Attitude at any position.

Vibration
Withstands the following vibration without failure or degraded performance: 0.06 inch double amplitude at 5 to 18 Hz; 1 G at 18 to 30 Hz; 0.02 inch double amplitude at 30 to 38 Hz; 2.5 G's at 48 to 70 Hz.

Shock
Withstands 15 G's in each of three mutually perpendicular axes.

Humidity
Will operate properly through condensing conditions.

Manual F-22396 A.

Typical Wiring Diagram
Bulletin 16H,16J,16K,16L, 16N, 16O, 16P, 16Q, 16R, 16S, 16T, 16U, 16V (for CE).

Weight
1.25 Kg (2.75 lbs.).

6.0 INSTALLATION

6.1 INTRODUCTION

This section provides general instructions for installing the DYNA II Digital ILS Modules. Power requirements, environmental precautions and location suggestions are included.

6.2 DC POWER REQUIREMENTS

The Digital ILS Module receives its DC power from the DYNA control box and a separate 9.0 to 30.0 Vdc voltage connected to terminal 24. This voltage can be the same DC power source as that used for the DYNA governor if the DC voltage is +12 or +24 Vdc.

6.3 ENVIRONMENTAL PRECAUTIONS

The Digital ILS Module is designed to operate properly over the ambient temperature range of -40° to 185°F (-40° to 85°C).

The unit can be mounted in any position. When mounting the Digital ILS Module, consider the following: adequate space for ventilation, proximity to other equipment, servicing or repairs and environmental conditions.

6.4 WIRING THE DIGITAL ILS MODULE

Wiring diagrams, Figures 4 and 4A, provide typical external connections for the Digital ILS Module. Make sure the wiring for the unit is installed properly and that all shields are connected as shown in the typical wiring diagram or as shown in the application bulletin.

NOTE
For CE certifications, all shield connections are to be terminated to the provided chassis terminals. (See Bulletin 16V)

NOTE
If neither terminal 17 nor terminal 18 is wired externally, wire terminal 15 to terminal 18.

CAUTION
Do not run shielded lines in same conduit as heavy current carrying cables.

6.5 DROOP ISOCHRONOUS SWITCH

This switch (see Figures 4 and 4A) is not required if the Digital ILS will only be used in the Isochronous mode of operation.

6.6 SIGNAL FLOW BACK DIAGRAM

Figure 3 shows the basic signal flow paths between the different sections of the Digital ILS Module.

6.7 WIRING OF PHASE VOLTAGE AND PHASE CURRENT

1. Proper phase and polarity must be maintained.
2. Phase voltages for A, B and C are obtained from the generator side of the circuit breaker and connected to the appropriate ILS terminals 1, 2 and 3.

NOTE
If the generator output voltage is higher than the input voltages of the ILS being installed, potential transformers must be used to step the voltage down to the appropriate values. (See notes 2 and 5 on Figure 4 for the current and voltage transformer VA ratings.)

CAUTION
Under-frequency protection should be provided for the generator if engine can be operated in an idle mode.

6.8 TEST EQUIPMENT (TYPICAL)

Type	Model	Characteristics
Volt-Ohm-Meter	Triplett 310 C or equivalent	20,000 ohms/volt ±3% accuracy

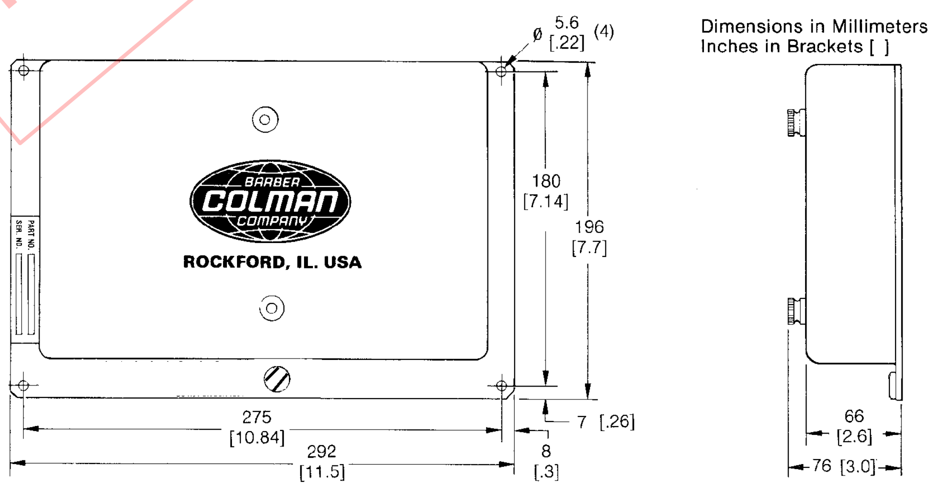

Figure 1. Dimensions
(for reference only)

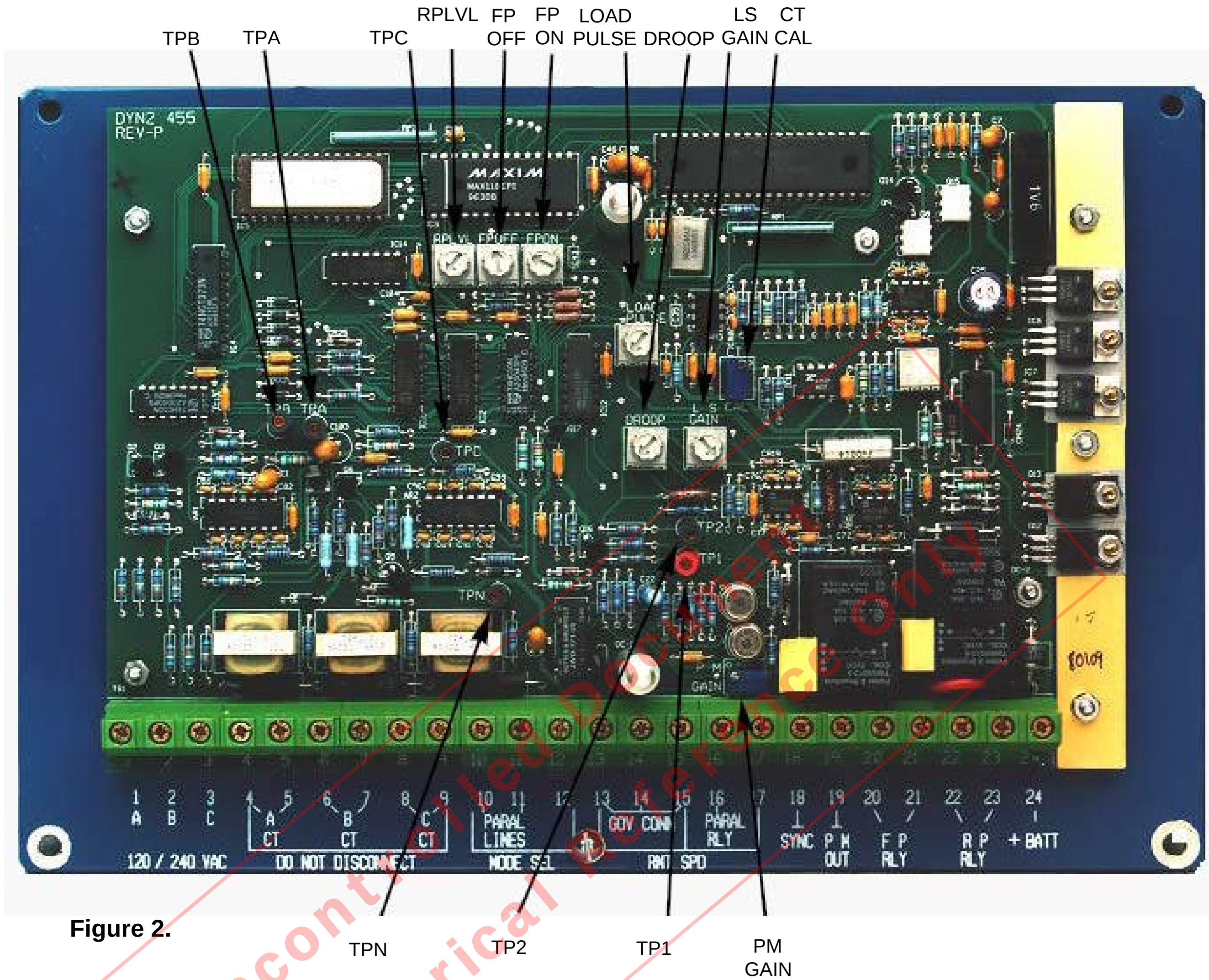

Figure 2.

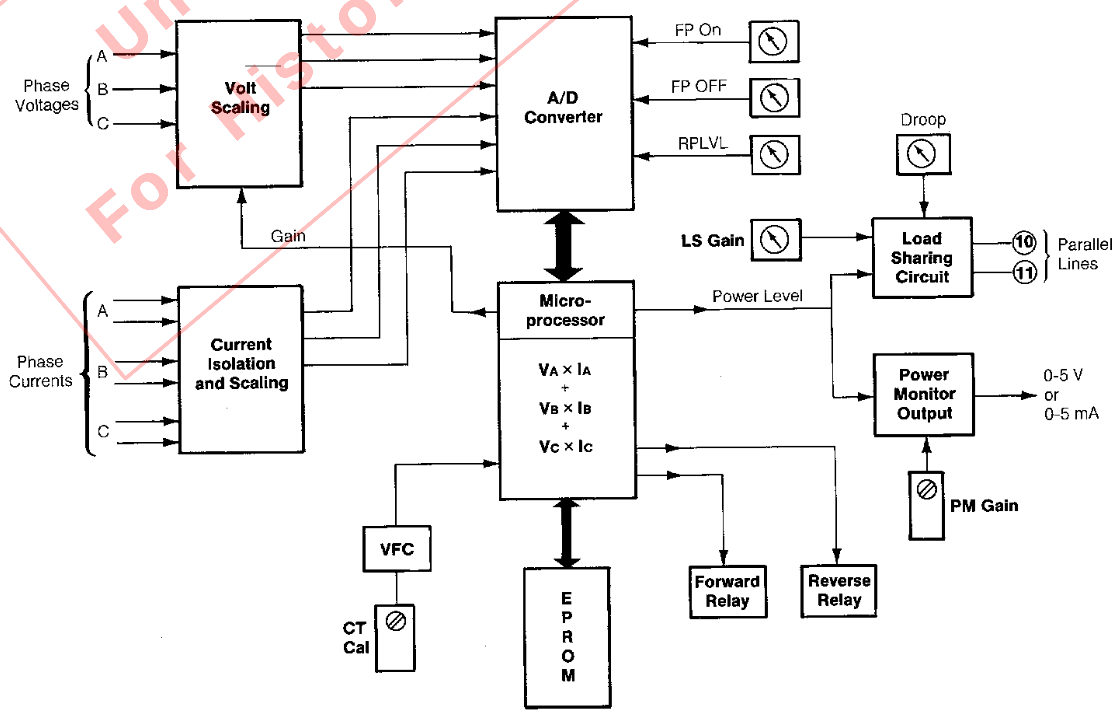

Figure 3. Block Diagram of DYNA II Digital Isochronous Load Sharing Module

6.9 DIGITAL ISOCHRONOUS LOAD SHARING CONTROL

The Digital Isochronous Load Sharing Control, DYN2 80108, DYN2 80109 or DYN2 80110 can be used with the DYNA 8000 governor to provide control of an engine generator set by maintaining preset engine speed or proportional sharing of load between similar or dissimilar generators. Both droop and isochronous modes can be selected.

Figure 4 illustrates the wiring of two engine generator sets having DYNA 8000 governors and Digital Isochronous Load Sharing Controls. Additional engine generator sets can be paralleled by wiring them at the point designated, PARALLELING LINES TO OTHER SYSTEMS.

CAUTION

It is recommended that an independent overspeed shutdown device be incorporated in every engine control system.

NOTES
(Refer to Figure 4 on next page)

1. If more than one engine is started using the same battery supply, use separate battery supply for each governor system. Twist power leads and use shielded leads as shown

2. Select current transformers to provide 2.5 to 5.0 amps at full rated load. Current transformers require nominal 0.32 VA/PHASE at 2.5 amps 1.25 VA/PHASE at 5.0 amps

3. Observe current transformer polarity markings when connecting.

4. Power switch current rating: 10 amps.

5. Phasing of potential to Terminals 1, 2 and 3 is necessary to keep each signal in its correct phase relationship. If the generator voltage is not the same as the voltage range on Terminals 1, 2 and 3 of the Isochronous Load Sharing Control, a step-down transformer is required. Correct phasing of the transformer leads is necessary. Step-down transformers require nominal 1 VA/PHASE

6. Droop/Isochronous switch is not required if units are always operated in the Isochronous mode

7. Digital ILS
   DYN2 80108 — 115/230 Vac input-50/60 Hz
   DYN2 80109 — 230/480 Vac input-50/60 Hz
   DYN2 80110 — 230/480 Vac input-400 Hz

8. DYNA 8000 Controllers

9. DYNA 8000, 8200, or 8400.

NOTE

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

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

NOTE

See Bulletin 16V for proper CE wiring.

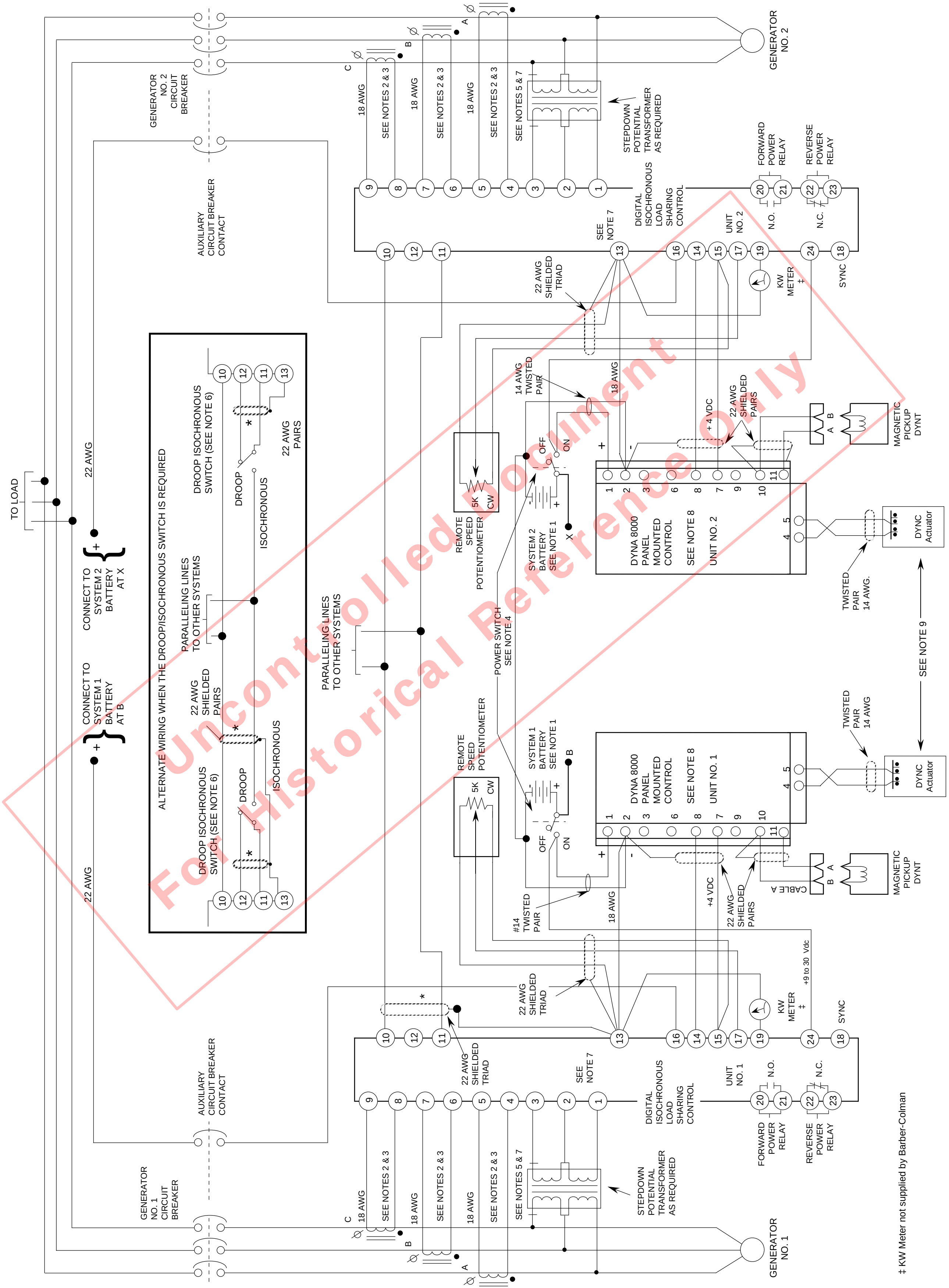

Figure 4. Typical Electrical Schematic DYNA 8000 Governor

6.10 DIGITAL ISOCHRONOUS LOAD SHARING CONTROL

The Digital Isochronous Load Sharing Control, DYN2 80108, DYN2 80109 or DYN2 80110 can be used with the DYNA governor to provide control of an engine generator set by maintaining preset engine speed or proportional sharing of load between similar or dissimilar generators. Both droop and isochronous modes can be selected.

Figure 4A illustrates the wiring of two engine generator sets having DYNA governors and Digital Isochronous Load Sharing Controls. Additional engine generator sets can be paralleled by wiring them at the point designated, PARALLELING LINES TO OTHER SYSTEMS.

CAUTION

It is recommended that an independent overspeed shutdown device be incorporated in every engine control system.

NOTES

(Refer to Figure 4A on next page.

1. If more than one engine is started using the same battery supply, use separate battery supply for each governor system. Twist power leads and use shielded leads as shown.
2. Select current transformers to provide 2.5 to 5.0 amps at full rated load. Current transformers require nominal 0.32 VA/ PHASE at 2.5 amps 1.25 VA/PHASE at 5.0 amps
3. Observe current transformer polarity markings when connecting.
4. Power switch current rating 10 amps.
5. Phasing of potential to Terminals 1, 2 and 3 is necessary to keep each signal in its correct phase relationship If the generator voltage is not the same as the voltage range on Terminals 1, 2 and 3 of the Isochronous Load Sharing Control, a step-down transformer is required. Correct phasing of the transformer leads is necessary. Step-down transformers require nominal 1 VA/ PHASE.
6. Droop/Isochronous switch is not required if nits are always operated in the Isochronous mode.
7. Digital ILS
   DYN2 80108 — 115/230 Vac input-50/60 Hz
   DYN2 80109 — 230/480 Vac input-50/60 Hz
   DYN2 80110 — 230/480 Vac input-400 Hz
8. DYNA Controllers: DYN1 10502, DYN1 10503, DYN1 10504 or DYN1 10506
9. DYNA Actuators: Plus 1 or Plus 4
   Plus 1 Units — DYNC 11000, DYNC 11001, DYNC 11002, DYNC 11004, DYNC 11005 or DYNC 11006
   Plus 4 Units — DYNC 14000

NOTE

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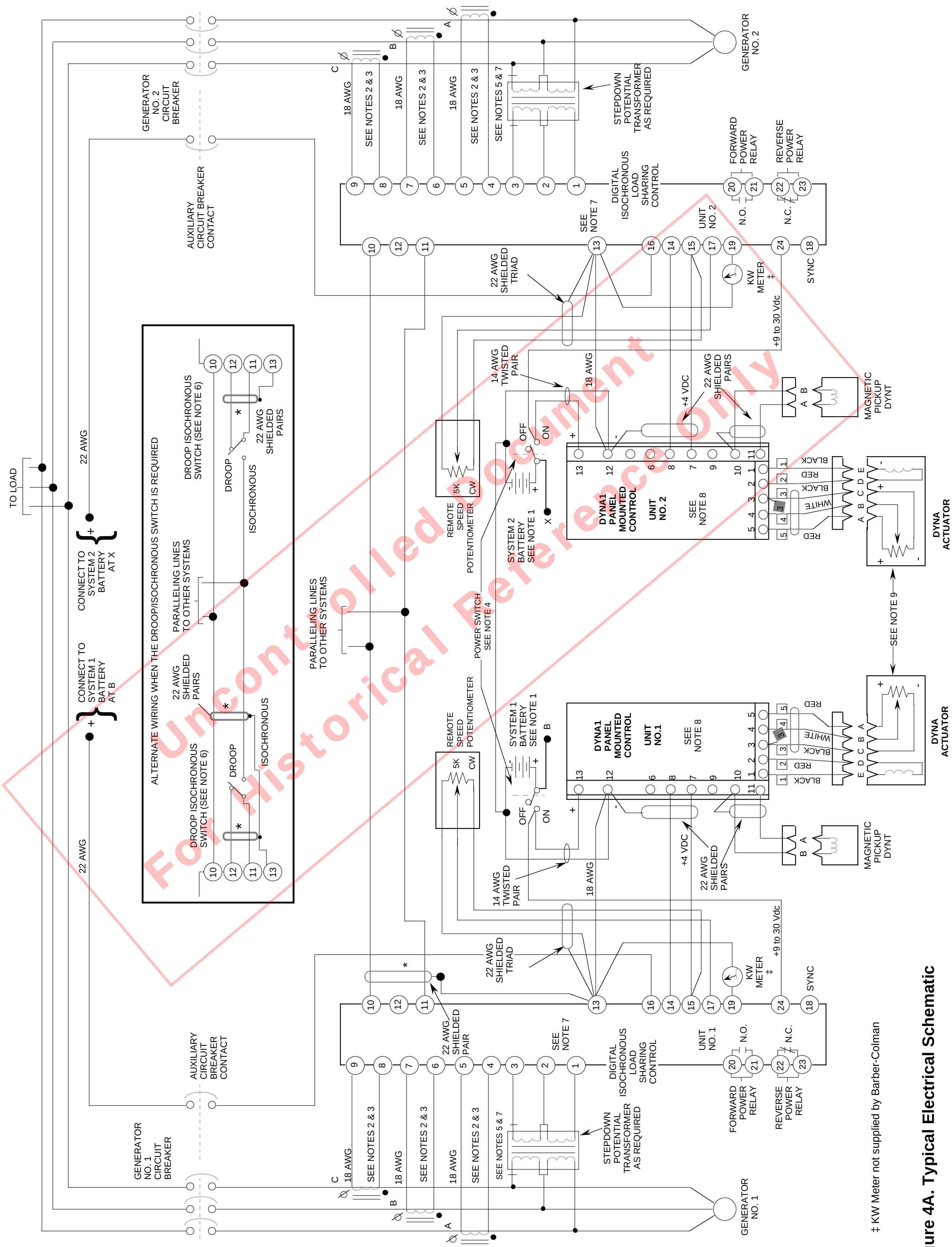
*Shielded Cable — should be purchased from Barber-Colman or customer should purchase a cable with a wrapped mylar supported aluminum foil shield with a drain wire.

NOTE

See Bulletin 16V for proper CE wiring.



‡ KW Meter not supplied by Barber-Colman

Figure 4A. Typical Electrical Schematic

7.0 CALIBRATION INSTRUCTIONS FOR DIGITAL ILS

7.1 INSTALLATION CHECKOUT

Following completion of system wiring and before starting the engine/generator, perform the checkout procedure to assist in verifying that the ILS unit is operational. These checks provide an indication of the unit's operating capability.

7.1.1 Remove the ILS module cover.

7.1.2 Visual inspection.

a. Check all wiring for loose connections or broken wires.

b. Check wiring to verify it agrees with the system wiring diagram.

c. Repair or correct wiring before starting engine/ generator.

7.1.3 ILS initial potentiometer settings.

a. Set "LS Gain" potentiometer fully clockwise.

b. Set "Droop" potentiometer fully counterclockwise.*

c. Set forward power on, "FP On", potentiometer fully CW.

d. Set forward power off, "FP Off", potentiometer fully CW.

e. Set reverse power, "RPLVL", potentiometer fully CW.

f. Set "Load Pulse" potentiometer fully CCW.

NOTE
"Balance" potentiometer is factory set.

* If the unit must be set up against an infinite bus, then set "Droop" potentiometer at mid-range for a starting point.

7.1.4 If "Remote Speed" potentiometer is used, set it to mid-range.

(The Barber-Colman potentiometer is a 10-turn unit.)

7.1.5 Check the DYNA controller and, if necessary, set potentiometer as called out on the calibration and adjustments sheet for the DYNA I controller.

CAUTION
Current transformers must be connected to burden resistors. Do not operate engine/generator when any leads are removed from terminals 4, 5, 6, 7, 8 or 9 of the ILS module. Current transformers can develop dangerously high voltages when they are operated into an open circuit.

7.1.6 Start the engine.

a. If the actuator does not allow the fuel system to open far enough to allow engine to start, the "Speed" potentiometer will have to be adjusted clockwise to increase the speed setting.

b. Adjust the DYNA controller's internal "Speed" potentiometer until the engine/generator is operating at the correct RPM for generating the desired generator output frequency.

c. Calibrate the DYNA controller per the calibration and adjustment sheet for the controller.

d. Once engine/generator is running stable, proceed to step 7.1.7, ILS voltage and current phasing check.

7.1.7 ILS voltage and current phasing check.

a. Start engine/generator and load unit to as near full load as possible with a unity power factor load. Keep load constant and balanced.

b. Connect DC voltmeter to TP1 and TP2 test jacks. See Figure 2 in the Installation section. The red jack is plus and the black jack is minus. The positive lead of the voltmeter goes into the red jack.

Adjust the C.T. CAL potentiometer to achieve 7.5 Vdc at the test points. Clockwise increases test point voltage; counterclockwise decreases test point voltage.

CAUTION
Current transformers must be connected to burden resistors. Do not operate engine/generator when any leads are removed from terminals 4, 5, 6, 7, 8 or 9 of the ILS module. Current transformers can develop dangerously high voltages when they are operated into an open circuit.

c. Check for correct phasing of the voltage and current inputs to the ILS module by placing a jumper between test points TPA and TPN (phase A). The voltage at test jacks TP1 and TP2 should drop by approximately 1/3. Remove jumper from between test points TPA and TPN.

Repeat procedure for test points TPB and TPN (phase B) and test points TPC and TPN (phase C). Each time the voltage should drop by 1/3. If the above conditions are not obtained, proceed with the next step to establish the correct phase relationship for the potential and current transformer connections. If the phase wiring is correct, proceed to step 7.1 .8.

NOTE
Improper wiring of the three-phase current and voltage inputs causes most parallel load sharing difficulties. The voltage of one phase is often wired with the current signal of another phase or transformers are wired in backwards so that the two signals oppose rather than add to each other.

d. Stop the engine. Recheck the wiring. Make certain all CTs are phased identically and that the voltage at terminal 1 comes from the same phase as the CT connected to terminals 4 and 5. Terminal 2's voltage connection should be from the same phase as the CT connected to terminals 6 and 7, and terminal 3's voltage should be from the same phase as the CT connected to terminals 8 and 9. Correct any mistakes and repeat steps A through C, recording the voltage at the test points for each step.

e. Stop the engine. If the test point voltage is negative, but still drops by 1/3 when the jumper is applied to each CT connection, then all CTs are phased backwards. Terminals 4 & 5, 6 & 7 and 8 & 9 should be swapped. If the jumper causes any test point voltage to increase, then it is likely that phase is backwards.

f. To determine if all CTs are functioning, the voltage across the ILS's burden resistors can be read. This voltage should be .05 ohms x secondary current. Check that the CT scaling is correct for your generator.

g. When proper power measurement is achieved, proceed to step 7.1.8.

7.1.8 CT Cal adjustment.

a. Start the engine and load the generator to 100% load. Then adjust the I LS module "CT Cal" potentiometer for 7.5 Vdc at TP1 and TP2. The following table can be used for setting TP1 and TP2 if 100% load cannot be obtained.

% Load	TP1 to TP2 DC Voltage
80	6.00
50	3.50
20	1.50

b. Do not adjust the CT Cal potentiometer again. It may be desirable to apply an adhesive such as RTV to make further adjustment more difficult.

7.1.9 LS Gain adjustment.

a. Next, with the same load applied, turn the "LS Gain" potentiometer CCW until the test point voltage drops to 8/10 of its previous value.

b. At unity power factor measure the governor KW output or calculate it based on voltage and current readings.

7.1.10 PM Gain adjustment.

a. The ILS current transformer burden resistors are .05 ohms. Phase currents can be determined by measuring the voltage across the burden resistors, calculating the current transformer current,

$$\frac{V_{burden}}{.05} = \text{CT current}$$

and scaling upward by the current transformer step down ratio.

KW can be calculated with the following equation:

$$KW = \frac{1.732\ V_{LL}}{3000}\ (I_A + I_B + I_C)$$

b. The power monitor output has a range of 0-5 volts DC or 0-5 mA for 100% load and the test points at 7.5 volts. Adjust the "PM Gain" potentiometer to provide the correct KW reading on your meter. Lock the "PM Gain" potentiometer with adhesive.

c. Now continue with the other adjustments as necessary in steps 7.1.11, 7.1.12, 7.1.13 and 7.1.14.

7.1.11 ILS "Droop" potentiometer adjustment.

a. Turning the "Droop" potentiometer clockwise increases the percentage of droop. The "Droop" potentiometer sets the amount of speed regulation for the prime mover. The "Droop" potentiometer biases the wheatstone bridge in a direction to cause the speed to decrease with an increase in load. Percent of droop is the difference in engine speed at no load with respect to engine speed at full load expressed as a percentage. The ratio of full load capacity to actual load must be taken into consideration when the load does not have a unit power factor. To set droop, proceed with the following steps.

b. Set Droop/Isochronous switch to droop position. If switch is not used, make sure ILS terminal 11 is connected to terminal 12.

c. Set ILS "LS Gain" potentiometer to obtain 6V at TP1 and TP2 at full load. This voltage TP1 and TP2 must be set to the same value on all engines in the same system.

NOTE

If stability problems are evident during paralleling, reduce the voltage at the TP1 and TP2 by turning the LS Gain CCW. This reduction must be done on all ILS modules. All test point voltages must be equal at full load.

d. Set "Droop" potentiometer to provide desired percentage of droop.

e. Operate engine/generator at correct frequency of 50 or 60 Hz no load and record Hz reading. This is frequency F1.

f. Load engine/generator to full load and record Hz reading. This is frequency F2.

g. Calculate droop as shown below:

$$\%\ \text{Droop} = \frac{F1 - F2}{F2} \times 100$$

h. The above procedure may have to be repeated several times to obtain the desired percentage of droop.

7.1.12 ILS "Load Pulse" potentiometer adjustment.

NOTE

If "Load Pulse" function is not being used, the "Load Pulse" potentiometer must be set fully counter-clockwise.

a. load pulse sensor provides a pulse output to the amplifier when a step change in load on the generator occurs.

b. The "Load Pulse" adjustment should be set to provide the minimum pulse necessary to meet the required transient response of the system.

c. Set "Load Pulse" potentiometer fully counterclockwise.

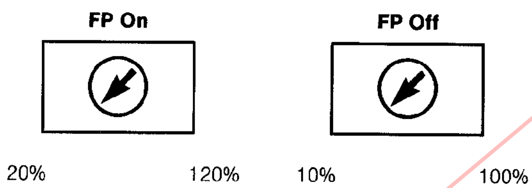
d. If a recording of transient response is necessary, connect recorder to engine/generator under test.

e. Apply and reject load per requirement.

f. Increase the "Load Pulse" potentiometer and repeat step e until the offspeed transients meet the limits specified.

7.1.13 Forward power on and off point adjustments (FP On and FP Off).

a. The forward power on and off points can be approximately set without starting the engine. The off point must always be lower than the on point, and if having off and on points close together is desired, proceed to step b.



If no relay closure is desired, set both adjustments fully CW.

b. Turn the Forward Power On potentiometer fully CW.

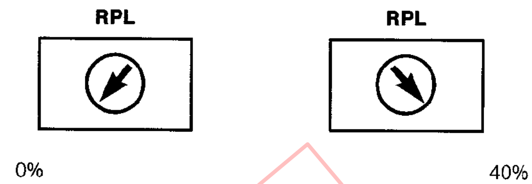
c. Turn the Forward Power Off potentiometer fully CCW.

d. Start the engine and load it to the desired forward power on point. Slowly turn the Forward Power On potentiometer CCW until the forward power relay closes. The Forward Power On potentiometer is now set.

e. Reduce generator loading to the desired forward power off point. Slowly turn the Forward Power Off potentiometer CW until the forward power relay opens again. The Forward Power Off potentiometer is set. It may be desirable to lock both settings with an adhesive to prevent further adjustment.

7.1.14 Reverse power level adjustment (RPLVL).

a. The reverse power relay trip point can be approximately set without starting the engine. Its range of adjustment is 0% to 40% of generator maximum load with 40% being fully clockwise.



b. If more precise adjustment is needed, the generator can be loaded to the reverse power level desired and the RPL potentiometer slowly turned CCW until the reverse power relay opens.

Reverse power level will have to be monitored at the test points. The power monitor output does not indicate reverse power.

c. If the generator cannot be loaded into a reverse power condition, simulated reverse power can be used for calibration by reversing the CT polarities. This can be done by reversing the CT leads at terminals 4 & 5, 6 & 7 and 8 & 9. Load the generator to the desired reverse power level but in forward power. Slowly turn the RPL potentiometer CCW until the reverse power relay opens. It may be wise to lock this adjustment also. Stop the engine and be sure to correct terminals 4 & 5, 6 & 7 and 8 & 9.

8.0 TROUBLESHOOTING FOR DYNA II DIGITAL ILS

All voltage measurements are made with respect to battery negative on the controller, unless otherwise noted.

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
I. Engine operating above desired rpm and adjusting Remote Speed potentiometer does not bring unit back to operating speed.	1. Lead between DYN1 controller and terminal 13 on ILS is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	2. Lead between terminal 17 of ILS and the Remote Speed potentiometer is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	3. Lead between DYN1 controller and terminal 14 of ILS is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	4. Lead between terminal 13 of ILS and the CCW end of Remote Speed potentiometer open or not connected.	1. Measure lead with ohmmeter for continuity. 2. Measure DC voltage between terminal 13 of ILS and the CW end of Remote Speed potentiometer. (CW end is positive.) This should be +4.0V ±0.5V.	1. Change or correct wiring.
	5. Faulty Remote Speed potentiometer. (Potentiometer open internally at CCW end.)	1. Remove lead from one end of Remote Speed potentiometer, then measure potentiometer with ohmmeter for continuity between CW and CCW end. Measure approximately 5000 ohms. If continuity is not achieved (measures open circuit), potentiometer is faulty.	1. Replace potentiometer.
II. Engine low in rpm and adjusting Remote Speed potentiometer does not bring unit back to operating speed.	1. Lead to terminal 14 of ILS shorted to pin 13 of ILS.	1. Using an ohmmeter, measure for a short circuit between terminals 13 and 14 on ILS.	1. Correct wiring.
	2. Lead between DYN1 controller and terminal 15 on ILS is open or not connected.	1. Measure lead with ohmmeter for continuity. 2. Measure DC voltage between terminals 13 and 15 of ILS. (Terminal 15 is positive.) This should be +4.0V ±0.5V.	1. Change or correct wiring.
	3. Faulty Remote Speed potentiometer. (Potentiometer open internally at CW end.)	1. Remove lead from one end of Remote Speed potentiometer. 2. Measure potentiometer with ohmmeter for continuity between CW and CCW end.	1. Replace potentiometer.

All voltage measurements are made with respect to battery negative on the controller, unless otherwise noted.

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
III. ILS units will not share load in correct proportions.	1.TP1 to TP2 voltage (Gain) not set up properly for each ILS unit.	1.Place units in parallel on bus, then load units until smallest generator is carrying 50% of its capability. Other unit should also be carrying 50% of its capacity. If not, proceed with corrective action.	1. Individually load each engine/generator set to full load. Set "Gain" adjust until voltage TP1 to TP2 reads 6.0 Vdc.**
	1. TP1 to TP2 voltage (Gain) not set up properly for each ILS unit.	1. Place units in parallel on bus, then load units until smallest generator is carrying 50% of its capability. Other unit should also by carrying 50% of its capacity. If not, proceed with corrective action.	2. If full load cannot be obtained but 50% can, then set "Gain" adjust until voltage TP1 to TP2 reads 3.0 Vdc.†
IV. ILS unit will not share load. (One of the engines takes all the load or it won't take any load.)	1. In the droop mode of parallel operation, there may not be enough droop set into the system or the droop settings are not the same.	1. Check the no load to full load droop of each ILS unit. Each ILS must be set to the same droop characteristics & the minimum droop setting is 3%.	1. Set all units to the same droop characteristics.
	2. Parallel lines between the ILS units are not connected when units are paralleled. (Terminal 10 of each ILS must be connected to terminal 10 of all other ILS units that are paralleled. Terminal 11 of each ILS must be connected to terminal 11 or all other ILS units that are paralleled.)	1. Check for continuity with an ohmmeter between terminal 10 of one ILS to terminal 10 of all other ILS units that are paralleled. (Resistance reading must be less than 10.0 ohms.)†† 2. Check for continuity with an ohmmeter between terminal 11 of one ILS to terminal 11 of all other ILS units that are paralleled. (Resistance reading must be less than 10.0 ohms.)††	1. Check and correct wiring.
	3. Parallel lines between units are reversed.	1. Check for continuity with an ohmmeter between terminals 10 & 11 of one ILS to terminal 10 & 11 of other ILS units in question. (Resistance and reading must be less than 10.0 ohms.)††	1. Check and correct wiring.

**TP1 to TP2 voltage may be set to a lower value if stability is a problem.
†Remember all ILS units being paralleled must be set to the same voltage, TP1 to TP2, an the same percent of full load.
††Operator may have to manually close all contacts in series with the parallel lines between terminals before making continuity check. (This must be done with system shut down.)

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

— 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.

Barber-Colman DYNA Products
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940
United States of America
Telephone (815) 637-3000
Facsimile (815) 877-0150
www.dynaproducts.com

In Europe contact: Barber-Colman GmbH
Am Neuen Rheinhafen 4, D-67346 Speyer, Germany
Telephone 06232 29903, Facsimile 06232 299155

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