MODEL SUPB TRANSDUCER

The SUPB is a heavy-duty transducer designed to accurately measure web tension in machines having live-shaft idler rolls. One is placed under the pillow block bearing on each end of a roll shaft. The SUPB has no hinges so it is more reliable and stronger than other UPB transducers on the market. It works equally well with both live and dead shaft idlers. The SUPB transducer is designed to measure forces which are mostly perpendicular to the top plate.

It is available in eight load ratings: 100, 200, 400, 800, and 1200 for Size 2, and 1000, 2500, and 5000 lbs for Size 3.

The transducer can be mounted in any angular orientation about the roll axis. It is designed for use with the tension force direction 'F_T' within +\- 45° of perpendicular to the transducer top plate (see diagram 2). Outside of this angular range, DFE's model UPBH transducer should be used. The UPBH transducer is used to measure tension with the applied force directed mostly parallel to the top-plate.

BENEFITS/FEATURES

- Low maintenance design - lifetime lubricated.
- Sensitive to loads perpendicular to the top plate.
- Corrosion-resistant stainless steel and aluminum construction.
- Entire length of top plate is clear for pillow block installation only along center line.
- Can be installed in any orientation.
- 360 degree overload stop.
- Splash resistant.
- Load ratings to 5000 lbs.
- Use with live or dead shaft idler rolls.

OPTIONS

- **Extended Range output (XR)**. Produces twice the output signal for a given load rating. Must be used with electronics having extended range option.
- **Environmental Connector (EC)**. Prevents liquid from entering transducer through the connector. Especially useful in corrosive environments.
- **Full Bridge (FB)**. Four strain gauges in only one transducer instead of two. Wheatstone Bridge configuration. Used only when a single SUPB is used.
- **Permanently Attached Cable (PT)**. Permanently attached cable instead of amphenol connector.
- **Permanently Attached Cable with Connector (PTC)**.
- **Right Angle Connector (RAB)**. Allows electrical connector to plug in at 90° angle.

PRODUCT CODE

You may order by description or by specifying the code by matching each labeled place with one of the choices below.

Example: SUPB2-100-S-EC,XR

SUPB X - XXX - X - OPTIONS

SIZE	LOAD RATING	CONNECTOR POSITION	OPTIONS
2 = Size 2 3 = Size 3	100 lb. [1] 200 lb. [1] 400 lb. [1] 800 lb. [1] 1000 lb. [2] 1200 lb. [1] 2500 lb. [2] 5000 lb. [2]	S = Standard O = Optional [1]	DT = Drill and Tap EC = Environmental Connector XR = Extended Range [4] FB = Full Bridge [3] PT = Permanently Attached Cable PTC = Permanently Attached Cable with connector RAB = Right Angle Connector [1] Z = Special (SPR)

NOTES:
1. Available on Size 2 only.
2. Available on Size 3 only.
3. Applies only if one transducer is used.
4. Controller / Indicator must have XRE option

SELECTION OF LOAD RATING

To select the correct load rating for an SUPB transducer you will need to calculate Net Force from Roll Weight and Net Force from Tension. The sum of these net force components equals the Total Net Force used to select the correct load rating.

F_T = direction of force midway between two tensions
V = line 'V', perpendicular to mount surface and top plate

1. Enter values from your application for the equation variables below.

T = max. tension in web _____
W = weight of roll and support bearings _____
A = angle between weight 'W' direction and line V_____
B = web wrap angle (=180° - C in diagram 2) _____
D = angle between tension force direction F_T and line V_____.

Dimensional Constants inches (mm)

	Size 2	Size 3
L =	2.4 (61)	4.5 (114)
H =	1.5 (38) + a*	3.0 (76) + a*
***a** =	1.0 (25.4) to 2.5 (63.5)	1.5 (38.1) to 2.5 (63.5)

*Where " a " is the idler roll shaft center height from the top plate surface.

2. Refer to the **Diagram 1** formulas for **Net Force from Roll Weight**. Determine whether the roll weight will be pushing toward or pulling away from the top plate, and whether the direction of the weight from the center of the roll is pointed in the 90° quadrant on the left or the right of line V (observe the pivot end marked "P"). Plug the values for your variables (and the dimensional constants) into the associated equation that most closely matches your application. Calculate the Net Force from Roll Weight. *Note:* It is critical to maintain the algebraic sign ("+" or "-") in the result.

If the Net Force from Roll Weight is more than 95% of the load rating chosen, the tension meter will probably not be adjustable to zero. If this is the case, one or more of the following changes must be made.

- Reduce the transducer weight.
- Decrease Angle A.
- Use the next higher load rating. Please consult DFE for advice.

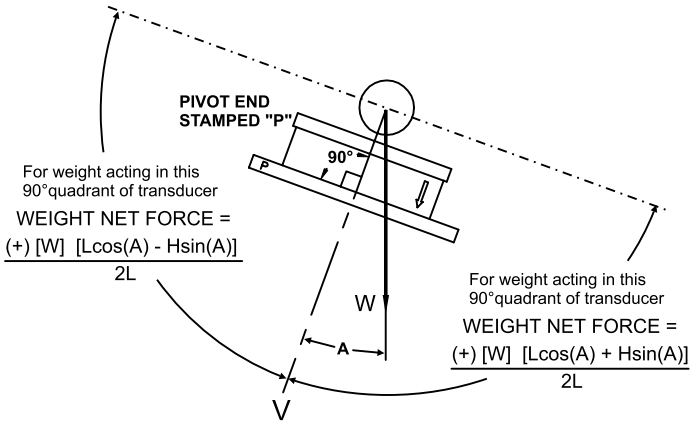
3. Refer to the **Diagram 2** formulas for **Net Force from Tension**. Select the drawing that most closely matches your application in terms of F_T direction relative to line V (observe the pivot end marked "P").
Note: When the calculated Net Force from Tension is negative (i.e. pulling away from the transducer) it is necessary to reverse the signal polarity in associated electronics (indicators or controllers). This optional reverse polarity can be specified when purchasing DFE electronics.

4. Add the Net Force from Weight and the Net Force from Tension paying close attention to the algebraic sign of each component. Use the total to select the appropriate load rating (lbs) from the list below.

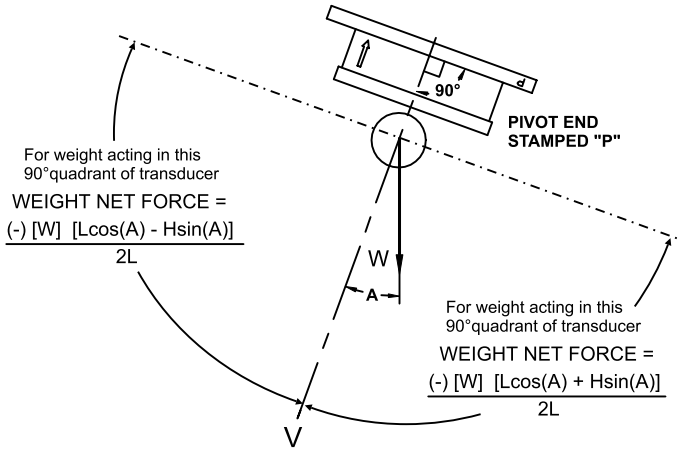
Size	Max. Net Force lbs. (Newtons)	Load Rating
2	up to 120 (550 N)	100 lbs. (450 N)
	240 (1075 N)	200 lbs. (900 N)
	480 (2150 N)	400 lbs. (1800 N)
	960 (4275 N)	800 lbs. (3600 N)
	1440 (6425 N)	1200 lbs. (5350 N)
3	up to 1200 (5350 N)	1000 lbs (4450 N)
	3000 (13350 N)	2500 lbs (11125 N)
	6000 (26700 N)	5000 lbs (22250 N)

DIAGRAM 1: FORMULAS FOR NET FORCE FROM ROLL WEIGHT

CASE A: Weight pushing toward top plate



CASE B: Weight pulling away from top plate



NOTE: When the transducer is mounted horizontally, the Weight Net Force equations can be simplified to W / 2 in CASE A, and (-) W / 2 in CASE B.

DIAGRAM 2: FORMULAS FOR NET FORCE FROM TENSION

Note:

If FT is perpendicular (Angle D = 0°, i.e. sinD = 0.0) and toward the top plate, either of the two drawing/formulas on the left can be used.

If FT is perpendicular (Angle D = 0°, i.e. sinD = 0.0) and pulling away from the top plate, either of the two drawing/formulas on the right can be used.

With wrap type 2 or 3 there will be no output if angle D = 45°, and there will be a reversal of signal polarity for angles greater than 45°.

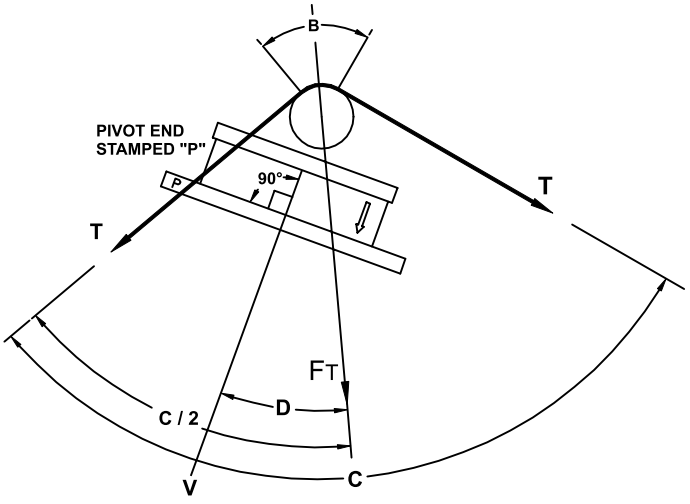
For wrap 1 or 4, as angle D increases beyond 45°, tension sensitivity decreases.

TABLE 1

Angle (Degrees)	SINE	COSINE
0	.000	1.000
5	.087	.996
10	.174	.985
15	.259	.966
20	.342	.940
25	.423	.906
30	.500	.866
35	.574	.819
40	.643	.766
45	.707	.707
50	.766	.643
55	.819	.574
60	.866	.500
65	.906	.423
70	.940	.342
75	.966	.259
80	.985	.174
85	.996	.087
90	1.000	.000

WRAP 1

FT **pushes toward** top plate and away **from** pivot end

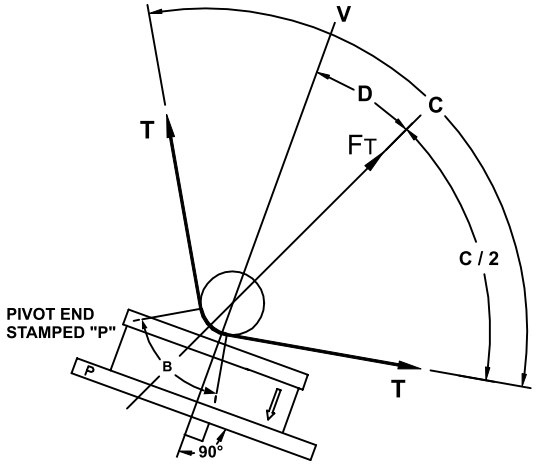


TENSION NET FORCE =

$$\frac{(+)\ [4T\sin(B/2)]\ [L\cos(D) + H\sin(D)]}{2L}$$

WRAP 3

FT **pulls from** the top plate and away **from** pivot end

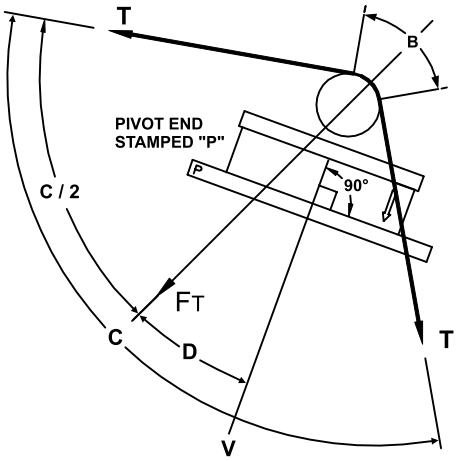


TENSION NET FORCE =

$$\frac{(-)\ [4T\sin(B/2)]\ [L\cos(D) - H\sin(D)]}{2L}$$

WRAP 2

FT **pushes toward** top plate and **toward** pivot end

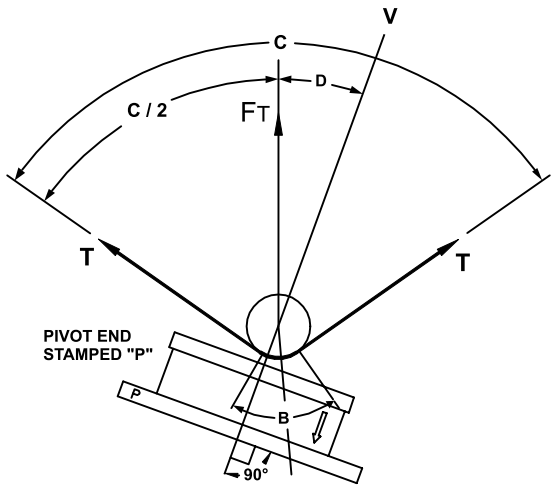


TENSION NET FORCE =

$$\frac{(+)\ [4T\sin(B/2)]\ [L\cos(D) - H\sin(D)]}{2L}$$

WRAP 4

FT **pulls from** the top plate and **toward** pivot end



TENSION NET FORCE =

$$\frac{(-)\ [4T\sin(B/2)]\ [L\cos(D) + H\sin(D)]}{2L}$$

SPECIFICATIONS

ELECTRICAL

Excitation:
5 Vdc, regulated (10Vdc with XR)

Output:
250 mVdc, nominal, at 5V excitation
(500 mVdc at 10V excitation with XR)

Strain Gage Resistance:
100 ohms, nominal

Non-Repeatability:
±1/4% Full Span (FS)

Combined Non-Linearity and Hysteresis:
±1/2% (FS)

Temperature range:
-10°F to 200°F (-23°F to 93°C)

Mating Electrical Connector:
3-Pin Amphenol with Clamp (DFE #721-1445)

Electrical Connector Position:
Refer to Dimension drawing on back page

MECHANICAL

Deflection:
Size 2 = 0.010 in. max. (0.3 mm)
Size 3 = 0.015 in. max. (0.4mm)

Load ratings:
Size 2 = 100, 200, 400, 800, 1200 lbs.
(450, 900, 1800, 3600, 5350 N)
Size 3 = 1000, 2500, 5000 lbs.
(4450, 11125, 22250 N)

Static Overload Capacity:
Size 2 = 3,000 lbs. (13,000 N)
Size 3 = 10,000 lbs. (44,000 N)

Material:
303, 304 Stainless Steel, 7075-T6 Aluminum;

Load Direction:
+/- 45° of perpendicular to top plate

Weight:
Size 2 = 9 lbs. (4 kg.) Size 3 = 30 lbs. (14 kg.)

BEARING RECOMMENDATION

The SUPB transducer will perform best if the proper bearings are used.

First, both of the bearings should have **self-aligning** capability. This will eliminate stresses on the top plate caused by roll deflection, misalignment and uneven mounting surfaces.

Second, the shaft should be able to **"float"** (move axially a small amount) relative to one of the bearings to compensate for roll/shaft length expansion.

DIMENSIONS

SIZE		A	B	C	D	E	F	H	K	L	M	N	O	P	R	S
2	in.	2.62	9.00	2.88	2.62	3.80	0.45	8.00	8.00	---	0.53	1.36	0.95	4.54	1.31	0.56
	mm	67	229	73	67	96	11	203	203	---	14	34	24	115	33	14
3	in.	4.50	13.5	5.74	4.12	---	0.94	12.25	11.25	2.75	0.53	2.97	1.65	6.82	---	0.94
	mm	114	343	146	105	---	24	311	286	70	14	75	42	173	---	24

Note: Connector position is on long side for Size 2, and pivot end for Size 3

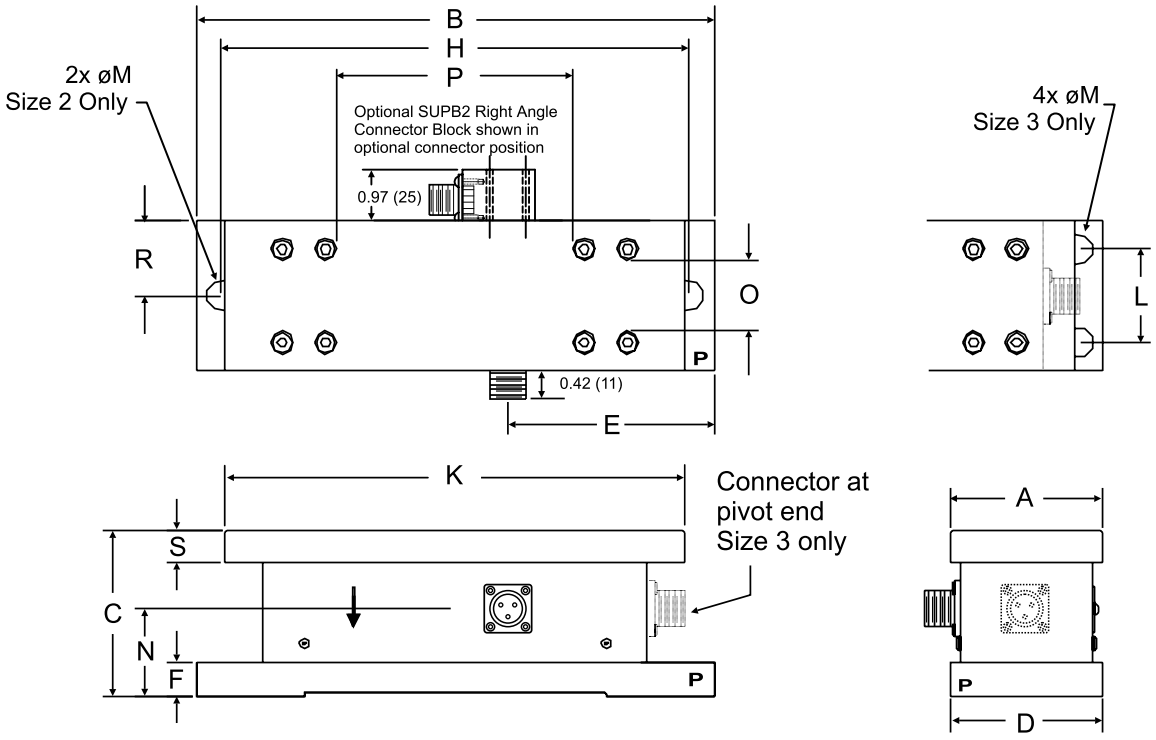
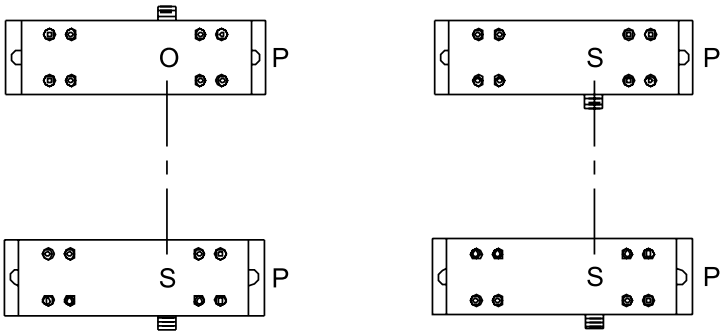


Figure below for Size 2 SUPB's only.



"P" Denotes Pivot End of Transducer
"S" Denotes Standard Connector Position
"O" Denotes Optional Connector Position

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