Developed by the Centre For Engineering Research Inc.

exclusively for **FARR Canada Limited.**

WinCatt

Monitoring and Control
System for Make-up of
Tubular Connections

Version 6.0

User Guide

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INTRODUCTION

The **WinCatt** software is a tool designed to work with a power tong system to provide real time monitoring and control of tubular connection make-up. The graphical user interface and logical software structure combined with powerful control, data acquisition and presentation capabilities enable the user to easily specify make-up parameters, control make-up and evaluate quality.

WinCatt was developed with an emphasis on the user's needs for reliability, accuracy, ease of use, and features. **WinCatt** is capable of:

- fail-safe operation
- monitoring torque, turns, and rotational speed during make-up,
- controlling both speed and final torque or final turns,
- analysing data immediately following make-up and determining shoulder point for premium connections, evaluating results for compliance with the user specified torque and turns limits, and allowing the user to enter either the recommended result and comment or a user specified comment.
- recalling results of previous make-ups,
- real time monitoring of connection pressure test results,
- real time monitoring of torque, hook load and rotational speed after make-up completion,
- immediate generation of hard copies of both make-up and pressure test results,
- recording detailed job reports,
- generating summary reports for statistical analysis and presentation,

- guiding the operator through shop and field calibration routines, fine tuning torque or turns calibrations in the field and maintaining calibration records.

Overview

This *User Guide* is both a learning tool and a reference manual for the **WinCatt** software. If you are either unfamiliar with computerised make-up control or inexperienced with Windows applications, this *Guide* provides you with several illustrated examples to demonstrate the capabilities of this system. A more experienced user may use the *Guide* as a reference manual to master **WinCatt**'s many features. In either case, reading the entire text is recommended.

The *User Guide* has been structured to help you find information quickly. Several levels of headings are used to signal the material covered in the subsequent text. In addition, a comprehensive index facilitates locating topics of interest. Extensive use of illustrations and screen shots assist in the interpretation of the information presented in this *Guide*.

User Guide Layout

The **WinCatt** *User Guide* is divided into the following three parts and three appendices:

Part 1: Introduction
This part describes:
- the features of **WinCatt**;
- the *Guide's* general layout; and
- copy protection and installation procedures.

Part 2: Using **WinCatt**
This part provides:
- comprehensive documentation on all aspects of using **WinCatt**;
- detailed instructions on program operation;
- explanations of program inputs and outputs; and
- descriptions of the windows, menus, buttons and output options.

Part 3: Sample Job
This part provides a detailed example to:
- illustrate the basic operation of **WinCatt**; and
- familiarise you with some of its capabilities.

Appendices

The three appendices provide additional information as follows:

<u>Appendix A</u>, Unit Conversions, provides conversion factors to convert between SI (System International) and Imperial units.

<u>Appendix B</u>, Output Reports, contains samples of all of the hard-copy output available.

<u>Appendix C</u>, WinCatt .INI File Format, provides a detailed description of the contents of the initialisation file.

Installation

Although your system is shipped pre-loaded with **WinCatt**, upgrades may be available from time to time.   **WinCatt** upgrades will be shipped on 1.44 MB 3.5 inch program disks.

To install WinCatt on your system:

1. Start Microsoft Windows NT.

2. Insert **WinCatt** program disk into your CD drive. If the installer does not start automatically, navigate to your CD drive and run the installation program "Setup.EXE".

3. Accept the default directory (d:\program) for **WinCatt** installation and click ***OK***. Note that this drive must have at least 12 megabytes of free space.

4. Follow the installer prompts. It is recommend that the default selections be used.

5. To abort the installation at any time, click the ***Cancel*** button or hit the ***Esc*** key.

6. Once all of the files have been copied to your installation directory, a program group will be created and a new icon installed.

7. The program will look for a group named **WinCatt** Version 6. If the group already exists, the new **WinCatt** program icon will be created erasing any old **WinCatt** program icons. If the group does not exist, it will be created and the new **WinCatt** program icon placed there.

8. The installation program will have created an initialisation file called WinCatt.INI in your d:\program directory. This file tells **WinCatt** what set-up and calibration parameters are active.

9. You can use the software, once you have attached the hardware protection device to your computer (see next section for details).

10. To run **WinCatt**, double-click the **WinCatt** icon.

Copy Protection

WinCatt is copy-protected through the use of a hardware-based copy protection system. This system uses a device known as a "security key" that is attached to one of the computers Universal Serial Bus (USB) ports. One security key is issued with each licensed copy of the software. Random checks for the presence of this security key are made by the program during its execution. This measure prevents unlicensed use of **WinCatt**.

The security key prevents the operation of **WinCatt** on any computer to which it is not attached. However, it does not prevent you from making backup copies of the software. It is recommended that you make at least one copy of the original distribution CD and then store it for safekeeping. The software may reside on as many computers as you require, however, the security key must be moved from one unit to another in order to run the program.

Although your system ships with the security key installed, replacements may be issued with new releases of the software.

To install the security key:

1. If you have not done so already, install the **WinCatt** program

2. Locate a free USB port on your computer.

3. Windows Plug and Play will recoginze the new USB device. If the Hardlock driver has been previously been installed, Windows will identify the USB device as a Hardlock security device..

4. You have now unlocked the program and will now be able to run **WinCatt**.

Wired or Wireless Sub

The **WinCatt** program can be use with two kinds of tongs. The conventional or wired tong has a direct connection to sensors via a cable. A wireless sub uses a slightly different arrangement of sensors but more significantly, communicates measurements wirelessly to the **WinCatt** program. Much of the operation of these different types of subs is the same. This users guide will refer to wired sub operations. Differences for wireless subs will be indicated where necessary.

Part

2

USING WINCATT

WinCatt can help you conduct consistent well documented connection make-up jobs and to use **WinCatt** to the fullest potential you should first be familiar with the program's general layout and many features.

This part of the *User Guide* takes you through the general architecture of the program to acquaint you with **WinCatt**'s capabilities. It describes all of the available windows including their purpose, buttons, inputs and outputs. If you are a new user, a quick overview of this part of the *Guide* will be helpful before you use the software. Conversely, if you are experienced with the software, this section will be an excellent reference source for **WinCatt**'s features.

For ease of use, this portion of the *User Guide* has been divided into the following four sections:

Section A: Program Overview - provides a detailed description of all **WinCatt** modules and features.

Section B: System Configuration - describes system preparation for new hardware and new jobs.

Section A: Program Overview

WinCatt is equipped to conduct make-up in three modes:

- *Torque, Turns, Time*
- *Torque, Turns* and
- *Torque, Time*.

Additionally, *torque monitoring* mode enables the user to continuously measure torque required to rotate a string during, for example, cementing jobs requiring casing rotation. **WinCatt** provides the capability of limiting applied torque in this mode.

Note that torque monitoring mode is not available with wireless operation

A job using **WinCatt** typically consists of:

- selecting a make-up mode;
- naming the job and lot using the *Job Management* module;
- inputting job specific documentation using the *Job Report* module;
- checking hardware function and calibration using the *Test and Config Hardware* module;
- specifying make-up parameters using the *Make-up Settings* module;
- selecting system options using the *System Options* module;
- conducting joint make-ups;
- analyse and view data using the *data presentation* package; and
- print reports, joint make-up graphs, pressure test graphs, summary report, histograms and statistical report using the *data presentation* package.
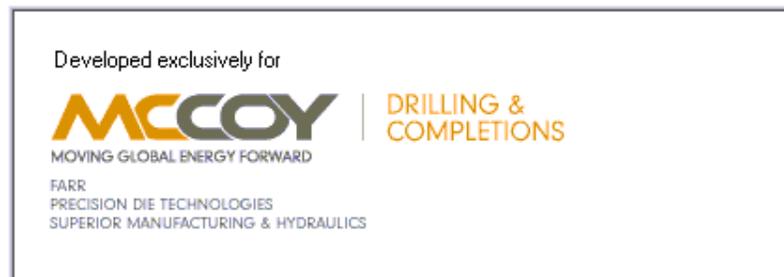
The following sections describe system operation including the function, input and output of each module.

Starting the Program

To start the program, double-click the **WinCatt** icon within the FARR Canada Ltd. Program group. Note that in order to use the software, you must have a security key attached to your computer.

After a few seconds, a **WinCatt** title screen similar to that shown below should appear on your screen. The version number of the software appears at the top of the image. A technical support contact is listed on this screen, which may be recalled by clicking the *About…* button on the "Home" screen which will appear when the program has finished loading.

WinCatt 2010

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WinCatt Welcome Screen.

WinCatt User Guide

After the program loads, you will be in the "Home" window. Clicking on the Wireless/Wired button toggles between using a Wireless sub and a wired (or conventional cabled) sub.
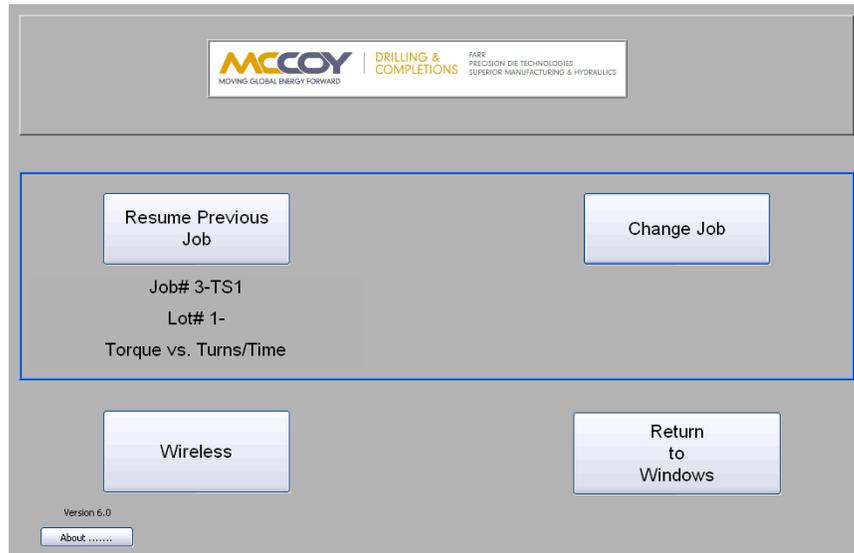
WinCatt Home Screen.

From the home screen you can either *resume the most recent job* conducted with this computer, or *change jobs*. If you choose to change jobs, it is replaced by the *Load Program* button and a list of available make-up modes appears beneith it.
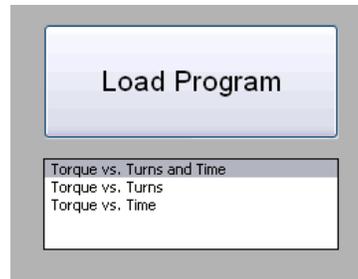
Select a mode and click on the *Load Program* button. **WinCatt** will present several options under the "Job Management" module.

Job Management Screen

Job Management Screen.

The most recent **job** and **lot** conducted under the specified make-up mode are listed below the window title. Note that the **job** and the **lot** may be both number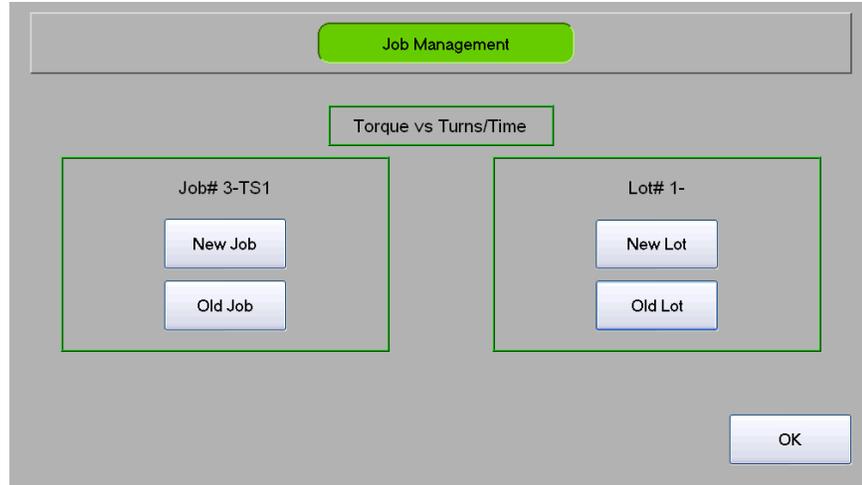ed and named. Numbering is automatic and is incremented from the existing data residing on the hard disk of the computer and provides a default sequential record of work. The naming capability allows the user to specify meaningful names for easy recall in the future.

Five buttons are available to the user as shown below. The **"OK"** button will be grey and therefore inactive unless the current job and lot are valid. If the **"OK"** button is available, clicking on it will have the same effect as the **"Resume Previous Job"** on the *Home Screen*. If the **"OK"** button is unavailable, the user must create a new **job**, new **lot**, or select an existing **job** or **lot**.

Clicking on **"New Job"** opens a new window, increments the **job** number, and prompts the user for a new **job** and **lot** name. Enter a descriptive name if you wish to

utilise this feature and click on **"OK"** to return to the *Job Management* window. Note that the new **job** and **lot** appear at the top of the window.

Clicking on **"New Lot"** opens a new window, increments the **lot** number and prompts the user for a new **lot** name and a starting **depth**. Enter a descriptive name if you like and specify the current **depth**. The **depth** value will tell **WinCatt** what **depth** the new **lot** starts at. Click **"OK"** to return to the *Job Management* window.

If you wish to resume a previous **job**, click on "Old Job". A new window with a list of **jobs** residing on the hard disk under the selected **make-up mode** will appear. Select the **job** you wish to resume and click on **"OK".** A new window will appear with a list of existing **lots** under the selected job.   Select the **lot** you wish to resume and click on **"OK"** to return to the *Job Management* window.

If you wish to resume an existing lot within the current job, click on **"Old Lot"**. A new window with a list of **lots** residing on the hard disk under the current **job** will appear. Select the **lot** you wish to resume and click on **"OK"** to return to the *Job Management* window.

When you are satisfied with the **job** and **lot** selection, click "OK" to advance to the *Program Screen.*

DAC Screen

The *DAC (Data Acquisition and Control) Screen*, shown below, is the starting point for all remaining system functions. Information presented on this screen is separated into several categories and corresponding locations. The appearance of this screen changes depending on the function being performed. Initially, the system is "ready" for action and during make-up, the system is in "action" mode. Some information is presented at all times, some only during "ready" mode, and some only during "action" mode.
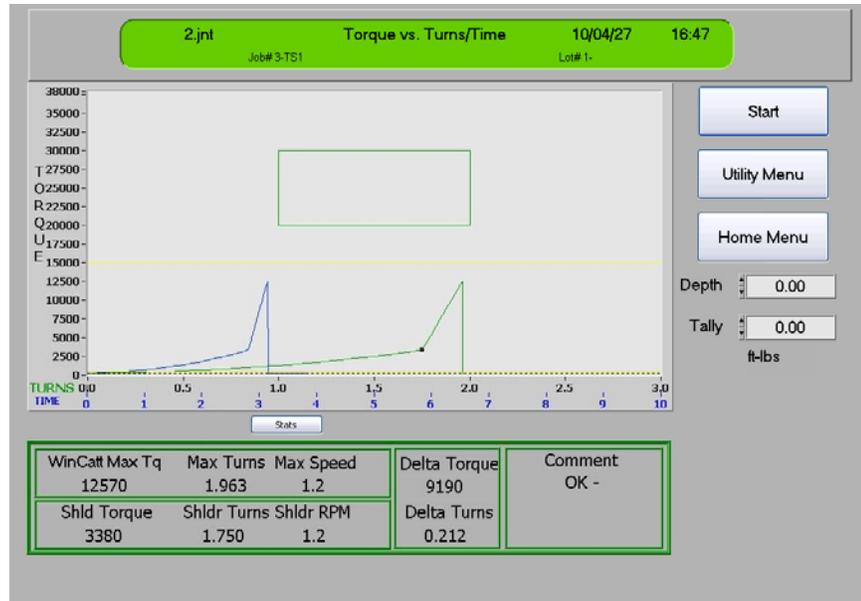
DAC Screen - Ready Mode

- The "Title Bar" is located at the top of the screen and presents general information at all times
  - **Make-up Mode**;
  - **Job** number and name;
  - **Lot** number and name;
  - **Joint** number; and
  - Time and Date
- The **"Start"** button is located at the top right hand corner of the screen and is displayed during "ready" mode. Clicking this button switches the system to "action" mode.
- The **"Utility"** button is located just below the start button and is displayed during "ready" mode. Clicking this button causes the **"Utility"** screen to appear.
- The **"Stats"** button causes a small floating screen to appear. The number of accepted joints made-up in the last one and the last twelve hours are displayed. Additionally, the maximum torque rise rate recorded during the pervious

make-up is displayed. This screen may be moved by clicking and dragging the title bar to the desired location.

- The **make-up graphical display** is located in the centre of the screen. Data recorded during the most recent make-up is displayed. If you want to view a portion of the data in more detail, place the mouse cursor at one corner of the area you wish to view, click and drag, using the left mouse button, to enclose the area of interest and release the mouse button. The graph will resize to magnify the area of interest. If you want to see a specific range of data different than that displayed by default, you may highlight the highest or lowest value on either graph axis and type in the desired value. Using this method, the graph view may be zoomed out or in. Note that a button labelled "Rescale Graph" appears at the bottom right hand corner of the graph. Clicking this button returns the graph to the original size. The following information is presented on this graph.
  - Torque versus turns and/or time;
  - Maximum and minimum allowable torque;
  - Maximum and minimum allowable turns (if appropriate);
  - Low and high shoulder values (if shoulder detection is enabled); and
  - Shoulder point (if shoulder detection is enabled).
- The **units** display is located in the lower right hand area of the screen and indicates the currently selected torque units.
- **Depth** and **Tally** are located at the bottom right hand corner of the **graphical display** and is displayed only during "ready" mode. **Depth** shows the current depth of the bottom of the string. This value may be manually adjusted if necessary, and **WinCatt** will warn the operator if it is adjusted in to a shallower value. **Tally** refers to the length of the joint being made-up. **Tally** is added to **depth** after each accepted make-up.
- The **"Final Results"** box is located at the bottom of the screen and is displayed only during "ready" mode. The following information is presented and refers to the data shown on the graphical display.
  - **WinCatt Max Tq** or **Legacy Max Tq** is the maximum torque applied during the previous make-up.
  - **Max Turns** is the rotational position corresponding to the **Max Torque**.
  - **Max speed** shows the greatest rotational speed achieved during make-up, including values below **reference torque**. Note that "Maximum speed" is reset at a time adjustable in the WinCatt.ini file (default is 0.25 seconds) after the initiation of make-up. This prevents initialisation instability in the speed algorithm from reporting a false high maximum speed.

- **Shld Torque** is the torque value at which **connection shouldering** occurred.
- **Shldr Turns** is the rotational position corresponding to the **Shoulder Torque**.
- **Shldr RPM** is the rotational speed at the shoulder point
- **Delta Torque** is the difference between **Final Torque** and **Shoulder Torque**.
- **Delta Turns** is the difference between **Final Turns** and **Shoulder Turns**.
- **Comment** is the selected or user entered comment associated with the previous makeup.
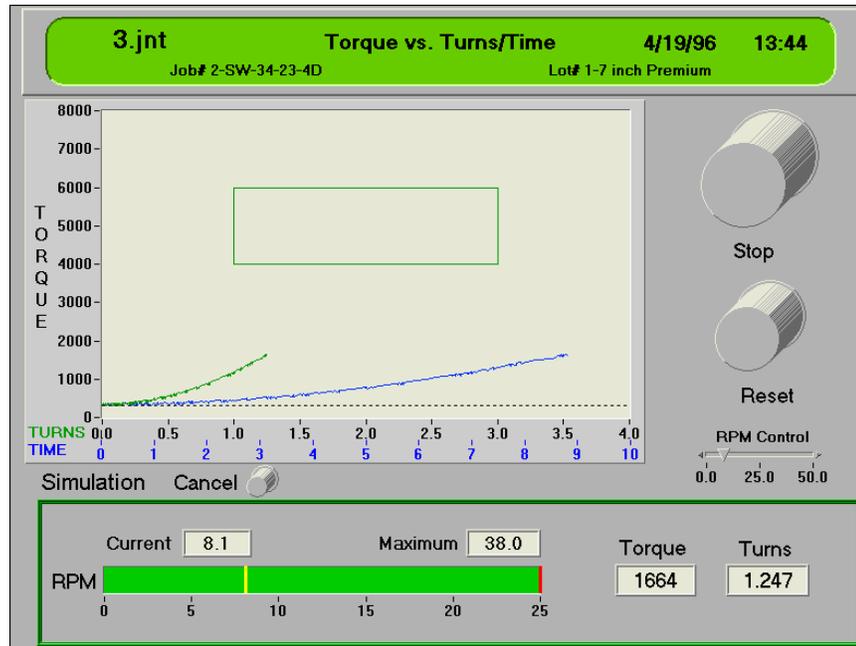
DAC Screen - Action Mode

- The **"Process Values"** box is located at the bottom of the screen and is displayed only during "action" mode. The following information is presented:

- **Make-up Speed** and **Maximum Speed** are shown both as a digital display and as a colour coded bar graph. The bar graph is coloured up to the maximum speed achieved during the entire make-up, including values below reference torque. The colour of the bar is red if speed is currently exceeding the maximum allowable specified under "Utility" ➪"Make-up Settings". The colour is green if speed is non-zero and below the specified maximum, and blue if speed is zero.
  - **Torque** is the value currently being applied to the joint.
  - **Turns** is the current rotational position.
- **"Simulation"** is displayed with a push button at the bottom of the **graphical display** when the program is running in demonstration mode. Clicking the push button returns the program to normal operation.
- **"Cancel Auto Mode"** is displayed with a push button on the right hand side of the screen when **WinCatt** is running in **"auto start"** mode, selected under "Utility" ➪"System Options". Clicking the push button returns the program to normal operation.
- **"Release Dump Valve"** is displayed with a push button to the left of **"Cancel Auto Mode"** when the dump valve has fired in "ready" mode as a result of **applied torque** exceeding **reference torque**. Clicking this button releases the dump valve and allows power to be applied to the **tong**.
- The **"Stop"** button is located at the top right hand corner of the screen and is display only during "action" mode. Clicking this button will cause the dump valve to fire and make-up to stop.
- The "**Reset**" button is located just below the "Stop" button and is displayed only during "action" mode. Clicking this button tells **WinCatt** to ignore the previous "reference" point (described under "Utility" ➪ "Make-up Settings"). This feature is used if torque exceeds reference torque as a result of something other than the onset of connection make-up and the operator wishes to cancel the false reference point.
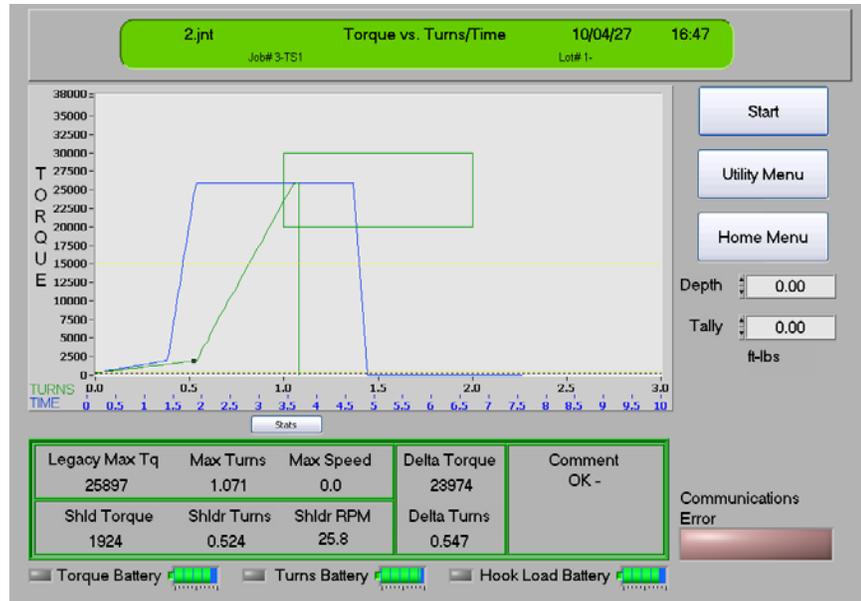
DAC Screen – Wireless Ready Mode

- In wireless operation in "ready" mode additional indicators are present.
  - Three indicators that resemble a battery displaying **"Torqe Battery"**, **"Turns Battery"** and **"Hook Load Battery"** levels.
  - Three lamps that display torque, turns and hook load communication. These lamps are grey if the sensor is connected and red if there is no signal.
  - An overall **"Communications Error"** lamp that flashes red when data communication on any channels is missing or degraded

Following make-up, **WinCatt** conducts a series of tasks.
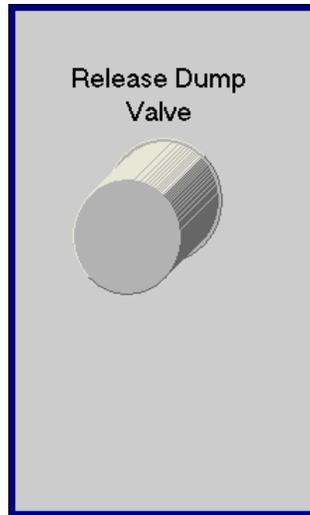
- First, the user is prompted to release the dump valve. This ensures that the tong may be rotated to a suitable standby position while the make-up analysis and comment are entered.
  NOTE: The dump valve is released automatically after two seconds if "Auto Mode" is selected under "Utility" ⇨ "System Options".
  NOTE: The wireless sub does not require a dump signal. The make-up is finished by selecting the stop button to proceed to the next make-up stage.
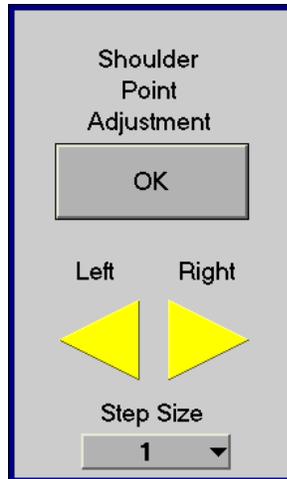
- If *Shoulder Detection* is selected under "Utility" ➭ "System Options", the user is then prompted to adjust or accept the shoulder point identified by **WinCatt**
- Next, if *Pressure Test* is selected under "Utility" ➭ "System Options", **WinCatt** runs the pressure test module. Note that *Pressure Test* is not available while using a wireless sub. See the Pressure Test section.
- For a wireless sub, if *Tubular Rotation Test* is selected under "Utility" ➭ "System Options", **WinCatt** runs the tubular rotation test module.

- **WinCatt** then analyses the recorded data to evaluate the quality of the result. If the final values fall outside the allowable defined under "Utility" ➪"Make-up Settings" **WinCatt** will suggest the comment which most accurately describes the failure.   The user may select the suggested result, or over-ride **WinCatt's** assessment.

- If the user chose the over-ride option, the default comment becomes "user comment". If **WinCatt's** assessment is accepted, the default comment is the result of the assessment. The user may select any comment from a drop down list and enter it at this point.
- The **"Cancel"** button is available to restart the task sequence listed above in the case that the user wishes to change a command.
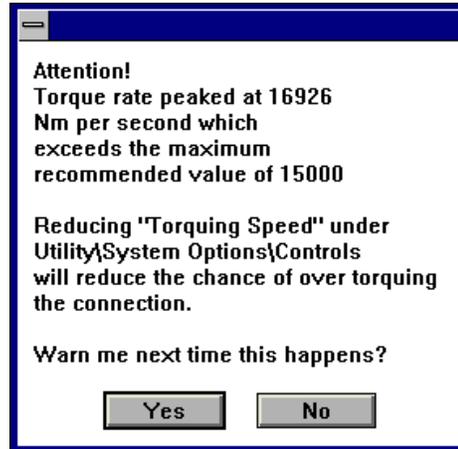
Attention!
Torque rate peaked at 16926
Nm per second which
exceeds the maximum
recommended value of 15000

Reducing "Torquing Speed" under
Utility\System Options\Controls
will reduce the chance of over torquing
the connection.

**Warn me next time this happens?**

[**Yes**]   [**No**]

- Following this task sequence, **WinCatt** compares the maximum torque rise rate to a maximum value specified in the WINCATT.INI file. If the process value exceeded the maximum recommended **WinCatt** tells the user what the maximum rise rate was and suggests that final speed be reduced. If the speed control module is available, this may be done by reducing "Torquing Speed" under "Utility" ⇨ "System Options" ⇨ "Controls". Otherwise, the tong may be operated at a lower throttle setting or the hydraulic power supply flow may be reduced.

Pressure Test

The pressure test module may be enabled under "Utility" ⇨ "System Options" and runs following make-up, before **WinCatt** conducts make-up analysis. This module monitors pressure applied to a transducer which should be connected to the pressure test equipment on the rig floor.

Initially, "Test Pressure" data is displayed on the right hand side of the graph. When test pressure has been reached, the user may click the "Start Test" button to tell **WinCatt** what the start pressure is (for use in evaluating results) and to begin recording data. "Start Pressure" is then displayed above "Test Pressure".
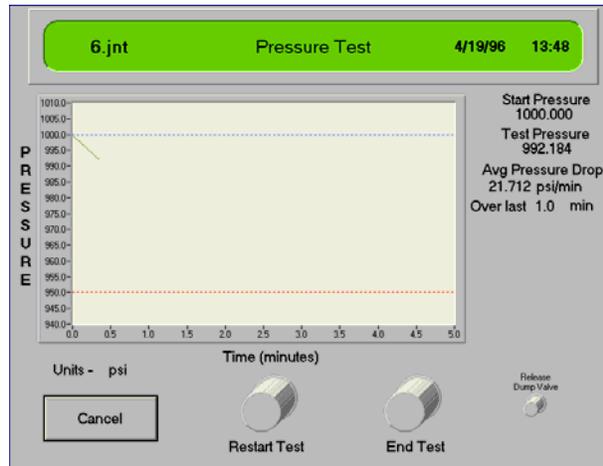
During the pressure test, the average pressure drop over a time period specified under "Utility" ⇨ "Pressure Test Options" is displayed below "Test Pressure". The following options are available during pressure testing.

- "Cancel" advances to the make-up analysis screen without recording pressure test data.
- "Restart Test" enables the user to re-define the start pressure. This is useful if pressure is added after the start button is initially clicked.
- "End Test" allows the user to terminate the pressure test before the entire test duration has passed. **WinCatt** assumes that the pressure test was a failure in this case.

The pressure test may terminate in one of three ways.

- The user may terminate the test by clicking "End Test". **WinCatt** assumes that the pressure test was a failure in this case.
- The pressure may drop more than the maximum allowable specified under "Utility" ⇨ "Pressure Test Options". This is also defined as failure.
- The entire test duration may pass with pressure dropping less than the acceptable maximum. This case is considered a successful pressure test.

The user may over-ride **WinCatt's** assessment of the pressure test. If this is the case, the default comment is "user comment". Otherwise, the default comment is the result of the pressure test assessment.

The user may choose to "Restart" the pressure test rather than choosing "Accept" or "Reject". This starts the pressure test process from the beginning.

Tubular Rotation Test

The tubular rotation test module may be enabled under "Utility" ⇨ "System Options" and runs following make-up, prior to **WinCatt** make-up analysis. This module monitors tubular rotation rate, torque applied and hook load.
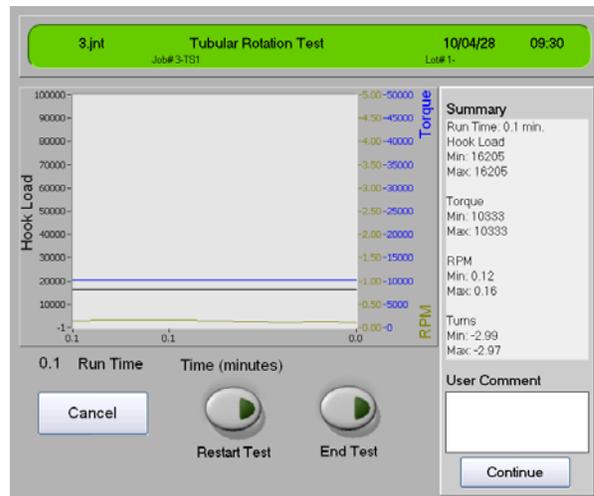
Initially, "Tubular Rotation" data is displayed on the right hand side of the graph. The graph for each sensor matches the axis color. Therefore hook load is shown in black, the blue graph shows Torque and RPM is in green. When a steady state has been reached, the user may click the "Start Test" button to begin recording data.

Unlike the pressure test above, there is no automatic end to this test. Once enough test data has been accumulated and the user is satisfied that the variance in torque, hookload and tubular rotation are acceptable, the "End Test" button can be selected. If the start values are incorrect, select the "Restart Test" button..

The user may supply a comment to the test. This comment is added to the tubular rotation test output.

Utility Screen
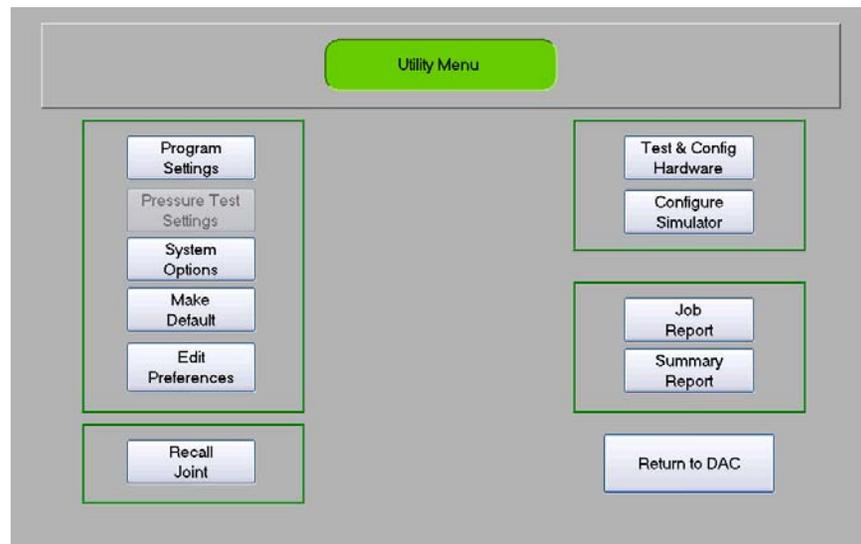
The utility screen presents several buttons to activate various program functions. Most buttons are always available, but some buttons appear gray and are therefore inactive if features have been switched off by the user, or were not purchased with the system. Available functions are listed below.

- **"Program Settings"** are used to specify torque, turns, speed, and time parameters for system control and make-up analysis.
- **"Pressure Test Settings"** are used to adjust pressure test parameters. The pressure test settings button is only visible when using a wired sub and is only available if the pressure test option has been switched on under **"System Options"**.
- **"Tubular Rotation Settings"** are used to adjust tubular rotation test parameters. The tubular rotation test settings button is only visible when using a wireless sub and is available when the tubular rotation test option has been switched on under **"System Options"**.
- **"System Options"** is used to specify system behaviour, to switch options on and off, and to view calibration data.
- **"Make Default"** causes **"Make-up Settings"** for all new jobs to be the same as the current settings.
- **"Recall Joint"** is a utility enabling the user to display data collected during any make-up of the current lot.
- **"Test and Configure Hardware"** is a utility for verifying hardware operation and conducting calibration.
- **"Configure Simulator"** is a utility for running simulated make-ups for training and demonstration purposes.
- **"Summary Report"** generates a data file containing **"Final Results"** for each connection in the current **lot**.
- **"Job Report"** provides a form listing job specific information for record keeping purposes.

Program Settings

WinCatt will warn the user that changing these settings may affect the statistical analysis, and that you may wish to change **lots** before continuing. This warning is given because **"Program Settings"** controls the torque and turns values used by **WinCatt** to stop make-up. Statistical analysis may be conducted on each **lot** to evaluate the consistency of the make-up process, and changing the target values will make the **lot** appear inconsistent in the statistical analysis.

The following parameters are specified on this screen.

- **"Maximum Torque"** is the greatest allowable torque value for an acceptable make-up.
- **"Optimum Torque"** is the torque which **WinCatt** targets for each make-up. This value is typically specified by the connection manufacturer.
- **"Minimum Torque"** is the smallest allowable torque value for an acceptable make-up.

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- **"Reference Torque"** is the torque value at which the turns reference is set. When applied torque reaches reference torque, turns are reset to zero and data is recorded.
- **"Low Shoulder"** is the smallest connection shouldering torque for an acceptable make-up.
- **"High Shoulder"** is the greatest connection shouldering torque for an acceptable make-up.
- **"Maximum Turns"** is the greatest allowable rotational value for an acceptable make-up.
- **"Minimum Turns"** is the smallest allowable rotation value for an acceptable make-up.
- **"Maximum Time"** specifies the range of time plotted on the **graphical display**.
- **"Maximum RPM"** is the speed at which the **process values** bar graph turns red.

Click **"OK"** to return to the "Utility" screen. **WinCatt** will check all entries for logical conflicts and notify the user if a conflict is detected.

Pressure Test Settings

The pressure test settings window enables the user to define the following variables:

- The **"units"** selector enables the user to display pressure in either Bar, kPa, or psi.
- **"Duration"** defines the length, in minutes, of the pressure test. This value is used by **WinCatt** to determine how often data is recorded and when to evaluate the pressure test results.
- **"Maximum Test Pressure"** is used by **WinCatt** to set the scale of the graphical pressure display. If test pressure exceeds the value specified here, the graphical display will automatically rescale to display the entire test pressure range.
- **"Allowable Pressure Drop"** is the decrease in pressure from the start of the test allowable for a successful pressure test.
- **"Averaging Time"** is used to tell **WinCatt** over what duration to calculate average pressure drop for the **moving average display**. (described in detail under "Pressure Test"

Tubular Rotation Test Settings

The tubular rotation test settings window enables the user to define the following variables:

- The **"units"** selector enables the user to display hook loak in either lbs or N.
- **"RPM Scale Maximum"** defines the maximum rotational speed displayed on the y-axis of the tubular rotation test graph.
- **"Hook Load Scale Maximum"** defines the maximum hook load displayed on the y-axis of the tubular rotation test graph.
- **"Torque Scale Maximum"** defines the maximum torque displayed on the y-axis of the tubular rotation test graph.

System Options

The "System Options" screen enables the user to enable **WinCatt's** features and set system wide preferences.

- **"Torque Units"** specifies whether torque will be displayed in foot pounds or Newton metres;
- **"Shoulder Detection"** tells **WinCatt** to look for a sudden change in torque, indicating shoulder engagement;
- **"Printer"** enables the field printout option;
- **"Pressure Test"** enables the pressure test module which is set to run following each make-up.

WinCatt **User Guide**

- **"Speed Control"** enables **WinCatt's** speed control module. If this switch is grayed out, this module is not available.

- **"Dump at Reference Torque"** causes **WinCatt** to fire the dump valve at reference torque. This may be desirable if the power tong is used to spin connections together in high gear, but connection make-up must be conducted in low gear. Using this feature, the tong is stopped automatically before make-up occurs, prompting the operator to shift gears.

- **"Auto Operation"** permits **WinCatt** to execute the most likely course of action following make-up, thereby reducing the number of key strokes required to accept or reject a make-up. The user may always review and over-ride **WinCatt's** decisions.

- **"Reset Dump Valve"** enables the feature that releases the dump valve four seconds after make-up is complete, permitting the operator to position the tong for the next joint.

- The **"Calibration"** section allows the user to view or change the effective tong arm length, pulses per turns, and pressure transducer settings.

System Options ⇨ Controls

The "Controls" screen is accessed from the "System Options" screen. This screen enables the user to define how **WinCatt** controls the make-up. Note that the Controls screen is not available for a wireless controlled sub.

The first setting is the "Torque Control" slider which compensates for hydraulic system reaction time. If "Torque Control" is set to "0" the dump valve is fired exactly when measured torque is equal to optimum torque. If the dump valve could fire immediately this would be fine, however even the fastest dump valves require several milliseconds (thousandths of seconds) to fire. When torque is rising quickly, firing the dump valve exactly when torque equals optimum will result in torque exceeding the target. "Torque Control" tells **WinCatt** what the hydraulic system reaction time is so that, based on real time torque rise rate, the dump valve may be fired at the right time to hit optimum torque.

The second group of settings are used if speed control is available.

- "Running Speed" determines how fast the tong will run when torque is below "Shift Torque". Setting speed to "0" results in minimum tong speed while setting speed to "100" results in maximum tong speed.
- "Shift Torque" is a percentage of optimum torque where **WinCatt** switches from "Running Speed" to "Torquing Speed". After torque has crossed this

value, speed remains at "Torquing Speed" even if torque drops below "Shift Torque".

- "Torquing Speed" controls tong speed after "Shift Torque" has been reached.
- The "Calibration" switch selects which speed signal is sent to the control valve when the "Controls" screen is active. It may be used to

Make Default

The **"Make Default"** button writes all current "Make-up Settings" to the **default settings** file. All new lots will be created with these settings. **WinCatt** will prompt the user to verify that old defaults may be overwritten.

Hint: A user library may be built by creating a **job** containing **lots** with connection specific "Make-up Settings" such as 3 ½ inch 8 round EUE, 7 inch VAM, etc. During preparation for a new job making up a connection contained in the user library, select **change job** from the "Home Screen" followed by the library job type, usually *Torque, Turns, Time*. Select the job containing your library **lots** and then select the **lot** containing the settings for the connection you are preparing to make-up. Enter the "Utility" screen and click "Make Default" to cause all new **lots** to be created with these settings. Return to the "Home" screen, select **change job** followed by **new job**. All **lots** created under this new **job** will default to the settings contained in your user library.

Test and Configure Hardware

The **"Hardware"** screen is used to calibrate transducers, verify operation, and manage calibration data. This screen may be divided into two main categories, calibration and operation.

The top half of the screen is used for calibration.

- "Current Load Cell" displays the name of the load cell settings being used by **WinCatt** to interpret force data and calculate torque;
- "Tong Arm" tells **WinCatt** at what distance from the pipe axis the load cell exerts force. Refer to *Technical Considerations* for details on how to determine tong arm. Note that the tong arm length is not used with the wireless sub.
- "Turns" calibration is in units of pulses per turn. This number may be input manually if you know the correct value and may be determined interactively by **WinCatt** through the "Turns Calibration" module.
- "Pressure" calibration is in units of pounds per square inch (psi) per volt. Because the primary purpose of monitoring pressure is to detect pressure changes and not highly accurate pressure values, **WinCatt** does not provide an automatic calibration module for the pressure transducer. A theoretical calibration factor may be calculated and checked with the following method. Calibration of the pressure transducer may be checked by applying a known pressure and adjusting the calibration factor until the output matches the

known pressure. Output should then be zeroed after pressure is removed, and checked again when pressure is reapplied. Note that pressure calibration is not available for a wireless sub.

- "Torque Calibration" provides access to **WinCatt's** torque calibration module. This module enables the user to select load cell settings stored in the system, add new load cell settings, change master calibration settings, and conduct field calibration checks. These functions are described in detail in the *System Configuration* section.
- "Turns Calibration" provides access to **WinCatt's** turns calibration module which leads the user through a simple exercise to quickly and accurately determine the number of pulses per turn.
- The "Zero Torque", "Zero Turns", and "Zero Pressure" buttons cause the current applied torque, turns position of the tong, and applied pressure to be defined as "zero". Zero pressure is only available for conventional wired subs.
  When "Zero Torque" is clicked, the current load cell voltage is written to the program initialisation file and subtracted from all future voltages so that all torque is reported relative to applied torque when the button was clicked.
  *NOTE - Always ensure applied torque is zero before clicking this button. No record of turns zero point is maintained because it is defined during each make-up.
  "Zero Pressure" works the same way as "Zero Torque" and should therefore only be clicked when applied pressure is zero.

The bottom half of the screen is used to verify system operation.

- "Torque Output" displays currently applied torque. This value is based on force applied to the **load cell** multiplied by the **tong arm**.
- "Turns Output" displays rotation relative the most recent turns zero point.
- "RPM" displays the current rotational speed of the tong.
- "Pressure" displays currently applied pressure.
- "Dump Valve Test" switches the dump valve between "open" or "fired" position and "closed" or "released" position.
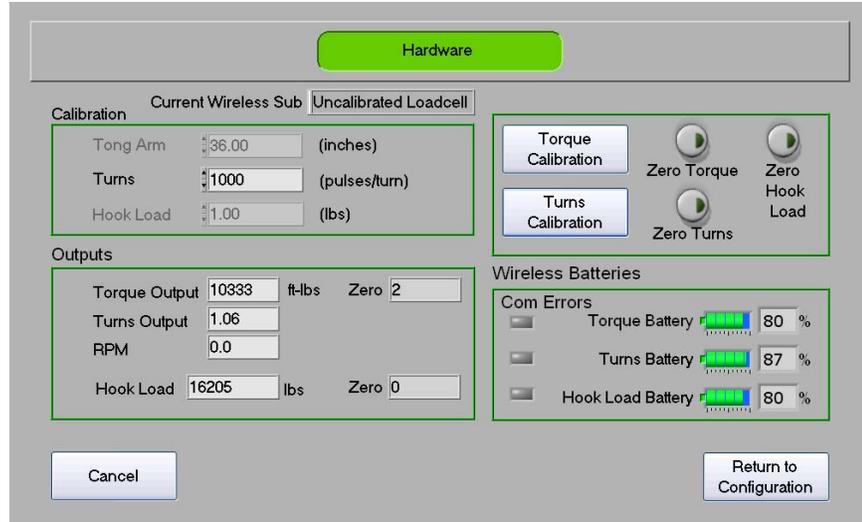
The hardware control and calibration screen for a wireless sub differs slightly from that of a wired sub.

- A dump valve is not part of a wireless sub setup, so no dump valve state or testing is provided.

- A wireless sub reports hook load and therefore requires a hook load zero.

- Battery and communication indicators are provided to monitor the battery strength on the sub. If the batteries get run down, radio signal quality will decline compromising the data collect during operation.

- The torque and hookload zeroing function test to see if the value of the zero is outside the range of the sensors allowable error. If it is, a pop-up message will appear alerting the user to the possibility that the sensor may need recalibration at the factory. The user can still operate the system normally.

Configure Simulator

This screen configures the training and demonstration module. The user may specify variables controlling simulated make-up data.

- **"Connection Type"** selects either 8 round or premium connection data;
- **"Noise Level"** specifies the amplitude of random variability on the torque signal;
- **"Make-up Variability"** controls the amount of variation in the thread interference portion of the make-up data;
- **"Cancel"** returns to the "Utility" screen; and
- **"Start Make-up"** exits the "Utility" module and initiates a simulated make-up.

During simulation mode, "simulation" is displayed on the left hand side of the "Program Screen".

Job Report

The **"Job Report"** screen, shown below, enables the user to record job specific information for use in documentation and reporting.

Summary Report

The **"Summary Report"** button writes the *final values* for each make-up in the current lot to a summary data file. This file is used by the *Data Presentation Package* as input for statistical analysis and job summary reporting.

WinCatt will display "Working…." in the centre of the screen while this operation is under way. When this message disappears, the summary report is complete.

Recall Joint
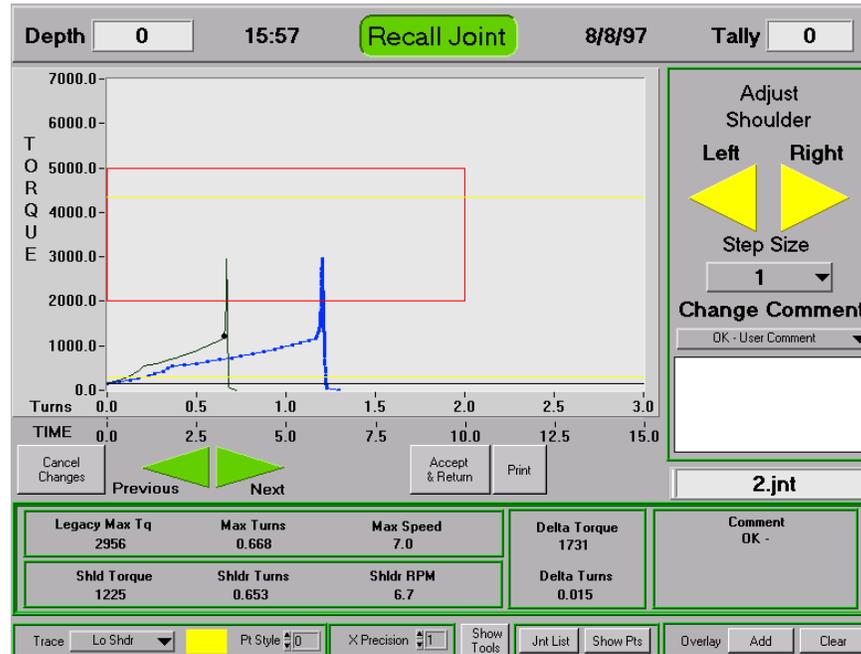
The "Recall Joint" module enables the user to review all recorded joints in the current lot, edit the shoulder point, edit the comment, and create overlays of recorded data. Data displayed on this screen is exactly the same as that displayed on the "Program Screen" following make-up.

In the top right hand corner of the screen, a drop down menu lists all available joints recorded under the current lot.

Hint: If the current lot contains many joints and scrolling through the drop down menu is too slow, type a number in the box to the right of "joint #" which corresponds to the index of the joint file you wish to view. Then click on the drop down menu to select a joint near the manually indexed file.

When a valid joint file is selected, a button labelled "Load Joint" appears. Clicking this button loads data recorded on the hard disk for viewing.

After a joint file is loaded, the drop down menu and the "Load Joint" button disappear and two buttons appear at the bottom of the screen. One is labelled "Show Pts" and causes symbols to appear on the graphical display. This is useful to demonstrate the frequency at which **WinCatt** has recorded data. The second button is labelled "Jnt List". Clicking this button causes the drop down menu to reappear.

Several action buttons are located at the bottom of the graphical display.

- "Cancel" causes any changes the user has made to the shoulder point or comment to revert to the original;
- The green left arrow saves the current changes and loads the previous joint file;
- The green right arrow saves the current changes and loads the next joint file;
- "Accept changes and Return" saves changes to the current joint file and returns to the "Utility" screen;
- "Rescale Graph" appears when the graph scale has been manually changed. Clicking this button sets the graph scale to the original default.

Hint: As with the graphical display on the "DAC screen", clicking and dragging the cursor around an area on the graph will zoom in on that area. Similarly, if you wish to view an area different than the default, highlight the highest or lowest value on either graph axis and type in the desired value. Clicking on "Rescale Graph" will return the graph to the default.

- "Trace" drop down menu allows the selection of any set of data shown on the graph and allows adjustment of color and point style (active when the "Show Pts" button is on).
- "X Precision" allows adjustment of the number of decimal places on the X-axis. (*Time axis* for Torque/Turns/Time and Torque/Time, *Turns axis* for Torque/Turns)
- "Show Tools" enables a graph scale manipulation utility palette providing greater "Zoom" capabilities than the default "Zoom" feature.

Section B: System Configuration

WinCatt is shipped pre-configured for a wide range of connection make-up requirements using hardware supplied with the system. This section of the *Guide* provides instruction for adding new load cell hardware, switching between load cells, and customising **WinCatt** error checking and data acquisition behaviour during connection make-up and pressure testing.

Switching Between Load Cells

Correct calibration data must be supplied to **WinCatt** for accurate torque measurement. Load cell calibration is managed through the calibration module under "Utility" ⇨ "Hardware Test & Config" ⇨ "Torque Calibration". The name of the current load cell is listed at the top of the screen. Clicking and holding on the *Instrument Name* drop down list displays the names of all load cells currently installed on the computer system. Drag the mouse to the desired load cell and release the mouse button. Clicking *Return* tells **WinCatt** to update load cell calibration data using the data under the selected instrument name. Clicking *Cancel* exits this screen without updating calibration data.

Load cell calibration data is stored on the hard disk under Program\Calibrations\ LoadCells*instrument name*.txt where *instrument name* is the individual load cell name. Load cells may be moved to a different computer system by copying the *instrument name*.txt file to the Program\Calibrations\ LoadCells directory on the other computer. *NOTE - DO NOT DELETE LOAD CELL CALIBRATION FILES YOU WISH TO USE AGAIN.

If you accidentally delete a calibration file is **WinCatt** not using, you may recreate it using the procedure described below and if you delete the current load cell file, you should refer to the troubleshooting section to correct the problem.

Adding a New Load Cell

New load cell calibration data is entered under "Utility" ⇨ "Hardware Test & Config" ⇨ "Torque Calibration" ⇨ "New Load Cell". The "Load Cell Setup" screen is shown below.

"Instrument Name" defaults to "new". Type a descriptive name for the new load cell for easy future recognition. Enter "Serial Number", "Excitation Voltage", "Full Scale Load", and "Factory Calibration" data supplied by the load cell manufacturer. This data is used by **WinCatt** to calculate the "Factory Calibration Factor" displayed in the lower left hand part of the screen.

You may choose between the factory calibration or a local calibration using the "Source" switch in the lower centre part of the screen, and enter calibration data by clicking "Return".

Running a Local Calibration

The system may be calibrated to a local force standard under "Run Local Calibration". **WinCatt** will lead you through a two point calibration exercise as follows.

Make sure no load is applied to the load cell, then click "Continue".
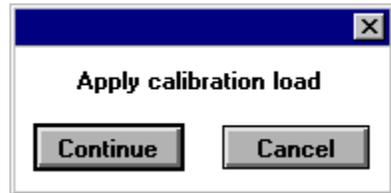
Apply a known force to the load cell. It is unnecessary to know what load you will apply at this time, however you must enter the load that was applied when you clicked the "Continue" button. Load must be stable over at least one second because **WinCatt** determines the calibration factor based on 1000 voltage readings acquired over one second. When this process is complete, you will be prompted to enter the calibration load as shown below.
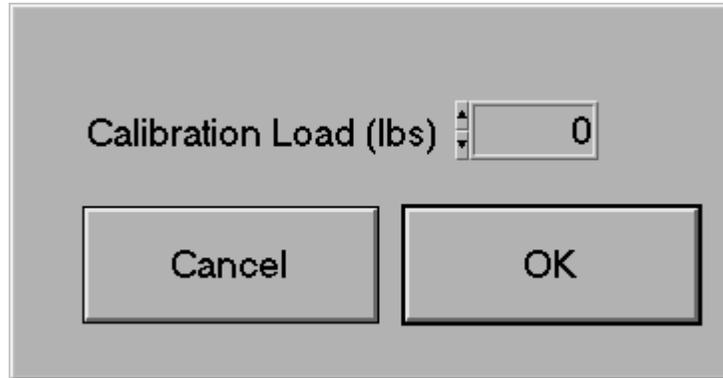
WinCatt calculates the system calibration factor based on the voltages measured over one second after clicking "Continue", the manually entered "Calibration Load", and the effective gain of the load cell instrument amplifier, discussed under Technical Considerations. The result of the local calibration is displayed and you are prompted to use either the Local Calibration or the Factory Calibration.

If you change your mind after this prompt, you can always specify Factory or Local calibration using the "Source" Switch in the lower centre part of the "Load Cell Set-up" screen.

Running a Master Shunt Calibration

Because any electronic system is subject to drift over time and with temperature change, **WinCatt** provides a "Shunt Calibration" module to ensure that system electronics are functioning at all times just as they were during calibration. This is done through a "Master Shunt Calibration" by applying a simulated load and measuring the resulting voltage immediately after calibration. The simulated load may be applied at any time providing an opportunity for **WinCatt** to check the resulting voltage against the "Master Shunt Calibration", advise the operator of the results, and make minor adjustments to the calibration factory to compensate for electronic drift.

Immediately following calibration, click the "New Master Shunt Calibration" button. **WinCatt** will prompt you to make sure applied load is "zero". When you click "Continue" **WinCatt** measures voltage with zero load, applies the simulated load, measures the resulting voltage, and subtracts "zero load voltage". The result is recorded as "Shunt Calibration Voltage". **WinCatt** shows the result and prompts you to "Enter value" or "check equipment and redo shunt calibration". The only reason to redo the shunt calibration is if load was applied during the operation, or a cable was unplugged, or connection broken resulting in a shunt calibration voltage of "zero".

Shunt calibration is 0.00 VDC

| Enter value | Check equipment & redo shunt calibration |
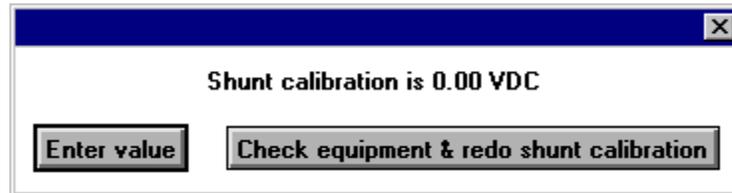
Running a Field Shunt Calibration

Field shunt calibration is conducted to check system electronics and make small corrections as necessary to the load cell calibration factor to compensate for electronic drift.

You may run a field shunt calibration from the "Load Cell Calibration" screen by clicking "Run Field Shunt Cal". **WinCatt** will prompt you to ensure applied load is zero. When you click "Continue" **WinCatt** will run a shunt calibration and report the percentage change since the last shunt calibration. You will then be prompted to accept the field shunt calibration or to check equipment and redo the operation. If the change since the

last shunt calibration is greater than 2%, a problem with either the load cell or the system electronics may exist. Refer to the Troubleshooting section for appropriate action.

Running a Turns Calibration

The turns calibration module provides a quick, accurate method for determining the number of pulses generated by the proximity switch or pulse encoder per turn. This module is accessed through "Utility" ➪ "Hardware Test & Config" ➪ "Turns Calibration" and guides the user through a calibration process as follows.
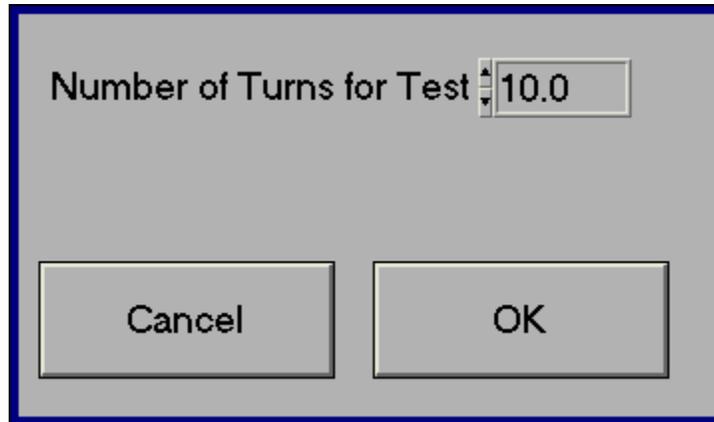
- **WinCatt** will prompt you to enter the number of turns for the test. The turns calibration number will be calculated by dividing the total number of pulses counted during the test by this number. The accuracy of the calibration therefore depends on the accuracy of your start and stop tong position. A greater number of turns provides greater accuracy, but testing over one turn provides the quickest indication of whether the current pulse count is close to the truth. Enter the desired number of turns for the test and click "OK".
- You will be prompted to ensure the tong is in the starting position. Take note of the current rotational position or rotate the tong to a convenient starting position; then click "OK".
- You will be prompted to run for the number of turns specified previously. Click "OK".

- **WinCatt** will now display both the number of turns you plan to run and the current turns based on the existing turns calibration. Count turns on the tong yourself and stop when you reach the number you specified in the first step. Now check to see how close the output on the screen is to the actual number of turns and click "OK"

- **WinCatt** will tell you what the current and the test calibrations are and prompt you to choose one. You may still specify any turns calibration you want after making a choice.

Customising and Error Checking

Settings described in this section affect the way **WinCatt** acquires data, checks user inputs, and protects connections from accidental over torque. The following settings are adjustable from "Utility" ⇨ "Edit Preferences" and should only be changed if the user fully understands the impact of the change on system operation. Maintaining a backup copy of the initialisation file is highly recommended.

The "Edit Preferences" screen is password protected to facilitate control over adjustment of critical program parameters. The password may be changed from the "Password" screen as shown below.
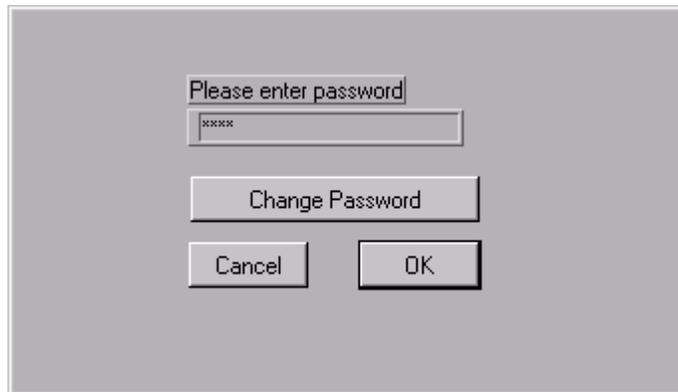
The password is stored in an encrypted text file named "system1.bin" and stored in the "\Program\defaults" directory. Maintaining a backup copy of this file is highly recommended. If you forget your password, contact FARR Canada Ltd. for a new password file or reinstall **WinCatt**.
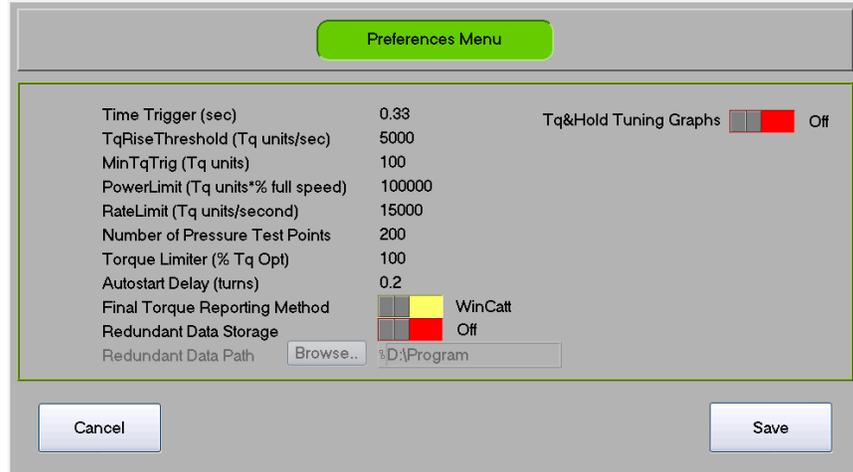
Error Checking

WinCatt conducts several checks on user inputs, some of which are user adjustable from the initialisation file. The first user adjustable parameter is "Power Limit". The number specified by "PowerLimit =*value*" is based on hydraulic power supply rating and effective gear ratio of the power tong system. This limit specifies what the maximum torque and maximum speed may be without stalling the hydraulic power unit. This value depends on:

- Hydraulic power unit prime mover rating;
- System gear ratio; and
- Mechanical efficiency of:
    - hydraulic power unit pump;
    - power tong hydraulic motor; and
    - power tong gear train.

After adjusting speed control settings and after changing make-up settings, **WinCatt** checks whether or not optimum torque times torquing speed (in % of full speed) exceed the power limit specified in the initialisation file.

Increasing this number may result in stalling the power unit with no software warning.

Following each make-up, **WinCatt** checks to see if the maximum torque rise rate during the make-up exceeds system capabilities specified in the initialisation file. If torque rise rate does exceed this value, **WinCatt** warns the user and displays the actual torque rise rate.

System capabilities are limited by a combination of computer speed, hydraulic hardware, and type of make-up. The most difficult control situations are when torque rise rate is high, but the difference between target torque and shoulder torque is low. Small diameter premium connections with a high shoulder torque present this combination of variables. As the duration of the shouldering event increases, so does the maximum rise rate.

Increasing RateLimit in the initialisation file may result in exceeding system capabilities with no software warning. When system capabilities are exceeded, final torque values become less consistent. This may be observed as an increased standard deviation and average final torque in the statistics report generated by the data presentation package. If final torque values are different than optimum torque, refer to the Troubleshooting section for possible solutions.

Data Acquisition Settings

WinCatt is, by default, set to sample each input signal 500 times per second during connection make-up. Each data point is the average of five samples. For example, data point number 100 is the average of voltage samples number 96 to 100, and data point number 101 is the average of voltage samples number 97 to 101. These settings effectively smooth out high frequency "noise" which does not describe connection make-up, and provide a response time of no more than 10 milliseconds. If higher data acquisition speeds are required, **WinCatt** may be configured to sample at speeds up to 10,000 samples per second.

Because the volume of data collected during each make-up would occupy a large amount of disk space and provide no more value than appropriately spaced data points, **WinCatt** saves only data points which satisfy two specific criteria. First, torque must have changed by more than the "torque trigger" value calculated by **WinCatt** based on optimum torque. The "torque trigger" value is chosen to provide 100 data points between reference torque and 75% of optimum and 50 data points between 75% of optimum and 100% of optimum torque. If torque is not changing very fast, you may still want to record data to show what was actually happening. You may specify a time period to tell **WinCatt** to record data even if torque has changed by less than the "torque trigger" value. The suggested setting for this feature is 0.33 seconds which provides three readings per second when torque is not changing. When optimum torque is small, the "torque trigger" value may be smaller than the variations in torque normally

observed during make-up. In this case, too much data may acquired. To avoid this problem, you may specify a "minimum torque trigger" value which must be exceeded before data is recorded.

"Autostart", part of "Auto Operation" is a feature enabled under "Utility" ⇨ "System Options" which allows **WinCatt** to sense when the tong has rotated a certain amount and start actively recording data and controlling make-up. You may use "Auto Start Delay" to specify a turns value for **WinCatt** to wait before starting data acquisition and control activities. During the waiting phase, current torque, turns, and speed are displayed below the graphical display on the left hand side while the final values of the previous make-up are shown in the main display area. These values disappear when **WinCatt** begins actively recording data and current values are shown in the main display area.

During make-up, the dump valve is fired strategically to provide the best chance of achieving a successful make-up. For example, below minimum turns the dump valve will fire to target maximum torque. If this happens, the connection will be rejected on "low turns". After minimum turns is reached, the dump valve will be fired to target optimum torque. If maximum turns is reached, the dump valve is fired and the connection is rejected on "high turns". Note that for a wireless sub, a dump valve is not used and a make-up is completed manually but the user.

During activities other than active make-up, **WinCatt** will fire the dump valve if torque exceeds a percentage of optimum torque specified by "TorqueLimit" under "Utility" ⇨ "Edit Preferences". This ensures that connections will not be accidentally over torqued before the "Start" button is clicked, or "Auto Start" triggers. The value for this "fail safe" feature may be set using "Torque Limit".

Final Torque Reporting

The "Final Torque Reporting Method" switch allows the user to select either the **WinCatt** method of reporting final torque or a legacy method which duplicates the behaviour of some other torque/turns computers.

The **WinCatt** method of reporting final torque is to monitor peak torque values at the maximum data acquisition rate (default is 500 Hz) and report torque, turns, speed, and time at this location as "Final Values".

The "Legacy" method of reporting final torque is to monitor data up to a prescribed percentage (default is 99%) of optimum torque, suspend recording for a prescribed duration (default is 0.5 seconds), and beginning to record data again incrementing time and turns from the beginning of the "suspension" period. The effect of this feature is

to ignore over torque values completely if torque falls below optimum torque in less than 0.5 seconds after reaching this target. True torque values are reported after the 0.5 second suspension period resulting in documentation of obvious over torque conditions.

> **Note: The use of this feature is recommended ONLY to illustrate the difference between WinCatt data quality and that of some other systems. The "Legacy" reporting practice is designed to duplicate behaviour of another torque/turns computer system as observed during controlled testing.**

Part

3

SAMPLE JOB

This section will provide a check list for configuring **WinCatt** and preparing for a new job. This checklist is intended to identify key operational variables which should be addressed and may be considered a recommended minimum level of preparation.

Pre-Job Tasks

The first information required to configure **WinCatt** for a new job is what data will be recorded. Assuming the necessary hardware is available, you may record torque versus turns and time, torque versus turns, or torque versus time. Under each of these job types, a unique job number is assigned and you may include a descriptive job name. Under each job, one or more "lots" are given unique numbers and, optionally, descriptive names. Post job analysis is conducted on a lot by lot basis. You should therefore have more than one lot if make-up parameters are adjusted, if you are running more than one tubular string per job, or if special connections to downhole equipment are included in the job.

When you have decided on the job type, load **WinCatt** by double clicking on the icon in the FARR Canada Ltd. program group on your computer. Click on the "Change Job" button, select the desired job type, and then click "Load Program". Click on "New Job", type in a descriptive name for the new job and the first lot, and click "OK". If you are satisfied with the names you have chosen, click "OK" again to advance to the data acquisition and control (DAC) screen.

If you know how long each joint will be, you can fill in the "Tally" section in the lower right hand part of the screen. **WinCatt** will use this number to keep track of string depth.

Select the options you wish to use under "Utility" ➪ "System Options". If you choose the "Pressure Test" or the "Tubular Rotation Test" options, make sure you configure the test parameters under "Utility" ➪ "Pressure Test Settings" or under "Utility" ➪ "Tubular Rotation Test Settings". The function of each option is described in Part 2 Section A.

You may initiate the job report by clicking on and filling in the information you have.

Instrument Verification

Equipment operation and calibration should be verified before each job. The components of your system are reliable, but if equipment has been damaged, it's better to find out in the shop than in the field. The equipment check is best done under "Utility" ➪ "Test and Configure Hardware" using the following steps.

- Check to make sure the load cell listed at the top left corner of the screen matches the load cell on the tong.
- Rotate the tong and check to see that the turns count is advancing, and that the rpm indicator is functioning.
- Apply a force to the load cell and verify that indicated torque changes.
- Click on the "Dump Valve Test" button and verify that the dump valve position indicator changes from closed to open.
- Conduct a "Field Shunt Calibration" as described in Section __
- Run a "Turns Calibration" as described in Section __ to verify that:
  - the turns calibration is correct. (Two gears on the same tong may have a different number of teeth per turn and be used for different turns counters. If you use more than one location for the turns counter this will catch mistakes before you get into a job!)
  - all the pulses are being picked up. If you get an unexpected turns calibration, your first step is to check your equipment and try again. If you get the same unexpected value twice, you should check the reason you were surprised by the first result. See Section _ - Troubleshooting for further information.

Running Make-ups

When the system is configured and tested, you are ready to make-up the first joint. Make sure the "Tally" value is correct and let the tong operator know you are ready to start.

Note: If the tong operator starts before the computer starts recording data and actively controlling make-up, **WinCatt** will allow rotation until torque reaches the percentage of optimum torque specified by "Torque Limit" under "Utility" ⇨ "Edit Preferences". This limit should be set to protect the joint from over torque and still allow the operator enough torque to correctly position the tong.

Hint: Set the torque limit to a value from which the pipe rep or company man will allow you continue make-up. That way you won't have to break out, clean and re-dope the connection if you have a false start.

The computer will start monitoring and actively controlling the make-up when you click "Start" or, if "Auto Operation" is enabled, after turns exceed the "Auto Start Delay" setting under "Utility" ⇨ "Edit Preferences".

The DAC screen changes appearance during make-up. As shown below, the "Start", "Utility", and "Home" buttons are replaced by "Stop" and "Reset" buttons.

Clicking the "Stop" button will cause the dump valve to fire immediately and clicking the "Reset" button will tell **WinCatt** that reference torque has not really been reached. "Reset" will therefore have no visible effect if torque is below reference. However, if torque has exceeded and then dropped back below reference, clicking "Reset" will cause **WinCatt** to discard all old data and start recording at the next reference crossing.

Note: Never click "Reset" when torque is above reference torque and the tong is moving. **WinCatt** depends on three data points above reference torque to anticipate when the dump valve should be fire to achieve optimum make-up torque. If you click reset just as the connection is shouldering, you run the risk of reaching optimum torque before **WinCatt** has a good estimate of how fast torque is changing. In the worst case, this may result in exceeding minimum torque by as much as torque rise rate X dump valve reaction time. For example, if torque is rising at 10,000 ft-lbs/sec and dump valve reaction time is 20 milliseconds you may exceed minimum torque by up to 10,000*0.020=200 ft-lbs.

WinCatt displays data as it is collected. When torque exceeds reference, data below reference, except maximum RPM, is cleared and the turns counter is reset. All data collected from the first reference crossing to 1 second past dump valve firing is recorded unless you click "Reset" as described above. You may fire the dump valve manually by clicking the "Stop" button in the top right part of the screen, but this is not normally necessary. **WinCatt** will fire the dump valve at the right time to result in final torque very

near optimum torque. If final torque not consistently near optimum, refer to Part 4 - Troubleshooting.

Following make-up, **WinCatt** will perform the following tasks:

- First, you are prompted to release the dump valve. This ensures that the tong may be rotated to a suitable standby position while the make-up analysis and comment are entered.

Note: The dump valve is released automatically after two seconds if "Auto Operation" is enabled under "Utility" ➪ "System Options".

- If *Shoulder Detection* is enabled under "Utility" ➪ "System Options", the user is then prompted to adjust or accept the shoulder point identified by **WinCatt**.
- Next, if *Pressure Test* is enabled under "Utility" ➪ "System Options", **WinCatt** runs the pressure test module.
- **WinCatt** then analyses the recorded data to evaluate the quality of the make-up. If the final values fall outside the allowable defined under "Utility" ➪ "Make-up Settings" **WinCatt** will suggest the comment which most accurately describes the discrepancy. The user may select the suggested result, or over-ride **WinCatt's** assessment.
- If the user chose the over-ride option, the default comment becomes "user comment". If **WinCatt's** assessment is accepted, the default comment is the result of the assessment. The user may select any comment from a drop down list and enter it at this point.
- The **"Cancel"** button is available to restart the task sequence listed above in case the user wishes to change an entry.
- If the "Printer" option is enabled under "Utility" ➪ "System Options", **WinCatt** will print make-up data and pressure test data in the field. If the printer option is disabled, a printout will still be available from the data analysis and presentation program.
- Following this task sequence, **WinCatt** compares the maximum torque rise rate to a maximum value specified in the WINCATT.INI file. If the process value exceeded the maximum recommended **WinCatt** tells the user what the maximum rise rate was and suggests that final speed be reduced. If the speed control module is available, this may be done by reducing "Torquing Speed" under "Utility" ➪ "System Options" ➪ "Controls". Otherwise, the tong may be operated at a lower throttle setting or the hydraulic power supply flow may be reduced. The user is given the option to cancel future warnings, but **WinCatt** will default to showing this warning each time the program is started.

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After each make-up the operator should check the length of the next joint and make sure the value entered in the "Tally" box is correct.

Reviewing Make-up Data

Data collected during any make-up may be viewed from **WinCatt** as long as the datafile has not been moved or deleted. The following methods may be used to review recorded data.

- Because the most recently completed make-up is usually of the greatest interest, **WinCatt** keeps both the graphical display and final values visible until the next make-up is started. The graph may be viewed in greater detail by clicking and dragging the mouse cursor around the area of interest.
- Data collected previously made-up joints from the current lot may be reviewed under Utility" ⇨ "Recall Joint". Detailed instructions for this module are available in Section __.
- Data collected during other jobs or other lots may be viewed by exiting the DAC screen, clicking "Change Job" and selecting the type of job from which you wish to review data. Click "Old Job" or "Old Lot" as required to select the lot containing the data you wish to review. **WinCatt** will load data collected during make-up of the last joint in the selected lot and display it on the DAC screen. You may review any make-up data recorded during this lot using the Recall Joint module.

Presenting Data

Data collected during make-up and pressure testing may be printed in the field by enabling the "Printer" option under "Utility" ⇨ "System Options" or printed following the job using the data analysis and presentation package included with **WinCatt**.

The data analysis and presentation package runs under Excel and provides the following features:

- Statistical analysis of make-up data on a per lot basis including:
  - histograms of final torque, final turns, shoulder torque, shoulder turns, delta torque, and delta turns;
  - average and standard deviation of final torque, final turns, shoulder torque, shoulder turns, delta torque, and delta turns; and

- graphical display of final torque distribution assuming normally distributed results.
- A job report including all data entered from **WinCatt**.
- A summary report listing the final torque, final turns, shoulder torque, shoulder turns, delta torque, delta turns, and comment of each make-up.
- Viewing utilities for both pressure tests and make-ups.
- A printout of data collected during each make-up and pressure on a per lot basis.

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Appendix A - Unit Conversions

From	multiply by	To
Newton Meters (Nm)	0.7376	foot-pounds (ft-lbs)
Bar	0.06895	pounds per square inch (psi)
Kilopascal (kPa)	6.895	pounds per square inch (psi)
meter (m)	39.37	inch (in)

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Appendix B - Output Reports

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Appendix C - WinCatt.ini File Format

[WinCatt]
useDefaultTimer=False
- LabVIEW system setting to enable high precision timing. Do not adjust.

OverSampling=2
- Number of samples averaged for each data point.

FeedForward=0.020
- "Torque Control" value. Adjustable from Utility ⇨ System Options ⇨ Controls

ScanRate=100
- 100% response frequency.   (Signals are sampled at "Scan Rate" (100) X "OverSampling" (10) = 1000 Hz.

ContinuousDAS=True
- Enables "gap free" data acquisition. Do not adjust.

TimeTrigger=0.20
- Maximum time (in seconds) between recorded samples

TqRiseThreshold=2000.00
- Torque rise rate (in current torque units) at which screen updates are suspended.

MinTqTrig=50.00
- Minimum torque change between recorded samples

PowerLimit=100000.00
- Power limit of hydraulic power supply in torque units X torquing speed (in % of full scale).

RateLimit=15000.00
- Recommended maximum torque rise rate.

VFullSpeed=10
- Voltage corresponding to full speed. Must be either 0 or 10

TMax=.2
- LabVIEW system setting. Do not adjust

#PtestPts=200.00
- Number of points acquired during pressure test. Adjustable from Utility ⇨ Edit Preferences

TqLimit=100.00

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- Safety dump level in percent of optimum torque. Adjustable from Utility ➪ Edit Preferences

ASDelay=0.25

- Auto start delay in turns. Adjustable from Utility ➪ Edit Preferences

FFArrayLenMult=3

- Width of feed forward window ranging from 1 to 10. 1 is most responsive, and 10 is least sensitive to torque fluctuations. Only use values greater than 3 for non-shouldering connections

ShoulderDetArray=.15

- Width of shoulder detection window ranging from 0.05 to 0.2. This value specifies the fraction of make-up data used as a window for the moving shoulder detection algorithm. Using smaller numbers will recognise smaller fluctuations in torque as indications of shouldering. Larger numbers will ignore small torque fluctuations and only recognise shoulders characterised by a significant amount of data.

BufferSize=4500

- Maximum number of data points gathered before firing the dump valve. DO NOT increase this number above 450 points without authorisation from FARR Canada Ltd. System performance may degrade under some conditions if this number is increased.

LegacyRep=False

- Indicates whether the Legacy reporting module is active or not.

LegacyLevel=1

- Specifies the fraction of optimum torque at which suspension of data reporting occurs.

LegacyLen=.5

- Specifies the duration (in seconds) of suspension of data reporting.

LegacyThreshold=.90

- Specifies the fraction of the legacy target torque at which to suspend data reporting.

MaxRPMDelay=.25

- Specifies delay (in seconds) after initiation of make-up for the activation of the maximum rpm recorder.

RdData=False

- Indicates whether a redundant copy of data is recorded.

RdDataPath=D:\ExtraData

- Location where redundant data is stored, if that option is enabled.

[calibration]
AmpGain=333

- Effective amplifier gain. Set prior to delivery. Do not adjust.

TQZero=2.046

- Voltage corresponding to zero torque

PrsZero=0.393

- Voltage corresponding to zero pressure

TongArm=3.875000

- Length of tong arm in feet. Adjustable from Utility ⇨ System Options or Utility ⇨ Test & Config Hardware *NOTE: Input is in inches.

TurnsCal=1932.301535

- Number of pulses per turn. Adjustable from Utility ⇨ System Options or Utility ⇨ Test & Config Hardware

PressureCal=1.000000

- Pressure transducer calibration. Adjustable from Utility ⇨ System Options or Utility ⇨ Test & Config Hardware.

[calibration]
loadcell=new

- Current loadcell

UpLim1=10
LowLim1=0
UpLim2=80
LowLim2=0
LimShift=1000

- PID control loop setpoint variables used for torque control simulation

HookLoadZero=0.000

- Calibration offset for current hook load reading

[settings]
LastJob=0

- Record of most recent job type.

IniPath0=D:\DATA\T_T_T\Job# 3-\Lot# 1-\settings\settings.ini
IniPath1= D:\DATA \T_TURN\Job# 1-\Lot# 1-\settings\settings.ini
IniPath2=D:\DATA\T_TIME\Job# 1- \Lot#- \settings\settings.ini
IniPath3= D:\DATA \T_MON \settings\settings.ini

- Record of most recent job in each program mode.

Wireless=true

- Wireless sub or conventional DAC (wired) sub

COMPort=COM3

- Serial communication port for wireless sub. Data received is torque, hookl oad and turns.

[ComList]
comment0=Reject - Low Turns
comment1=Reject - High Turns

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comment2=Reject - Low Torque
comment3=Reject - High Torque
comment4=Reject - Low Shoulder
comment5=Reject - High Shoulder
comment6=Reject - Laid Out
comment7=Reject - Backups Slipped
comment8=Reject - Gas test failure
comment9=Reject - User Comment
comment10=Connection OK
comment11=OK - By Pipe Rep
comment12=OK - User Comment
comment13=OK - Position Reached

- Comment list. User may change comments 6, 7, and 11.

last line