UserManual

Test-I Go

Ver.: 4.0.1

Contents

Startup Information

Firmware: On the top left corner we see Firmware Version.

Moving to the right, we see the memory percentage left and a battery load %.

Keep moving to the right, we see SD Memory left.

Finally, we see date and hour on top right corner.

Buttons

On regards to the *hardware* buttons or *hardware* keys we have basically eight of them to operate Test I Go: four keys on the side and four on the lower part.

Side buttons:

Two navigation keys

We use these keys to go up or down options displayed on window.

An enter key

We use it to access menus, submenus and options we select with navigation keys

An exit key

Goes back to the previous menu or submenu. (Does not work on all cases, sometimes we need to use an “Exit” button on screen to go back).

There are duplicates of these keys on the other side of the screen, they hold the same functions.

Lower part buttons

These are Context Sensitive Function Keys; they could also be regarded as four *Multi-function* keys, since they do not have pre-programmed functions.

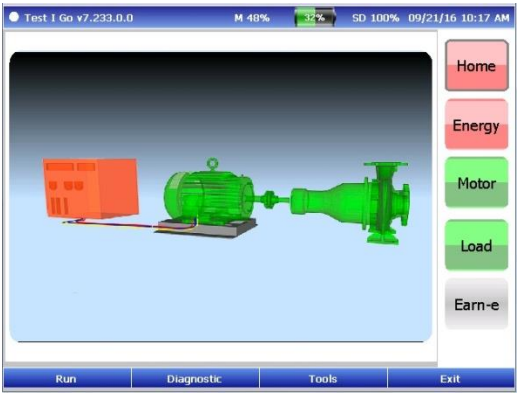
They are the F1, F2, F3 and F4 keys. Each one of these *hardware* keys correlate to *software* digital buttons.

These digital buttons change depending on window that are displayed. This is why these *hardware* keys (F1, F2, F3, and F4) hold as many functions as the different windows can provide.

Main Window

Once we run the test, the Test I Go displays a diagram of the energy, the motor and the load in different colors.

This is the Home Menu



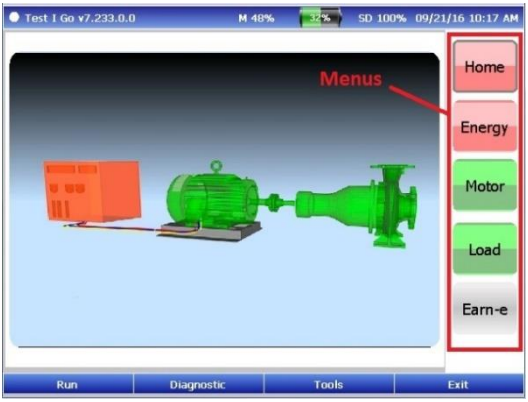
Color Code

- Green = Running within tolerances. No actions needed.
- Yellow = Machine has exceeded a caution threshold. Action

should be taken to avoid future problems.

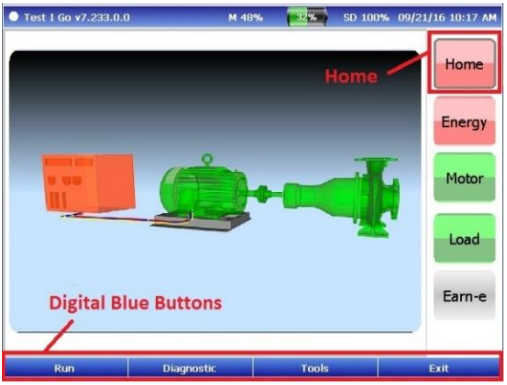
- Red = It has exceeded a warning threshold. Action needs to be taken to correct problem.
- Blue = Not applicable thresholds.

We can use the up and down blue keys on the DSP Logger Expert sides to navigate through the *menus* on the right side of the screen. These menus, from the top, are: Home, Energy, Motor, Load and Earn-e.



Home Menu

In this window, in addition to menus on the right side of the window, we see blue buttons on the bottom.
From left to right: Run, Diagnostic, Tools and Exit.



In this window the bottom blue buttons are from left to right: **Run**, **Diagnostic**, **Tools** and **Exit**.

Run

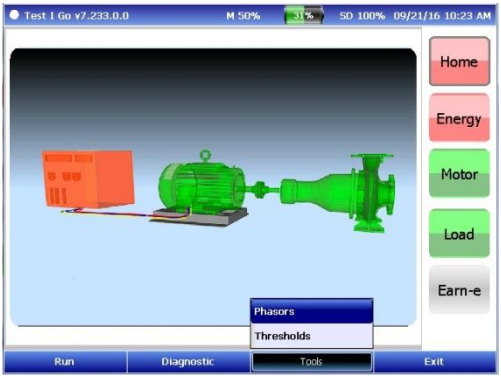
Performs the test.

Diagnostic

Shows a list of elements tested by Test I Go, alongside a color-coded state indicator of the elements.

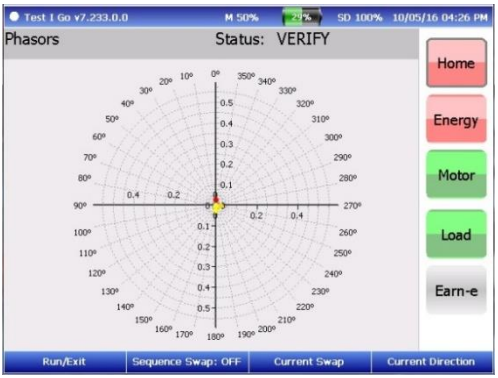
Tools

Within the “Tools” option we find another two options: “Phasors” and “Thresholds”.



Phasors

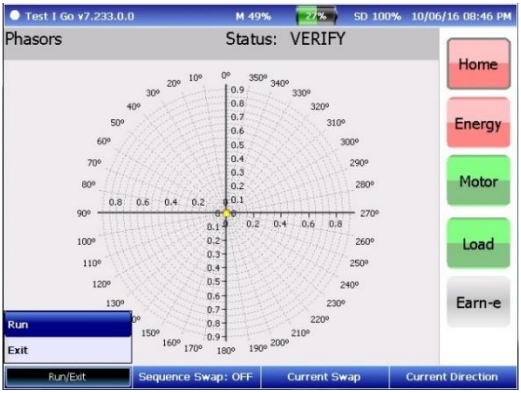
This window shows the **a, b, c** phasors.



Bottom blue buttons: Run/Exit, Sequence Swap: OFF, Current Swap and Current Direction.

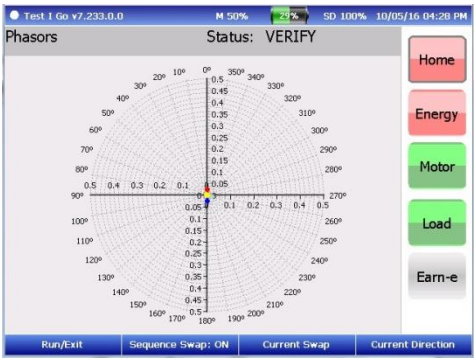
Run/Exit

Displays another two options: “Run” and “Exit”.



Sequence Swap: Off

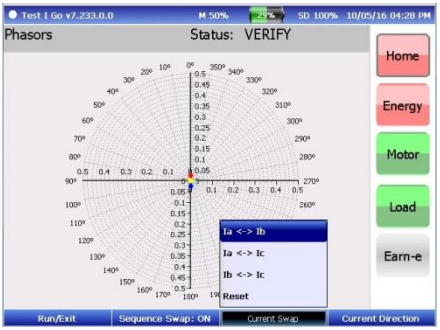
When we enter this key, it switches from “Sequence: On” to “Sequence: Off”.



Current Swap

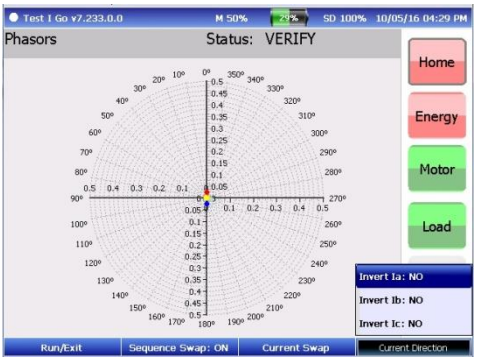
This option displays another four options:

“Ia <-> Ib”, “Ia <-> Ic”, “Ib <-> Ic” and “Reset”.



This allows you to swap any two phases.

Current Direction



This option displays another three options: **“Invert Ia: NO”, “Invert Ib: NO**” and “**Invert Ic: NO”**.

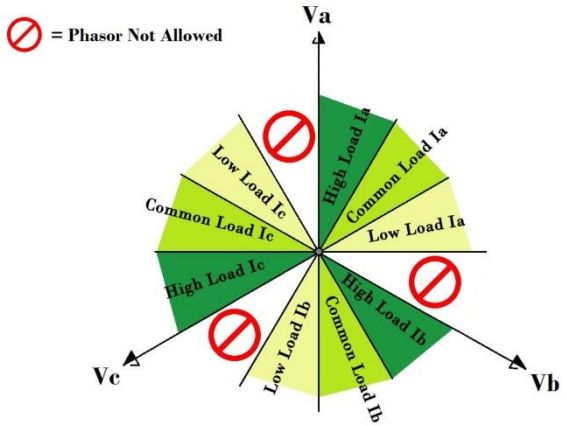
We can invert the direction of **“Ia”, “Ib” and “Ic**” by switching from “**NO**” to “**YES**” any of three options displayed.

Adjusting Phasors Manually

There are two rules for this:

1) All phasors (currents and voltages) should have an angle between them of 120 degrees ±5.
2) For all induction motors, the current phasor must follow the voltage phasor by a maximum of 90 degrees.

The next image shows all phasor positions.



To get a correct setup, all three current phasors must be in the same area.

As an example, we could say that if an **Ia** phasor is in the high load position, **Ib** and **Ic** must also be in the high load position.

The ***Prohibited* sign** shows areas where phasors are not allowed. Although mathematically this can be achieved, phasors cannot physically reside in the prohibited areas (three phase induction motors) without Power Factor correcting devices.

There is possibility that phasors can reside in the high load position or be rotated 180 degrees and be in low load position.

In order to minimize potential errors, we have provided a load estimate.

If phasors are setup in high load position and load estimate is 300 percent or higher, then most likely correct solution is to rotate phasors to low load position.

To go from a high-load position to a low-load position, rotate each dial one position to the left. To go from a low load position to a high load position: rotate each dial to the right one position.

Threshold

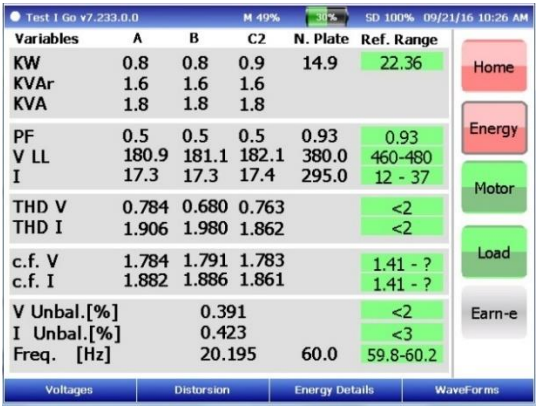
When entered we get this window below.

In this window we can define thresholds against which machines will be tested. In each test type, we must enter caution and warning thresholds. Using navigation keys, we can select any box we want to modify.

Keep in mind that we must enter caution and warning thresholds for over and under voltages independently from each other.

Energy Menu

In this menu we provide with information of power qualities for each phase, along with average / sum values.



Energy Menu window

Is divided into five horizontal sections

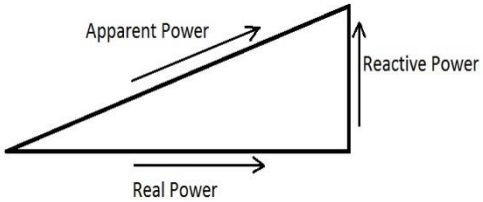
1) **First section** displays kilowatts (kW), kilovolt amperes reactive (kVAr), and kilovolt amperes (kVA).
2) **Second section** displays the power factor (PF), voltage (V), and current (I) values.
3) Total harmonic distortion voltage (THD V) and total harmonic distortion current (THD I) are presented in **third section**.
4) Crest factor voltage (c.f. V) and crest factor current (c.f. I) values are shown in the **fourth section**.
5) Voltage unbalance percentage (V Unbal. [%]), current unbalance percentage (I Unbal. [%], and frequency (Freq. [Hz]) are presented in **fifth section**.

In the lower part of the window, we can see that the blue buttons changed to a new four option menu (this happens every time we navigate to a new window).
From left to right: Voltage, Distortion, Energy Details and Waveforms.

A quick approach to Power Factor

We understand power factor as the relation between Real Power (energy that is producing real work) and Apparent Power (energy that is being consumed, but is not in its entirety being used to produce work); and ultimately the Reactive Power (this is understood as the energy that does not provide any actual work).

Graphical representation of these three powers is the power triangle. Using this graphic, we have a better understanding of this close relationship between powers.



kW is the Real Power. It is power that is actually doing work. It is also known as Actual Power or Active Power.

kVAR is the Reactive Power. This power is consumed by magnetic field created in the winding. This power does not provide any actual work, but it is needed for machine to work.

kVA is the Apparent Power. It's the product of Real Power (kW) and Reactive Power (kVAR).

Below we see an example of a corrected power factor.

Image number one shows a power factor of 83%. While image number 2 shows a corrected power factor of 97%.

Image 1

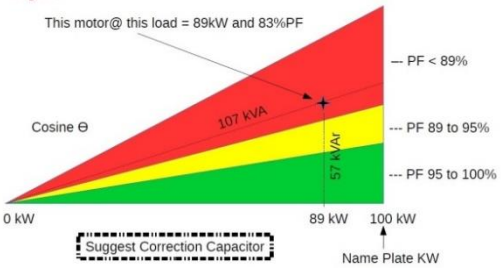
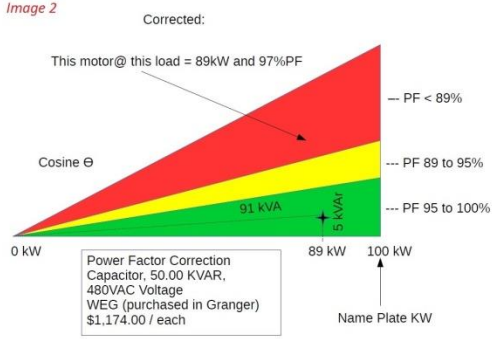


Image 2



We can see that the amount of power provided by the motor is 89kW in both scenarios, but with the crucial distinction that when power factor is corrected the Apparent Power is 16kVA less, that is, motor consumes 16kVA less for the same amount of work.
We can also see a 52kVAR difference in the Reactive Power.

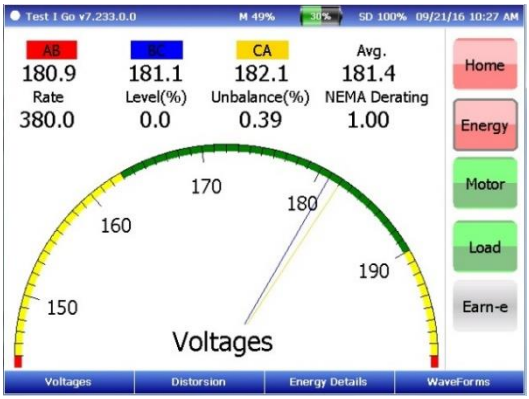
Bottom Blue Buttons: Voltages, Distortion, Energy Details and Waveforms.

Voltages

When accessed, this option displays another two options: “Voltages” and “Unbalance Trend”.

Voltages

When entered we get the next window



On the top with three different colors, we see voltages for voltage phasors. Also, on the top we see the Rate, Level (%), Unbalance (%) and NEMA Derating.

Test I Go examines single-phase voltage in motor by calculating its percentage unbalance, utilizing NEMA derating. It compares the voltage unbalance level with stored threshold.

Negative sequence currents within the stator can be caused by an unbalanced voltage condition, resulting in excessive heat.

This voltage unbalance test determines if an unbalance voltage condition exists in the machine. Test I Go uses the NEMA derating curve that specifies a maximal load for each type of unbalance.

The rest of the window is occupied by a graphic indicator, a speedometer like graphic.

Unbalance Trend

This option displays the next window:

Above we see the title “Voltage Unbalance Trend”, while on the bottom part we see graphically displayed the value of monitored quantity (y-axis) against test numbers (x-axis).

x-axis shows the number of measurements performed for that particular motor ID.

Distortion

This is the second option on bottom menu from left to right. When entered, it shows another four options:

1) “Harmonic/Total Distortion”

2) “Harmonic”

3) “THD Trend” and

4) “TDV Trend”.

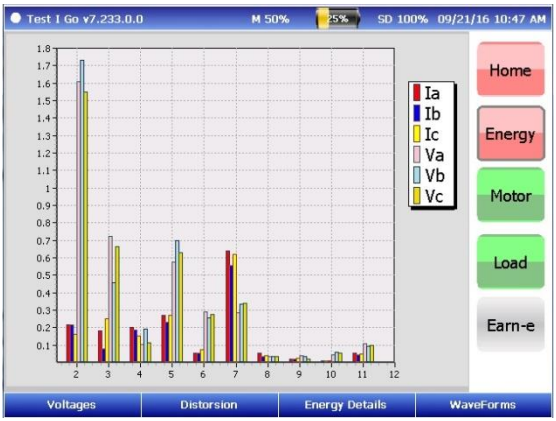
Harmonic/Total Distortion

What this function does is examinate total harmonic distortion of three single phases to neutral voltages. The function compares level of total harmonic distortion to threshold values that you define.

On the top we see: THD V, THD I, C.F., TD V, TD I. First three correspond to Harmonic distortion, while the other two correspond to Total Distortion.

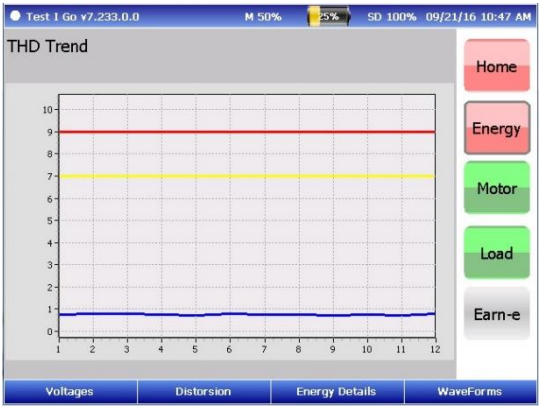
Two graphic and numeric indicators for Harmonic Distortion and Total Distortion can be seen on the lower part of window.

Harmonic

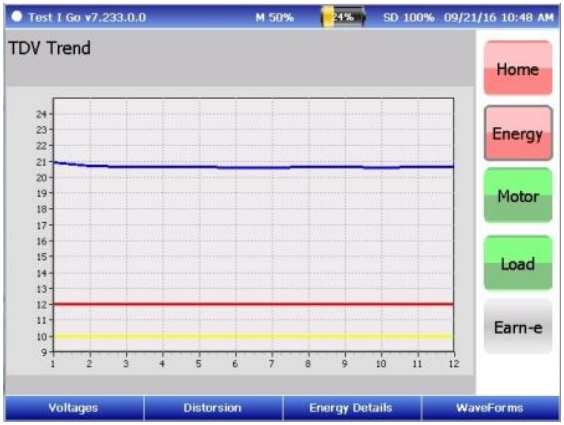


Harmonic components compare magnitude of harmonic components to fundamental currents and voltages of system. Bar chart displays distribution of content on different harmonic numbers for all currents and voltages.

THD Trend



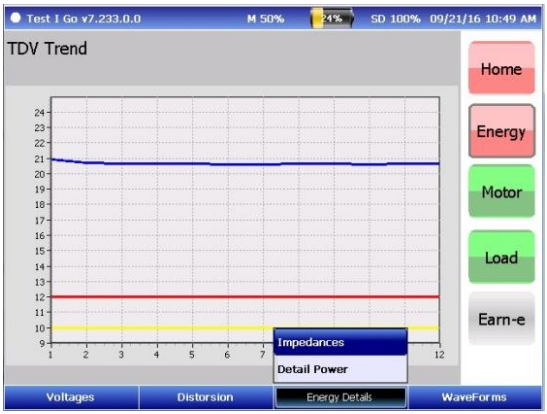
TDV Trend



Energy Details

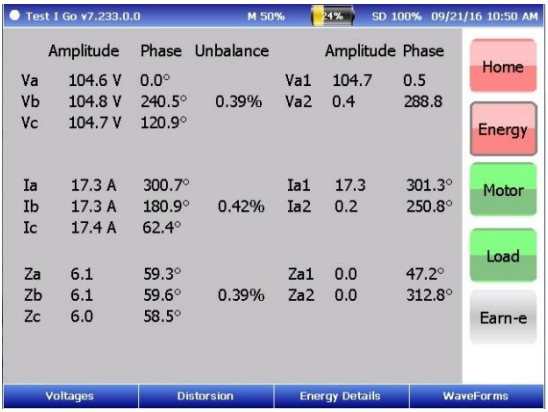
The third option in bottom bar is Energy Details.

When entered, it displays another two options: “Impedances” and “Detail Power”.

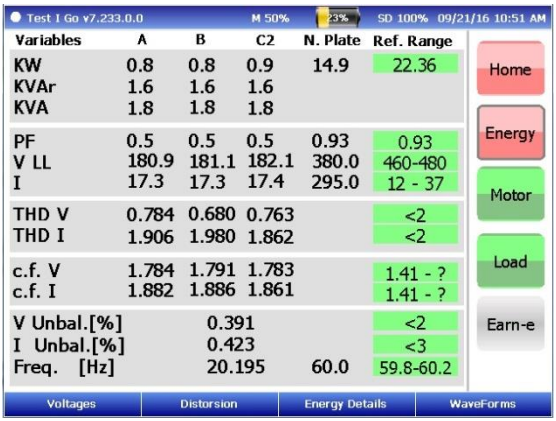


Impedances

This window displays voltage, current and impedance unbalance, positive sequence (accelerating), and the negative sequence (retarding) current, voltage, and impedance information.



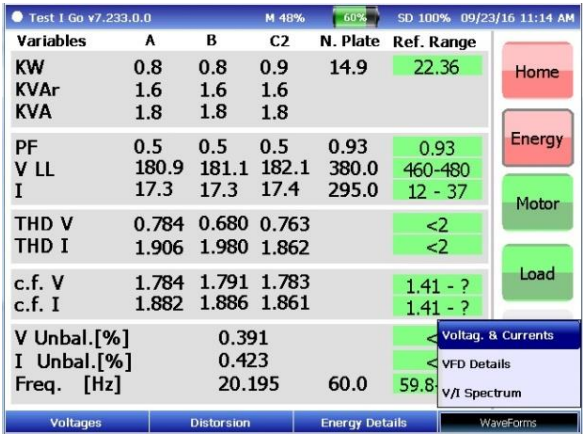
Detail Power



When we enter Detail Power it displays the same data as data that is displayed when we enter the Energy Menu that we see on the right side of the window.

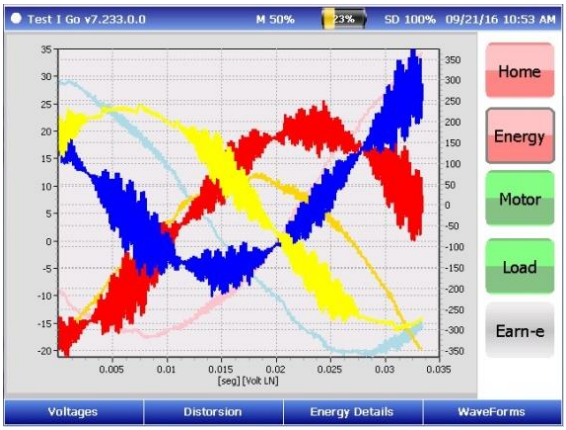
Waveforms

The fourth option in bottom bar is Waveforms.
When entered it displays another three options; 1) “Voltages & Currents” 2) “VFD Details” and 3) “V/I Spectrum”.



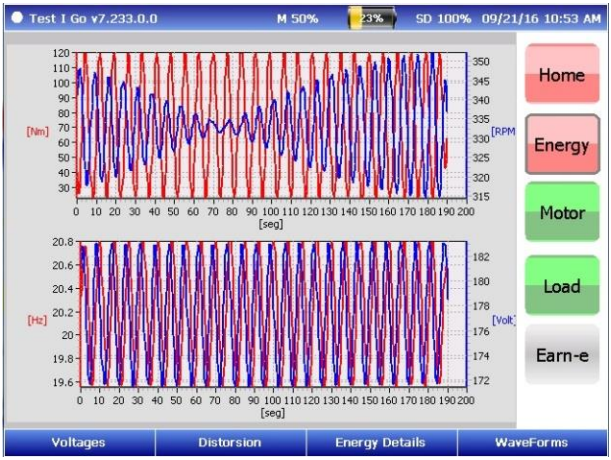
Voltages & Currents

Displays waveforms for all three current and voltage measurements.



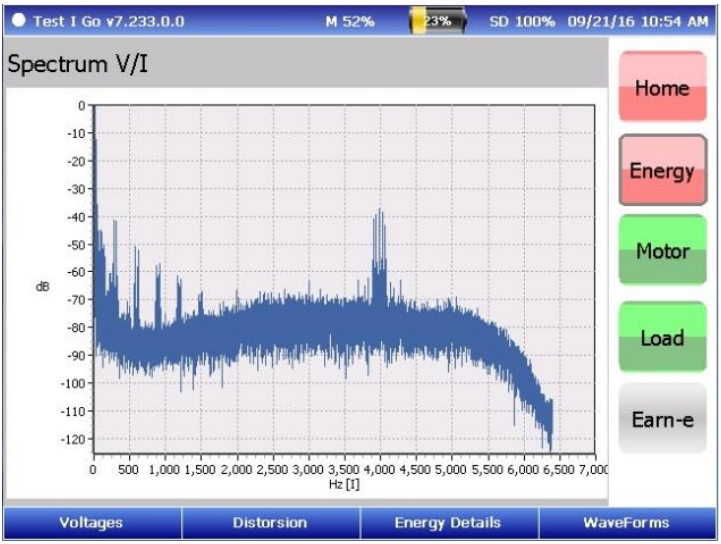
VFD Details

In this window we can find dynamic behavior of voltage level, torque, frequency, and speed as a function of time.



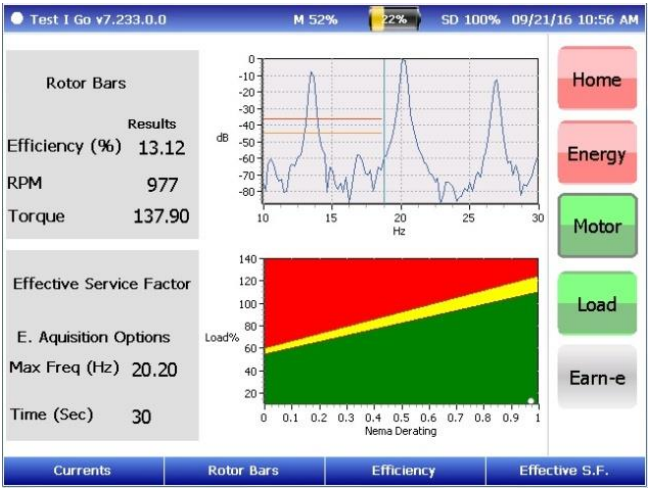
V/I Spectrum

Through this function we can analyze frequency spectra of three line-to-neutral voltage waveforms and three-line currents independently of each other.



Motor Menu

In this menu we find that window is divided in two. The top part shows the Rotor Bar function, while on bottom we see Effective Service Factor function.



Rotor Bar

The way this function operates is: it records the relative amplitude of rotor-bar sideband, and compares the rotor cage signature to stored thresholds.

An overall condition evaluation of the machine can be achieved with this function.

It's been shown that situations like excessive heat on machine, decreasing efficiency, shortening insulation life, and even possibly core damage can be the result of broken rotor bars.

Effective Service Factor

This function displays estimated percentage load derated with NEMA derating factor.

Effective Service Factor test identifies how closely to its effective service factor is motor operating. Through this test we can predict heat-based deterioration and provide an accurate thermal assessment of motor.

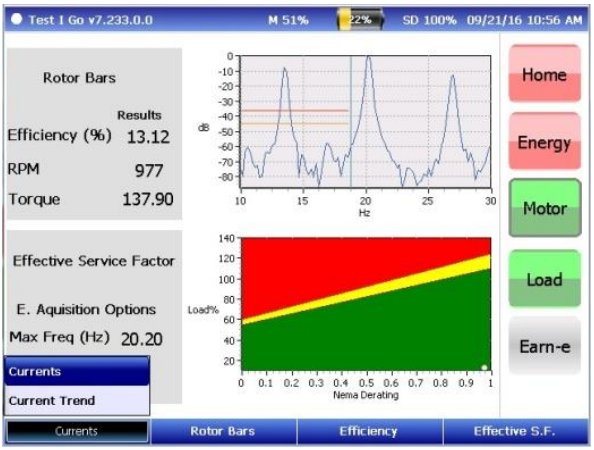
Bottom blue buttons:

In Motor Menu we find that bottom blue buttons are now:

Currents, Rotor Bars, Efficiency and Effective S.F.

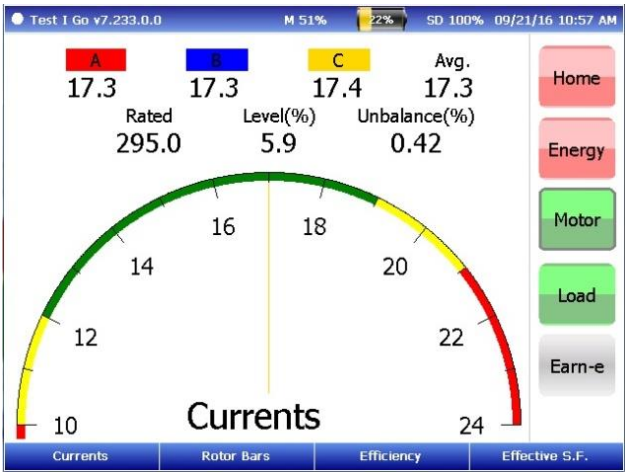
Currents

Within this option we find another two options: “Currents” and “Current Trend”.



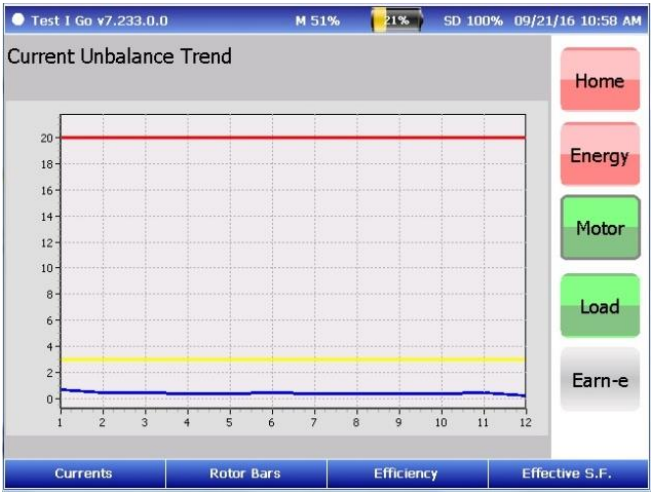
Currents

In this window we find information about Rated current, Level (%) current and Unbalance (%) current.



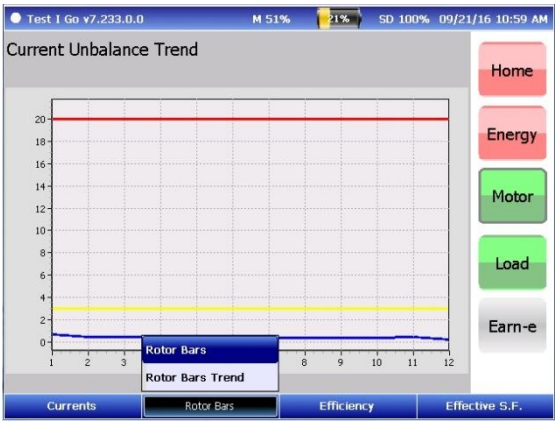
Current Trend

Displays Current Unbalance Trend.



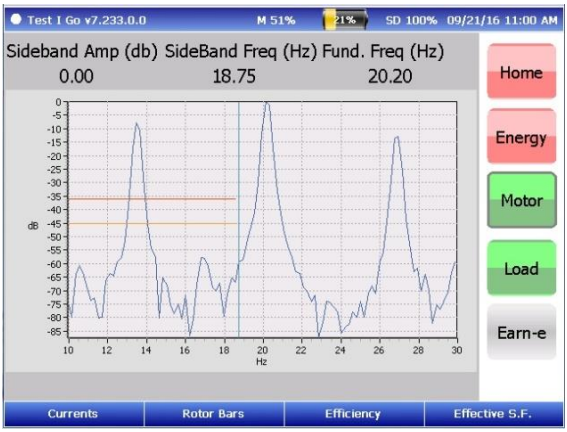
Rotor Bars

Within this option we find another two options: “Rotor Bars” and “Rotor Bars Trend”.



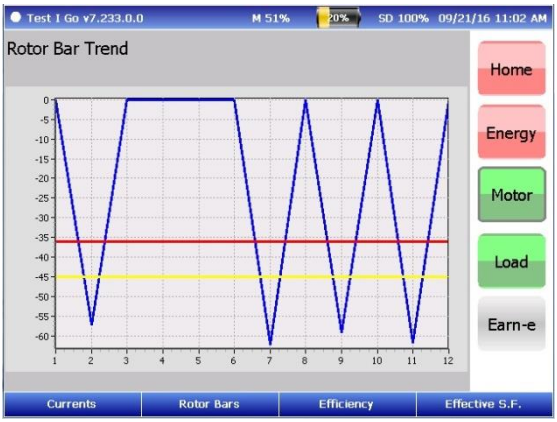
Rotor Bars

This option displays a more detailed approach to Rotor Bar function that has been already described, by showing the Sideband Amplitude (dB), the Sideband Frequency (Hz) and the Fund. Frequency (Hz).



Rotor Bars Trend

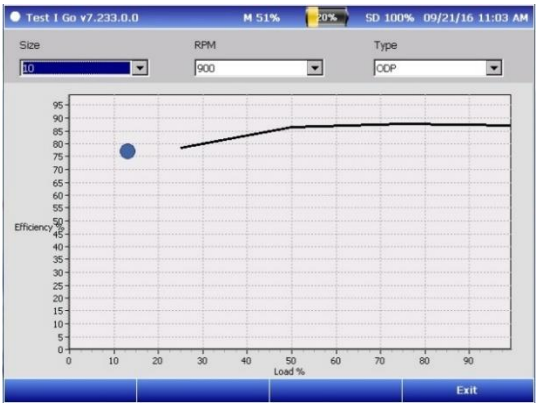
Displays Rotor Bar Trend.



Efficiency

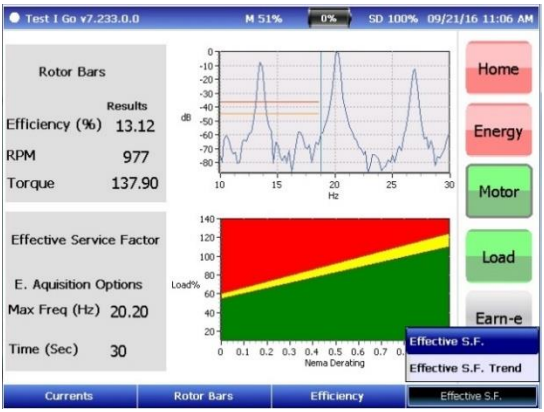
This window provides a graphic of electrical data for test. On y-axis we see efficiency % while on x-axis we see load %.

On top of window, we find three variables that we can modify: ODP, RPM and Type.



Effective S.F.

Within this option we find another two options: “Effective S.F.” and “Effective S.F. Trend”.



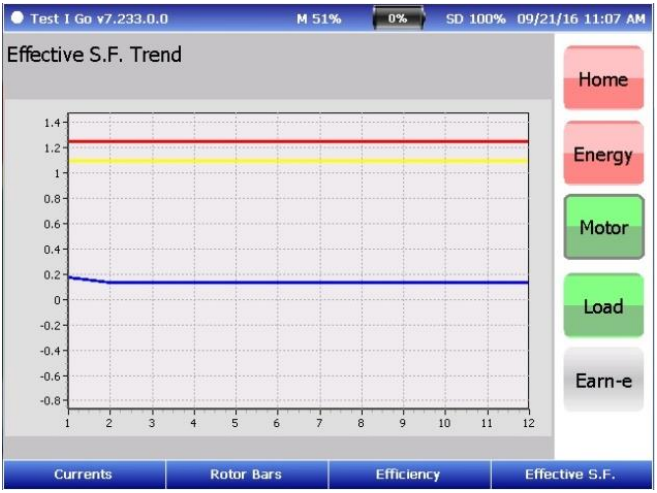
Effective S.F.

This function takes a closer look into Effective Service Factor function that has already been explained above. We find the NEMA Derating on the x-axis and the Load % on the y-axis.

Additionally, we see specifications in the top part of window: Ef S.F., Load % and NEMA Derating.

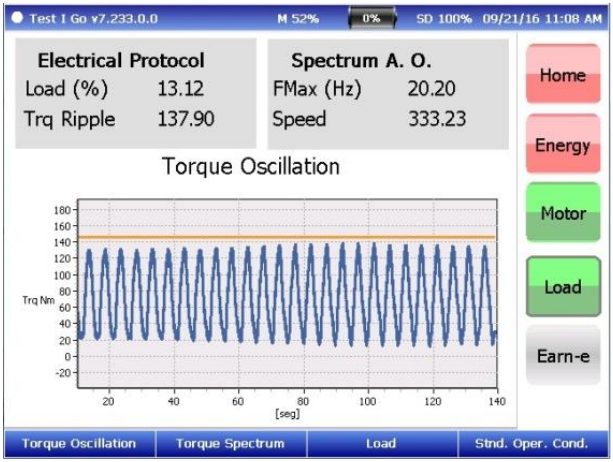
Effective S.F. Trend

Displays the Effective S.F. Trend.



Load Menu

In this menu we find a graphical display of torque oscillation; window shows measured torque over time compared to rated torque calculated from motor nameplate information.



"Electrical Protocol" division on top left part of the window shows Load (%) and Torque Ripple. While Spectrum A.O., on the right side, shows the Fmax (Hz) and Speed.

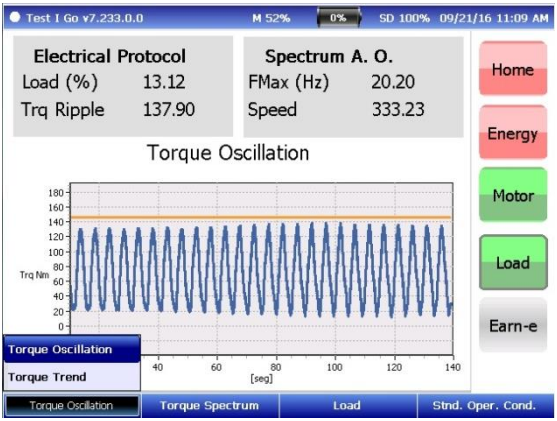
Bottom blue buttons

Load Menu bottom blue buttons are:

Torque Oscillation, **Torque Spectrum**, **Load**, and **Stnd. Oper. Cond**.

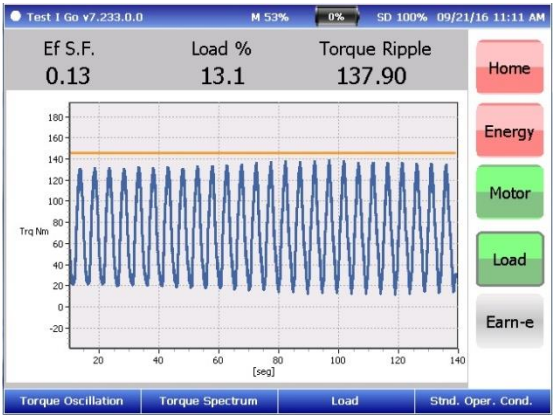
Torque Oscillation

When entered, this option displays another two options: "Torque Oscillation" and "Torque Trend".



Torque Oscillation

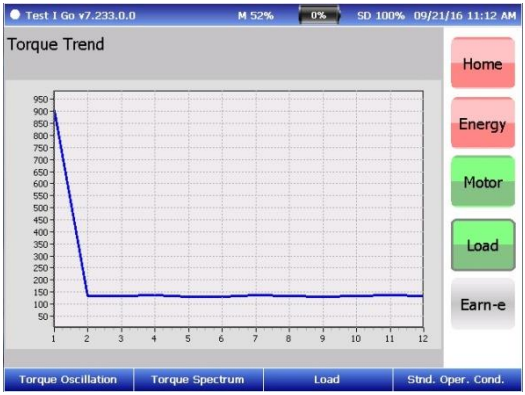
This window is very much like main window that has already been described. We find graphical display of torque oscillation with Torque Newton Meter (Abbreviated as “Trq Nm”) on y-axis, and [seg] on x-axis.



In addition, on top we see the Effective Service Factor, Load % and Torque Ripple.

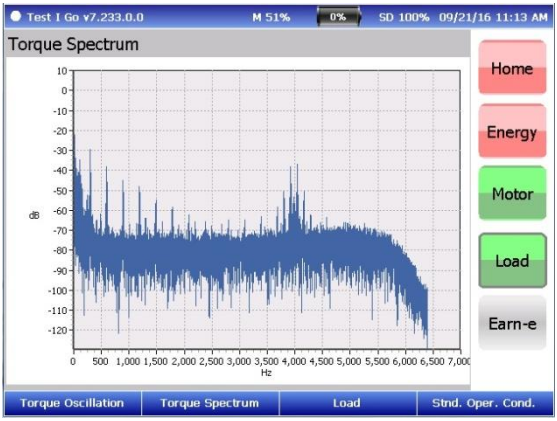
Torque Trend

Displays Torque Trend.



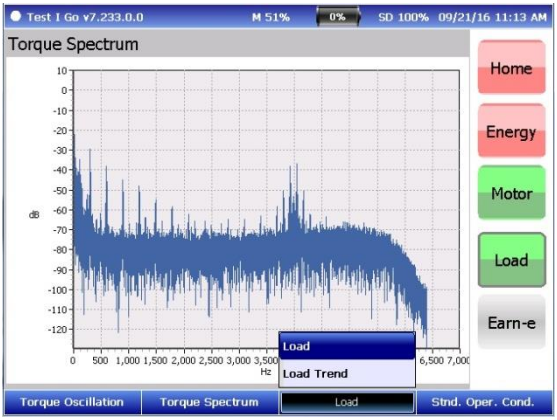
Torque Spectrum

This option displays a window in which it's shown frequency spectra of torque; with dB on y-axis and Hz in x-axis.



Load

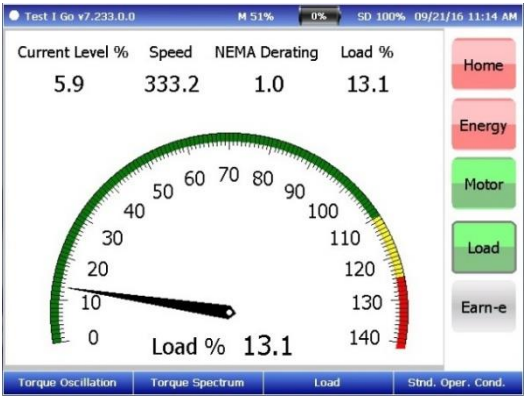
This option displays another two options: "Load" and "Load Trend".



Load:

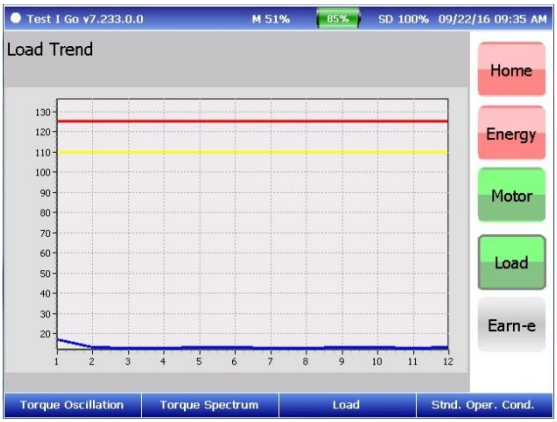
Displays a window in which we see Current Level %, Speed, NEMA Derating and Load %.

A Load % graphic is seen in bottom part of window.



Load Trend

Displays Load Trend.



SEMAPI provides technical information on the Internet for help with product use: visit

www.dsplogger.com for technical manuals, a database with frequently asked questions, and application notes. You can also find instructional videos about firmware for the DSP Logger Expert at: