



### MODEL F SERIES TENSION TRANSDUCER



Model F Series transducers (load cells) mount under pillow-block bearings at each end of an idler roll shaft. Designed for use in demanding tension measurement environments, the Model F transducer shell has a one-piece aluminum base with a removable stainless steel top plate.

A rubber seal between the base and top plate prevents water ingress and dust contamination to IP65 standards. The transducer's electrical connector is located at the end of a short cable for easier articulation during installation.

The Model F transducer is available in a V (vertical) configuration for when the applied force is roughly

perpendicular to the top plate of the transducer. It is also available in an H (horizontal) configuration for use when the applied force is closer to parallel with the transducer top plate.

The Model F transducer is available in two sizes – 2 and 3, and mounts on a flat surface using one bolt (size 2) or two bolts (size 3) on each end of the base. Load ratings range from 100 to 1,200 lbs in the size 2 and 1,000 to 7,500 lbs in the size 3 (7,500 lb load rating available in H configuration only).

The Model F Series load cells supersede UPB and SUPB tension transducers manufactured from 1992 to 2010.

## FEATURES & BENEFITS

- Low-maintenance design.
- Entire length of top plate is clear for pillow block installation.
- Can be installed in any orientation.
- High overload protection.
- Splash resistant.
- Use with live-shaft or dead-shaft idler rolls.
- Corrosion-resistant stainless steel and aluminum construction.
- Attached cable with amphenol connector.
- Tethered top plate prevents separation from transducer in the unlikely event of beam breakage.
- Robust overload protection. Load stops limit beam deflection to 125% of rated output.
- Designed to meet CE mark requirements for Measurement & Control equipment: EN61326 for EMI.
- Designed to meet the IP 65 standard for ingress protection.

## OPTIONS

- Drill and Tap (D&T)** - Drill and tap the top plate.
- Extended Range Output (XR)** - Increased sensitivity when used with legacy amplifiers and indicators such as the TI14, TI15, TI17, TI18, TI23 and TI24.
- Oversize Top Plate (OTP)** - For mounting of large pillow-block bearing.
- Permanent Cable with Tinned Leads (PT)** - Flying leads in place of standard cable connector.

## SPECIFICATIONS

- Excitation Voltage:** 5 VDC max (10 VDC with XR option)
- Full Scale Output:** 50 mV/V, nominal
- Strain Gages:** Semiconductor, 100 ohms, nominal (200 ohms with XR)
- Non-Repeatability:** ± 1/4% full span
- Combined Non-Linearity and Hysteresis:** ± 1/2% full span
- Temperature Range:** -10°F to 200°F (-23°C to 93°C)
- Mating Electrical Connector:** P/N: 721-1445
- Materials:** 303/304 stainless steel and aluminum
- Load Ratings:**  
 Size 2: 100, 200, 400, 800, 1200 lbs (450, 900, 1800, 3600, 5350 N)  
 Size 3: 1000, 2500, 5000, 7500<sup>2</sup> lbs (4450, 11125, 22250, 33360<sup>2</sup> N)
- Static Overload Capacity:**  
5 times load rating, minimum
- Weight:** Size 2: 7 lbs (3 Kg)  
Size 3: 42 lbs (19 Kg)

## PRODUCT CODE

You may order by description or by indicating your feature choices in place of the X's in the product code shown below. **Example: F2V-200-D&T,XR**

**F   X   -   X   -   X   -   OPTIONS (Separated by Commas)**

SIZE	FORCE DIRECTION	LOAD RATING	OPTIONS
2	V = Vertical H = Horizontal	100 lbs (Size 2 only)	D&T = Drill & Tap OTP = Oversize Top Plate PT = Permanent Cable with tinned leads XR = Extended Range <sup>1</sup>
3		200 lbs (Size 2 only)	
		400 lbs (Size 2 only)	
		800 lbs (Size 2 only)	
		1,000 lbs (Size 3 only)	
		1,200 lbs (Size 2 only)	
		2,500 lbs (Size 3 only)	
		5,000 lbs (Size 3 only)	
	7,500 <sup>2</sup> lbs (Size 3 only)		

- NOTES:**
1. For maximum performance, legacy electronics should be configured with the XRE option.
  2. 7,500 lbs available in horizontal force direction only.

# SELECTION OF LOAD RATING FOR MODEL F TYPE H TRANSDUCER

The Model FH Transducer is available in several standard load ratings, ranging from 100 lbs (450 N) to 7,500 lbs (33,360 N). The correct rating for any particular application depends on web tension, transducer roll weight, wrap angle and the direction of the tension force. Select the appropriate wrap configuration from the sketches below and apply the formula below the sketch.

- The Model FH transducer is sensitive to forces parallel to its top plate.
- Angle "D" should be as small as possible. Output will rapidly drop as D gets larger. Do not exceed 30°.
- If A = 0, idler weight will not produce any output signal.

Use the chart at bottom of page to select the correct load rating. In some cases, the load rating may be less than the calculated value. Sometimes the weight of a transducer roll uses up most of the operating range of the transducers. When this happens, it may not be possible to adjust the tension indicating meter to read zero when tension is zero

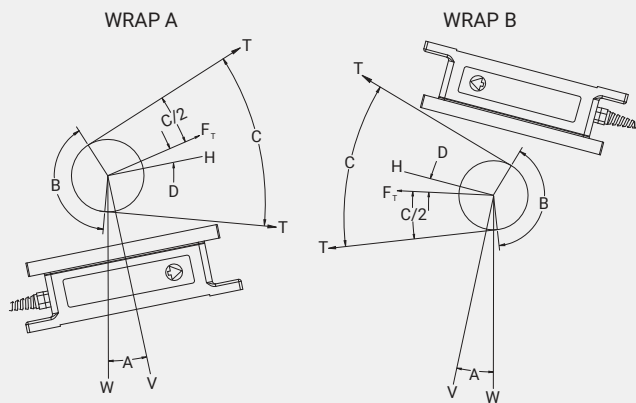
because the adjustment range of the electronic circuit has been exceeded. If the effective roll weight, represented by the  $W \sin(A)$  term in the formulas below, is more than 95% of the load rating chosen, the tension meter will probably not be adjustable to zero. If this is the case, one or more of the following changes must be made to reduce  $W \sin(A)$ .

- Reduce the transducer roll weight.
- Decrease angle (A).
- Use the next higher load rating (this is the least desirable choice because it reduces the transducer output signal).

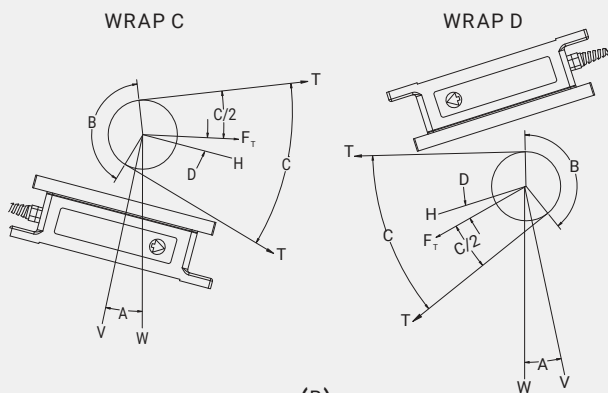
### Recommended Roll Weight Maximums:

- 100 lbs load rating: 400 lbs max. roll weight
- 200 to 400 lbs load rating: 1,000 lbs max. roll weight
- 800 to 1,200 lbs load rating: 2,500 lbs max. roll weight
- 2,500 lbs load rating: 5,100 lbs max. roll weight
- 5,000 lbs load rating: 11,000 lbs max. roll weight
- 7,500 lbs load rating: 16,500 lbs max. roll weight

- T = Total maximum tension
- C = Angle between entering and exiting web
- F = Resultant force due to tension
- W = Idler roll weight
- B = Wrap Angle =  $180^\circ - C^\circ$
- A = Angle between line "V" and vertical direction
- D = Angle between top plate and direction of force. Do not exceed 30° for best accuracy.
- "H" is a line parallel to the top plate



$$\text{Load Rating} = \frac{4T \sin\left(\frac{B}{2}\right) \cos(D) - W \sin(A)}{2}$$

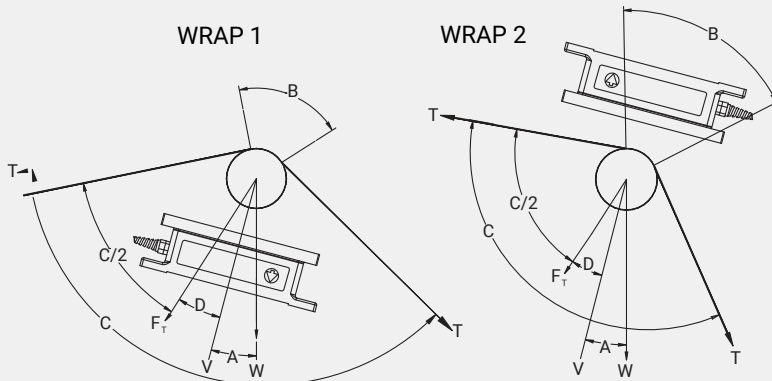


$$\text{Load Rating} = \frac{4T \sin\left(\frac{B}{2}\right) \cos(D) + W \sin(A)}{2}$$

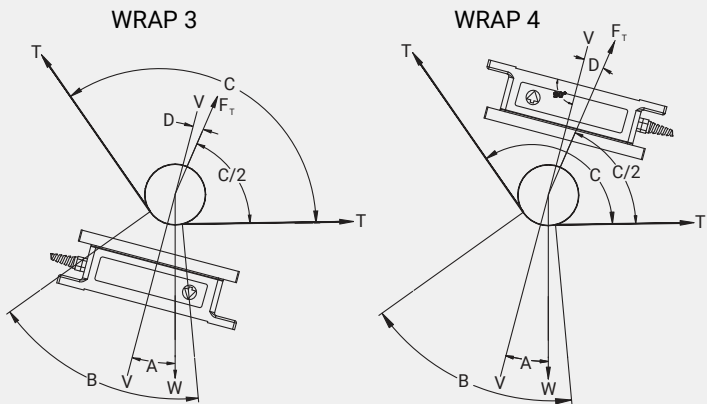
SIZE	Calculated Load Rating (lbs)	Recommended Load Rating
2	up to 120	100 lbs (450 N)
	121 - 240	200 lbs (900 N)
	241 - 480	400 lbs (1,800 N)
	481 - 960	800 lbs (3,600 N)
	721 - 1,440	1,200 lbs (5,350 N)
3	up to - 1,200	1,000 lbs (4,450 N)
	1,201 - 3,000	2,500 lbs (11,125 N)
	3,001 - 6,000	5,000 lbs (22,250 N)
	6,001 - 9,000	7,500 lbs (33,360 N)

## SELECTION OF LOAD RATING FOR MODEL F TYPE V TRANSDUCER

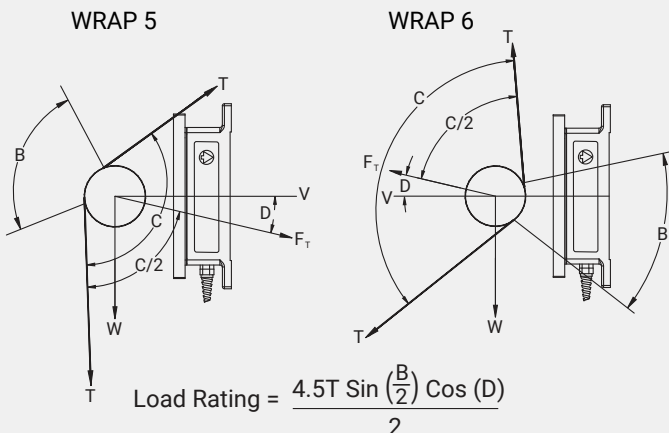
The Model FV transducer senses forces perpendicular to its top plate. It is also available in several standard load ratings, ranging from 100 lbs (450 N) to 5,000 lbs (22,250 N). The correct rating for any particular application depends on web tension, transducer roll weight, wrap angle and the direction of the tension force. Select the appropriate wrap configuration from the sketches below and apply the formula below the sketch. Use the chart at bottom of page to select the correct load rating.



$$\text{Load Rating} = \frac{4.5T \sin\left(\frac{B}{2}\right) \cos(D) + W \cos(A)}{2}$$



$$\text{Load Rating} = \frac{4.5T \sin\left(\frac{B}{2}\right) \cos(D) - W \cos(A)}{2}$$



$$\text{Load Rating} = \frac{4.5T \sin\left(\frac{B}{2}\right) \cos(D)}{2}$$

**NOTES:**

1. Angle "D" should not exceed 30° for best accuracy.
2. If the  $W \cos(A)$  term in equations for wraps 1, 2, 3, & 4 exceed 95% of the transducer load rating, use the next larger size transducer.

- T = Total maximum tension
- C = Angle between entering and exiting web
- F = Resultant force due to tension
- W = Idler roll weight
- B = Wrap Angle =  $180^\circ - C^\circ$
- A = Angle between line "V" and vertical direction
- D = Angle between top plate and direction of force. Do not exceed 30° for best accuracy.

"V" is a line perpendicular to the top plate

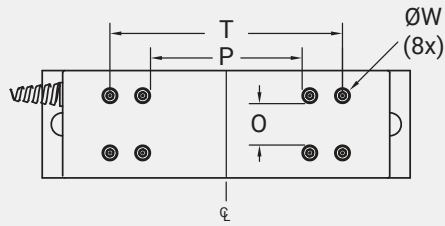
ANGLE	SINE	COSINE
0°	0.000	1.000
5°	0.087	0.996
10°	0.174	0.985
15°	0.259	0.966
20°	0.342	0.940
25°	0.423	0.906
30°	0.500	0.866
35°	0.574	0.819
40°	0.643	0.766
45°	0.707	0.707
50°	0.766	0.643
55°	0.819	0.574
60°	0.866	0.500
65°	0.906	0.423
70°	0.940	0.342
75°	0.966	0.259
80°	0.985	0.174
85°	0.996	0.087
90°	1.000	0.000

SIZE	Calculated Load Rating (lbs)	Recommended Load Rating
2	up to 120	100 lbs (450 N)
	121 - 240	200 lbs (900 N)
	241 - 480	400 lbs (1,800 N)
	481 - 960	800 lbs (3,600 N)
	721 - 1,440	1,200 lbs (5,350 N)
3	up to - 1,200	1,000 lbs (4,450 N)
	1,201 - 3,000	2,500 lbs (11,125 N)
	3,001 - 6,000	5,000 lbs (22,250 N)

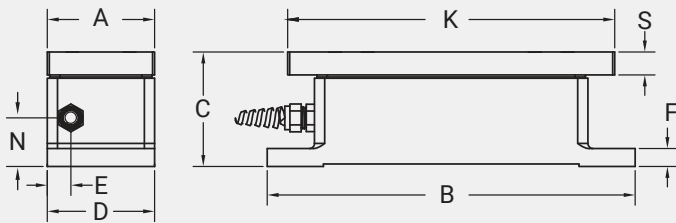
# DIMENSIONS

SIZE		A	B	C	D	E	F	H	J	K	L	M	N	O	P	R	S	T	W
2	IN	2.63	9.00	2.81	2.63	0.58	0.44	8.00	9.75	8.00	.....	0.56	1.19	1.03	3.71	1.31	0.56	5.69	0.37
	MM	66.8	228.6	71.4	66.8	14.7	11.2	203.2	247.7	203.2	.....	14.2	30.2	26.2	94.2	33.3	14.2	144.5	9.4
3	IN	4.50	13.50	4.89	4.50	2.25	0.94	12.25	14.00	11.00	2.75	0.53	2.19	2.24	5.86	0.88	0.94	8.72	0.56
	MM	114.3	342.2	124.2	114.3	57.2	23.9	311.2	355.6	279.4	69.9	13.5	55.6	56.9	148.8	22.4	23.9	221.5	14.2

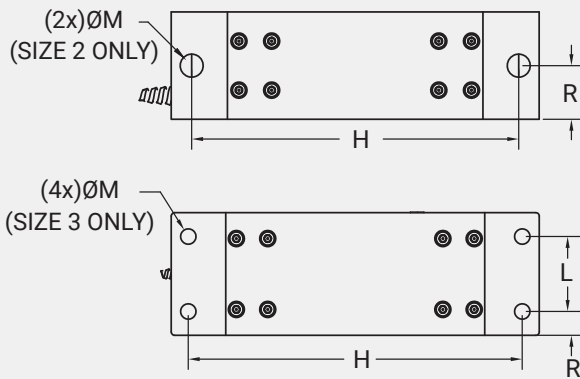
**STANDARD**



**TOP VIEW**

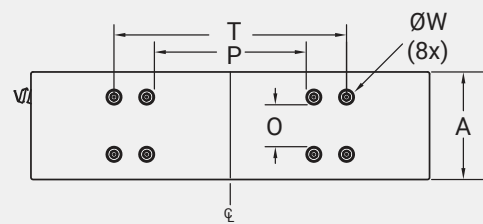


**SIDE VIEW**

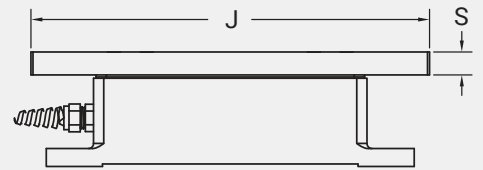


**BOTTOM VIEW**

**WITH (OTP) OPTION**



**TOP VIEW**

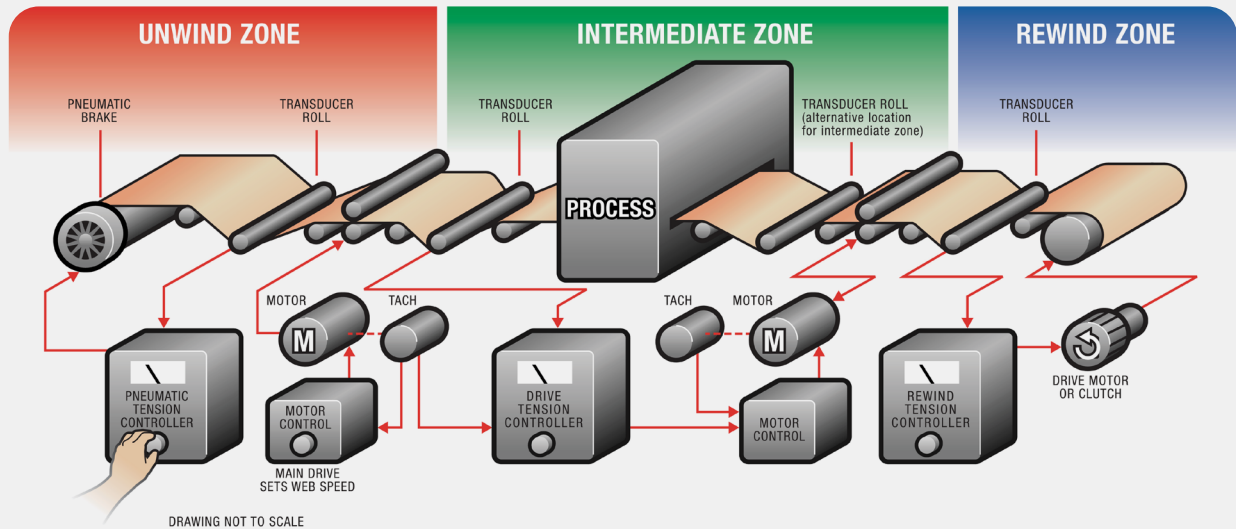


**SIDE VIEW**

# BEARING RECOMMENDATION

The F transducer will perform best if the proper bearings are used. First, 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, one of the bearings should be able to "float" (move axially a small amount) to compensate for roll/shaft expansion caused by heat. The other bearing should not float.

# TENSION ZONE DIAGRAM



## REPLACEMENT PARTS & ACCESSORIES

To complement DFE's 5 Year Warranty, responsive Technical Support and the rest of our tension-free customer care program, you will find just what you need when it comes to spare parts and accessories. These items are listed in the instruction manuals for your Dover Flexo Electronics products. Order replacement parts quickly, simply and securely by calling or e-mailing our sales department.

- Budget-friendly repair services available
- Tension transducer interface cables
- Spare option boards and plug-in circuit cards
- Analog and digital tension meters
- Brake accessories, actuator assemblies and friction pads
- Fast turnaround
- Reasonable prices
- All major credit cards accepted

## TYPICAL RUNNING TENSIONS OF COMMON WEB MATERIALS

Material	English		Metric		Material	English		Metric		
	Weight (points)	Tension (lbs/lin. inch)	Weight (g/m <sup>2</sup> )	Tension (kg/cm)		Tension (lbs/in/mil)	Tension (kg/cm/mm)	Copper Wire (15,000 psi)	Tension (lbs)	Tension (kg)
Paperboard	8	3.0	105	0.54	Aluminum Foils	0.5	3.52	#16 (.051 inches)	30.00	13.6
	12	4.0	157	0.72	Cellophanes	0.75	5.27	#20 (.032 inches)	12.00	5.5
	15	4.5	196	0.90	Acetate	0.5	3.52	#24 (.020 inches)	4.50	2.0
	20	5.5	260	1.26	Myler (Polyester)	0.75	5.27	#28 (.013 inches)	1.75	0.79
	25	6.5	326	1.62	Polyethylene	0.25	1.76	#30 (.010 inches)	1.25	0.57
	30	8.0	391	1.98	Polypropylene	0.25	1.76	#34 (.006 inches)	0.50	0.23
Paper (based on 3,000 sq. foot ream)					Polystyrene	1.0	7.03	#36 (.005 inches)	0.25	0.11
	15	0.40	25	0.135	Saran	0.15	1.05	#40 (.003 inches)	0.10	0.045
	20	0.50	30	0.180	Vinyl	0.25	1.76	Run aluminum wire at ½ - 2/3 these values. 15,000 psi = 103.42 MPa 1 mil = 25.4 microns = 0.0254 mm		
	30	0.75	50	0.270	Nylon	0.25	1.76			
	40	1.25	65	0.360	Wax Paper	1.0	7.03			
	60	2.00	100	0.540						
	80	3.00	130	0.720						

For laminated webs sum the tensions for the individual webs and add 0.1 lb/in. (0.018 kg/cm) of width.