MOD II MODULE TEST STAND OPERATION (BOUNDARY)

The module test stand is a test device designed to test all of the MOD II modules. Its primary function is to assist in the testing of governor modules to isolate and identify module problems.

Its secondary function is its ability to replace the governor electronics in a faulty governor. This permits the unit to continue generating while the problem is being searched out.

The module test stand comes equipped with its own power supply, indicating tachometer, speed adjustment, and speed regulation controls.

Two volt meters are also part of the module test stand. One is a digital and the other an analog type voltmeter.

The digital voltmeter is used in conjunction with a selector switch and is used to monitor the power supplies, voltage comparator input, telemetry output, and also may be used as a test voltmeter for external circuits up to 20VDC.

The analog voltmeter is used to measure the output of the proportional, integrator, and derivative modules in addition to the power amplifier output.

The module test stand cabinet is mounted on casters which permit it to be used as a piece of portable test equipment.

I TEST STAND OPERATION

A general understanding of the governor system is a basic requirement for proper application of the test stand. The following governor publications should be read prior to using the module test stand:

07075	ELECTRIC GOVERNOR FOR HYDRAULIC TURBINES
11007	SPEED SIGNAL GENERATOR
25031-I	THE CONTROLLED SYSTEM
25031-II	SPEED GOVERNOR FUNDAMENTALS
25031-III	PARALLEL OPERATION OF ALTERNATORS

SEE PRINT # 9980-905 FOR DEVICE DESIGNATIONS/LOCATIONS

CHECKOUT OF MODULE TEST STAND

1. Plug in test stand 120VAC power cord.

2. Turn on the AC supply switch item #19. The following 24VAC lights should come on:
   A. AC on indication B. Power supply indication C. Speed Signal indication D. Voltage Comparator Selection indication E. Voltage Comparator Relay indication

3. Use digital voltmeter selector switch to check for the presence of the following power supply voltages:

   Position 1 = + 15V Position 2 = - 15V Position 3 = + 12V Position 4 = + 5V

   If the power supply voltages are not correct the power supply may be calibrated per procedure MII-C-14.

   Connect the 120VDC power inlet cord from the Module test stand to a 120VDC supply. Turn on the AC supply switch item #19. The power supply should still be operating. Use the digital voltmeter selector switch to measure the power supply voltages.

NOT NORMALLY USED FOR ROUTINE MAINT

OPERATING PROCEDURE

There are two ways to check modules. One method is to supply the two racks , servo amplifier and the auxiliary, with modules which are functional. Assuming the servo amplifier rack assembly has functioning modules the following test procedure may be used.

1. Plug in test stand 120 VAC power cord.
2. Turn on the AC supply switch (item 19). This powers the rack assembly.
3. Operate the voltmeter switch (item 4) and check that all DC power supply voltages are available. The voltage level will be shown on the voltmeter (item 2).
4. Connect a function generator via the test interface box assy to the speed signal input. The test interface box assy to be wired per sheet 4 of the W/D 9973-254. Adjust the frequency of the signal generator to the frequency shown on the data sheet. The output amplitude should be between (4-6) VRMS. The function generator should be plugged into the isolated AC outlet on the stand.
5. By adjusting the speed adjustment control (item 14), the

SET AMPLITUDE OF SIG. GEN W/NO LOAD, NO CONN. TO INTERFACE BOX

The 55G has a divide by two for freq. 540Hz = 270Hz 100% speed

transducer or power amplifier output, which is indicated on voltmeter (item 3), may be brought to zero or null position. By increasing the speed adjustment control (turn dial toward the 10 position), the meter should deflect toward the right (face view). By decreasing the speed adjustment control (turn dial toward zero), the meter should deflect toward the left (face view). This operation helps insure that the stand is functioning properly and that it is now capable of testing unit modules.

~~The second way a module may be tested is by using the adapter test module. When the adapter test module is used the pin connections for the module to be tested are made using the banana jacks.~~

~~The test leads, with banana jacks supplied with the module tester are to be used when the adapter test module is to be used.~~

~~Refer to the individual module write up for the correct connections required.~~

~~The adapter test module has been designed to specifically test modules which are not part of the standard governor.~~

The following is a description, test and calibration procedure covering the modules that may be tested in the module test stand:

1. Line Receiver and Pulse Driver Module No. 5438-244
   Board No. 5430-410

   Reference: MII-D-04

   Prepare the test stand using operating procedure steps 1 through 5.

   Using an oscilloscope (Plugged into the isolated AC outlet on the stand), measure the output of the green test jacks with respect to center tap. A signal with a 4-6 volt amplitude at the normal SSG frequency should be observed. 9 VAC PEAK-PEAK

   2.35 Vrms

   If these signals are present, use the oscilloscope to measure the output of the #2 pulse test jack. A 50 to 70 micro-second pulse should be observed, recurring with a frequency the same as normal SSG frequency.

   Use the oscilloscope to measure the #1 pulse test jack. A 10 microsecond pulse should be observed, recurring at a frequency the same as normal SSG frequency.

   Observe the speed signal failure indicating lamp and lower the function generator frequency. The speed signal failure light should light somewhere below 100Hz-function generator frequency.

   ↖ approx 50 Hz on frequency counter

The module is operating normally if these tests are passed.

2. Speed Sensor Module No. 5438-336, 5432-090
Board No. 5430-550, 5431-362

Reference: MII-D-01

Prepare the test stand using operating procedure steps 1 through 5.

Set the digital voltmeter selector switch (item 11) to position 11. Connect the voltmeter test lead probe to the speed sensor output jack on the module. Turn the speed ajustment knob to six turns and adjust the frequency generator so the speed sensor output is 0.00 volts.

Turn the speed adjustment knob above and below its 6 turn setting to insure that the speed sensor output varies above and below zero.

Adjust the frequency generator above and below the normal SSG frequency to insure that the speed sensor output varies below and above zero volts.

3. Speed Switch Module No. 5438-028
Board No. 5431-212

Reference: MII-D-11

A board extender is required for calibration of this module.

Prepare the test stand using operating procedure steps 1 through 5.

Determine what signal frequency is desired to operate the switch. Refer to the board drawing 5431-212 to determine the position of the range switch.

speed, Light will not come ON.

Adjust P1 and P2 fully CW.
Adjust frequency generator to the desired trip speed.
Adjust P2 until speed switch lamp lights (goes off).
Adjust the frequency generator to the desired reset speed.
Adjust P1 until the speed switch lamp goes off (lights).

4. Watt Transducer Amplifier Module No. 5422-003

BOARD EXTENDER REQUIRED
REFER TO SECTION ON WATT TRANSDUCER AMPLIFIER MII-C-11
MANUAL 07085-11

Board No. 5431-390

Adjust signal Load. D.N.I # 12

Reference: MII-D-17

Refer to unit block diagram to determine input current at full load, and output voltage at 100% generation error.

Adjust the load adjustment pot to simulate full unit load. Adjust P2 for the 100% generation error voltage at blue test point output 1.

0 = % load
10V = 100% load

5. Proportional Module No. 5438-226
Board No. 5430-394

Reference: MI-D-01

Prepare the test stand using operating procedure steps 1 through 5. A board extender is required for calibratin of this module.

Set the off-line, on-line gain adjustments to their normal operating position. Connect pin #15 to center tap, pin #8, and adjust P3 until zero volts output is measure between the blue and yellow test jacks. Remove jumper.

To test a proportional module to determine if it is working, proceed as follows:

Install the module from the unit. Remove the integrator module. (Make sure the interlock bypass switch- item #17 - is on.) Next, either adjust the frequency of the function generator, or the speed adjustment control (item #14) and the analog voltmeter (item 11, position 4) should show an output. The polarity of the output is positive for an increase of the speed adjustment or lowering of the function generator frequency.

-12V freq decrease
+12 freq increase
Check on-line gain switch.

6. Integrator Module No. 5432-048
Board No. 5431-274

Reference: MII-D-02

Prepare the test stand using operating procedure steps 1 through 5. A board extender is required for calibration of this module.

SET LOAD SIGNAL TO 0.

Connect pins #5 and #12 to center tap (pin #8). Increase the speed adjustment control to 8 turns and make sure the function generator is at normal SSG frequency. When the output of the

integrator has stopped movivng in the negative direction, adjust the clamp control (P3) to bring the output voltage to the normal clamp voltage level (usually - 0.6 volts). Return the speed adjustment control to 6 turns. Remove jumpers.

To determine if this module is functioning, perform the following test:

Turn the gain on both the proportional and derivative modules to zero. By changing either the function generator frequency or the speed adjustment control, the integrator output should change at a uniform rate. This may be checked by either observing the integrator output with a voltmeter connected between the blue and yellow test jacks, or watching the power amplifier voltage.
make sure both on-line and off line gain control.

7. Derivative Module No. 5438-042
Board No. 5430-142

There are no calibrating adjustments on the derivative module. To check operation, measure the voltage between the blue and the yellow test jacks. With a steady speed input, this voltage should be zero. Turning the speed adjustment potentiometer (item 14) rapidly should produce an output from the derivative module as long as the knob is being turned. The amplitude of the output for a given rate of change will be proportional to the gain setting.

8. Power Amplifier Module No. 5438-234
Board No. 5430-408
Could not do.

Prepare the test stand using operating procedure steps 1 through 5. A board extender is required for calibration of this module.
VERIFY WIRE LIFTED FROM MA-4, TERM. STRIP BEHIND CARD. — JUMPER PIN 2 TO CT PIN 8
Make sure there is no input on pin #2. Adjust P2 so that zero voltage is measured from pin #5 to the yellow test jack. The center tap on the power amplifier is pin #8.

Connect a nine volt source between pin #2 and pin #8. Adjust P4 for 3.42 volts measured on pin #5 referenced to center tap.

9. Rotation Telemetry Module No. 5438-334
Board No. 5430-392
°5430-932

Prepare the test stand using operating procedure steps 1 through

5. A board extender is required for calibration of this module.

With normal SSG frequency connected to the speed signal input, adjust P4 so the voltage ~~across a 1200 ohm resistor connected~~ between pin #3 and pin #8 measures 6 volts. Adjust P1 until the tachometer indicator item #1 reads normal speed (100%). P1 MUST BE ADJUSTED IN MACHINE TO MATCH INDIVIDUAL UNIT.

To test the tach pulser, depress the creep-test switch (item #18) and hold it in. OBSERVE PULSING OF TACH

To check creep indication, reduce the frequency generator frequency. At approximately 100 Hz (50 Hz ON COUNTER) the creep-test lamp should light. To reset the creep indication, turn-off the frequency generator and depress the creep-test switch once. The lamp should turn off.

II REPLACING GOVERNOR ELECTRONIC CONTROL WITH THE MODULE TESTER

If a governor problem cannot be located through systematic testing of the individual modules, the module test stand may be connected to operate as a replacement for the governor electronics on a temporary basis.

The following is a step-by-step instruction procedure for interconnection between the module test stand and the governor, and must be followed explicitly in order to keep external noise from affecting operation. The governor's cable shielding system must be completely isolated from that of the module test stand. Since shielded interconnecting cables are used, particular care must be taken to avoid contact between the shield and ANY point other than the specified connection terminal. The required electrical connections are shown on the attached data sheets.

Some auxiliary functions such as electric speed switches may be inoperative.

CHECKOUT BEFORE RUNNING UNIT

After the electrical connections have been made, the following procedure should be followed before any attempt is made to control unit speed:

1. Set speed adjustment dial to 6 turns (100% speed).
2. Set speed regulation dial to desired percent regulation.
3. Re-apply power to governor cubicle if removed during interconnection.
4. Plug module test stand power cord into suitable 120 V 60 Hz outlet.
5. Turn "AC" switch to "ON" and read power supply voltages as

selected by "Power Supply" switch and read on the test stand voltmeter. Voltages should read within +/- 0.5 volts of rated voltage for both positive and negative voltages. If voltages are not within +/- 0.5 volts, remove power and recheck interconnecting wiring.

UNIT START AND OPERATION

1. Set "gain" switch to "off line".
2. Follow normal starting and synchronizing procedure.
3. Set "gain" switch to "on-line" after synchronization, if desired.
4. To increase load, SLOWLY manually increase the setting of the speed adjustment control. If desired, the speed regulation control may be calibrated at this time.
   a) Set speed regulation at 5%.
   b) Slowly increase speed adjustment to 7 turns (102.5% speed).
   c) Adjust "speed droop calibration" control until gates come to 50%.
5. The module test stand is now performing as the governor. It is recommended that an operator maintain watch at the module test stand at all times during which it is being used as a governor.
6. To re-instate normal governor operation, reverse instruction II 1 through II 6.

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GOVERNOR TEST INSTRUMENTS AT SITE

1. Initial Installation

Since the governor was adjusted and calibrated with meticulous care prior to leaving the factory, the main use for instrumentation during set-up is that of checking continuity of associated wiring, and polarities and amplitudes of supply voltages.

A volt-ohm-milliammeter will suffice. It may be an analog type, such as a Simpson Model 260, or it may be a digital type similar to a Data Precision Model 245.

2. Calibration

The speed adjustment range, the speed droop (or the regulation), et are expected to stay calibrated for long periods of time. These may be checked during overhaul or other shutdown periods. Additionally, it might be required that the operating point of electron speed switches be changed at times.

The following types of instrumentation are recommended:

A. A 4½ digit volt-ohm-milliammeter, such as a Data Precision Model 245.

B. A stable function generator which will produce sine waves or square waves from 5 Hz to 30 KHz. It should be capable of at least 3.5 volts peak into a load of 600 ohms.

C. A digital frequency counter should be used unless the frequency source (in B. above) can be read to four significant places. The counter must respond to frequencies from 5 Hz to at least 30 KHz. Data precision model 5740 is a possible choice.

3. Troubleshooting

The foregoing instruments will prove ample for most troubleshooting. At times, however, it may be necessary to examine waveforms, or to look for effects due to extraneous electrical interference (noise).

An oscilloscope is required for such activities. Its frequency capability should be at least 10 MHz. It should have "triggered sweep", and, preferably, would have two channels so that <u>cause</u> and <u>effect</u> might be observed simultaneously.

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