

04578092  
P7529  
Edition 1  
January, 2002

# Expert Torque Analyzers ETA2 and ETA5 **OPERATORS MANUAL**



©2002 Ingersoll-Rand

04578092  
Form P7529  
Edition 1  
January, 2002

## OPERATORS MANUAL FOR MODEL ETA2 AND ETA5 ANALYZERS

### NOTICE

This ETA Analyzer is used for calibration or data collection of torque tools, power and hand operated, using external transducer(s). This Analyzer can also be used for joint development and as a failure analysis instrument (using external transducers). Ingersoll-Rand is not responsible for customer modification of units for applications on which Ingersoll-Rand was not consulted.



This symbol is to alert the user and service personnel to the presence of important operating instructions that must be read and understood to prevent personal injury, electrical shock or damage to the equipment.



### WARNING

**IMPORTANT SAFETY INFORMATION ENCLOSED -  
SAVE THESE INSTRUCTIONS.**

**READ AND UNDERSTAND THIS MANUAL BEFORE OPERATING THIS PRODUCT.**

**IT IS YOUR RESPONSIBILITY TO MAKE THIS SAFETY INFORMATION  
AVAILABLE TO OTHERS THAT WILL OPERATE THIS PRODUCT.**

**FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN  
ELECTRIC SHOCK, FIRE AND/OR SERIOUS PERSONAL INJURY.**

Refer All Communications to the Nearest Ingersoll-Rand  
Office or Distributor.  
© Ingersoll-Rand Company 2002  
Printed in U.S.A.

 **Ingersoll-Rand®**

---

## **PLACING ANALYZER IN SERVICE**

---

- Always install, operate, inspect and maintain this product in accordance with all applicable standards and regulations (local, state, country, federal, etc.).
- Keep work area clean, uncluttered, ventilated and illuminated.
- Do not remove any labels. Replace any damaged label.

---

## **USING THE ANALYZER**

---

- Always wear eye protection when operating or performing maintenance on this tool.
- Always use Personal Protective Equipment appropriate to the tool used and material worked. This may include dust mask or other breathing apparatus, safety glasses, ear plugs, gloves, apron, safety shoes, hard hat and other equipment.
- Keep others at a safe distance from your work area, or ensure they use appropriate Personal Protective Equipment.
- This tool is not insulated against electric shock.
- This unit is for indoor use only.
- Store idle units. When not in use, units should be stored in a dry, high or locked location, out of the reach of children.
- Power tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.
- Keep body stance balanced and firm. Do not overreach when operating this tool. Anticipate and be alert for sudden changes in motion, reaction torques, or forces during start up and operation.
- Ensure work pieces are secure. Use clamps or vises to hold work piece whenever possible.
- Never use a damaged or malfunctioning tool or accessory.
- Maintain unit with care. Keep unit clean for better and safer performance. Follow instructions for changing accessories. Inspect unit cords periodically and if damaged, have them repaired by an authorized service facility.
- Do not operate this product in explosive atmospheres, such as in the presence of flammable liquids, gases or dust.
- Do not modify this product, safety devices, or accessories.
- Do not use this product for purposes other than those recommended.
- Use accessories recommended by Ingersoll-Rand for your model.
- Don't abuse the cord. Never use the cord to pull the plug from an outlet. Keep cords away from heat, oil, sharp edges or moving parts. Replace damaged cords immediately.
- Avoid body contact with grounded surfaces such as pipes, metal structures or other electrical products.
- Stay alert, watch what you are doing and use common sense when operating this product. Do not use this product while tired or under the influence of drugs, alcohol, or medication.
- Do not use this product near water or other liquids.
- Do not attach or place external loads on any part of the unit.
- Replace battery with the same or equivalent type recommended by the battery manufacturer. Observe correct polarity when installing battery. Dispose of used batteries according to battery manufacturer's instructions.

## CAUTION

- The unit should be checked periodically to ensure that the torque readings are accurate.
- DO NOT store the unit in relative humidity above 85%.
- Have the unit calibrated at least once a year.
- Keep the exterior of the unit clean and dry.
- Do not drop or abuse the unit.
- Do not allow chemicals such as acetone, benzene, thinner, ketone or trichloroethylene to come in contact with the housings, as damage will result.
- The instrument should not be subjected to vibration or shock.
- For calibration or repair, return to:  
  
Ingersoll-Rand  
ETA Dept.  
510 Hester Dr.  
Whitehouse, TN 37188  
  
Ingersoll-Rand IDC  
ETA Dept.  
Swan Lane, Hindley Green  
Nr. Wigan  
Lancashire, WN2 4EZ  
U.K.

## NOTICE

Ingersoll-Rand Company makes no warranty or implies any warranty or liabilities due to the misuse or damage resulting from the application of the information supplied by this manual.

Liabilities due to errors in the manual are only limited to replacement of the manual.

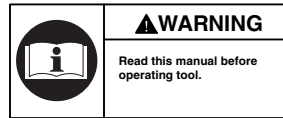
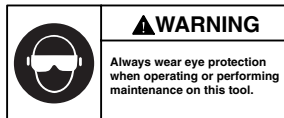
Ingersoll-Rand reserves the right to change information contained in this manual or the program without notice at any time.

All programs and the manual are copyrighted and rights reserved. Reproduction is prohibited without prior permission of Ingersoll-Rand.

The use of other than genuine Ingersoll-Rand replacement parts may result in safety hazards, decreased tool performance, and increased maintenance, and may invalidate all warranties.

Repairs should be made only by authorized trained personnel. Consult your nearest Ingersoll-Rand Authorized Servicenter.

## **WARNING SYMBOL IDENTIFICATION**



### **NOTICE**

**SAVE THESE INSTRUCTIONS. DO NOT DESTROY.**

**When the life of the tool has expired, it is recommended that the tool be disassembled, degreased and the parts be separated by material so that they can be recycled.**

## Table of Contents

	Page No.
ETA Analyzer usage and warnings . . . . .	1
Placing Analyzer in Service . . . . .	2
Using the Analyzer . . . . .	2
Warning Symbol Identification . . . . .	4
How to use this Manual . . . . .	7
Packing List . . . . .	8
Care and Storage. . . . .	9
Battery Charging . . . . .	9
Edit Transducer File . . . . .	10
Barcode read input for characteristic names and comments. . . . .	13
Measure Mode (Up to 200 readings stored) . . . . .	14
Measure Mode Circle--Store Option . . . . .	16
Direct Measure Mode -- ETA5 ONLY . . . . .	17
To set up a Characteristic -- ETA5 ONLY . . . . .	19
Direct Characteristic Mode -- ETA5 ONLY . . . . .	21
To Store Data (single characteristic) -- ETA5 ONLY . . . . .	23
To set up a Round -- ETA5 ONLY . . . . .	25
To Store Data by Round -- ETA5 ONLY . . . . .	26
To set up a Master Round -- ETA5 ONLY . . . . .	27
To Store Data by Master Round. . . . .	28
To Display Recorded Data on ETA2 and ETA5 . . . . .	29
To View Cp and Cpk . . . . .	30
French Cp and Cpk . . . . .	31
To Erase Stored Data. . . . .	31
To Erase Stored Data and Setups on ETA5. . . . .	32


## Table of Contents *(continued)*



	Page No.
Printing.....	34
To Print details of Setup or Analysis of Data from ETA5 .....	34
Printing Data to PC .....	39
To Set Date and Time .....	39
To Set Power Off and Backlight Time Delays. ....	40
To Configure Printer Port .....	40
To Display Software Version Number. ....	41
To Set Password Protection .....	41
To Clear Password Protection .....	42
To Perform Software Reset .....	43
To Communicate with a PC using PC Comms Software .....	44
Printout of Readings taken in Measure Mode .....	45
Printout of Setup and Readings taken by Characteristic .....	46
Printout of Analysis by Characteristic .....	47
Printout of details of all Characteristic setups .....	48
Printout of Round setup.....	49
Printout of Readings taken by Characteristic. ....	50
Rotary and Stationary Joint Kits .....	51
Nominal Joint Stiffnesses - Table .....	52
Bolt Hole Diagram and Sectional View Diagram .....	53
Parts List - Table .....	54
Glossary of Terms .....	55
Error Messages .....	58
External Connections.....	61


## How to use this Manual

This manual is split into sections describing the steps to be taken to configure the ETA for use in measuring and recording torque values.


There are a number of other parameters which are set from the Software Reset Menu, some of which are detailed elsewhere in this manual.

Pressing  after making a selection will take the user on to the next screen.

Pressing  will give the user the option to exit to the Misc menu or continue to edit by pressing .

Screens can be skipped using the  and  keys.

**The following method is adopted throughout this manual.**

Keys to be pressed will be shown as the key legend in large type: **Example** 

Any special instructions or point to note will be shown as:





Refer to the table of contents to find action to be performed.


Follow instructions for key presses required to carry out required action.

**Note:** It is possible to change the default primary character on dual function keys. ie: when text is entered into various fields, it is possible to set the ETA to default to either the numerals or text as the primary character (the alternate character is selected by pressing the shift key before typing). To set this:


**From main menu:**



Press  then press  (Misc)

Press  then press  (Software Reset)

Press the  7 times to access the 'Shift key' menu

Select between options 1 'Characters' or 2 'Numbers' using:  

Press  Screen will prompt "End of setup"

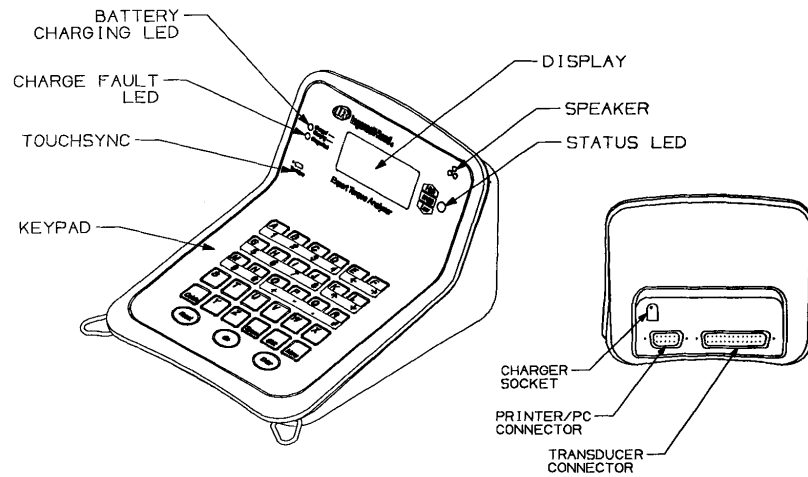
Press   to return to main menu



## Packing List

The following items, except those listed as optional, are included with the ETA unit:

1 x ETA Analyzer .....	ETA
1 x Camera (Neck) Strap .....	ETA-STRAP
1 x 9 way D type to 9 way D type PC cable .....	ETA-PC99
1 x 9 way D type to 25 way D type Printer cable .....	ETA-P925
1 x 25 way D type to 25 way D type Port Saver .....	ETA-PS25
1 x Fastcharge Charging Unit (Max. current 1 A) .....	ETA-BC
1 x Operators Manual .....	7464
1 x Warranty Card .....	50807
1 x Carrying Case .....	ETA-CASE
1 x Certificate of Calibration .....	89937759



(Dwg. TPA1821)

## Care and Storage

When not in use the unit should be returned to the supplied carry case.

This unit is designed for indoor use only

Operating temperature range  
5-40 degrees C

Storage temperature range  
0-50 degrees C

The membrane keypad may be wiped clean with a soft damp cloth. The unit is not water-proofed and spillages should be avoided.

**THIS UNIT CONTAINS NO USER SERVICEABLE PARTS. ONLY QUALIFIED SERVICE PERSONNEL SHOULD REPLACE OR FIT PARTS.**

## Battery Charging

The batteries in the ETA unit are shipped fully charged.

In continuous use with a transducer connected, the batteries have a life of at least 8 hours.

With the unit switched off from a 10% charge state, the batteries will fully discharge in 25-50 days. To prevent the loss of all setup data, the unit has additional battery backup for the internal memory.

### Automatic Power Off

To conserve battery life in use, the unit will switch off automatically after a predefined period. Pressing the on key will restore the unit to the last display prior to powering off.

### Fast Charge

The ETA's should only be recharged with the supplied ETA-BC (Model MPP3OUS12) Battery Charger. ETA's, are supplied with internal NiMH (Nickel Metal Hydride) batteries. These are environmentally friendly batteries presenting no problems for safe disposal and are capable of sustaining a rapid recharge. From fully discharged, the unit will require a charging period of approximately 2.5 hours.

To charge the batteries following a period of use, connect the supplied charger to the charging socket on the back of the unit and plug the charger into a suitable supply. The green LED will come on to indicate the machine is charging and will start to flash when the unit is fully charged. If the red LED comes on, this means there is a problem and usually indicates a faulty battery.

The Fast Charge method gives an increase in the effective life of the charged batteries.

## Edit Transducer File

### WARNING

Failure to input proper information may result in inaccurate readings.

The following instructions for “Edit Transducer File” must be followed before any reading or measurements can be taken.

This section may be skipped if you are using an Ingersoll-Rand TSD, TRD or Crane UTA Series Transducer.

There are 5 types of transducers and inputs which the ETA will accept.

1. **High Output (H/O).** These transducers have an internal amplifier and give an output signal level of 1-2 Volts.
2. **Industry Standard (IS).** These transducers have no internal amplifier. The exact span or rated torque will be marked on the transducer nameplate. The sensitivity of these transducers is 2 mV/V., they are fitted with a 350 Ohm bridge.
3. **Serial.** These are digital type transducers and produce an RS232 signal.
4. **Keypad (KPD).** This is an optional keypad which connects to the ETA.
5. **Keyboard (KEY).** Keyboard on ETA.

Use of any of the above 5 types of inputs requires that settings are made in the transducer file before any measurements can take place. The procedure for entering settings follows.

#### For ETA2:

At main menu, press **1** (Edit Tx)



#### For ETA5:

At main menu, press **1** (Configure) then press **2** (Edit Tx)

Screen will show

Transducer  
B (Current set-up)  
Complete set-up

The 'B' indicates that this is the 'B' file in memory. It is the first of 8 memories (labelled B to I) reserved for the saving of transducer set-ups. Your most used transducer setting should be stored in this memory.

The remaining memories (C to I) may be accessed by pressing  .




Press 


Select input type H/O, I/S, SER, KPD or


KEY using  ; press .


Depending on type of type selected above, continue set-up by following the appropriate section.


### If you have chosen I/S


Select units of measure - inlb, ftlb etc. using   press 



Type in transducer span- press 




Type in mV/V press 


Type in Bridge resistance press 

Type in Pulses Per Rev (only for angle type) press 




Type in Serial Number press 

To set-up another transducer press  



Select another memory (B to I) using the   keys and press 




To return to the main menu, press 


### If you have chosen SER

Select location of decimal point using   press 



Select Baud Rate, Data Bits, Stop Bits and Parity in the same manner

To set-up another transducer press  


Select another memory (B to I) using the   keys and press 


To return to main menu press 


### If you have selected H/O

Select units of measure- inlb, ftlb, etc. using  

Note: High Output devices usually produce an output voltage of approximately 1-2 Volts. This analogue voltage signal will not be exact and may not be linear. If you are using a device that has a nominal 1Volt output, we suggest that you multiply the span of your transducer by 2.5 to determine the new span setting.

Type in your new span; press 

Type in Serial Number; press 




Screen will indicate 'End of Set-up'; press  to return to main menu




Connect your high output device and select measure mode



(refer to instruction sheet for measure mode only)




Use an independent measuring device to apply a torque to the transducer and check the reading on the independent unit against the reading shown on the ETA. It will be necessary to return to the 'Edit Tx' menu option and adjust the span setting until the two readings agree. You may have to repeat the above procedure several times until your high output transducer is correctly calibrated.


### If you have selected KPD

Select location of decimal point using   then press 




Select Parity- *Odd, Even* or *Disabled* using   then press 



To set-up another transducer press  




Select another memory (B to I) using the   keys and press 


To return to main menu press 

### If you have selected KEY

Select location of decimal point using   then press 

To set-up another transducer press  

Select another memory (B to I) using the   keys and press 


To return to main menu press 

## Barcode read input for characteristic names and comments

It is possible to scan a barcode name in ETA5 at certain prompt lines. The input of a barcode is allowed at the characteristic name prompt in store characteristic, direct characteristic and edit characteristic modes. In addition it is also possible to scan a barcode in the comment field in store characteristic only. Edit characteristic and normal store behave in a slightly different manner to direct characteristic. The ETA5 will accept most barcode reading formats, but not all.

### General Operational Method for Scanning Bar Code Data

Connect the Bar Code Reader ETA-BAR to the Printer/PC connector at the rear of the ETA5. Barcode readings can generally be taken at the prompt to input data (Characteristic name or a comment) when the flashing cursor is on the screen. This can be on a blank line or following a line of data (an existing characteristic or a comment). When the cursor is flashing, scan the code with a barcode reader and observe the screen. If the flashing cursor disappears, the code has been captured - wait a few seconds for the data to appear in the display. If the flashing cursor remains, re-scan the code until it is accepted.

When the data is displayed, press  to continue. From this point, follow the instructions as for normal data input.

When entering data via the Bar Code Reader into a comment field, make sure you have reserved enough characters in the comment field to accept the code. If the number of characters scanned in exceeds the number reserved, the ETA5 will beep and refuse to accept the data. Refer to the instructions on Configuration for more details.

## Measure Mode (Up to 200 readings stored)

To start, press **On**

Press **MENU**

Press **2** (measure)

Plug in transducer; press **Enter**

select proper transducer using **←** **→**

then press **Enter**

If using I/S or H/O type transducers  
continue with instructions.  
If using SER, KPD or KEY, you are now  
ready to take measurements.

Select units of measure using **←** **→**; press **Enter**

Select Peak, Track, Impulse or 'Click Dip' using **←** **→**; press **Enter**

Use Peak for direct drive tools, Track for diagnostics, Impulse for pulse tools, and 'Click Dip' for click wrenches.

Select measurement direction using **←** **→** (Right is clockwise. Left is anti-clockwise);


press **Enter**

Select 'Cycle end Time' using **←** **→**; press **Enter** (normal is 0.5 sec.)


Select frequency response using **←** **→**; press **Enter**




Type in Max torque value; press **Enter**

Type in Min torque value; press **Enter**


Type in threshold value; press 


**Note:** When selecting a threshold torque value the ETA will ignore any torque that is below this value. You cannot take another reading until the applied torque falls below this value.


Type in amount of Dip; press 

Select Second Parameter using  ; press 


If the setup and transducer has not been changed since the ETA was last used you are now ready to take torque measurements.

Pressing  after taking a series of readings will result in statistical information being displayed (Range, mean and standard deviation) for the stored readings.

To return to measure mode, press 


If you have selected 'Click Dip' type in the amount of 'Dip' to be sensed; press 


**Note:** 5% of torque for 0 to 100 Nm and 10% of torque for over 100 Nm generally provide excellent results.

You are now ready to take torque measurements. When finished press 


**Note:** When taking readings you can change the set-up parameters by pressing the up arrow 


Changing any of the set parameters will result in the ETA prompting to erase all data.

To erase stored readings, press 

To return to setup screens, press 

**Example:** You have been measuring in a right hand direction and you want to switch to left hand.

Press the up arrow  twice, change from right hand to left hand. Screen will prompt to erase all data.

Press  to erase all stored readings and return to the measure screen.



### Printing of stored readings from measure mode

Pressing **P** from the measure mode will result in all stored readings being printed to an attached printer or computer.

**Note: Transducer needs to be connected to ETA.**

## Measure Mode Circle-Store Option

Circle-Store is a function to increase the number of stored readings to extend beyond the normal maximum of 200 readings possible in measure mode. With the circle-store option selected, readings will be accepted beyond the 200 limit but the first readings taken will be lost. Effectively the last 200 readings taken will be stored but the user is not limited to taking only 200 readings.

### To select this option:

#### From main menu

Press **→** then press **6** (Misc')

Press **→** then press **6** (Software Reset)

Press the **↓** 6 times to access the *Circle-store* menu

Select option 2 '*Circle-store On*' using **←** **→**; press **Enter**

Press **MENU** Screen will prompt: "*End of setup*"

Press **MENU** **MENU** to return to main menu

## Direct Measure Mode - ETA5 ONLY (Ingersoll-Rand TRD, TSD or Crane UTA Type Transducers)

Direct measure mode allows an operator to connect different transducers which may have different spans and an angle output, and can switch between them using an external T switch. This is a display only function and readings are not stored or printed out.

To start, press

ON

press

MENU

press

4

(Direct)

press

1

(Direct Measure)

press

1

(Setup)

select units of measure using

←

→

; press

Enter

select peak, track, Impulse or 'Click Dip' using

←

→

; press

Enter

select measurement direction using

←

→

(Right is clockwise. Left is anti-clockwise);

press

Enter

select 'Cycle end Time' using

←

→

; press

Enter

select frequency response using

←

→

; press

Enter

type in the Threshold Percent (mx 50.0; mn 0.0), and press

Enter

type in amount of Click (mx 100.0 Nm; mn 0.0 Nm), and press

Enter

select 'Second Parameter' using

←

→

; press

Enter

Screen shows "End of Setup", press

MENU

to exit

press

MENU

MENU

to return to main menu

**The READ option allows you to read the torque from a connected transducer.**

From the main menu, press **4** (Direct)

press **1** (Direct Measure)

press **2** (Read)

If no transducer is connected, display will prompt: "Insert Tx" (transducer)


connect transducer and press **Enter**

Screen will show the span of the connected transducer and the torque measured in units selected at setup. The display will show the last reading taken until the next torque input exceeds the threshold level set.

**Note:** If password protection has been set on Direct measure, then exit is by password only. A correct password returns you to the setup read sub-menu. Entering three incorrect passwords will force the user back into read mode. See password protection later in this book.

## To set up a Characteristic - ETA5 ONLY

To set up a job


To start, press 

press 


plug in transducer


press  (Configure)


press  (Edit Char)




Type in Job Name \_\_\_\_\_, press 




Alternatively, when the cursor is flashing, you may connect a Bar Code Reader to the Printer/PC connector on the back of the ETA5 and scan the information from a barcode. Scan across the label (from left or right) and watch the display. If the flashing cursor disappears, the reading has been captured; wait a few seconds for the reading to be displayed. If not, re-scan until the data is accepted.




When the information is displayed on the screen, press 




Type in number of samples \_\_\_\_\_, press 

Type in number of subgroups \_\_\_\_\_, press 




Select transducer ID using  , press 

Select units of measure using  , press 

Select 'Peak', 'Impulse', or 'Click' using  ; then press 


Select measurement direction using  ; then press 


Select cycle end time using  ; then press 




Select Frequency Response using   ; then press 


**Note:** No prompt will appear for frequency response if this value is set as a default during a software reset.

Type in maximum torque specification \_\_\_\_\_, then press 


Type in minimum torque specification \_\_\_\_\_, then press 



Type in threshold torque value \_\_\_\_\_, then press 

Select 'Second Parameter' using   , press 

If you have selected 'Click Dip', type in amount of 'Dip' to be sensed, press 

**Note:** 5% of torque value for 0 to 100 Nm and 10% of torque value for over 100 Nm generally provide excellent results.

Type in number of characters to reserve for subgroup comment, then press 

To return to main menu, press  

**Note:** Repeat above steps for each additional job or characteristic. If you wish to establish a route or 'ROUND', enter all of your characteristics or jobs now.

## Direct Characteristic Mode - ETA5 ONLY

Direct characteristic mode is a quick entry method of using a pre-set characteristic and can be used directly or stored for setting up torque measuring equipment. The characteristics used are taken from the edit characteristic function in ETA5.

At main menu, press **4** (Direct)

press **2** (Direct Char)

select storage option by pressing **1** (Do not store), or **2** (Store)

type in the characteristic name and press **Enter**. Use the **←** and **→** keys to scroll

through the available characteristics and press **Enter**

Alternatively, when the cursor is flashing, you may connect a Bar Code Reader to the Printer/PC connector on the back of the ETA5 and scan the information from a barcode. Scan across the label (from left or right) and watch the display. If the flashing cursor disappears, the reading has been captured; wait a few seconds for the reading to be displayed. If not, re-scan until the data

is accepted. If a further reading needs to be taken, press **Reset** to clear the data and allow a further scan to be taken or data to be keyed in.

When the information is displayed on the screen, press **Enter**

Display now shows the status of the characteristic. Press **Enter**

Display now prompts "Insert TX" (transducer)

Connect the transducer to the ETA5 and press **Enter**

Torque measurement can now be taken and will be overwritten or stored depending on the selection made previously. At the end of the subgroup of readings, the display will return to characteristic name entry line and the LEDs on the ETA5 will flash to show the subgroup status:

RED LED = One or more readings out of the specified range

GREEN LED = All readings within the specified range

Press  to accept the subgroup and prepare to accept readings for the next subgroup.

When all the subgroups are full, the display will return to characteristic name entry line

(pressing  will also do this).

**Note:** If password protection has been set on Direct measure, then exit is by password only. A correct password returns you the Store/Not store sub-menu. Entering three incorrect passwords will keep the user at the current display. See password protection later in this book.

If Store mode has been used, results can be printed or analyzed using the appropriate ETA Functions.

## To Store Data (single characteristic) - ETA5 ONLY

At main menu, press **3** (Store)  
 press **1** (Single Characteristic)  
 press **Enter**

A job name will appear on screen. If more than one job has been set up in the ETA5, you can scroll through the jobs in sequence using **←** **→**

You can also find your job by typing in the name after you press **1**, then pressing **Enter**

Alternatively, after pressing **1**, when the cursor is flashing, you may connect a Bar Code Reader to the Printer/PC connector on the back of the ETA5 and scan the information from a barcode. Scan across the label (from left or right) and watch the display. If the flashing cursor disappears, the reading has been captured; wait a few seconds for the reading to be displayed. If not, re-scan until the data is accepted.

If a further reading needs to be taken, press **Reset** to clear the data and allow a further scan to be taken or data to be keyed in.

When correct job appears on screen, press **Enter**

If you are using an Ingersoll-Rand TRD, TSD or Crane UTA type transducer and it is already plugged in, you are now ready to take readings. The screen will show transducer size and Sub 1 Sam 1

If you are using any other type of transducer or it is not yet plugged in, you will be prompted to insert transducer and select transducer type required.

Plug in correct transducer and press **Enter**


When you have taken all readings, the screen will show that all torque collection is complete.


To return to the main menu, press **MENU** **MENU**

**Note: When each reading is taken you will get an audible/visual signal.**




- 1 beep/Amber LED = Torque value or Angle/Pulse count is low (if used)
- 2 beeps/Green LED = Torque value or Angle/Pulse count is OK (if used)
- 3 beeps/Red LED = Torque value or Angle/Pulse count is high (if used)
- The final reading of a subgroup will be indicated by an extended beep.


If you make a mistake when taking a reading it can be erased by pressing .

If you continue to press  you can erase all readings within the current subgroup. It is not possible to erase readings taken in a previous subgroup.

No readings will be stored if the torque value is below the threshold value previously set.

If the characteristic has been configured with Subgroup comment size set to a value other than 0, then pressing  will allow a subgroup comment to be entered.



Alternatively, when the cursor is flashing, you may connect a Bar Code Reader to the Printer/PC connector on the back of the ETA5 and scan the information from a barcode. Scan across the label (from left or right), and watch the display. If the flashing cursor disappears, the reading has been captured; wait a few seconds for the reading to be displayed. If not, re-scan until the data

is accepted. If a further reading needs to be taken, press  to clear the data and allow a further scan to be taken or data to be keyed in.

**Note:** If the bar code data exceeds the number of characters reserved for the comment, the ETA5 will beep and show an error message. The data will not be accepted.

When the information is displayed on the screen, press .

Pressing  gives analysis of last completed subgroup. (Press  again to continue.)

Pressing  gives analysis of current subgroup, up to current reading. (Press  again to continue.)

## To set up a Round - ETA5 ONLY

To set a sequence of jobs to be performed in a set order, the method detailed below should be used.

**Note:** In order to set up a Round, there must be at least 2 Characteristics set up in the ETA5.

At main menu, press **1** (Configure)

press **4** (Round)

press **Enter**

Type in the name of your round and press **Enter**

Type in the number of characteristics (jobs) that are to be included in the round and press **Enter**

Select Vertical, Horizontal or Vert+Prompt sampling using **←** **→** and press **Enter**

**Note:** If you choose Vertical sampling, the ETA5 will automatically switch between jobs at the end of each subgroup. If you select Horizontal sampling, the switch will be made after each individual reading. Vert+Prompt will ask you to insert a transducer at the start of each subgroup.

Screen will show "Characteristic No 1 of ?"

Select which job you want to be the first job using **←** **→** and press **Enter**

Screen will show "Characteristic No 2 of ?"

Select which job you want to be the second job using **←** **→** and press **Enter**

Continue selecting jobs in this way until all jobs to be included have been selected.

Screen will now show "End of Set-up"

To return to the main menu, press **MENU** **MENU**

## To Store Data by Round - ETA5 ONLY

At main menu, press **3** (Store)

Press **2** (Round)

Screen will show *"Select Round No"*

Select round number using **←** **→** and press **Enter**

The maximum number of rounds that can be stored is 25.

If you are using an Ingersoll-Rand TRD, TSD or Crane UTA type transducer and it is already plugged in, you are now ready to take readings. The job that appears on screen will be the job that you selected to be first when you set up the round.

If you are using any other type of transducer or it is not yet plugged in, you will be prompted to insert transducer and select transducer to be used. Plug in the transducer and press **Enter**

When a complete subgroup of readings has been taken for all jobs in the round, screen will show *"Next Round Cycle →"*. To continue taking readings, press **→** (this message will be repeated at the end of each complete subgroup Sub1, Sub2, etc.)

When you have finished taking all readings, pressing **→** will result in a message that the round is complete. Press **MENU**.

To return to the main menu, press **MENU** **MENU**

**Note:** You can erase the last reading taken by pressing **Reset**.

If you have selected Horizontal sampling and the ETA5 has already switched to the next job, it will switch back when you

press **Reset**.

It is not possible to erase any readings other than the last one taken in Horizontal sampling mode.

If the characteristic has been configured with Subgroup comment size set to a value other than 0:

Pressing **[Z]** will allow a subgroup comment to be entered.

Pressing **[#]** gives analysis of last completed subgroup. (Press **[#]** again to continue.)

Pressing **[.]** gives analysis up to current subgroup. (Press **[.]** again to continue.)

## To set up a Master Round - ETA5 ONLY

To set a sequence of Rounds to be performed in a set order, the method detailed below should be used.

**Note:** In order to set up Master Round, there must be at least 2 rounds set up in ETA5.

At main menu, press **[1]** (Configure)  
 press **[5]** (Edit Master Round)  
 press **[Enter]**

Type in the number of "rounds" to be included and press **[Enter]**

Select first "round" to be included using **[←]** **[→]** and press **[Enter]**

Continue selecting rounds to be included using **[←]** **[→]** and press **[Enter]**

**Note:** When all rounds have been selected, screen will show **"End of Set-up"**

To return to the main menu, press **[MENU]** **[MENU]**

## To Store Data by Master Round

At main menu, press **3** (Store)

Press **3** (Master Round)

If you are using an Ingersoll-Rand TRD, TSD or Crane UTA type transducer and it is already plugged in, you are now ready to take readings. The job that appears on screen will be the job that you selected to be first when you set up the master round.

If you are using any other type of transducer or it is not yet plugged in, you will be prompted to insert transducer and select transducer to be used. Plug in transducer and press **Enter**.

To return to the main menu, press **MENU** **MENU**

**Note:** You can erase the last reading taken by pressing **Reset**. If you have selected Horizontal sampling and the ETA5 has already switched to the next job, it will switch back when you press **Reset**.

**It is not possible to erase any readings other than the last one taken in Horizontal sampling mode.**

If the characteristic has been configured with Subgroup comment size set to a value other than 0:

Pressing **Z** will allow a subgroup comment to be entered.

Pressing **#** gives analysis of last completed subgroup. (Press **#** again to continue.)

Pressing **.** gives analysis up to current subgroup. (Press **.** again to continue.)

## To Display Recorded Data on ETA2

From main menu, press **9** (Display/Analyze)

Screen will show job name and Specs; press **→**

Screen will now show x-bar, R, and sigma for total readings

From any Subgroup display, press **↓**

Screen will show the Date and Time the readings for that subgroup were taken.

Press **↓**, screen will show subgroup comment.

Press **↓** again to see the individual readings displayed in groups of four readings per screen.

## To Display Recorded Data on ETA5

From main menu, press **9** (Display/Analyze)

Press **Enter** to display the last recorded Characteristic

Select the job that you want to see using **←** **→** and press **Enter**

Screen will show job name and Specs; press **→**

Screen will now show x-bar, R, and sigma for Sub1; press **→**


Screen will now show same information for Sub2

You can use **←** **→** to go back and forth between subgroups as required

From any Subgroup display, press **↓**

Screen will show the Date and Time the readings for that subgroup were taken.


Press **↓**, screen will show subgroup comment.


Press  again to see the individual readings displayed in groups of four readings per screen.

**Note:** By using the four arrow keys it is possible to move back and forth through all of the subgroups and individual readings.


To view another job, press  and repeat above procedure.


## To View Cp and Cpk

At the job name/spec screen press , screen will show the Cp and Cpk and the number of samples used in the calculations.

Press , screen will now show x-bar, R and sigma based on all of the data (all subgroups calculated together).

The number of samples that were NOK will also be displayed expressed as a percentage.

Press , screen will show the highest and lowest torque recorded and the number of readings that were above the maximum torque value and minimum torque value.

To return to the main menu, press .

**For more information on Cp, Cpk and CAM, refer to the glossary.**



## French Cp and Cpk

It is possible to view the French Cpk/CAM calculations as an alternative to the standard Cp and Cpk.


Readings must be a minimum of 30 samples.




### To set this function:

From main menu



Press  then press  (Misc')


Press  then press  (Software reset)

Press  5 times to access the Cpk Calculation screen

Use the  and  arrow keys to access option 2 'French Cpk/CAM' and press 

Press  to confirm, screen will prompt "End of setup"

Press  to accept and exit, or  to edit


Press  to return to main menu

Returning to Normal Cpk calculations is done as above, selecting option 1 'Normal Cpk/no CAM'

**For more information on Cp, Cpk and CAM, please refer to the glossary.**

## To Erase Stored Data

### To Erase Readings Stored in Measure Mode:

From the main menu, press 

ETA will erase all readings taken in measure mode.



## To Erase Stored Data and Setups on ETA5

### To Erase Characteristic Setup:

At main menu, press **1** (Configure)

press **3** (Erase)

press **1** (Char' Set-up)

Select Characteristic name by pressing **Enter** and select Characteristic required

by pressing **←** **→**

Press **Enter**, screen will display the Characteristic number and prompt *"Erase Set-up Data"*

Press **Enter** to erase the characteristic data or **Reset** to return to Erase menu

If **Enter** was pressed, display shows *"Erased OK"*

Press **↑** to erase more data or press **MENU** **MENU** **MENU** to return to main menu

### To Erase Characteristic Data:

At main menu, press **1** (Configure)

press **3** (Erase)

press **2** (Char' Data)

Select Characteristic name by pressing **Enter** and select Characteristic required by

pressing **←** **→**

Press **Enter**, screen will display the Characteristic number and prompt *"Erase data only"*

Press **Enter** to erase the characteristic data or **Reset** to return to Erase menu

If **Enter** was pressed, display shows *"Erased OK"*

Press **↑** to erase more data or press **MENU** **MENU** **MENU** to return to main menu

**To Erase Round Data:**

At main menu, press **1** (Configure)  
press **3** (Erase)  
press **3** (Round Data)

Select required round by pressing **←** **→**, press **Enter**

To erase data by round, press **Enter**

To exit without erasing round data, press **MENU**

To return to main menu, press **MENU** **MENU** **MENU**

**To Erase Round Setup Information:**

At main menu, press **1** (Configure)  
Then press **4** (Edit Round)

Select required round by pressing **←** **→**, press **Enter**

Display shows "Round Label", press **Reset**

Round label is cleared from display. Press **Enter**

Display will prompt "Erase Rnd Set-up"

To erase round setup, press **Enter**; display will then show "ROUND ERASED"

Or, press **Reset** to return to *Configure Menu*

To return to main menu, press **MENU**

## Printing



### To print readings taken in measure mode:





Connect ETA to printer or computer and switch the device ON

#### On ETA:

Press  *On*


Press  MENU

Press  then press  (Print)

Press    then press  (Print Measure)

ETA will print details of stored readings taken in measure mode (with date/time stamp)

A sample printout can be found on page 45.

To return to main menu, press  MENU

## To print details of Setup or Analysis of Data from ETA5

### To print settings and readings taken by characteristic:



Connect ETA5 to printer or computer and switch the device ON

Ensure ETA5 is configured to printer by referring to "Configure Printer Port" section

#### On ETA5:


Press  *On*

Press  MENU

Press , then press  (Print)

Press  (Print Char')

Select Characteristic name by pressing  and select Characteristic required by pressing  

To start printing, press 

ETA5 will print details of setup and stored reading by characteristic name.

**To print settings and data analysis of readings taken by characteristic:**

Connect ETA5 to printer or computer and switch the device ON

**On ETA5:**

Press



Press



Press




, then press  (Print)

Press



(Print/Analyze Char')

Select Characteristic name by pressing  and select Characteristic required by pressing  

To start printing, press 

ETA5 will print details of setup and analysis of stored reading by characteristic name.

**To print details of readings by round:**

Connect ETA5 to printer or computer and switch the device ON



**On ETA5:**



Press






Press



Press , then press  (Print)

Press , then press  (Print Round)

Select round by using  


To start printing, press 


ETA5 will print details of setup and stored reading by round name.



**To print details of setup and analysis of readings by round:**



Connect ETA5 to printer or computer and switch the device ON



**On ETA5:**


Press 

Press 

Press , then press  (Print)

Press , then press  (Print/Analyze Round)

Select round by using  

To start printing, press 

ETA5 will print details of setup and analysis of stored reading by round name.



**To print details of all characteristic setups:**



Connect ETA5 to printer or computer and switch the device ON

**On ETA5:**

Press 

Press 

Press , then press  (Print)

Press , then press  (Print All Char's Setup)

ETA5 will print details of all characteristic setups which are stored.

**To print details of a particular round setup:**

Connect ETA5 to printer or computer and switch the device ON



**On ETA5:**



Press






Press



Press , then press  (Print)

Press , then press  (Print Round Setup)

Select round by using  

To start printing, press 

ETA5 will print details of all round setups which are stored.

**To print readings taken by characteristic:**

Connect ETA5 to printer or computer and switch the device ON



**On ETA5:**

Press





Press




Press , then press  (Print)

Press   , then press  (Print Char' Readings)

Select Characteristic name by pressing  and select Characteristic required by

pressing  

To start printing, press 

ETA5 will print details of readings taken by characteristic.



**To print readings taken in measure mode:**





Connect ETA5 to printer or computer and switch the device ON

**On ETA5:**

Press 


Press 

Press , then press  (Print)

Press   , then press  (Print Measure)

ETA5 will print details of stored readings taken in measure mode (with date/time stamp)


A sample printout can be found on page 45.

To return to main menu, press 



**To print setup and readings for all used characteristics containing readings:**






Connect ETA5 to printer or computer and switch the device ON

**On ETA5:**

Press 


Press 

Press , then press  (Print)

Press    , then press  (Print All Used Chars')

ETA5 will print details of stored characteristic setups containing readings.

A sample printout can be found on page 46.

To return to main menu, press 



## Printing Data to PC


Most data that can be sent to a printer may also be sent to a PC. Follow the same instructions for printing. Connect the cable to the PC using Com 1. Use Hyper Terminal (found under Accessories) or other communication programs.



**Note:** Be sure communication protocols are set the same on the PC and ETA.


## To Set Date and Time



**From main menu:**

Press  then press  (Misc)

Press  (Set Date/Time)

Select date format using  



Enter date and time and press 


To return to main menu, press  








## To Set Power Off and Backlight Time Delays



**From main menu:**

Press  then press  (Misc)

Press  (Select Power Off/Backlight Time Delays)



Select Power Off time delay using   Press 



Select Backlight Delay using   Press 

To return to main menu press  

## To Configure Printer Port

**From main menu:**

Press  then press  (Misc)



Press  then press  (Printer port)

Select Baud Rate using   then press 

Select number of data bits using   then press 



Select number of Stop Bits using   then press 



Select Parity using   then press 



To return to main menu press  

## To Display Software Version Number

**From main menu:**



Press  then press  (Misc)



Press  then press  (Version #)

To return to main menu, press  


## To Set Password Protection

**From main menu:**



Press  then press  (Misc)



Press  then press  (Password)

Screen will prompt *"Enter new Password"*

Type in the password (4 characters) and press 



Screen will prompt *"confirm password"*


Press  to accept or  to reject

Select desired option using  

Options for protection are:

- 1- Power up
- 2- Configure
- 3- Direct Measure
- 4- Direct Characteristic
- 5- Software Reset
- 6- Date and Time



Press  to protect your selected option or  to exit

**Note:** When an option is password protected, '

Pressing  will remove the protection.

Press  to exit



Display now reads *"End of setup"*



To return to main menu press  or press  to edit password protection


The remaining options can be password protected in the same manner.

## To Clear Password Protection

### From main menu:

Press  then press  (Misc)



Press  then press  (Password)

Screen will prompt *"Password"* - - - enter the existing password (4 characters) and press 


Screen will prompt *"Confirm Password"* and display the existing password

Press  to confirm or press  to clear the password protection

Screen will prompt *"Enter new Password"*

Press  to clear the password (keying in 4 characters before pressing  will result in a new password being created)

Screen will say *"Confirm password"*

Press  to confirm and password is cleared



### Notes on Password Protection:


Be aware of the implications of password protection. Always keep a note of the chosen password somewhere safe. As there is no function to enable an existing password to be removed without it first being entered, it may be advisable for the person who is ultimately responsible for the ETA to initially set a password and issue it only to personnel who need the information. This will prevent an unknown password being entered, accidentally or deliberately, without anyone else's knowledge. If an unknown password is encountered, please contact Ingersoll-Rand for advice.


## To Perform Software Reset

**CAUTION:** Use of this function will result in the loss of all stored data. Following this procedure will return the ETA to its factory default state. This feature should only be used when it is desired to clear all settings from the ETA.


**From main menu:**


Press  then press  (Misc)

Press  then press  (S/W Reset)

Press the  key 8 times to access the Software Reset screen




Screen will display *"Erase all data and set mode?"*



To carry out S/W reset, press 

To exit without performing S/W reset, press 


Screen will display *"ERASING ALL CHARACTERISTICS ROUNDS AND MASTER ROUNDS"*




- wait a moment for display to change



Select Subgroup mode using   and press  screen will display *"End of setup"*

To return to main menu, press  













There are a number of other parameters which are set from the Software Reset Menu, some of which are detailed elsewhere in this manual.

Pressing  after making a selection will take the user on to the next screen.

Pressing  will give the user the option to exit to the Misc menu by pressing  or continuing to edit by pressing .

Screens can be skipped using the  and  keys.

**Settings in the order they appear when the *Software Reset* Menu is accessed.**

<b>Cm max samples</b>	- type in the required figure
<b>Cm min samples</b>	- type in the required figure
<b>Language</b>	- select using  
<b>Autoprint mode</b>	- select using  
<b>Capability label</b>	- select using  
<b>Cpk Calculation</b>	- select using  
<b>Circle-store (On/Off)</b>	- select using  
<b>Shift key mode</b>	- select using  

## To Communicate with a PC using PC Comms Software

Connect ETA5 to PC via cable provided

On PC, start PC Comms

**On ETA5:**

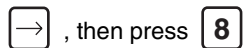
Press



Press



Press



You can now setup and view all information/data via the PC

**Note:** This optional PC software is used primarily to write and store characteristics and rounds on the PC. The format of the data stored on the PC is of little use to the computer operator without further processing.

### Example Printout of Readings taken in Measure Mode

MEASURE-Peak		Capability Results Torque	
-----		-----	
No of Samples	200	Based on last	15. samples
Transducer	C I/S 75.00 Nm	/x	6.96 Nm
Serial Number:	99999	Range	8.30 Nm
Measurement Dir	Right	Sigma	2.210
Max Torque Value	20.00 Nm	Cp	0.754
Min Torque Value	10.00 Nm	Cpk	- 0.458
Thrshld Torq Val	2.00 Nm	Max found	12.65 Nm
Freq response	1676 Hz	Min found	4.35 Nm
Cycle end time	0.1 Sec	Readings above max	0.
		Readings below min	13.
		Percentage not OK	86.66 %

	Date	Time	Torque
1	07/01/95	12:38:32	7.21 LO
2	07/01/95	12:38:35	4.87 LO
3	07/01/95	12:38:38	6.65 LO
4	07/01/95	12:38:40	6.56 LO
5	07/01/95	12:38:42	7.45 LO
6	07/01/95	12:38:45	5.76 LO
7	07/01/95	12:38:47	7.07 LO
8	07/01/95	12:38:49	12.65
9	07/01/95	12:38:52	9.37 LO
10	07/01/95	12:38:54	5.29 LO
11	07/01/95	12:38:56	6.09 LO
12	07/01/95	12:38:59	4.35 LO
13	07/01/95	12:39:01	5.90 LO
14	07/01/95	12:39:04	5.25 LO
15	07/01/95	12:39:06	10.03

### Printout of Setup and Readings taken by Characteristic

Ingersoll-Rand ETA5

08/01/01 11:59:44

Characteristic

WHEELNUT

Capability Results Torque

No of Samples	4	Based on last	8. samples
No of Sub-groups	2		
Transducer	A TRD 75.00 Nm	/x	13.93 Nm
Serial Number:	99999	Range	17.21 Nm
Measurement Dir	Right	Sigma	5.936
Max Torque Value	14.00 Nm	Cp	0.224
Min Torque Value	6.00 Nm	Cpk	0.003
Thrshld Torq Val	2.00 Nm	Max found	22.17 Nm
Freq response	1676 Hz	Min found	4.96 Nm
Cycle end time	0.1 Sec	Readings above max	4.
		Readings below min	1.
		Percentage not OK	62.50 %

Sg-sp	Date	Time	Torque
1 1	08/01/01	11:31:16	4.96 LO
1 2			12.28
1 3			9.79
1 4			8.81
		/x	8.96
		Range	7.32
		Sigma	3.040
2 1	08/01/01	11:31:46	15.70 HI
2 2			18.93 HI
2 3			21.17 HI
2 4			18.84 HI
		/x	18.91
		Range	6.47
		Sigma	2.641

### Printout of Analysis by Characteristic

Ingersoll-Rand ETA5

08/01/01 11:45:36

Characteristic

WHEELNUT

Capability Results Torque

No of Samples	4	Based on last	8. samples
No of Sub-groups	2		
Transducer	A TRD 75.00 Nm	/x	13.93 Nm
Serial Number:	99999	Range	17.21 Nm
Measurement Dir	Right	Sigma	5.936
Max Torque Value	14.00 Nm	Cp	0.224
Min Torque Value	6.00 Nm	Cpk	0.003
Thrshld Torq Val	2.00 Nm	Max found	22.17 Nm
Freq response	1676 Hz	Min found	4.96 Nm
Cycle end time	0.1 Sec	Readings above max	4.
		Readings below min	1.
		Percentage not OK	62.50 %

Sg-sp	Date	Time		Torque
1	08/01/01	11:31:16	/x	8.96
			Range	7.32
			Sigma	3.040
2	08/01/01	11:31:46	/x	18.91
			Range	6.47
			Sigma	2.641



**Printout of details of all Characteristic setups**

Ingersoll-Rand ETA5

08/02/01 14:36:22

Name	smpl	sgrp	transducer	direc	max	min	thr	units
WHEELNUTS	16	3	A TRD 11.29 Nm	Right	8.	6.	2.	Nm
EX MANIFOLD	6	3	A TRD 11.29 Nm	Right	10.	6.	3.	Nm
DOORLOCK	3	3	A TRD 11.29 Nm	Right	9.	7.	3.	Nm

### Printout of Round setup

Ingersoll-Rand ETA5

08/02/01 14:51:26

-----

#### Round 1

Round Label	CAVALIER	Complete Setup
-------------	----------	----------------

Sampling	Vertical
----------	----------

No of charact s	3
-----------------	---

Characteristic 1	DOORLOCK	Complete Setup
------------------	----------	----------------

Characteristic 2	WHEELNUTS	All Data Stored
------------------	-----------	-----------------

Characteristic 3	EX MANIFOLD	Complete Setup
------------------	-------------	----------------

**Printout of Readings taken by Characteristic**

5.90	10.0
6.28	9.0
7.39	10.0
2.90	5.0
2.87	4.0
3.46	5.0
3.62	5.0
3.19	6.0
3.23	3.0
3.07	5.0
3.78	4.0
4.03	5.0
4.01	6.0
2.93	4.0
3.07	3.0
2.70	3.0
4.51	4.0
3.63	4.0
4.99	4.0
4.06	2.0
4.25	4.0
7.53	4.0
6.10	4.0
2.90	3.0
4.71	3.0
5.64	4.0
5.62	3.0
7.78	3.0
5.19	2.0
5.72	4.0
9.74	5.0
5.16	5.0
8.22	1.0
6.27	4.0
5.42	3.0
5.38	3.0
6.22	3.0
5.84	3.0
7.70	3.0
7.01	3.0
4.98	3.0
5.71	3.0
5.52	3.0
7.40	3.0
5.98	3.0
5.11	3.0
8.33	3.0
5.93	4.0

## Rotary and Stationary Joint Kits

### Introduction

The joint kits are designed as a convenient, repeatable, variable stiffness joint for assessing the performance of torque tools. They can be used with the Ingersoll-Rand stationary (static) or rotary transducers.

Each kit may be assembled in different ways to vary the stiffness of the joint. Reference Table 1, to select from the available options. Care should be taken to ensure that the maximum torque for the joint is not exceeded. Please note that the joint kit is not designed to provide an exact joint stiffness and that the rates shown in Table 1 are given as rough guide only.

### Joint Assessment

The first task is to choose the stiffness of the joint that the tool will be used to assemble. This is best done with a torque wrench on an actual production part. If available an angle measurement protractor may be used, but this is not essential. Tighten the fastener until it is snug, note the torque  $T_s$  in Nm (or lbft). Tighten to the required target torque  $T_f$  Nm (or lbft), and note the angle of rotation  $E$  in degrees. The required joint stiffness may now be calculated. The resulting units are degrees per Nm (or degrees per lbft).

$$E / (T_f - T_s) \quad \begin{array}{l} T_s = \text{Snug Torque} \\ T_f = \text{Target Torque} \\ E = \text{Angle} \end{array}$$

It should be noted that for packaging convenience Joint Kits will be delivered assembled with full stacks of belleville washers. The spacers will be bagged separately. The Joint Kits DO NOT represent a usable joint without adjustment to the required stiffness. A Pictorial guide to the description of components is shown in Figure 2. Table 2 shows the parts available for each model.

### Joint Assembly

Having selected the required joint stiffness from Table 1, count out the number of Belleville washers required for the first and second stacks. Grease each washer and assemble the first stack around the bolt, such that the internal diameter rests against the shoulder of the bolt. Invert the second stack such that the outside diameters of the last and first washers in the two stacks touch. If only one stack is to be fitted, it should be mounted such that the external diameter rests against the bolt shoulder. Select and fit the spacer required to complete the joint. After greasing the bearing surface, slide the assembly into the external sleeve, fit the end collar and secure by applying the retaining clip.

The base plate or transducer, depending on model, should be mounted onto a rigid surface. See Figure 1 for bolt hole pattern. Place the bolt assembly just completed into the shroud and then onto the transducer or base plate. The last step is to apply the steel washer onto the bolt before applying the nut.

**IMPORTANT**

- Grease the threads and fit the nut.
- Ensure that the threads are kept clean and lubricated.

The joint is now ready for use. Eventually the bolt and nut threads will wear and will need to be replaced. IR recommends replacing worn joints with the appropriate bolt kit that matches your joint kit model: JKS30-BKIT, JKS150-BKIT, JKS300-BKIT or JKS1000-BKIT.

## Nominal Joint Stiffnesses

Joint Kit	Rate		Max Torque		1st Stack	2nd Stack	Spacer(s) mm
	Deg/Nm	Deg/lbin	Nm	lbin			
1/4"	50	6	5.65	50	3	3	17.1
	30	3.4	13.5	120	6	6	11.5
	20	2.2	21.5	190	12	12	-
	8	0.9	28.25	250	24	-	-
	3.5	0.4	28.25	250	-	-	11.5+12.3
		Deg/lbft		lbft			
3/8"	6	8	67.8	50	5	5	15.5
	4	5.5	120	90	9	9	-
	2	2.5	100	73.75	16	-	5
	1	1.3	100	73.75	-	-	5+18.6+15.5
1/2"	3	4	135.6	100	5	5	19.5
	2	2.7	220	160	9	9	-
	1.1	1.5	271	200	9	-	23.3
	0.4	0.55	271	200	-	-	3.9+23.3+19.5
3/4"	0.88	1.2	460	340	5	3	39.5
	0.55	0.7	830	610	10	5	-
	0.35	0.5	775	570	10	-	41.3
	0.11	0.15	1017	750	-	-	39.2+41.3

Table 1

### WARNING

Failure to mount the base plate or transducer, depending on model, could result in injury.

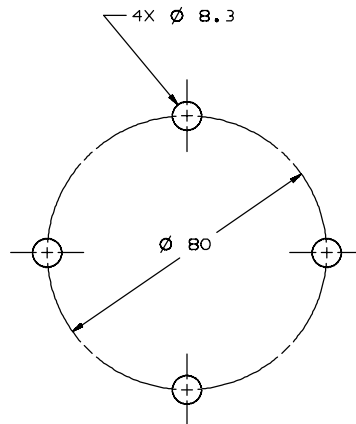


Figure 1.  
Bolt Hole Pattern, in mm.

(Dwg. TPA1919)

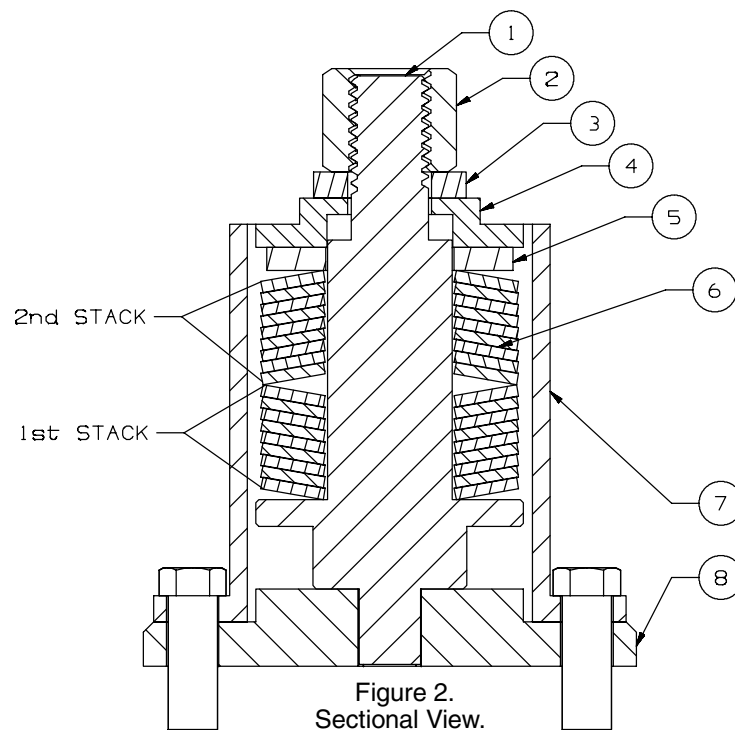


Figure 2.  
Sectional View.

(Dwg. TPA1923)

## Parts List

Callout Number	Description	Joint Kit JKR20 & JKS30 Part #	Joint Kit JKR75 & JKS150 Part #
1	M8X55 Square Bolt	JKS30-800	JKS150-120
2	M8 Nut	JKS30-80	JKS150-102
3	Washers	JKS30-81	JKS150-121
4	Thrust Plate	JKS30-11	JKS150-11
5	Spacer (Set of 3)	JKS30-10-3	JKS150-10-3
6	Belleville Washer (Set of 18 or 20)	JKS30-904-18	JKS150-906-18
7	Shroud	JKS30-727, JKR20-727*	JKS150-727, JKR75-727*
8*	Base Plate	JKR20-13	JKR75-13
<b>Not Pictured</b>	Bolt Kit - Includes 1 Bolt, 2 Nuts, Belleville Washers Set	JKS30-BKIT	JKS150-BKIT

Callout Number	Description	Joint Kit JKR180 & JKS300 Part #	Joint Kit JKR500 & JKS1000 Part #
1	M8X55 Square Bolt	JKS300-160	JKS1000-240
2	M8 Nut	JKS300-106	JKS1000-204
3	Washers	JKS300-161	JKS1000-241
4	Thrust Plate	JKS300-11	JKS1000-11
5	Spacer (Set of 3)	JKS300-10-3	JKS1000-10-3
6	Belleville Washer (Set of 18 or 20)	JKS300-908-18	JKS1000-912-20
7	Shroud	JKS300-727, JKR180-727*	JKS1000-727, JKR500-727*
8*	Base Plate	JKR180-13	JKR500-13
<b>Not Pictured</b>	Bolt Kit - Includes 1 Bolt, 2 Nuts, Belleville Washers Set	JKS300-BKIT	JKS1000-BKIT

Table 2

**Note:** Items denoted with (\*) are only used with JKR20, JKR75, JKR180 and JKR500.

## Glossary of Terms

**Characteristic** Specification of one particular torque value to be collected. Each characteristic has a name of up to 14 characters. ETA5 can store up to 48 different characteristics at any one time.

**Cp** This is a capability index which shows the process capability potential but takes no account of how centred the process is. This is used for capability studies and Cp may range in value from 0 to infinity. A large value indicates greater potential capability and a value of 1.33 or greater is desirable.

$$Cp = \frac{\text{Max} - \text{Min}}{6 \sigma}$$

(Max and Min are limit values)

**CpK** This is an index which indicates whether the process will produce units within the tolerance limits. If the process is centred on the nominal value then CpK will have a value equal to Cp. For values of CpK between 0 and 1 then some of the 6 sigma spread will fall outside tolerance limits but for values greater than 1 these will all be within tolerance. A negative value of CpK indicates that the process mean is outside tolerance limits. A value of 1.33 or greater is desirable.

$$CpK = \text{lesser of } \frac{(\text{Max} - \bar{x})}{3 \sigma} \quad \text{or} \quad \frac{(\bar{x} - \text{Min})}{3 \sigma}$$

(Max and Min are limit values)

**CAM** This is an alternative capability index requiring a minimum of 30 readings to be taken. In this implementation, 5 sub-groups of 6 samples are used for each calculation. The CAM calculation uses the following formula:

$$\frac{\text{Max} - \text{Min} \times \text{Cam Factor}^*}{6 \times \text{Average Sample Value}}$$

\* CAM Factor is taken from a table  
(in the case of 5 x 6 samples = 1.910)



**High Output Transducer (H/O)**

Torque transducer with no coding links but internal pre-amplifier giving an output signal level of typically 1 or 2 volts.

**Horizontal Sampling**

Collection of data by round, taking one reading for each characteristic in turn.

**Industry Standard Transducer (I/S)**

Type of transducer, with no pre-amplifier or coding links, but with the exact rated torque, marked on the body.

**Master Round**

A sequence of up to five rounds. It is used to allow a collection sequence, which is part vertical, part horizontal.

**Max Torque Value**

Upper tolerance level of any reading. This can equal but not exceed the torque rating of the transducer to be used.

**Min Torque Value**

Lower tolerance level of any reading.

**No. of Sub Groups**

Number used to allocate memory space in ETA, for a particular characteristic. May be set in the range of 1 to 99.

**Round**

A sequence of characteristics to be collected either horizontally or vertically. Each round has a name of up to 14 characters.

**Sample**

Individual torque reading.

**Standard Deviation  $\sigma$** 

Is a measure of the variation of the samples of a statistical group. If a group of 'n' values has a mean of ' $\bar{x}$ ' then its standard deviation is given by:

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

**Sub-Group** Grouping of samples to enable analysis, with an allowable range of 1-50.

**Threshold Torque Value**

Level of torque in which a signal must rise above and then fall below to be considered a valid torque cycle. This may be set in the range of 1 to 50% of rated span or the Min Torque Value, whichever is the lower.

**Units of Measure**

It is possible with ETA to read a transducer calibrated in for instance, Nm, and convert internally to display and store in any of the other torque units.

**Vertical Prompt** Collection of data by round, where a full sub-group is collected for a characteristic, before stepping to the next characteristic.

**Vertical Plus Prompt**

Identical in procedure to that of Vertical mode except that before stepping to the next characteristic, ETA5 will prompt for the fitting of a transducer (even though the correct one is installed) and will require the ENTR key to be pressed. Stepping to the next characteristic, ETA5 will prompt for the fitting of a transducer (even though the correct one is installed) and will require the ENTR key to be pressed.

## Error Messages

Code	Message	Explanation
101	RANGE	The selection made is not within the allowable range. See the limits specified max to min.
104	EXISTS	The characteristic name entered already exists.
105	NO SPACE	Insufficient memory space is available to create a new characteristic.
106	NONE	No characteristics have been created.
107	ON PC	Characteristic or round was sent from PC. These may not be edited or erased on ETA.
108	CONV' OUT OF RANGE	The units selected would generate too great or too small a number.
109	NO NAME	A characteristic name must be entered.
110	NO SETUP	The characteristic exists but configuration is not complete.
111	NO DATA	The characteristic exists, but no data is stored.
113	DAT STR	More than one sub group of data is now stored.
114	ALL STR	All of the sub groups for this characteristic have now been collected. Erase these after printing to allow further collection.
120	NO Tx	Transducer has been selected but none is connected.
121	TxID - FLT	Transducer ID level not recognized. Use another transducer or get transducer recalibrated.
122	AZ OFFSET	An auto-zero calibration on the transducer has detected an excessive offset from zero.

Code	Message	Explanation
123	AZ DISCR	An auto-zero calibration on the transducer has detected an excessive discrepancy between the Tracking and Peak inputs.
124	Tx FAULT	Adc saturation due to transducer fault, no transducer fitted or over torque.
200	INCOR-TX	The correct transducer is not connected.
300	IN ROUND	This characteristic has already been included in the round.
301	CHARACTS	A minimum of two characteristics must be defined before entering Edit Round.
306	RS232	Invalid RS232 data on the serial input.
400	INVALID	Incorrect time or date format.
600	ONLY 1	Only one round programmed so not possible to generate master round.
601	NO RND	No rounds programmed so not possible to generate master round.
602	IN M RND	This round has already been entered into the master round. It is not possible to enter a round twice.
701	RND COMP	The round is complete, no skipping is allowed.
702	ALL SKIP	All other characteristics have already been skipped.
800	MEMORY	Message on power up if memory error found. (See note below)
801	MENU ERR	Invalid menu entered due to fault.
802	PROM CKS	The EPROM has an error.

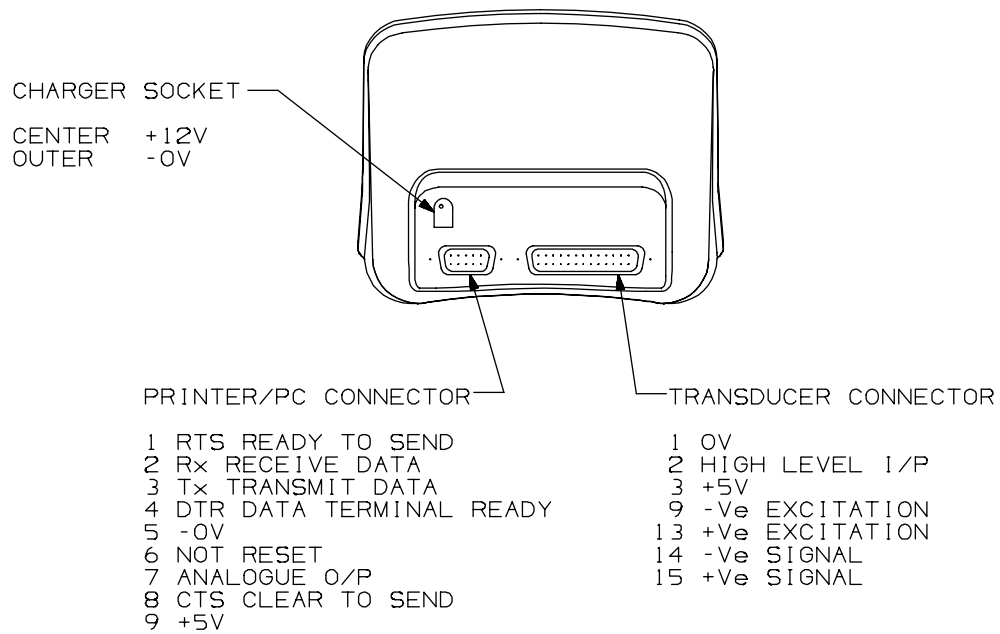
Code	Message	Explanation
803	OP CODE ERR	The processor has attempted to execute an illegal instruction.
804	STACK ERR	The processor stack has overflowed.
901	TX SPEC	Illegal transducer specification number received from PC.
902	TX TYPE	Illegal transducer type received from PC.
904	TX UNITS	Illegal transducer units data received from PC.
905	SERIAL	Illegal serial transducer data received from PC.
906	UNITS	Illegal units of measure data received from PC.
907	DIRECT	Illegal direction data received from PC.
908	NAME	Name sent from PC is too long.
909	RANGE	Numeric Parameter sent from PC is out of range.
920	RS232	Error receiving RS232 data from PC.
921	TIMEOUT	Timed out receiving message from PC.
922	CRC	Message received from PC has incorrect CRC value.
923	ILL MSG	Illegal message received from PC.

---

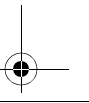
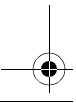
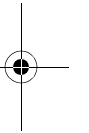
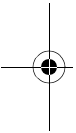
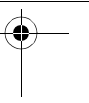
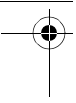
**NOTE:** If ETA can be switched on, but fails to respond to the keyboard, the electronic circuitry may be reset by linking pins 5 and 6 in the PC connector, with a length of wire. This will turn the unit off. Turn the unit on again by pressing 'ON'. If after this reset ETA still fails to operate correctly, use '6' for Miscellaneous and '6' Software Reset to clear memory. Having carried out a hardware reset as described above the message '800 MEMORY' may be displayed on the next power up, and a software reset should be carried out.

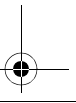
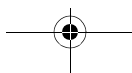
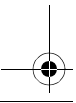
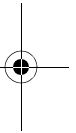
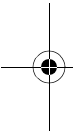
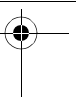
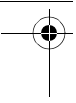
---

## External Connections

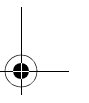
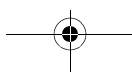
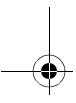
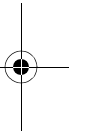
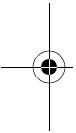
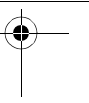
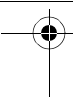


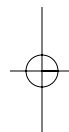
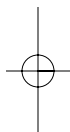
(Dwg. TPA1822)











**0102**

Printed in USA

