FLUKE®

The Most Trusted Tools in the World.

Laser Alignment and the Fluke 830

Technical Presentation – Technical Training

Agenda

Benefits – why is it needed

- Proactive Maintenance
- Benefits of Precision Shaft Alignment

Alignment Principles and Laser Technology

- What is shaft alignment / Why is it needed / Why laser alignment

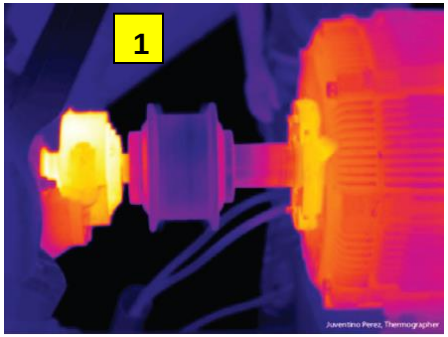
Fluke 830 Overview - technology

- Fluke 830 Hardware overview
- Key Features and Benefits
- Quick, Easy, Step by step, Precision alignment (QRG)
  - Overview, Mount Brackets, Setup, Measure, Diagnose, Correction
- Other: Soft Foot, Save, Report, Extend, Switch, Clock, Vertical, Settings
- Appendix – Sensor Cable, Updates
- Technical Specs
- Support - Frequently Asked Questions
- Optional items
- Service / Calibration

Fluke tools help you keep your plant running

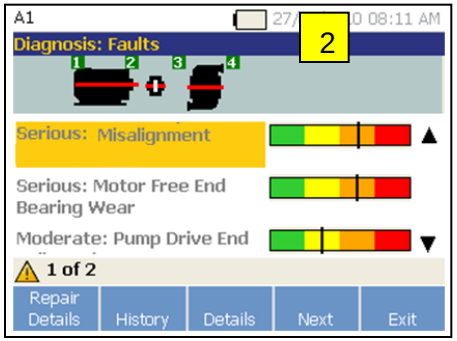
1) Fluke Thermal Imager and Vibration Meter finds machine problems
2) Fluke Vibration Tester diagnoses fault, severity and repair recommendation
3) Fluke Connect shares data between users - allows planner to generate work order
4) Fluke Alignment Tool corrects the problem
5) Fluke Vibration Tester checks the machine is fixed

Fluke Thermal Imager



Problem found

Fluke Vibration Tester

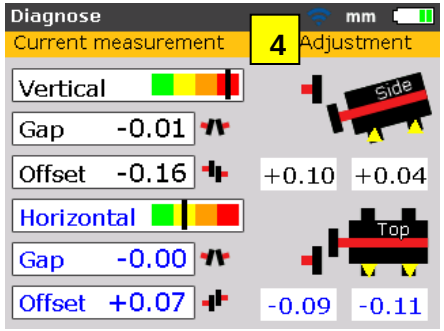


Problem identified & repair recommended

Fluke Connect

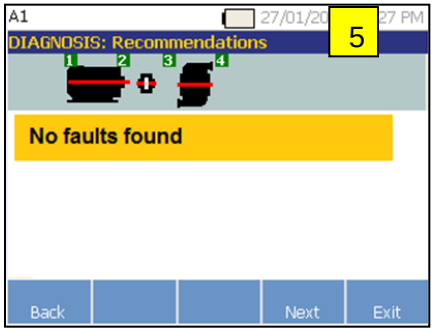
Work order generated

Fluke Alignment Tool



Problem corrected

Fluke Vibration Tester

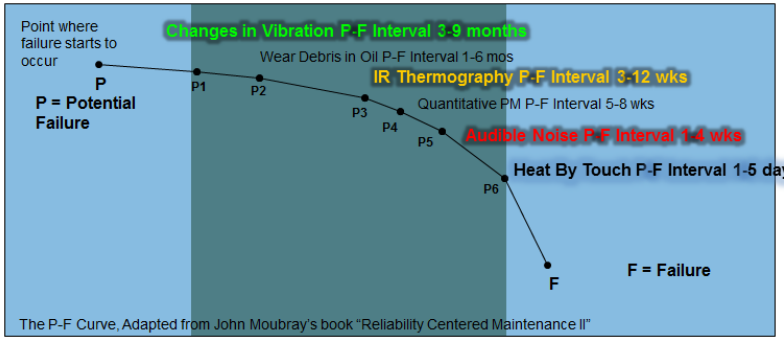


Machine checked - good

Machine returned to service – no production loss

Benefits of Proactive Maintenance

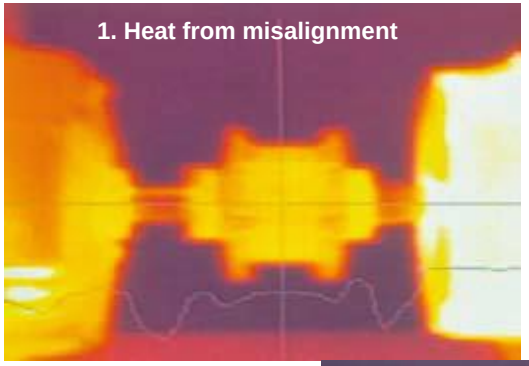
- **Predictability:** give maintenance staff time to schedule required repairs and acquire parts.
- **Safety:** take faulty equipment offline before a hazardous condition occurs.
- **Revenue:** fewer unexpected and serious failures, helping to prevent production stoppages that cut into the bottom line.
- **Increased maintenance intervals:** life of equipment can be extended and maintenance can be scheduled by need.
- **Reliability:** fewer unexpected or catastrophic failures - problem areas can be anticipated before failure
- **Peace of mind:** builds confidence in maintenance schedules, budgeting, and productivity estimates.

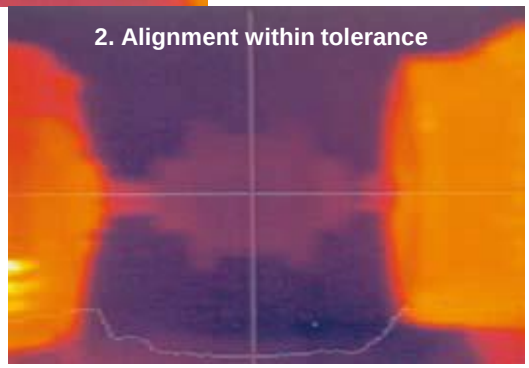


Asset Uptime begins with shaft alignment

Why precision alignment?

- Reduce your energy consumption
- Fewer failures of seals, couplings and bearings
- Lower temperatures of bearings and coupling
- Lower vibration levels – that result in fewer mechanical faults
- No shaft cracking or failures
- No lose foundation bolts





1. The flexible coupling heats up and the machine develops higher temperatures, especially at the bearings.
2. The high reaction forces are drastically reduced after precision alignment and so are the faults that lead to asset failure and production losses.

Applications/Users/Industries

Typical Applications:

•Precision alignment of rotating machinery

Value Proposition:

•Energy savings
•Prevent Unplanned Downtime
•Reduce Component Replacement Costs
•Reduce Repair Time
•Easier to Use

Industries:

•Chemical/Petrochemical
•Oil and Gas
•Power
•Automotive
•Pulp, Paper and Printing
•Food processing
•Marine
•Steel
•Mining
•Machinery manufacturing
•Cement
•Service organizations

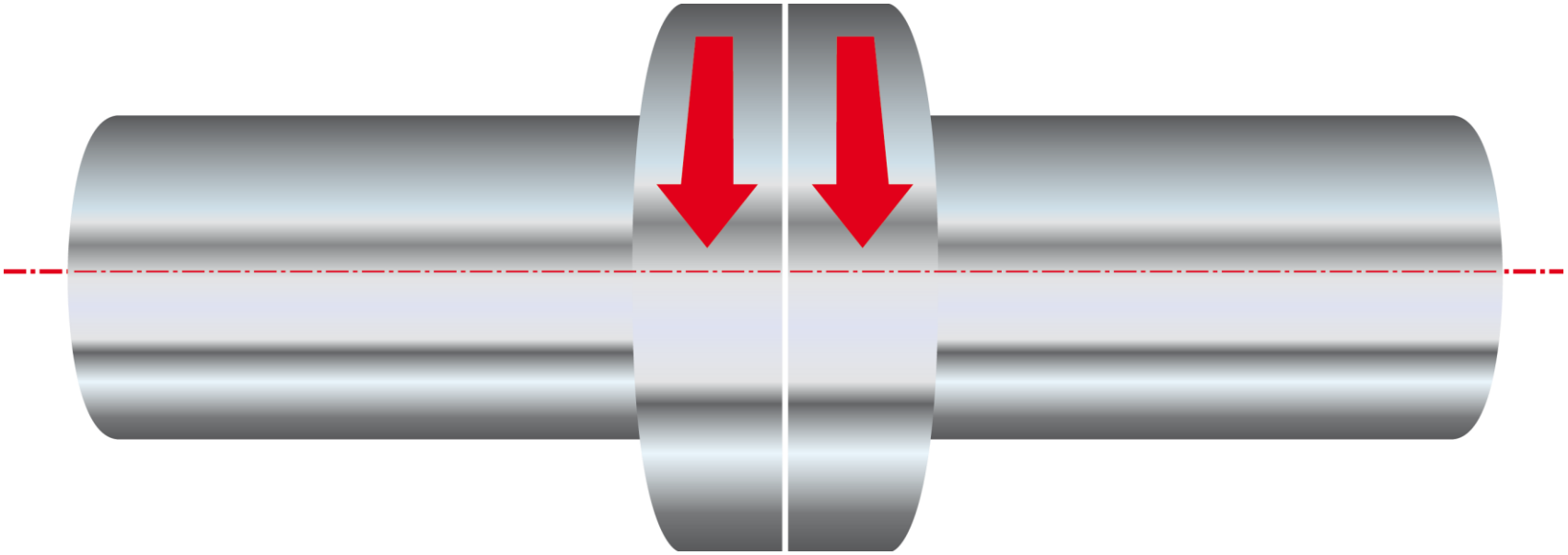
Target Segment:

•Mechanical Maintenance Technicians
•Facilities Engineers
•Existing Fluke 805 and 810 users

Preliminary Positioning:

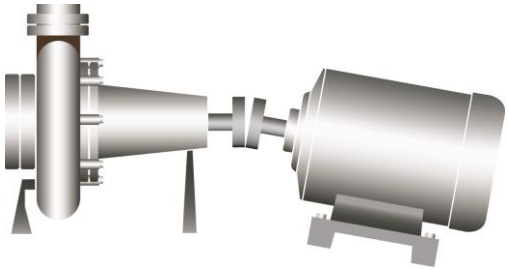
•Misalignment is costing you $$,$$$
•Fluke Laser alignment is the most precise
•Fluke Laser Alignment is the fastest
•Rulers and Dials are antiquated tools

What is shaft alignment ?

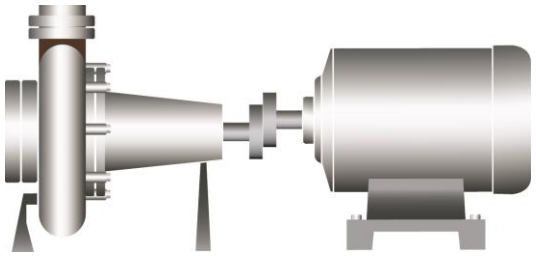


at the point of power transfer from one shaft to another, the axes of rotation of both shafts should be colinear when the machine is running under normal operating conditions

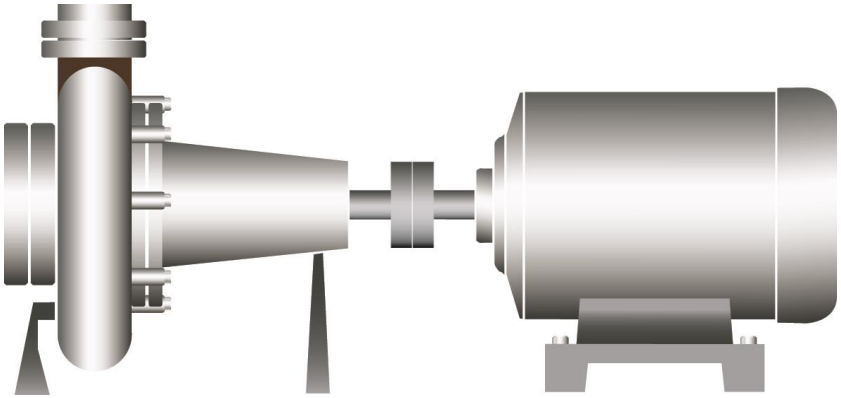
The 4 alignment parameters

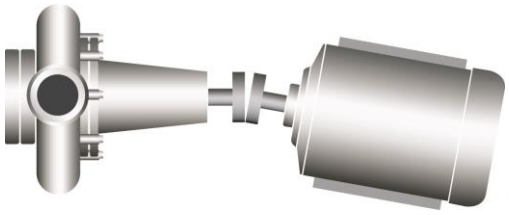


Vertical angularity

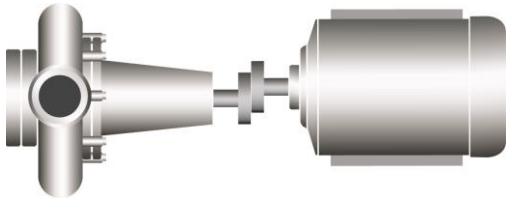


Vertical offset





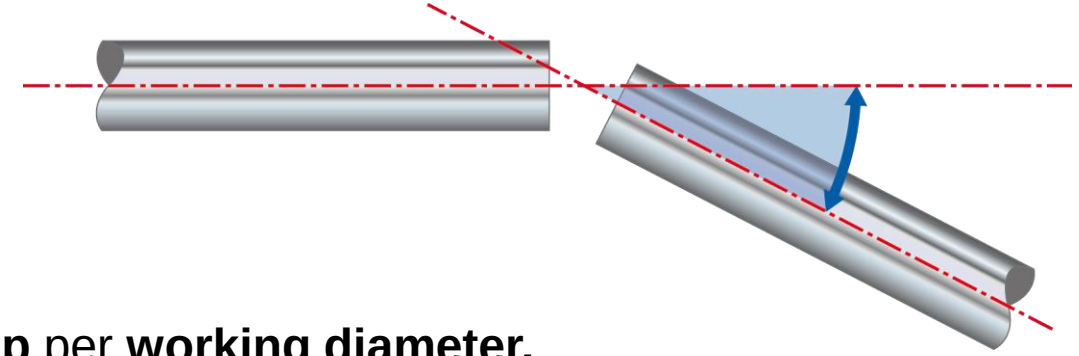
Horizontal angularity



Horizontal offset

Angularity and gap

Angularity means the angle between two rotation axes



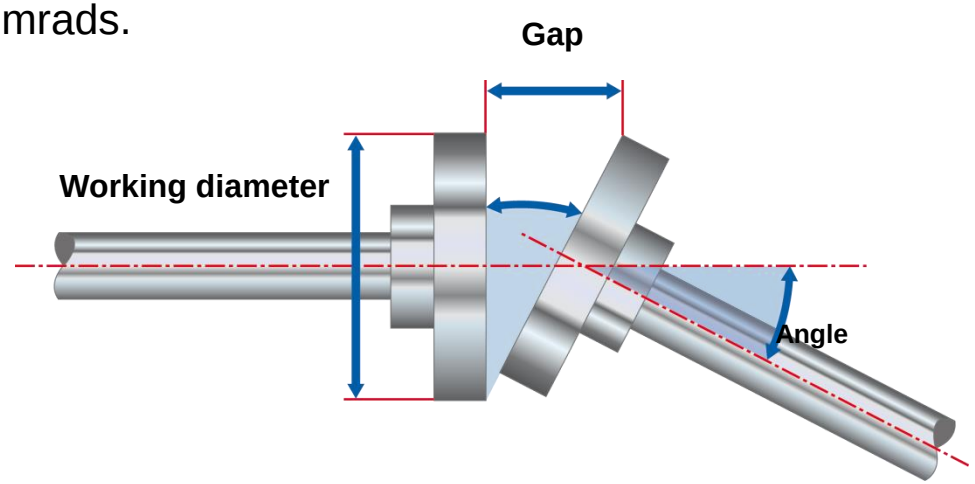
The angle is usually given as a **gap** per **working diameter.**

A 6“ (152.4 mm) coupling open at the top by 0.005“ (0.127 mm)

gives an angle between shaft axes of 0.83 mrads.

$\theta = gap / working\ diameter$

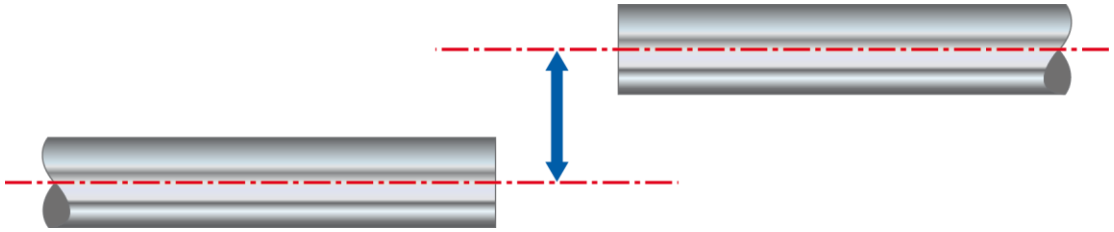
θ = 0,127/152,4 = 8,33 10^{-4} rad = 0,83 mm/m



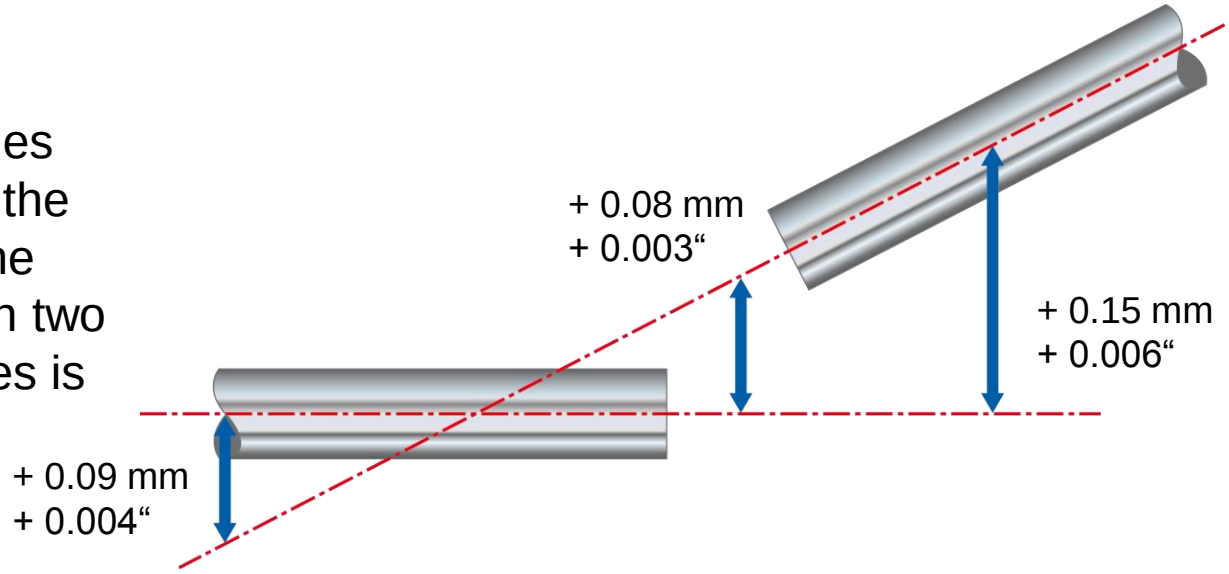
Note:
1 mrad = 1 thousandth of an inch per inch
1 mrad = 1 mm / m

Offset

Offset means distance between rotation axes at a given point

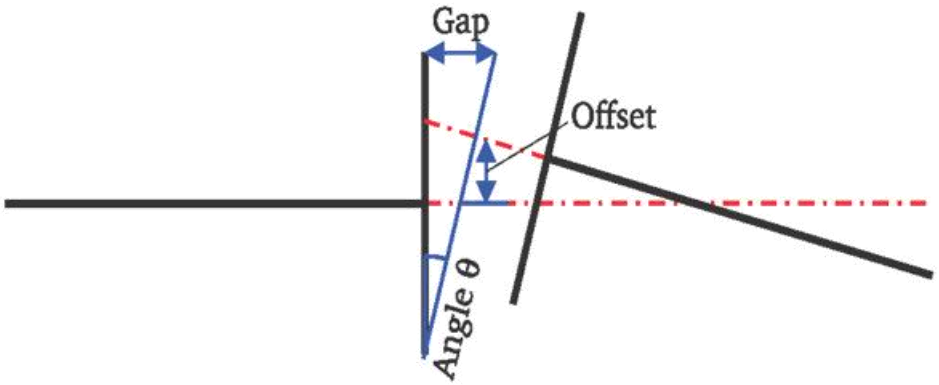


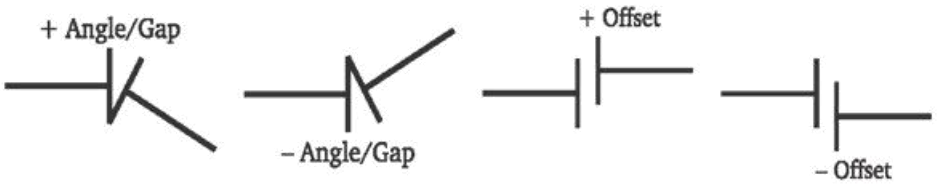
Offset value varies depending upon the location where the distance between two shaft rotation axes is measured



Alignment condition

- Alignment condition is always a combination of angularity and offset
- Machine has to be corrected in both vertical and horizontal planes
- 4 values are required to fully describe the alignment condition:
  1. Vertical angularity (or gap per diameter)
  2. Vertical offset
  3. Horizontal angularity (or gap per diameter)
  4. Horizontal offset
- **Offset refers to distance between shaft rotation axes at coupling center**





Coupling tolerance

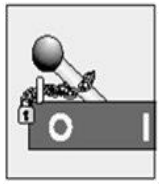
An often quoted comment is “...**why bother to align the machine when it is fitted with a flexible coupling designed to take misalignment?”**

It is true that flexible couplings are designed to take misalignment, typically up to 10mm or more radial offset of the shafts. But the **load imposed on shafts, and thus the bearings and seals increase dramatically due to the reaction forces created within the coupling when misaligned.**

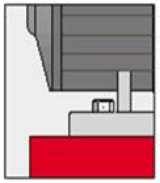
Symptoms of misalignment

- Excessive radial and axial vibration.
- High casing temperatures at or near the bearings or high discharge oil temperatures.
- Excessive amount of oil leakage at the bearing seals.
- Loose foundation bolts, shim packs or dowel pins.
- Loose or broken coupling bolts.
- Some flexible coupling designs run hot under misalignment conditions. If it is an elastomeric type, look for rubber powder inside the coupling shroud.
- Similar pieces of equipment are vibrating less or seem to have a longer operating life.
- Unusually high number of coupling failures or they wear quickly.
- The shafts are breaking (or cracking) at/or close to the inboard bearings or coupling hubs.
- Excessive amounts of grease (or oil) on the inside of the coupling guard.

Pre-alignment checklist



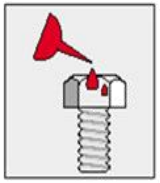
Machines tagged out -
Padlock on switchgear



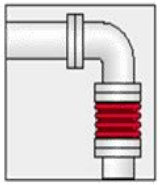
Base OK?

Shims OK?
(maximum 4 shims!)

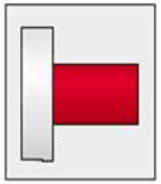
Bent bolts?
Cupped washers?



Hold-down bolts,
jacking bolts
lubricated?

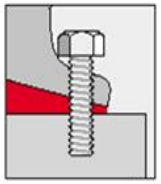


Pipe/bracket
strain
eliminated?

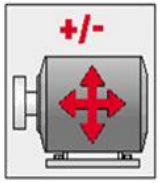


Shafts OK?
Run out, bending,
bearing play?

Coupling OK?
Proper fit on shaft, looseness,
eccentricity, flexible elements OK?

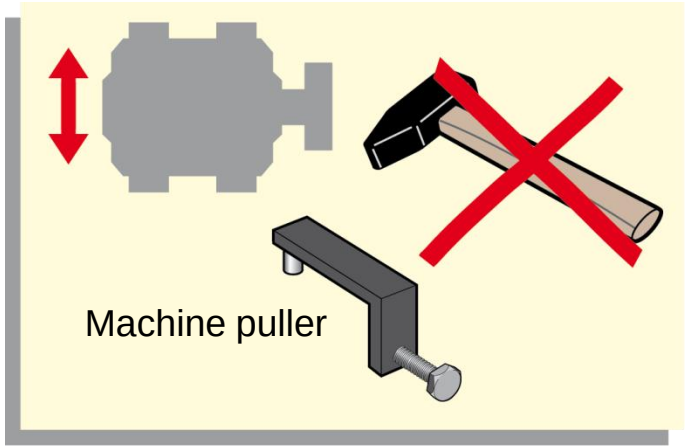


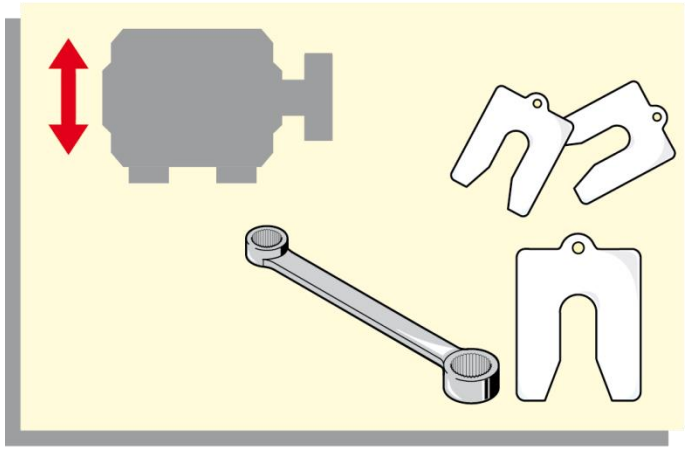
Soft foot
eliminated?

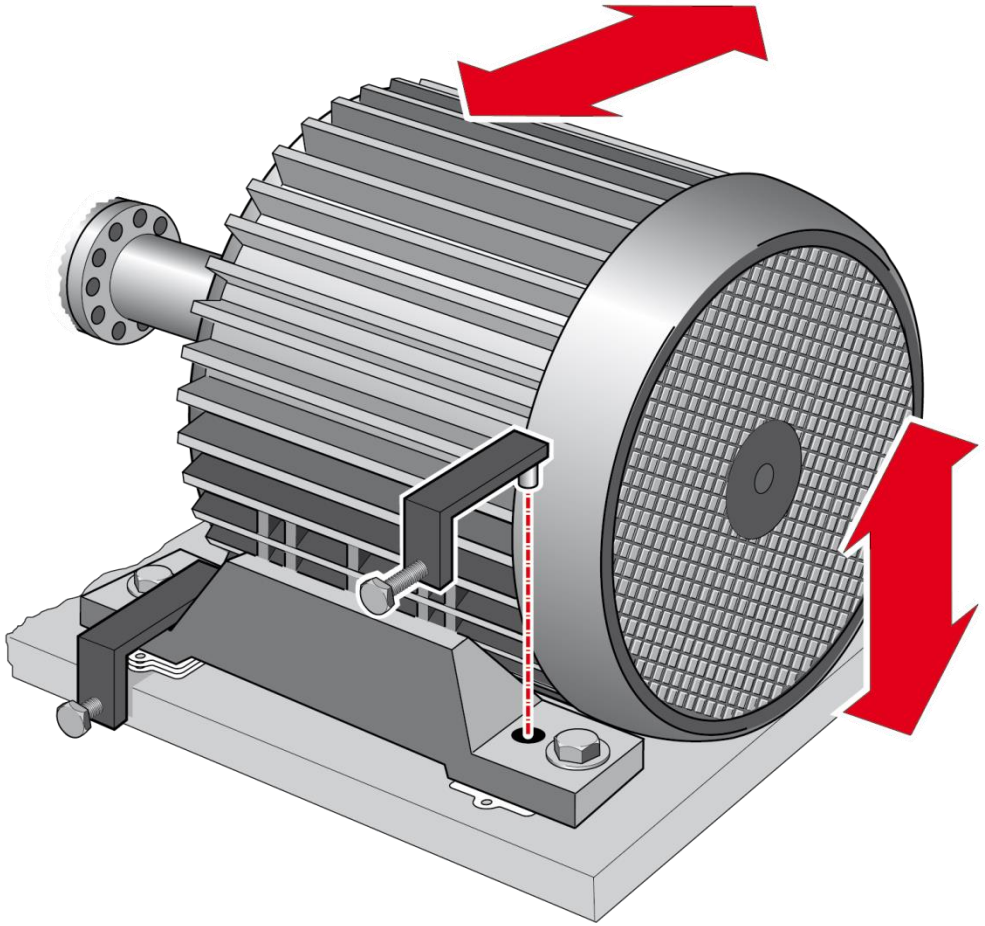


Targets,
tolerances
established?

Machine mobility – feet corrections

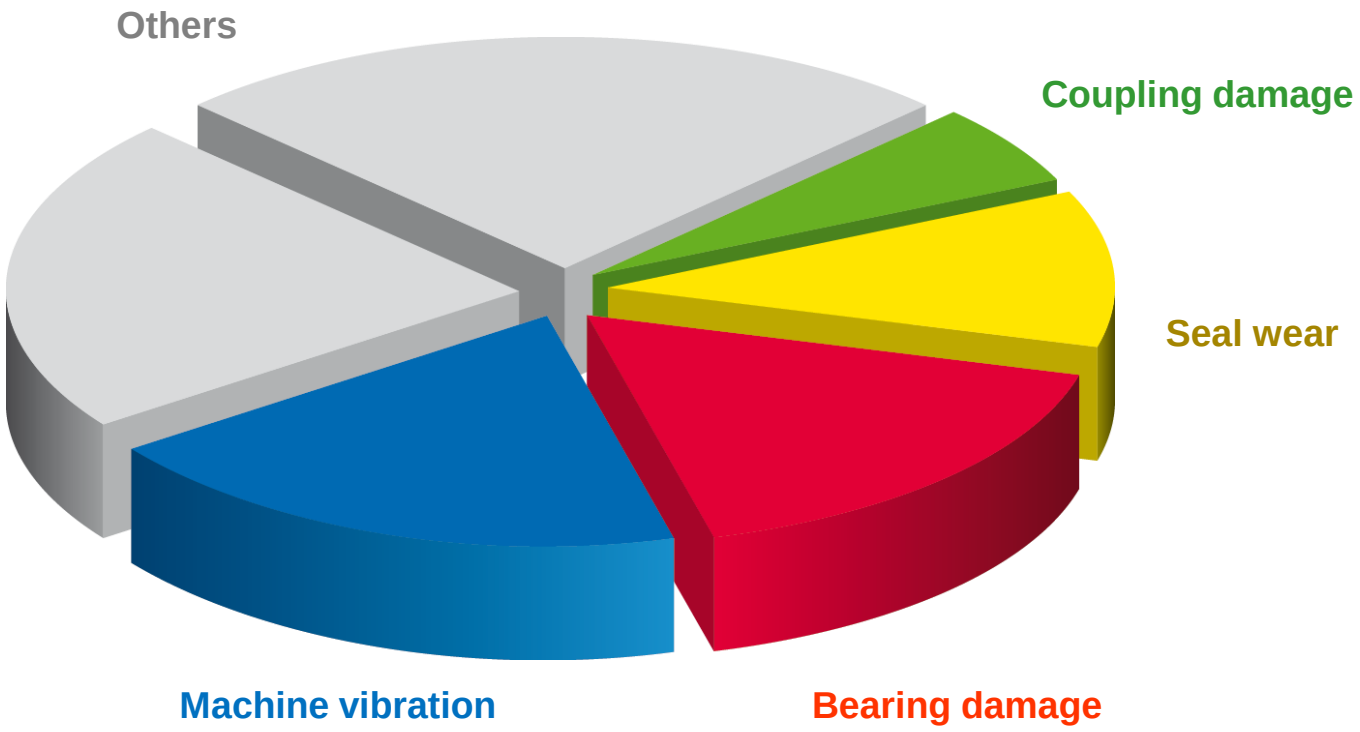






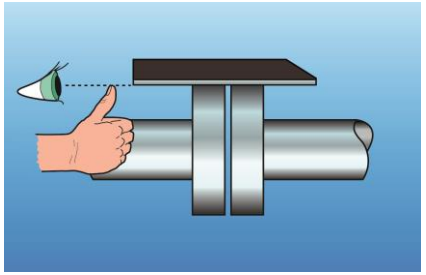
Once alignment condition found, a correction is recommended

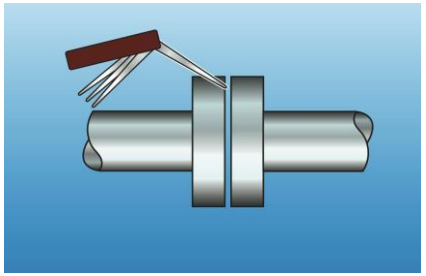
Consequences of misalignment



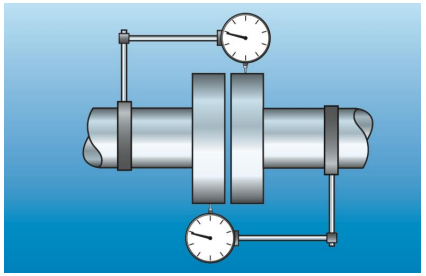
Common alignment methods

Straightedge/Feeler gauge
Resolution 1/10 mm

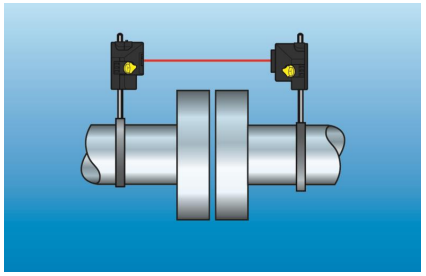




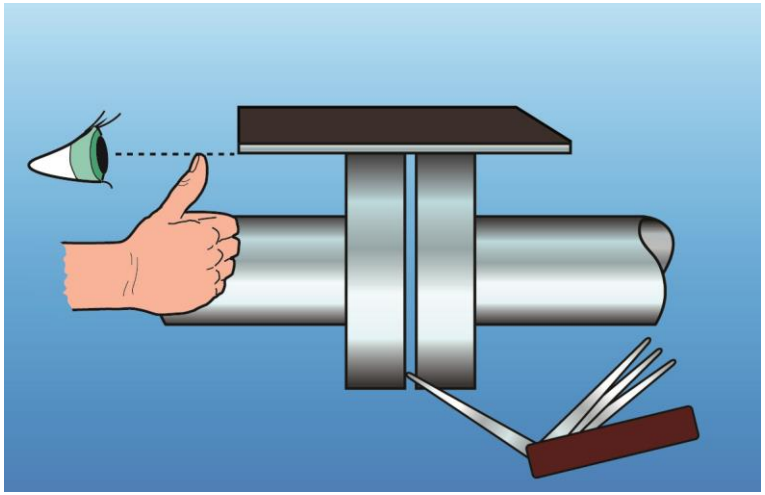
Dial indicator
Resolution 1/100 mm



Laser-optical alignment
Resolution 1/1000 mm

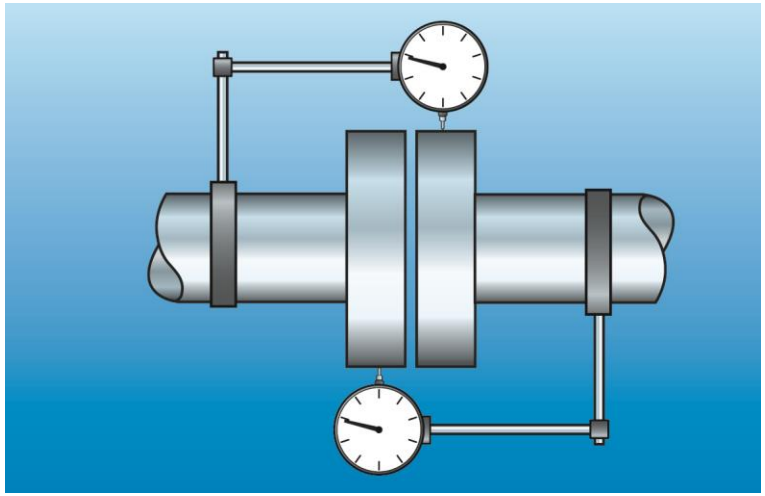


Straightedge and feeler gauges

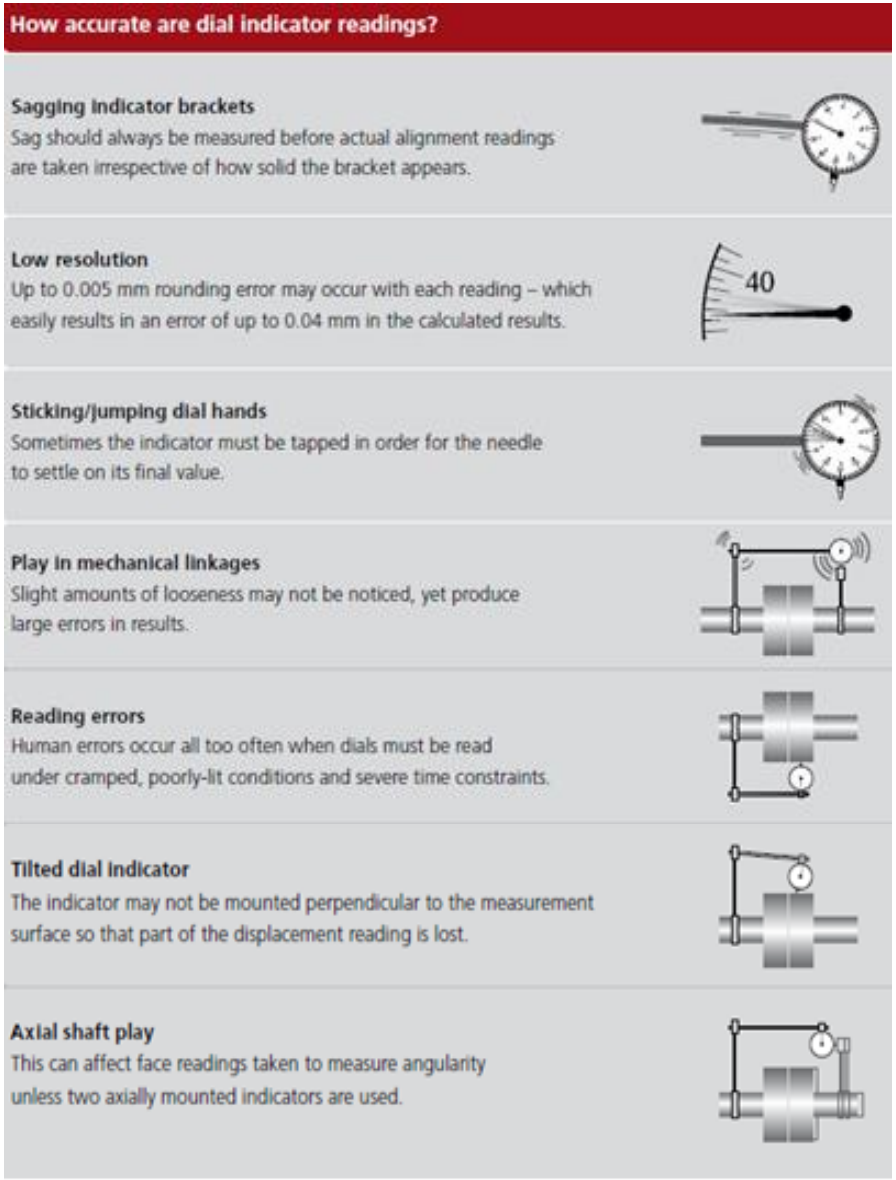


- Limited resolution of the human eye: 0.1 mm /0.004”
- Coupling alignment - not shaft alignment
- Prone to coupling fitting errors
- Trial and error corrections
- No documentation
- Far too inaccurate for most machines

Dial indicators

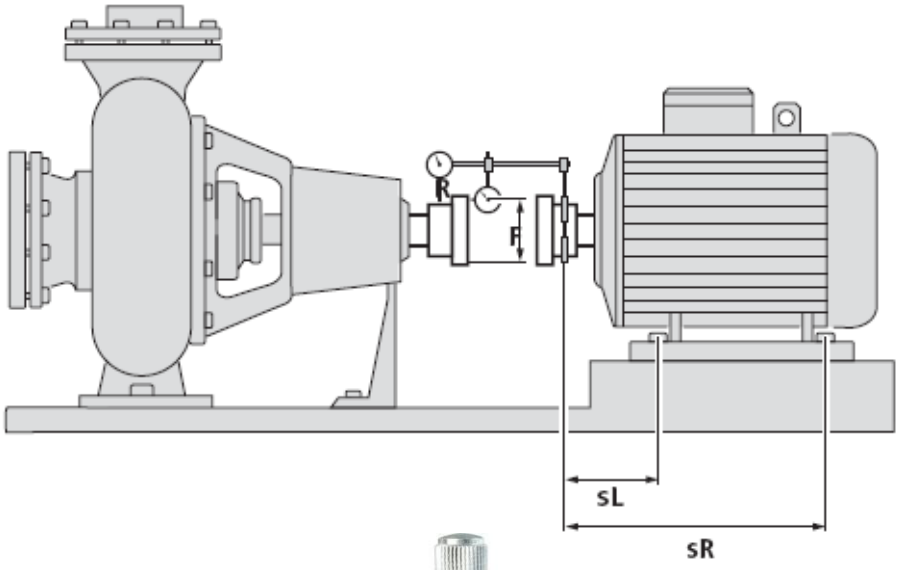


- Resolution (typical): 0.01 mm /0.0004”
- Bracket sag
- Mechanical play
- Possible sign error
- Calculations complicated
- Requires high user experienced.

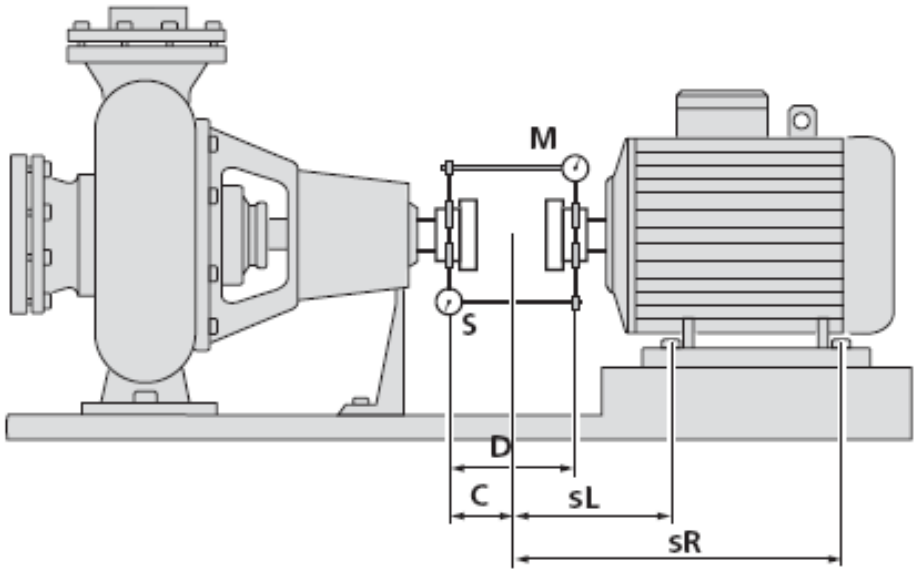


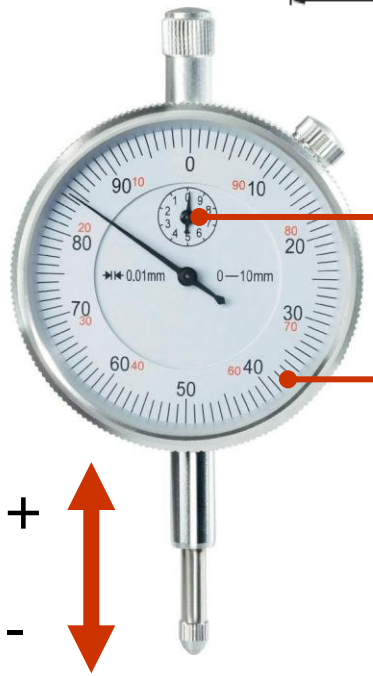
Shaft alignment methods: Dial indicators

Rim and face method



Reverse indicator method



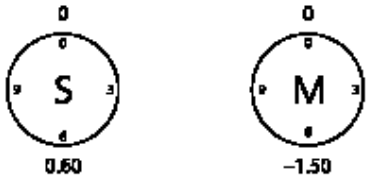


Inner scale has one division per rotation

Outside scale can be rotated for zeroing

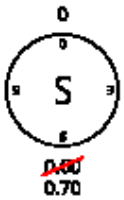
Dial indicators - Reverse method using a graph

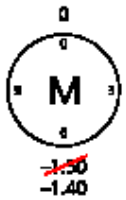
e.g. for vertical direction



All values are shown in mm.

The indictor bracket sag was –0.10 mm. The total indicator readings (TIRs) after correction for bracket sag are thus:



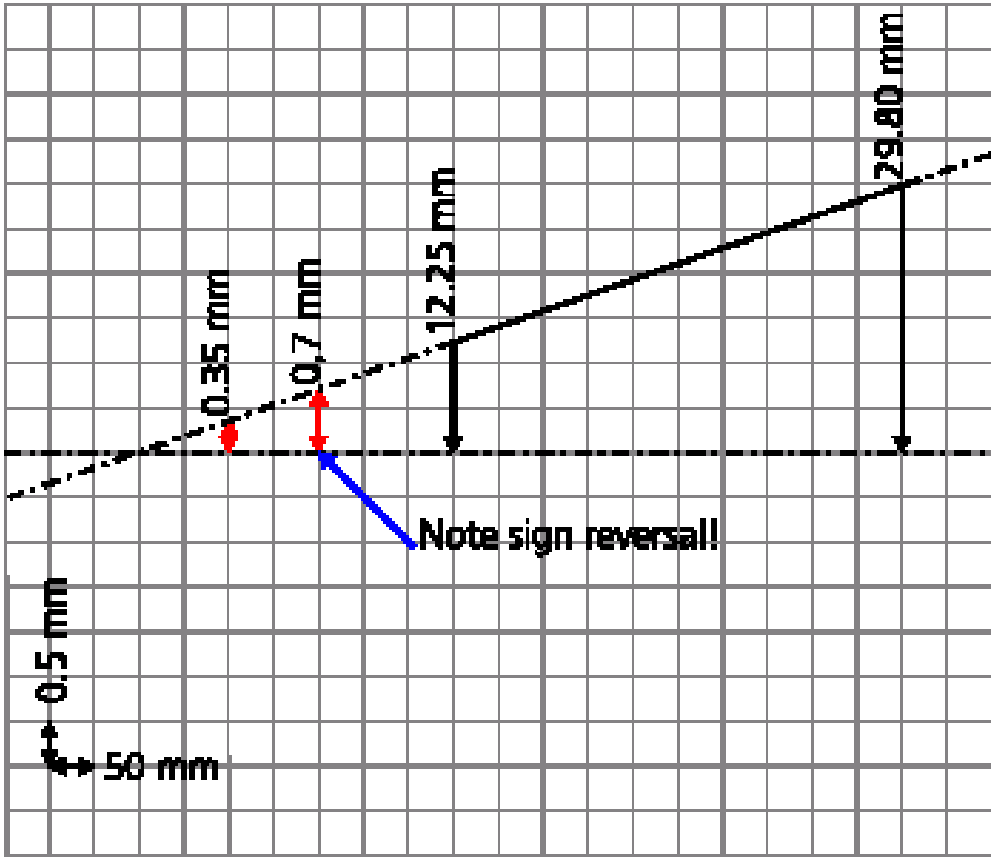


The TIR values must be divided by 2 to determine the true shaft offset values in the planes of the dial indicators:

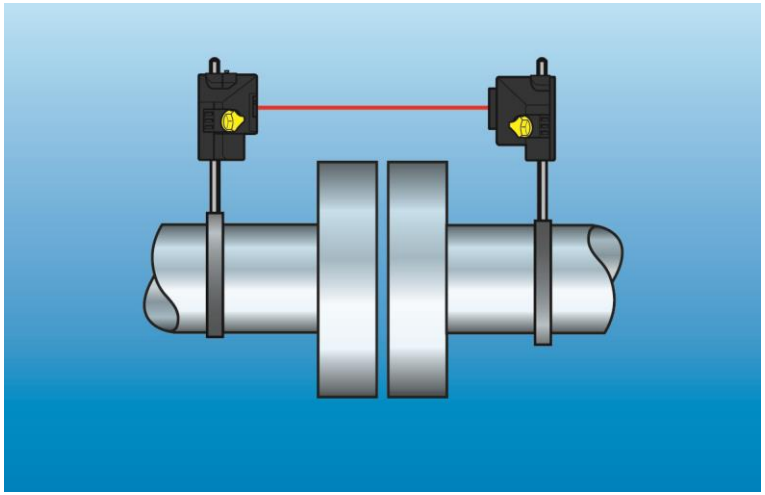
Offset S = + 0.70 / 2 = + 0.35 mm

– Offset M = –1.40 / 2 = – 0.70 mm

The offsets are plotted on the graph as shown below :

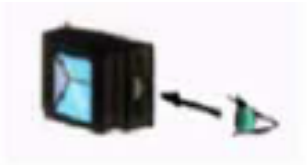


Laser alignment methods

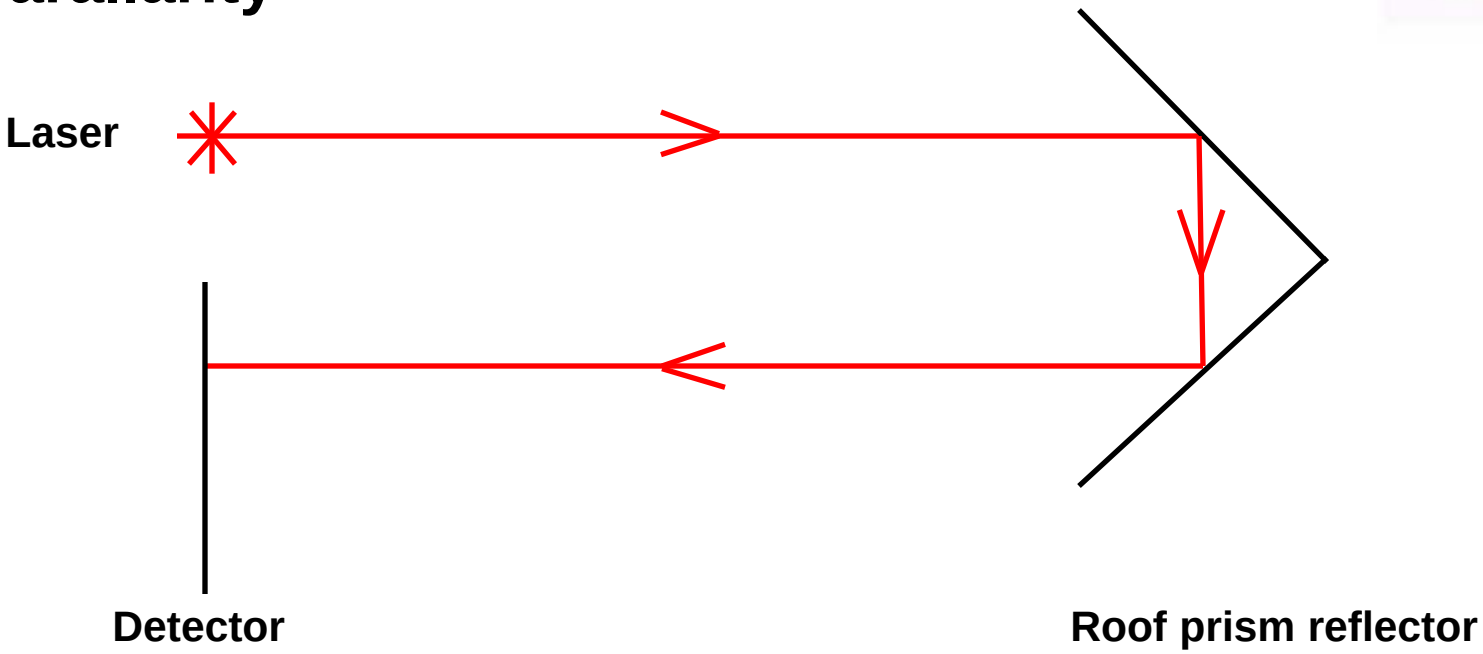


- Resolution of 1/1000 mm (0.00004")
- Universal bracket
- No bracket sag influence
- Human error free
- Accurate measurement
- Graphical result display:
  No misinterpretation
- Alignment evaluation
- “Live” corrections
- Documented results

Measurement principle

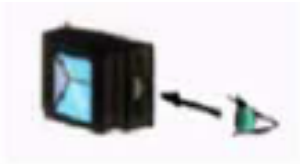


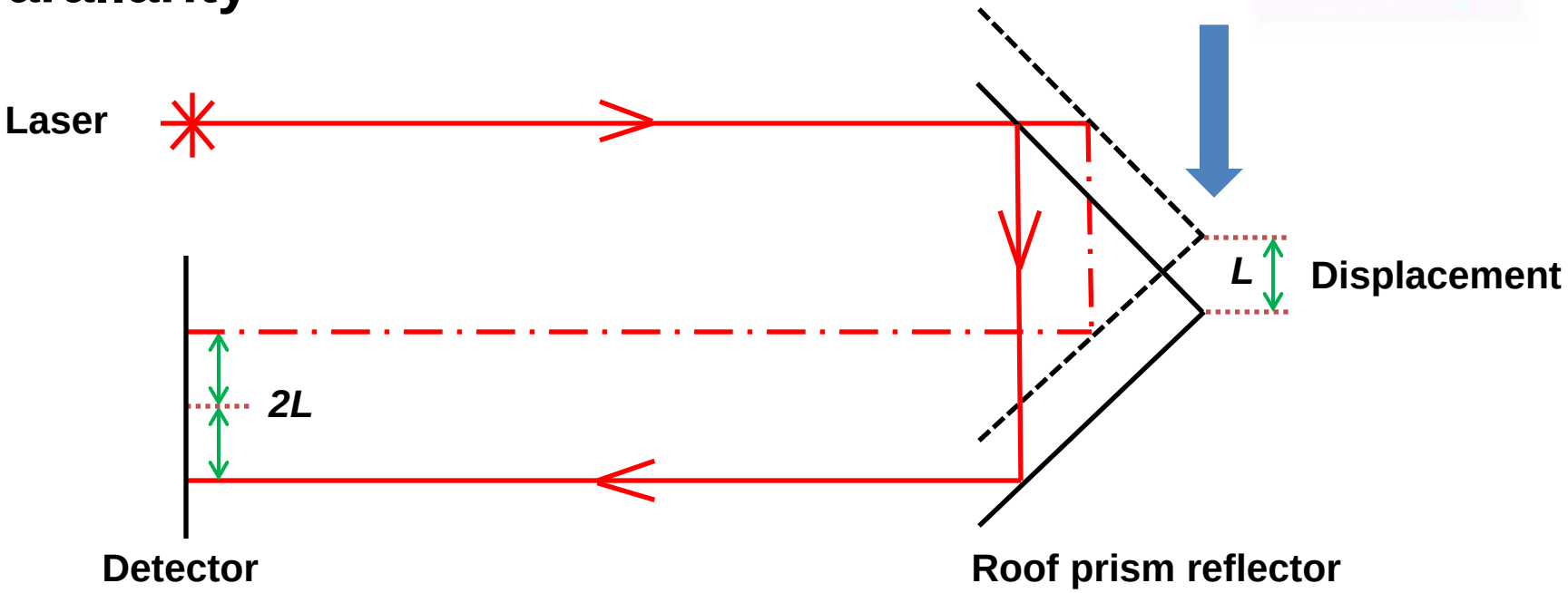
Parallarity



Measurement principle

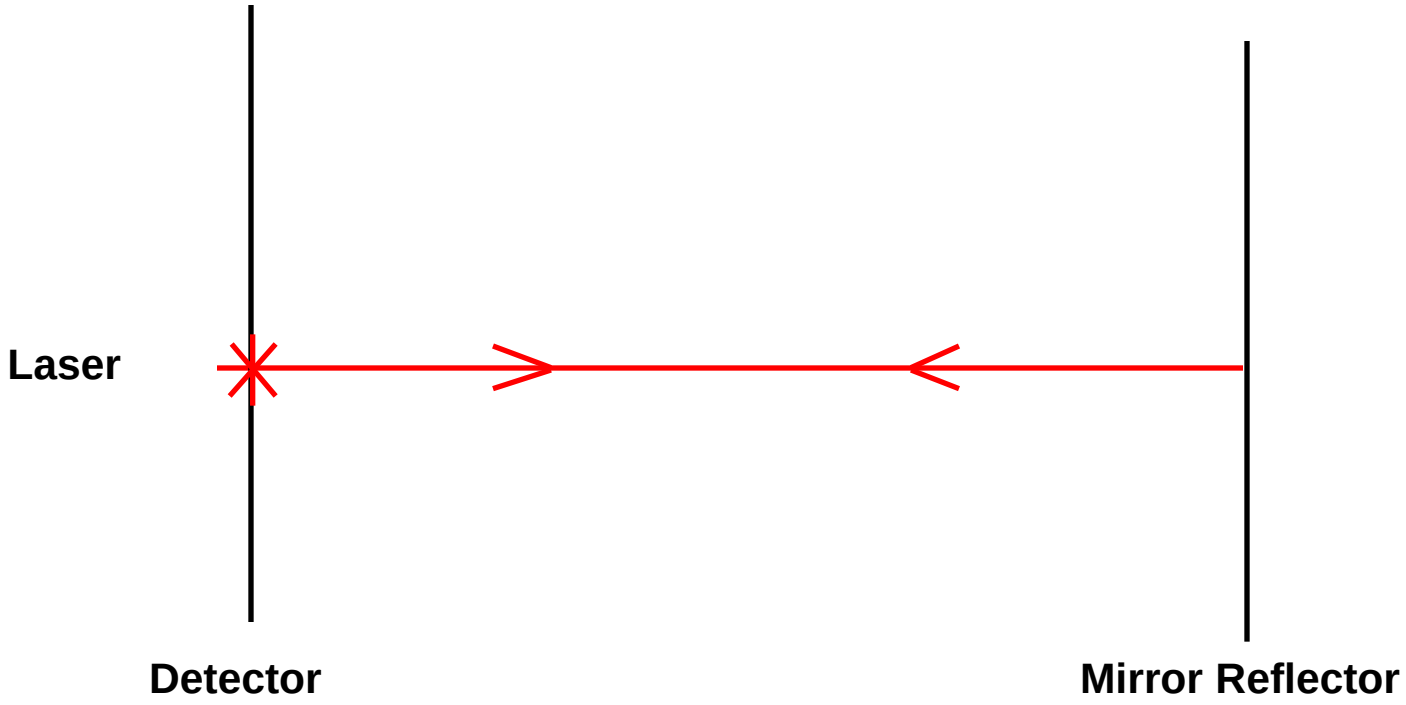
Parallarity





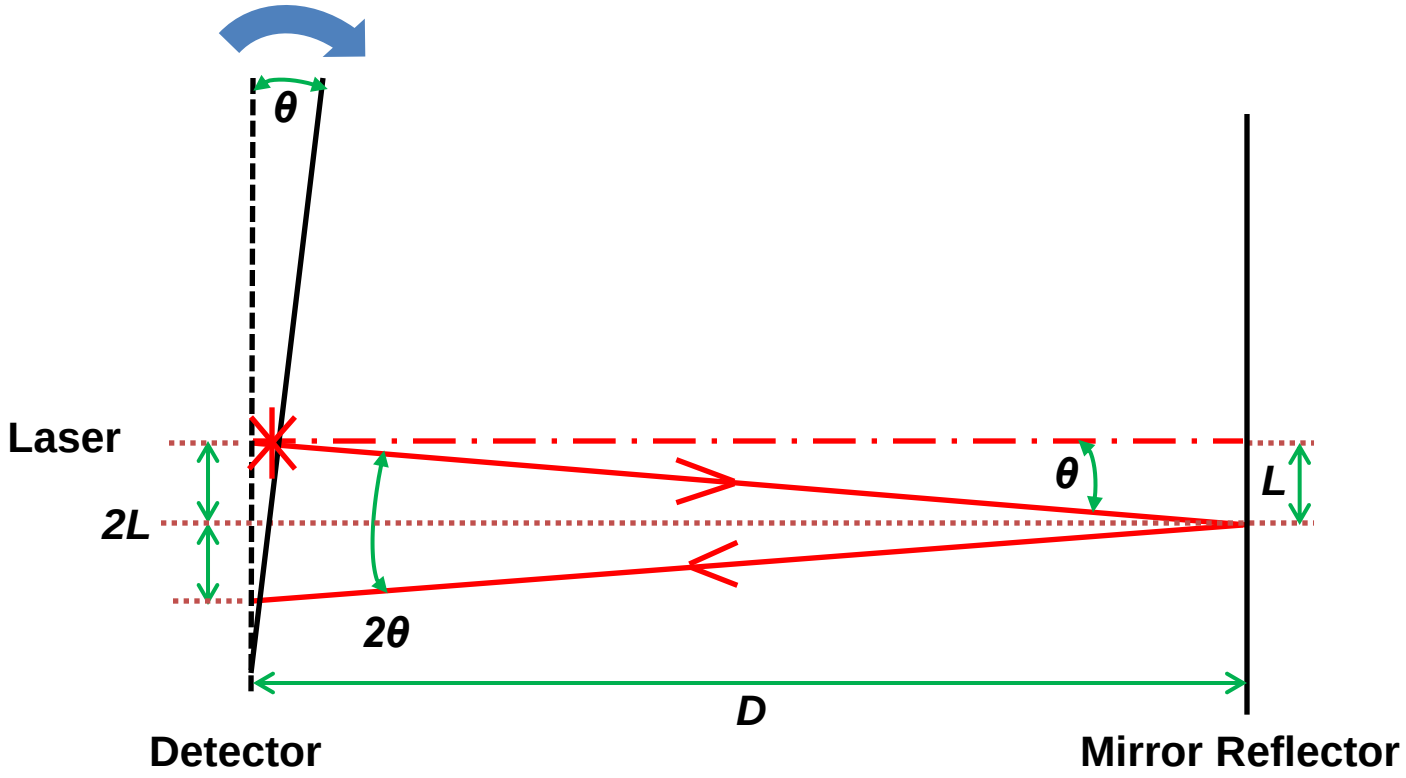
Laser Alignment technology

Angularity

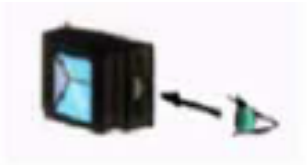


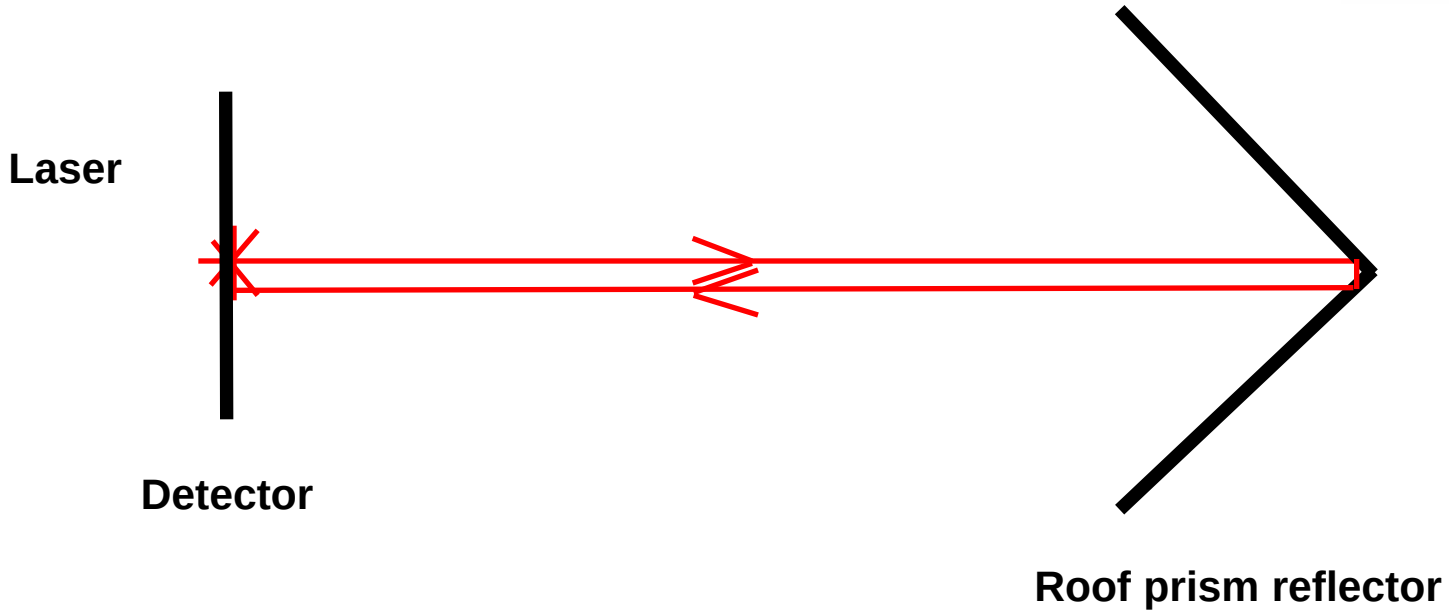
Measurement principle

Angularity



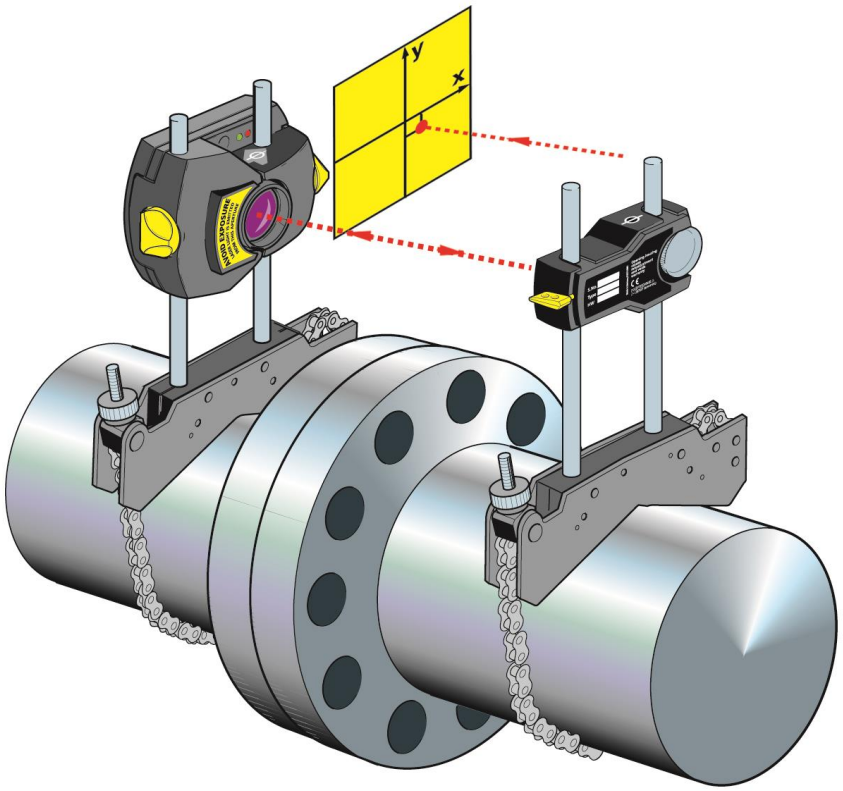
Measurement principle





- The **auto-collimating laser optics system** is less susceptible to backlash

Measurement principle

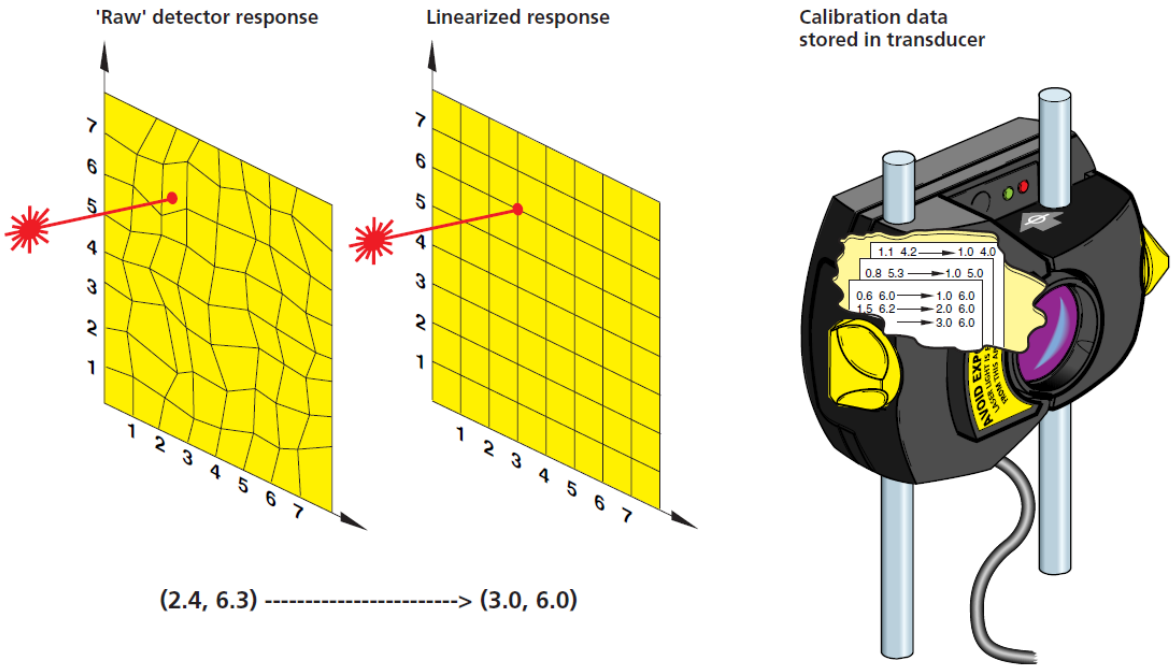


Laser principle

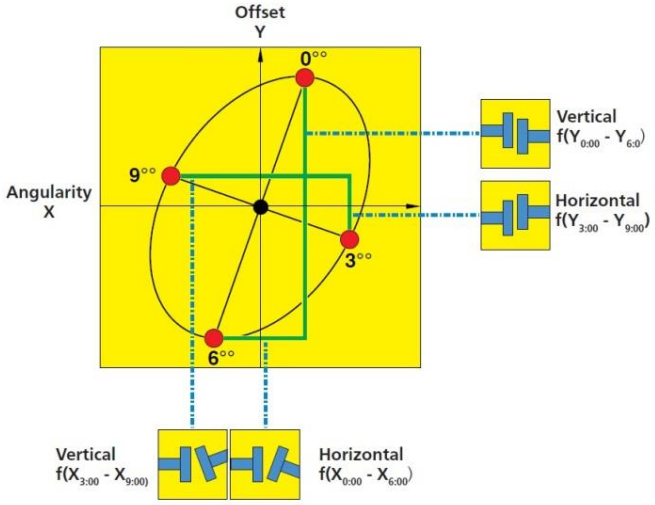
- One sensor / prism
- Laser: semiconductor laser
- One roof prism as reflector
- Quick setup and laser beam adjustment
- Built-in electronic inclinometer

Measurement principle

Highly accurate linearization = highly accurate alignment on first attempt!



Offset and angularity from the calculation ellipse



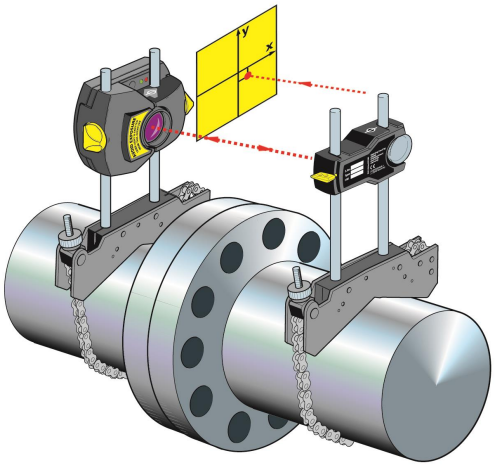
Fluke 830 Overview and How to Use

- Fluke 830 Hardware overview
  - Sensor and Prism
  - Measurement principle
- Key Features and Benefits
- Quick, Easy, Step by step, Precision alignment (QRG)
  - Overview of 830
  - Steps of Precision Alignment
    - ✓ Mount Brackets - preparation
    - ✓ Setup – enter machine dimensions
    - ✓ Measure – take 3 of 8 available positions
    - ✓ Diagnose – alignment results, condition, feet adjustments
    - ✓ Make Corrections – vertical, then horizontal, save & print
  - Other: Soft Foot, Save, Report, Extend, Switch, Clock, Vertical, Settings
  - Appendix – Sensor Cable, Updates, Specs, Options, Service / Calibration

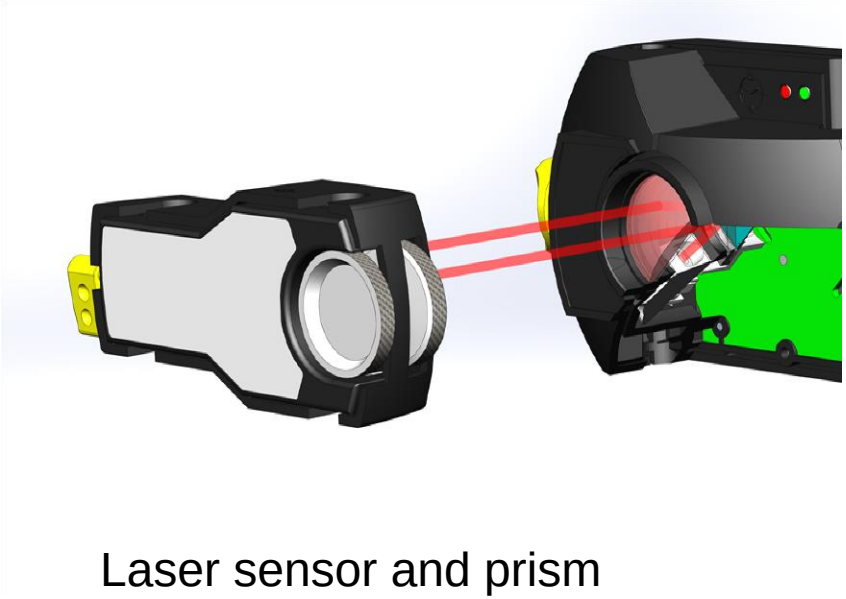
Fluke 830 Alignment – hardware overview

Alignment tool

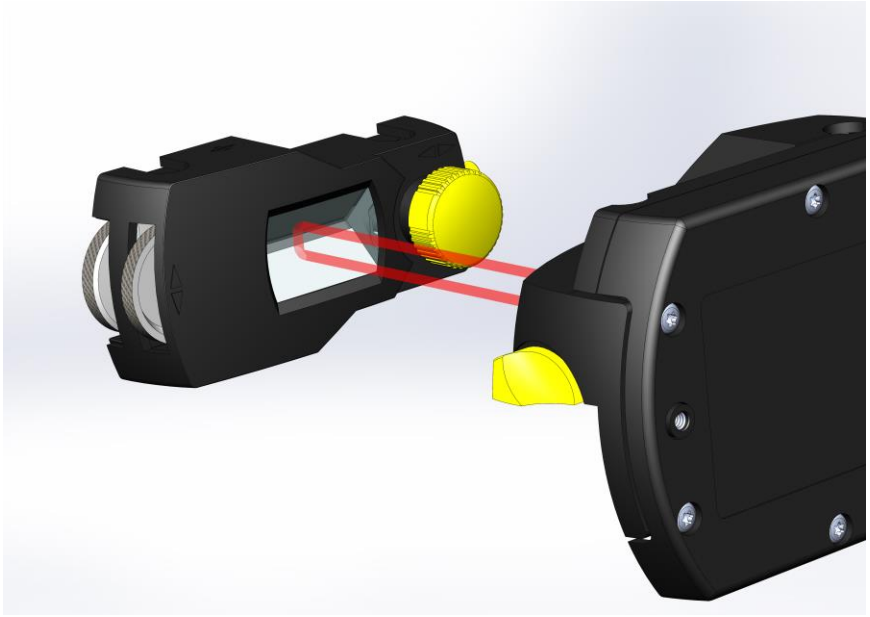
Bluetooth



Single Laser: sensor - prism



Laser sensor and prism



Precision prism reflects beam back

Laser Alignment Technology - Sensor

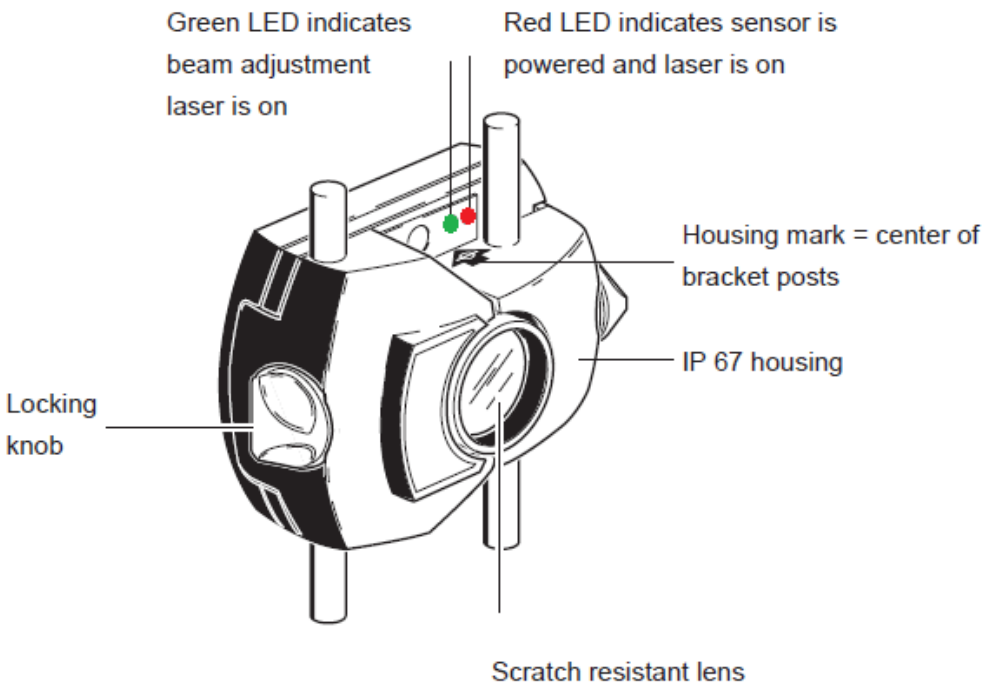
CAUTION
DON'T STARE INTO BEAM

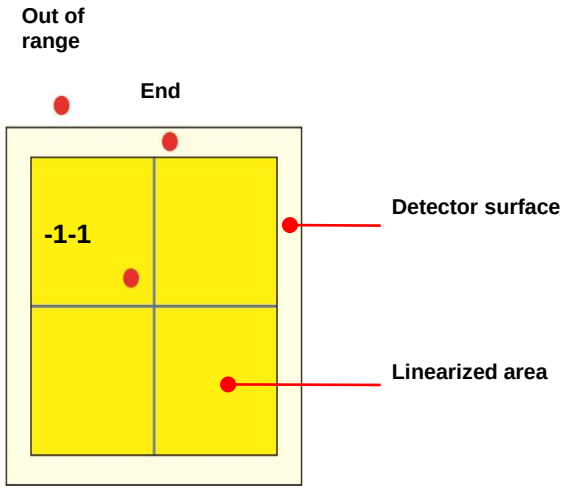
Laser type
AlGaInP
semiconductor
laser

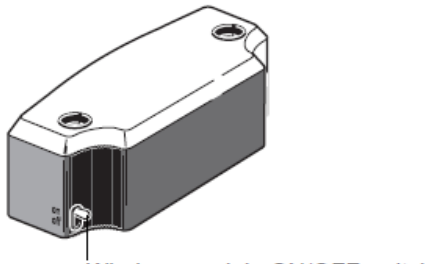
Wavelength
675 nm
(red, visible)

Safety class
Class 2

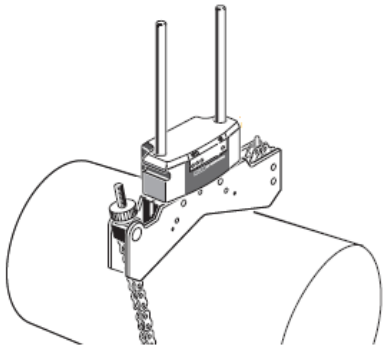
Beam power
< 1mW



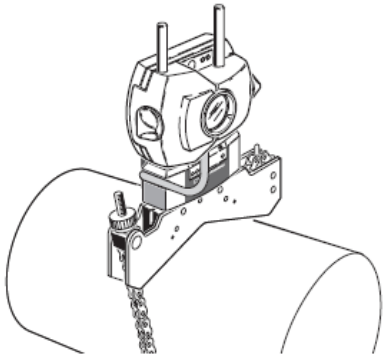




Wireless module slides onto the support posts

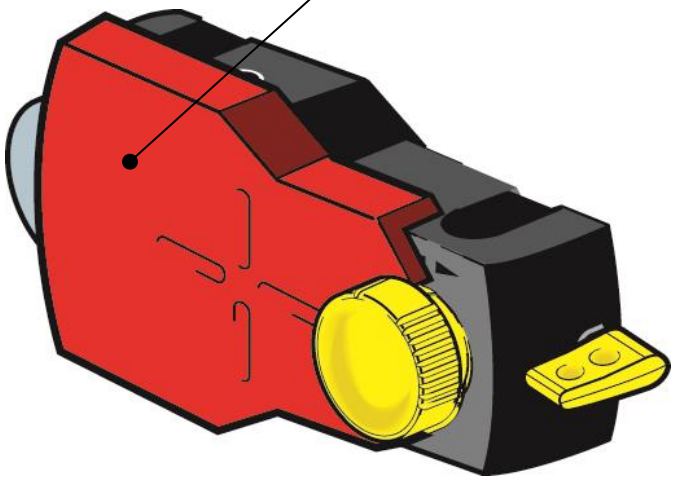


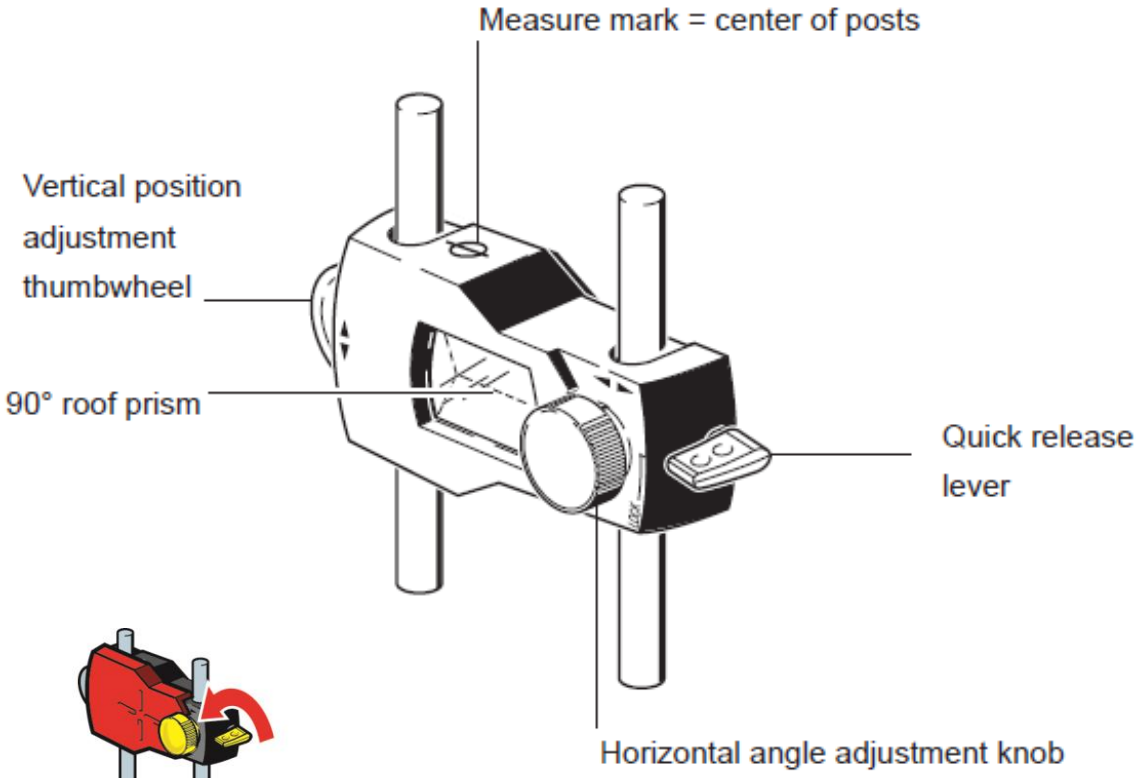
1. Wirelss module held in place by friction fit

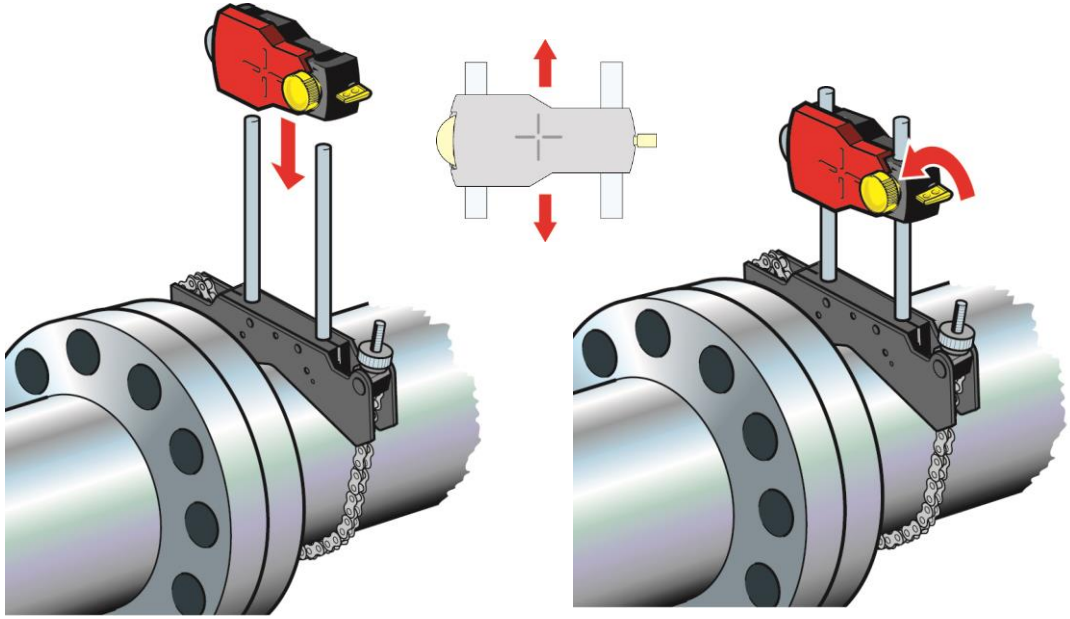


2. Tighten the yellow knobs; attach cable connector from wireless module

Laser Alignment Technology - Prism





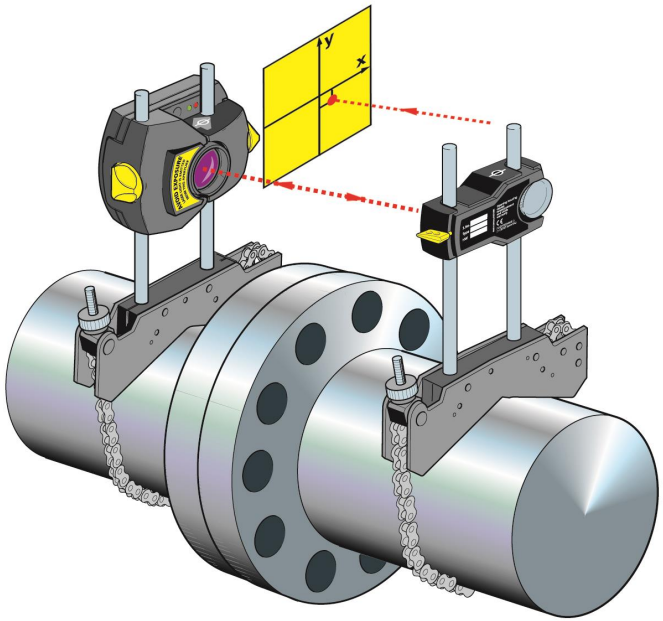


Type 90° roof prism
Protection IP 67

Fluke 830 - Key features and benefits

1. Single Laser Beam: auto-collimating laser optics system is less susceptible to backlash => less error means more accurate and more repeatable

- **Rugged design**: ergonomic, robust, and protected from dust & water
- **Best in Class Repeatability:** patented single laser, precision manufactured parts and high quality fasteners coupled with extremely accurate lab calibrations give you added confidence in your measurement results.
- **Wireless:** Bluetooth communication removes cables that take longer to use
- **Integrated batteries:** Li-Ion rechargeable for long life



Fluke 830 Key features and benefits

2. Intuitive guided user interface: eliminates guesswork, increases accuracy

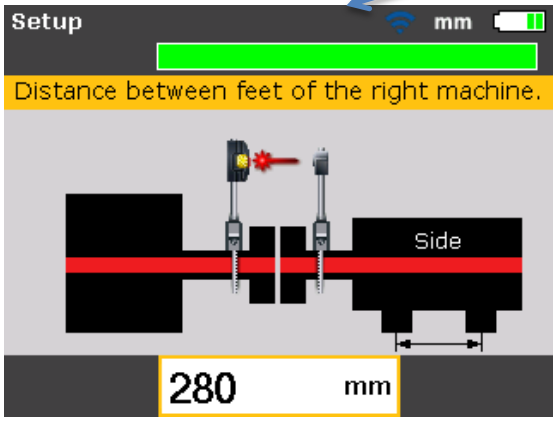
Many tools are simple, but take time to re-learn what the numbers mean – you need answers

Shaft alignment focus: remove high-end programs not needed

3 simple steps: walk you through steps (like 810)

1. Setup – step by step to input the machine dimensions (saved from last time)
2. Measure – starts when shafts rotated – take readings from 3 sectors when turn green on screen.
3. Diagnose – actual correction numbers given: use precision shims to save time and precision alignment every time

1



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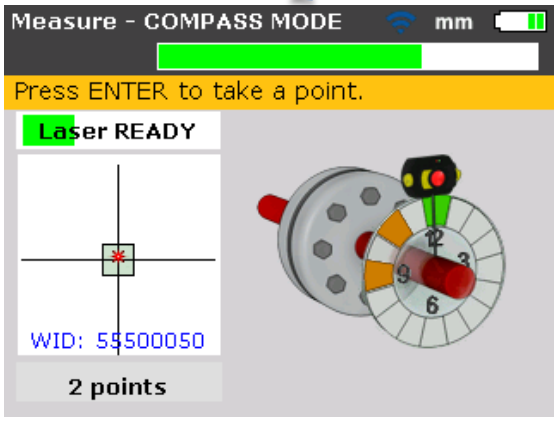

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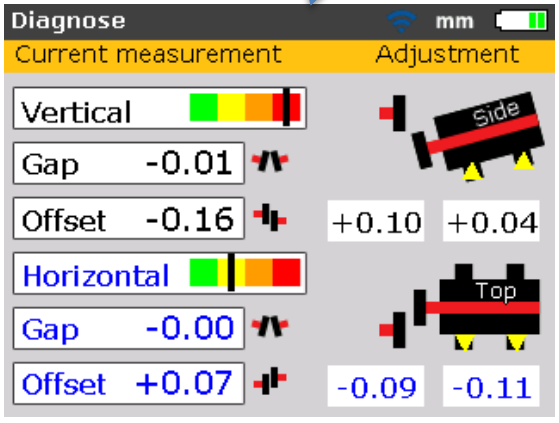
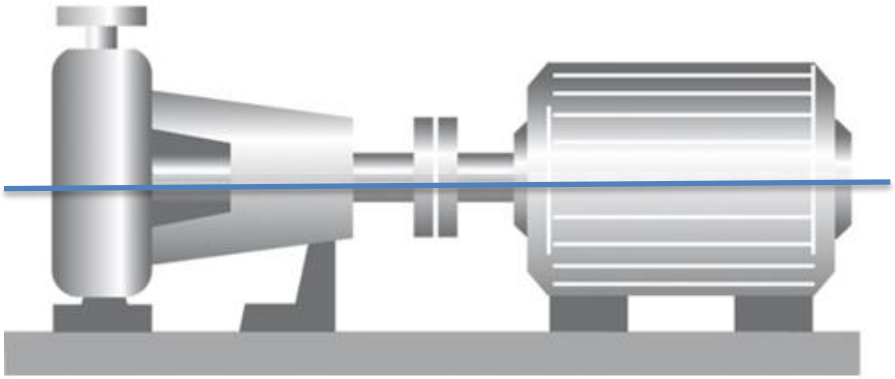


Fluke 830 Key features and benefits

3. Compass Measurement Mode: enables flexible, reliable and repeatable measurements using a built-in activated electronic inclinometer.
Answers NOT just data: Any tool can give numbers – even dial indicators, but you need answers to quickly align the machine and get it running fast.
"All in One" result screen shows both coupling results and feet corrections (vertical and horizontal)

4. Dynamic Machine Tolerance Check: provides continuous evaluation of alignment adjustments to know when machine in acceptable range. 4-level color severity scale indicates when alignment is acceptable – Green = excellent, Yellow = acceptable, Orange = out of tolerance, Red = grossly misaligned.



Tolerance table mm

Press ENTER to disable tolerances.

Diameter: 50 mm Enabled

RPM	Acceptable	Excellent
750	Gap: 0.06 Offset: 0.19	Gap: 0.04 Offset: 0.09
1500	Gap: 0.03 Offset: 0.09	Gap: 0.02 Offset: 0.06
1770	Gap: 0.03 Offset: 0.08	Gap: 0.02 Offset: 0.05
3000	Gap: 0.02 Offset: 0.06	Gap: 0.01 Offset: 0.03

Fluke 830 Key features and benefits

5. Data Protection ensures your data is there when you need it with auto save and resume capability

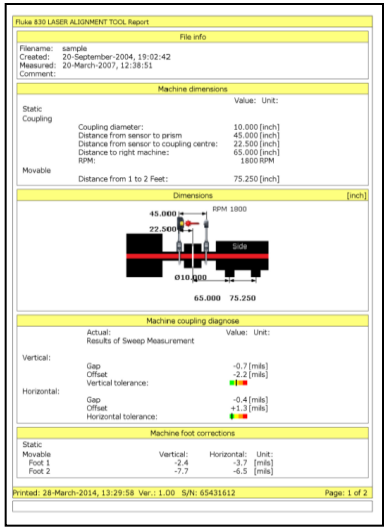
Reports: document work done – print report “as found “and “as left”

6. Unique Extend Mode: offers unlimited measurement ranges to handle gross misalignment scenarios with best accuracy.

How big is the sensor? The real question should be: how big is the misalignment?

•Don’t waste time with a rough alignment or pay for expensive big, bulky sensors

•Virtually increases the sensor area when needed


Fluke 830 LASER ALIGNMENT TOOL Report

File info

Filename: sample
Created: 20-September-2004, 19:02:42
Measured: 20-March-2007, 12:38:51
Comment:

Machine dimensions

Value: Unit:

Static
Coupling
Coupling diameter: 10.000 [inch]
Distance from sensor to prism 45.000 [inch]
Distance from sensor to coupling centre: 22.500 [inch]
Distance to right machine: 65.000 [inch]
RPM: 1800 RPM
Movable
Distance from 1 to 2 Feet: 75.250 [inch]

Dimensions [inch]

45.000
22.500
RPM 1800
Side
Ø10.000
65.000 75.250

Machine coupling diagnose

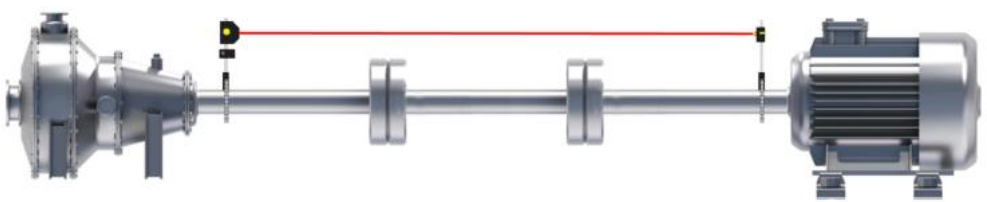
Actual: Value: Unit:
Results of Sweep Measurement

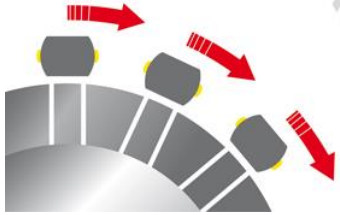
Vertical:
Gap -0.7 [mils]
Offset -2.2 [mils]
Vertical tolerance:
Horizontal:
Gap -0.4 [mils]
Offset +1.3 [mils]
Horizontal tolerance:

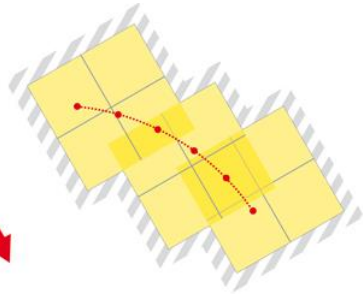
Machine foot corrections

Static:
Movable Vertical: Horizontal: Unit:
Foot 1 -2.4 -3.7 [mils]
Foot 2 -7.7 -6.5 [mils]

Printed: 28-March-2014, 13:29:58 Ver.: 1.00 S/N: 65431612 Page: 1 of 2







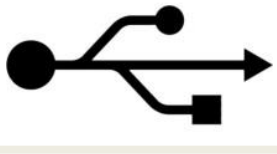
Static Mode: align vertical, uncoupled and non-rotatable shafts
Soft foot: check to make sure misalignment not from foundation problem

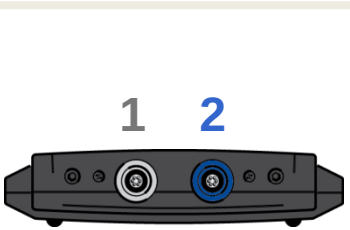
Fluke 830 Alignment Tool

- Robust design – the computer is protected against dust and water in compliance with classification IP 65
- Color TFT ¼ VGA screen
- 'Lithium-ion polymer rechargeable battery
- Wireless communication with sensor via Bluetooth
- Keyboard including Setup, Measure, Diagnose, SF & Move keys
- Interfaces

  1. USB PC/printer port, charging socket

  2. Sensor port RS 232
- Multicolor LED for battery status, wireless connection & tolerance condition





Fluke 830 Alignment Tool - package

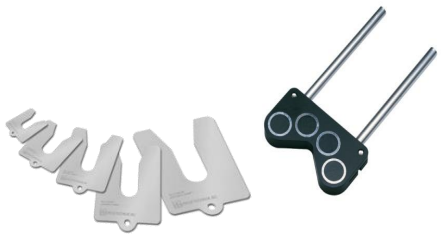
Item Description

1. Fluke 830 Laser Alignment Tool
2. Storage case
3. Sensor including dust cap and wireless module cable
4. Prism including dust cap
5. Chain-type bracket (2X) – each comprises two support posts and chain
6. Wireless module
7. Sensor cable
8. Adapter/charger
9. PC cable
10. USB cable
11. USB memory stick
12. Cleaning cloth

Quick reference guide
Safety sheets
Users manual on CD

Options

Magnetic Brackets
Precision Shim Kit



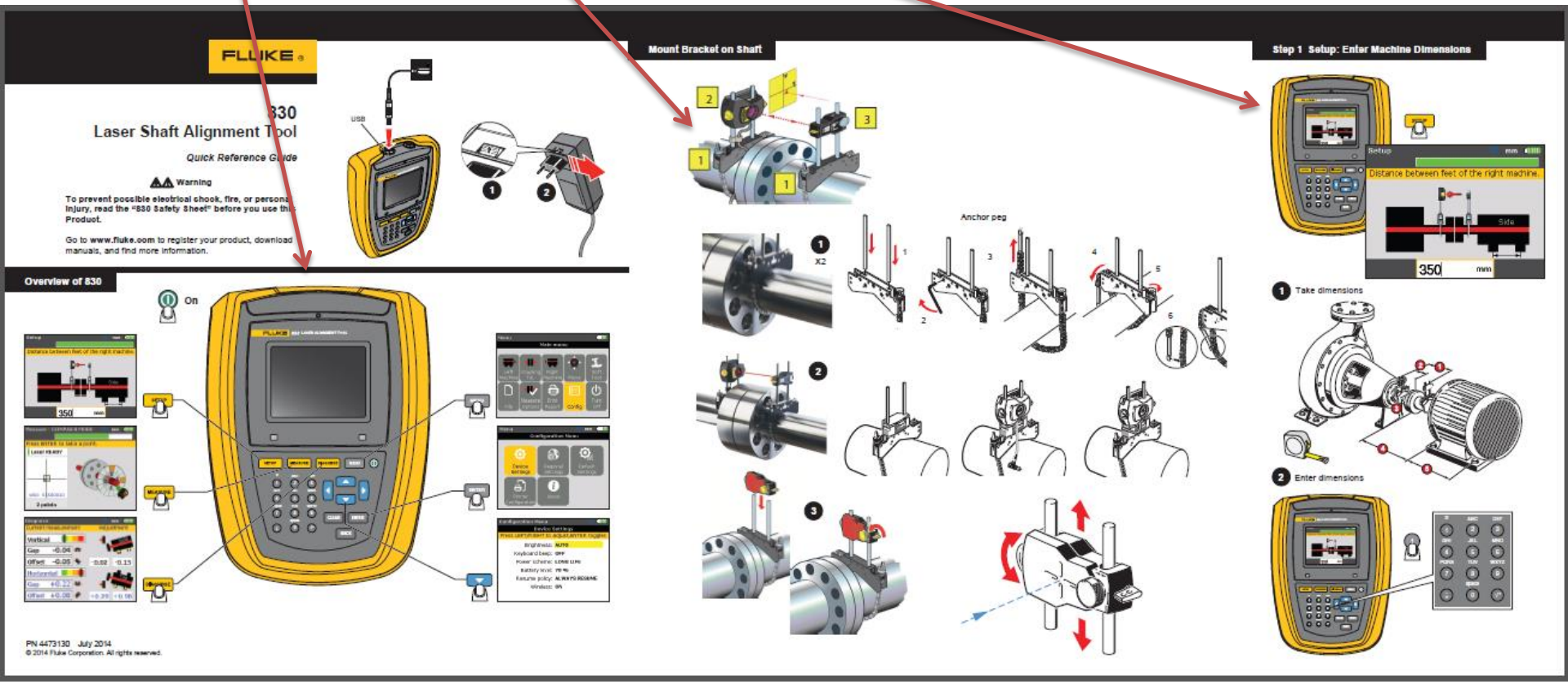
Overview of 830

Item	Element	Function
1	SETUP	The 'Setup' key opens the machine dimensions screen.
2	MEASURE	The 'Measure' key is used to start the measure process.
3	DIAGNOSE	The 'Diagnose' key is used to display measured and corrective alignment results.
4	LED (battery status/ wireless communication indicator)	Shows the battery and wireless communication statuses.
5	USB PC/printer port (grey)	The port is used to charge the Product, print and save measurement files, carry out firmware updates as well as display screen on a PC.
6	Ambient light sensor	Use to regulate the Product's display brightness.
7	Sensor port (blue)	The port is used to connect to Product when the wireless module is not available
8	LED (alignment condition and laser beam adjustment)	Used for laser beam adjustment and as a tolerance check for measured alignment condition.
9	MENU	The 'Menu' key is used to access the main menu which possesses the Product's useful functions.
10	⏻	The 'On' key is used to switch the Product on. The Product is switched off via the main menu item 'Turn off'.
11	▼ ▲ ▶ ▶	The navigation keys are used to navigate through the program steps.
12	ENTER	The 'Enter' key is used to confirm entered values and access any selected item.
13	BACK	The 'Back' key is used to return to previously selected screen.
14	CLEAR	The 'Clear' key is used to delete information entered inadvertently.
15	0 – 9, ., -/+	The data entry keys are used to enter machine dimensions and file name.

Quick, Easy, Step by step, Precision alignment

Quick Reference Guide – included with Fluke 830

Overview, Mount Brackets, Setup, Measure, Diagnose, Make Correction

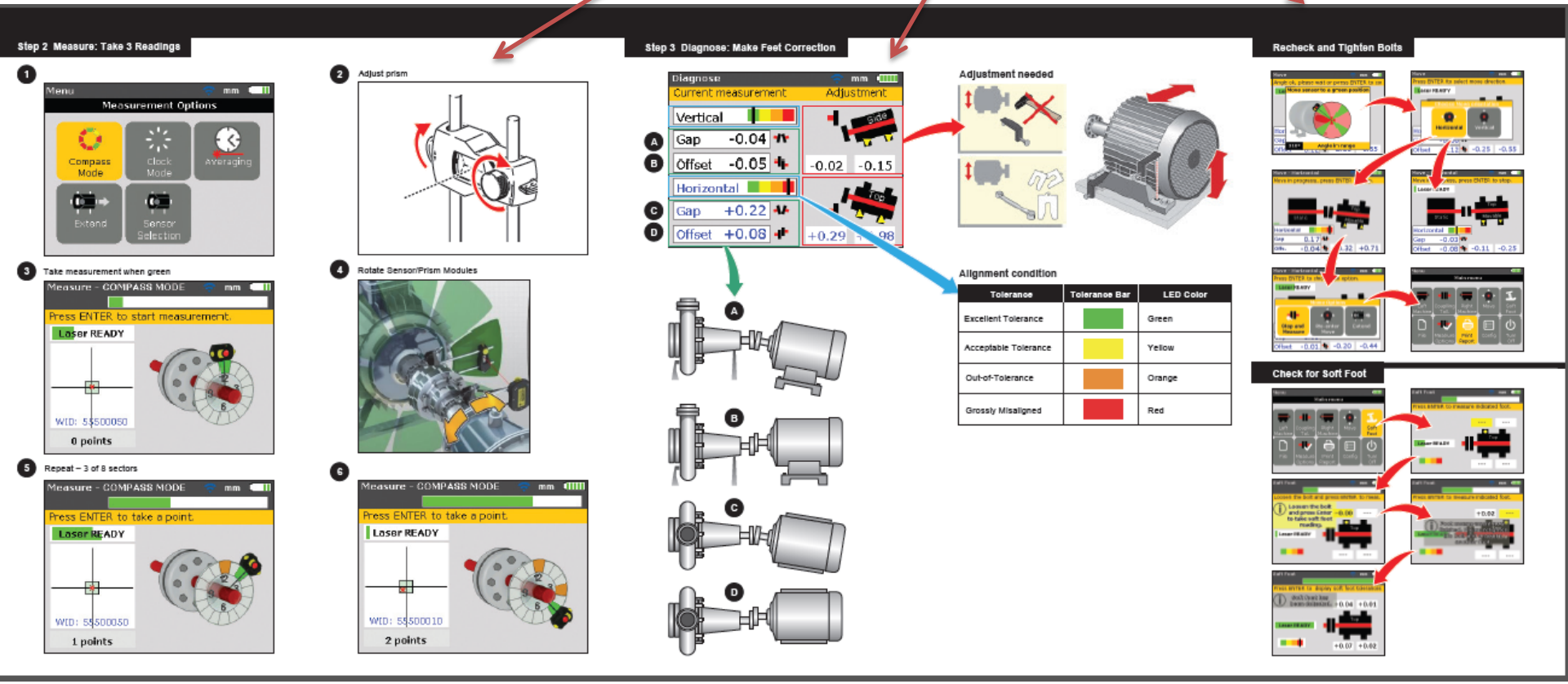


Quick, Easy, Step by step, Precision alignment

FLUKE®

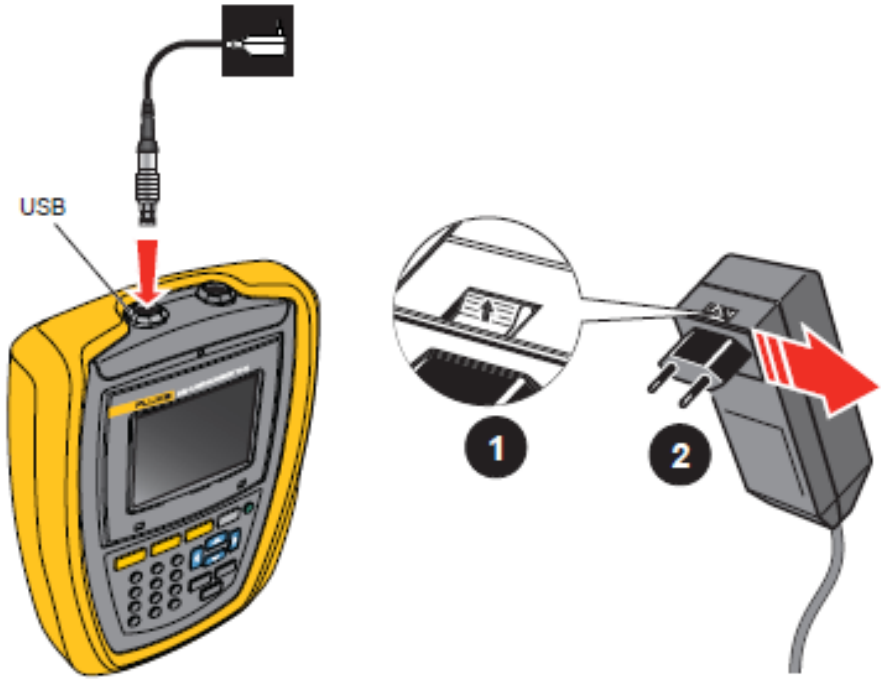
Quick Reference Guide – included with Fluke 830

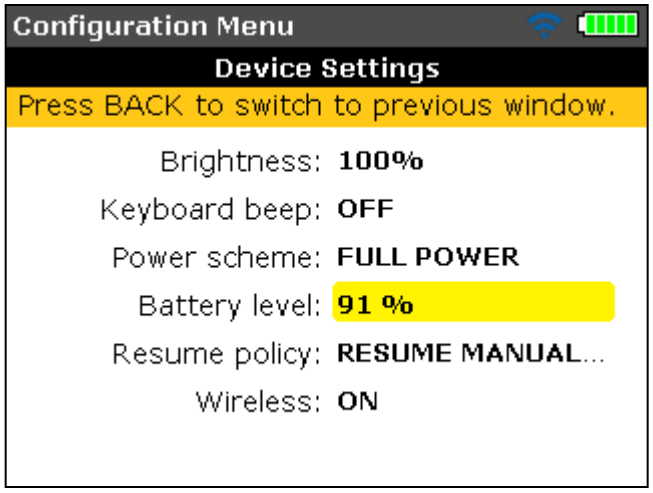
Overview, Mount Brackets, Setup, Measure, Diagnose, Make Correction



Overview of 830 - Quick Reference Guide

- Non-removable 7.4 V 2.6 Ah Lithium-ion polymer rechargeable battery, charged via USB port with adapter/charger
- Operation of up to 17 hours (33% active measurement, 33% computation, 33% ‘sleep’ mode)
- *Before charging, battery should be discharged as much as possible*
- *Charge the battery from 0% to 100% capacity takes approximately 4 hours*
- LED flashes green at initialization and during the charging process
- A constantly lit green LED denotes that the battery is fully charged.
- Charge level of the battery is displayed under the menu item ‘Device settings’





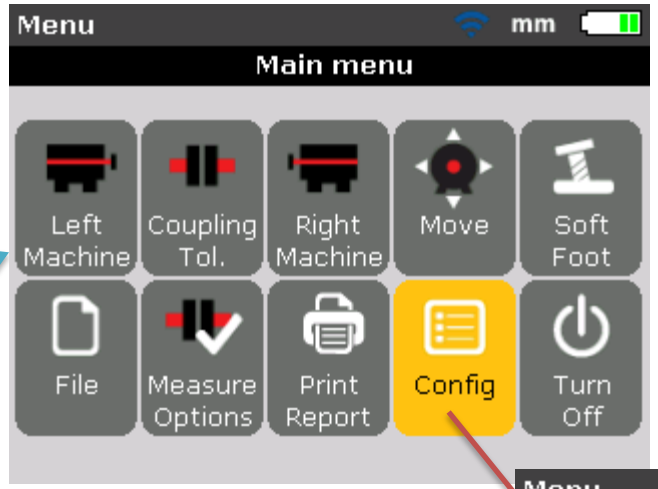
Overview of 830 - Quick Reference Guide

Overview of 830

Alignment tool – Main Menu

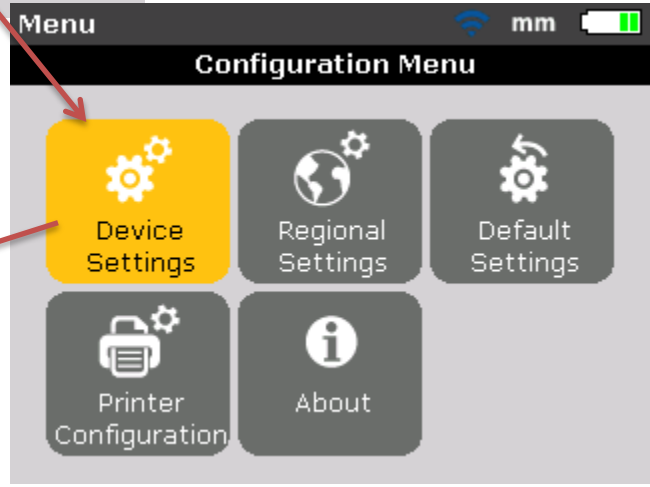
Press Menu

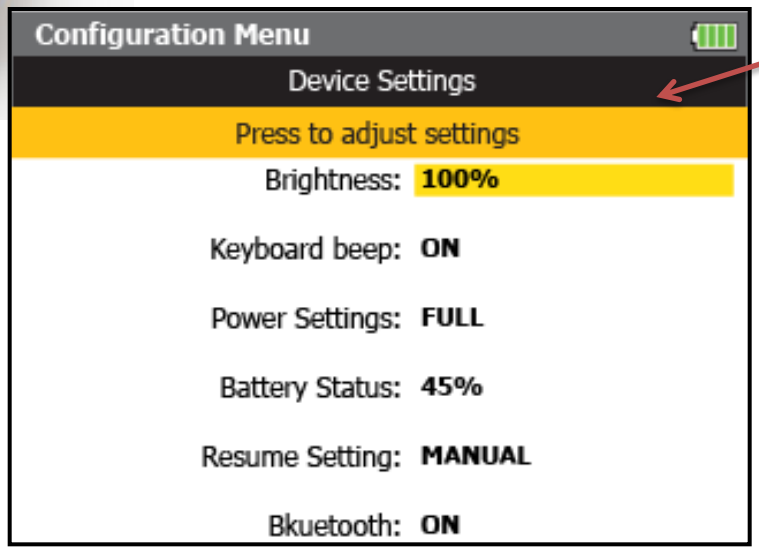
MENU



Press Enter

ENTER



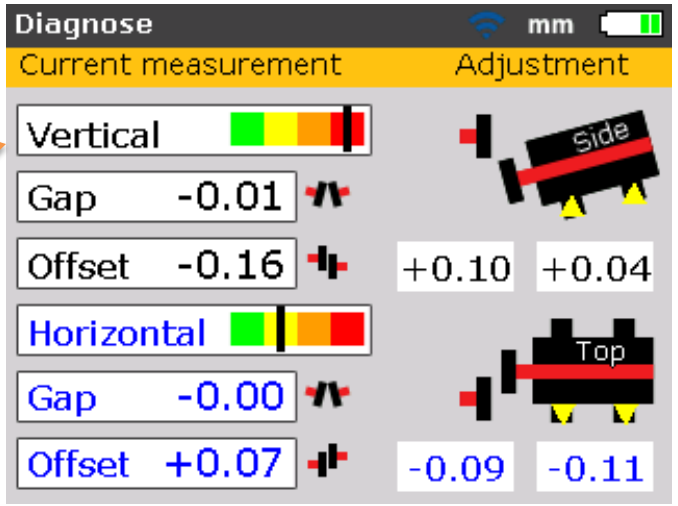


Press Down Arrow

Alignment tool

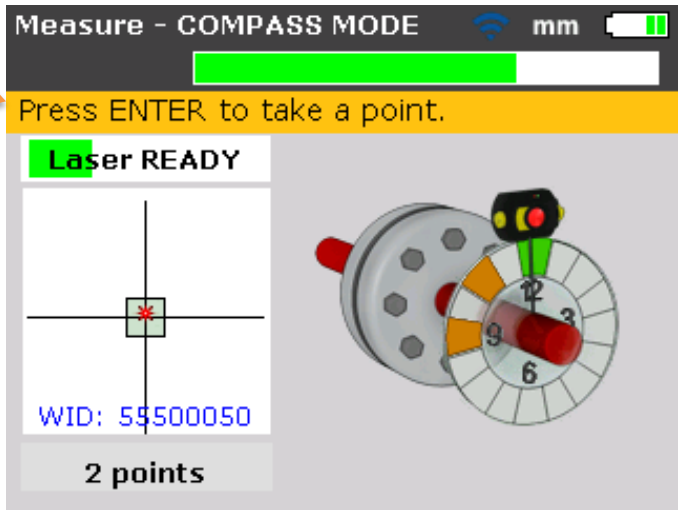
Step 3

DIAGNOSE



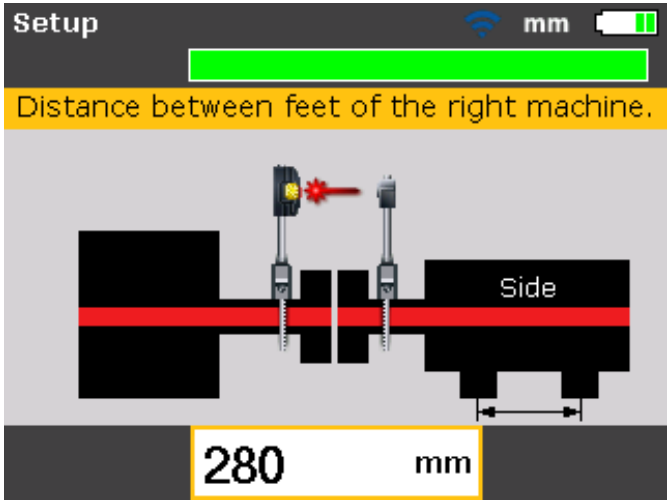
Step 2

MEASURE



Step 1

SETUP

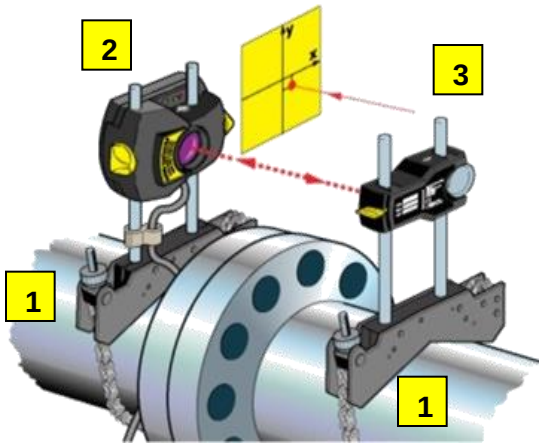


Fluke 830 – How to Use

Steps of Precision Alignment

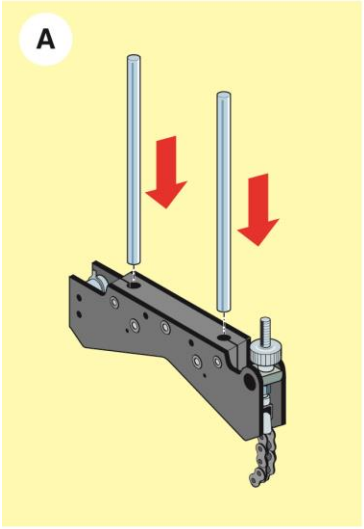
- ✓ Mount Brackets - preparation
- ✓ Setup – enter machine dimensions
- ✓ Measure – take 3 of 8 available positions
- ✓ Diagnose – alignment results, condition, feet adjustments
- ✓ Make Corrections – vertical, then horizontal, save & print

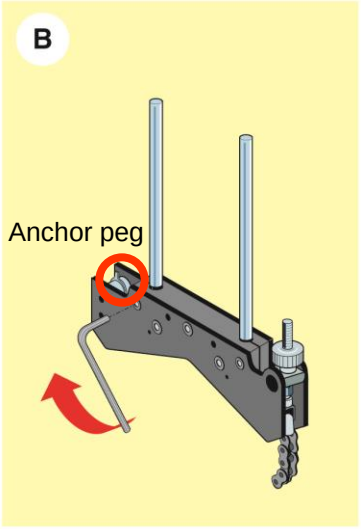
Mount brackets on shaft in preparation

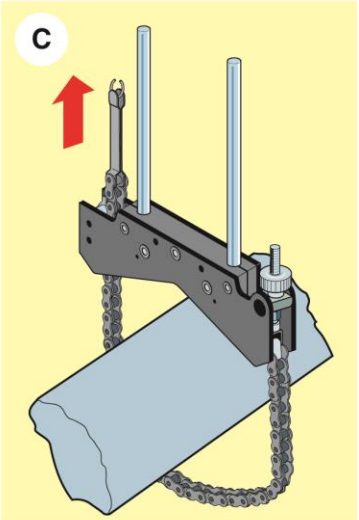


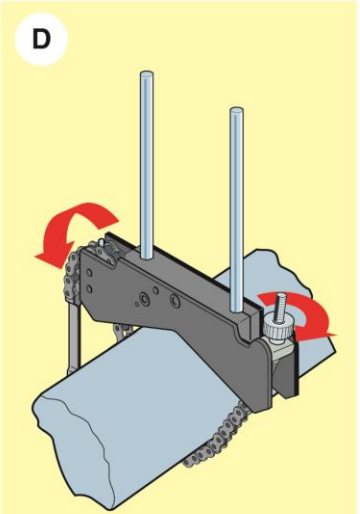
1. Mount brackets on both sides of the coupling tightly on shaft

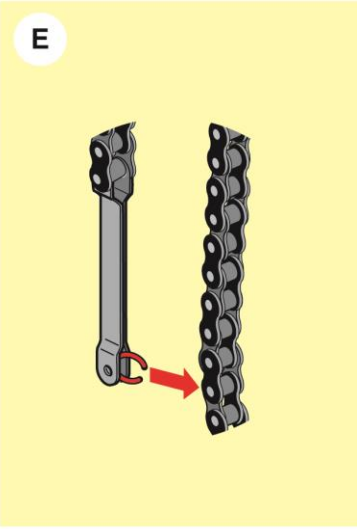
X2



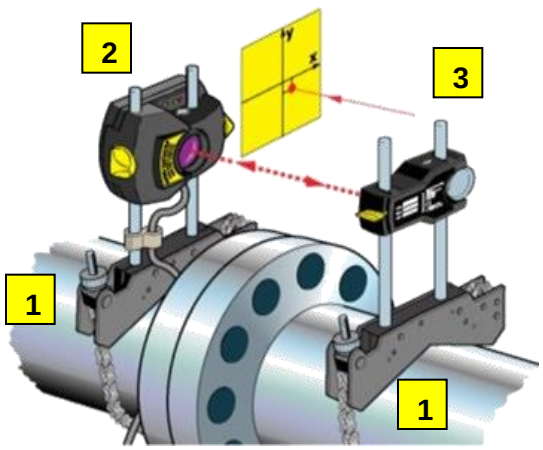




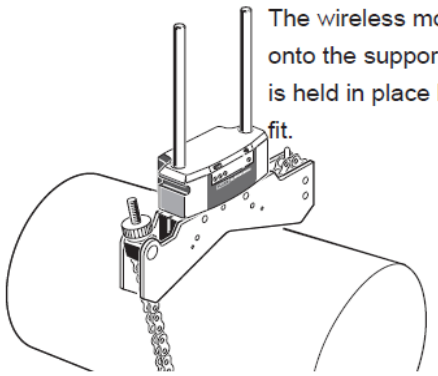


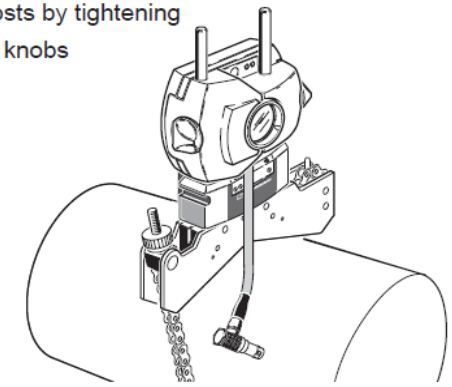


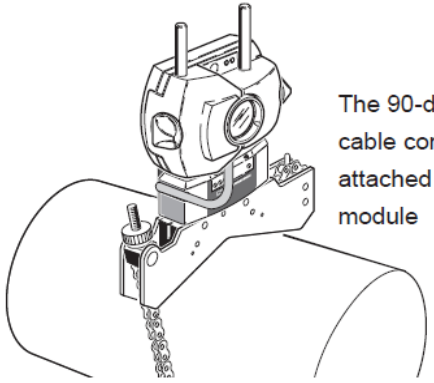
Slide wireless module and sensor on posts



2. Mount wireless module and sensor on “Left machine” – usually Stationary
- Mount as low as possible but high enough for beam to clear coupling flange





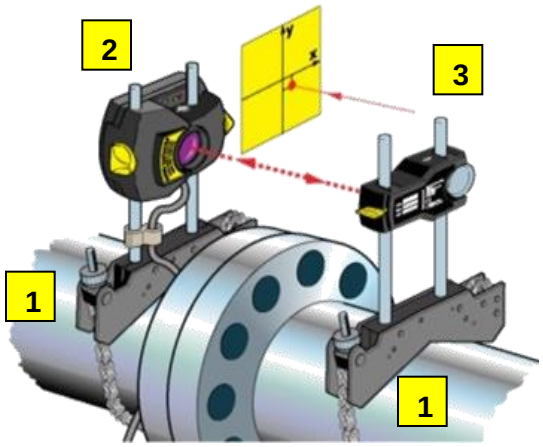


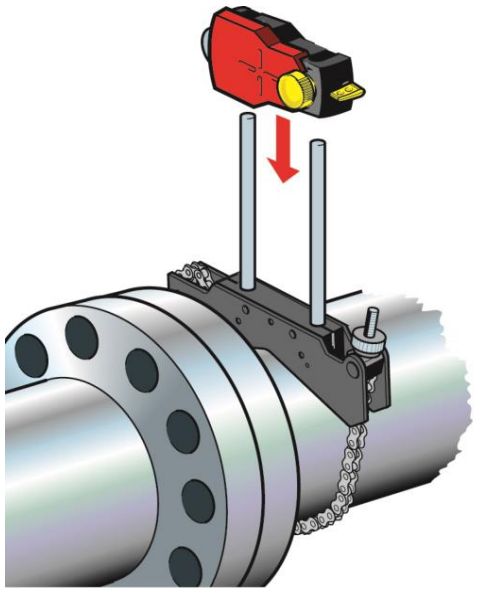
After connecting sensor to wireless module, switch on wireless module

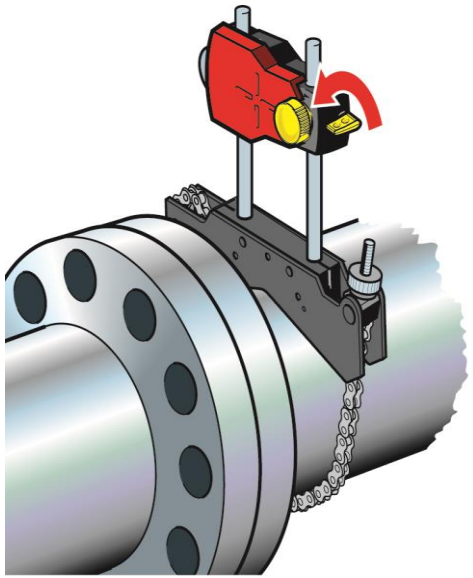
LEDs	Battery life
3 LEDs	75%–100%
2 LEDs	50%–75%
1 LED	25%–50%

Blinking slowly - under 25%
Blinking fast - critical phase
(2 x AA disposable batteries)

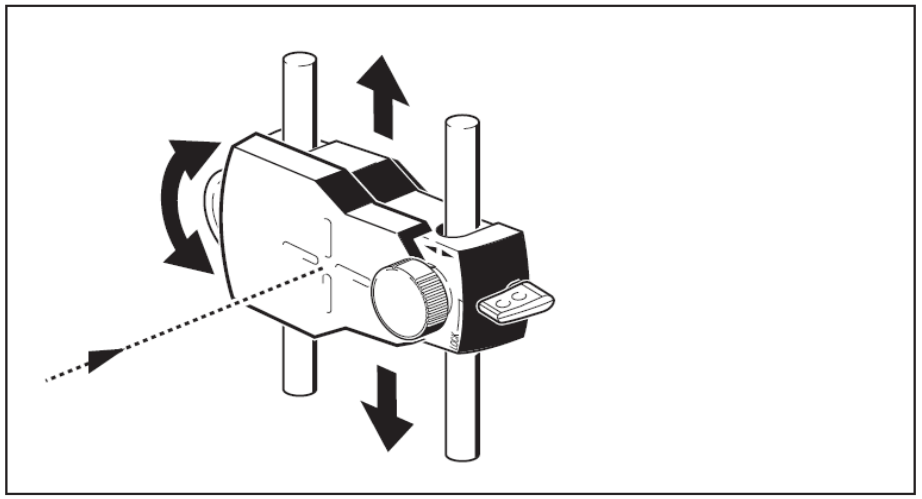
Slide prism on posts







3. Mount prism on “Right machine” the same height as sensor. Center the laser dot on the prism dust cap

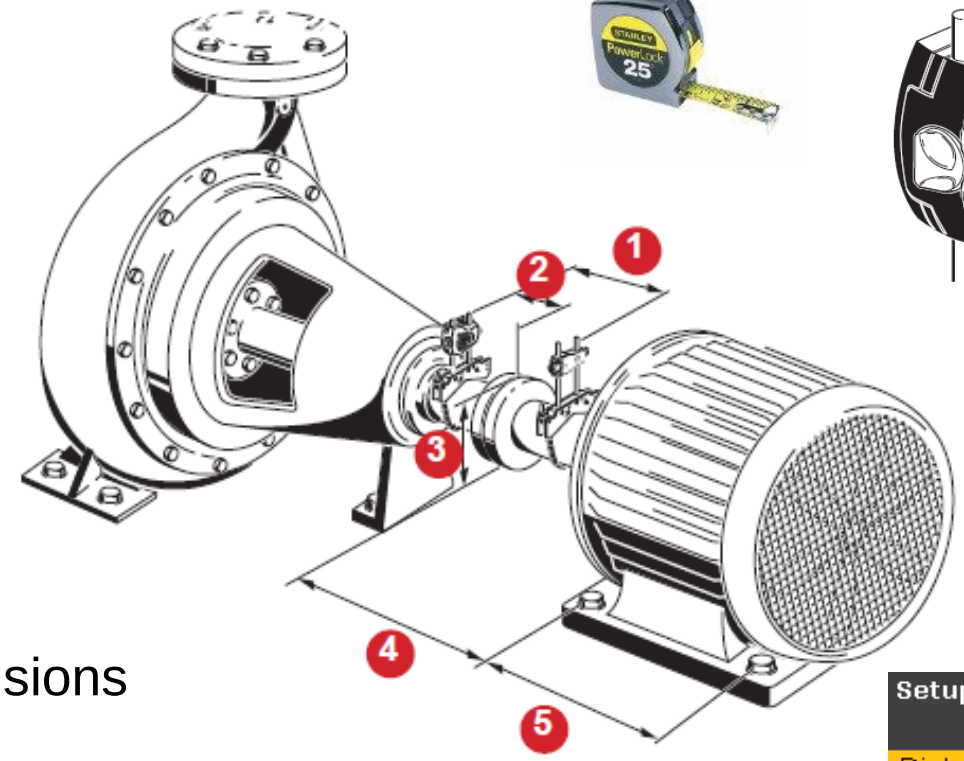


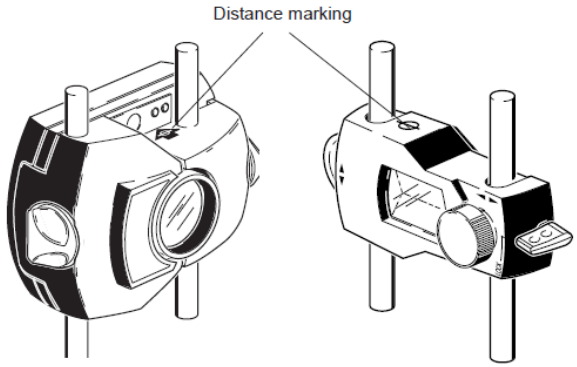
Step 1 - Setup Machine

1 SETUP

FLUKE

Press Setup SETUP



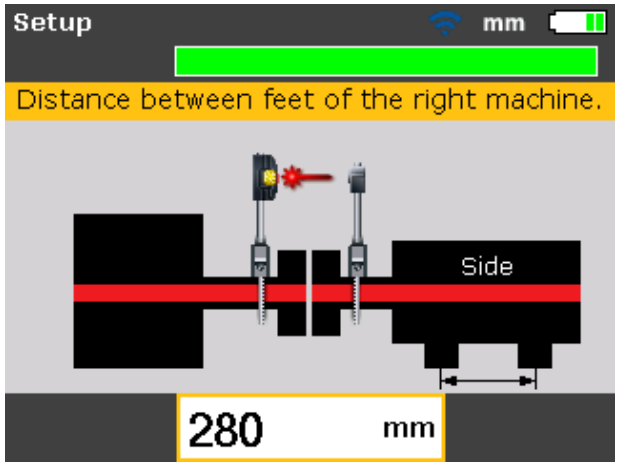


1 Measure machine dimensions

1. Sensor to prism
2. Sensor to center of coupling
3. Coupling diameter (default is 100 mm / 10”) RPM
4. Center of coupling to front foot (right machine)
5. Front foot to back foot (right machine)

After the last required dimension has been entered, the measurement screen appears.

2 Enter dimensions Step by step



Step 2 - Measure Machine

2 MEASURE

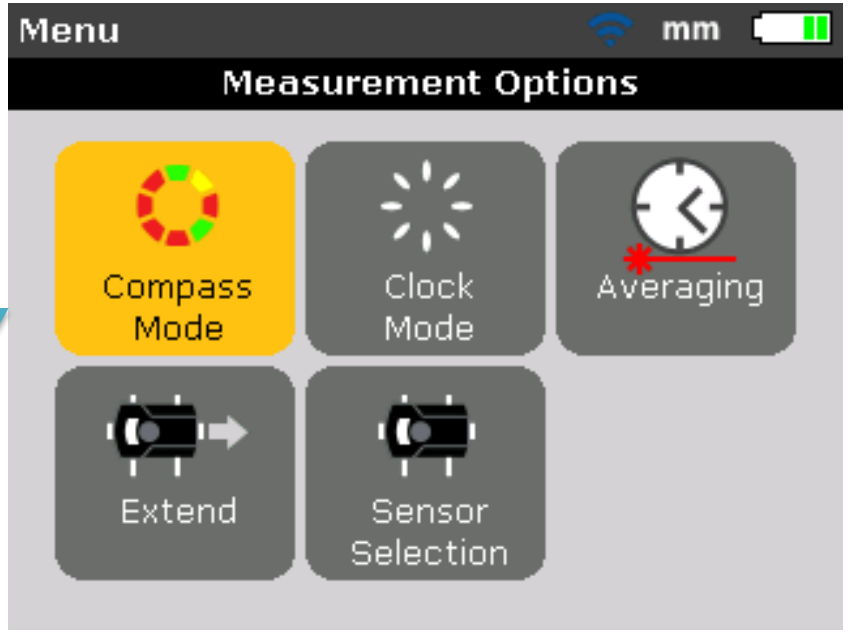
FLUKE

1 MEASURE

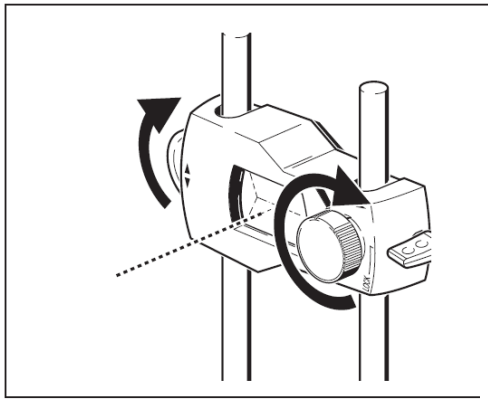
Press Measure

OR MENU

Press Menu and select Compass Mode

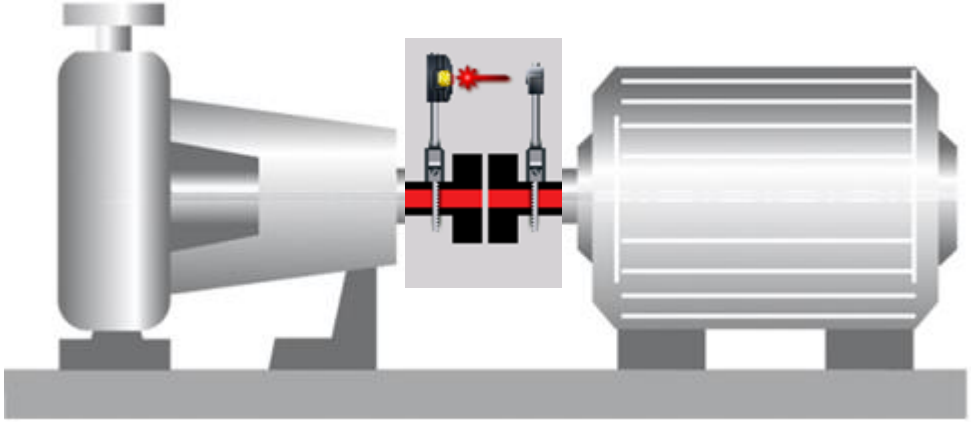


Horizontal = Compass Mode; Vertical = Clock Mode



2

Adjust prism – center reflected laser beam using thumbwheel and adjustment knob



Step 2 - Measure Machine

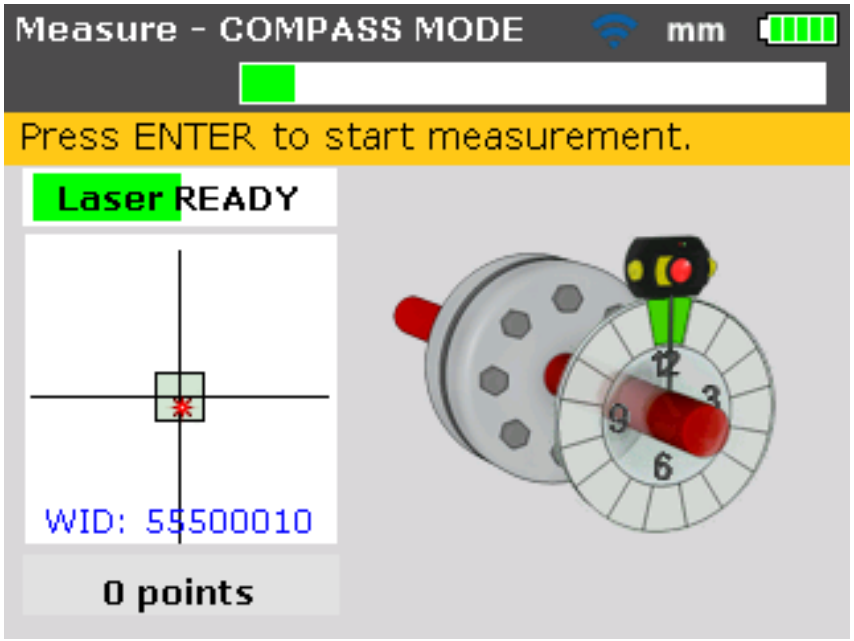
2 MEASURE

FLUKE

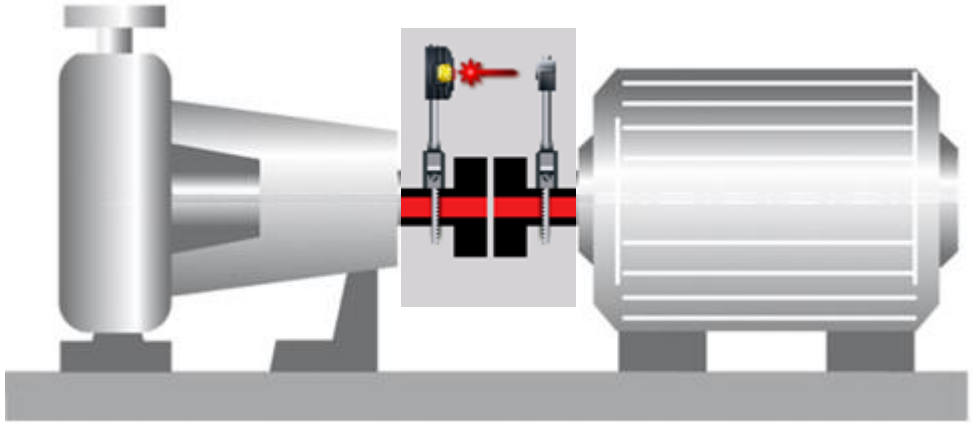
3 Rotate shaft to first measurement position. Take measurement when sector turns green.

Notes:

- *Always turn shafts in normal rotation direction of machine*
- *Don't touch mounted components*



4 Rotate shaft to another sector



Inclinometer automatically determines angle on shaft

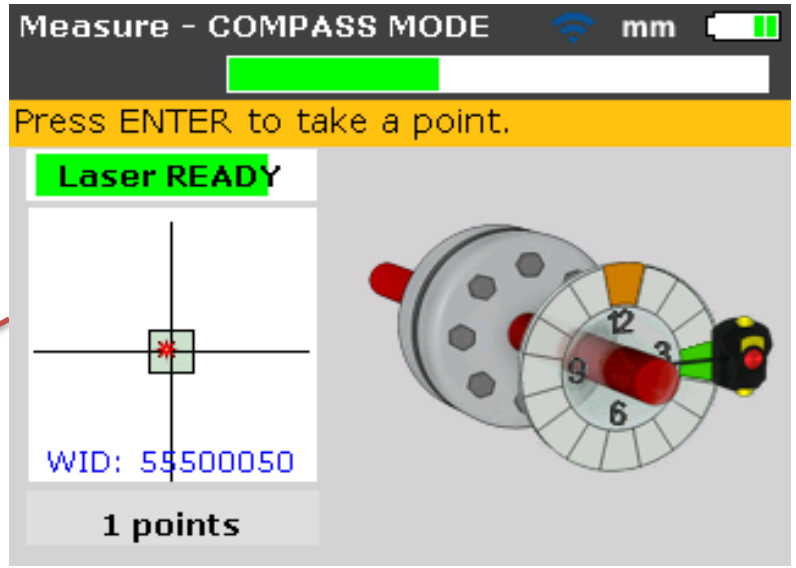
Step 2 - Measure Machine

2 MEASURE

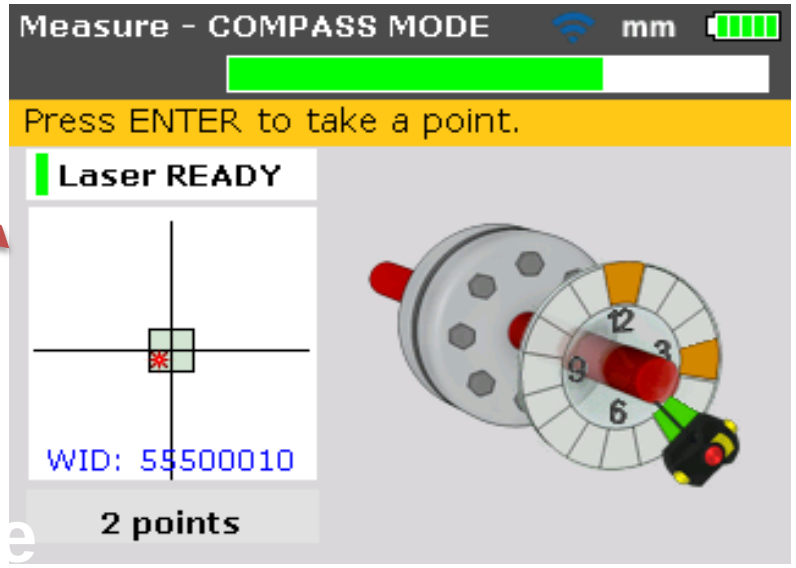
FLUKE

Measure from any 3 of 8 available positions

- ✓ **Measure -1**
- ✓ **Rotate to another sector**
- ✓ **Measure - 2**
- ✓ **Rotate to another sector**
- ✓ **Measure - 3**



5 Take measurement #2 when sector turns green – turns orange when measurement is complete



6 Take measurement #3 when sector turns green

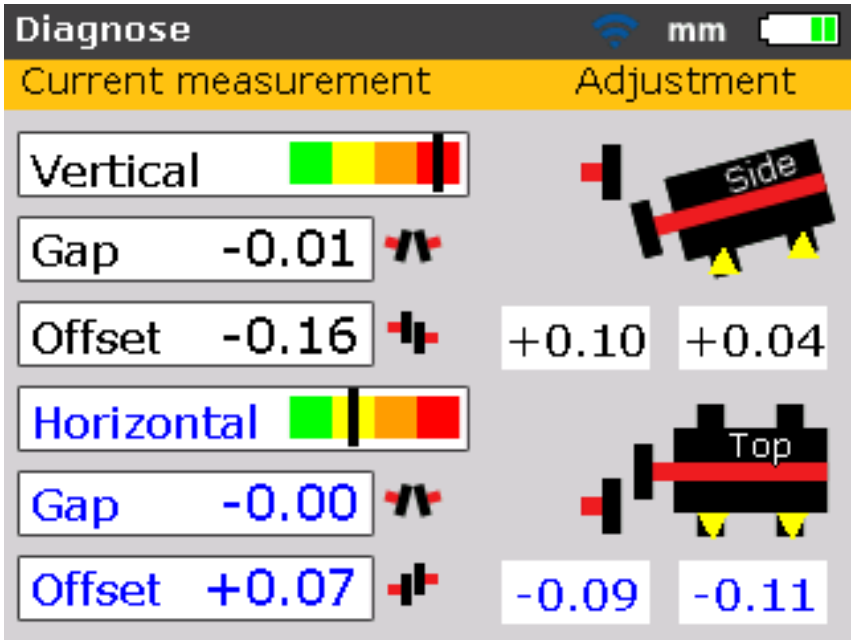
Step 3 – Diagnose Faults

3 DIAGNOSE

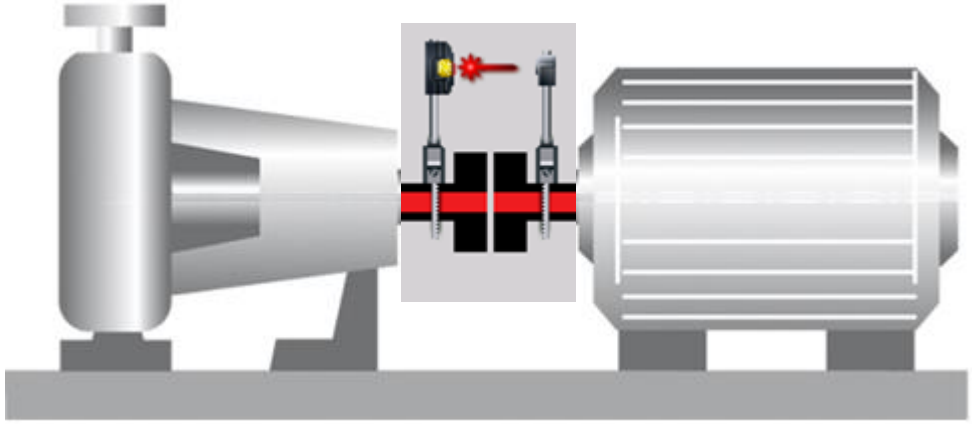
FLUKE

Press Diagnose

DIAGNOSE



Alignment results with coupling values, condition and foot adjustment in both vertical and horizontal directions are displayed automatically

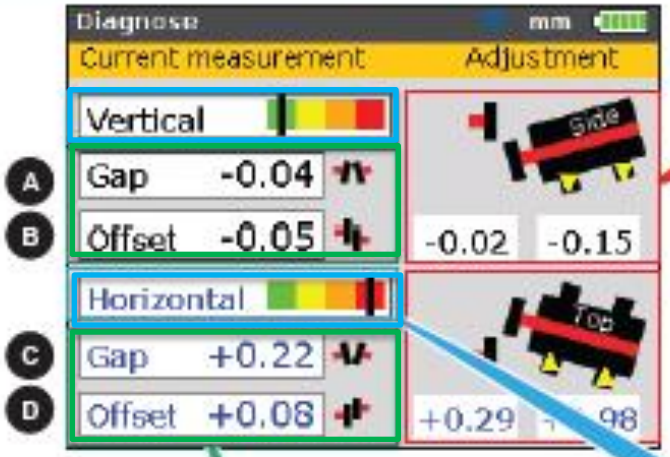


Step 3 – Diagnose Faults

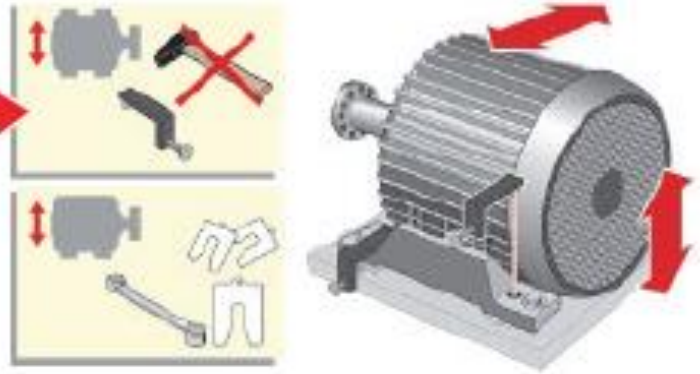
3 DIAGNOSE

FLUKE

“All-In-One” screen

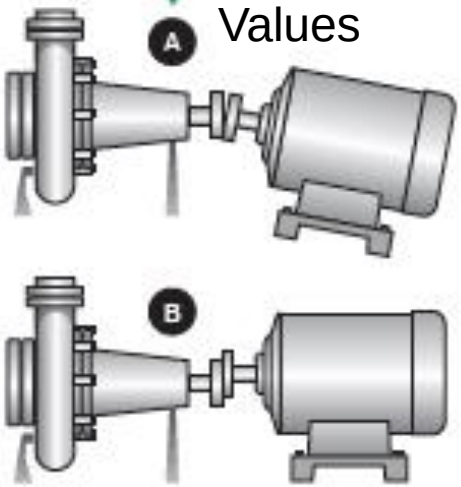


3. Corrections Needed



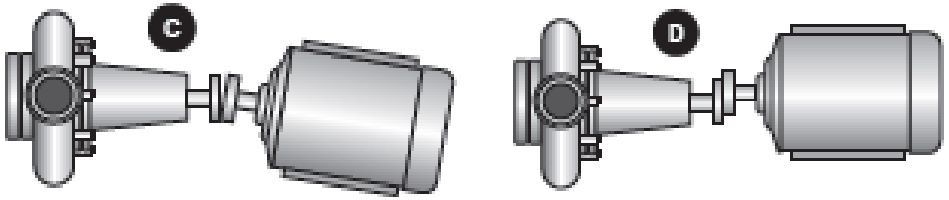
Align machine - move it vertically by shimming feet - horizontally by shifting it sideways

1. Misalignment Values

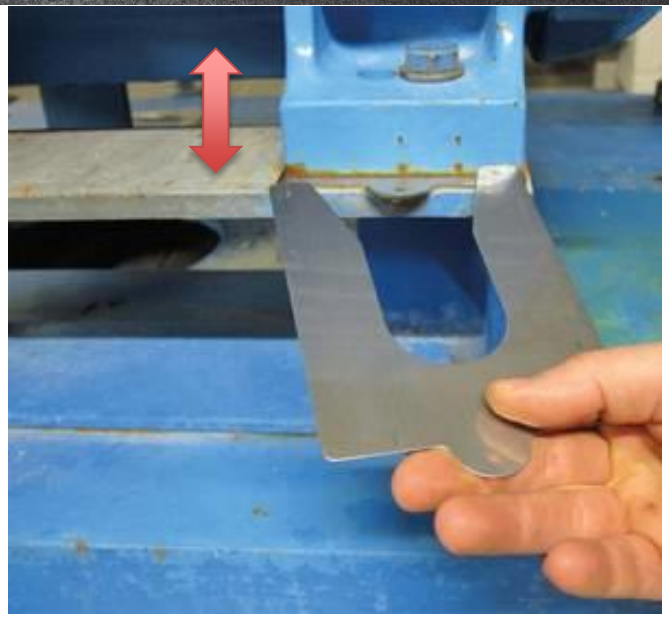


2. Alignment Condition

Tolerance	Tolerance Bar	LED Color
Excellent Tolerance		Green
Acceptable Tolerance		Yellow
Out-of-Tolerance		Orange
Grossly Misaligned		Red



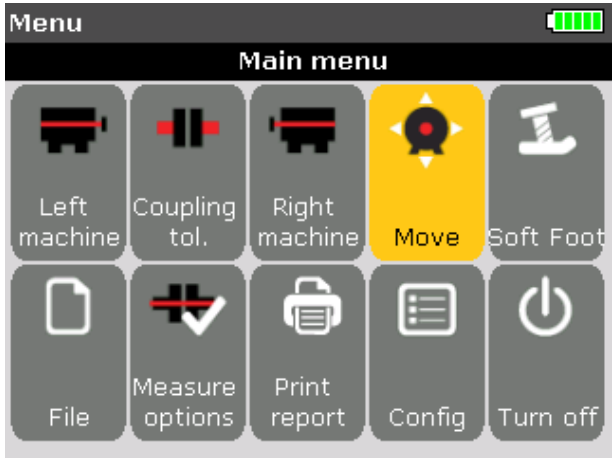
Make vertical corrections



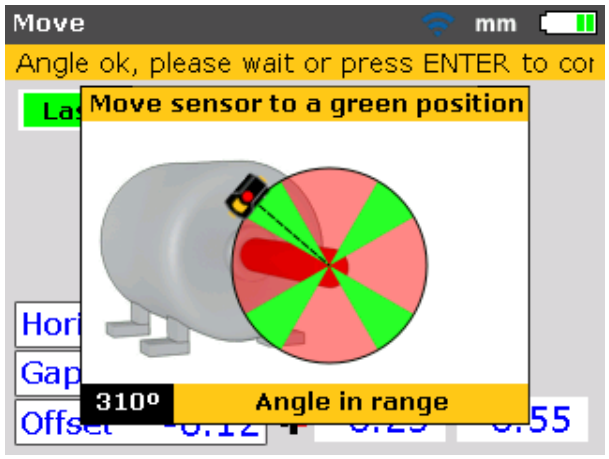
Once alignment condition is found, a correction is recommended:

- Loosen bolts and shim **first** for vertical correction
- Jack up machine and insert or remove shims of known thicknesses
- Use vertical foot correction values to shim BOTH front and back feet
- Positive foot correction values suggest addition of shims
- Negative feet correction values indicate feet are high and remove shims
- Retighten bolts and Re-measure - Use Horizontal live Mode

Make horizontal corrections

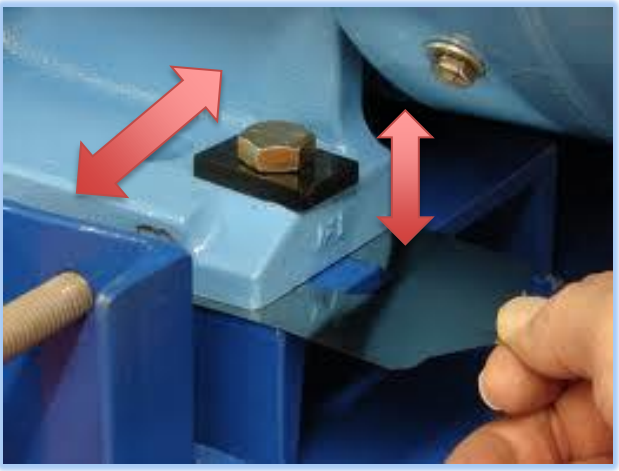


Select ‘Move’ icon

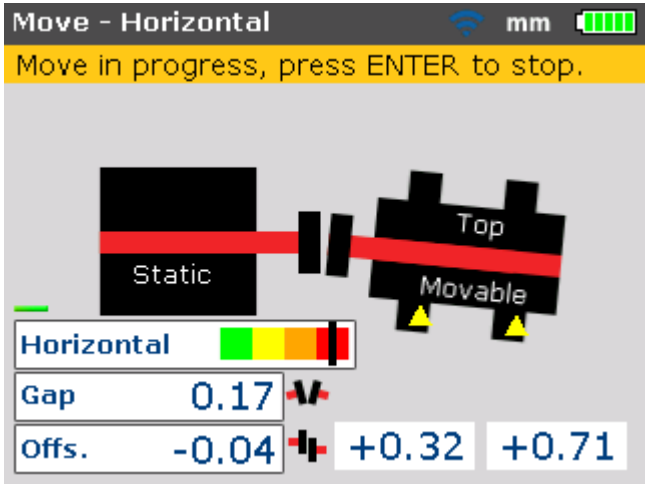


Rotate shaft to any 45° position

Select “Horizontal”



Shim for “Vertical”
Jack for “Horizontal”

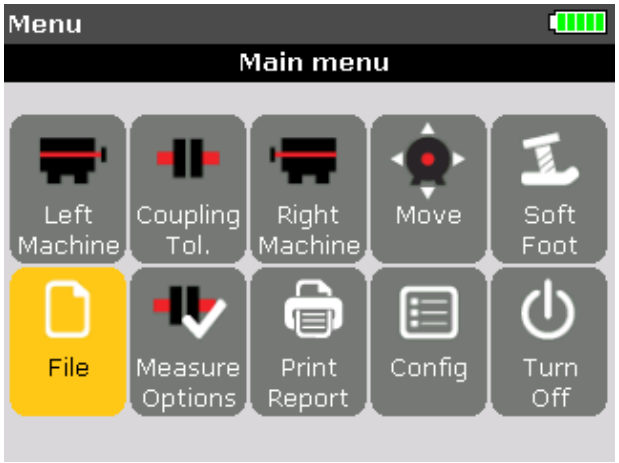


Loosen bolts and move machine in direction of yellow triangles

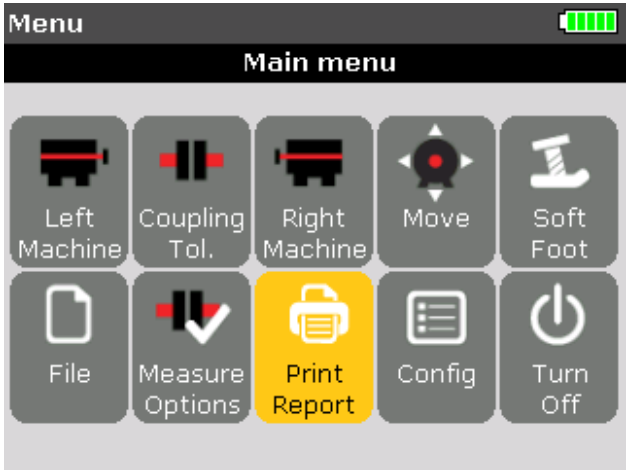
Watch color-coded tolerance bar.
When green or yellow, tighten feet anchor bolts.

Recheck alignment

Recheck alignment



Save data



Print report to document work

Finally

Switch 830 off, remove components from shafts, and store them in case

Poor repeatability? Possible causes:

- Incorrect or loose bracket mounting; Mounted components move during rotation
- Significant shaft bearing play or coupling backlash
- Soft foot can cause positioning errors that make repeat measurement necessary
- Loose anchor bolts; Uneven shaft rotation; Vibration
- Yellow knobs on sensor loose, or prism not locked into horizontal position
- Sensor is mounted incorrectly or upside down
- Temperature change: machine recently shut down

Fluke 830 – How to Use

Other Steps

- ✓Soft Foot – check before alignment
- ✓Tolerance Table – know when to stop
- ✓Save File
- ✓Report – print “as found” and “as left”
- ✓Extend Sensor Range for gross misalignment
- ✓Switch Machine Setup – Left or Right machine
- ✓Clock Mode – uncoupled, nonrotating, or vertical shafts
- ✓Averaging
- ✓Settings – Device, Regional, Printer, About
- ✓Sensor selection & Laser beam adjustment

Check Soft Foot before alignment

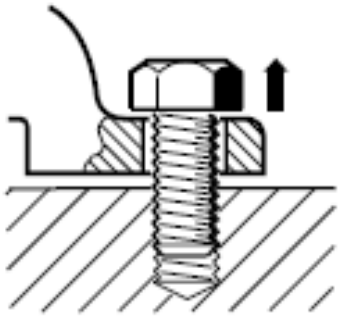
Any cause that results in machine frame distortion when machine is anchored to its foundation is a soft foot. Some of the principal causes are:

- Non-coplanar machine mounting surfaces
- Deformed machine frame or feet
- External forces from connecting piping or brackets
- Improper shimming or soiled machine feet
- Too many shims under a machine foot (maximum of 4 shims)

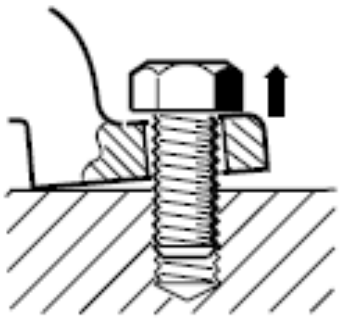
Forcibly tightening down feet deforms machine frame, causes bent shaft and distorts bearings.

Soft foot should be checked before aligning the shafts.

- Calculate how much each foot has moved as bolt is loosened.
- Results are interpreted and translated into shim thicknesses to be placed under the feet.

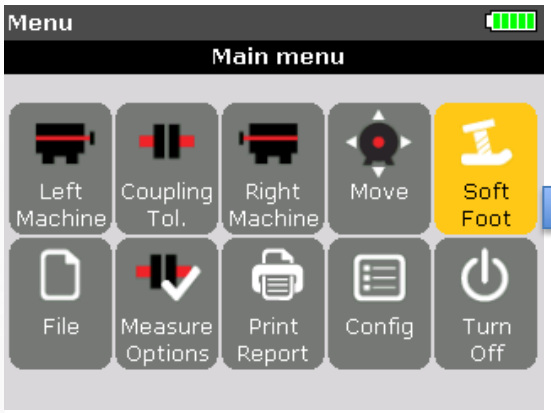


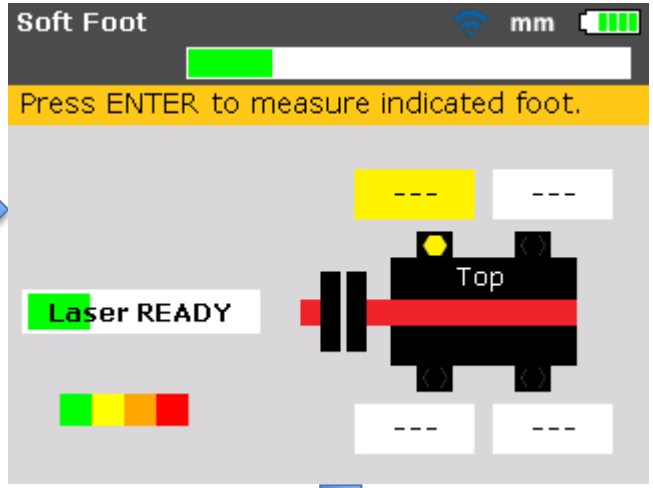
Parallel soft foot



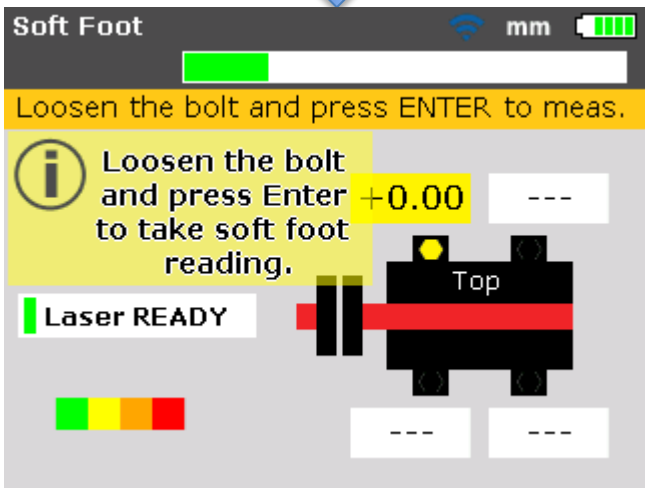
Angular soft foot

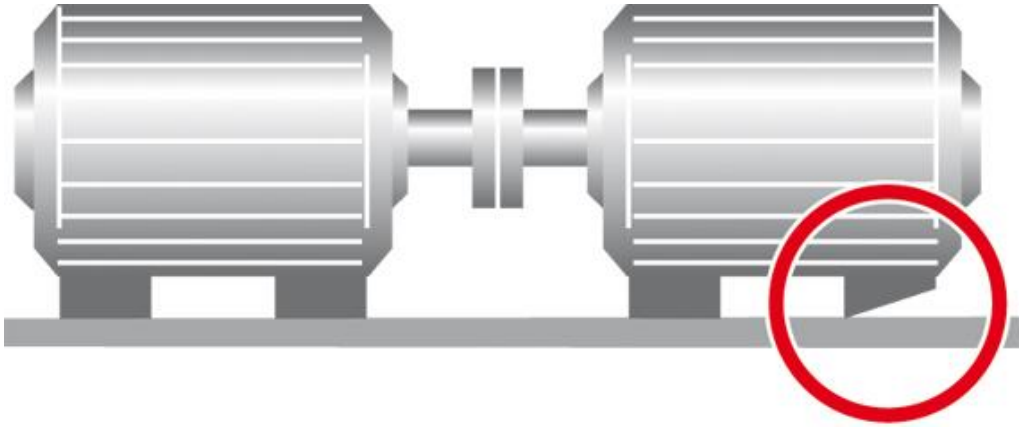
Soft Foot check





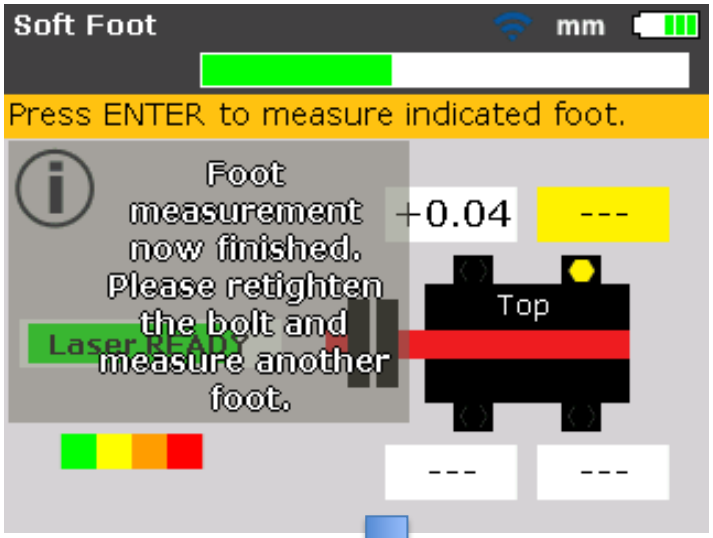
Loosen one motor anchor bolt and take a measurement

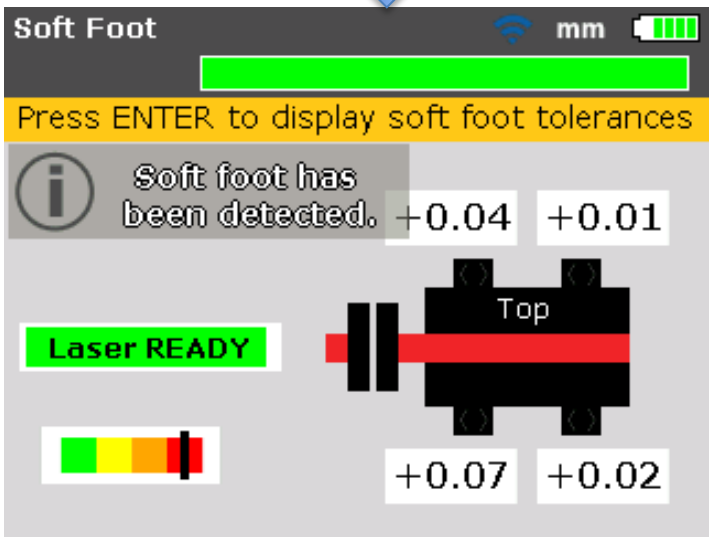




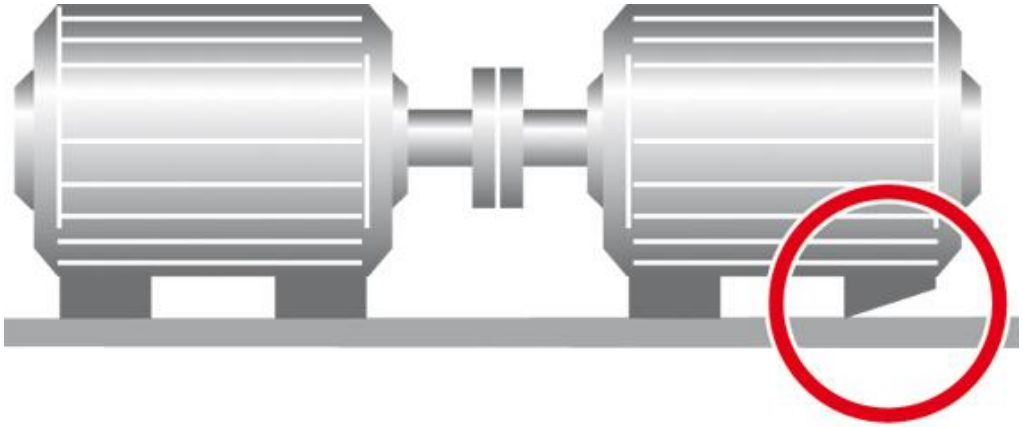
Soft Foot check

- Retighten each motor anchor bolt and measure another foot.
- Repeat procedure for each foot.
- Color-coded tolerance bar shows value of the measured soft foot.
- Shimming corrections are necessary





Soft Foot tolerance = 0.06 mm (0.002 inch)



Tolerance Table

Excellent – perfectly aligned

Acceptable – still within tolerance

Out of tolerance

Grossly misaligned

Tolerance table mm

Press ENTER to disable tolerances.

Diameter: 100 mm **Enabled**

RPM	Acceptable	Excellent
750	Gap: 0.13 Offset: 0.19	Gap: 0.09 Offset: 0.09
1500	Gap: 0.07 Offset: 0.09	Gap: 0.05 Offset: 0.06
3000	Gap: 0.04 Offset: 0.06	Gap: 0.03 Offset: 0.03
6000	Gap: 0.03 Offset: 0.03	Gap: 0.02 Offset: 0.02

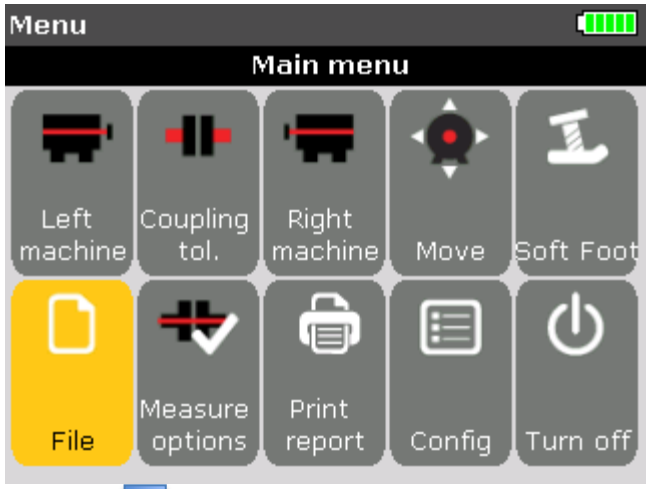
	[RPM]	metric [mm]		inch [mils]	
Soft foot	any	0.06 mm		2.0 mils	
Short "flexible" couplings Offset		Acceptable	Excellent	Acceptable	Excellent
	600			9.0	5.0
	750	0.19	0.09		
	900			6.0	3.0
	1200			4.0	2.5
	1500	0.09	0.06		
	1800			3.0	2.0
	3000	0.06	0.03		
	3600			1.5	1.0
	6000	0.03	0.02		
	7200			1.0	0.5
Angularity coupling gap difference per 100 mm or 10" diameter	600			15.0	10.0
	750	0.13	0.09		
	900			10.0	7.0
	1200			8.0	5.0
	1500	0.07	0.05		
	1800			5.0	3.0
	3000	0.04	0.03		
	3600			3.0	2.0
	6000	0.03	0.02		
	7200			2.0	1.0

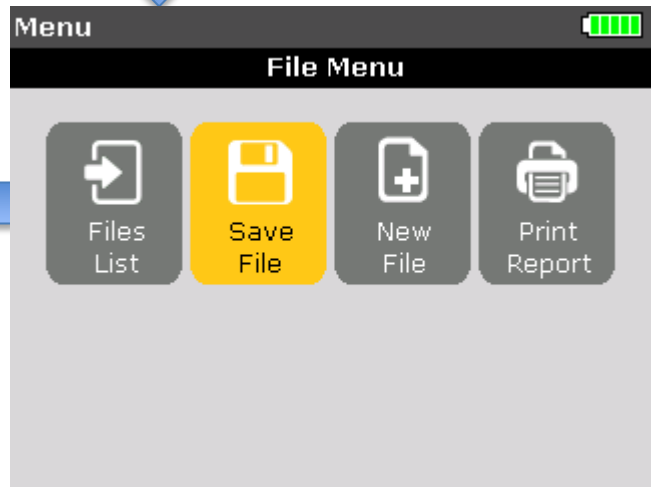
Save File

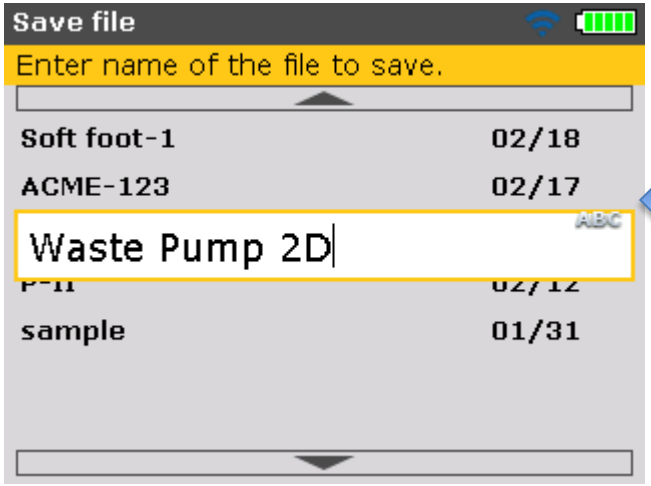
Save machines

200 Files

- Dimensions
- Measurements
- Diagnosis
- Settings

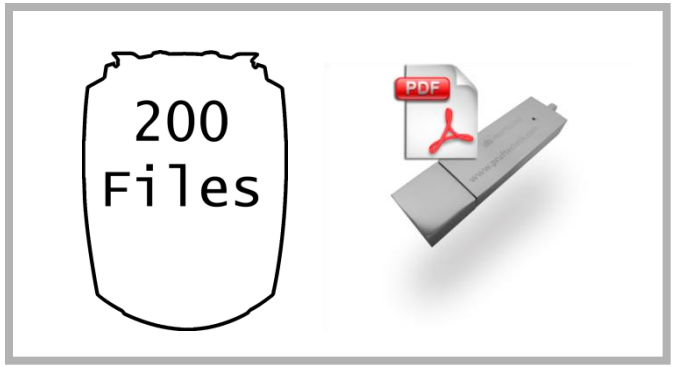






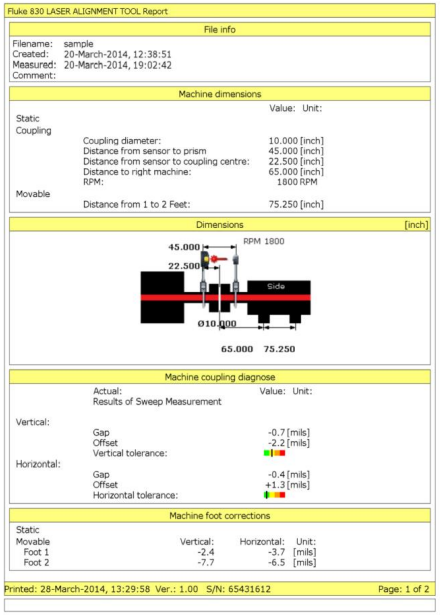
Print Report – Save PDF Report to USB stick

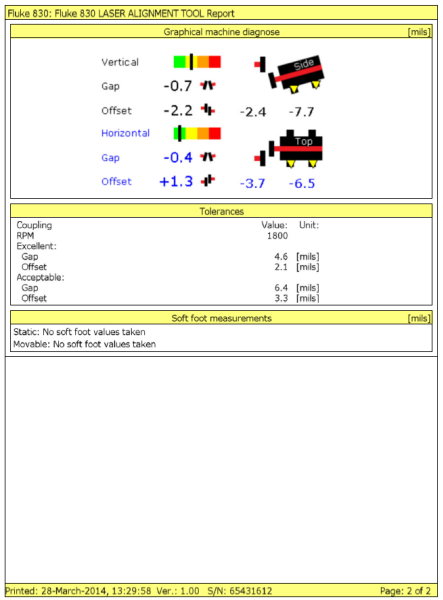
File management

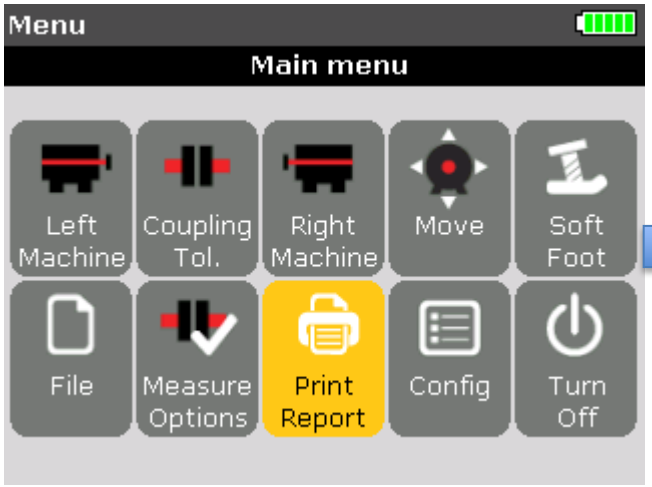


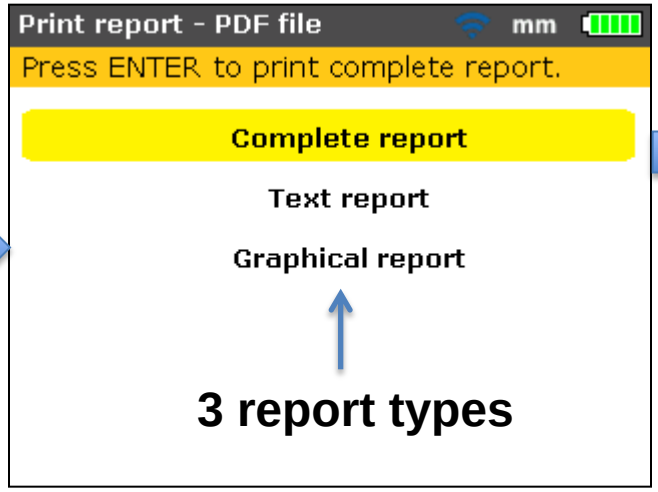
Save PDF to USB drive

- Copy PDF to PC to print
- Save to PDF on PC for history









Also print to printer - Need printer USB cable

Document work with PDF Reports

Fluke 830 LASER ALIGNMENT TOOL Report

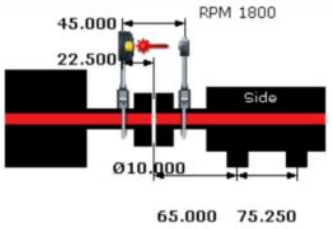
File info

Filename: sample
Created: 20-March-2014, 12:38:51
Measured: 20-March-2014, 19:02:42
Comment:

Machine dimensions

		Value:	Unit:
Static			
Coupling			
	Coupling diameter:	10.000	[inch]
	Distance from sensor to prism	45.000	[inch]
	Distance from sensor to coupling centre:	22.500	[inch]
	Distance to right machine:	65.000	[inch]
	RPM:	1800	RPM
Movable			
	Distance from 1 to 2 Feet:	75.250	[inch]

Dimensions [inch]



Machine coupling diagnose

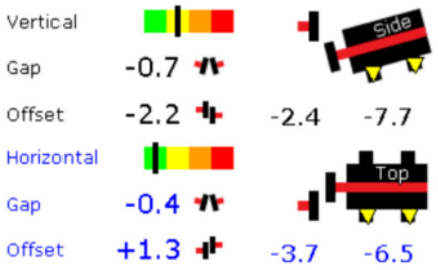
	Actual: Results of Sweep Measurement	Value:	Unit:
Vertical:			
	Gap	-0.7	[mils]
	Offset	-2.2	[mils]
	Vertical tolerance:		
Horizontal:			
	Gap	-0.4	[mils]
	Offset	+1.3	[mils]
	Horizontal tolerance:		

Machine foot corrections

	Vertical:	Horizontal:	Unit:
Static			
Movable			
Foot 1	-2.4	-3.7	[mils]
Foot 2	-7.7	-6.5	[mils]

Fluke 830: Fluke 830 LASER ALIGNMENT TOOL Report

Graphical machine diagnose [mils]



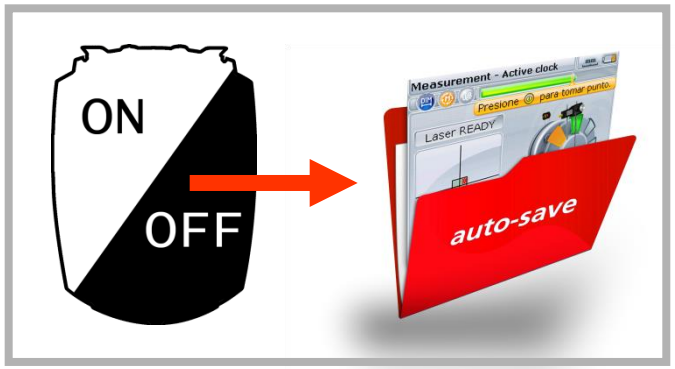
Tolerances

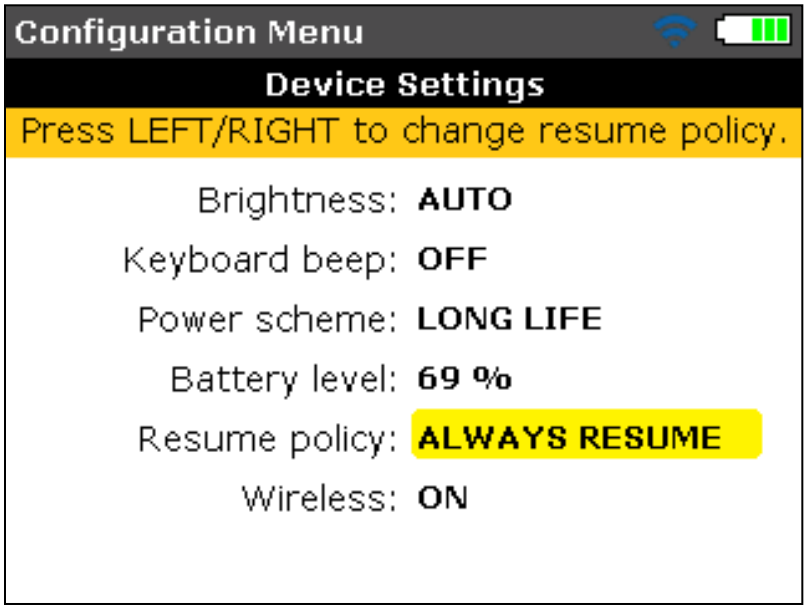
	Value:	Unit:
Coupling		
RPM	1800	
Excellent:		
Gap	4.6	[mils]
Offset	2.1	[mils]
Acceptable:		
Gap	6.4	[mils]
Offset	3.3	[mils]

Soft foot measurements [mils]

Static: No soft foot values taken
Movable: No soft foot values taken

Data protection

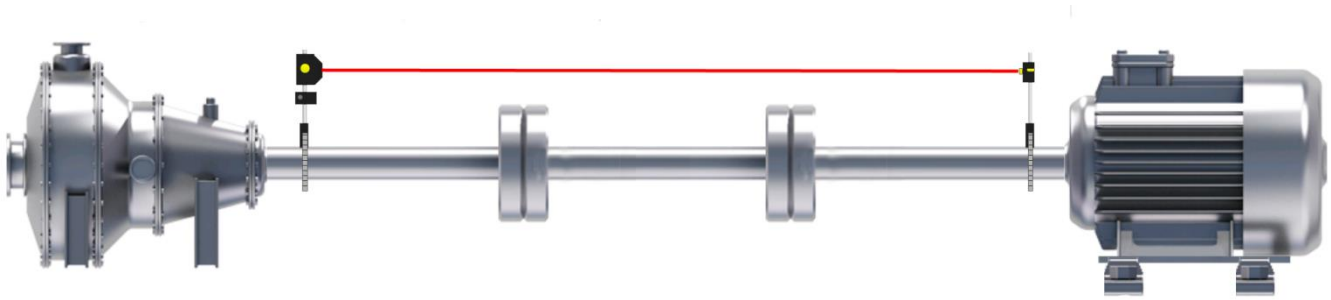




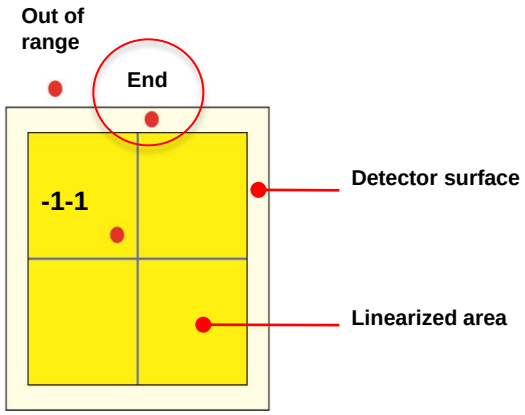
1. Press Menu and choose device settings
2. Change Resume Setting to Always Resume
3. It allows you to open the last used measurement file

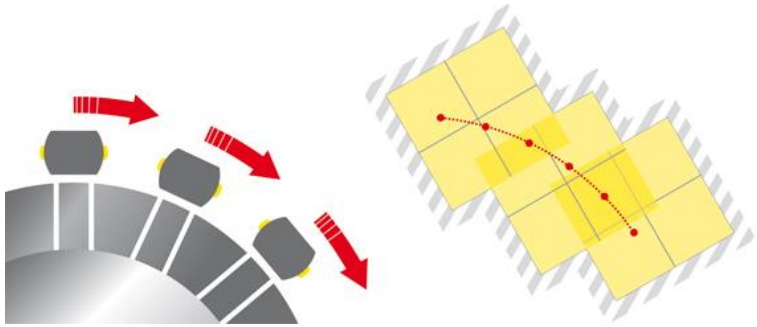
Measurement options – Extend

Extend Detector Range



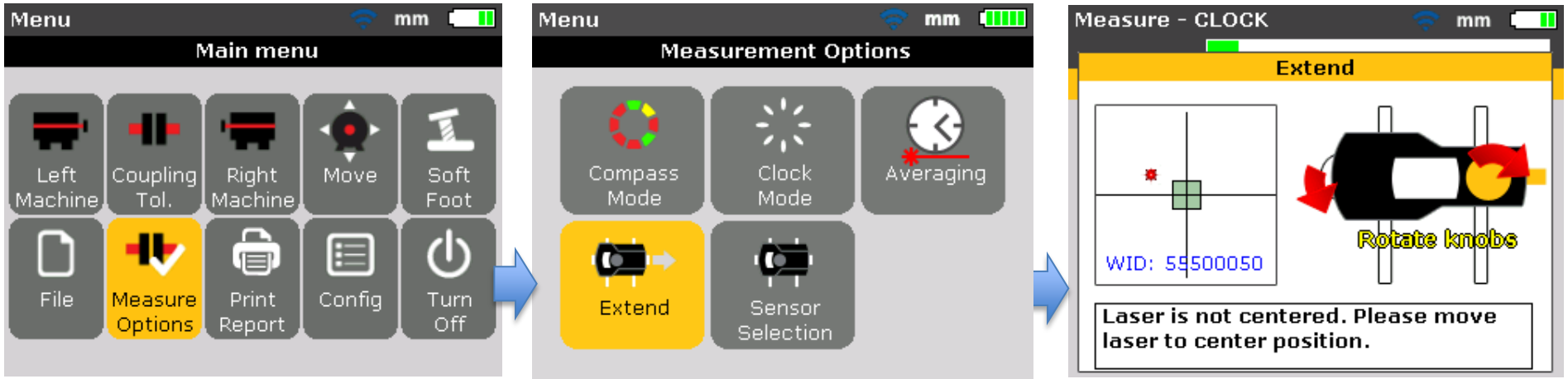
- Gross misalignment of shafts or angular misalignment over large distances can cause the laser beam to miss the detector surface during measurement.
- When this happens, ‘Laser End’ appears on the display screen and the ‘Extend’ function can be used.
- Shaft should be rotated backwards until the laser beam re-enters the measurement range and then the Extend function can be started



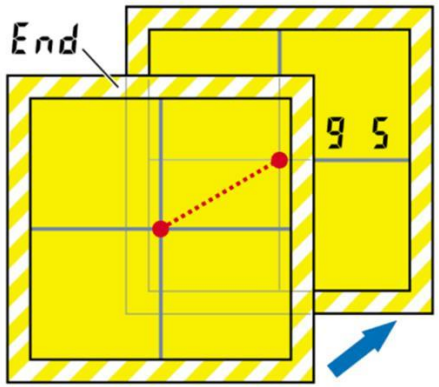


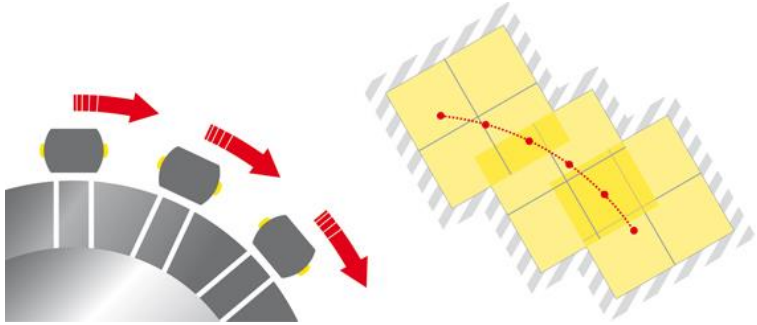
Measurement options – Extend

- Extend interrupts measurement and switches to the beam adjustment screen

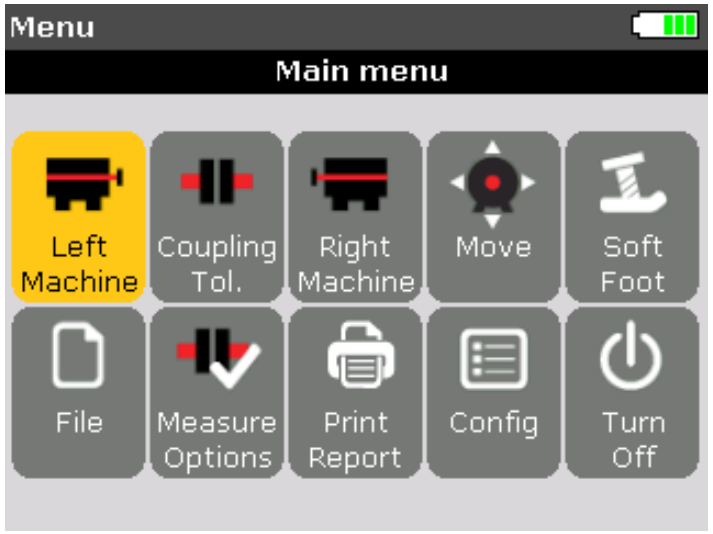


- Current beam position is automatically recorded and taken as starting point for range extension. Center the laser dot as restart point for next measurement,
- Continue measurement as before, rotating shafts and pressing ENTER to take measurements at the available positions.
- Program includes displacement of beam readjustment in its alignment calculations



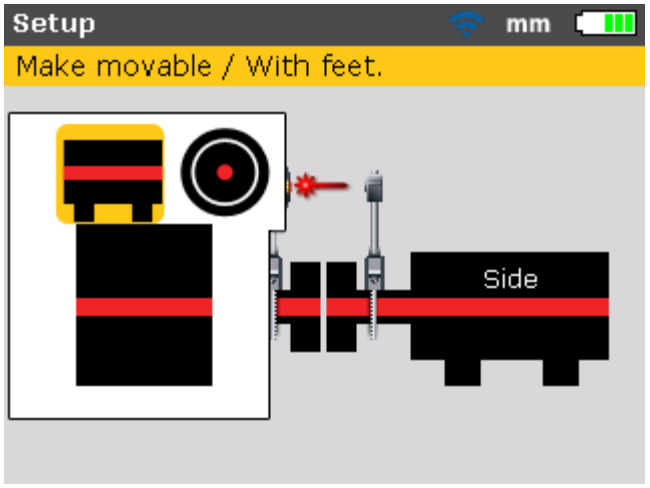


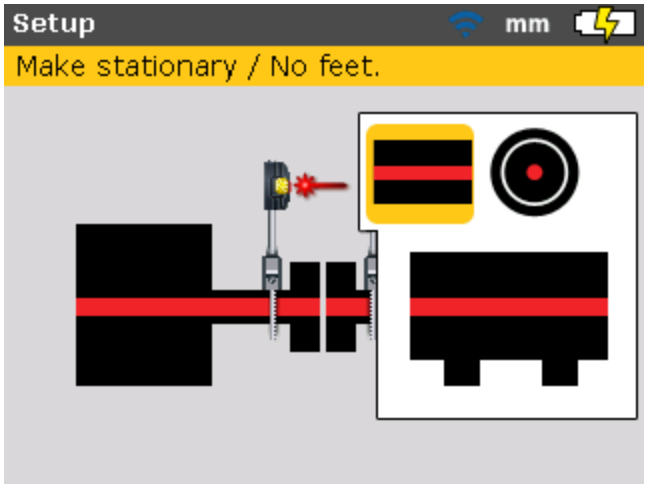
Switch Machine Set-up



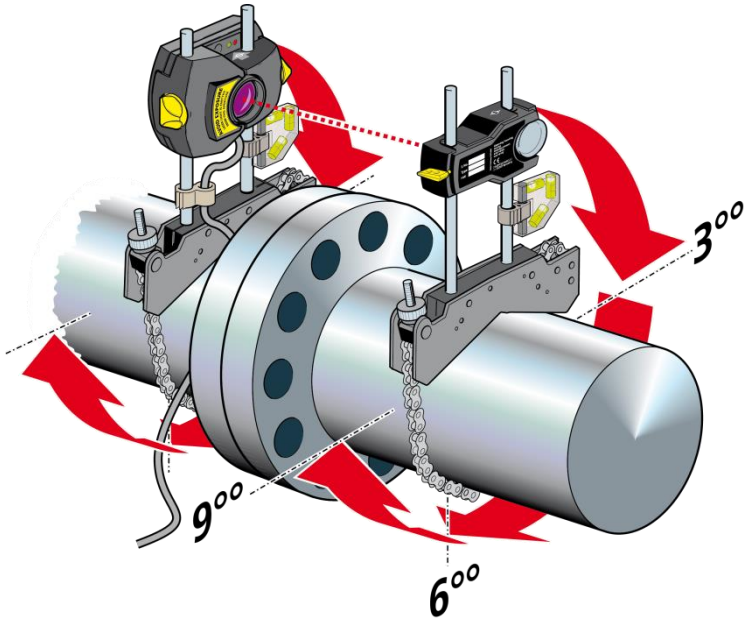
1. Select Left machine or Right Machine
Moveable (motor) on Right is preferred unless obstruction makes switching necessary

2. Select stationary or movable or the flange position



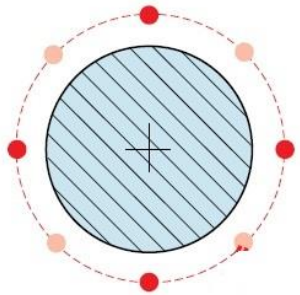


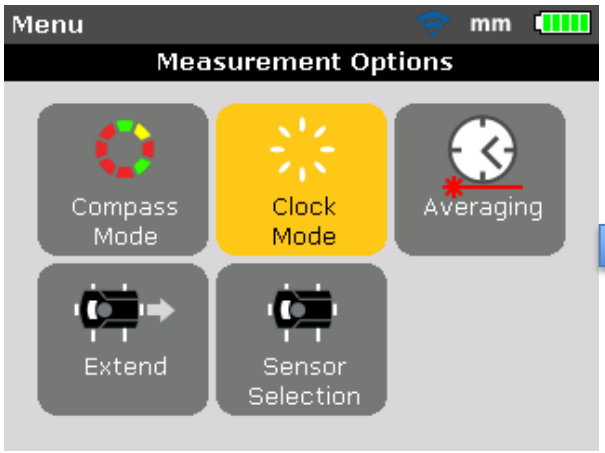
Measurement Options – Clock Mode

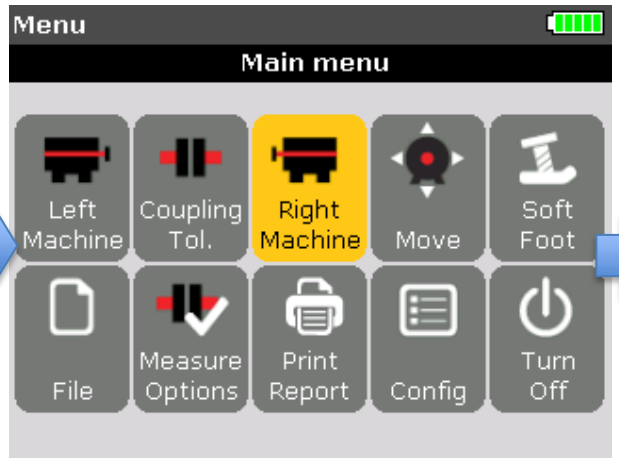


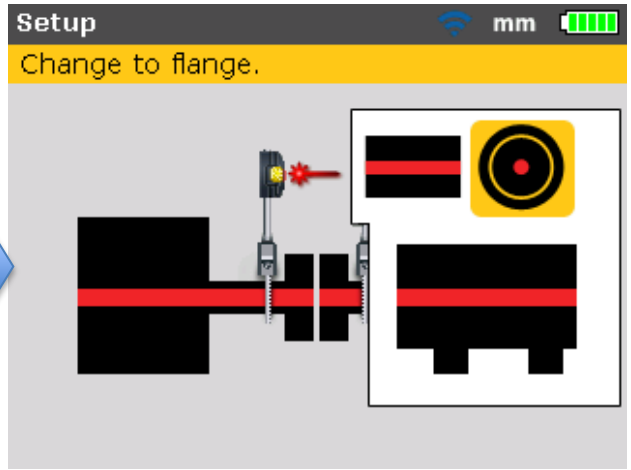
Clock mode is used for

- Uncoupled shafts
- Nonrotatable shafts
- Vertical foot-mounted

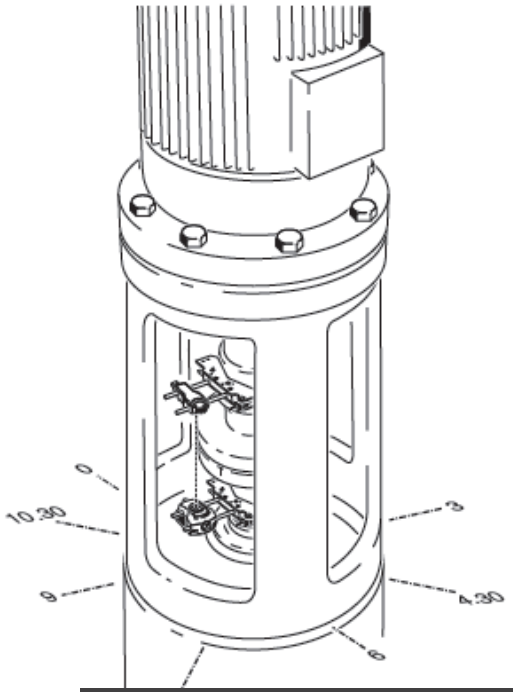




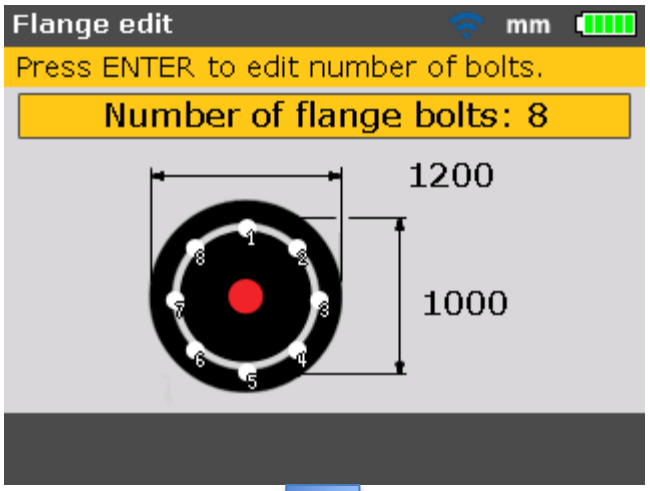


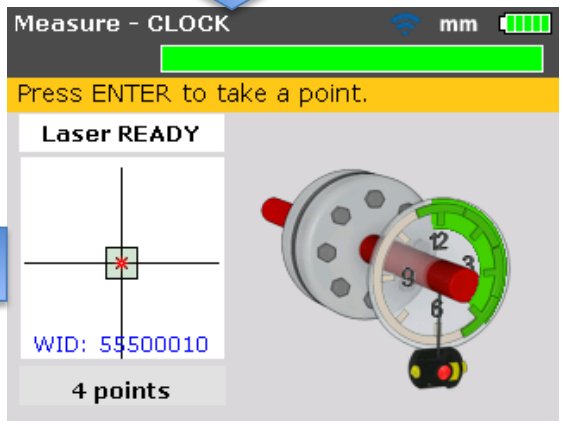


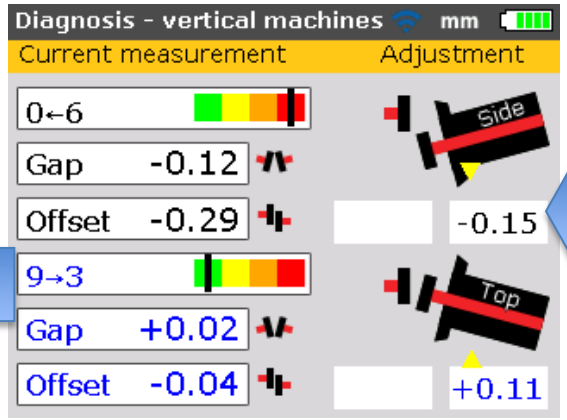
Measurement options – Vertical Machines

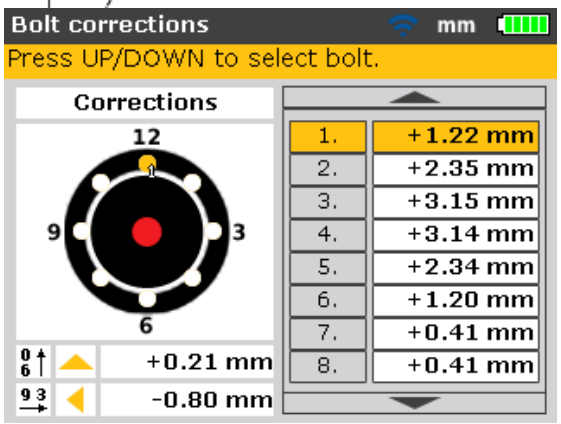


The circular housing is numbered clockwise looking down the shaft, starting at 0 followed by the clock positions 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 and 10:30.









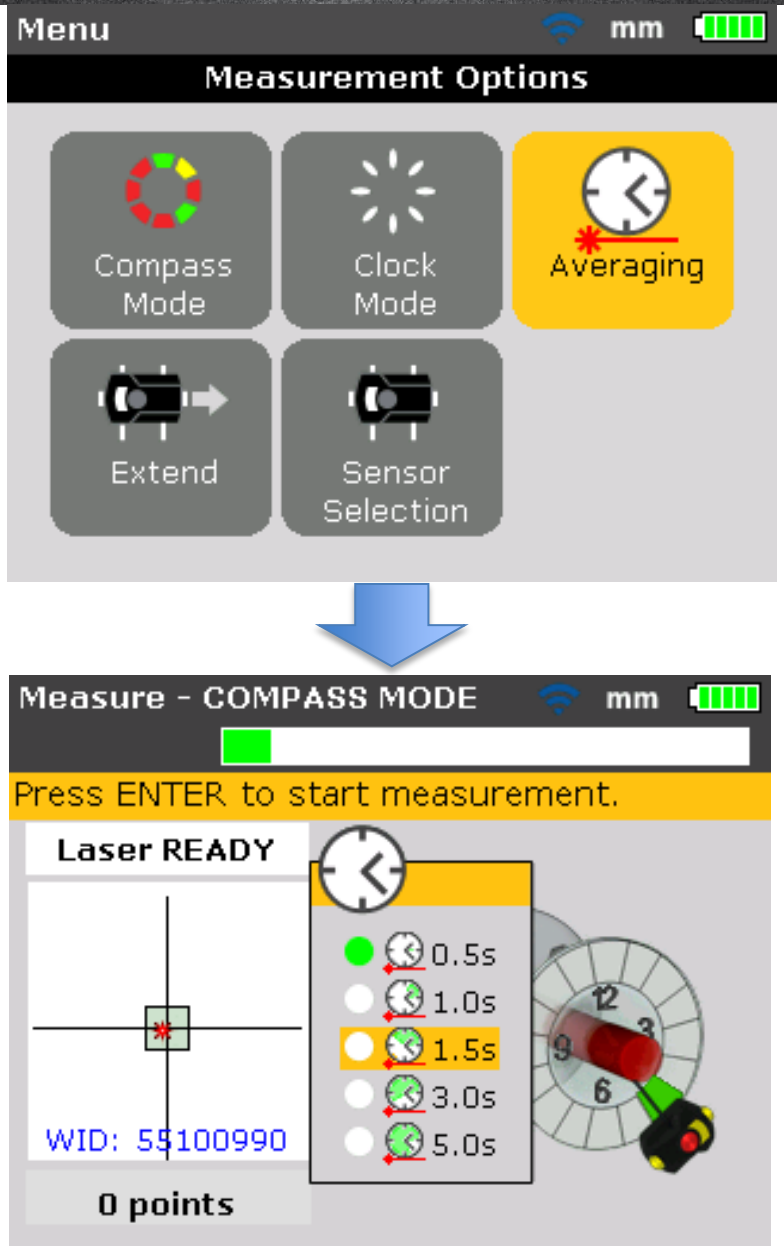
Take from 3 up to 8 measurement positions

Shim corrections are numbered to correspond with bolt positions

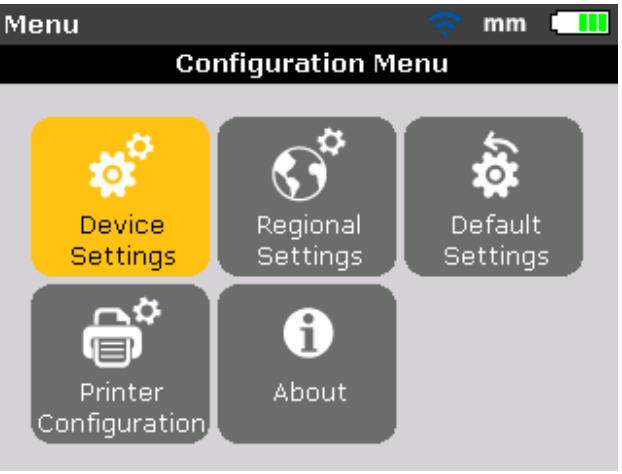
Measurement options – Averaging

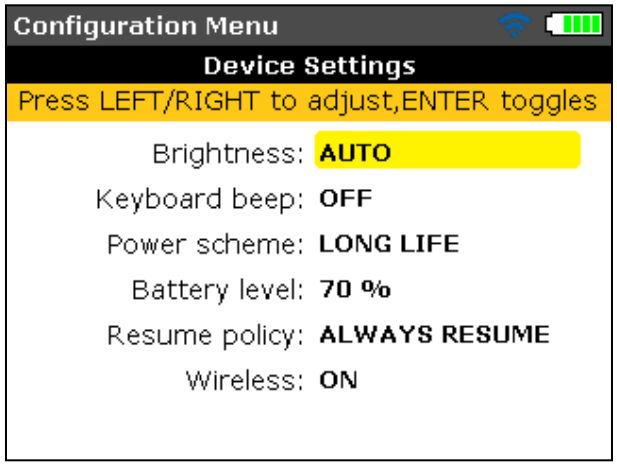
Averaging

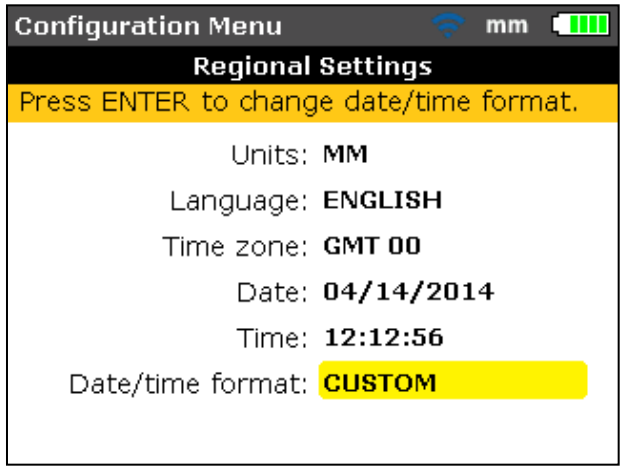
- It may be necessary to increase number of measurements to attain a desired accuracy
- Particular cases include applications with increased machinery vibration
- Increased averaging improves accuracy when measuring sleeve bearings, white metal bearings and journal bearings

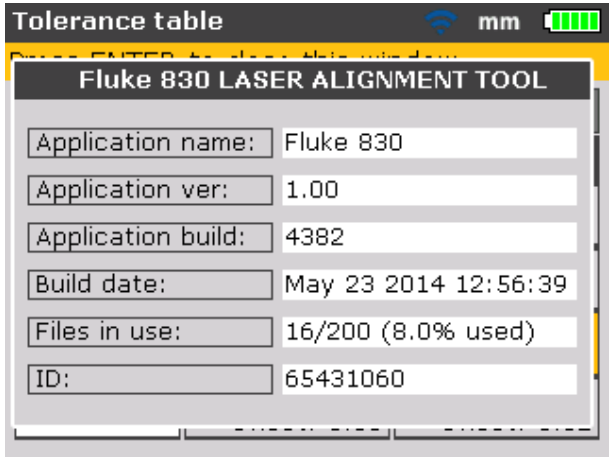


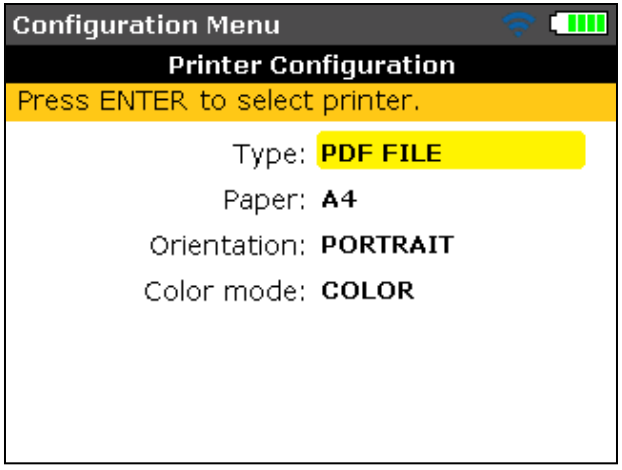
System Settings – Device, Regional, Default

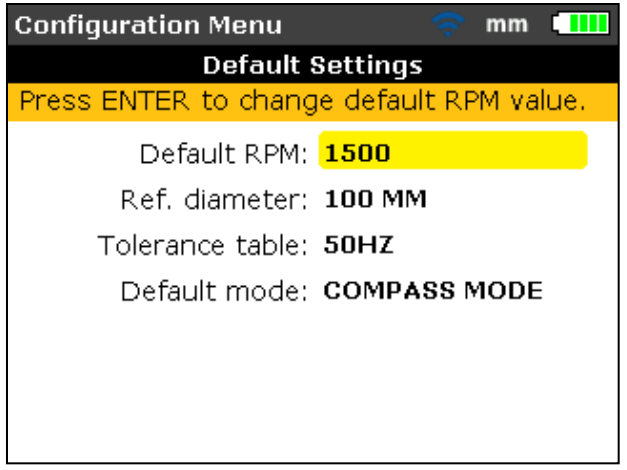




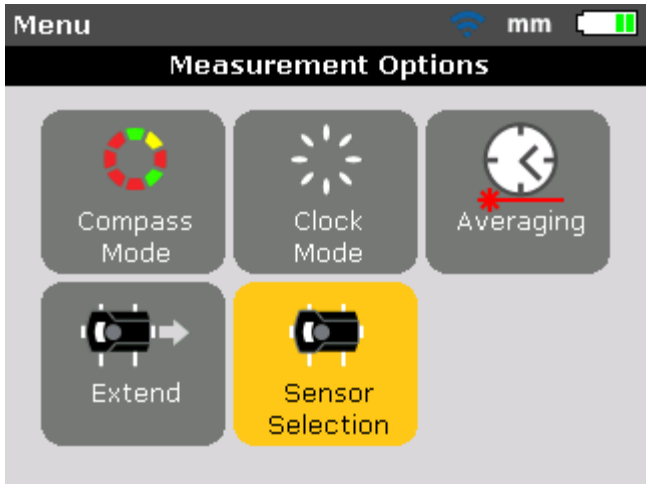


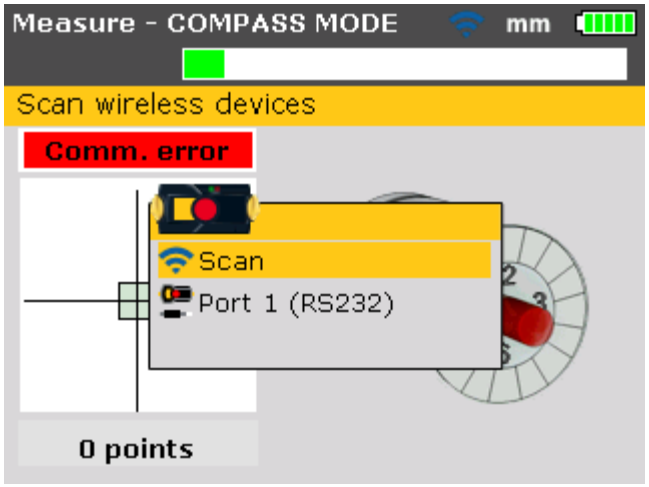




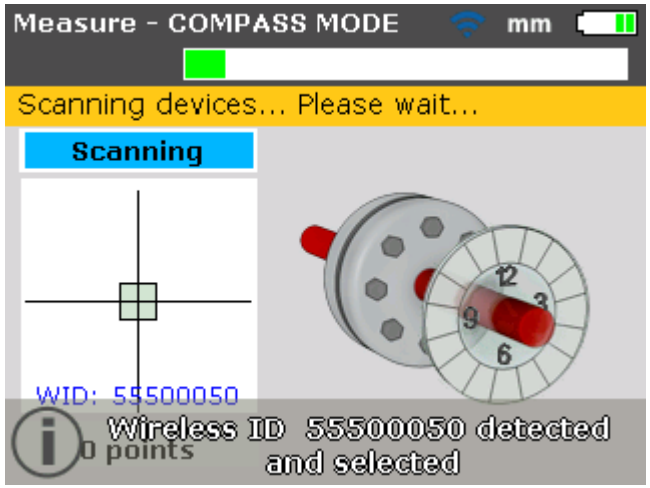


Sensor selection & Laser beam adjustment





Highlight ‘Scan’ and press ENTER to scan wireless modules within nearby.



Once detected, the module is automatically connected and communication established between the sensor and the 830.

The serial number of the wireless module in use is displayed on the screen during measurement.

Now proceed with laser beam adjustment

Laser beam adjustment

Adjust prism until GREEN sensor LED lights and 830's right LED turns blue

•Sensor has a red and a green LED to indicate beam adjustment condition

•830 simultaneously monitors alignment with the right LED

When reflected beam fails to strike detector surface, right LED on 830 turns red and sensor red LED blinks

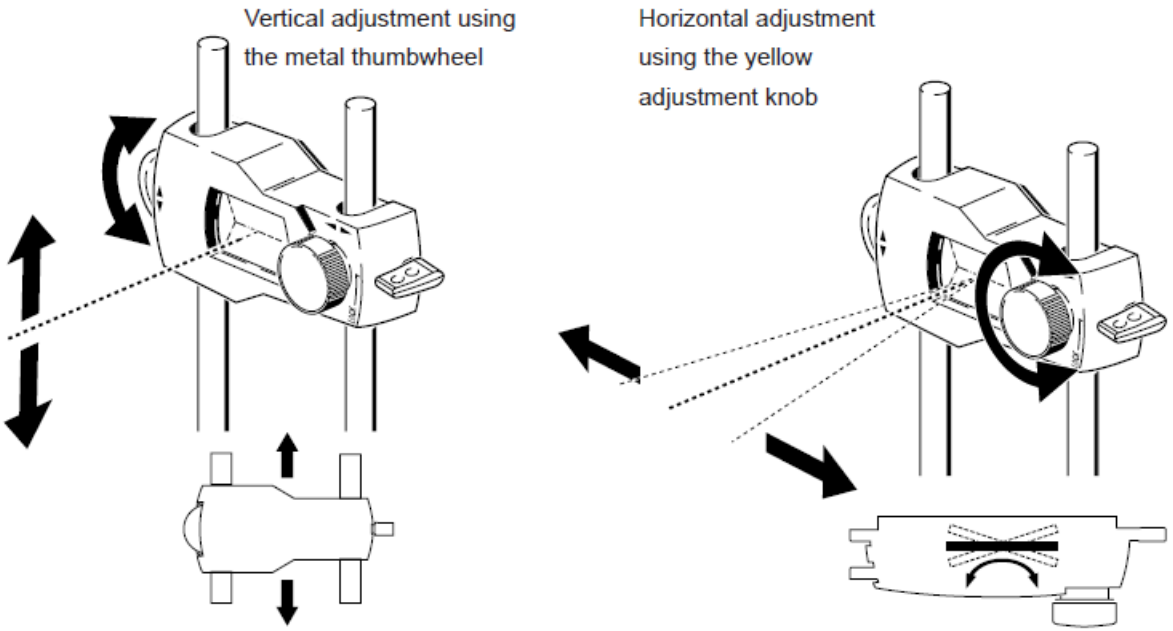
•Message 'Laser OFF' appears on display screen

•Adjust reflected beam using prism metal thumbwheel and yellow adjustment knob

•As reflected beam strikes edge of detector, right LED on 830 turns orange with the red sensor LED blinks quickly.

•Message 'Laser End' appears on the display screen.

Note
Make sure that prism and sensor lens are clean.
Use a soft lint-free cloth.
A lens cleaning cloth is supplied.



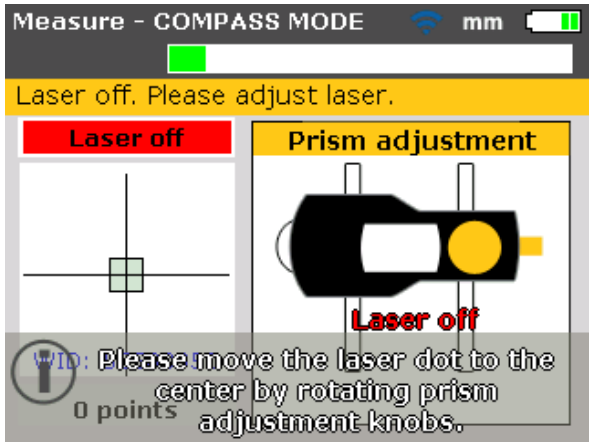
Laser beam adjustment

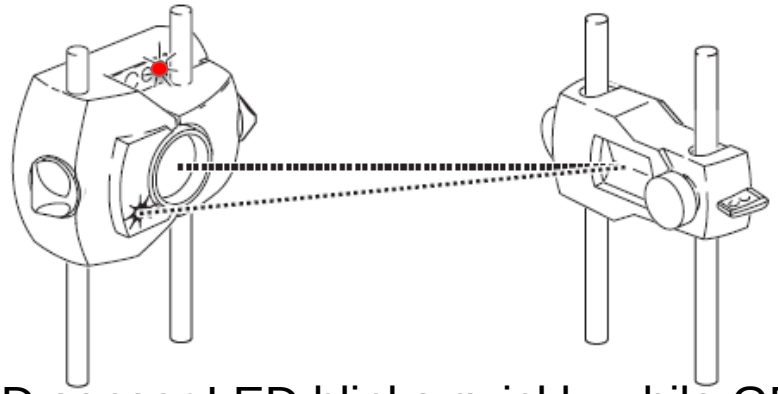
Center beam such that 830's right LED turns blue (green?)

Adjust laser beam until laser dot is positioned in green square in center of detector

- Horizontal adjustment with yellow prism knob
- Vertical adjustment with the side metal thumbwheel

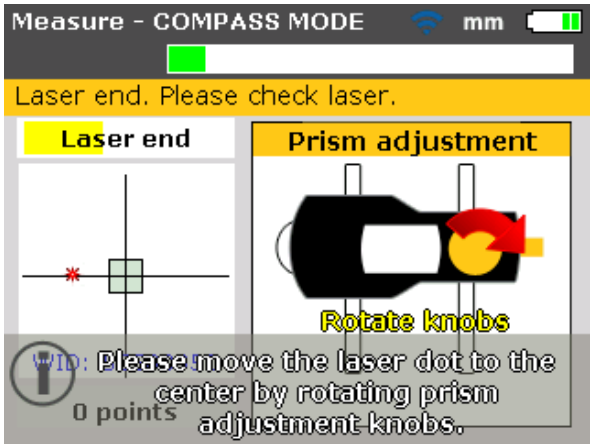
Right LED on 830 turns blue

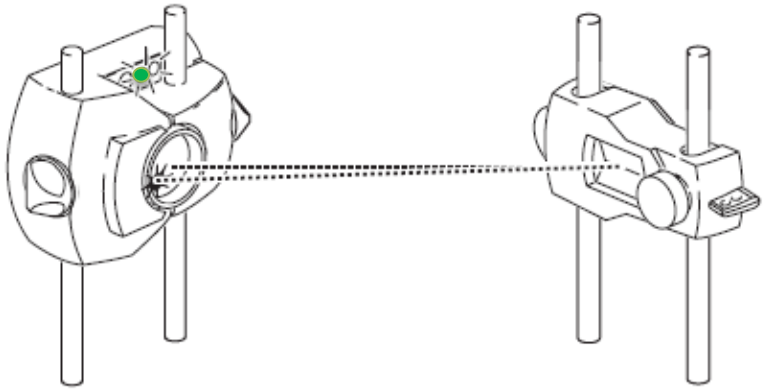




RED sensor LED blinks quickly while GREEN is OFF

830's RIGHT LED turns RED



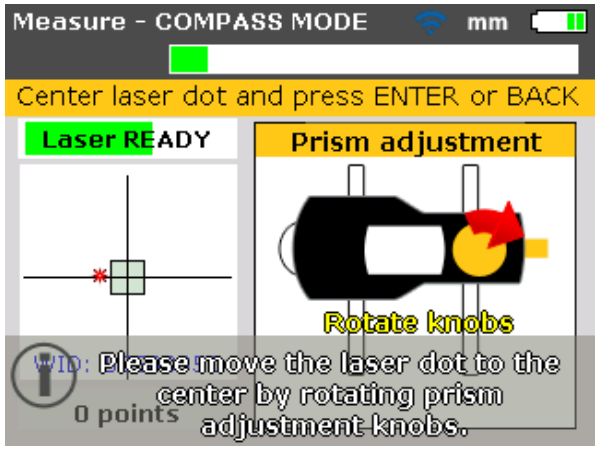


Both sensor LEDs blink quickly and alternately

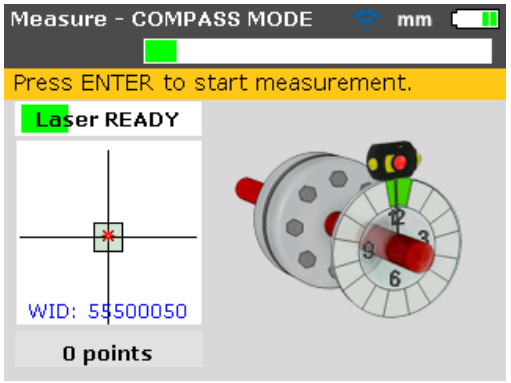
830's RIGHT LED turns ORANGE

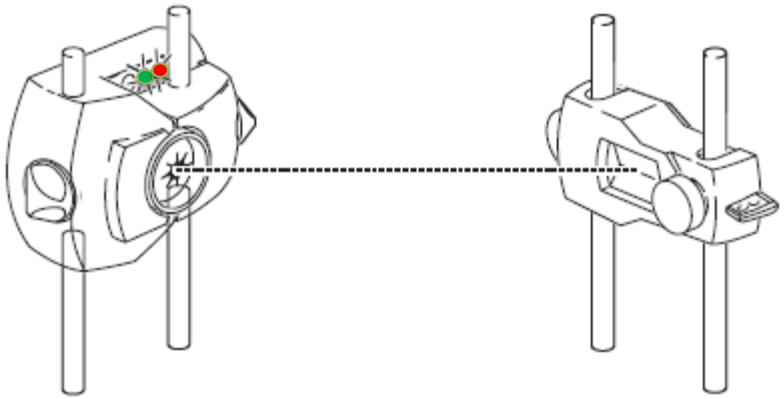
Laser beam adjustment

Center beam such that 830's right LED turns blue (green?)



Red arrow on yellow knob assists user by indicating which way knob to be turned. Closer beam comes to being centered, the smaller this arrow becomes. When laser beam is inside center square, GREEN sensor LED lights constantly.





GREEN sensor LED blinks slowly
830's RIGHT LED turns GREEN (BLUE?)

Notes

- *Beam does not have to be exactly at center of crosshair - will not affect measurement accuracy. However, maximum range for measurement is available when beam is well centered.*
- *Once centered, sensor and prism must not be touched - any movement during measurement will be interpreted as misalignment. Components may be moved when extending measurement range.*

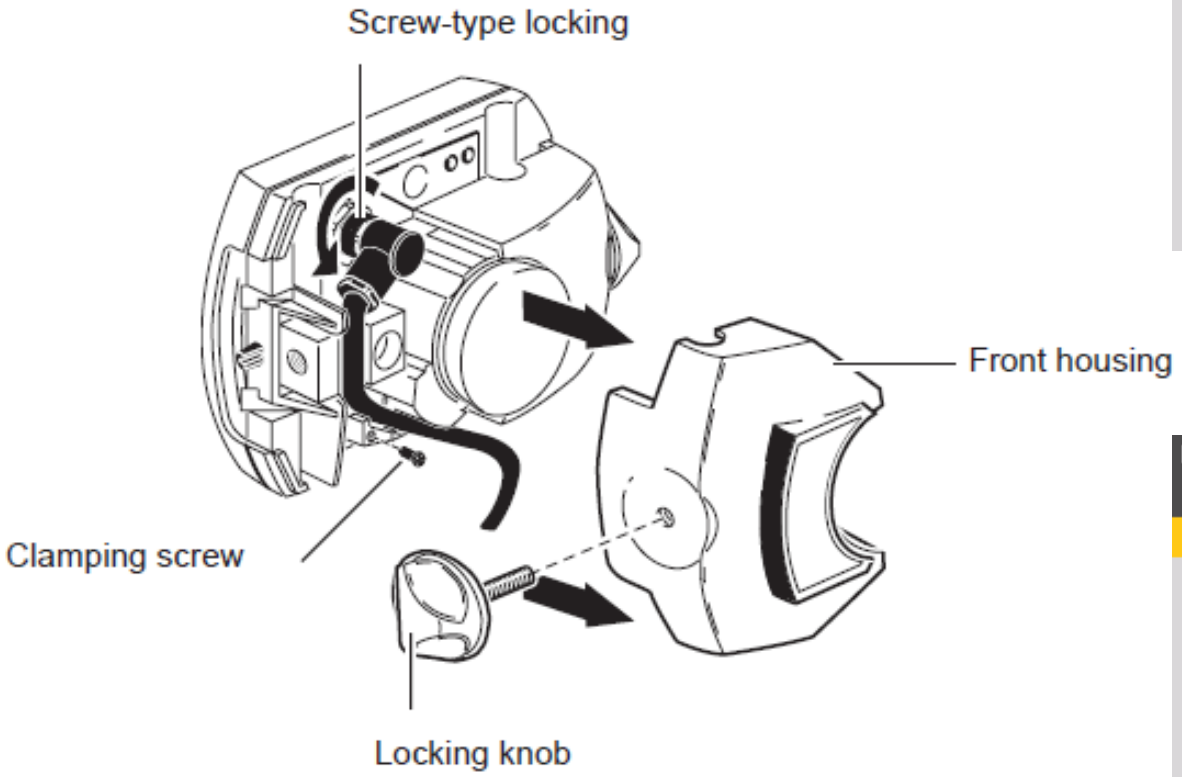
Fluke 830 – How to Use

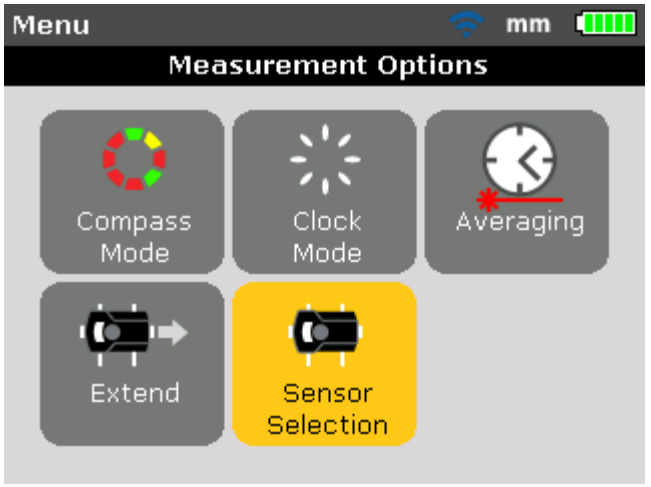
Appendix

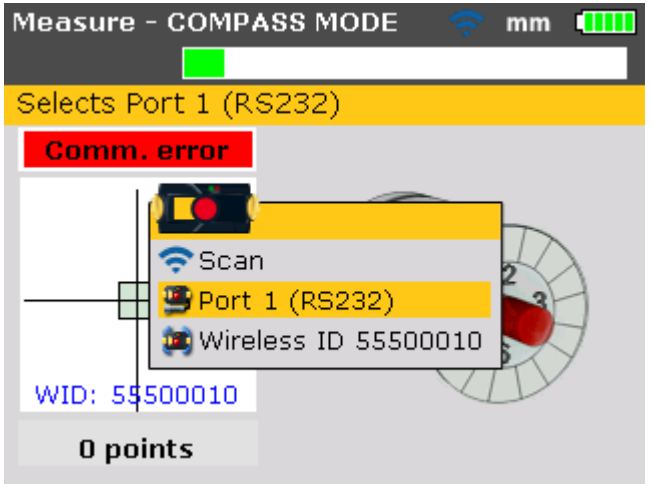
- ✓ Sensor Cable – wireless not available
- ✓ Update – 830 and sensor firmware
- ✓ Technical Specifications
- ✓ Optional – magnetic brackets and shims
- ✓ Service & Calibration

Appendix - Using Sensor Cable

If you need to use the sensor cable (due to flat batteries in the wireless module)

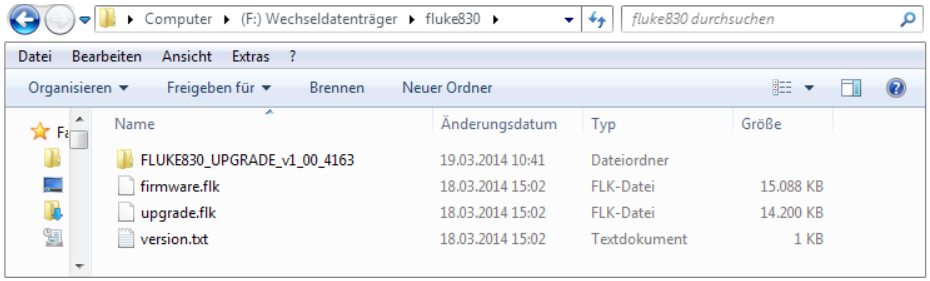




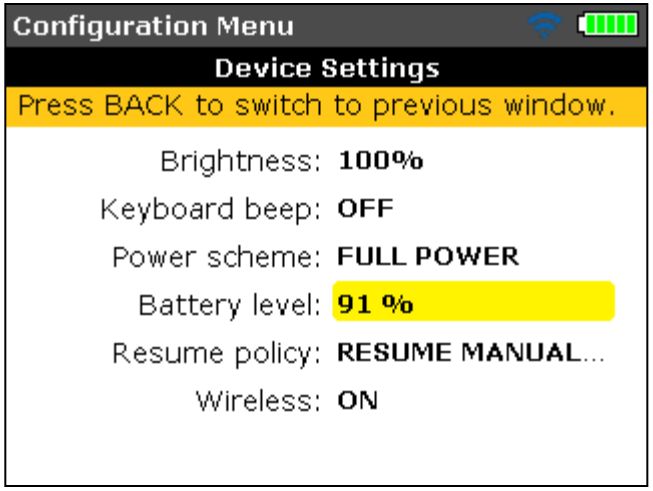


Appendix – Update 830 firmware

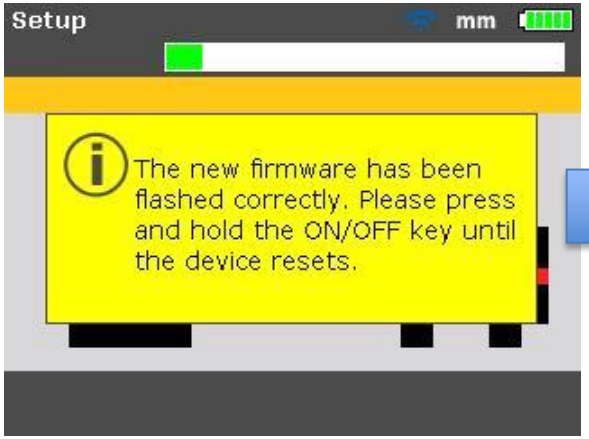
Firmware update is carried out using the memory stick and the ‘short’ USB cable. The actual update does not require a PC.

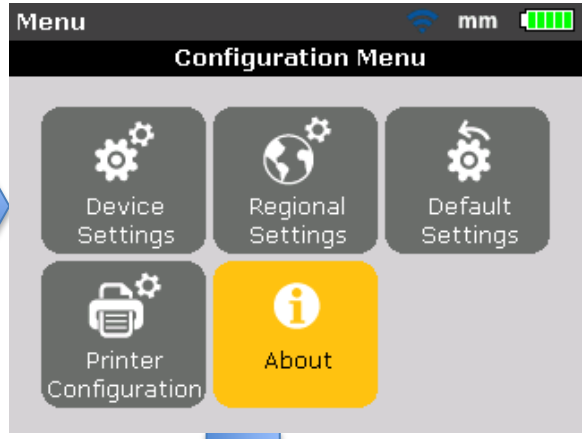


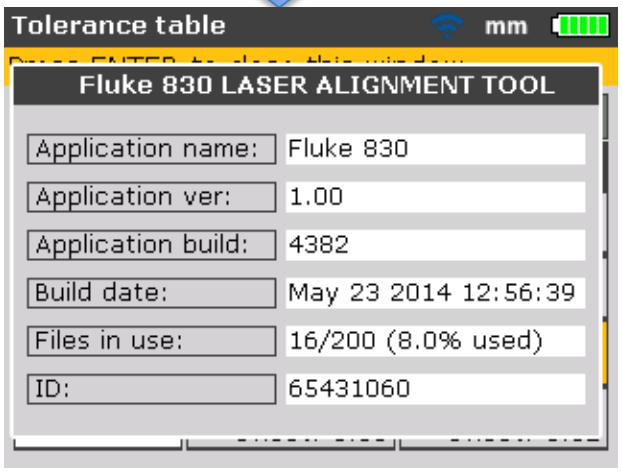
Note
Before proceeding with the update ensure that the indicated nominal capacity of the battery is greater than 50%. If this is not the case, recharge the battery to full capacity first.



Appendix – Update 830 firmware

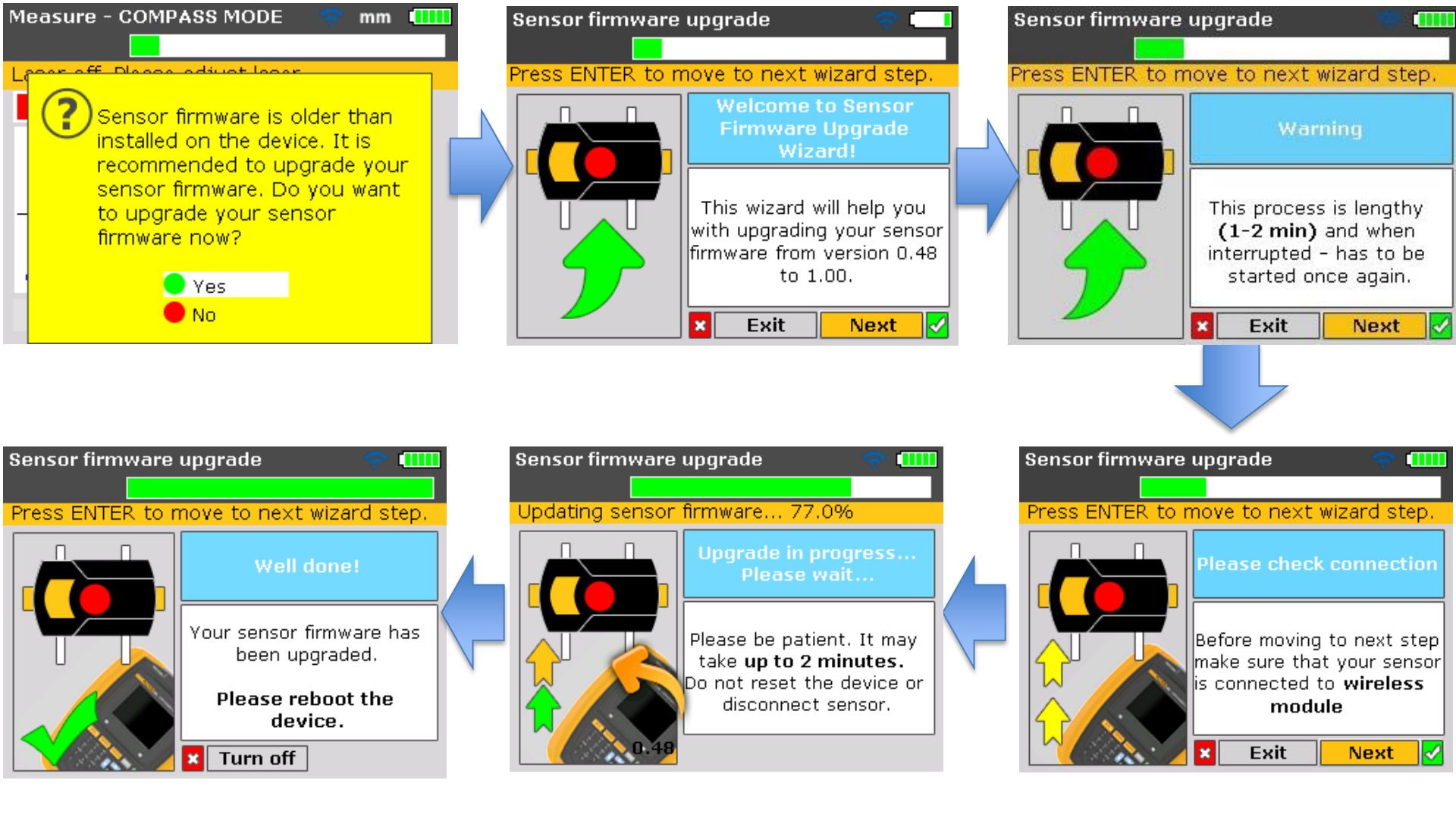






Appendix – Update sensor firmware

If a sensor with an older firmware version is connected to the Product, a hint indicating that sensor firmware requires updating appears on display



830 Laser Alignment Tool technical data

FLUKE®

Product	
CPU	Intel XScale PXA270 running at 312 MHz
Memory	64 MB RAM, 32 MB Flash
Display	Type: TFT, transmissive (sunlight-readable), 65 535 colours, backlit LED
	Integrated light sensor for automated adjustment of the brightness to the display according to the lighting conditions hence extending battery life
	Resolution: 320 x 240 Pixel
	Dimensions: 3.5 inch [8.9 cm] diagonal
	Keyboard elements: SETUP, MEASURE, DIAGNOSE, MENU, CLEAR, ENTER, BACK keys, Navigation cursor cross, alphanumeric keyboard and on/off button
LED indicators	Multicolour LED for laser status and alignment condition
	Multicolour LED for battery status
Power supply	Integrated Lithium-ion polymer rechargeable battery: 7.4 V / 2.6 Ah with typical operating time of 17 hours (based upon an operating cycle of 33% measurement, 33% computation and 33% 'sleep' mode)
External interface	USB host
	USB device (slave)
	RS232 (serial) for sensor
	AC adapter/charger socket
Environmental protection	IP 65 (dustproof and water spray resistant), shockproof
	Relative humidity 10% to 90%
Temperature range	Operation: -10°C to 50°C [14°F to 122°F]
	Storage: -20°C to 60°C [-4°F to 140°F]
Altitude	2000 m [6500 ft]
Dimensions	Approx. 220 x 165 x 45 mm [8.7" x 6.5" x 1.8"]
Weight	742 g [1.64 lb]

830 Laser Alignment Tool technical data

FLUKE®

Sensor

Particulars	Measurement principle: Coaxial, reflected laser beam
	Environmental protection: IP 67 (submersible, dustproof)
	Ambient light protection: yes
	Storage temperature: -20°C to 80°C [-4°F to 176°F]
	Operating temperature: 0°C to 55°C [32°F to 131°F]
	Dimensions: approx. 107 x 70 x 49 mm [4 1/4" x 2 3/4" x 2"]
	Weight: approx. 177 g [6 1/2 oz.]
Laser	Type: Ga-Al-As semiconductor laser
	Wavelength (typical) 675 nm (red, visible)
	Beam power: < 1 mW
Detector	Measurement area: unlimited, dynamically extendible
	Resolution: 1 µm
	Accuracy (avg): > 98%
Inclinometer	Measurement range: 0° to 360°
	Resolution: <1°

Prism

Particulars	Type: 90° roof prism
	Accuracy (avg): > 99%
	Environmental protection: IP 67 (submersible, dustproof)
	Storage temperature: -20°C to 80°C [-4°F to 176°F]
	Operating temperature: -20°C to 60°C [-4°F to 140°F]
	Dimensions: approx. 100 x 41 x 35 mm [4" x 1 5/8" x 1 3/8"]
	Weight: approx. 65 g [2 1/2 oz.]

830 Laser Alignment Tool technical data

FLUKE®

Wireless module	
Particulars	Class 1 connectivity, transmitting power 100 mW Transmission distance: 10 m [33 ft.] Complies with FCC rules part 15.247 LED indicators: 1 LED for Bluetooth communication, 3 green LEDs for battery status Power supply: Batteries 2 x 1.5 V IEC LR6 ("AA") Operating time: 14 hours typical use (based upon an operating cycle of 50% measurement, 50% standby) Storage temperature: -20°C to 60°C [-4°F to 140°F] Operating temperature: -10°C to 50°C [14°F to 122°F] Environmental protection:IP 65 (dustproof and water spray resistant), shockproof Dimensions: Approx. 81 x 41 x 34 mm [3 1/8" x 1 11/16" x 1 5/16"] Weight: Approx. 133 g [4.7 oz.] including batteries and cable
Safety	
Electrical	IEC 61010-1
Battery	IEC 62133
Laser	IEC 60825-1, 21 CFR 1040.10, .11 with Laser Notice 50
Electromagnetic Environment	
Particulars	IEC 61326-1: Basic
Radio Frequency Emissions	
Particulars	IEC CISPR 11: Group 1, Class A. Group 1 have intentionally generated and/or use conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself. Class A equipment is suitable for use in non-domestic locations and/or directly connected to a low-voltage power supply network.

Support – Frequently Asked Questions

Mounting sensor and laser

How do I position myself in front of the machines?	The graphic in the ‘Set-up’ screen shows the sensor on the left machine and the prism on the right machine which is the MTBM (usually the motor).
Where can I mount the chain type bracket?	The chain type bracket may be mounted either directly on the shaft or on the coupling.
Is there a minimum distance required between the sensor and the prism?	The components must never touch one another during rotation of the shafts.
Is there a maximum distance between the sensor and the prism?	The recommended maximum distance is ca. 5 m (197 in.)
Do surfaces of shafts and couplings have an influence on the results?	During the shaft alignment procedure, the shafts (as well as the couplings) are rotated, and therefore, any uneven or rough surfaces have no bearing on the result.
Does the distance between the sensor and the reflector play a role in the accuracy of the results?	The larger the separation distance between the sensor and the laser the higher (better) the accuracy.
Does the physical position of the sensor and laser on the support posts influence the results?	The sensor and laser may be mounted at any height on the support posts. Mount as low as possible but high enough for beam to clear coupling flange.

Support – Frequently Asked Questions

Entering dimensions

How exact must the inputted dimensions be?	Readings within +/- 2 mm (+/- 1/16 in.) taken with the standard tape measure are sufficient.
Where is the coupling plane?	The coupling plane is the point of power transmission (this could be at the elastomer or disc location)
How should foot dimensions be entered when measuring large non-symmetric machines?	The dimensions should be taken from the center of the foot bolts.

Initializing sensor and laser

Sensor initialization has failed.	Wireless module has not been turned on/connected to the sensor, or the Wireless module batteries have no capacity.
The laser beam cannot be detected on the laser dust cap.	Lighting condition of the surroundings is extremely bright.
Are any extra safety precautions necessary when working with the laser?	Do not look directly into the laser beam at any time.
The laser beam does not strike the sensor.	The yellow reflector knob has been misadjusted or there is a considerable angular misalignment.
The sensor cannot be detected by the computer.	The Wireless module has not been assigned within the computer.
The laser cannot be correctly adjusted or is not detected by the sensor.	The powerful source of light out powers the sensor detector.

Support – Frequently Asked Questions

FLUKE®

Measurement (turn shafts)

Which causes can influence the measurement and lead to poor measurement repeatability?

- Loosely mounted bracket frame
- Support posts mounted on bracket frame loosely
- Loose mounting of the sensor and laser on the support posts
- Loose machine anchor bolts
- Unstable or damaged machine foundation
- Sensor and laser brush the shafts or strike the machine foundation during shaft rotation
- Sensor and laser touched during shaft rotation
- Restoring force of tight couplings due to gross misalignment
- Shafts initially rotated in a direction opposite to the normal direction of operation, and then changed to during measurement to the normal direction of operation
- Friction bearing machines with active oil pump
- Temperature effects within the machines (coupling heating up or heaters)
- External vibration from other rotating machinery

Note:
Tolerance table gap values (included within slide 37) are based on actual coupling gap (gap tolerance limits automatically updated based on entered diameter in Setup screen).
The printed tolerance table gap values included within the instructional manual are based on 'fixed' gap values for set for 100mm or 10 in. diameter (referenced within slide 65).

Support – Frequently Asked Questions

Results and Move

What is V – vertical and H – horizontal?	V is the side view (height) and H is the plan view of the machine combination.
On which coupling diameter are the coupling gap values based?	Gap values are based on the coupling diameter entered in the Set-up screen.
Is the analysis of the results influenced by the coupling diameter?	The resulting gap values are recalculated for a coupling diameter of 100 mm (10 in.), and are then comparable with the internal table values.
How are the foot corrections to be assessed?	The values show the position of the machine with respect to the reference machine. Positive values indicate that the machine is lower or closer to the viewer.
How are the arrows and the machine feet to be interpreted?	The arrows indicate the foot correction to be made. If arrow faces upwards, machines required adding shims. If arrows are directed away from the viewer, the machine is to be moved away from viewer.

Optional - Shaft Alignment Brackets

Speedy mounting for shaft alignment products

Compact magnetic bracket

For instant mounting onto any ferromagnetic surface

- Instant mounting
- Fits onto any ferromagnetic surface
- Extremely stable, but simple to adjust

Instant mounting on any ferromagnetic surface: just place the compact magnetic brackets onto coupling flanges or shaft faces and you're all set! Four powerful magnets hold sensors firmly in place for measurement – even on narrow coupling flanges – yet allowing extremely easy and flexible adjustment.

Precision Shims – for precision alignment

FLUKE®

PERMABLOC

Stainless steel precut shims –

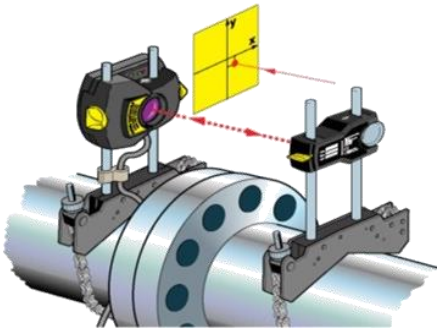
The alignment time-saver

Designed to speed up the alignment job when even minutes of downtime count

- Bur-free for higher accuracy in machinery alignment
- Several machine foot sizes and thicknesses
- Corrosion-resistant high-quality stainless steel
- Time-saving permanent thickness / dimension marking
- No 'leaf spring' effect from stacked shims: only 3 shims are enough!
- Perfectly flat for stable, consistent machine support
- Perforated tab for easier positioning and removal

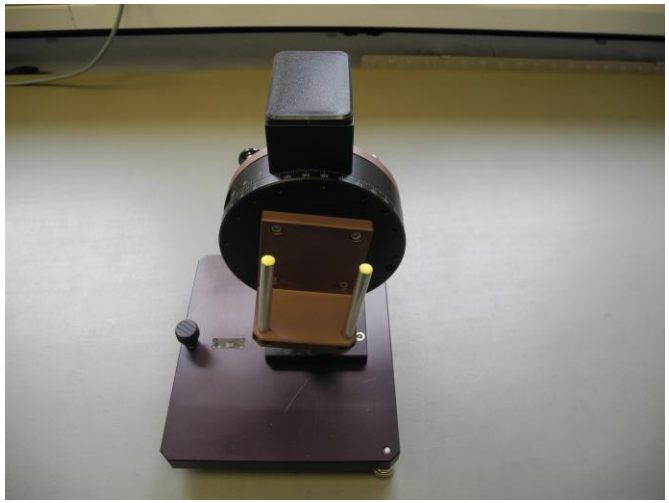
Service / Calibration

Alignment tool



Single Laser sensor - prism

Inclinometer station



Calibration station