

**Model ST-2400S  
Horsepower Computer System  
User Manual**

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## **Description:**

The function of the Model 2400S Horsepower Computer is to provide the operator with a continuous digital readout of the RPM, TORQUE, POWER (Horsepower or Kilowatts) and percentage of Torque Rise ( % TORQUE RISE) when properly attached to a compatible dynamometer.

The RPM readout shows the operator the rotation speed (rotations per minute) of the power shaft of the dynamometer. The RPM is measured by a pickup and gear combination that is mounted on the dynamometer and coupled to the power shaft of the dynamometer.

The TORQUE readout shows the operator the torque (Foot-Pounds or Newton-Meters) being produced by the prime mover being tested. This is the same as the torque applied to the dynamometer by the power source (motor, engine, drive wheels, etc.). The torque is measured by a load cell that is mounted on the dynamometer.

The POWER readout shows the operator the amount of power being produced by the prime mover and applied to the dynamometer. This is the same as the power being absorbed by the dynamometer. It is computed by the Horsepower Computer using the RPM and Torque measurements using the formulae below:

$$\text{HORSEPOWER} = ( \text{RPM} * \text{TORQUE (foot-pounds)} ) / 5252$$

$$\text{KILOWATTS} = ( \text{RPM} * \text{TORQUE (Newton-Meters)} ) / 9549$$

The % Torque Rise (% Torque Load) meter shows the torque as a percentage compared to a reference torque value. It is used to measure the “lugging ability” of an engine.

The Horsepower Computer has a RS-232 compatible serial interface which can be connected EITHER to compatible serial printer OR to an external computer system. When connected to a printer, the system may be used to provide a “hard copy” printout of measurement results. When connected to an external computer, the system may be used for printing, storing, graphing, (etc.) the measurements performed by the dynamometer system (including the dynamometer, horsepower computer, and external computer).

## **Installation:**

The Model 2400S horsepower computer should be installed in a location where the unit is not exposed to wetness, extremely high temperatures, prolonged direct sunlight, or other environmental factors that would shorten the life expectancy of the unit.

## Power Supply:

The Model 2400S horsepower computer is normally operated from 110 to 125 VAC (60 Hz) using the outlet mounted power supply that is supplied with the unit. The power consumption of the computer is very low and the unit has a very high tolerance for power supply variations, so nearly any standard 115 VAC utility power outlet should power the unit adequately. See (below) information on a special (optional) “wide-range” power supply which will power the unit properly when the line voltage is either very low or very high.

The computer may also be operated from a source of 12 to 18 Volts DC such as a small DC power supply or 12 Volt storage battery. If a storage battery is used, be sure that it is properly charged. If the battery voltage is low, the POWER LED of the unit will flash “on” and “off” about once every second – indicating that the power supply voltage is inadequate to power the unit properly. **NOTE: WHEN OPERATING THE UNIT FROM A BATTERY OR POWER SUPPLY, THE POLARITY (+/- WIRING) MUST BE CORRECT OR THE UNIT WILL NOT OPERATE. WIRING A BATTERY OR POWER SUPPLY TO THE UNIT WITH IMPROPER POLARITY MAY RESULT IN DAMAGE TO THE UNIT.**

## Operation of the unit from a 110 to 250 VAC 50 to 60 Hz power source

A special “universal input” power supply is available (as an option) which will allow the unit to be operated from a wide range of AC power sources – both domestic and international.

This power supply has a detachable power cable which may be easily replaced with a power cable which matches the local power system.

**This power supply is also very useful when operating the unit from power sources which may be lower than standard and/or slightly erratic. This power supply will result in proper operation when the AC power source is as low as about 90 Volts AC.**

## Operation:

The horsepower computer normally operates with a two second measurement cycle. It can optionally be factory programmed for a one second measurement cycle. During the measurement cycle, the RPM of the dynamometer shaft is measured along with the torque sensed by the dynamometer load cell. At the end of each measurement cycle, the RPM and TORQUE values (averaged over the measurement interval) are displayed and the POWER and % TORQUE RISE

values are computed and displayed. This process is repeated continuously while the unit is in operation.

### **Computer Function Switch:**

The computer function switch is used to turn the system power ON/OFF and to control the functional operation of the horsepower computer. The function switch has four positions ( “OFF”, “ZERO”, “CHECK”, and “RUN”).

In the “OFF” position, the power to the horsepower computer (and the load cell, etc.) is turned “OFF”. The power is turned “ON” in the other three positions of the computer function switch.

The horsepower computer has two user controllable self test modes (“ZERO” and “CHECK”). These can be used to test much of the horsepower computer’s internal circuits for proper operation. In the ZERO position, internal test signals are fed into the RPM and TORQUE measurement circuits. In the ZERO position of the function switch, these signals should result in readings of zero on all four displays. If the reading of any display remains substantially different from zero (more than +/- 1 or 2 counts) when in the zero mode, some type of malfunction of the unit is indicated.

The second user controllable test mode is the CHECK mode. In this mode, internal test signals are fed to the RPM and TORQUE measuring circuits to simulate normal operation of the unit at about 37.5 % of full scale torque. The actual readings shown on the displays of the unit depend on internal factory set optional settings – principally the full scale torque value (which corresponds to the size of the load cell being used with the unit). The RPM display should read about 4000 RPM (+/- 1 or 2 counts) on all units. The Torque display should read about 37.5 % of the load cell rating. Refer to the tables below for the proper readings of the Torque and Power displays for your unit. The Power reading should agree with the power you compute from the actual RPM and TORQUE readings (within +/- 1 or 2 counts) using the above formulae for the horsepower or kilowatts.

Load Cell Rating (Ft.-Lbs.)	Torque (Ft.-Lbs.)	Power (HP)
100	37.50	28.56
200	75.00	57.10
500	187.5	142.8
1,000	375.0	285.6
2,000	750.0	571.0
5,000	1875	1428

10,000	3750	2856
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CHECK readings using Ft.-Lbs. & Horsepower

Load Cell Rating (Ft.-Lbs.)	Torque (N-M)	Power (KW)
100 (135.5 N-M)	50.84	21.30
200 (271 N-M)	101.6	42.60
500 (677.5 N-M)	254.2	106.5
1,000 (1355 N-M)	508.4	213.0
2,000 (2710 N-M)	1016	426.0
5,000 (6775 N-M)	2542	1065
10,000 (13550 N-M)	5084	2130

CHECK readings using Newton-Meters and Kilowatts

The ZERO and CHECK positions of the computer function switch provide quick checks to determine whether the horsepower computer is operating properly. Proper readings indicate that the major portion of the computer is working correctly. Note that the Load Cell sensor circuits and the RPM pickup circuits are NOT tested in the ZERO and CHECK modes.

With the dynamometer at rest and the computer function switch set to "RUN", the speed and power displays should show zero ("0"). The torque display may show some small value --- typically less than +/- 3 Ft.-Lbs (4 N-M). The % torque rise display reading depends on whether or not the reference torque has been set and if so, to what value – so the reading of this display should be ignored at this time. See also the section below.

### **System Power LED:**

The system power LED (Light Emitting Diode) is located on the front panel of the unit, just to the left of the computer function switch.

This green LED indicates that power is applied to the unit and the unit is turned "ON".

If this light is slowly flashing ON and OFF, this indicates that the power supplied to the unit is inadequate (voltage is too low or too un-steady) and that the readings produced by the unit are likely in-accurate as a result.

### **Torque Set Switch:**

The reference torque set switch is located on the front panel of the unit – just to the right of the computer function switch. Your unit may (as an option) be equipped with a remote torque set switch. This switch is located remotely from the horsepower computer but functions the same as the torque set switch.

The torque set switch is used to set the torque reference which is used to compute the % Torque Rise reading. To set the torque reference, proceed as follows:

Run the engine at its rated speed, loaded at rated power or torque output. This represents the 100% torque output condition for the engine.

With the engine running at its rated speed and load, press the Torque Set switch momentarily. The reference torque value is now set to the rated engine 100% torque and the % Torque Rise display should now read 100.0 (100%). All future measurements will now display the torque on the % Torque Rise meter as the percentage of the reference torque value. For example, if the % torque rise meter reads 75.0, this means that the current actual torque is 75.0% of the reference (or rated) torque.

### **Printer / Computer Interface:**

The Model 2400S horsepower computer is equipped with a RS-232-C compatible serial interface. This interface can be used to operate a small serial printer to make “hard copy” printouts of test results. Alternately, this interface can be used to connect the horsepower computer to a Windows type personal computer for calibration setup and so that test results can be saved, printed using the PC’s printer, etc. The horsepower computer senses which type of device is connected to the serial interface (printer or computer) and operates the interface accordingly. It is NOT possible to connect a serial printer and a personal computer to the horsepower computer at the same time.

The print rate controls (“Report Rate” and/or “Manual Print”) are used to select which measurements are printed or sent to the personal computer. These controls are located on the front panel of the unit, above the Computer Function switch. Your unit may (optionally) be equipped with a remote manual print switch – which functions the same as the manual print switch but which may be located remotely from the horsepower computer.

The Report Rate switch is used to control the rate at which the unit prints test results. Various automatic rates are available, from one report every 10 seconds up to one report every thirty minutes. There is also a “manual” position on this switch. In the manual position, the unit only makes a printout when the manual print switch is pressed (momentarily).

The manual print switch can be used at all settings of the report rate switch. It is NOT necessary to set the report rate switch to manual in order to use the manual print switch (or the optional remote print switch) to trigger a print report.



When the horsepower computer is used with a companion personal computer, a standard (9 pin) RS-232-C extension cable is used to connect the two computers together. This extension cable is normally 10 feet long, but can be up to 50 feet long (and even longer if special “long range” RS-232-C extension cables are used). The print rate and manual print switches serve to notify the personal computer which measurements are to be saved (or printed) in much the same way they are used when a printer is attached to the horsepower computer.

### **Software for the 2400S horsepower computer:**

There are several software programs for the 2400S horsepower computer. These include:

#### **Calibration Setup Software for the 2400S:**

HpcOptionsW32 is software for the 2400S horsepower computer which is used to prepare the 2400S for calibration. This is done so that the 2400S will “know” the details of the method you will use to check the torque calibration of the unit. This “factory setup” is normally performed on the 2400S by your dealer prior to delivery of the 2400S to you so won't have to.

If you change your calibration method or calibration tools, this program can be used to inform the 2400S of the changes so that subsequent torque calibrations will be accurate.

If you use a NIST traceable calibration method, this program must be used periodically (each time the load cell and the 2000S horsepower computer are sent in to have their NIST calibrations checked) to inform the 2400S of any changes to the load cell calibration or the internal 2400S traceable shunt resistor calibration.

HpcOptionsW32 is compatible with most Windows based computer systems including Win95, Win98, WinMe, Win2000 and WinXP.

#### **Data Recording Software for the 2400S (Dyno32):**

The Dyno32 software makes it easy to reproduce the 2400S horsepower displays on the screen of the personal computer for remote viewing, etc. There are also features for printing and recording (saving) your dyno measurements. Data printing and

recording can be controlled from the 2400S horsepower computer and / or using the personal computer's keyboard or mouse.

Recorded data can be printed on the PC's printer and / or can be easily "imported" into Microsoft Excel (or other analysis programs) for further operations such as graphing, etc.

Dyno32 is compatible with most Windows based computer systems including Win95, Win98, WinMe, Win2000 and WinXP.

### **Data Recording and Graphing Software for the 2400S:**

DynoGraph software combines most of the features of Dyno32 with a "built-in" storage, printing, and graphing capability to streamline the computerization of your dynamometer system.

The DynoGraph software integrates the important Dyno data collection, display, storage, and printing functions into one easy to use program that helps you to maintain complete records of the measurements you take using your dynamometer system. It also creates professional reports of your measurements including graphs of the important parameters such as Torque vs. RPM, Power vs. RPM, etc

Up to 100 measurement "points" can be included in one DynoGraph document. There is provision to include your company info (name, address, etc.) along with the important information about the device being measured (customer info, machine info, date and time of the measurements, etc.)

DynoGraph software is compatible with most Windows computer systems including Win95, Win98, WinMe, Win2000 and WinXP.

### **Calibration:**

The calibration of the Model 2400S horsepower computer should be checked at least once per year – or sooner if any doubts or questions arise as to whether the readings produced by the unit are within the accuracy specifications of the unit.

The Model 2400S should also have its calibration checked if any of the following events occur:

- 1.) The instrument has been dropped or otherwise mistreated.

- 2.) The instrument has been moved (re-installed) from one dynamometer to another.
- 3.) The load cell of the dynamometer has been replaced, overloaded, dropped or otherwise mistreated.
- 4.) The power supply to the unit has been repaired or replaced.
- 5.) Prior to any measurements that require especially high accuracy.
- 6.) The instrument has been repaired, exchanged or replaced.

#### **IMPORTANT NOTE:**

**The Model 2400S is a delicate instrument and should be treated accordingly. It should not be allowed to get wet, be exposed to excessive temperatures, dropped or subjected to excessive shock or vibration. It should only be used with an approved power supply.**

**It contains no user serviceable parts and no attempt should be made to repair or modify the unit.**

**If the unit is in need of repair, it should be returned to the dealer or directly to Ries Labs, Inc. for repair.**

When it becomes necessary to check the calibration of the unit, follow the procedure below.

#### **Calibration Procedure:**

The Model 2400S horsepower computer uses quick and easy “push-button” calibration methods and can be calibrated using a variety of methods. Be sure to use the one that is correct for your dynamometer system and the calibration tools that are available to you.

**Prior to attempting calibration, first verify that the 2400S is operating correctly using the ZERO and CHECK positions of the computer function switch. If the 2400S does not pass these checks, there is a problem with the unit and it should be repaired before any attempt is made to calibrate the unit.**

Calibration of the Model 2400S is a simple, two step process:

- 1.) Set the ZERO calibration: The dynamometer should not be running and should be disconnected from the engine, tractor, motor, etc. The RPM reading should be exactly zero and the TORQUE reading should be fairly close to zero – especially if the unit has previously been calibrated to the load cell. If necessary, disconnect the load cell from

the torque arm of the dynamometer to insure that there is no force being applied to the load cell (which would result in an inaccurate zero calibration). Remove the calibration access cover panel and set the **calibration mode switch** to the **ZERO** position. Also, be sure that the **shunt resistor switch** is set to the **OFF** position. At this time note that the RPM display of the unit should indicate “1111” and the POWER display should indicate “0000”. The TORQUE display indicates the TORQUE and should read near zero. If the torque indication is excessive (plus or minus), the POWER display will read “EEEE” – which indicates that the zero offset of the load cell is excessive and that the ZERO calibration cannot proceed (see calibration notes below). Otherwise, press and release the ENTER push-button switch to perform the zero calibration. At this point, the TORQUE display should indicate zero and the zero calibration procedure has been completed.

- 2.) Set the TORQUE SPAN calibration: Apply the CALIBRATION TORQUE (see calibration torque notes below) to the unit and set the **calibration mode switch** to the **SPAN** position. At this point the RPM display should indicate “2222”, the POWER display should indicate “0000”, and the TORQUE display should indicate a value **approximately** equal to the CALIBRATION TORQUE. If the deviation between the torque reading and the calibration torque is excessive, the POWER display will read “EEEE” – indicating that the TORQUE SPAN calibration cannot proceed (see calibration notes below). Otherwise, press and release the ENTER push-button switch to perform the TORQUE SPAN calibration. Now the TORQUE display should indicate the value of the CALIBRATION TORQUE and the torque span calibration has been completed.
- 3.) Resume normal operation: Set the **calibration mode** switch back to the **OFF** (center) position. This turns off calibration mode and restores the unit to normal operation. Be sure to return the **shunt resistor switch** to the **OFF** position (if you used it during the torque span calibration). Replace the calibration access cover panel. The unit has now been accurately calibrated.

### Calibration Procedure Notes:

1. ZERO CALIBRATION cannot proceed. This problem occurs when the ZERO OFFSET is excessive – too large for the zero offset correction facility of the 2400S to correct. Check the following:
  - 1.1 Make sure that the load cell is properly connected to the 2400S horsepower computer. Inspect the cable for damage, especially at the load cell end and the connector end. Make sure the connector is securely fastened to the 2400S torque sensor connector.
  - 1.2 Make sure that the load has been completely removed from the load cell. “Rock” the drive shaft of the dynamometer CW and CCW slightly (applying a small

positive and negative torque to the unit) and verify that the torque reading returns closely to the same value. A failure here indicates a likely problem with the dynamometer. Have the dynamometer checked by your dealer or dyno service person.

1.3 Make sure that the load has been completely removed from the load cell. Disconnect the load cell from the torque arm of the dynamometer by removing the coupling fastener. If this does not correct the excessive zero offset a likely defective or damaged load cell is indicated. You should have the load cell checked by your dealer or dyno service person.

1.4 Make sure that the shunt resistor switch is set to the OFF position.

2. TORQUE SPAN CALIBRATION cannot proceed. This problem occurs when the torque reading is not sufficiently close to that expected from the CALIBRATION TORQUE value. Check the following:

2.1 Check to be sure that the CALIBRATION TORQUE is the value expected by the 2400S horsepower computer. The expected calibration torque value is normally programmed into the 2400S by your dealer to match the calibration value and method you will be using to check and adjust the calibration of your unit. You can check this by setting the calibration mode switch back to the OFF position while leaving the CALIBRATION TORQUE applied to the unit. The TORQUE display will now read the (approximate) torque you have applied. If this value is within about +/- 10% of the CALIBRATION TORQUE that you have applied, then it is likely that the value expected by the 2400S for the CALIBRATION TORQUE is different than the value you are using. Check with your dealer or dyno service person to determine the calibration torque you should be using or use the 2400S calibration setup software to re-program the 2400S to expect the calibration torque you are currently using.

2.2 If the TORQUE display does not read (within +/- about 10%) the torque that you have applied a possible defective or damaged load cell is indicated and may need to be repaired or replaced. Have your dealer or dyno service person assist you.

## Torque Calibration Notes:

There are several methods which can be used to apply a calibration torque value to the 2400S horsepower computer.

1.) Dead Weight Test Fixture: This method uses a **Torque Test Bar** (dead weight test fixture) and one or more **calibration weights**. The torque test bar is attached to the torque arm of the dynamometer, being careful to align the position of the mark on the torque test bar with corresponding mark on the torque arm of the dynamometer. Then connect the test weight(s) onto the torque test bar at the indicated position, usually the 4 foot (1.210 meter) position. The torque produced by the torque test bar must be accurately known, the total weight of the test weights must be accurately known, and the horizontal distance from the center line of the dyno to the indicated position must be accurately known. If any of these three factors is not accurate, then the resulting calibration will not be accurate –and the result is in-accurate torque and power readings from the

dynamometer. The calibration torque produced is equal to the sum of the torque produced by the Torque Test Bar itself plus the torque produced by the test weight(s) – which is equal to the total weight of the test weight(s) times the horizontal distance from the center line of the dyno to the position of the test weights. For example, assume the torque of the torque test bar itself is 17 Ft.-Lbs., the total weight is 100 Lbs. and the horizontal distance is 4.00 Ft. The calibration torque value produced by this setup is equal to 417 Ft.-Lbs. ( $= 4.00 \text{ Ft.} * 100 \text{ Lbs.} + 17 \text{ Ft.-Lbs.}$ )

- 2.) Shunt Resistor: The 2400S horsepower computer has an internal shunt resistor which can be used to check the torque span calibration. The 2400S can (optionally) be equipped with a precision shunt resistor which can be used to perform a NIST (National Institute of Standards and Time) traceable torque calibration. The “torque” introduced by the shunt resistor depends on the resistance value of the shunt resistor as well as the properties of the load cell. For the NIST traceable torque calibration to be accurate, both the shunt resistor value and the load cell must have NIST traceable calibrations which should be checked periodically. A 2400S horsepower computer without the precision shunt resistor is equipped with a 1% precision 45.3 K Ohm shunt resistor (not adequate for NIST traceable calibrations) which can be used for a quick and fairly accurate check on the torque calibration and the torque sensor circuits of the 2400S. After performing the calibration of the unit using the dead weight test fixture calibration method, remove the dead weight test fixture and set the Shunt Resistor Switch to ON. The shunt resistor will produce a torque reading that is (roughly) 2/3 of the full scale torque of the unit (i.e. about 3300 Ft.-Lbs. on a 5000 Ft.-Lbs. full scale 2400S). More precise values are shown in the table below. The reading should be within +/- 2 or 3 % of the appropriate value from the table below. The tolerance derives from the +/- 1% tolerance of the 45.3 K Ohm shunt resistor plus the tolerance of the load cell (likely +/- 1 or 2 %). If the reading is not this close, you should double check the calibration and your procedure as a likely problem is indicated. If the reading is within the above limits, record its value. It can be used later for a quick check on your unit’s calibration as it should be stable over time and temperature to within +/- 0.25% or better.

Full scale Torque (Ft.-Lbs.)	45.3 K Ohm Shunt Resistor Torque
100	64.14
200	128.3
500	320.7
1,000	641.4
2,000	1283
5,000	3207
10,000	6414

## **In Case of Difficulty:**

The following is a troubleshooting guide that will help you to resolve any problems that may arise.

The Model 2400S Horsepower Computer contains no user serviceable parts. If it needs to be repaired you may return the unit to your dealer (who can also assist you with other repair problems such as problem diagnosis, replacement of the load cell, RPM pickup, other dynamometer repairs, etc.) or directly to:

**In the USA:**  
**STAR TEST DYNAMOMETER, INC.**  
**712 THISTLEWOOD COURT**  
**NORMAL, ILLINOIS 61761**  
**PHONE: (309) 826-1484**

**In Mexico, Central & South America:**  
**Negociaciones Fuentes S.A. DE CV**  
**Av. La Luz 4549 Col. Cortijo del Rio**  
**Monterey, N.L. Mexico 64890**  
**Phone: 81.8349.1416**

You may also return the 2400S Horsepower Computer and its power supply directly to the manufacturer for repair:

**RIES LABS, INC.**  
**2275 RAVEN ROAD**  
**FARINA, ILLINOIS 62838**  
**PHONE: (618) 238-1400**  
**E-MAIL: ADMIN@RIESLABS.COM**

Be sure to include a written description of the problems you are having with the unit, the name and phone number of a person to call if we need to discuss your problem with you, and return shipping instructions. If the unit is out of warranty, please also include a repair order and information about how you want the repaired unit returned to you. Ries Labs, Inc. does not open commercial accounts (charge accounts) for repair work. Ries Labs, Inc. accepts electronic payments (credit card or otherwise) using PayPal. You can sign up for your PalPal account by visiting <http://www.paypal.com/> Sending your payment via PalPal is FREE, EASY, QUICK and SAFE.

Ries Labs, Inc. does not offer repair services for the other components of your dynamometer – only 2000S and 2400S horsepower computers, their power supply, and other items manufactured by Ries Labs, Inc.

The following table is useful for you to determine that cause of any problems that you might be able to fix yourself.

Problem	Possible causes and remedies
No indication on displays. Power LED is not lit.	There is likely no power to the unit. Check the power supply to be sure it is plugged in. Check the fuse on the front panel of the unit. Replace ONLY with the correct ½ amp fuse. DO NOT use a slow blow or higher value fuse as this can result in severe damage to the unit.
Power LED comes ON and OFF erratically	Check to be sure the power supply is plugged in securely. Try another outlet. Make sure the power connector is fastened tightly to the front of the unit.
Power LED flashes ON and OFF regularly	Power supply voltage is too low. Check the power supply or battery. The supply voltage must be at least 12 Volts with low power supply “ripple” for the unit to operate properly.
Unit blows fuses	Power supply voltage may be too high. The power supply voltage should be less than 20 Volts DC or damage to the unit will occur. Send the 2400S for repairs if the unit blows fuses when the power supply voltage is less than 20 Volts DC. Use only the correct size ( ½ amp) and type (fast blow) fuse – or severe damage to the unit will likely occur.
RPM display reads zero all the time, or is erratic	Check the RPM pickup on the dynamometer. Be sure that it is not loose. Check the wiring from the RPM pickup to the horsepower computer. Make sure the RPM sensor connector is tight. Have the horsepower computer checked.
Torque display reads – EEE or some other value all the time (or is erratic)	Check the load cell on the dynamometer. Be sure that it is not loose. Check the cable between the load cell and the horsepower computer. Make sure the Torque Sensor connector is tight. The load cell may be bad and need to be replaced. Have the horsepower computer checked.
Printer doesn’t work (or works erratically)	Check the printer cable between the horsepower computer and the printer. Be sure both ends are tight in their respective connectors. Make sure the printer is plugged into a proper power source. Perform a “self test” on the printer to be sure it is working. Have the horsepower computer checked.
Horsepower or Kilowatt readings are low or not correct	Check the torque calibration. If Chassis dyno, the tires may be slipping on the dynamometer rolls – increase chain tension to obtain more “over center” action between tires and rolls. Excess speed often causes power losses. If farm tractor, the PTO clutch may be slipping (refer to the tractor repair manual). Engine may not be performing properly. Have the horsepower computer checked.
RPM readings are inaccurate	Operate the unit in the CHECK function. If the reading is not 4000 RPM, have the horsepower computer repaired. If the CHECK reading is 4000 RPM, check the RPM pickup



	<p>and the RPM sensor gear. Make sure that they are not loose and that the runout of the RPM gear is not excessive. Check the RPM sensor connector to be sure that it is tight. Check the cable from the RPM pickup to the horsepower computer. Check the power supply to the horsepower computer. Have the horsepower computer checked.</p>
<p>Torque readings are inaccurate</p>	<p>Operate the unit using the ZERO and CHECK functions. If the readings do not agree with the tables above, unit needs to be repaired. Check the load cell mounting to be sure that it is not loose. Check the dynamometer to be sure that it is not in a bind. Check the torque calibration of the horsepower computer. Check the power supply to the horsepower computer. Have the horsepower computer checked.</p>
<p>Residual Torque readings are high when the dynamometer is stopped.</p>	<p>Pressure or force on the dynamometer absorption unit cradle may be causing the residual readings. Remove the load cell from the torque arm of the dyno to see if this removes the excessive residual torque reading. Manually rock the torque arm of the dyno. It should move freely and easily a minimum of 0.5 inches (12.7 mm) up and down. The load cell must be in a free floating position when not under load. Re-adjust the torque cable and connectors if necessary. Check the calibration zero of the horsepower computer. The load cell may be damaged and need to be replaced. Have the horsepower computer checked.</p>

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