Food Technology Corporation

Texture Lab Pro

Software Reference Manual

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Contents

Running the PC Software

Before running the TMS-Pro control software, your PC should be connected to the test stand that has a load cell connected to it (refer to the hardware manual). Texture Lab Pro will not proceed to function until checking whether:

1. The PC is connected to a test stand
2. The test stand is turned on
3. A load cell is connected to the test stand
4. The load cell is calibrated
5. No significant residual load is being registered by the load cell
7 The test stand is not reporting an unresolved fault condition

A negative result on point (1), (2) or (3) will display a warning message, but clicking on the OK button will allow the software to load in limited functionality mode. In this mode, existing test data can be inspected and processed, but new test data cannot be accumulated. When in limited functionality, any attempt to re-connect will re-display the appropriate warning message. A negative result on point (5) will offer options of either entering the Calibration & Service screen or closing TMS-Pro. A negative result on point (6) will display a warning message and offer the option of backing-off the residual load and displaying a load of zero; clicking on OK will allow the software to continue loading. A negative result on point (7) will display a message advising the operator to contact his Food Technology agent.

When starting, TMS-Pro will also advise the operator in the event of:
1. A load cell that has never been connected to the system being detected. TMS-Pro will then update the database of available load cells.
2. The current “maximum load” setting exceeding the capacity of the load cell. TMS-Pro will automatically adjust this setting to the capacity of the load cell.

When the Texture Lab Pro software is first started, the program will prompt for Operator or Master and then ask if the operator wants to calibrate the absolute position. This is an optional routine but can be very helpful for repeat test set ups. If you click no, the software starts right up. If you click yes, the software will prompt you to check to make sure there is nothing preventing the cross head from moving

all the way up. If all is clear click “OK” to proceed. The test stand will move to the absolute top position and back down a few millimeters.

This will now be the “Zero” position for displacement measurements. The zero position is held in the test stand memory until the test stand is powered off or it is changed by the operator or program. This allows programs to be written that require the test stand’s cross head to be positioned at the exact same place from day to day. Such a condition is necessary for tests employing the CS-1 Kramer Shear cell. The top portion of the test cell needs to be at the correct height in relation to the bottom assembly in order for the blades to mesh properly in the top grid.

Using Windows Software

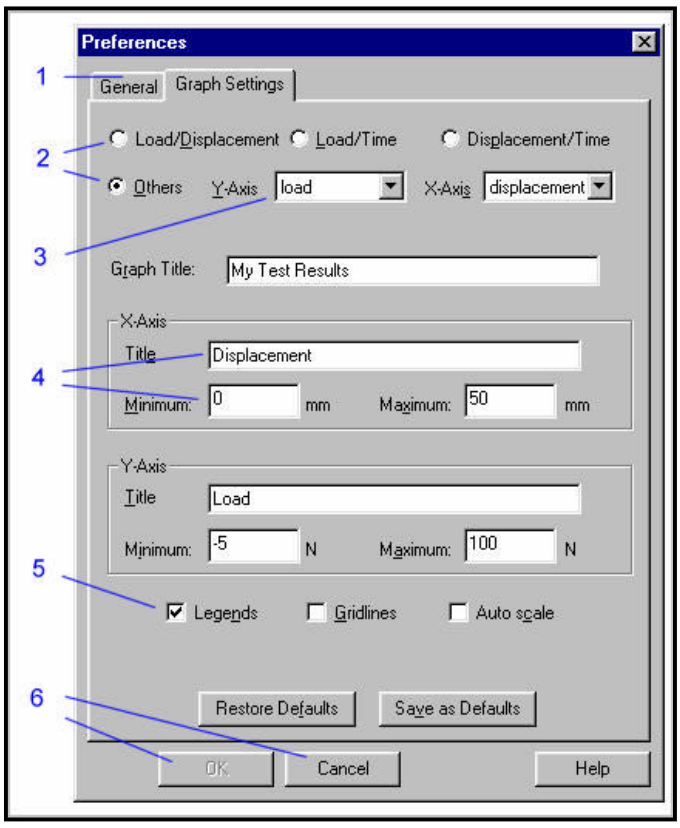


Figure 1 : A typical dialog box

This section applies to all Windows software, not just to TMS-Pro. When the operator selects an option from a menu or a toolbar, a “dialog box” will appear. The “typical dialog box” shows the different facilities available within Windows for operators to set-up software to behave according to their preferences.

A dialog box needs to control a number of features that are related. However, attempting to control all the available features within one screen can very easily become “messy”, but completely separating related features can make software less intuitive. The solution is to separate groups of features with “tabs.” The dialog box above has two tabs (1); it shows the right hand tab selected. Clicking on the left-hand tab will display another group of features from which the operator can choose.

It will often be necessary for an operator to make one choice from a list of options. When the list is relatively short (typically two, three or four items), this is done with a group of “option buttons” (also known as “radio buttons”.) There are four option buttons in the screen shot above (2). Clicking into one of the three “empty” buttons will move the black dot there, and the new choice will have been made.

When it is necessary to choose one option from a longer list, a dropdown list box (or “combo box”) is used (3). Clicking on the down arrow to the right of the box (as illustrated by the cursor) displays a list; clicking on the appropriate item in that list will update the box, and the new choice will have been made.

Windows has a facility for the operator to type in something for the software to work with. Two boxes are indicated by (4). The operator can type whatever he likes into either box. The upper box is a “text box” and it will accept most characters that are typed into it. The lower box appears just the same, however it is a “value box”, so the software is expecting a number to be typed into it. The software will at some stage reject non-numeric input, and insist that an appropriate number be typed in.

Sometimes the operator will be able to choose more than one option from a list. This is usually arranged with a group of “checkboxes” (5). Three such boxes are illustrated above, and just the left-hand option has been chosen. It is possible however to choose any one, two, or all of the three options by clicking in a checkbox and turning the tick on or off.

There are usually two buttons that enable the operator to return to the main program. The OK button carries out all the changes made within the dialog box, whereas the Cancel button ignores all such changes.

Dialog boxes usually also contain a number of buttons. The label on each buttons describes the effect of clicking on that button. Note that the label on one of the buttons (6) is grey rather than black.

An important general feature of Windows software is illustrated in (6) above. If, for example, current settings make an option or operation inappropriate or unnecessary, or, possibly, the absence of data makes the completion of a task impossible, Windows will use grey text to indicate that, for the moment, a feature has been disabled.

The operator can, by choosing Toolbars option from the Display menu, decide whether to display the Standard toolbar and the Load / Displacement toolbar.

Note: The Load/Displacement toolbar will be disabled, if no LOAD CELL or RTC was detected on boot-up.

The Start button will be disabled until a test program is loaded or written.

Setting Zeroes

The Load/Displacement toolbar enables load or displacement values to be set or re-set. Rather than set the load or displacement to zero manually, it might be better to use the ZERO command in the first line of a program

Click on the Zero Load button and the value appearing in the “Load” display box will change to zero, i.e. the operator will have been able to tare out the weight of the test cell, or any residual load in the sample. Clicking on the Restore Load button will restore the “true” reading.

Note: clicking twice on the Zero Load button will mean that the “true” load reading is irretrievably lost - as far as the “Load” display box is concerned.

Click on the Zero Displacement button and the value appearing in the “Displacement” display box will change to zero. TMS-Pro will “remember” the position of this zero, and clicking on the Park button, will return the crosshead to this position.

Within the program, clicking on the appropriate drive button in the Test screen will initiate movement of the crosshead. The drive button and the displayed speed will flash red, when the crosshead is being manually driven.

A single click on the upper drive button will start the crosshead moving up at 5mm/min (or the minimum speed if greater), subsequent clicks will scroll the speed through 10, 20, 50, 100, 200, 300mm/min etc. – until the top speed is reached. Clicking on the lower drive button will scroll the speed back through the above list. The crosshead can be made to move down by using a similar procedure. When the crosshead is driven manually, readings in the “Displacement”, “Speed”, and (if appropriate) “Load” display boxes will be updated

Within the program, any of the following will stop the crosshead moving:

Clicking on the grey Start button

Clicking on the Stop button

Pressing the [Space Bar]

Pressing the [Esc] key

Pressing the control panel [Emergency Stop] button

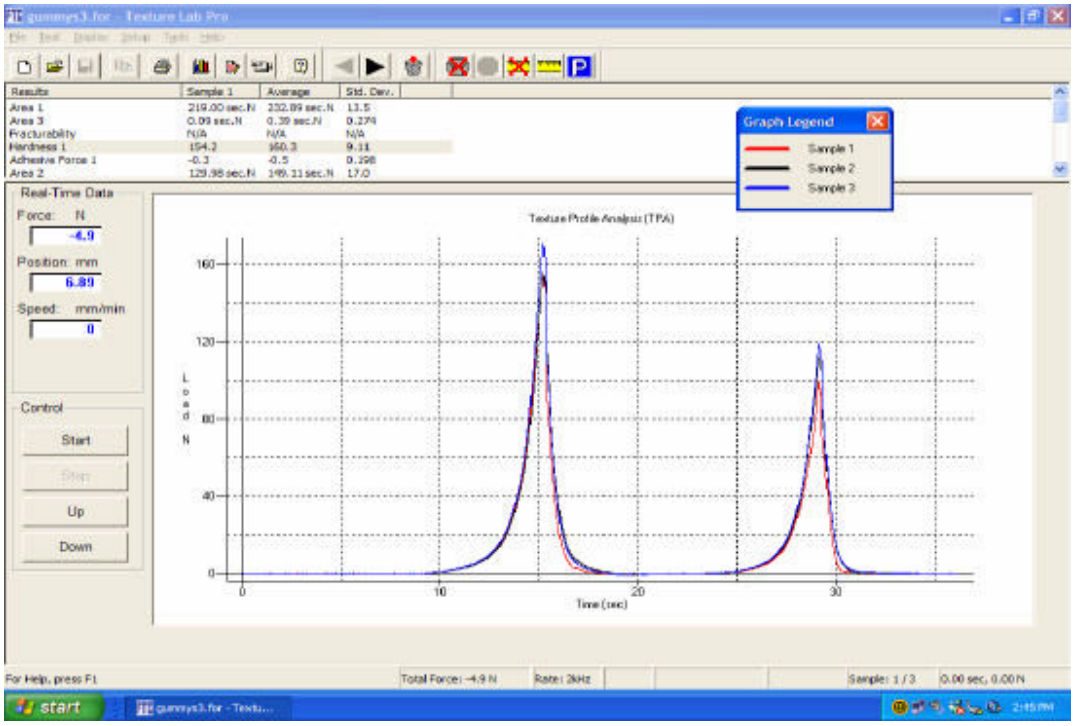


Figure 2 : The TMS-Pro Main Operating Screen

Program Development

Writing a program with TMS-Pro essentially involves three things:

1. Telling TMS-Pro what commands to send to the test stand – choose the Program option from Test menu for this

2. Telling TMS-Pro you want to do with the data generated during the test – choose the Calculations option from Test menu for this

3. Telling other people about the samples you are testing, what you are trying to do to them, and possibly why – choose the Notes option from Test menu for this

TMS-Pro needs to understand the first 2 steps so these instructions will need to be written in a particular format. Consider the expression:
RESULT = FUNCTION (PARAMETER)
This is mathematical shorthand for; take the PARAMETER (s) do something to it which is described by FUNCTION and that will give you the RESULT. A function can have more than one parameter, RESULT = AREA (WIDTH, LENGTH)
Once TMS-Pro has been told both the length and width, it will be able to multiply the two together and calculate the area.

The program facility and the calculations facility of TMS-Pro both feature an interface that will help you develop commands and calculations of this kind. Choosing either Program or Calculations option from Test menu will display a dialog box containing three text boxes. Clicking on the arrow to the right of the Command box will display a list of the entire program or calculation functions available.

Select the required function by clicking on it.
Now specify the parameter(s) of the function, by clicking on […] button to the right of the Parameter box.

A new dialog box will be displayed, but the OK button will be disabled until a value for all the required parameters (in the units indicated) have been typed in.

Click on the OK button and the Parameter box will be updated. Click on Append and a new line will appear, in a numbered position, in the main text box.

Repeating the procedure above will enable a series of program commands (i.e. a program) or a series of calculations to be developed. Clicking on the Print button can print out a list of calculations or program commands.

The TMS-Pro software uses two types of files; Library files, (with an extension of .lib) and data or “force” files (with an extension of .for). They both contain all of the same program, calculation and user preference data. The exception is that the data files (.for) contain the accumulated test data acquired during the testing session. Because of the high data acquisition rate of the TMS-Pro, data or force file can be quite large.

Editing Programs

Load the test program, either by choosing Open option or Load Library Program option from File menu. Minor changes to any program line or calculation can be made by choosing either Program or Calculations option from Test menu then selecting the line to be changed by clicking on it.

Then click on […] button to display the parameters of the line selected in the Parameters text box.

Click and edit within that box, make the necessary corrections.

Finally, click on OK and then Update and the selected line within the main text box will be updated.

A single line may be permanently deleted by clicking on Remove. A single line may be moved by clicking on Cut. The Paste button becomes enabled, thus indicating that the line just cut has been stored. Select a line, click on Paste, and the cut line will be added just before the selected line. The Copy button behaves in a similar manner to the Cut button, but the selected line is not removed from its original position – thus enabling a line to be duplicated.

The same line can, when required, be duplicated several times by cutting (or copying) and then repeating the pasting procedure. Lines can be duplicated into adjacent positions by clicking on the line to be duplicated, and then clicking on the Insert button.

A block of lines can be removed by selecting the line at the end of the block, then repeatedly clicking on Remove.

Several load set points can, for example, be efficiently determined by duplicating a line, then using the Update feature to make minor changes to the parameter(s) of that line.

All lines within the main text box can be removed by clicking on Clear All. This feature may prove to be useful, for example, when several completely different sets of calculations need to be saved in association with a “standard” set of program commands.

De-bugging Programs

Choosing either Program or Calculations option from Test menu will display dialog boxes with similar layouts. The Program dialog box does however include one extra feature – a “Debug Program” checkbox. Enable the box by clicking in it, click on the OK button to return to the main testing screen, then try to run the program by clicking on the Start button; the de-bug window will be displayed. Step-by-step” de-bugging is a useful technique for diagnosing errors that are caused by a variable temporarily assuming a value that the programmer might not have anticipated

The Debug window contains two text boxes, three buttons and a checkbox. The text box on the left displays each line of the test program; the box on the right displays the value of each variable and the current message.

Click on the Run Program button, TMS-Pro will highlight the first program line and try to execute that line. If the line contains an error, a warning message will be displayed. If the line contains no error(s) TMS-Pro will update the value of each of the variables, the

message text, and then move on automatically to the next line.

Some program lines, which contain no errors, might be executed so quickly that it would not be possible to observe the consequences before reaching the next line(s). Under these circumstances it may be useful to click in the “Single Step” checkbox, this will enable the Next Step button. Click on the Run Program button, and then click on the Next Step button. The first program line will be executed as above, but TMS-Pro will not execute the second line until the Next Step button has been clicked on again.

When de-bugging a long program it is not essential to run through the whole program. Simply click on Cancel to return to the main Programmed Testing screen.

Modifying Programs

It will often be necessary to make small modifications to a program. Modifications to a library program can be made, and the program can be re-saved or saved with a new name, as required. There must however be restrictions to modifying a test program.

There is no restriction to modifying the calculations associated with a test program. TMS-Pro, if necessary, can take care of recalculating results – but arranging to re-test all samples is not possible

Imagine, for example, that a sample has been tested at 25mm/min, then the program, calculations and data are saved. If the program were modified by changing the test speed to 50mm/min, it would be inappropriate to allow the new test program to be saved in the same file as data from the old program. Therefore choosing Program option from Test menu will, whenever appropriate, display a message warning that it will only be possible to save a modified program, together with any associated data, if a new file name is chosen.

Note that it is possible to save data from different test procedures within one file - if an ENTER command is used to vary test conditions. It would only be appropriate to use such a technique during program development to investigate the effect of systematically varying a particular parameter within a test procedure.

Saving Library Programs

While developing a test procedure, it should regularly be re-saved by choosing Save Library Program option from File Menu, and clicking on Yes. TMS-Pro warns that a file with the same name already exists. Whenever significant modifications have been made to a program, it is good practice to save it under a new filename. If."TEST7a", has been changed significantly, it would be appropriate to save it as "TEST7b" or "TEST8"

Once both the test procedure and its calculations are operating in a satisfactory manner, it should be saved as a library program with an appropriate filename. It might then become appropriate to delete all the files saved while the final program was being developed.

Loading Library Programs

Files which have been saved into TMS-Pros library of test procedures can be loaded by choosing Load Library Program option from File menu, selecting the appropriate library file by clicking on it, then clicking on Open button.

TMS-Pro also has the facility to load (as a single operation) a test procedure, calculations, sample description, graph customizations and associated test data (a data .for file) by using Open option from File menu.

Programming Tips

Load cells are delicate instruments. Although the TMS-Pro has integral features to protect against overload, no software can react sufficiently rapidly to a near infinite rate of increase of load to ensure protection under all circumstances. If, for example, a test running down at high speed drives the load cell and probe into the metal plate at the base of the stand, it is quite likely to inflict irreparable damage upon the load cell. Some test routines do however require that the load cell probe touches onto a solid fixture. When developing programs for such applications, it is strongly recommended that slower speeds and greater margins of overload protection, relative to those that will be ultimately required, are set. Then, when the new test program is fully debugged, the final test parameters can be selected.

When testing a sample for the first time the programmer may have absolutely no idea what the maximum and minimum values of the x-axis and y-axis ought to be. Therefore, when developing a new program it may be useful to set a small range for both x and y-axes. TMS-Pros auto-ranging facility will then automatically expand these ranges to accommodate the test curve. Once a program has been developed and the maximum and minimum values likely to be encountered have been established, it is recommended that, before saving the program, ranges should be set to values 10 or 20% greater than those likely to be encountered. The reason is that, after a series of test has been running for some time and auto-ranging does becomes necessary, TMS-Pro may need to re-plot some hundreds of thousands of data points. Even with a fast PC, this could take quite a long amount of time. The delay associated with re-plotting data during a test becomes even more significant if the multi-trace facility is active.

Discarding a Test

When performing a series of tests it is possible that you will not wish to keep data for all the samples that you have tested – perhaps one of the samples had some foreign material in it. If the Allow Sample Deletion box is checked in the Preferences settings, under the Set Up menu, data from any test can be discarded by clicking on the “trash can” button. The remaining samples will all be re-numbered, and the file will be saved without the data for the sample you wish to discard.

PROGRAM COMMANDS

In order for the TMS-Pro to perform a test, you must tell it what to do. This is accomplished by a list of commands compiled into a program. The TMS-Pro has 16 commands to choose from. The program can be as simple as 2 lines, go to a point and stop, or many lines as in a multi stroke

test with changeable set points. In many cases the program will only need to contain a few lines of instruction. If you have a special case and need assistance, always feel free to contact FTC for help. Programs and calculations can be easily created elsewhere and emailed to you.

Program commands can be described in the following general manner:

FUNCTION (PARAMETER 1, PARAMETER 2 …..)

Many parameter fields can be left blank and TMS-Pro will, where appropriate, execute the command on the basis of a default value. The section dealing with individual program commands gives details of default values and required parameters.

A typical example of a RUN command would be: RUN (125, 75, , 60,)

Once the user has created this command and added it to the program, TMS-Pro will display the corresponding command line in a sentence style format:

RUN @ 125mm/min until load = 75.0N, or time = 60.000sec

It is not necessary to enter numeric values into every parameter field. Any function which requires a numeric value in one of its parameter fields will also accept a variable rather than a constant value. The command line:

RUN @ 125mm/min until load = V7N, or time = V2sec

is equivalent to the RUN instruction in the above paragraph if V7 is 75 Newton and V2 is 60 seconds. This allows any program line to be much more flexible.

TMS-Pro will also change the parameters of program functions whenever the preferred units are changed in the Preferences dialog box. TMS-Pro will not allow dimensional conflict within variables. It will detect and reject an instruction to RUN to a load of 75mm, or a time of 60 Newton. Many parameter fields can be left blank and TMS-Pro will execute the command on the basis of a default value; details are given in the section dealing with the individual command.

RUN

Syntax: RUN (speed, load, displacement, time, break %)

Run at given “speed” - TO a given “load”, OR a “displacement”, OR for a given “time” OR until a “break criterion” is met. Note that negative values of speed are allowed, and thus the direction of crosshead movement can be controlled given that the test is a compression or tension based test (see Tension or Compression under the Set UP Menu Commands).

Example: RUN @ 100 mm/min until load = 20.0N, or displacement = 3.00mm, or time = 40.000sec, or break % = 5

Note: the above command makes use of every available parameter. Commands must provide every required parameter but they need not use optional parameters

Required Parameters: Speed, AND at least one of the following:

“load”, “displacement” or “time”.

Optional Parameters: break %” (this must be between 1 and 100)

Example: The program command line: “RUN @ 50mm/min until displacement = 140mm, or break% = 10%”

means “run at a speed of 50 mm/min until either the displacement reaches 140mm or the load suddenly drops to below 90% of the highest value observed during execution of this RUN command”

The break detect feature will be dormant until a load greater than 2% of the LOAD CELL capacity is observed – otherwise, at very low loads, false break events will be detected. TMS-Pro will not accept a command just to run, at a given speed, to a to a 10% break. It needs to know when to stop executing the RUN command if the sample does not break. This can be achieved by also entering a relatively large value of load, displacement or time. In the example given, the programmer expects break to occur at a displacement much lower than 140

REPEAT

Syntax: REPEAT (loop to line, times)

Description: Repeats part of program by jumping to a given “line” for a given number of “times”

Example: REPEAT 20 times from line 10

Required Parameters: “loop to line”

Defaults: “times” = infi nity, (i.e. cycling continues forever)

Restrictions: “Loop to line” and “times” must be integers, positive and non-zero

“line” must refer to a line which exists and cannot be a variable

Example: “REPEAT ? times from line 7”

means “jump to line 7 every time”

REPEAT primarily has been designed to transfer control to a different part of the program. It will often appear after an IF command. REPEAT needs to be used to determine number of cycles to failure, because the loop could include a RUN command with the break detect facility active.

MESSAGE

Syntax: MESSAGE (message text)

Displays a message on the Test screen. It is possible to move the message by dragging, if needed. Use this command when you want to ask the operator to do something or advise what is happening now. When you move the message box TMS-Pro will display any further messages in the new position.

Example: MESSAGE "Testing the sample"

Required Parameters: “message text”

Restrictions: “message text” string must not exceed 110 characters

Example: If it is necessary to prompt the operator to do something, and tell the system to wait until it receives an instruction to continue the test, this can be achieved with:

MESSAGE "Please load new sample, then click the [Resume] button"

PAUSE for ? sec, audio disabled

The above program can be refined by using the feature of the MESSAGE command which enables the value of a variable to be displayed. If the (dimensionless) variable V3 is being used as a counter, then:

MESSAGE "Please load Sample {V3}, then click on the [Resume] button"

PAUSE for ? sec, audio disabled will halt the program, advise the operator which sample should be loaded next, and wait for the instruction to continue.

CLEAR MESSAGE

Syntax: CLEAR MESSAGE

Description: Clears message from the Test screen

Example: This might be used to remove a prompt that was telling the operator to do something. However once the operator has responded to it, leaving the prompt there would be confusing. Alternatively a new message, “The test is continuing”, could be written by using another MESSAGE command.

CYCLE

Syntax: CYCLE (speed, {x}, upper, lower, cycles)

Description: Run at specified “speed” between “upper” and “lower” values for specified number of “cycles”. The values must be “load”, or “displacement”

Example: CYCLE @ 1 in/min 50 times between –4 in and –30 in

Required Parameters: “speed”, {x}, “upper”, “cycles”

Restrictions: {x} cannot be time, “cycles” must be integer number between 1 and 1000’ value of “upper” must be greater than “lower” and within capability of system.

Optional Parameters: “lower”

Defaults: “lower” = {current value of x}

Restrictions: values within capability of system

Examples: After touching the top of a sample, and Zeroing the displacement, the command “CYCLE @ 25 mm/min 10 times between 0.00mm and 12mm”, might typically be used simulate a chewing mechanic on the sample. Note that the sign of the speed will determine the initial direction of motion of the crosshead. In the particular case of determining number of cycles to break, it is necessary to use the REPEAT command.

IF

Syntax: IF (parameter, condition, test value, true line number, false line number)

Description: A conditional test determining to which line the program goes next.

A dropdown list box offers “load”, “displacement”, “time” or any variable, for the first parameter; clicking [Enter] will have no effect until a valid condition statement has been completed.

Example: IF V1 <= 30.00 go to line 4 else goto line 50

Required Parameters: “parameter”, “condition”, “test value”, “true line number”

Defaults: “false line number” = next line

Restrictions: First field must be a “condition” (as illustrated)

“line number” must exist and cannot be a variable

Example: A spring is compressed to a specified length (which might, for example, represent the size of the assembly into which it will be installed).

The command IF load < 55.0N goto line 24 else goto line Next Line will, while the program is running allow TMS-Pro to decide whether the spring is within specification. If the load is sufficient, a MESSAGE command in the next line will advise the operator that everything is OK, and the following lines could then release the spring and END the program. If however the load is not enough, the program will jump to line 24 which will need to be an appropriate MESSAGE command, perhaps MESSAGE "Reject this spring, or add a shim"

Note: the “less than” symbol in this example could be replaced by a “greater than” or “equals to” symbol, if required.

The END command in this example will stop the program execution “dropping through” and possibly arriving at line 24 even though the condition was not satisfied.

ZERO

Syntax: ZERO ({x1}, {x2})

Description: Zeroes the value(s) of “load” and/or “displacement”.

Note that TMS-Pro will “remember” load and displacement zero settings, even after execution of the program finishes. Click on the appropriate checkbox for the parameter(s) that needs to be set to zero.

Example: ZERO value of load and displacement

Required Parameters: {x1}

Restrictions: This command cannot be used to set “time” to zero. However “time” can be reset using CLEAR DATA

Example: Cyclic tensile load needs to be applied to a length pasta. The RUN command should be used until a small increase in load is detected. At that point, having "taken up the slack", the command "ZERO load and displacement" will start the "real" test with data accumulating at the origin of a load/displacement graph.

Note: by zeroing the load, any residual weight of the test sample has also been compensated for.

A ZERO command can be "undone" with the RESTORE command. Note however that if the ZERO command is executed twice it cannot be undone.

A ZERO command will usually be used in conjunction with a CLEAR DATA command.

If the CLEAR DATA command is omitted, then the occurrence feature which appears in many of the calculation commands (i.e. the VALUE command) may produce unexpected results. In the example above, if the load at a particular displacement is required, then after "taking up the slack", use a CLEAR DATA command, and ask for the load at the first occurrence of that displacement.

Note that the ZERO command has the opposite effect to that of the RESTORE command.

RESTORE

Syntax: RESTORE ({x1}, {x2})

Description: Restores the value(s) of "load" and/or "displacement". This command is the reverse of the ZERO command.

Example: RESTORE value of load

Required Parameters: {x1}.

Restrictions: This command cannot be used to re-set "time".

Example: Touch on

CLEAR DATA

Syntax: CLEAR DATA

Description: Clears all data which have been accumulated up to this point

Example: TMS-Pro test data files can become very large. Therefore avoiding storing unnecessary data is good programming practice. There are many types of test that initially accumulate data that do not really need to be retained. Using a CLEAR DATA command immediately after the CYCLE command means that only the "proper" part of the test will be recorded once a test has been completed, the crop feature can be used for stripping out redundant data. There is no facility to "undo" this command in the manner that the RESTORE command will undo the most recent ZERO command.

CLEAR GRAPH

Syntax: CLEAR GRAPH

Description: Clears trace from graph, and re-draws axes

Example: Many tests will accumulate data at the start which do not really need to be retained. Using a CLEAR GRAPH command means that the meaningful part of the test data can be accumulating only. There is no facility to "undo" this command in the manner that the RESTORE command will undo the most recent ZERO command.

PAUSE

Syntax: PAUSE (time)

Description: Delays the execution of the next program command, while logging and display of data still continue.

Example: PAUSE for 100 sec, audio enabled

Required Parameters: "time"

Defaults: "time" = infinity

Example: A MESSAGE command instructs the operator to remove the old sample and fit a new one. Overestimating how long this will take and programming in this time is bad programming practice – because it would be inefficient. Underestimating how long this will take is infinitely worse programming practice – because it would be dangerous. To address this particular dilemma, the "Pause time:" box may be left blank. When TMS-Pro encounters this command, the Stop button will be changed to Resume and program execution will be halted until the operator clicks on that Resume button. When no pause time is entered, the command will re-display in pseudo-sentence format as "PAUSE for ? sec, audio disabled"

Safety Note: Any motorized test stand has the potential to inflict serious injury upon an operator or passer-by, to minimize this risk a number of precautions should always be observed. Never leaving an operating test frame unattended is one such precaution. The PAUSE command (because it enables an apparently inert test frame to suddenly start operating again) does represent a hazard in this particular context. Consequently TMS-Pro

has an audio warning facility incorporated into the PAUSE command; this will sound an alarm five seconds before the crosshead starts to move. When a pause duration of ten seconds or more is typed in, a checkbox to activate the audio alarm will become enabled – it is strongly recommended that this feature be always used. The audio warning facility requires that your PC be fitted with an appropriate sound card and speakers. Your IT department will be able to arrange this.

END

Syntax: END

Description: Prevents any subsequent program lines being executed

Example: Putting this at the end of any program would be tidy, but putting it in the middle of a branched program could be vital. See the example given with the IF command.

ENTER

Syntax: ENTER (units, name, variable)

Description: Accepts and allocates input from keyboard.

Example: Enter @ “Duration of relaxation?”, time value (sec) for V4

Required Parameters: “units”, “name”, “variable”

Restrictions: “variable” must be V0, V1, V2……V48, V49 “name” must be no more than 50 characters

Example: When TMS-Pro encounters the program line

ENTER @ “Enter a load to which the component should be compressed now.”, load value (N) for V3,

Will pause the program and display the message “Enter the load to which the component should be compressed now.” Clicking on the OK button will allocate the entered value to the variable V3, and resume program execution. Obviously the next program line is likely to involve a RUN instruction, perhaps

RUN @ 125 mm/min until load = V3N, or time = 40.000sec

When the test is repeated TMS-Pro will “remember” the most recent value of a variable, until either a CLEAR VARIABLES command, a FORMULA command or another ENTER command is encountered.

It is important whenever possible to ensure that all ENTER commands are executed before any load is applied to the sample. Imagine the result if a non-elastic sample is loaded up to a certain point, then an ENTER command is executed and the corresponding prompt is displayed but there

is a five minute delay before the OK button is clicked, some results could now be completely useless - because the sample may well have relaxed by a significant amount.

The execution of an ASSIGN command which is, in effect, an “automatic ENTER command” will still involve a minuscule delay; this is true of any command.

ASSIGN

Syntax: ASSIGN ({y}, variable)

Description: Allocates a current value to a variable

This is an automatic version of the ENTER command

Example: ASSIGN displacement to V2

Required Parameters: {y}, “variable”

Restrictions: “variable” must be V0, V1, V2……V48, V49

Example: ASSIGN load to V1 or ASSIGN displacement to V3

CLEAR VARIABLES

Syntax: CLEAR VARIABLES

Description: Re-sets the value of all variables to zero; also re-sets the dimension.

Examples: This command enables the programmer to make it clear that a particular phase of a test has been completed. Consequently, the program becomes easier for another person to understand. It is often useful to run an “initialization” program, which might, measure (and “remember”) the length of a typical sample, then run a “main” program which actually tests a number of samples. A powerful feature of TMS-Pro is that all variables stored will be retained until TMS-Pro is re-booted. Unfortunately, what might be a powerful feature for one group of operators could be an annoying feature for another. The CLEAR VARIABLES command is for the benefit of this second group.

FORMULA

Syntax: FORMULA (equation)

Description: Allows variables to be operated upon mathematically during a test, using the four standard arithmetical operations.

Example: V1 = V2 + 1

V2 must be a dimensionless number, or a dimensional conflict error will occur

Required Parameters: “equation”

Restrictions: “equation” must be an equation, without dimensional conflict and cannot exceed 110 characters

Example: A particular sample resists motion within an acceptable range of forces – until a critical speed is exceeded. A program to test it at a speed of V7 then keep doubling speed and repeating the test until a certain force is exceeded would involve the program line, V7 = V7*2.

Note: it is important not to confuse the FORMULA command with the DO-SUM command. The FORMULA command is to create/modify a variable (i.e. load, displacement, time, number or speed) which TMS-Pro may need to use during a test. It is not for complex calculations that can be carried out after a test. If this command is used to create a variable which cannot be used during a test (a volume, area or slope perhaps) any attempt to use it will not be accepted.

CALCULATION COMMANDS

After testing a sample and collecting the data, it is always necessary to perform calculations on the data to transform test data into meaningful information. This is done with the calculations functions.

Calculation commands can be described in the following general manner:

RESULT = FUNCTION (PARAMETER 1, PARAMETER 2…)

Many parameter fields can be left blank and TMS-Pro will, where appropriate, execute the command on the basis of a default value. The section dealing with each individual calculation command gives details of default values and required parameters.

Example: VALUE (displacement, load, 163, 5,, 2, “Point X”, show result)

Once the user, by choosing appropriate parameters, has created this command and added it to the list of calculations, TMS-Pro will display the corresponding calculation in pseudo-sentence format:

VALUE of displacement (“Point X”) @ 163N (for occurrence 2, between load at 5.00 sec and End of test sec), Assign to V7, Show result

This command would mean:

“Find the displacement (position) at which the load (force) value passed for the second time, through 163 Newton, but do not start counting until 5 seconds after the start of the test, then keep going until the test has finished. Assign the result to the variable ‘V7” and show the result as “Point X” in the test results section after the test”.

It is not necessary when writing a program to enter particular values into every parameter field. Variables can also be used in the calculations and program commands. They are designated as V0, V1, V2, V3, etc. There can be up to 50 variables used in a test, (command / calculation) set up. Any function, which requires a numeric value in one of its parameter fields, should also accept a variable rather than a particular value.

Calculation results can be displayed or hidden as required. If the calculation is just an interim value for determining another more meaningful result, then check the “Hide Result” box in the command’s window.

It is important to note that a variable used in a program command can be also applied as assigned, in the calculations commands. Therefore if one does not intend to share the same value for a variable in both the program commands and the calculations after, then different variables would need to be assigned.

The calculation line: VALUE of displacement ("Point X") @ V2N (for occurrence V0, between load at V9 sec and End of test sec), Assign to V7, Show result is equivalent to the VALUE instruction in the above paragraph if V2 is 163 Newton, V9 is 5 seconds, and V0 is dimensionless with a value of 2.

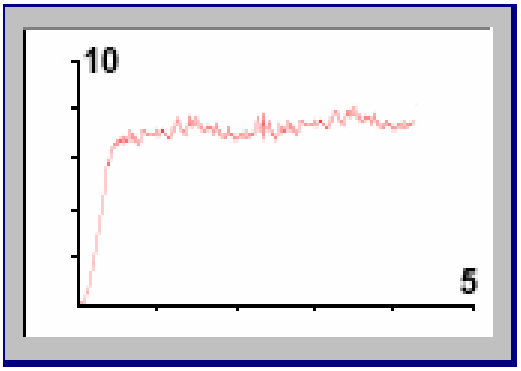
This allows any calculation to be much more flexible. TMS-Pro will not allow dimensional conflict with variables; it will detect and reject a VALUE instruction involving a load of 163 mm, or an occurrence count of 3 Newton. TMS-Pro will also, automatically change the parameters of all program and calculation functions whenever the preferred units are changed in the Preferences dialog box.

It can be frustrating to write a program asking TMS-Pro to return the peak load between 17 and 32mm, and then, when you are actually able to look at a graph of your data, see that the peak you were really interested in actually occurred at 33 mm. TMS-Pro will let you return to the Test Program facility and change 'PEAK in load = f(displacement), between 17.00mm and 32.00mm, with order of 1, condition = 10%' to 'PEAK in load = f(displacement), between 17.00mm and 35.00mm, with order of 1, condition = 10%'. The program will then recalculate the results.

Most all of the calculations results can be linked to a variable, given a name, (such as "Chewiness") or can be hidden from the test result at the end. Sometimes a calculation will be made for reference purposes only within the test and the result need not be displayed.

Multi-valued Functions

Consider the equation: Y = 5 X. When TMS-Pro is given the value of 'x' and asked to calculate 'y' it is easy because for any value of 'x' there is only one possible value of 'y'. Unfortunately many functions are either inherently multi-valued, or else noise on a signal can make an inherently single-valued dataset multi-valued. Consider the following curve:



Force is on the 'y' axis and position is on the 'x' axis. If you ask the software to tell you the load when the position is 3 that is easy, because there is only one answer. However if you ask for the value of position when the load is 7, that is a difficult because there are lots of correct answers.

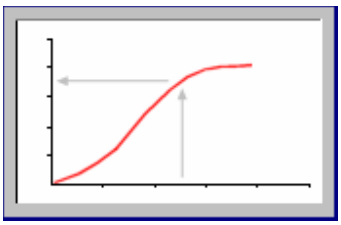
When testing your product and asking the software to return a value of ‘x’ for a particular value of ‘y’, you are likely to find that there are many different answers. You will probably regard one answer as ‘right’ and all the others as ‘wrong’. Many of TMS-Pro’s calculation commands incorporate powerful facilities to enable you to teach TMS-Pro to recognize and return only results which are of particular interest for your test. Details are given in the section on each individual command.

VALUE

Syntax: VALUE ({y}, {x}, x value, start time, finish time, occurrence)

Options: Name the result, assign the result to a variable, hide the result

Description: Returns the value of {y} at a given value of {x}, within a defined time range, for a given occurrence. It is this command that enables set points to be determined. The section on multi-valued functions discusses background to the development of the advanced features available with this command.



Example:

VALUE of displacement @ 300.0N (for occurrence 6, between load at 40.000 sec and 50.000 sec)

Required Parameters: {x}, {y}, ‘x value’

Defaults: 'start time' - first point, 'finish time' - last point, ‘occurrence’ - 1

Restrictions: ‘start time’ and ‘finish time’ must be contained within the test data. If values of 'x value' and 'occurrence' mean that solution does not exist, then N/A will be returned as the answer.

Output: Value {y} @ {x} {x units} = {result} {y units}

Note: if {x} is ‘time’, ‘occurrence’ must be ‘1’, ‘x value’ must be between ‘Start time:’ and ‘Finish time:’, and 'Finish time:' must not be less than the 'Start time:'

Example:

VALUE of time @ 46.9N (for occurrence 1, between load at Zero sec and End of test sec) means ‘look at all the data and return the time at which the load passed, for the first time, through 46.9 Newton.’ In the case of a dataset which is not monotonic, this may not be the result required, but

simply reflect the fact that the programmer has accepted the default values proposed for 'Start time:', 'Finish time:' and ‘Occurrence:’

The VALUE command can however be made much more selective, thus returning the value that is 'right' for the requirement of the particular test.

For example; VALUE of time @ 46.9N (for occurrence 3, between load at 12.000 sec and 42.000 sec

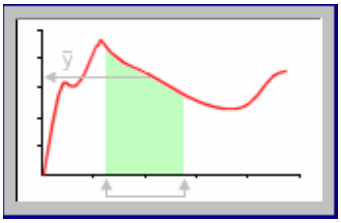
means ‘return the time at which the load value passed through 46.9 Newton for the third time, but do not start counting until the test has been running for 12 seconds, and if after 42 seconds it has not passed through that load for the third time, then do not return any result at all.

AVERAGE

Syntax: AVERAGE ({y}, {x}, start, finish)

Options: Name the result, assign the result to a variable, hide the result

Description: Average {y} value over given range of {x} values



Example:

AVERAGE load = f (time), from 30.000sec to 40.000sec

Required Parameters: {x}, {y}

Defaults: 'start' - first point 'finish' - last point

Restrictions: 'start' and 'finish' must exist

Output: Average {y} = {result} {y units}

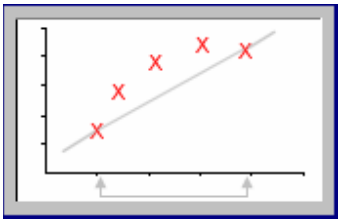
Examples: 'AVERAGE displacement = f(time), from 13.000 sec to 17.000 sec' means ‘return the average value of the displacement over the time period between 13sec and 17sec'.

SLOPE

Syntax: SLOPE ({y}, {x}, start, finish)

Options: Name the result, assign the result to a variable, hide the result

Description: The gradient of {y} as a function of {x} within a defined range of {x} values, determined by two point linear interpolation. Note that this function calculates the slope of a line that has been constrained to pass through (or very close to) data points at the chosen 'start' and 'finish' values. The BEST-FIT function does not impose this constraint.



Example:

SLOPE of displacement = f (time), from 3 min to 4 min

Required Parameters: {y}, {x}

Defaults: 'start' - first point 'finish' - last point

Restrictions: 'start' and 'finish' must exist

Output: Slope = {result} {y/x units}

Example:

SLOPE of load = f (displacement), from 2.00 mm to 3.00 mm

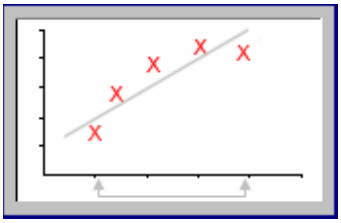
means ‘return the gradient of the load as a function of displacement for the straight line connecting data points at displacement values of 2mm and 3mm’. Such a command would be used when testing the hardness of various samples. The SLOPE command will take no notice of any of the data points between the two specified displacement values

BEST-FIT

Syntax: BEST-FIT ({y}, {x}, start, finish)

Options: Name the result, assign the result to a variable, hide the result

Description: The gradient of {y} as a function of {x} within defined range of {x} values, determined by linear regression. Note that when 'y' is 'stress' and 'x' is 'strain', this is called 'Young's Modulus'



Example: BEST-FIT to load = f(displacement), from 3 % to 40 %

Required Parameters: {y}, {x}

Defaults: 'start' - first point 'finish' - last point

Restrictions: 'start' and 'finish' must exist

Output: Best Fit Gradient = {result} {y/x units}

Example:

BEST-FIT to load = f(displacement), from 19.05 mm to 25.40 mm

means ‘return the gradient of the load as a function of displacement for the data between the data points at displacement values of 19.05mm and 25.40mm’. Such a command would be used to determine the stiffness of a sample when it is deformed by 6.35mm. The BEST-FIT command will regard each of the data points between the two specified displacement values as being of equal importance.

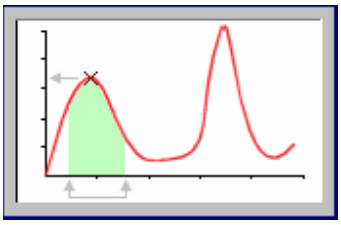
Note that this is typical of how TMS-Pro will re-display a command which, although originally created using 'round' numbers of imperial units, is now being used by an operator who prefers to work with metric units.

PEAK

Syntax: PEAK ({y}, {x}, start, finish, order, %)

Options: Name the result, assign the result to a variable, hide the result

Description: The maximum {y} value within a given range of {x} values, subject to other criteria enabling small peaks to be detected. The percent field allows the PEAK command to distinguish between small spikes that are a genuine signal, and background noise. If after the peak the y-value does not fall by at least the selected percentage of the total range of y-values, then that spike is not a genuine peak.



Example:

PEAK in load = f(time), between Initial sec and 400 sec, with order 5, condition = 6%

Required Parameters: {y}, {x}

Defaults: '%' – 10 'start' - first point 'finish' - last point 'order' - 1

Restrictions: 'start' and 'finish' must exist

Note: If you set the order parameter to:

0 - Finds the maximum peak within range (percentage does not matter)

1 - Finds first peak with a rise and drop that matches the percentage setting

2 - Finds second peak with a rise and drop that matches the percentage setting

3 - Finds third peak with a rise and drop that matches the percentage setting

Output: Peak {y} @ {x} {x units} = {result} {y units}

Examples: A heat-sealed foil on a square plastic tray is being peeled and the peel force is being measured,

PEAK in load = f(displacement) between Initial mm and Final mm, with order of 0, condition = 10%

will simply return the maximum load whatever the percent condition. This is likely to be the load to initiate the peel (i.e. just before the broken bond begins to propagate) - which may not be the result required.

Let us assume that this initiation 'peak' always occurs at between 10 and 11mm. If the peak when the bond break ‘turns the corner’ is required, then the initiation peak must be avoided, this could be achieved with the command

PEAK in load = f(displacement) between 12.00 mm and Final mm, with order of 0, condition = 10%

This will ignore all data until the displacement reaches a value of 12mm, and then return the highest subsequent load value. It could also be returned by the command

PEAK in load = f(displacement) between 12.00 mm and Final mm, with order of 1, condition = 10%

which will return the highest subsequent load peak. In reality it is unlikely that the bond break will reach both corners at the same time; there will probably be two secondary peaks, with the smaller of these two peaks appearing as a ‘shoulder’ on the larger. The command

PEAK in load = f(displacement) between 12 and Final with order of 2, condition = 10%

may return the smaller of the two peaks. If however the two peaks are very close together, it may be necessary to experiment with smaller values than '10' in one of the '%:' boxes.

If the initiation peak does not occur within a predictable displacement range, then, provided there is only one initiation peak, the commands 'PEAK in load = f(displacement) between Initial mm and Final mm, with order of 2, condition =10%' and 'PEAK in load = f(displacement) between Initial and Final with order of 3' will return the two values required

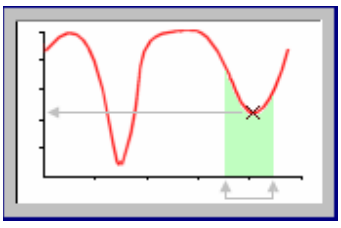
Note: In the example above, although the PEAK command returns both the load and the displacement value of the peak to the Results screen, the x-co-ordinate (i.e. the displacement) is not included in a report. Similarly for the TROUGH command.

TROUGH

Syntax: TROUGH ({y}, {x}, start, finish, order, %)

Options: Name the result, assign the result to a variable, hide the result

Description: Minimum {y} value within a given range of {x} values, subject to other criteria enabling small troughs to be detected. The percent field allows the TROUGH command to distinguish between small dips which are a genuine signal, and background noise. If after the trough the signal does not climb by at least the selected percentage of the total range of y values, then that dip is not a genuine trough



Example:

TROUGH in load = f(displacement), between Initial in and 44.000 in, with order of 1, condition = 10%

Required Parameters: {y}, {x}

Defaults: '%' – 10, “start” – first point, “finish” - last point, “order” - 1

Restrictions: 'start' and 'finish' must exist.

Note: trough of order 0 will simply return the minimum value

Output: Trough {y} @ {x} {x units} = {result} {y units}

Example:

A compression test to evaluate the ‘tactile signature’ (i.e. the ‘feel’) of a PC mouse has been carried out. The displacement corresponding to the peak and trough on the actuation profile of the left and right buttons must be determined. The PEAK command enables each peak to be measured. The command

TROUGH in load = f(displacement), between Initial mm and Final mm, with order of 0, condition = 5%

will return the minimum value of load observed during the test - almost certainly zero! The required trough could, of course, be determined manually after the test, but the command

TROUGH in load = f(displacement) between Initial mm and Final mm, with order of 1, condition = 5%

will return the trough automatically, provided a reasonable value for the percent criterion, has been entered in to the '%:' box.

Alternatively such a 'trial and error' technique for program development could be refined by using the command

TROUGH in load = f(displacement) between Initial and Final with order of 1, condition = V0%

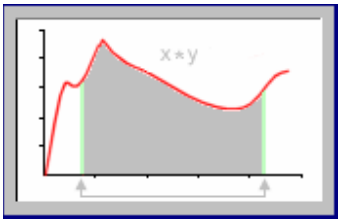
in conjunction with an ENTER command which stores a dimensionless variable as 'V0'. Subsequently, when a reasonable value for the percent criterion has been identified, this can be programmed directly into the TROUGH command as a fixed value.

AREA

Syntax: AREA ({y}, {x}, start, finish)

Options: Name the result, assign the result to a variable, hide the result

Description: Area under test curve within a given range of {x} values



Example:

AREA under load = f(time), between 300 sec and 400 sec

Required Parameters: {y}, {x}

Defaults: 'start' - first point 'finish' - last point

Restrictions: 'start' and 'finish' must exist

Output: Area between {'start'} – {'finish'}{x units) = {result} {x*y units

When ‘x’ is ‘Newton’ and ‘y’ is ‘mm’ then the result will be described as 'mill joules', or 'joules', if greater than 1J

Example:

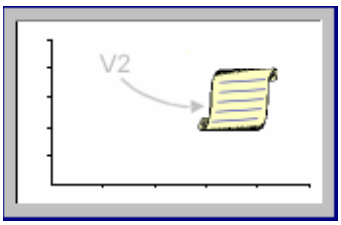
AREA under load = f(displacement), from 56 mm to 78 mm

means ‘return the area under the load versus displacement curve between deflections of 56mm and 78mm'. Note that, even if between some points in this range the load drops below zero, the area under this region of the curve is still considered to be positive, and will be added to the total area, i.e. this function returns the TOTAL energy exchange between the test system and the sample.

VARIABLE

Syntax: VARIABLE (variable, text)

Description: Returns the value of a variable and its units, preceded by some explanatory text and a gap



Example:

VARIABLE V1, value is Original Height of The Sample

Required Parameters: 'variable'

Defaults: 'text' – variable

Restrictions: No more than 50 characters in 'text'

Output: {text} = {result} {units of variable}

Examples:

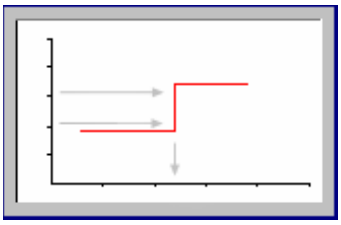
When a program is finished, the value of V5 is 34.5 N/mm, then the line VARIABLE V5, value is The Burleigh coefficient means that, the burleigh coefficient = 34.5 N/mm will be returned to the Results screen.

STEP

Syntax: STEP ({x}, {y}, from, to, %, occurrence)

Options: Name the result, assign the result to a variable, hide the result

Description: Detects / estimates the value of {x} when the value of {y} passes sharply from one steady value to another.



Example: STEP in event = f(displacement), between 0 and 1 @ 50%, for occurrence 2

Required Parameters: {x}, {y}, 'from', 'to'

Defaults: '%' - 50, 'occurrence' - 1

Output: Step = {result} {x units}

Note:

the STEP command differs in one fundamental respect from the VALUE, AVERAGE, AREA, SLOPE, BEST-FIT, PEAK, and TROUGH, commands. The STEP command requires two y values as input parameters. The other commands require an x value, or a range of x values, as input parameters.

Example:

With a version of TMS-Pro in which the 'switch actuation' facility has been enabled, during a test, one column of the Data Matrix is accumulating blocks of (dimensionless) 0's and 1's. In Version 2 of TMS-Pro the command

STEP in event = f(displacement), between 1 and 0 @ 50%, for occurrence 3'

will allow return of the displacement at which a switch opens for the final time, assuming that it started off closed, but was switched off and then back on three times during the test

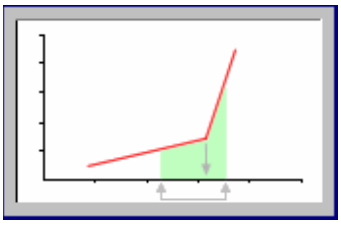
KINK

Syntax: KINK ({y}, {x}, from, to, interval, occurrence)

Options: Name the result, assign the result to a variable, hide the result

Description: Detects / estimates the value of {x} when the slope of {y} as a function of {x} passes sharply from one steady value to another

The KINK command is generically similar to STEP, which detects a discontinuity - KINK detects a point of non-differentiability.



Example:

KINK in load = f(displacement), between Initial mm and 44.00 mm, with interval of 0.500 sec, for occurrence 2

Required Parameters: {x}, {y}, 'from', 'to', 'interval', 'occurrence'

Defaults: 'from' - first point, 'to' - last point, 'interval' - 0.3s, 'occurrence' - 1

Restrictions: 'to' and 'from' must exist and 'interval' must be greater than 0.01s

'Interval' is the time period over which each slope is calculated. Then TMS-Pro looks at the progressive change of these slope values, and decides whether any kinks have occurred.

Output: Kink = {result} {x units}

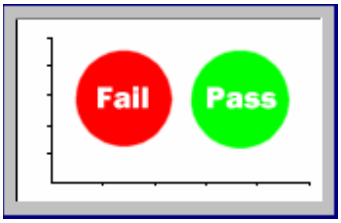
Examples:

'KINK in displacement =f(load) between Initial N and Final N, with interval of 0.3sec, for occurrence 1'

VERDICT

Syntax: VERDICT (minimum 'pass' value, maximum 'pass' value)

Description: Range of values for which the result of the calculation in the previous line can be considered to be a 'pass' or a 'fail'



Required Parameters: ‘minimum 'pass' value’, ‘maximum 'pass' value’

Restrictions: This command cannot be the first calculation line. The values do not automatically change. If the previous line changes the minimum and maximum pass values must be changed manually. This will be necessary, for example, when units of measurement are changed.

Output: The VERDICT command does not generate its own line in the Results screen, it modifies the appearance of the preceding line, see below.

Example: VERDICT for value in above line: between 10 and 20 is “pass”, else is “fail”

The VERDICT command enables TMS-Pro to determine and display whether the sample being tested is within specification, or whether it has ‘failed’ the test.

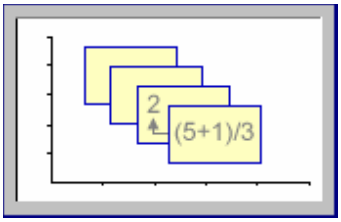
If the result of the Calculation command in the preceding line is less than 10 or more than 20, that line will be printed in the Results screen in red. If the value is between 10 and 20 that line will be printed in the Results screen in green

DO-SUM

Syntax: DO-SUM (expression, units)

Options: Name the result, assign the result to a variable, hide the result

Description: Allows a test result or a variable to be operated upon mathematically after the test has been completed.



Examples: DO-SUM (“Gumminess”) V5*6.2+ 3, Assign to V9, Show result

This would multiply the value of the variable V5 by 6.2 then add 3. The results would be called “Gumminess”, assigned to the variable V9 and the final value will be displayed in the results at the end of the test.

Required Parameters: ‘expression’ and 'units' string

Note that for DO-SUM commands, TMS-Pro will ask for a 'units' string; just entering a [Space], is sufficient if no units string needs to be displayed in Results.

Restrictions:

'expression' must be a valid mathematical expression

'expression' must be free from dimensional conflict

'expression' string must not exceed 90 characters

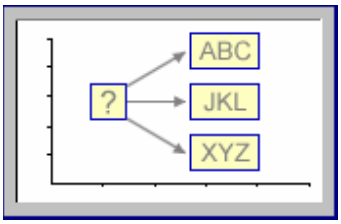
'units' string must not exceed 15 characters.

The DO-SUM command allows variables to be operated upon mathematically, and the 'expression' is returned to the Results screen. It is similar to the FORMULA command, i.e. anything FORMULA can do during a test, DO-SUM can do after a test. The FORMULA command is restricted to calculating things that TMS-Pro can make use of during a test; the DO-SUM command is not

PRINT-WHEN

Syntax: PRINT-WHEN (parameter, condition, test value, true text, false text)

Description: Applies a condition to value of a variable and returns text that depends on the result of the conditional test. The result from this command does not appear in reports.



Example: PRINT-WHEN V1 = 3 "Sample passed", else print "Sample failed"

Required Parameters: 'parameter', 'condition', 'test value', 'true text'

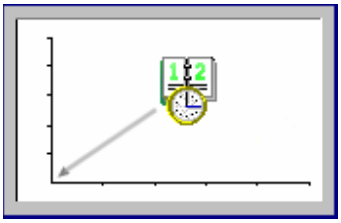
Restrictions: Neither 'true text' nor 'false text' can exceed 40 characters.

Output: {true text} OR {false text}

TIME-STAMP

Syntax: TIME-STAMP

Description: At the moment before each test starts TMS-Pro reads and stores the internal calendar and clock values. This command will return these values to the Results screen. The result from this command does not appear in reports



Output: Test started at {time} on {date}

Example: A typical line returned to the Results screen would be:

Test Started at 11:49 on 3/9/02

Toolbars

There are several toolbars that are displayed when entering an appropriate part of TMS-Pro.

Figure 3

The Standard toolbar just provides a “shortcut” to the features of TMS-Pro that are likely to be used most frequently. Most of the features of this toolbar can be accessed by choosing appropriate options from the Menu Bar Therefore the toolbar can be toggled on and off by choosing Toolbars option from Display menu.

1 New Button (The same as selecting New Option from File menu)

2 Open Button (The same as selecting Open Option from File menu)

3 Save Button (The same as selecting Save Option from File menu)

4 Copy Graph Button (The same as selecting Copy Graph Option from Display menu)

5 Print Button (The same as selecting Print Option from File menu, then clicking on OK)

6 Display Graph Button (The same as selecting Graph Option from Display menu)

7 Results Button (The same as selecting Results Option from Test menu)

8 Replay Button (The same as selecting Replay Option from Display menu)

9 Help Topics Button. (The same as selecting Help Topics Option from Help menu)

If two or more tests have been run, the following 2 buttons will be active

10 Review Previous Test Button

11 Review Next Test Button

12 Delete Test Sample Button

The Load/Displacement toolbar provides facilities that are particularly convenient when tests are being set-up or carried out. The toolbar, which is not essential for running tests, can be toggled on and off by choosing Toolbars option from Display menu.

When the system is in limited functionality mode the toolbar can serve no useful purpose and is therefore disabled. Neither does the toolbar serve any purpose in the Graph screen or the Replay screen; therefore, within these screens, it is never displayed.

13 Zero Load Button –Tares the weight of any load on the load cell

14 Restore Load Button – Removes the tare

15 Zero Displacement Button – Sets the current position to zero

16 Restore Displacement Button – Restores the zero position to the previous value

17 Park Button – Move the cross head to the Zero position

Menus

File Menu Commands

New

Choosing from File menu will remove any current test program / data. A warning message will be displayed before erasing any unsaved data.

Open

Choosing Open option will display the files in TMS-Pro format which are in the folder that was most recently accessed by TMS-Pro. Only files in TMS-Pro format can be opened by this command. If the file required has been used recently, then using the List of Files feature, in the File Menu, may be a more convenient way to load the required file.

It is possible that the file being opened will make use of features that are beyond the capabilities of your particular test system. Under these circumstances TMS-Pro will display a warning message and advise running the program de-bug facility. The operator will be allowed limited access to the test program, but it will not be possible to run a test. Features that will trigger such a warning are either, a load greater than the capacity of the load cell, or an auxiliary input which your software cannot process.

Save

Choosing Save option will save the current test program and all current data, using the existing test file name. The file will remain open so that you can continue to work on it.

TMS-Pro will save the program Samples with a filename “Samples.for”. This “force test file” will not just contain information about the test procedure and calculations, it will also contain:

1. Any information about the particular test sample(s) - such as size, lot number, or operator comments.

2. Information about preferred units of measure and whether the test is in tension or compression.

3. Information about the presentation of data - such as graph titles, axis labels and maximum values of graph axes.

4. Information specifying the reporting format, batch size, for example.

5. The test data for all the samples in the report or batch.

To save only a test procedure with the associated calculations and preferences, but not any data, use the Save Library Program command

Save As

Choosing Save As will enable the current test program, calculations and data to be saved using a file name selected by the operator. This command can be used either to name a new data file, or save an existing data file under a new name while leaving the original data file unchanged. The file will remain open so you can continue working with it. If you wish to save your file to a folder different from the one which TMS-Pro suggests in the "Save in:" text box, click on the drop-down arrow to the right of that box, select the appropriate folder, type the file name of your choice in the "File name:" text box, then click on Save button.

Cut, Compress and Crop: The high data acquisition rate which TMS-Pro - based systems deliver means that data files can be very large. TMS-Pro does therefore incorporate "Cut", "Compress" and "Crop" features that allow data to be saved as smaller files. To save a portion of the original data, click the Compress button and a dialog box, giving the number of data points in the data file, will be displayed. Click on the up/down arrows to the right of the "Compress by:" box until the appropriate integer number (between 2 and 100) appears in that box; then click on the Save button.

Note: after a test, the Compress feature can be used to "de-tune" the performance delivered by TMS-Pro, and enable more direct comparison with data archived by earlier generation testing software. If there are 6000 data points in the original file, "Compress by 4" will throw away 3 out of 4 points and there will be 1500 points in the modified file.

To re-scale the data file to a given number of data points, click the Cut button and a dialog box, giving the number of data points in the data file, will be displayed. Click on the up/down arrows to the right of the "Cut to:" box until the number of data points required in the modified file (probably a nice round number) appears in that box; then click on the Save button. The "Cut" feature does involve calculating data points by linear interpolation, but it can only decrease the number of data points stored. Note that some points would not actually have existed in the original test.

Under some circumstances, it is much more useful to retain all the data points from just part of a test. Click on the Crop button, then click on the up/down arrows to the right of the “Start time:” box until the appropriate time appears, then click on the up/down arrows to the right of the “Finish time:” box until the appropriate time appears; then click on the Save button. It may be necessary to examine the original data, before suitable Start and Finish times can be identified.

Note: if cut, cropped, or compressed data are saved using the same file name as the original data then it will not be possible to recover all of the original data. Therefore, it may be useful to save such data using a new file name.

It will not always be appropriate for data for each sample to be compressed, cut or cropped in exactly the same manner. Data can be cropped to a suitable time range for individual samples by choosing the “Individual” option from “Save Setup” combo box, clicking on the appropriate sample, clicking in “Crop”, entering the appropriate time range, clicking on any other sample, and finally clicking on Save.

To save only a test procedure with the associated calculations and preferences, but not any data at all, use the Save Library Program command

Load Library Program

Choosing Load Library Program option will display the library files in TMS-Pros Library folder. Select the required library file by clicking on it, then click on Open button. If you wish to load a file from another folder, click on the drop-down arrow to the right of the “Look In:” box, select the appropriate folder, select the appropriate file, then click on Open button.

Save Library Program

Choosing Save Library Program will save the current test program, calculations, preferences, and (if appropriate) report parameters; however no test data or notes will be saved. The file will remain open so that you can continue to work on it. TMS-Pro will try to save the program “Samples” with a filename “Samples.lif”. If a library file with this name already exists, a warning will be displayed before the file is overwritten. Clicking on Yes will overwrite the existing library file, but clicking on No will enable the file to be saved with a new name and/or path.

When a test program has been saved as a library program (in *.lif format), but before it has been saved as a test file (in *.for format) the colored title bar at the top of the window will describe the program as “Untitled”. Although choosing either Program or Calculations option from Test menu will display a dialog box with the library filename in the title bar, that will not of course be permanently displayed. It is therefore recommended that, before saving a library program, the programmer selects Settings option from Display menu and types a description into the “Graph Title:” box.

Print Summary

Selecting Print Summary, will print a pre-formatted “executive summary” onto one sheet of paper. The summary includes the information in Notes ,a graph of the test data and the calculated test results. It will display the dialog box to set-up your printing preferences. Windows may be aware of more than one available printer. If a different printer from the one appearing in the “Name:” text box is required, click on the dropdown arrow to the right of that box, select the appropriate printer, then click on OK button.

Print Set-up

Choosing Print Set-up will display the dialog box that will set-up your printing preferences. Windows may be aware of more than one available printer. If a different printer from the one appearing in the “Name:” text box is required, click on the dropdown arrow to the right of that box, select the appropriate printer, and then click on OK button. The Orientation is likely to be set to “Portrait”, because most popular software applications are more likely to need printouts of this type. Printouts of TMS-Pro graphs do however look better in Landscape format so it may be better to change this setting. The “Paper, Size:” setting should reflect the paper which is loaded into your printer. Once your printing has been set-up, just click on the printer icon in the Standard toolbar to print

Print Preview

Choosing Print Preview will display an image of the way the sheet(s) of paper in your printer will appear if you were to click on Print button. To increase the magnification of the pre-viewed image click (once or twice) on the Zoom In button. To decrease the magnification of the previewed image click (once or twice) on the Zoom Out button. To print directly from the Print Preview facility click on the Print button. Click Close to return to TMS-Pro.

Print

Choosing Print will display the dialog box that will set-up your printing preferences. Windows may be aware of more than one available printer. If a different printer from the one appearing in the “Name:” text box is required, click on the dropdown arrow to the right of that box, select the appropriate printer, then click on OK button. Once your printing has been set-up, just click on the printer icon in the Standard tool bar to print

Export

TMS-Pro incorporates a comprehensive range of calculation facilities and tools for customizing calculations to the testing requirements of individual users. However, no software can cover all calculations for every possible application. The Export command enables data accumulated by TMS-Pro to be exported to other PC software packages, where more calculations can be made. TMS-Pro’s high data acquisition rate means that data files can be very large so, the Export command offers a dialogue box which incorporates “Cut”, “Compress” and “Crop” features.

Click on the OK button to enter the Export Settings dialogue box. This allows the delimiter to be chosen, the options are “Tab” or “Comma”. The operator can choose how many columns of data are in the exported file; normally three columns would be exported by selecting “Force”, Distance” and “Time” from the “Fields” list. However when secondary data are available up five fields can be selected, and when a reference file (for use with the Tolerance Band feature) is being created just the two appropriate fields should be chosen.

It can also be useful occasionally to “pick out” just a few individual data points to be displayed within another software application. This can be done by entering TMS-Pro’s display data facility, then using the Copy button to send data to the clipboard.

Recent File List

Clicking on File offers a menu with eleven items. The tenth item is a list of the most recently used files. Selecting the name of any of these files will load the selected file. There will be up to eight files on this list.

Exit

Clicking on Exit will (after terminating all operation of the associated test stand and displaying a warning if any test data have not been saved) return to the Windows desktop.

Test Menu Commands

Notes

Before printing a test summary, it will be necessary to choose Notes option from Test menu. This will display a dialog box with a number of text boxes. The following information should be entered:

Type a sample number or description in the “Specimen”: box.

Type a batch number or code in the “Batch:” box.

The current date will appear automatically in the “Date:” box.

The operator of the test series on the “Operator:” box.

The final box allows free typing of further information, such as test description.

This dialog box can be re-visited and the notes can be updated, at any time. Note that it is the date of most recent modification that is recorded here. It is also possible to archive the precise date and time that a test was carried out by using the TIME-STAMP command.

Program

Choosing Program will display a dialog box that enables test programs to be written and edited. The layout and features of this dialog box are described in the section on program development. It is the details of each program command which are described here. This option is only available to master access

Calculations

Choosing Calculations option from Test menu will display the dialog box that will enable the calculations to be made with the test data to be specified. The results of these calculations will be displayed in the Results screen. This option is only available to master access

Results

Choosing Results option from Test menu will display a dialog box with two “card index tabs” at the top of this screen, one labeled “Results” and the other labeled “Report”. “Results” is the default, when this is chosen the results from all the calculations specified will be displayed. There may be too many results to fit , in which case use the scroll bar on the right to display the result(s) of particular interest.

To print all of the results for one sample, click on the Print current results button. Similarly, to print all of the results for all of the samples in the file, click on the Print results for all samples button. In both cases it is possible to print only some of the results, by using the technique of cutting and pasting. Selected results can then be pasted to other software and printed from there. Similarly the results could be Emailed to a

colleague by pasting into your Email software, or processed mathematically by pasting into a spreadsheet.

If results for more than one sample are available, choose the appropriate sample by clicking on the up/down arrows to the right of the “Sample Number:” box.

Clicking on the Report tab will bring to the front the screen where batch reporting and writing results to an open report can be controlled.

Reports are saved in a format that can easily be imported into most other software packages. This format uses a “comma” as the delimiter. Whenever a report is opened, TMS-Pro will automatically give the report a name, unless the operator has checked the “Specify filename for report” box and entered an appropriate name.

An inconvenience of using such a universal format for report files is that TMS-Pro may be denied access to a report, because that report is “open” within another software package - Notepad or Excel, for example. Operators should avoid using another software package to open a report while TMS-Pro is still being used to complete the report - because the report file will “locked” when TMS-Pro tries to read or update it. The error messages “Failed to create/open report file”, or “Failed to open results report file” indicate that a report is “locked”

If the “Batch Size:” box is left blank, when entering the first record, clicking on the Add to Report button will increment the contents of the “Records in Report:” box from “0” to “1” – from this point onward the associated report will be open-ended, the arrows for adjusting batch size will become disabled and data can be added “ad infinitum”. Data from the report can be browsed or printed at any time by clicking on the View Report or Print Report button respectively Once open reporting has been specified for a test file, the file will need to be saved under a new name before a batch report can be accumulated.

Batch Reporting

Once the “Batch size:” is set to a value, and the first record has been added to the new batch report, the View Report, Print Report, and arrows for adjusting batch size will become disabled. Further records can be added to the batch report by clicking on the Add to Report button – until the “Records in Report:” is equal to the “Batch Size:” – the batch test has now been completed. Once a full set of batch data has been completed:

The Add to Report button will become disabled. The View Report and Print Report buttons will become enabled. Clicking on View Report or Print Report button will respectively display or print both the results for each sample and the batch statistics for each result. Batch statistics” means the mean and standard deviation for each result.

It will only be possible to store more batch data, by setting up a new batch report. If, for example, the batch test “WIDGET18.for” has been completed, re-load the appropriate library program by selecting Load Library Program option from the File menu. Then, when the first test has been completed and the batch size has been set, select Save As option from File menu, and type “WIDGET19” in the “File Name:” text box. It will be possible to decide not to store the new data in batch report format, simply by not entering a value into “Batch size”.

Every report file knows the name of the "parent" test data file from which it was created. If the name of the "parent" data file is changed, the currently open "daughter" report file will be updated. It is strongly recommended that a batch report file is not completed before saving the data from the "parent" file – otherwise (whatever may happen in the future) the report file will become an "orphan", believing that it was created by a data file called "untitled.for".

The fact that ever report file remembers the name of the "parent" data file, also means that TMS-Pro can detect, and reject, an attempt to add data to a report which is not a "daughter" of the active data file. The message "The selected report file is not compatible with the current data file, choose another report file" will be displayed.

Similarly, every test data file knows the path to the current "daughter" report file. If, before the report has been completed, the report file is moved, or re-named TMS-Pro cannot update it. Also if TMS-Pro detects that the report file has been "corrupted" by being written to by other software, it will make no attempt to update it.

When a batch report has been completed, and one further test has been carried out, TMS-Pro will, if automatic reporting is active, display the prompt "Batch report completed. Start another similar report? [Yes] [No]". It is important to remember that, if the completed report was opened for inspection, it should have been closed down before the testing continued, otherwise the above message cannot be displayed. Choosing the "Yes" option will display the Report screen with the settings of the previous report proposed, but choosing the "No" option will display the Report screen with no settings proposed. TMS-Pro cannot detect that the previous report is "full", if that report is locked.

Automatic Reporting

The default setting of TMS-Pro means that data will not be added to an open report or a batch report until the Add to Report button is clicked. It may be useful on some occasions to ensure that data from every completed test are reported – whether or not the operator likes the look of them. This will occur if the "Auto-add data from completed tests:" checkbox (in the Report dialog box) is enabled. "Master" access is required to change the setting of "Auto-add data from completed test(s)" checkbox.

If the operator checks the "Auto-add data from completed tests:" box, data for every sample tested within the current file will be added to the report the next time the Add to Report button is clicked. Subsequently, whenever a test is completed, data for the new test will automatically be added to the report. If the number of samples exceeds the batch size, TMS-Pro will automatically make the report "open" rather than "batch"

Interrupted Reporting

While a report is still in the process of being completed, if TMS-Pro is closed down, the message "The results file has been modified do you wish to save changes before closing TMS-Pro? [Yes][No]" may appear, under these circumstances the Yes option should be chosen. This will ensure that test data file is updated and enable TMS-Pro to "keep track of" the report file being compiled

Until the Save As or Save option is chosen from the File menu, storage of test data is volatile because it is in RAM. If TMS-Pro is closed down by an interruption to the power supply, there is unfortunately nothing that can be done to prevent any unsaved test data from being lost. However, because reports are updated to non-volatile storage immediately after a test is completed if automatic reporting is active, test results associated with the lost test data will not be lost. TMS-Pro may however have lost track of the name, path and status of the test report. Therefore after re-booting TMS-Pro, and reloading the test data file, the recommended procedure is to choose the Results option from the Test menu, click on the Report tab, and, if necessary, Browse for the appropriate test report; the Report dialog box will then be updated, and testing / reporting can continue. Storage of report data is also non-volatile when clicking on the Add to Report button

Reporting Calculation Changes

If, with a report only partially completed, a new calculation is added to the "parent" *.for file no immediate change is made to the "daughter" report. If another test is carried out, when the results of the new test are added to the report, the results for all the records within the report are updated to include the new calculation.

It should however be noted that a "parent" test data file could have more than one "daughter" report file. When calculation changes are introduced, only the currently open batch report file will be automatically updated when a new record is saved.

Display Menu Commands

Graph

TMS-Pro will enter the Graph screen when Graph option from Test menu is chosen. The Graph toolbar will be displayed, and the Sample toolbar will be displayed if results for more than one test sample are available.

Figure 4: Test Sample Selection Toolbar

1. Previous Test Sample button
2. Jump to a Sample
3. Next Test Sample button
4. Delete the currently selected sample

If two or more tests have been run, the above toolbar will be available. When a number of samples have been tested, but data for only one sample

can be displayed, this allows a particular sample to be chosen. A counter indicating the number of the sample selected (and the total number of samples tested) is displayed in the Status Bar. The Overlays command can be used to display data for more than one sample

Two buttons on the Graph toolbar allow the graph to be re-drawn: Preferences & Zoom

The remaining three options allow interrogation of the test data: Cursor Drop, Timeline and Review Results Note: These features can be accessed directly from Display menu, by selecting Interrogate option.

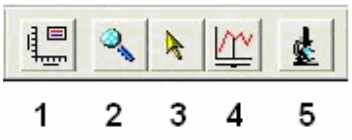


Figure 5: Graph Toolbar

1. Graph Settings Button
2. Zoom Button
3. Cursor-drop Button
4. Timeline Button
5. Review / Display Results Button

The Graph toolbar is displayed automatically when entering the Graph screen.

Settings

This dialog box allows the appearance of the graph to be customized and can be accessed from different parts of TMS-Pro. Details of the facilities available are given within the section on the Graph command.

Overlays

Choosing Overlays option from Display menu will display a dialog box that will allow data from more than just one graph to be plotted. This option is only available to master access. There are three radio buttons at the top of this dialog box: “Neither”, “Multiple Traces”, and “Tolerance Band”. The default is “Neither”, and in this case, all other facilities within the dialog box (apart from OK and Cancel) are disabled. This setting means that data for a single sample will be displayed on the graph.

Displaying the Sample toolbar will automatically re-set Overlays to “Neither”

The Sample toolbar determines the single sample for which data will be plotted.

Multiple Traces Option

Selecting the "Multiple Traces" option makes the Sample(s) list on the left-hand side of the dialog box available - the list appears in black rather than grey. It is now possible to plot up to eight graphs concurrently by clicking on the appropriate samples. If a new test is started, and if fewer than seven test traces are already plotted, data for the new test will be plotted in addition to data for the existing test traces.

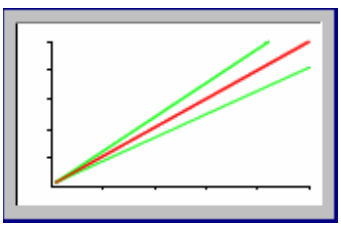
Tolerance Band Option

Selecting "Tolerance Band" option makes the Tolerance Band options panel available. This feature will allow your test data to be compared with data for a reference sample. TMS-Pro will need to know the path to the file that contains the reference data. This can either be found by using the Browse button, or it can be typed directly into the "Reference File" box. The data in this reference file must be available either as a tab-delimited or comma-delimited text file – called "reference.txt", perhaps. This could have been produced within a spreadsheet by generating theoretical data, or by exporting real data from an ideal sample, or by averaging the exported data from several typical samples. The easiest way to create a reference file, is to minimize noise with the sampling rate facility, then export the data, after cutting to no more than 100 points.

There must be only two columns in the reference text file, with the data to be plotted on the y-axis being in the first column. The data for the first data point should appear in the third row, the data for the second data point should be in the forth row, etc.… Text strings giving the units of the data following should appear in the second row.

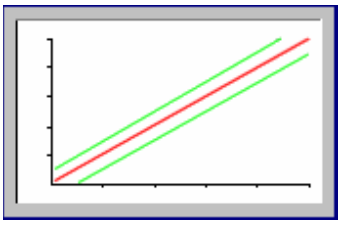
TMS-Pro will generally configure itself automatically to respond to the units of measurement which are preferred by the operator. However, in the particular case of tolerance bands, TMS-Pro will, for example, reject a reference file with load data in Newton, if the displayed test data are in kgf or lbf. Under these circumstances the operator must either: Change the units in which the test data are displayed, by using the preferences facility, or arrange for a new reference file to be generated.

Two types of tolerance bands can be generated. Typing a number into the "Factor" box (20%, for example) will generate a factor-based tolerance band:



A factor tolerance band: the data in the reference file are shown in red, and the tolerance limits that will appear on the graph are shown in green.

Typing a number into the “Difference” box (5 Newton, for example) will generate a difference-based tolerance band:



A difference tolerance band: Please note that tolerance bands are calculated on the basis of there being an acceptable range of values for the parameter plotted on the y-axis. If, for example, data have been plotted as Load/Displacement, but you need to work with a specification that requires test data to be within ± 5mm of the data for a reference sample, then use the “Others” option in the graph settings facility to generate a Displacement/Load plot.

It can sometimes be awkward to devise the calculation(s) necessary to detect when a sample is not within tolerance. TMS-Pro therefore has the facility to do this automatically. Clicking in the “Display Tolerance Alert” checkbox, will ensure that, when appropriate, a warning will appear in the Results screen. Data which “fail” (i.e. fall outside the y-axis limits of the tolerance band) will be plotted in red, but data which “pass” (i.e. fall within the y-axis limits of the tolerance band) will be plotted in green. Data that fall outside the x-axis limits of the tolerance band) will be plotted in black.

Data

Choosing Data option from Display menu will display a dialog box that presents the test data as a table. This will allow the test data to be inspected, if required. The high data acquisition rate delivered by TMS-Pro -based systems does however mean that there will probably be many data points to display. Consequently, the operator will need to drag the vertical scroll bar down to the region of interest.

If the duration of a test is more than 16secs, then TMS-Pro can only make values available to the Data command in discrete blocks. If the Next button is enabled, then even dragging the vertical scroll bar down to the bottom of its travel limit will not display all the stored data. Under these circumstances, using the Next or Previous buttons to select the appropriate data block, will enable the scroll bar to be used to display those data points which are of particular interest. This table will usually have three columns, unless TMS-Pros auxiliary or event input modules are available.

There is no button that will simply print out all the test data. It may be necessary however to select a limited number of data points to be included

within a document or spreadsheet. This can be achieved either by left clicking on the first data point in the desired range, then holding down Shift and clicking on the last data point in that range, or by holding down Ctrl and clicking on each data point individually. When the required data have been selected, either clicking on Copy, or right clicking, will save the selected data points to the clipboard; the data can from there be taken into other Widows software by cutting and pasting. The data can then be printed from this other software package. If data need to be systematically cut, cropped or compressed before being displayed within another software application, this can be done efficiently by using TMS-Pro "s export facility.

Replay

TMS-Pro will display the Replay screen when Replay option from Test menu is chosen. The Replay toolbar will be available, and the Sample toolbar will be displayed if results for more than one test sample are available.

Figure 6: Replay Toolbar

1. The Fast Forward button
2. The Play button
3. The Return to Start button
4. The Stop button
5. The Exit button

The Replay toolbar is displayed automatically when entering the Replay screen.

Clicking on the Play button in the Replay Toolbar will replay the test data in real-time. During replay, clicking on the Fast Forward button will increase the speed of replay by a factor of ten. When replaying data in Fast Forward mode, re-clicking on the Play button will resume data replay at normal speed. During replay, clicking on the Return to Start button will clear all plotted data from the display and automatically replay data from the start of the test. Clicking on the Stop button will stop further data being plotted – until the operator re-clicks on Play. Clicking on the Exit button of the Replay Toolbar re-displays the main programmed testing screen.

When the current test file contains data for more than one sample, the Sample Toolbar determines the sample for which data will be replayed; the sample counter is displayed on the Status Bar.

When TMS-Pro is replaying test data, a slider at the bottom of the screen moves from left to right to indicate the fraction of the available test data that has been plotted. It is possible to jump to any particular stage of the test by slowly dragging the slider to a new position.

Language

Choosing Language option from Display menu will display a dialog box which enables the user to choose which language TMS-Pro and the associated Help system will operate in; choosing from a list of up to three languages is possible. TMS-Pro will translate all text messages, but it will make no attempt to translate Program or Calculation commands or any variable.

Copy Graph

Choosing the Copy Graph option from Test menu enables an TMS-Pro graph to be copied to the clipboard. The graph can then be incorporated into other software packages by using the Paste button in the target software.

When TMS-Pro is in the Graph screen, clicking on the right-hand mouse button and selecting the Copy Graph option from the menu displayed will also export a graph to the clipboard. Note that information superimposed onto the graph with the Cursor Drop, Timeline, or Review Results tools will not be copied to the clipboard. A printout of a displayed graph (original or annotated) can however be generated by choosing Print option from File menu, or by clicking on the Print button in the Standard toolbar.

Interrogate

This allows direct access to the facilities for graphically interrogating the test data: Cursor Drop, Timeline, Review Results etc.

Summary View

Selecting Summary View displays the test results in a window under the tool bars. All of the current results as the accumulated statistics are displayed. The widow can be sized to display as much of the data as desired. If the window is too small to display all the data, a scroll bar is positioned to the right side of the window.

Toolbars

The operator can, by choosing Toolbars option from Display menu, determine whether the Standard toolbar and/or the Load / Displacement toolbar will be displayed. Within the dropdown Display, Toolbars menu, a tick next to the command indicates that the toolbar is active. TMS-Pro will automatically display the Graph toolbar, the Sample toolbar, and the Replay toolbar when appropriate.

Status Bar

The operator can, by clicking on the Status Bar option from Display menu, determine whether the status bar will appear at the bottom of the screen. A tick next to the command indicates that the status bar will be displayed. The Status Bar provides, the following items of information:

The cycle number, and total number of cycles – when a CYCLE command is being executed.

The "zoom level" – when a zoomed graph is being displayed.

The sample counter and the total number of samples – when there is more than one sample in the file.

The x and y co-ordinates of the position of the cursor – when the cursor is in part of the screen used for displaying graphs.

Settings

Clicking on the Settings button on the Graph toolbar will display a dialog box that will allow the parameters which determine the layout of a graph to be selected and stored. This option is available to operator access, although Setup, Preferences is not.

Under most circumstances the data plotted will be:

Load on the Y-axis versus displacement on the X-axis

Load on the Y-axis versus time on the X-axis

Displacement on the Y-axis versus time on the X-axis

Each of these axis pairings can be chosen by selecting the appropriate radio button.

When TMS-Pro has extra facilities for measuring, logging and plotting secondary data, i.e. from the auxiliary input or the event input, then some other axis pairings will be need to be available. This can be achieved by selecting the "Others" option, which will enable the dropdown lists associated with "Y-Axis" and "X-Axis". Click on the [Down arrow] to the right of the "Y-Axis" box, and choose from the list of primary and secondary data parameters displayed. Then click on the [Down arrow] to the right of the "X-Axis" box, and choose from the list of primary and secondary data parameters that remain available. Even if secondary data facilities are not available, an operator might occasionally feel the need to plot time on the Y-axis.

Clicking on the Display accumulative displacement box causes the graph to be drawn with the movement on the x axis always in a positive direction.

Titles and Ranges: When a graph is printed out, the text which appears at the top of that printout is determined by what is typed into the "Graph Title:" text box. Similarly the text which is printed parallel to the x-axis and the y-axis is determined by what is typed into the "X-Axis, Graph Title:" the "Y-Axis, Graph Title:" text boxes respectively. The range of data which is plotted on both the x and y axes of the graph is determined by the values which are typed into the appropriate "Minimum:" and "Maximum:" text boxes. Within TMS-Pro "limit" means what is allowed during a test, while "range" means what is displayed after a test.

Other Features

Activating the "Legends" checkbox will only affect the printout of a graph if the "Multiple Traces" option has been selected in the Overlays dialog box. Under these circumstances, a key to which trace is associated with each sample will appear under the printed graph.

When there is no tick in the "Grid lines" checkbox, the trace will be plotted on a plain white background. Activating this checkbox will result in the trace appearing to be plotted on graph paper.

If the "Auto-scale" checkbox is activated, when the graph is re-plotted, the maxima and minima of both axes will be automatically adjusted to precisely "fit" the data.

With multi-sample data, axes are adjusted to accommodate data for all samples

Zoom

Click on the Zoom button on the Graph toolbar to activate the multi-level zoom facility. Define one corner of the zoom box, by moving the cursor into the graph area, clicking on the left-hand mouse button, and holding it down. As the cursor is moved across the graph area, a rectangle representing the zoom box will be drawn on the graph. The opposite corner of the zoom box will be defined by the position of the cursor when the left-hand mouse button is released; the graph will be re-drawn to the limits defined by the zoom box.

To "undo" a zoom operation, click on the right-hand mouse button and select the Zoom Out option from the displayed menu.

Four levels of zoom are available, (i.e. it is possible to magnify a small area of the graph by zooming in up to four times concurrently.) The zoom level is displayed on the Status Bar

Cursor Drop

Click on the Cursor Drop button on the Graph toolbar to activate the cursor drop facility. Drag the cursor into the graph area – the "normal" cursor will change to a "cross hair" cursor. Move this cursor to a point on the graph that is of particular interest, then click on the left-hand mouse button. TMS-Pro will "remember" the co-ordinates of this point which will be connected by a lilac line to the current cursor position. Left-clicking again will "drop" the cursor and display a box containing the co-ordinates of the dropped cursor.

The box can be moved or deleted by clicking on the right-hand mouse button and selecting either Move Box or Remove Cursor Drop. User-defined text can be added to the box by selecting the Add/Edit Caption option from the menu that is displayed, and typing in the required caption or modifying the existing caption. Note that only one line of text can be added.

Timeline

Click on the Timeline button on the Graph toolbar. A single slider beneath the graph area indicates that timeline facility is active. Move the cursor over the pointer on the slider, click and hold down the left-hand mouse button, and drag the pointer to another position. Note that the data in the value boxes above the graph change, and that a vertical black marker line appears on the graph. To display the data at the start of the test, drag the pointer to the left-hand limit of the slider. Similarly, to display the data at the end of the test, drag the pointer to the right hand limit of the slider.

Note that the marker line can only remain vertically aligned with the pointer if: the x axis displays "time", and the maximum limit of the x axis is set (in Preferences) to the duration of the test.

The Timeline, in effect, enables an operator to "graphically interrogate" the test data. It would, of course, be possible to select the Data option from the Display menu, and identify the particular row of values that have produced each interesting feature on the test curve. It is however much more convenient to drag the Timeline pointer until the marker line points at each interesting feature.

Review Results

The test calculations can be "graphically interrogated" by clicking on the Review Results button on the Graph toolbar. A double slider beneath the graph area indicates that the review results facility is active. The result of the first calculation is displayed, and the point, line or area corresponding to this calculation is superimposed on the graph. Clicking on the Next Result button will display the result of the second calculation.

Some calculations can be more precisely defined by specifying a range of values. Consider the AVERAGE command. The example given asked for the average value of the displacement to be calculated between 13 and 17 seconds. When the result for this calculation is displayed (with suitable preference settings) within Review Results, two vertical black marker lines at 13 and 17 seconds will be superimposed on the graph. The operator may need to "fine tune" the range which was originally specified. Each marker line corresponds to a slider below the graph, and either marker line can be re-positioned by dragging the pointer on the appropriate slider.

When markers are repositioned not only are calculations updated and re-displayed, the range values in the corresponding calculation command are also updated, i.e. the test program will have been changed. Consequently when closing the TMS-Pro "force file" (*.for) the operator will be warned that the program has changed, and asked if the changes should be saved.

The Review Results facility enables an operator to refine a program calculation "with the benefit of hindsight"

Any corresponding TMS-Pro “library file” (*.lif) will not however be changed automatically

Set-up Menu Commands

Preferences

Choosing Preferences option from Set-up menu will display a dialog box with three tab options. “General” is the default. This will allow selection and storage of: units of measurement, acceptable range of each unit, and the sign convention for load (i.e. “tension” or “compression”).

Selecting the “Graph Settings” tab reproduces the effect of selecting Graph option from Display menu, then clicking on the Preferences button on the Graph toolbar. This option is only available to master access

Selecting the Automate tab allows the user to select the “Return to zero displacement” box. This feature makes the TMS-Pro return to the last point of position that the displacement was zeroed to, after the completion of each test.

General

The “Units” group of drop down list boxes enables force units, displacement units, and time units to be selected. When preferred force, displacement and time units have been selected, clicking on the Save as Defaults button ensures that TMS-Pro will in future boot up in, and operate with, the units chosen.

Tension or Compression

Whether the “Tension” or “Compression” option is chosen has a fundamental effect upon:

1. The direction of movement of the crosshead when a test starts

2. What sign appears on load and displacement values measured during a test

3. Whether, when a program is being developed, a minus sign needs to be entered before each value of load, displacement or speed.

When the “Tension” option is chosen:

“4.59N” will be a tensile load

“-4.59N” will be compressive load

“23.7mm” will be a displacement above the zero position

“-23.7mm” will be a displacement below the zero position

The program command “RUN @ 75mm/min until time = 5.000sec”

Will move the crosshead up

The program command “RUN @ -75mm/min until time = 5.000sec”

Will move the crosshead down

When the crosshead moves up the displacement increases, so a command to RUN to a displacement which is smaller than the current displacement cannot be executed

However when the “Compression” option is chosen:

“4.59N” will be a compressive load

“-4.59N” will be tensile load

“23.7mm” will be a displacement below the zero position

“-23.7mm” will be a displacement above the zero position

The program command “RUN @ 75mm/min until time = 5.000sec”

Will move the crosshead down

The program command “RUN @ -75mm/min until time = 5.000sec”

Will move the crosshead up

When the crosshead moves up the displacement decreases, so a command to RUN to a displacement which is larger than the current displacement cannot be executed

The tension / compression setting would normally be selected before testing begins, i.e. when the displacement is zero and the load is close to zero. Note that if the tension/compression setting is changed after the crosshead has been driven and when the system is under load, the sign of the displayed values of the current load and displacement will change.

The following conventions apply to the display of speed, whether the “Tension” or “Compression” option is chosen, whether the crosshead is being driven under manual control or program control, a positive speed value indicates that the crosshead is moving up, and a negative speed value indicates that the crosshead is moving down.

The above paragraph initially may appear to be inconsistent with the fact that when developing a program the tension/compression setting affects the sign of the speed that must be entered. Consider however the user who only has operator access and therefore can neither inspect the test program nor see the settings within this “General” Preferences screen. It would be unacceptable to have a test system that responds in different ways, depending upon a setting of which the operator is completely unaware.

Units:

Force Units: Clicking on the arrow to the right of the current force unit will display a dropdown list of the units available, move the cursor to the desired unit and single click with the left mouse button to select that unit. The units available are: kN, N, mN, kgf, lbf, ozf, MPa, kPa and psi If a unit of stress is chosen the OK and Default buttons will become disabled, and the “Cross Sectional Area of Sample:” text box will become enabled. Choose the appropriate sample symmetry by selecting either the “Circular:” or “Rectangular:” radio button, and type in the required

dimensions in the units indicated It will be possible to confirm the selection of a force unit without entering the cross-sectional area

Displacement Units:

Clicking on the arrow to the right of the current displacement unit will display a drop-down list of the units available, move the cursor to the desired unit and single click with the left mouse button to select that unit. The units available are: millimeters, inches and %. If "%" is chosen the OK and Save as Default buttons will become disabled, and the "Original Length of Sample:" text box will become enabled. Type in the appropriate length in the units indicated. It will be possible to confirm the selection of a simple displacement unit without entering the original length of the sample.

Time Units:

Clicking on the arrow to the right of the current time unit will display a drop-down list of the units available, move the cursor to the desired unit and single click with the left mouse button to select that unit. The units available are: seconds, minutes and hours.

Sometimes a user will carry out a test on a source PC, save the data file, send it to a colleague to display the data on his PC. When it comes to the choice of units, TMS-Pro will initially display data on the target PC using the units selected on the source PC.

Limits:

It is possible to set upper limits of: Load, Displacement, Time and Speed by entering appropriate values into each Dialog Box in the units indicated.

TMS-Pro will always impose a "global overload" equal to the physical capacity of the load cell. Think of the load maximum being imposed here as a (smaller) "local overload". Displacement and speed values will be limited in a similar manner.

A test program will stop running when the maximum absolute value of load or the maximum value of displacement or time is reached. When a program is being written TMS-Pro will where possible detect and display a warning when a command that will exceed any of the above maxima is created.

Once the settings in this screen have been saved by clicking on Save as Defaults, they will apply to all subsequent new programs until they are changed

When developing a program TMS-Pro can, for example, detect a command to RUN to an illegal displacement. It cannot predict that running to a legal displacement will involve sustaining an illegal load.

Note: Clicking on Save As Defaults when the "General" tab is active will only save the displayed settings - i.e. to save the graph settings as defaults it will be necessary to click on Save As Defaults when the "Graph Settings" tab is active.

Graph Settings

This dialog box allows the appearance of the graph to be customized.

Note: this dialogue box can be accessed from different parts of TMS-Pro. Details of the facilities available are given within the section on the Graph command

Automate

Selecting the Automate tab allows the user to select the "Return to zero displacement" box. This feature makes the TMS-Pro return to the last point of position that the displacement was zeroed to, after the completion of each test.

System

Once a suitable PC has been set-up in the manner recommended, TMS-Pro should be set-up for operation with the available hardware. This option is only available to master access. Choosing System option from Set-up menu will display a dialog box, with three tab options, "System Settings", "Load cell Deflection" and "Load Damping". "System Settings" is the default; this enables serial communications and internet access options to be specified.

System Settings

Data from your Food Technology test stand will be sent via an RS232 link. TMS-Pro needs to know at which of the PC serial communication port the data will be arriving.

Note: When a new release of TMS-Pro boots up for the very first time, this Dialog Box will be displayed automatically. Click on the arrow to the right of the dropdown list box for "Primary Data Input" and select "COM1", "COM2", "COM3" or "COM4". If you are not sure which port to select, your IT department will be able to advise you.

Internet Access If the PC running your TMS-Pro software is able to access the Internet, click in the "Internet Access;" checkbox and a tick will appear. It will now be possible to type in a path to access your Web browser. Your IT department will be able to advise you of the appropriate path. TMS-Pro will automatically use the Email software that has been set-up as the default within Windows.

When TMS-Pros Email facility is active, this will enable Emails to be sent directly to your local Food Technology representative. When a Web browser path has been specified, it will be possible to connect directly to the Food Technology Web Site.

Load cell Deflection

This facility allows the load cell deflection compensation to be set up. TMS-Pro measures displacement – which is not necessarily precisely the same thing as deformation of the sample being tested. This is because the sample is not the only thing that deforms under load. TMS-Pro has the ability to compensate for these “other” deformations. This is achieved by typing a stiffness factor, in appropriate units, into the “Stiffness:” text box.

It is, of course, necessary to determine the stiffn ess not just of the load cell but also of the whole test system. Food Technology engineers, as part of the pre-delivery inspection procedure, do this for each test stand and load cell(s) combination when supplied complete. A certificate giving appropriate stiffness value(s) and serial number(s) is provided together with the load cell calibration certificate(s).

Under circumstances where it is acceptable to have a displacement error of, at the most, one millimeter, there is no need to apply load cell deflection compensation. This can be achieved by leaving the “Stiffness:” box empty. When the data file is saved, TMS-Pro will “remember” that no compensation has been applied. With uncompensated data, the *.for file can be loaded onto any other Imperial test system, and TMS-Pro will allow data obtained upon the second system to be added to the data obtained with the original system.

However, when load cell deflection compensation has been applied, the data saved become “tied” both to the serial number of the LOAD CELL used, and to the stiffness of the original system. Such data can still be loaded into TMS-Pro on any other PC – but access will be upon a “read-only” basis.

Each copy of TMS-Pro maintains a database of the capacity, serial number, and stiffness of every LOAD CELL to which it has ever been connected. It is possible to maintain this database by selecting Setup, System, Load cell Deflection, then stiffness values can be updated, and data for load cells no longer available can be deleted.

It is important to realize that load cell deflection compensation is not applied until after the test has been completed. The deflection that is plotted during a test is the movement of the crosshead, i.e. uncompensated displacement data.

Sample Rate

This Dialog Box has four radio buttons labeled: “2 kHz:”, “1 kHz:”, “100 Hz:” and “10 Hz:”, the default is “2 kHz:”. TMS-Pro -based systems enable data to be accumulated at the high frequency of 2kHz.

When this is selected, TMS-Pro will display every peak and trough in the load signal that it can detect. This may be absolutely marvelous for those users who are particularly interested in such fine structure. However, other users may well see this as “noise” - which just obscures the

relatively slow trends in load, which interest them. TMS-Pro's high response speed means that it is able to “see” tiny spikes and dips in the load – even those that only last for a few milliseconds

Selecting the “100 Hz” option means that each reading is averaged over a period of 10 milliseconds, this will have the effect of “smoothing” the data. Similarly selecting the “10 Hz” option means that each reading is averaged over a period of 0.1seconds, this will have an even greater smoothing effect.

Access

Master or Operator:

There are two levels of access for users of test systems controlled by TMS-Pro – master access and operator access. Choosing Access option from Set-up menu will enable the appropriate access level to be chosen.

To set up the system for operator access click on the option button to the left of the word “Operator”, then click on OK button.

To set up the system for master access when no password has been entered previously, or when you wish to enter a password for the first time, click next to the word “Master”. Type a password into the “New Password:” text box, when you start this the OK button will become disabled, and the “Confirm New Password:” text box will become enabled. Re-type the new password into this text box, when you start this the OK button will become enabled. When you have finished, click on the OK button, and provided the same password has been entered both times this will become the new password, and the system will be in master access mode.

If you know the current password, and wish to obtain master access, type the current password into the “Current Password:” and click on the OK button.

Every operator can have master access without needing to remember a password. If you wish all operators to have master access, TMS-Pro will accept the null string as a password; select the radio button to the left of “Master” then click on the OK button. Subsequently any operator who wishes to obtain master access will be able to do so by simply repeating this procedure

Operator Access Restrictions

The following facilities are not available to operator access:

Program command (Test menu)

Calculation command (Test menu)

Graph command (Display menu) – The Overlay feature

Language command (Display menu)

Preferences command (Set-up menu)

Access command (Set-up menu) - the Password feature

System command (Set-up menu)

Load Damping command (Set-up menu)

Tools Menu Commands

Calibrate Zero Position

This selection allows the operator calibrate or re-calibrate the Zero position for the displacement of the cross head. It initiates the same procedure that is call up at software start up and moves the cross head to the top most position. This position is now position 0.0 for running any test.

Upgrade

This option is only available to master access. It may be necessary at some time in the future to upgrade the firmware within your Imperial or Imperator test stand. To install the upgrade you will need to choose Upgrade option from Tools menu. TMS-Pro software upgrades can be supplied in two ways, floppy disc, or Email.

If the upgrade has been supplied by Email, you will need to run the upgrade file that was attached to the support Email. A PC file can be run either by clicking on the Start button and choosing the Run option, or by double-clicking on the file in Windows Explorer. If further advice is needed, all you should need to do is ask your IT department to help you "run a self-extracting ZIP file". When the file is about to be run it will be necessary to put a blank 3½-inch floppy disc into the A-drive of your PC; the upgrade files will then be exploded onto that disc.

When there is an upgrade disc in the A-drive of your PC, choose Upgrade option from Tools menu. Clicking on the OK button will display a copy of the standard Terms and Conditions for Food Technology software, if you wish to proceed with the upgrade click on the Yes, I accept button. When the upgrade has been successfully completed you will see the message, "Test Stand Re-programmed Successfully, Communications Re-established." – In the unlikely event of this message not being displayed, you should contact your Food Technology Agent, and advise him precisely what message has been displayed.

Make Diagnostic Report

This option is only available to master access. In the unlikely event of any difficulties arising with a TMS-Pro system, your local Food Technology Agent will almost certainly be able to resolve these quickly and effectively. It may however occasionally be appropriate for the remote report making facility of TMS-Pro to be used. If and when your Agent does recommend this, you will need to choose the Make Report option from the Tools menu. Your agent will then guide you through the following steps:

If your difficulties involve the development of a particular program, you should have this program loaded, and have already run the program to the exact point where you first experience a problem. Then, when prompted to do so, you will need to enable the "Include current test program, calculations and sample details" checkbox.

If the PC does not have Internet access insert a blank 3½-inch floppy disc into the A-drive of your PC, then clicking on OK will write a diagnostic report to the blank disc. This disc will then need to be posted to your local Agent (or the file on the disc will need to be Emailed to your local Agent from another PC.)

If the PC does have Internet access, TMS-Pro will detect the default Email client software. A diagnostic report, addressed to the TMS-Pro International Helpdesk, will then be added to the "out-tray".

Note: TMS-Pro is intolerant of competing with other software for the attention of the PC. If your Email software has booted up to send out a report, it is recommended that this software be closed down before continuing to use TMS-Pro.

Calibration & Service

It will not be possible to select the Calibration & Service option from the Tools menu, unless TMS-Pro is in master access mode, and a test stand with an appropriate LOAD CELL fitted is connected. Only Food Technology-approved calibration laboratories, Food Technology service engineers, or Food Technology-approved agents will have the ability to enter TMS-Pros Calibration & Service screen by typing in their special access code. Although the Calibration and Service Dialog Box is available to master access, another password will be required before the calibration facility itself can be accessed

Reconnect

If for any reason the PC loses communication with the test stand, TMS-Pro goes into limited functionality mode. Choose Reconnect option from Tools menu to re-establish communication. The error message that prompts you to use this facility is: "Test system has gone into limited functionality. You will now need to reconnect before testing can continue", this message will often follow another error message which prompts the operator to click on an Abort button.

Help Menu Commands

Help Menu

Choosing Help Topics option from Help menu will display a dialog box with three tabs. The Contents tab will be the default, and the main categories into which the Help system has been organized will be displayed. Double clicking on any category will display the sub-headings into which that category has been divided. It is possible to display two levels of Help windows on the screen at the same time. For example, clicking on Programmed Testing, Test Menu Commands, and Program command, and then selecting the first option (also called "Program command") from the list of sub-headings will display a list of all the program commands. Clicking on any item in that list will display a window giving the details of the particular command, but it will also leave the list of commands on the screen. This facility has been provided at the level within the Help system that will assist with the identification of the most suitable Program.

Clicking on the Find tab will display a screen similar to the Index screen, but it will be possible to find any word within the Help system. Clicking on the Index tab will display an alphabetical list of topics. Use the right scroll bar to scroll through the topic list, or type (into the upper text box) the first few letters of the topic you are trying to find and then click on the Display button.

Email

This facility will only be available if TMS-Pro has been set up for access to the Internet.

Choosing Email option from Help menu will display a screen from your Email software that has been configured ready for sending an Email directly to your local Food Technology agent or distributor. In the event of any issue arising with a TMS-Pro system, this is likely to be a particularly efficient method to obtain support.

About

Choosing About option from Help menu will display a text box that includes:

The build date of your TMS-Pro software, precise details of the version numbers of all software and firmware, together with a copyright statement.

Contact data either for Food Technology Corporation or for your local Agent/Distributor.

A button linking directly to the FTC site on the World Wide Web.

Note that TMS-Pro cannot actually turn your modem on and dial the number of your Internet Access Provider. An error message advising that a "connection with the server could not be established" means that this needs to be done.