

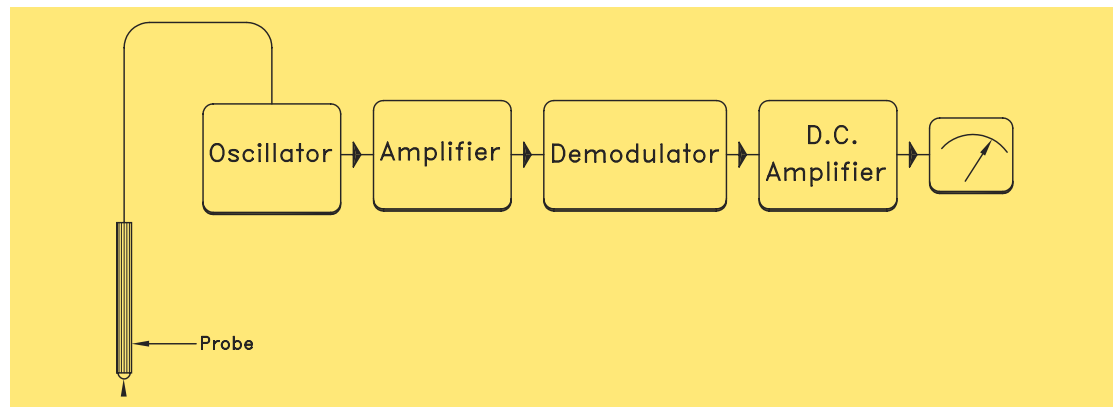


ELECTRONIC GAUGES

Electronic Gauge

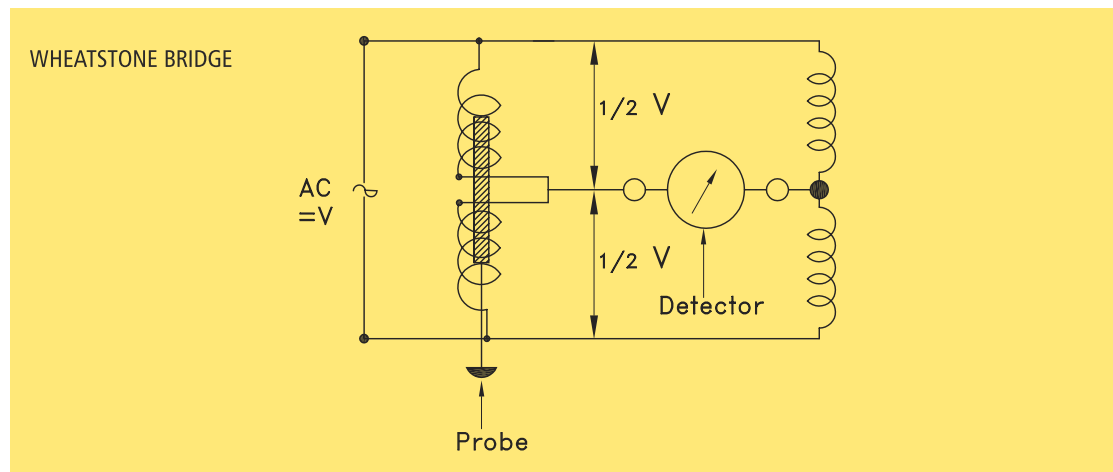
WORKING PRINCIPLE

Electronic gauges are basically comparative in function i.e. the measurements are made in comparison to a calibrated setting master. A transducer commonly termed as 'PROBE', senses variations in the dimension of component under measurement. The movement of the plunger is converted to an electrical output which is processed by an Electronic circuit, this in turn drives a display in a form appropriate to the application.



The gauge unit consists of a highly stable oscillator which applies the voltage to the Wheatstone bridge. The small amplitude output A.C. signal generated by the bridge due to the unbalanced condition caused by the linear displacement of the armature during measurement, is amplified by an A.C. amplifier.

The demodulator then converts this amplified A.C. output into a D.C. signal which is then amplified by a variable gain D.C. amplifier that provides range selection. The output of this amplifier operates a display which can be in the form of a moving coil meter, digital display or bar graph column.



A piece of magnetic material called 'armature' attached to the probe plunger is located between two coils. The position of the armature in the coils is such that if the armature is more inside one coil, it is less in the other coil. The plunger, the armature and the coil are housed in a metallic shell.

The two coils in the probe combined with two more coils inside the gauge unit form a Wheatstone bridge which is fed by an A.C. power source. The bridge is said to be balanced when the armature is exactly halfway between the coils windings. The axial movement of the probe which in turn moves the armature, causes a change in the inductance. This generates a small signal which is processed and finally displayed by the gauge unit.



PROBE COMBINATIONS

APPLICATIONS

Multiple probe & polarity combinations are possible to achieve relation gauging as shown below:

Probe arrangement	Probe Socket Connections		Probe Tip Movement		Display Movement	Units of Display Movement per Unit Tip Movement
	A Probe	B Probe	A Probe	B Probe		
1 Probe only Probe A	A+					+1
II	A+					-1
II	A-					-1
II	A-					+1
2 Probes A and B	A+	B+				+2
II	A+	B+				-2
II	A+	B+				0
II	A+	B+				0
II	A-	B+				0
II	A-	B+				0
II	A-	B+				+2
II	A-	B+				-2
II	A+	B-				0
II	A+	B-				0
II	A+	B-				+2
II	A-	B-				-2
II	A-	B-				+2
II	A-	B-				0
II	A-	B-				0

 THICKNESS HEIGHT		 INTERNAL DIAMETER	
 DIAMETER CYLINDRICITY		 WALL THICKNESS	
 CONCENTRICITY TO DATUM CENTRE		 SQUARENESS	
 DIAMETER LOBING		 CONCENTRICITY DIAMETERS TO CENTRE	
 STRAIGHTNESS		 TWO DIAMETERS	
 CONTINUOUS THICKNESS		 TAPER	
 INTERNAL DIAMETER		 POSITION	
 INTERNAL DIAMETER		 RUN-OUT TO DATUM CENTRE	
 FLOATING DIAMETER		 POSITION	



Electronic Gauge

TWIN CHANNEL



941



941 ANALOGUE

- Dual scale 3-0-3 and 10-0-10 galvanometer with enclosed tolerance pointers
- 5 Metric and 5 Inch ranges



943



943 DIGITAL

- Large 1", 3½" digits bright red LED display
- 2 Metric and 2 Inch ranges



945



945 COLUMN

- 254 mm tall analogue red LED bar graph display with 100 segments
- Variable bar graph intensity selection
- 5 Metric and 5 Inch ranges

	941	943	945
Metric Ranges	±10, ±30, ±100, ±300, ±1000 μm	± 200 & ±2000 μm	±10, ±30, ±100, ±300, ±1000 μm
Resolution	0.5, 1, 5, 10, 50 μm	0.1 & 1 μm	0.2, 1, 2, 10, 20 μm
INCH Ranges	±0.0003, ±0.001, ±0.003, ±0.01, ±0.03 inch	± 0.020 & ±0.200 inch	±0.0003, ±0.001, ±0.003, ±0.01, ±0.03 inch
Resolution	0.00001, 0.00005, 0.0001, 0.0005, 0.001 inch	0.00001 & 0.0001 inch	0.00001, 0.00002, 0.0001, 0.0002, 0.001 inch

FEATURES

- Twin channel gauge units with selectable probe combinations of +A, -A, +B, -B, +A +B, +A -B, -A +B, -A -B
- Inch and Metric measuring ranges
- RED, GREEN and YELLOW tolerance lamps for REJECT, ACCEPT and REWORK indications
- RS232 data output
- Comprehensive outputs for further processing
- Compatible with Half-bridge and LVDT type inductive measuring probes
- Sturdy, Ergonomic design, suitable for shop floor environment
- Splash proof and sealed against dust
- Add-on Modules available for various applications e.g. Light Grading Module, Relay Module, etc.
- Mains supply 220 volts AC



MICROPROCESSOR BASED TWIN CHANNEL



2041N

2041N ANALOGUE

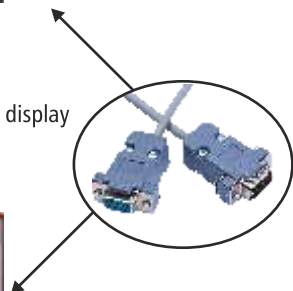
- Digitally driven, Analogue Galvanometer type measurement display
- Five Metric & Five Inch Measuring ranges



2043N

2043N DIGITAL

- 8 character, LED type, 7 segment digital display shows measurements either in absolute or comparative form
- Exclusive 8-character alphanumeric dot-matrix type digital display for menu setting
- Two metric & two inch measuring ranges



2045N

2045N COLUMN

- 101 segment, 3 colour LED bar-graph column type measurement display
- Column can be configured to originate from the centre or one end of scale
- 8-character alphanumeric dot-matrix digital type display shows measurements either in absolute or comparative form
- Exclusive 8 character alphanumeric dot-matrix digital type display for menu setting
- Five metric & five inch measuring ranges

	2041N	2043N	2045N
Metric Ranges	$\pm 10, \pm 30, \pm 100, \pm 300, \pm 1000 \mu\text{m}$	$\pm 200 \text{ \& } \pm 2000 \mu\text{m}$	$\pm 10, \pm 30, \pm 100, \pm 300, \pm 1000 \mu\text{m}$
Resolution	0.5, 1, 5, 10, 50 μm	0.1 & 1 μm	Bar graph : 0.2, 1, 2, 10, 20 μm Dig. Display : 0.1, 0.1, 0.1, 1, 1 μm
INCH Ranges	$\pm 0.0003, \pm 0.001, \pm 0.003, \pm 0.01, \pm 0.03 \text{ inch}$	$\pm 0.020 \text{ \& } \pm 0.200 \text{ inch}$	$\pm 0.0003, \pm 0.001, \pm 0.003, \pm 0.01, \pm 0.03 \text{ inch}$
Resolution	0.00001, 0.00005, 0.0001, 0.0005, 0.001 inch	0.00001 & 0.0001 inch	Bar Graph : 0.00001, 0.00002, 0.0001, 0.0002, 0.001 inch Digital Display : 0.00001, 0.00001, 0.00001, 0.0001, 0.0001 inch

FEATURES

- State-of-the-art technology with host of features, a must for today's shop process quality engineering
- Two level password, prevents unauthorized alteration
- Multiple-level display intensity for operators comfort
- Inch & metric measuring ranges
- Static & dynamic measurement
- Permits incorporation of complex formulae for probe combination
- Display of tolerance and control limit status – supports process control
- Classifies tolerance band into uniform or non-uniform tailor made grades
- Permits menu entries up to 16 different settings for quick application changeover
- Wide range of process control based electrical outputs facilitates automation
- Auto calibration
- Compatible with half bridge and LVDT type inductive measuring probe
- RS232 based interface with real time tagged measurements
- Aesthetically appealing, sturdy and ergonomic design, suitable for shop-floor applications
- USB interface to PC and flash drive



Electronic Gauge

GAUGING SYSTEMS WITH STATISTICAL PROCESS CONTROL



SPC 3000 E4/E8

SPC 3000

BAKER SPC 3000 is built to cater to the gauging requirements on any industrial shop floor. Besides the main activity of dimensional measurement, it is also capable of Statistical Process Control (SPC). It has the capability to digitalise your gauging system output via Ethernet, Wi-Fi, USB (for flash drive, external keyboard, scanner) etc. in line with Industry 4.0 requirements.

The BAKER SPC 3000 is available in 2 configurations

ELECTRONIC GAUGE
SPC 3000 E4 (4 PROBE INPUTS)
SPC 3000 E8 (8 PROBE INPUTS)

FEATURES

- 7 Inch Graphic colour LCD Display
- Resolution- 0.0001mm / 0.001mm
- Available with 4/ 8 probe inputs
- SPC Calculations
- Internal memory
- Internal memory storage : 8 GB
- Ethernet output
- RS232 data output
- View to store measurements
- Status of stored measurements
- Connectivity to USB flash drive
- Connectivity to External keyboard
- Barcode scanner output (Optional)



SPC 3000 E8

Electronic Gauge



TECHNICAL SPECIFICATION SPC 3000

SPECIFICATION	SPC3000 E4	SPC3000 E8
7 inch Graphic LCD Display	✓	✓
Analogue + Digital Display	6 (Max)	6 (Max)
Digital + Bar graph Column Display	8 (Max)	8 (Max)
Pneumatic inputs	—	—
Probe inputs	4	8
No. of Results	8 (Max)	8 (Max)
Static measurements	✓	✓
Combination of inputs for Results	8 (Max)	8 (Max)
Dynamic measurements	✓	✓
Inch / Metric selection	✓	✓
Display Resolution : 0.0001mm/0.001mm; 0.00001/0.0001 in.	✓	✓
Double Mastering	✓	✓
Maximum Permissible Error (MPE)	±0.5% of measuring range	±0.5% of measuring range
Single Mastering	✓	✓
RS232 Data output	✓	✓
Ethernet Data output	✓	✓
Internal Memory storage	8GB	8GB
USB flash drive connectivity	✓	✓
Barcode reader input	Optional	Optional
Logic output; OK/Not OK, Hi/OK/Lo	✓	✓
Auto Air cut-off	Optional	Optional
External key board connectivity	✓	✓

CONSISTENT

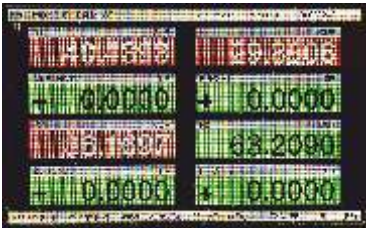
ADAPTABLE



ROBUST & VERSATILE

INDUSTRY 4.0 READY

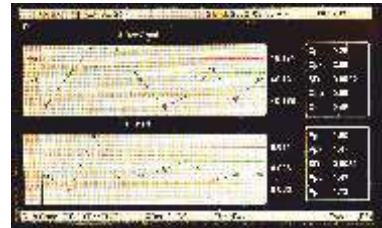
MEASUREMENT DISPLAY



RUN CHART



X BAR R CHART



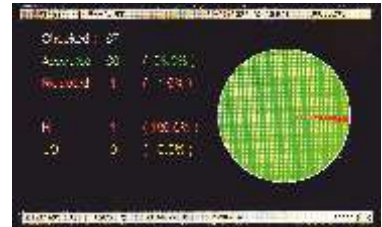
X BAR S CHART



HISTOGRAM



PIE CHART

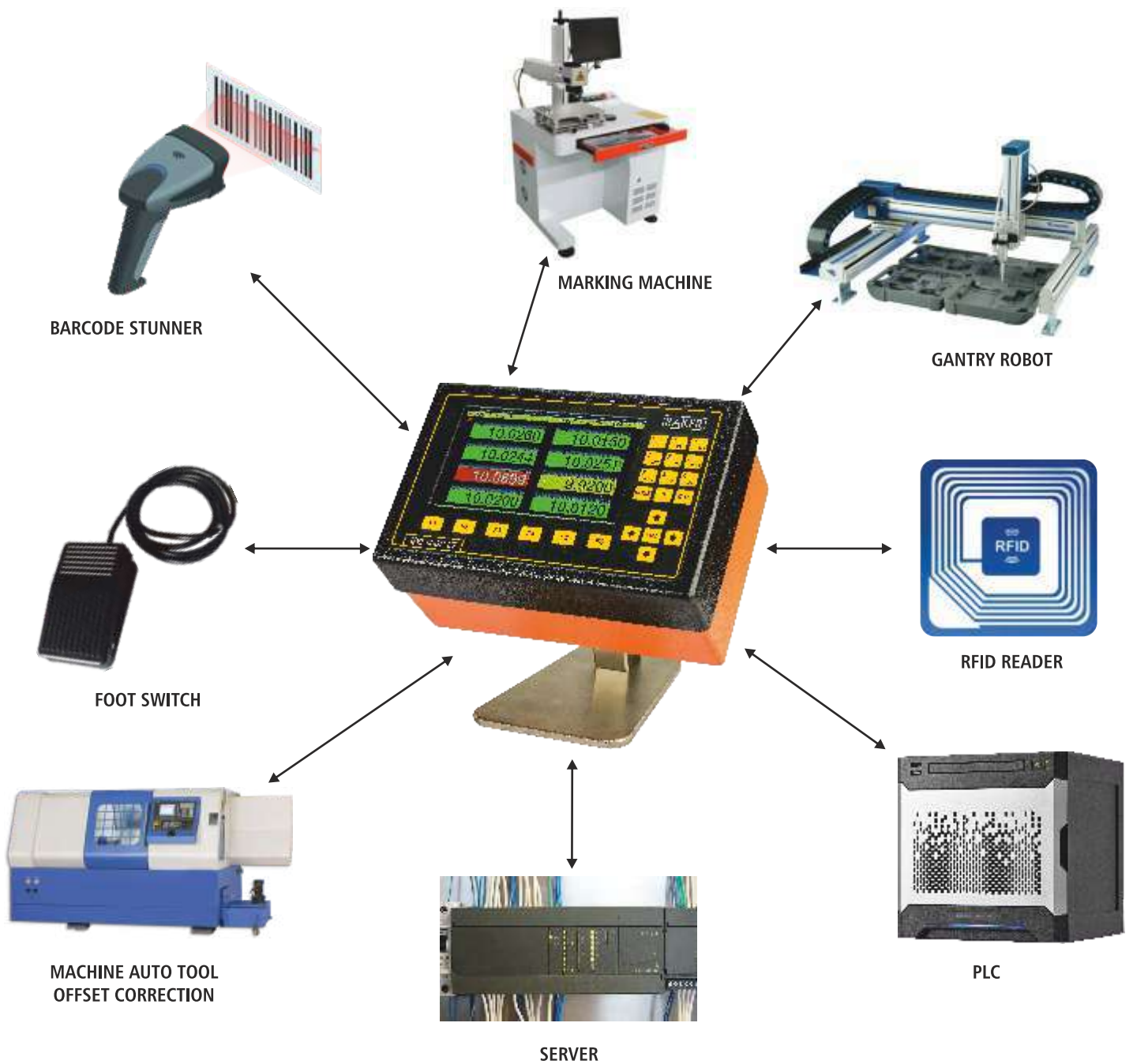


LOGGED DATA



INDUSTRY 4.0

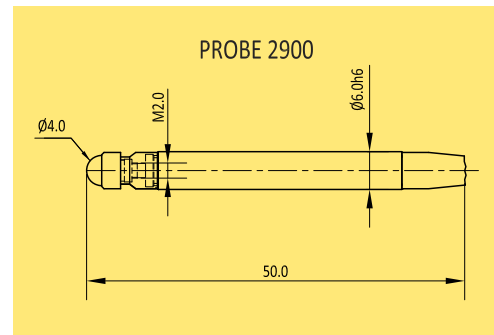
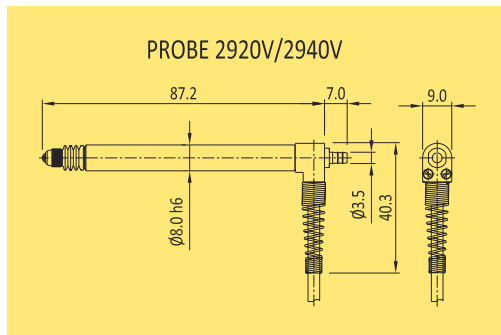
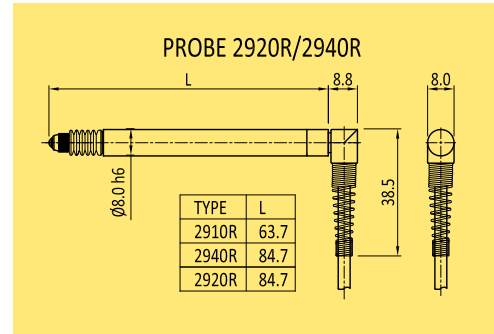
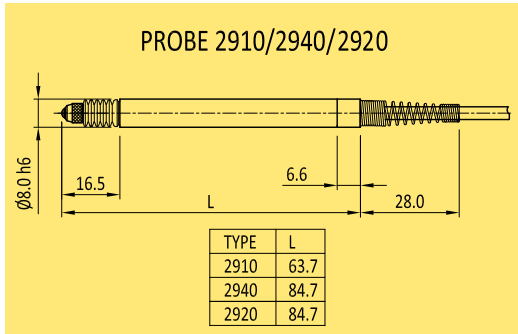
Industry 4.0 refers to “smart” and “connected” production systems that are designed to sense, predict, and interact with the physical world, so as to make decisions that support production in real-time. In manufacturing, it can increase productivity, energy efficiency, and sustainability.



Electronic Probe



PROBE



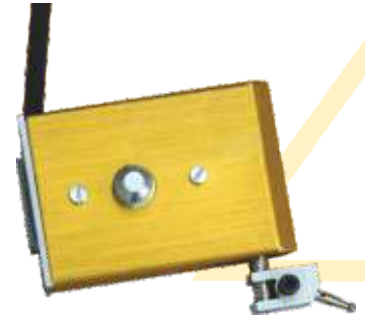
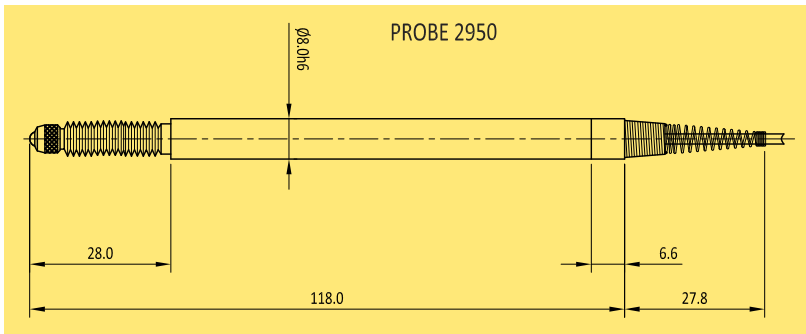
SPECIFICATION & FEATURES

Specifications	2920 / 2920R	2940 / 2940R	2920V / 2940V (Vacuum Lift)	2910/2910R	2900
Measuring Travel	± 1 mm	± 2 mm	± 2 mm (± 1 mm for 2920V)	± 0.5 mm	± 0.3 mm
Total Travel	3 mm	4.5 mm	4.5 mm (3 mm for 2920V)	2.25 mm	1 mm
Linearity	± 0.3%	± 0.3% (in ± 1000 μm range)	± 0.3% (in ± 1000 μm range)	± 0.3% (of total measuring range)	± 0.5% (of total measuring range)
Repeatability	0.02 μm	0.02 μm	0.02 μm	0.02 μm	0.15 μm
Measuring force	0.6 N	0.6 N	0.45 to 0.75 N	0.6 N	0.8 N
Pre-travel	Variable	Variable	Variable	Variable	Fixed
Application	Universal	Universal	Vacuum Lift	Universal	Universal
Environmental Protection (IEC 529)	IP 64	IP 64	IP 66	IP 64	IP 64
Plunger guide	Pre-loaded, caged linear ball bearing	Pre-loaded, caged linear ball bearing	Pre-loaded, caged linear ball bearing	Preloaded, caged linear ball bearing	Preloaded, caged linear ball bearing
Cable	2 m (Axial) Polyurethane	2 m (Axial) Polyurethane	2 m (Axial) Polyurethane	2 m., Polyurethane.	2 m., Polyurethane.
Cable support spring	Present	Present	Present	Present	N.A.
Connecting adaptor	5-pin, Male DIN plug (240°)	5-pin, Male DIN plug (240°)	5-pin, Male DIN plug (240°)	5-pin, Male DIN plug (240°)	5-pin, Male DIN plug (240°)
Total Length (with support spring)	112 mm	112 mm	114 mm	87	50
Probe Body	Hardened & ground stainless steel (55HRC) (Diameter 8h6)	Hardened & ground stainless steel (55HRC) (Diameter 8h6)	Hardened & ground stainless steel (55HRC) (Diameter 8h6)	Hardened and ground stainless steel (55HRC); Diameter 8h6	Hardened and ground stainless steel (55HRC); Diameter 5h6
Reference temperature	20 °C ± 1°C	20 °C ± 1°C	20 °C ± 1°C	20 °C ± 1°C	20 °C ± 1°C
Contact Tip	Tungsten Carbide Ball 3 mm Dia, M2.5 Thread	Tungsten Carbide Ball 3 mm Dia, M2.5 Thread	Tungsten Carbide Ball 3 mm Dia, M2.5 Thread(240°) with screw	Tungsten carbide ball 3 mm Dia, M2.5 Thread.	Tungsten carbide ball 4 mm Dia, M2 Thread.
Sealing bellow	Viton with metal clips	Viton with metal clips	Viton with metal clips	Viton with metal clips	Viton

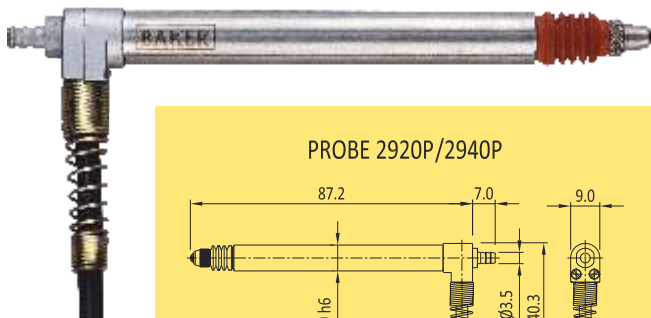
PROBE



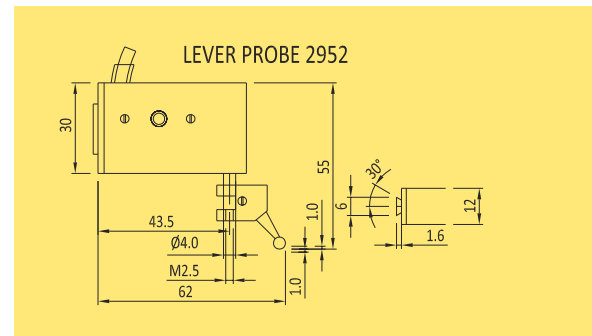
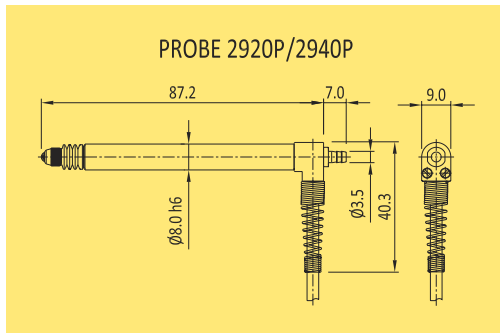
2950



2952



2920P/2940P



SPECIFICATION & FEATURES

Specifications	2950	2920P/2940P Pneumatic Push	2952 Lever Type
Measuring Travel	± 5 mm	± 2 mm (± 1 mm for 2920P)	± 1 mm
Total Travel	10.5 mm max.	4.5 mm (3 mm for 2920P)	2 mm
Linearity	± 1.5 % (of total measuring range)	± 0.3% (in ± 1000 µm range)	± 0.3%
Repeatability	0.15 µm	0.02 µm	0.5 µm
Measuring force	2.5 N	0.45 to 0.75 N	0.25 N
Pre-travel	Variable	Variable	Fixed
Application	Universal	Pneumatic push	Low Measuring Force
Environmental Protection (IEC 529)	IP 64	IP 66	IP50
Plunger guide	Preloaded, caged linear ball bearing	Pre-loaded, caged linear ball bearing	Parallel Leaf Spring
Cable	2 m., Polyurethane.	2 m (Axial), Polyurethane	PVC
Cable support spring	Present	Present	NA
Connecting adaptor	5-pin, Male DIN plug (240°)	5 pin, Male DIN plug (240°)	5-pin, Male DIN plug (240°)
Total Length (with support spring)	145	114 mm	-
Probe Body	Hardened and ground stainless steel (55HRC); Diameter 8h6	Hardened & ground stainless steel (55HRC)(Diameter 8h6)	-
Reference temperature	20 °C ± 1°C	20 °C, ± 1°C	20 °C ± 1°C
Contact Tip	Tungsten carbide ball 3 mm Dia, M2.5 Thread.	Tungsten carbide ball, 3mm Dia, M2.5 thread.	9 mm long stylus having M1.6 threads & Ø 2 mm tungsten carbide ball tip
Sealing bellow	Viton	Viton	-

SPECIAL MEASURING SYSTEMS

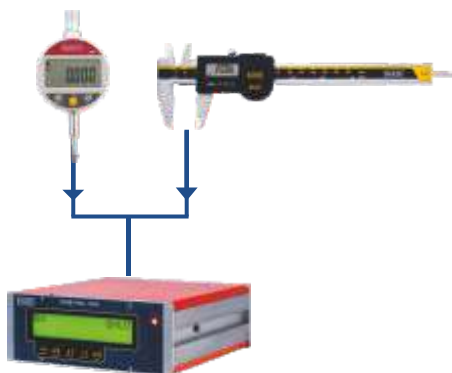
Non-standard solutions sought by customers, for purpose of measurement, control or analysis, may warrant the undertaking of special development processes to satisfy needs of such variations. Features and specifications of a sample non-standard system developed by us is shown below

DIGITAL CLASSIFYING MODULE



FEATURES

- Accepts and displays RS232 based measurement data from Baker electronic instruments / gauges
- Tolerance status of measurement data is displayed in form of icons and lamps
- The acceptable measurement band can be graded into as many as 99 classes
- If required for the application, control outputs can be provided against tolerance or grade limits
- RS232 output tagged with tolerance and grade status can be sent to receiving PC



Application

- Remote display for Baker Digital Instruments. For e.g. In some cases where the digital dial is in a fixture or mounted in a position where the display is not directly visible then we can extend its display on the digital classifying module.
- For ease of viewing if the display size need to be enlarged.

Electronic Gauge Interface

STANDARD PROBE MODULE



FEATURES

- Eight measuring channels having pre-determined full-scale DC output voltage, based on a pre-determined measuring range
- Interfaced to eight Baker Inductive probes
- Recessed 'Zero' control per channel: Travel 50 to 60 μm
- Recessed calibration control per channel
- Max. permissible error (MPE) per channel is less than or equal to $\pm 1\%$ of the full scale measuring range
- Reference temperature of calibration is 20 $^{\circ}\text{C}$
- Output drift over operating temperature range : $< 0.5\% / ^{\circ}\text{C}$
- Drift of sensitivity over operating temperature range : $< 0.5\% / ^{\circ}\text{C}$
- Output instability: $< 200\text{ mV}$
- Display stability time: $< 500\text{ ms}$
- Power consumed by module 20 VA (max)
- Voltage supply to the read-out module: 230 V AC $\pm 10\%$, 50 Hz
- Operating temperature range 0 $^{\circ}\text{C}$ to 45 $^{\circ}\text{C}$. Humidity should not exceed 60 % Rh (non-condensing)
- All measuring channels are compatible only to the Baker Axial probes
- Also available in 4 & 2 Channel (Probe inputs)

Electronic Gauge Interface



SERIAL PROBE MODULE



4/8 CHANNEL

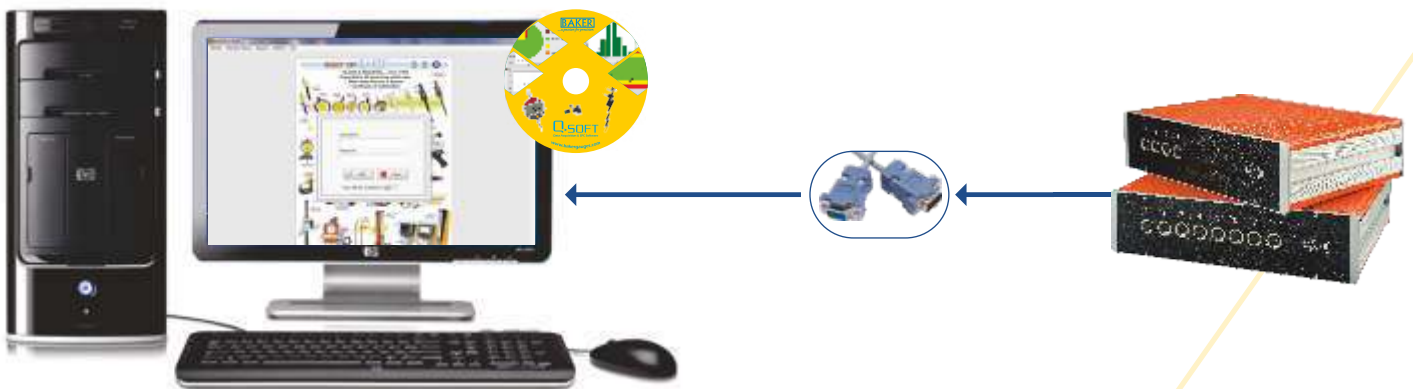


FEATURES

- Interfaces with 4 / 8 Baker Half-Bridge inductive probes
- The new Serial Probe module is equipped with probe signal conditioner as well as analog to digital conversion capability
Therefore, now the computer does not have to be equipped with an ADC interface card, as required by the old probe module
- RS232 serial data communication between PC and Serial Probe module
- Digital measurement value is data tagged with input and output Digital status, which eliminates requirement of a separate input / output interface card in the PC. 8 Digital inputs and 8 digital outputs (TTL compatible)
- Compact size

Note

- For applications requiring more than 8 probes, two or more serial probe modules of appropriate input capability may be used



Electronic Gauge Interface



MULTIPLEXER

The Baker Multiplexer is a simple measurement data transfer device. It serves as a hub for interfacing more than one Baker Digital input (from digital instruments or digital readout units) to the PC for data acquisition, storage and analysis.



TECHNICAL DATA

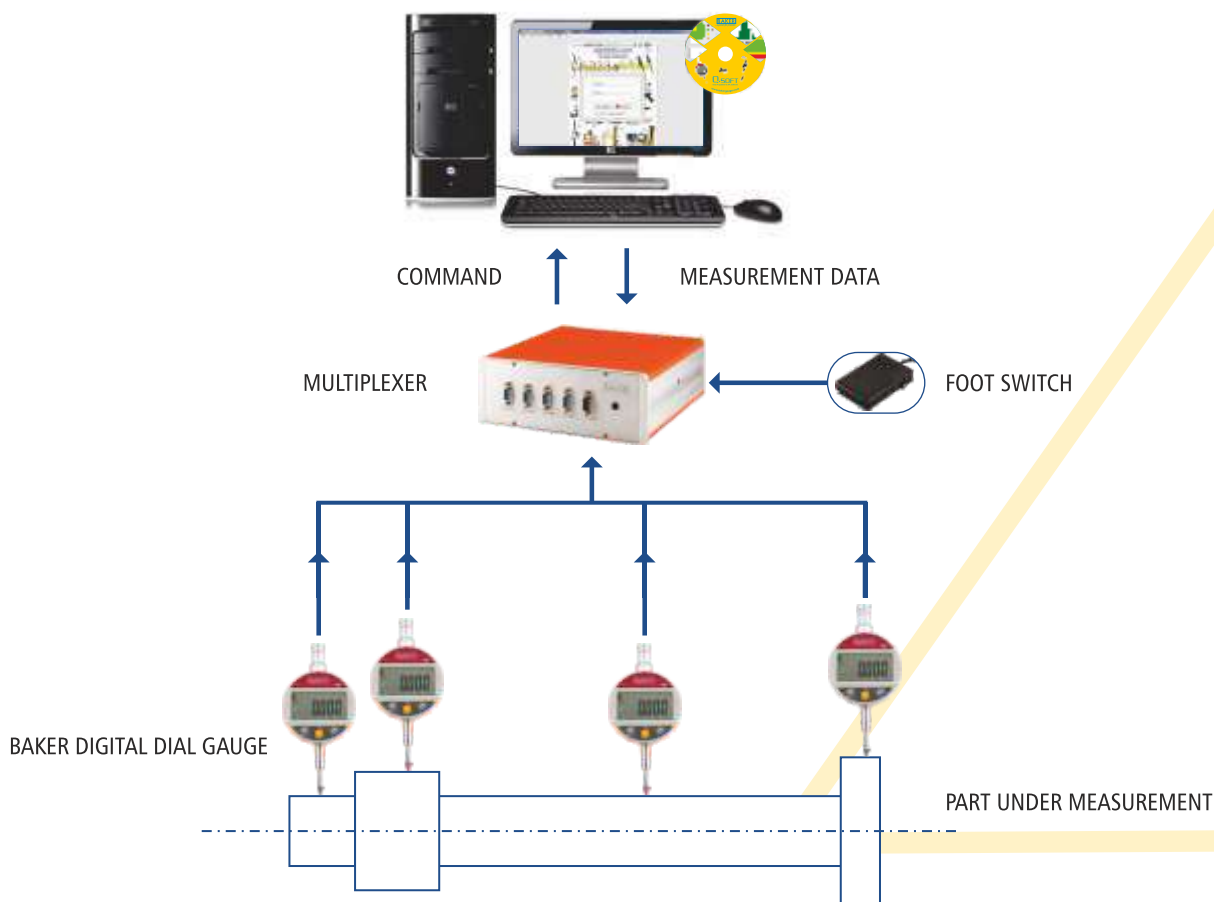
- Data Input port : 4 Channels (RS232)
- Data Output port : One (RS232)
- Data Output format : RS232 C
- Data transmission method : Simplex or Half-duplex
- Data transmission code : ASCII
- Data length : 8 bits
- Start bit : 1
- Stop bit : 1
- Parity check : None
- Baud rate : 9,600 / 19,200
- Power supply : 230 V AC
- Dimensions : (W x D x H) : 235 x 245 x 90 mm
- Optional Accessory : Foot switch

FEATURES

- Up to 4 RS232 compatible Baker electronic measuring inputs can be interfaced to one 4 channel multiplexer
- PC can access RS232 data from the four Baker electronic measuring instruments through RS232 Output port of the 4 channel multiplexer
- Maximum distance between Baker multiplexer and PC is 2 meters, and that of Baker instrument to the multiplexer is 3 meters
- Data from each Baker instrument is tagged by a unique ID to prevent data loss, corruption or mixing

Data acquisition possible in following methods

- By pressing data switch on digital instrument / digital read out unit
- By pressing a foot switch
- Calling command from PC to fetch data from the digital instrument / digital read out unit



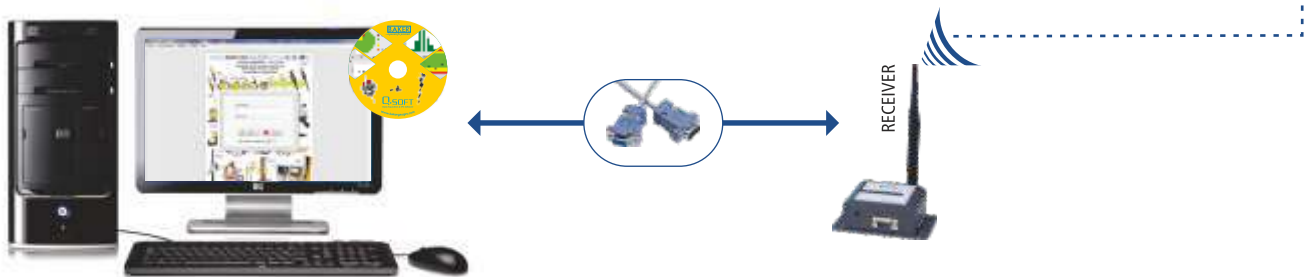
Wireless Data Acquisition

Baker provides a wireless data transfer system to transfer reading from Baker digital instruments and read out units to a centralized PC.

DATA TRANSMISSION SIDE



DATA RECEIVING SIDE



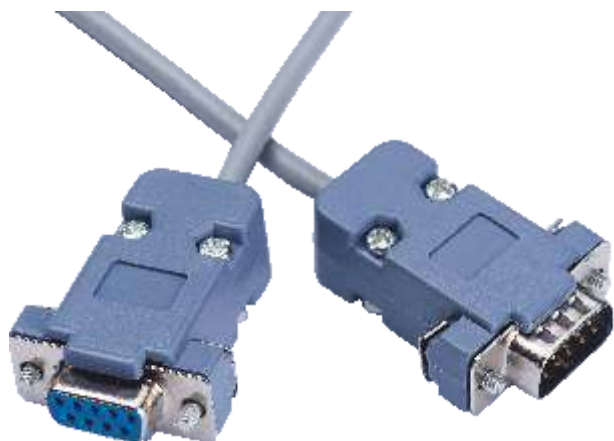
FEATURES

- RS232 compatible Baker electronic measuring instruments, each equipped with a Wireless Transmitter (WT), can be interfaced to a Wireless Receiver (WR) at PC end
- Small and compact wireless modules, easy to use
- License free operating frequency (2.4GHz), ISM (Industrial Scientific & Medical) frequency band
- RS232 interface
- Wireless communication up to 250Kbps
- In-built network security like: 128 bit AES (Advanced Encryption Standard) Encryption, 16 bit customized Network ID
- Supports Mesh network topology
- Transmission range 100 meters, this depends on environment and clear line of sight
- Transmission range can be extended using active Baker instruments fitted with Wireless Transmitters or Wireless Repeaters (WRP)
- Very high receiver sensitivity and low power operation

NOTE

- If clear line of sight, between antennas of WTs and WR is interrupted, then one or more WRPs will have to be introduced
- Number of WRPs that will be required for a networking project, cannot be ascertained at the beginning, and can be fully determined only during installation and commissioning

CABLES



BAKER readout RS232 cable
Used to interface BAKER
204x, AEPx, SPC3000Px, SPC3000Ex.



Ethernet Cable to interface
Baker SPC3000Px, SPC3000Ex



Proximity RS232 Cable
Used to interface BAKER
W1, W1A, W2, W2A, W3, W3A, ZD10, ZD20, ZD30.



Power RS Cable
Used to interface BAKER
W1, W1A, W2, W2A, W3, W3A.



USB Data Cable for V series Digital dial gauges
Used to interface BAKER
V1, V1P, V2, V2P, V3, V3P.



Proximity USB Cable
Used to interface BAKER
W1, W1A, W2, W2A, W3, W3A, ZD10, ZD20, ZD30.



USB Data Cable P1502 and Switch P1601 for
Digital External Micrometers.
Used to interface BAKER
DMM25-1, DMM50-1, DMM75-1, DMM100-1