Technical Manual

For

DYNA II

Isochronous Load Sharing Module

Models

DYN2 80100

DYN2 80101

DYN2 80104

DYN2 80105

Table of Contents

INTRODUCTION
DYNA II

Function

The Barber-Colman DYNA II 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.

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.

Four Models

Four models of the isochronous load sharing control are available. There are two basic ILS models and two optional ILS models each with load pulse and ramp generator features.

Basic Models

One basic model is voltage-rated at 115 or 230 volts AC line to line. The other is rated at 230 or 370-480 volts AC line to line.

Load Pulse/Ramp Options

The two optional models are rated at 115 or 230 volts AC line to line and 230 or 370-480 volts AC line to line, and have a load pulse feature and a ramp generator feature.

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 per cent. The amount of load pulse is adjustable.

The ramp generator is an engine control feature that permits engine warm-up before running the engine at operational speed. Operating from an oil pressure monitor switch or a water temperature switch, the ramp first controls the engine at an adjustable idle speed and then gradually increases to operational speed over a time range adjustable to 10 or 20 seconds.

Safety

A special low-voltage terminal strip, located separately from the high-voltage terminals, permits safe phasing and voltage/polarity checks during installation. The module cover protects all adjustments and covers the terminal strip when in place.

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 per cent at full load.

High Reliability

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

Enclosure

The ILS Module is one compact assembly. No separate burden resistor box is required. 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.

*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.

PARALLEL OPERATION USING ILS MODULE

I. 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 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 ILS wiring diagram for parallel isochronous operation of two generators.

II. 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.

III. LOAD PULSE/RAMP OPTIONS

The two optional models are rated at 115 or 230 volts AC, and 230 or 370-480 volts AC, and have a load pulse feature and a ramp generator feature.

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.

The ramp generator is an engine control feature that permits engine warm-up before running the engine at operational speed. Operating from an oil pressure monitor switch or a water temperature switch, the ramp first controls the engine at an adjustable idle speed and then gradually increases to operational speed over a time range adjustable to 10 or 20 seconds.

IV. THE ILS MODULE CAN PROVIDE GOVERNOR CONTROL IN FOUR MODES:

1. Single unit isochronous

2. Single unit droop.

3. Parallel unit isochronous

4. Parallel unit droop.

SPECIFICATIONS

Models with Line to Line Voltage of 115/230 ± 15% Vac Input

Basic ILS Module — Part Number DYN2 80100

ILS Module with load pulse and ramp options — Part Number DYN2 80101

Models with Line to Line Voltage of 230/370-480 ± 15% Vac Input

Basic ILS Module — Part Number DYN2 80104

ILS Module with load pulse and ramp options — Part Number DYN2 80105

Load Sharing Accuracy

Adjustable to + 0.5% between sets at full load

Current Input — All Models

2.5 to 5 amps per phase at maximum generator load

3.2 VA burden per phase on each current transformer at 2.5 amps

12.5 VA burden per phase on each current transformer at 5.0 amps

Output

(Dependent on load gain adjustment)

Test Jacks — 9V typical at full load

Paralleling Lines — 4.5V typical at full load

Adjustments — All Models

Droop — 0-10 per cent, CW to increase

Gain — CW to increase

Adjustments — Models with options

Ramp Time — 0-10 or 20 seconds, CW to increase

Idle Speed — CW to increase

Load Pulse — 0-100 per cent CW to increase

Operating Temperature

-55°C to 82°C

-65°F to 180°F

Weight

1.5 Kg (3.25 lb.)

Listed

INSTALLATION
Reference: DYNA I Controller Manual

Introduction

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

DC Power Requirements

1. The ILS module without ramp generators receives all of its DC power from the DYNA Control Box .

2. The ILS module with ramp generator requires a DC voltage connected to terminal number 21. This voltage can be the same DC power source as that used for the DYNA governor if the DC voltage is +12, +24 or +32V DC.

Environmental Precautions

The ILS module is designed to operate properly over the ambient temperature range of -65°F to 180°F (-55°C to 82°C).

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

Wiring of the ILS Module

Wiring diagram Figure 4 provides typical external connections for the 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 application bulletin 16.

NOTE

If neither terminal 17 or 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.

Droop Isochronous Switch

This switch (See Figure 4) is not required if the ILS will only be used in the isochronous mode of operation.

Signal Flow Block Diagram

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

Wiring of Phase Voltage and Phase Current

1. Proper phase and polarity must be maintained.

2. Voltage from each Phase A, B and C are obtained from the generator side of the circuit break and connected to the appropriate ILS terminals 1, 2 and 3. The installer must determine what voltage terminals are to be used and then make connections to the correct voltage terminals on the ILS.

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.

Test Equipment (Typical)

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

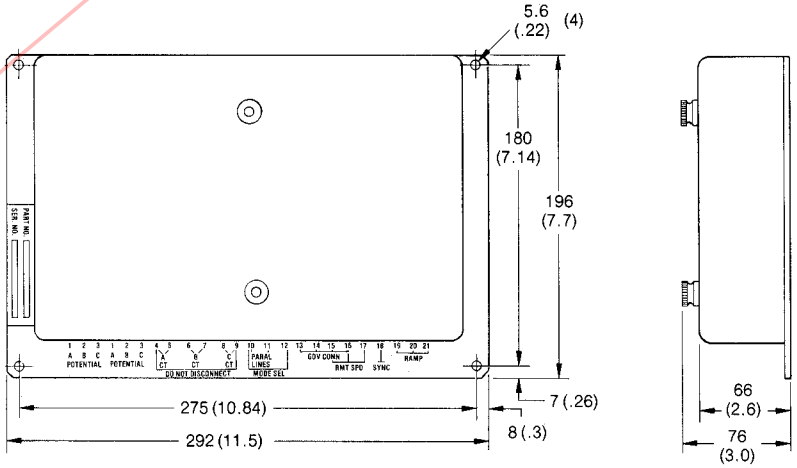
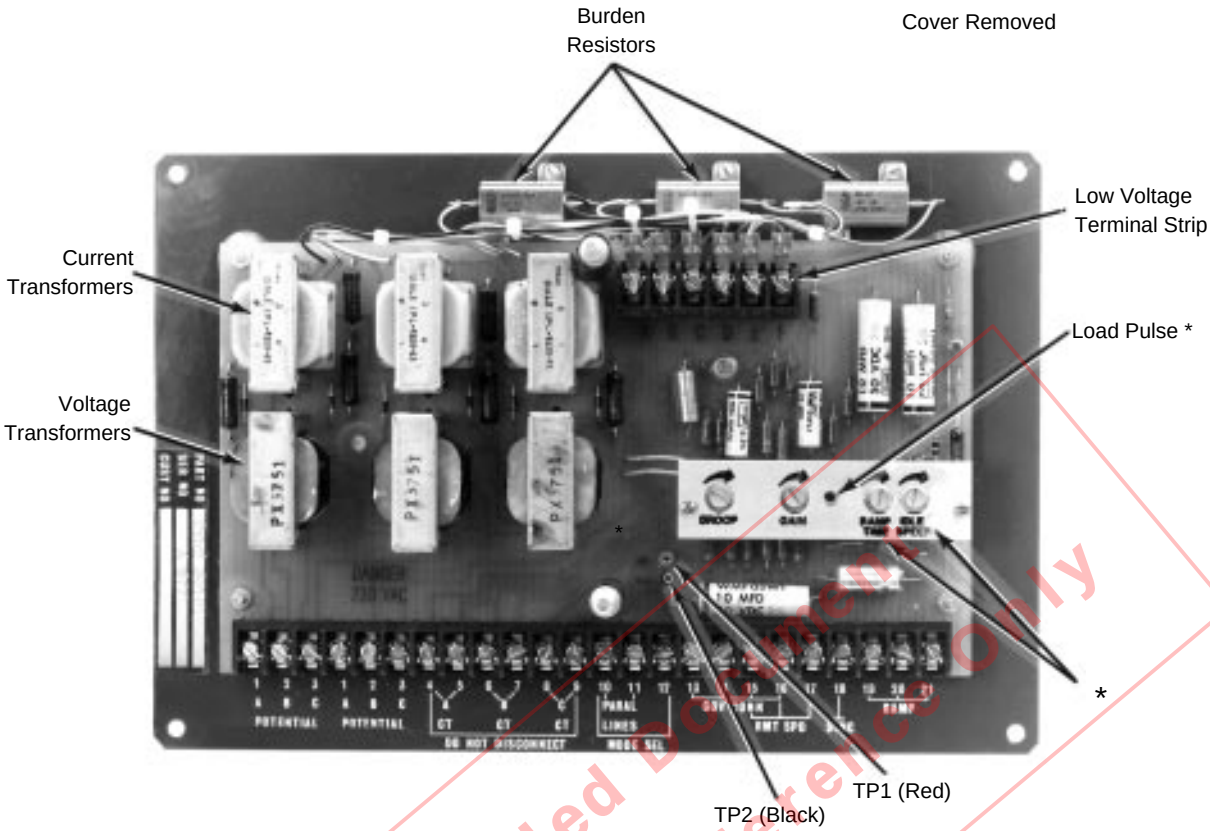
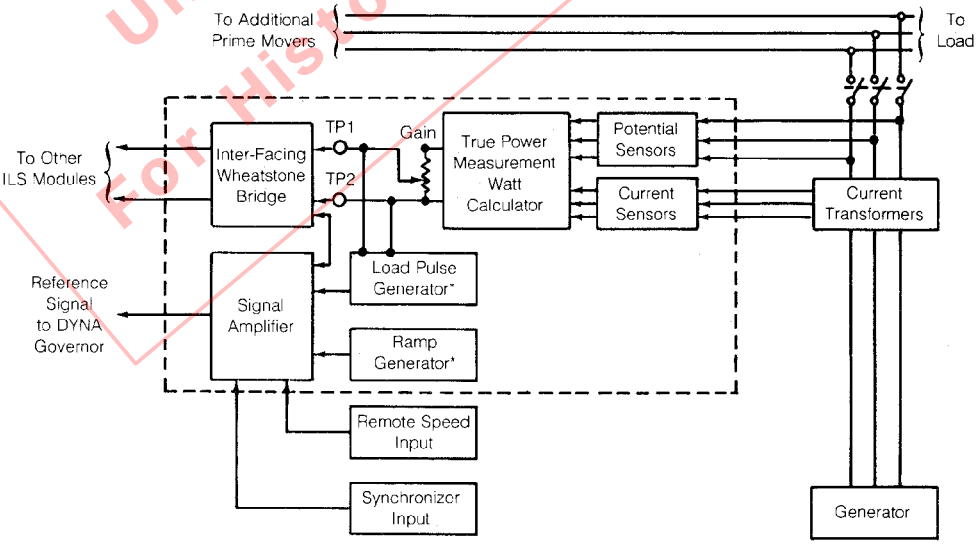


Figure 1. Dimensions (For Reference only)



* These adjustments are not on Models DYN2 80100 and DYN2 80104

Figure 2.



*These functions are not included on Models DYN2 80100 and DYN2 80104.

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

DYNA II Isochronous Load Sharing Control

The DYNA II Isochronous Load Sharing Control (P/N's DYN2 80000, DYN2 80001, DYN2 80100, DYN2 80101, DYN2 80104, or DYN2 80105) can be used with the DYNA I 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 I governors and DYNA II Isochronous Load Sharing Controls. Additional engine generator sets can be paralleled by wiring them at the point designated, PARALLELING LINES TO OTHER SYSTEMS.

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

NOTES

1. Systems battery supply. If more than one engine is started using the same battery supply, use separate battery supply for the DYNA System. Twist power leads as shown. 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 3.2 VA/PHASE at 2.5 amps; 12.5 VA/PHASE at 5.0 amps.
3. Observe current transformer polarity markings when connecting.
4. Power switch current rating:
   For + 1 or + 4 actuators — 10 amps
   For + 8 actuators — 25 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 rating on Terminals 1, 2 and 3 of the isochronous load sharing control, a step-down transformer is required. Contact phasing of the transformer leads is necessary. Step-down transformers require nominal 6 VA/PHASE.
6. Ramp switch may be an oil pressure switch, water temperature switch or a manually operated switch. Closing the switch starts the ramping function. Opening the switch returns the engine to idle speed.
7. Ramp switch and connections to Terminal 19, 20 and 21 are required only on ILS Model Nos. DYN2 80101 and DYN2 80105.
8. Droop/Isochronous switch is not required it units are always operated in the isochronous mode.
9. Standard ramp time is adjustable from 0.5 to 10 seconds. Ramp time adjustment range can be increased to 20 seconds by connecting a 180 mfd (25 Vdc) between Terminals 13 and 19. Capacitor should be a Sprague Type 137D, GE Type 69F, CDE Type TX67 or equivalent.
10. DYNA II Isochronous load sharing units can be used with all of the DYNA actuators.
11. If "Load Pulse" function is not being used, the "Load Pulse" Potentiometer must be set fully counterclockwise.
12. Power Connection, to terminal 21 on ILS, is not required when ramp generator is not being used.
13. Droop/Isochronous switch is not required if units are always operated in the isochronous mode.
14. When neither terminal 17 or 18 is wired externally, wire terminal 18 to terminal 15.

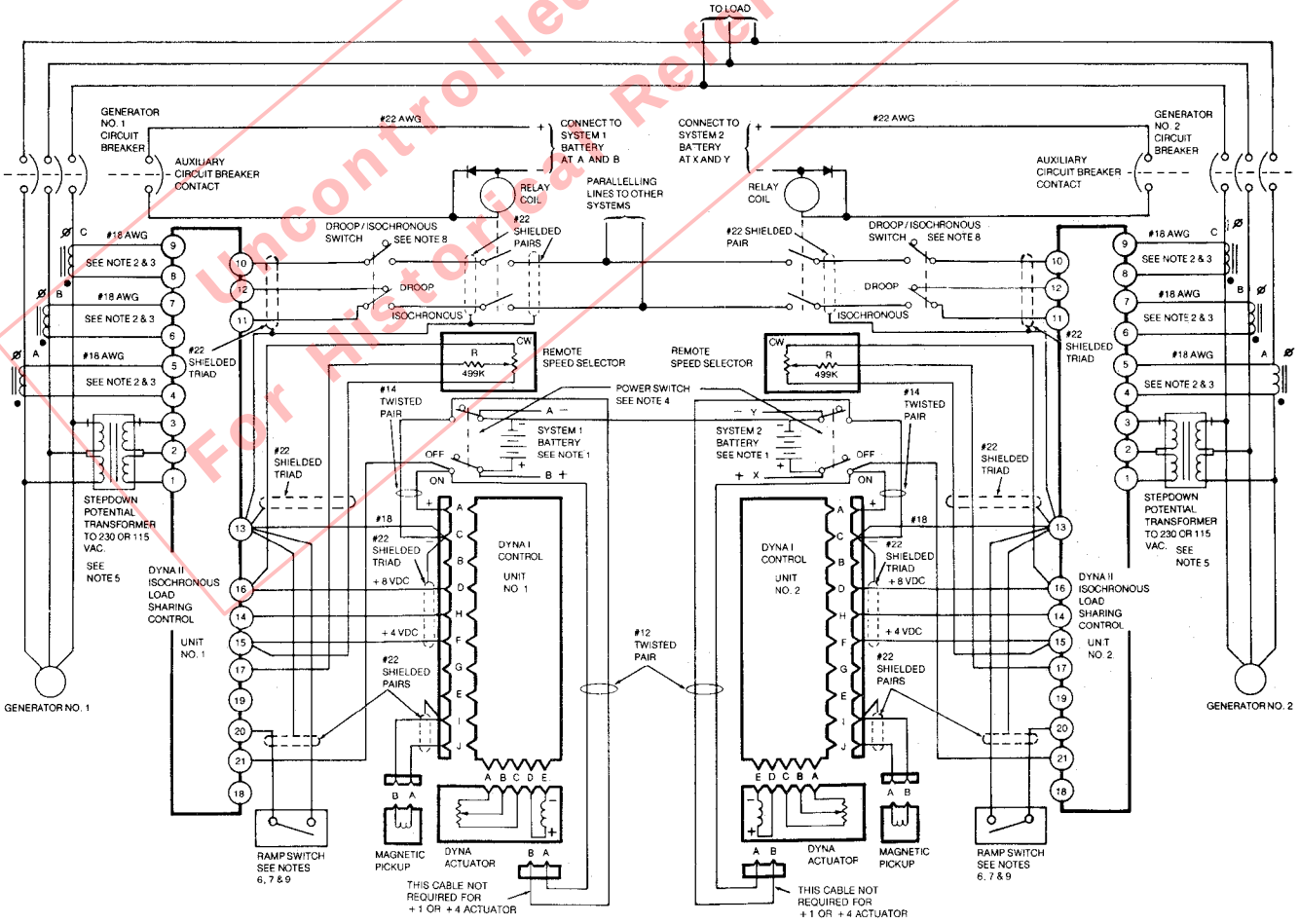


Figure 4. Typical Electrical Schematic

Two Generator Sets with DYNA I Governors & DYNA II ILS Controls

* 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.

CHECKS AND ADJUSTMENTS

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 units operating capability.

1. Remove the ILS Module Cover

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.

3. ILS Initial Potentiometer Settings

A. Set “Gain” potentiometer fully clockwise.

B. Set “Droop” potentiometer fully counterclockwise. *

C. Set “Ramp Time” potentiometer fully counterclockwise. * *

D. Set “Idle Speed” potentiometer fully counterclockwise. * *

NOTE

If the Ramp Generator is on a unit and it is not being used, the “Idle Speed” potentiometer must be set full clockwise.

E. Set “Load Pulse” potentiometer fully counterclockwise. * *

NOTE

Balance potentiometer is factory set.

4. If Remote Speed Potentiometer Is Used, Set It To Mid-Range.

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

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

** ”Ramp Time”, “Idle Speed” and “Load Pulse” adjustments are not on all ILS units.

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.

6. Start the engine.

A. If the actuator does not allow the fuel system to open far enough to allow engine to start, the “Idle Speed” potentiometer will have to be adjusted clockwise to increase the idle 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. If you have an ILS module that has the ramp generator and it is being used, the ramp switch must be closed before setting the correct RPM above. If the ramp generator is not being used, the “Idle Speed” potentiometer must be set full clockwise.

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, ILS Voltage and Current Phasing Check.

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.

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.

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 terminals 4 and 5 (Phase A). The voltage at the test jacks TP1 and TP2 should drop by 1/3. Remove jumper from between terminals 4 and 5.

Repeat procedure for terminals 6 and 7 (Phase B) and terminals 8 and 9 (Phase C). Each time the voltage should drop by 1/3. If the above conditions or if proper parallel operations 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 and parallel load sharing is satisfactory, proceed to Step T.

NOTE

Improper wiring of the three-phase current and voltage inputs cause 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. Measure the AC voltage across each burden resistor by measuring the voltage between terminals 4 and 5, 6 and 7, 8 and 9. This voltage is equal to 0.5 ohms X secondary current. Record these readings.

E. Measure the DC voltage at TP1 and TP2. The input phase wiring is correct when the TP1 and TP2 voltage is variable from 0.0 volts ±0.5 volts to approximately 5.5 volts, when the ILS "Gain" potentiometer is adjusted through its full range and an AC signal voltage of 1.0 volts is developed across each burden resistor.

The phase wiring is also correct when the TP1 and TP2 voltage is variable from 0.0 volts ±0.5 volts to approximately 11.0 volts, when the ILS "Gain" potentiometer is adjusted through its full range, with an AC signal voltage of 2.0 volts developed across each burden resistor.

Other AC signal voltage levels should give the same proportional DC voltage ranges.

F. Shut down the engine/generator.

G. The phase wiring is incorrect if the conditions outlined in Step E cannot be met. Proceed to Step H. If the conditions are met, proceed to Step T.

H. There is a terminal strip (6 pin) inside the ILS module. The terminals are marked "A" through "F". Leads "A" and "B", "C" and "D", "E" and "F" are pairs from each of the current transformer burden resistors. These pairs can be removed from the terminal strip while still keeping the burden resistor connected across each current transformer. Record the color coding and order of the wires connected to this terminal strip so that they can be reconnected to the same terminal after the phasing problem has been identified.

I. Remove the lead pairs from the 6 pin terminal strip. Do not allow these leads to become shorted or touch other equipment.

J. Set the ILS "Gain" potentiometer fully clockwise.

K. Start the engine/generator and load the generator to as near full load as possible, with a unity power factor load. Maintain a constant load.

L. Reconnect any pair of wires "A" and "B", "C" and "D", "E" and "F" to "C" and "D". Observe the DC voltage level and polarity across TP1 and TP2. If the voltage polarity is reversed, reverse leads to "C" and "D". Write down the voltage reading.

M. Remove the wires from terminals "C" and "D" and then repeat Step L with the two remaining pairs of leads.

N. One pair of the three pairs of leads when connected to terminals "C" and "D" in Steps L and M above show a higher voltage than the other two. Connect this pair to terminals "C" and "D". Be sure to maintain proper polarity at TP1 and TP2.

O. Connect a jumper wire across terminals "C" to "D" .

P. Connect each of the two remaining pairs, one at a time, to terminals "A" and "B". Observe the DC polarity at TP1 and TP2 and permanently connect the pair of leads to terminals "A" and "B" that indicated the higher DC voltage. Remember the correct polarity at TP1 and TP2 must be maintained.

Q. Connect a jumper wire across terminals "A" to "B".

R. Permanently connect the remaining pair of leads to terminals "E" and "F". Remember the correct polarity at TP1 and TP2 must be maintained.

S. Remove the jumper wire from terminals "A" to "B" and "C" to "D" and shut engine down.

NOTE

Now that proper phasing has been determined correct the external wiring to the ILS module as determined necessary by the wiring changes made in the previous steps. Then make sure the internal wiring on the 6 Pin terminal strip is returned to its original configuration. This maintains replaceability of ILS boxes without having to correct the phasing each time.

T. Start the engine and load the generator to 100% load. Then adjust the ILS module "Gain" potentiometer for 9 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**
75	6.75
50	4.5
25	2.25

U. Now after the field wiring has been corrected and the ILS returned to its original internal wiring configuration, verify correct phase wiring again by shorting between terminals 4 and 5 (Phase A). The voltage TP1 and TP2 should drop by 1/3. Repeat this procedure for terminals 6 and 7 (Phase B) and terminals 8 and 9 (Phase C). If phasing is not correct, then one will have to repeat Steps A through U.

V. Now continue with the other adjustments as necessary in Steps 8, 9, 10 and 11.

8. 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 unity 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 "Gain" potentiometer to obtain 9V 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 to 6 VDC. This reduction must be done on all ILS modules.

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.

NOTE

Adjustments in steps 9, 10 and 11 are not required on units without the load pulse and ramp generator feature.

9. ILS "Load Pulse" Potentiometer Adjustment

NOTE

If "Load Pulse" function is not being used, the "Load Pulse" Potentiometer must be set fully counterclockwise.

A. Turning the "Load Pulse" potentiometer clockwise increases the amplitude of the load pulse signal. The 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.

10. ILS Ramp Generator "Idle Speed" Potentiometer Adjustment

NOTE

If Ramp Generator function is not being used, the "Idle Speed" Potentiometer must be set fully clockwise.

A. Turning the "Idle Speed" potentiometer clockwise increases the ramp generator idle speed setting.

B. Start the engine/generator with the ramp switch open.

C. If the actuator does not allow the fuel system to open far enough to allow engine to run at idle RPM, the "Idle Speed" potentiometer will have to be increased clockwise to increase the idle speed setting.

D. Once engine is running, then set the "Idle Speed" Potentiometer to control the engine at the desired idle RPM .

11. ILS Ramp Generator "Ramp Time" Potentiometer Adjustment

NOTE

If Ramp Generator function is not being used, the "Ramp Time" Potentiometer must be set fully counterclockwise.

A. Turning the "Ramp Time" potentiometer clockwise increases the ramp time of the ramp generator.

B. Ramp time is adjustable from 0.5 to 10 seconds. The ramp time can be increased to 20 seconds by connecting a 180 MFD (25 VDC) capacitor between ILS terminals 13 and 19. Capacitor should be a Sprague type 137D, GE type 69F, CDE type TX67 or equivalent. Positive terminal of the capacitor must be connected to ILS terminal 19.

C. Start the engine/generator with the "Ramp Switch" open.

D. Once engine is running at the desired idle RPM, close the "Ramp Switch" and time (in seconds) how long it takes the engine to reach the governed RPM.

E. Opening the "Ramp Switch" immediately forces the engine back to its idle RPM. (Unit does not ramp to idle RPM .)

F. Adjust "Ramp Time" potentiometer, if necessary, and repeat steps D and E until ramp time is correct.

DYNA II ILS TROUBLESHOOTING

All voltage measurements are made with respect to Pin C or common 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 Pin C of 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 Pin F of DYN1 Controller and Terminal 15 on ILS is open or not connected.	1. Measure lead with ohmmeter for continuity. 2. Measure DC voltage between Terminal 13 and 15 of ILS. (Terminal 15 is positive) This should be + 4.0V ± 0.5V.	1. Change or correct wiring.
	3. Lead between Terminal 15 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 CCW end of Remote Speed Potentiometer. (CCW end is positive.) This should be + 4.0V ± 0.5V.	1. Change or correct wiring.
	4. 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. One should measure approximately 5000 Ohms. If continuity does not exist (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 between Pin H of DYN1 Controller and Terminal 14 of ILS is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	2. 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.
	3. Lead between Pin D of DYN1 Controller and Terminal 16 of ILS is open or not connected.*	1. Measure lead with ohmmeter for continuity. 2. Measure DC voltage between Terminal 13 and 16 of ILS. (Terminal 16 is positive.) This should be + 8.0V ± 0.5V.	1. Change or correct wiring.
	4. Lead between Terminal 16 of ILS and CW end of Remote Speed Potentiometer is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	5. Lead between Terminal 17 of ILS and the 499K resistor in series with Remote Speed Potentiometer is open or not connected.	1. Measure lead with ohmmeter for continuity.	1. Change or correct wiring.
	6. 499K Ohm resistor open.	1. Check resistor for continuity.	1. Change resistor.
	7. 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.

*Some engines won't start. If the engine was running, it goes to idle or shuts off.

Evidence of Failure	Possible Causes	Means of Detection	Corrective Action
II. (Cont.)	Following is for ILS units with ramp generator inside the ILS unit:	1. Check position of ramp switch. (Must be in ramp position.)	1. Close switch.
	8. Ramp switch is open.	2. Measure across switch with ohmmeter for continuity.	2. Change switch if it's failed.
	9. Leads from ramp switch are broken.	1. Measure leads with ohmmeter for continuity.	1. Change or correct wiring.
	10. Pin 19 shorted to Pin 13 of ILS.	1. Check wiring.	1. Correct wiring.
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 9.0 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 be 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 4.5 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 and 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 of 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 Terminal 10 and 11 of one ILS to Terminal 10 and 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, at 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.)

Barber-Colman Company
Aerospace & Power Controls Division
DYNA Product Group

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940
United States of America

Telephone (815) 637-3000
Facsimile (815) 877-0150

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

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.