KEI KEMKRAFT ENGINEERING, INC.

INSTRUCTION MANUAL

**STEERING WHEEL TORQUE/
INCLINOMETER SYSTEM
MODEL KEI-300
WITH INTERNAL BARCODE SCANNER**

47650 CLIPPER DR. PLYMOUTH TWP., MI. 48170 (734) 414-6500

Revision History

Rev. Date	Author	Current Version	Revision Description
11-17-06	JB	N/A	Initial Release.

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KEMKRAFT *ENGINEERING, INC.*
MODEL KEI-300 STEERING WHEEL TORQUE/INCLINOMETER TESTER

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KEMKRAFT *ENGINEERING, INC.*
MODEL KEI-300 STEERING WHEEL TORQUE/INCLINOMETER TESTER

GENERAL DESCRIPTION

- The Kemkraft Model KEI-300 Steering Wheel Torque/Inclinometer Data Acquisition System is a precision test instrument.
- This unit is capable of displaying and storing "Straight ahead steering torque and angle" during a vehicle drive audit.
- Multiple audits can be run and each is identified with a number (e.g. Run 1/2) as well as a date and time stamp
- After an audit is performed, the Mean for both the torque and the angle is shown on the LCD display.
- The results of these audits can then be stored in the Steering Wheel Torque/Inclinometer Tester.
- A configurable length of time for test runs, allows the unit to accommodate test tracks of different lengths.
- With a sample rate of ten samples per second, there will be many sample points along the audit, allowing for more accurate results.
- Any raw data that has been stored in internal memory can then be transferred to a PC, using the provided Windows based software, for SPC purposes.
- Using the optional torque knob, the unit is capable of displaying and recording the force required to keep the vehicle straight.
- With the optional barcode scanner, the VIN for each vehicle tested can be scanned and stored with the results, tying those results to that vehicle.

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INSTALLATION

NOTE: These units are fully charged and calibrated when shipped. Depending upon the length of time before using, the battery may have lost some of that charge.

We recommend fully charging the unit before use, with the provided quick charger, which will indicate when the charge is complete. Also make sure that the angle inclinometer and force transducer are both calibrated before use.

1) Fig. 1, below, shows the 300 Torque/Inclinometer properly mounted to a steering wheel. Make sure the rollers on both sides of the tool are firmly seated into the steering wheel. Clamp the unit into place by tightening the thumbscrew on top of the tool. (Do not over tighten)
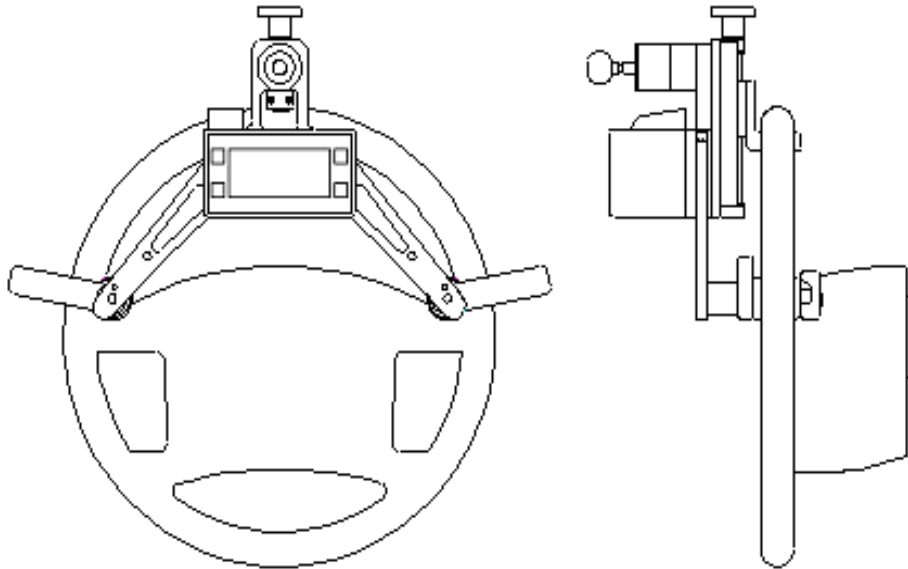

Fig. 1

The installation is now complete.

Note: Although all KEI-300 units utilize an angle inclinometer, the force transducer and the internal barcode scanner are both optional and may not be installed on your unit. The images throughout this manual are of complete units with optional equipment installed. Although this may not look exactly like your unit, the processes are the same. For questions regarding any or all of the optional equipment, contact Kemkraft Engineering for further assistance.

OPERATION

NOTE: The tool has been balanced and has internal compensation for its own weight, making it neutral in the torque readings. This causes the torque value to read only the amount of force that is applied to the torque knob.

*** See last page for multiple wheel radius values ***

1) Make sure the test parameters (e.g. S.W. radius, Test Timeout, a 1 or a 2 run test) are set for the vehicle being tested. Details for setting these parameters can be found on page 17.
2) Power on the Steering Wheel Torque/Inclinometer Tester.
   a) The home screen will be displayed.
      i) This shows:
         (1) The live angle with the current run and total runs on the first row.
         (2) The live torque on the second row.

```
-xx.x°Agl  x/x Runs
-xx.xxNm  SMPL=Start
```

3) Press SMPL to begin.
   a) If the optional internal scanner has been installed and enabled, continue through this section. Otherwise, skip to step 5a.

```
SMPL=Scan    ESC=Quit
MODE=Run with no VIN
```

4) Press SMPL to trigger the scanner and aim the scanner beam at the VIN barcode to be read.
   a) To run a test without a VIN, press MODE to move to the next screen
   b) When a VIN has been read successfully, the unit will display the last six digits of the VIN. As shown by xxxxxx below.

```
   VIN: (xxxxxx)
 ESC=Abort SMPL=Run
```

5) Press SMPL to continue. You will then be able to verify the settings before starting the test.
   a) This shows the steering wheel radius and the crown offset.

```
SwRd=xxxx.xmm  ESC=↑
CrOs=xx.x° SMPL=Next
```

6) The unit should now be installed on to the steering wheel, as detailed above.

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7) Press SMPL to continue. You then have the ability to ensure the torque reading is 0.00Nm at zero degrees.
   a) This shows the sign (+/-) and the live angle on the top row as well as the sign (+/-) and the live torque reading on the bottom row.
   b) Without touching the torque knob, center the steering wheel so that the angle reads 0.00°. If the torque reading is not 0.00Nm, press the MODE button to set zero.

```
-xx.x° MODE=ZeroXdcr
-xx.xxNm  SMPL=Ready
```

8) Press SMPL to view the final setting verification screen.
   a) This shows:
      i)   The number of seconds to delay before starting (Dly=x.xs)
      ii) The Tool ID (ID=xx)
      iii) The number of seconds the test will run (RunTm=xxs)

```
Dly=x.xs ID=xx ESC=↑
RunTm=xxs     SMPL=Run
```

9) Press SMPL to begin the data collection. If the delay is set, you will see the delay countdown before the start of data collection.
   a) During the running time, you will see the readings as they are collected.
      i)   This shows:
           (1) The live angle and the remaining time for data collection, on the top row.
           (2) The live torque and the current run on the second row
   b) Pressing ESC will abort the current test and return you to step 2a.

```
-xx.x°  RUNNING xx.x
-xx.xxNm x/x ESC=Abt
```

10) After the test run has completed:
    a) If the unit is configured for a single run test, skip to step 12, on the next page.
11) For a two run test, you will be prompted to start the next test.
    a) This shows:
       i) The Mean angle on the top row
       ii) The mean torque on the second row.
    b) You now have two options
       i) You can repeat the previous test by pressing ESC.
       ii) You can start the next test by pressing SMPL.

```
-xx.x° MEAN  ESC=Rpt
-xx.xxNm 1/2 SMP=Nxt
```

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12) You are now shown the average result and have the option to save this test or quit without saving.
    a) This shows:
        i)   The average angle on the top row.
        ii) The average torque on the bottom row.
    b) You can press SMPL to save the results to memory or press ESC to discard these results.

```
-xx.x°   Avrg ESC=Qt
-xx.xxNm Avrg SMP=Sv
```

13) This returns you to step 2a and completes the test process

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SYSTEM SETUP

Certain system parameters must be modified when changing to a new vehicle or when an adjustment is required. The Steering Wheel radius, measured from the *center of wheel* to the *center of the driving knob*, must be changed when switching to a new vehicle.

System setup as well as calibration is done through a series of sequential menus. These menus, as well as screenshots will be shown and explained in the order they appear. All aspects of configuration and options are accessed through these menus. These menus are accessed by pressing MODE while at the home screen.

```
-xx.x°Agl  x/x Runs
-xx.xxNm  SMPL=Start
```

The main setup categories are as follows:
1) **Calibration**. (Begins on page 11)

```
   Setup Tool:  ESC=↑
MODE=Cal        SMPL=↓
```

   a) This allows access to the calibration of both the angle inclinometer and the force transducer.
2) **Date and Time**. (Begins on page 16)

```
Chg Date/Time  ESC=↑
MODE=Edit       SMPL=↓
```

   a) This allows you to configure as well as verify the date and time.
3) **Miscellaneous**. (Begins on page 17)

```
Setup Misc?    ESC=↑
MODE=Yes        SMPL=↓
```

   a) This allows you to change the options that modify test parameters.
4) **Mass Compensation**. (Begins on page 19)

```
Set MassComp?  ESC=↑
MODE=Yes        SMPL=↓
```

   a) This allows you to change the compensation for the weight of the tool.
      i)   These values are determined during final testing of the unit and should not be changed unless instructed to do so in the multiple wheel reference sheet(s) at the end of this manual.

Throughout these menus, there will be some configuration values that you may want to change. For the values that can be configured, you will see "MODE=Edit" on the screen, as shown below. Pressing MODE will give you the ability to change these values by increasing (ESC=+) or decreasing (SMPL=-) the value displayed. Holding down either the ESC or SMPL button will slowly increase the speed at which these values change. When the new value is acceptable, pressing MODE will prompt you to save or discard the change.

This shows a typical sequence to change a configuration value. For this we will change the year of the date.

```
Year=06          ESC=↑
MODE=Edit        SMPL=↓
```

1) Press MODE to edit the value

```
Year=06          ESC=+
MODE=Done        SMPL=-
```

2) Press ESC to increase the value

```
Year=07          ESC=+
MODE=Done        SMPL=-
```

3) Press MODE to complete

```
Year=07          ESC=Y
   Save ?        SMPL=Y
```

4) Press SMPL to accept

At any point during the configuration, the ESC button can be held down or pressed multiple times until the intro screen, shown below, is displayed. After a short delay, the unit will be ready to begin a test

```
 KEMKRAFT  ENG.  INC.
 S.W.Ver: xxxxxxxx
```

This intro screen displays Kemkraft Engineering, Inc. (The manufacturer) on the top row and the version of the software on the bottom row, represented by xxxxxxx. (Example: 0300001_)
If you are going to contact Kemkraft Engineering with any questions regarding this unit, having both the software version and the serial number of the unit will greatly increase the information you will be able to obtain.

All configuration changes will work in the manner described above.

ANGLE INCLINOMETER CALIBRATION

Periodic re-calibration of the system is necessary, we recommend at least once per week. This inclinometer calibration must be performed with a certified calibration stand and the unit fully charged.

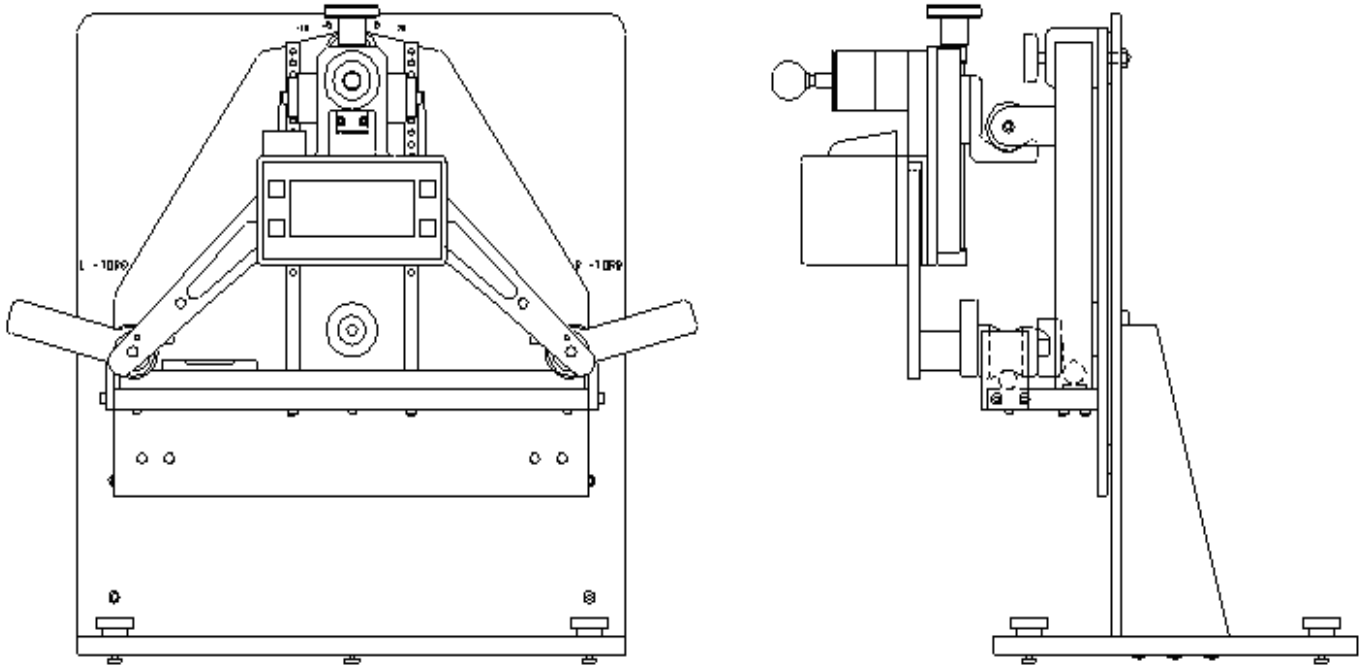1) Mount the KEI-300 Steering Wheel Torque/Inclinometer Tester to the Calibration Stand.

Fig. 2

2) Power on the Steering Wheel Torque/Inclinometer Tester.
3) Press MODE to enter setup.

```
    Setup Tool:   ESC=↑
MODE=Cal       SMPL=↓
```

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4) Press MODE again to enter calibration
   a) You are now prompted to choose the item to calibrate

```
Calibrate    ESC=Incl
MODE=Quit   SMPL=Load
```

5) Press ESC to calibrate the Inclinometer or press SMPL and skip to page 14, step 1 to calibrate the force transducer.
   a) Verify that the Calibration Stand is Level and set on 0 Degrees
   b) Press SMPL to set the zero of the angle inclinometer.
      i) **Note**: The rightmost value of the top row shows the raw value received from the transducer. If this value does not change or it is extremely unstable, the unit may need to be serviced, which is explained on the last page of this manual.

```
Calib. @ 0.0°  xxxxx
SMPL=Cal    ESC=Abort
```

6) The next calibration screen will have you set the calibration stand to -10°. (Fig. 3)
   a) After doing so, allow a couple of seconds for the unit to settle and then press SMPL.

```
Calib. @ -10.0°xxxxx
SMPL=Cal    ESC=Abort
```


Fig. 3

7) The next calibration screen will have you set the calibration stand to +10°. (Fig. 4)
   a) After doing so, allow a couple of seconds for the unit to settle and then press SMPL.
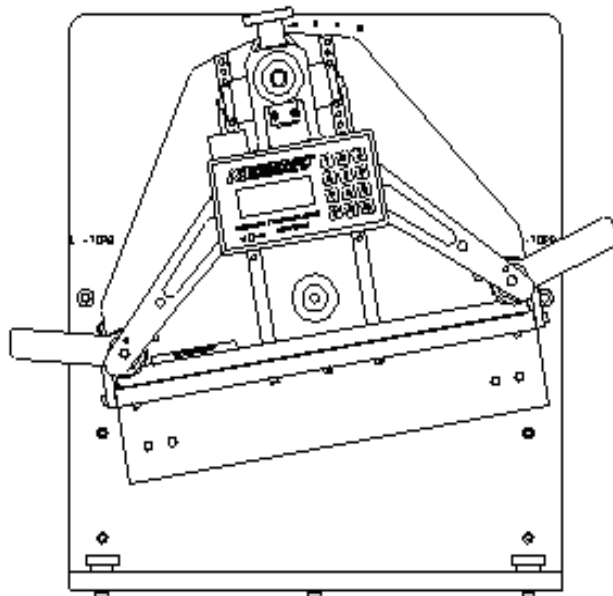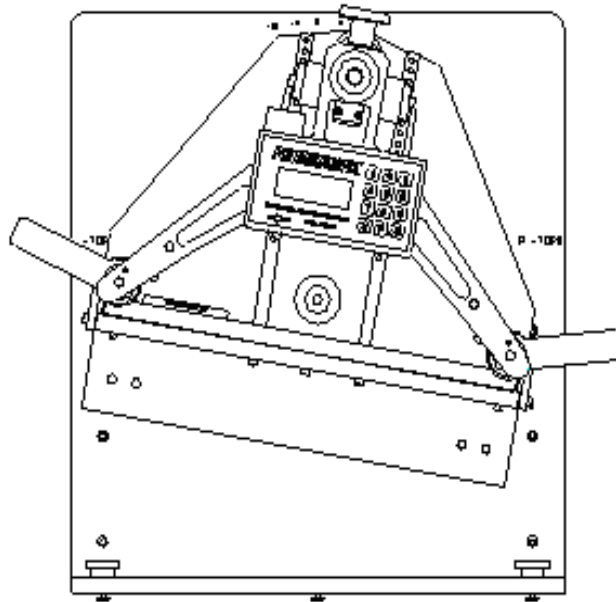
```
Calib. @ +10.0°xxxxx
SMPL=Cal   ESC=Abort
```


Fig. 4

8) The angle inclinometer calibration is complete and you are returned to step 4a (On page 12) of the calibration procedure.
   a) Press SMPL to calibrate the force transducer and then continue to the next page.

```
Calibrate    ESC=Incl
MODE=Quit   SMPL=Load
```

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FORCE TRANSDUCER CALIBRATION

If the unit is not already mounted and ready to calibrate the force transducer, or the unit does not have the display as shown below, refer to page 11, step 1 before proceeding.

1) The calibration stand, with the tool securely mounted, must be set at 0°.
   a) Press SMPL to accept the force value at zero.
   b) **Note**: The rightmost value of the top row shows the raw value received from the transducer. If this value does not change or it is extremely unstable, the unit may need to be serviced, which is explained on the last page of this manual.

```
Cal Load @ 0.0N xxxx
SMPL=Cal    ESC=Abort
```

2) You are then prompted to verify that the Cal. Constant is entered correctly.
   a) This value can be found as a label on the side of the force transducer. If the two values do not match, press MODE and make the necessary changes.

```
CgCnst=xx.xxN ESC=Qt
MODE=Change SMPL=Cal
```

3) The unit will then take some internal measurements. Do not touch the force transducer.

```
Applying Shunt   xxxx
DO NOT TOUCH LD CELL
```

4) After successful internal measurements, you will be informed and have the option to verify a successful calibration. Press SMPL to continue.

```
Load Cell Calibrated
SMPL=Verify ESC=Done
```

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5) Position the calibration stand, with the tool securely mounted, at the torque position.
    a) This position is determined by the mounting of the force transducer.
        i) If the force transducer is mounted above the electronic unit, the torque position is typically at +90°. (Fig. 6)
        ii) If the force transducer is mounted on the far right side of the tool, the torque position is typically at +30°.
        iii) You will see this torque position marked on the calibration stand.
    b) Press SMPL to view the verification screen.

```
Pos. Torq Audit Tool
SMPL=Cont   ESC=Abort
```

6) You can now hang a certified weight on the torque transducer and view the weight, in pounds, on the display.

```
HANG CERT. WT. VERF.
   x.xx lbs SMPL=Nxt
```

7) Press SMPL to return to the main screen.
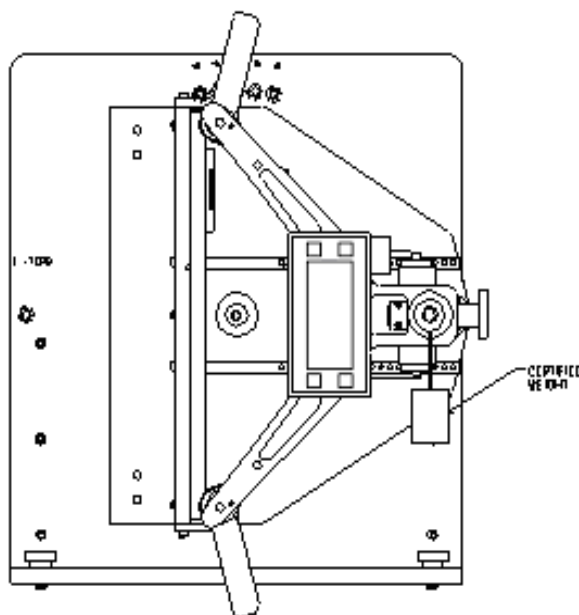8) The calibration of the force transducer is now complete.

Fig. 6

DATE AND TIME

1) While at the main screen, press MODE to enter menu screens.

```
   Setup Tool:  ESC=↑
MODE=Cal        SMPL=↓
```

2) Press SMPL to move down to the next menu.
   a) You will be notified that the Options are next.

```
   View/Edit    ESC=↑
    Options     SMPL=↓
```

3) Press SMPL to view the date and time as setup in the tool

```
HH:MM:SS Time   ESC=↑
MM/DD/YY Date SMPL=↓
```

4) Press SMPL to view the date and time setup menu.

```
Chg Date/Time   ESC=↑
MODE=Edit       SMPL=↓
```

5) Press MODE to change the configuration.

```
Year=xx         ESC=↑
MODE=Edit       SMPL=↓
```

   a) Pressing SMPL will move to the next configurable value. This can be done multiple times, each time moving to the next available configuration item.

```
Month=xx        ESC=↑
MODE=Edit       SMPL=↓
```

   b) Pressing SMPL brings you to the day of the month.

```
Date=xx         ESC=↑
MODE=Edit       SMPL=↓
```

   c) Pressing SMPL brings you to the hour of the day, in 24 hour format.

```
Hour=xx         ESC=↑
MODE=Edit       SMPL=↓
```

6) This will continue until all configurable values have been reached, the last one being the seconds.

Note: The clock should be checked for accuracy and reset for daylight savings time.

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TEST PARAMETERS

The parameters throughout this section will directly affect how a test is performed as well as the final results. To enter this configuration section, from the main screen, you will press MODE then press SMPL four times. This will bring you to the screen shown below.

```
Setup Misc?     ESC=↑
MODE=Yes        SMPL=↓
```

1) Press MODE to begin this sequence.
    a) This allows you to change the **Tool ID**.

```
ToolID=xx       ESC=↑
MODE=Edit       SMPL=↓
```

2) When finished, press SMPL to continue.
    a) This brings you to the **Steering Wheel Radius**.
        i) This value has been determined by Kemkraft Engineering during the initial testing of the tool. If there are multiple steering wheels and they each require a different radius, you will find a reference to these values at the end of this manual.

```
SwRd=xxxx.xmm   ESC=↑
MODE=Edit       SMPL=↓
```

3) When finished, press SMPL to continue.
    a) This brings you to the **Crown Offset**.
        i) This value is determined by the surface the vehicle under test is driven on. This allows the vehicle to be driven on a surface that has a crown, usually for water runoff. The final angle will be compensated to include this value.

```
CrOS=xx.x°      ESC=↑
MODE=Edit       SMPL=↓
```

4) When finished, press SMPL to continue.
    a) This brings you to the number of **Runs per Test**.
        i) This allows the unit to take the average values of a single run or the average values of a two run test. A two run test will store the average of both runs. This is useful for a test track that requires the operator drive in one direction before turning around for the return trip.

```
Runs/Test=x     ESC=↑
MODE=Edit       SMPL=↓
```

5) When finished, press SMPL to continue.
    a) This brings you to the **Start Delay**.
        i) This will begin a count down, for the number of seconds that have been configured, before any samples are taken. This is useful for a rolling start on to the test track and will be done before both the first and the second run.

```
StDly=x.xs      ESC=↑
MODE=Edit       SMPL=↓
```

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6) When finished, press SMPL to continue.
   a) This brings you to the **Run Time**.
      i) This is the number of seconds for the unit to take samples. This value is determined by the time it takes for the vehicle under test to travel between the starting and stopping points of the test track. If the unit is configured for a two run test, this should be configured for the shorter of the two runs.

```
RunTm=xxs        ESC=↑
MODE=Edit        SMPL=↓
```

7) When finished, press SMPL to continue.
   a) This brings you to **Bypass**
      i) This allows bypassing of certain screens when starting a run.

```
Bypass=Off       ESC=↑
MODE=Edit        SMPL=↓
```

8) When finished, press SMPL to continue.
   a) This brings you to the **Backlight Duration**.
      i) This is the number of seconds for the backlight to remain on after the last push of a button. Note: The longer the backlight remains on, the shorter the battery life.

```
BLDur=xxs        ESC=↑
MODE=Edit        SMPL=↓
```

9) When finished, press SMPL to continue.
   a) This brings you to the **Scanner**
      i) This will determine if a VIN barcode is to be scanned before starting a test. This is detailed further in the operation section of this manual.

```
Scanr=Off        ESC=↑
MODE=Edit        SMPL=↓
```

10) When finished, press SMPL to continue.
    a) This brings you back to the Tool ID.
    b) Press ESC until the intro screen is display and you are ready to begin testing.

ADDITIONAL PARAMETERS

The parameters in this section can have undesirable results if not configured correctly. These are available due to the increase of multiple steering wheel support. These values are determined during final testing of the unit and **should not be changed unless instructed to do so** in the multiple wheel reference sheet(s) at the end of this manual.

To enter this configuration section, from the main screen, you will press MODE then press SMPL five times. This will bring you to the screen shown below

```
Set MassComp?  ESC=↑
MODE=Yes       SMPL=↓
```

1) Press MODE to begin Mass Compensation. (You will be warned)
   a) The first screen determines if Mass Compensation is on or off, **this should never be changed to off**. If it is, the test results will be inaccurate.
   b) Every time the unit is powered on, this value will be set to on, to minimize the risk that it is inadvertently changed.

```
MassComp=On    EXC=↑
MODE=Edit      SMPL=↓
```

2) Press SMPL to continue.
   a) This brings you to the Force @ 90.
      i) This value determines the amount of force the tool puts on the force transducer.

```
F@90°=xxx.xxN  ESC=↑
MODE=Edit      SMPL=↓
```

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TRANSFERING DATA

The KEI-300 Steering Wheel Torque/Inclinometer Tester can store data, which can be transferred to a computer for further analysis.

This requires:
1) The Kemload32 program. (A Windows PC based application)
2) A null modem serial cable. (A Female DE-9 to Female DE-9 cable)
3) An available serial port on the PC.

The program and cable are both supplied by Kemkraft Engineering and are shipped along with the tool.

To begin the data transfer:
1) The null modem cable must be fully and securely connect to a serial port on the PC at one end.
2) The Kemload32 application must be running and active on the PC.
   a) The port settings must be 19200,N,8,1. This can be seen on the status bar at the bottom of the application.
   b) To configure this, choose Options, Serial Port Configuration from within Kemload32.
   c) The Port Indicator must be green, indicating that the serial port is available and ready.
3) The KEI-300 Steering Wheel Torque/Inclinometer must be at the main display.
   a) This is the main screen after powering on the unit.
4) Connect the serial port of the KEI-300 Steering Wheel Torque/Inclinometer to the other end of the null modem cable.
5) Either press F6 on the PC keyboard or choose File, Download from within Kemload32.
6) The unit will now display that a data transfer is in progress.
   a) You will also see the data arriving within Kemload32.
   b) Pressing ESC will abort the transfer; this will result in a partial transfer and will skip the rest of this section.

```
 UpLoading   ESC=HALT
********************
```

7) When a successful data transfer is complete, the unit will purge all stored records.
   a) The unit will display a screen informing that a record purge is in progress.
   b) Pressing ESC will abort the purge; this will result in the existing data being transferred, in front of any new data, on the next transfer.

```
Purge Recs ESC=Abort
********************
```

8) The unit will then display the number of records that were transferred as well as the number of records purged.

```
Purge Done   SMPL=Nxt
Tx=xxx D=xxx
```

9) The unit can now be powered off and disconnected from the null modem cable.
10) The data transfer is now complete.
   a) This data is both displayed on the screen of kemload32 and saved to a file named "Kemload32.txt" which resides within the installation directory of Kemload32.
   b) This file has a fixed column width format, for easy importing into other programs.

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Warranty

Kemkraft Engineering, Inc. warrants your product to be free from defects in material and workmanship for a period of 1 year from the original date of release. If you discover a defect in a product covered by this warranty, we will, at our option, repair or replace products which prove defective. This warranty is covered out of Kemkrafts' Plymouth, MI facility.

Warranty Exclusions

This warranty covers defects in manufacturing discovered while using the product as recommended by the manufacturer. The warranty does not cover loss or theft, nor does coverage extend to damage caused by misuse, abuse, unauthorized modification, improper storage conditions, lightening, natural disasters or damage caused by shipping. The warranty does not cover parts that are subject to normal wear and tear, such as batteries, adjustment screws and/or moveable parts.

Limits Of Liability

Should the product(s) fail, your sole recourse shall be repair or replacement, as described in the preceding paragraphs. We will not be held liable to you or any other party for any damages that result from the failure of this product. Damages excluded include, but are not limited to, the following: lost profits, lost savings, lost data, damage to other equipment, and incidental or consequential damages arising from the use, or inability to use this product. In no event will Kemkraft Engineering, Inc. be liable for more than the amount of your purchase price, not to exceed the current list price of the product, and excluding tax, shipping and handling charges.

Kemkraft Engineering, Inc. disclaims any other warranties, expressed or implied.
By installing or using the product, the user accepts all terms described herein.

How To Obtain Service Under This Warranty

Said equipment would either need to:
1. Be sent to Kemkraft Engineering, Inc. for evaluation and/or repair

    47650 Clipper Drive
    Plymouth, MI 48170
    PH: (734) 414-6500
    FAX: (734) 414-6599

2. If required, Kemkraft Engineering, Inc. would repair the equipment on site provided the end user pays all travel costs.

Requirements

The cost of shipping to the manufacturer or authorized repair center or payments of any customs clearance fees or duties are the responsibility of the user.