Contents

Warner Electric Tension Control Systems

Warner Electric offers the most complete line of tensioning products available. Several different types of electric and pneumatic brakes designed specifically for tension applications range in torque ratings from 1 oz.in. through 1785 lb.ft. Controls vary from simple manual adjust models through sophisticated closed loop dancer and load cell systems.

Whether tensioning wire, film, foil, paper, kraft stock, or steel, Warner Electric offers the right tension system for your application. Let our tension specialists help you design the ideal system for your needs.

About This Catalog

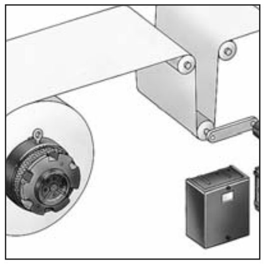
This Warner Electric Master Tension Systems Catalog provides the designer with a complete design guide. Matching system component performance characteristics to your application is made easier through the extensive "Design Considerations & Selection" section and product comparison charts. In addition to selection information, the catalog includes product specifications, dimensions, a glossary of terms, and an application data form. It is the most complete tensioning catalog and design guide available.

Warner capabilities:

- Control technologies from manual operation to closed loop dancer control
- Multiple technologies – Electric, pneumatic and electronic
- Full roll to core control
- Consistent tension, even during flying splices and emergency stops
- Web flutter eliminated to allow better registration control
- Reduction of material waste, downtime and maintenance
- Material flexibility – Thin films, heavy mylar, rolled metals, newsprint, paperboard, laminate foils, wire
- Global distribution
- Local, professional service.

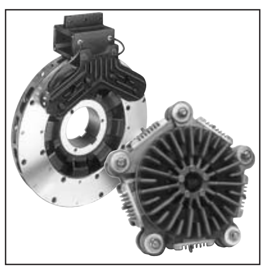
PTDA

Tension Control Systems

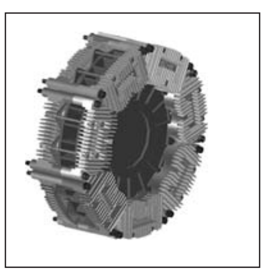


Tension Controls

Tension Brakes and Clutches



ModEvo Pneumatic Brakes



Sensors

Modular Control Units

MCS2000 Series Digital Web Tension Controls

The MCS2000 Web Tension Controller handles all winding, intermediate zone and unwinding applications. MCS2000 easily interfaces to the appropriate clutch/brake driver or motor drive. The digital controller ends the problem of handling large diameter ratios greater than 10:1. See page 46.

- P-I-D parameter programming
- Automatic P-I-D parameter adaption
- Dual outputs in either current or voltage operation modes
- Auto-splice circuit
- Optically isolated I/O
- PLC compatible
- Auto ranging of sensors
- Programmed via hand held programmer or Windows PC program
- Programmable based parameters may be saved on a plug-in memory card
- Multilingual programming
- Usable for unwind/zone/rewind: Electric or Pneumatic Clutches and Brakes, AC, DC, Servo or Stepping Motor Drives.

Analog Controls

TCS Series Analog/Manual Controls

The TCS-200 is a manual analog control for the Electro Disc Tensioning Brake. The control is a constant-current output type that uses a front panel or remote potentiometer to adjust the output. The TCS-200-1/-1H is a manual analog control for any 24 VDC tension brake. It can also accept a 0-10 VDC or 4-20mA analog input for adjusting the output. See page 56.

TCS-200

- Input: 24–30 VAC, 50/60 Hz
- Output: 0-270 mA continuous per magnet up to 12 electro disc magnets, adjustable 3.24 amps
- Torque adjust, brake on, run, brake off switch on front panel
- Remote torque adjust, roll follower inputs

TCS-200-1 Selectable Voltage

- Input: 115/230 VAC, 50/60 Hz
- Output: 0-24 VDC adjustable, 4.25 amps continuous
- Torque adjust, brake on/off, run switch
- Remote torque adjust, roll follower inputs

TCS-200-1H

- Input: 115/230 VAC, 50/60 Hz
- Output: 0-24 VDC adjustable, 5.8 amps continuous
- Torque adjust, brake on/off, run switch
- Remote torque adjust, roll follower, analog voltage or current option

MCS-204 Analog Tension Control

The MCS-204 is a solid-state control designed for manual or analog input to operate one or two 24 VDC tension brakes. It is designed for use with the MCS-166 power supply. See page 57.

- Input 24–28 VDC @ 3 amps
- Operates from torque adjust control knob on front, remote potentiometer, roll follower, or current loop
- Panel mount with exposed wiring or wall/shelf mount enclosure with conduit entrance.

TCS-220 Analog Tension Control

The TCS-220 operates an Electro Disc or other electromagnetic tension brake from an analog input (customer supplied) or the manual setting of the "Torque Adjust" dial on the control face. See page 58.

- Input: 48 VDC. 1.6 amps continuous, 6 amps intermittent. Analog inputs from roll follower or current loop.
- Output per magnet is 0–270 mA running, 270–500 mA stopping
- Cabinet mounting enclosure with exposed wiring or wall/shelf mounting enclosure with conduit entrance.

MCS-208 Analog Tension Control

The MCS-208 operates pneumatic tension brakes through an E to P transducer, which varies air pressure accordingly. Control output is based on an analog input (customer supplied) or the manual setting of the "Torque Adjust" dial on the control face. See page 59.

- Input: 26 VDC. Analog inputs from roll follower or current loop
- Output: 1–9 VDC; 1–5 mA, 4–20 mA, or 10–50 mA, depending on transducer needs
- Cabinet mounting enclosure with exposed wiring or wall/shelf mounting enclosure with conduit entrance.

TCS-320 Analog Splicer Control

The TCS-320 is a solid state splicer control that operates two Electro Disc or other electromagnetic tension brakes, one brake controlling and one brake holding, or two tension brakes operating simultaneously. It can also be used as a dual brake control operating up to 24 MTB brake magnets. See page 60.

- Input: 48 VDC, 3.2 amps continuous, 12 amps intermittent
- Output per magnet is 0–270 mA running, 270–500 mA stopping, 9–90 mA holding
- Available as open frame or with NEMA 4 enclosure

Dancer Controls

MCS-203 Dancer Control

The MCS-203 automatically controls web tension through a dancer roll and sensor. It has 24 VDC output for use with TB, ATTB & ATTC, and Magnetic Particle clutches and brakes. See page 61.

- Operates two 24 VDC tension brakes in parallel when using dual MCS-166 power supplies
- Full P-I-D loop adjustment and system gain adjustment for optimum control.
- Available in open frame or enclosed wall/shelf mount enclosure.

TCS-210 Dancer Control

The TCS-210 automatically controls web tension through a dancer roll and position sensor. It outputs to an Electro Disc or other electromagnetic tension brake. See page 62.

- Input: 48 VDC, 1.6 amps continuous, 6 amps intermittent
- Output per magnet: 0–270 mA running, 270–500 mA stopping
- Cabinet mounting enclosure with exposed wiring or wall/shelf mounting enclosure with conduit entrance.

MCS-207 Pneumatic Dancer Control

This control provides automatic web tensioning using a dancer roll and pivot point sensor. See page 63.

- Operates most pneumatic clutches and brakes
- Automatic control for precise tensioning with minimal operator involvement
- Full P-I-D loop and system gain adjustments for optimum control
- Switch selectable output operates E to P transducers (0–10VDC) or I to P transducers (1–5mA, 4–20mA, 20–50mA) with zero and span adjustments.

TCS-310 Dancer Splicer Control

The TCS-310 is an automatic splicer control that operates two Electro Disc or other electromagnetic tension brakes, one brake controlling and one brake holding, or two tension brakes operating simultaneously. It can also be used as a dual brake control operating up to 24 MTB brake magnets. See page 64.

- Input: 48 VDC, 3.2 amps continuous, 12 amps intermittent
- Output per magnet is 0–270 mA running, 270–500 mA stopping, 0–90 mA holding
- Available as open frame or with NEMA 4 enclosure

Power Supplies

MCS-166 Power Supply Module

The MCS-166 Power Supply Module provides power for the MCS-203, MCS-204, MCS-207, or MCS-208 control modules. See page 65.

- 120V/220V/240 VAC, 50/60 Hz
- 24 VDC, 1.5 amp output
- May be connected in parallel for increased current capacity.

TCS-167 Power Supply

The TCS-167 Power Supply provides power for either the TCS-210 or TCS-220 control modules. See page 65.

- 120V/240 VAC, 50/60 Hz operation, switch selectable
- Output: 9 VDC @ 1.5 amps and 48 VDC @ 1.6 amps continuous, 6 amps intermittent
- Internally fused for protection.
- Available in open frame or enclosed wall/shelf mount enclosure.

TCS-168 Power Supply

The TCS-168 Power Supply provides power to either the TCS-310 or 320 dancer tension controls. See page 65.

- Input switch selectable for 120 or 240 VAC, 50/60Hz
- Output 3.2 amps continuous, 12 amps intermittent

Sensing Devices

Ultrasonic Sensors

- Analog outputs with selectable 0–10V – 4–20mA
- Input voltage 20–30VDC
- Range control zero and span
- Short circuit protected
- 80" max. distance
- Response time 50 mSec

Pivot Point Sensors

The TCS-605-1 and TCS-605-5 pivot point sensors close the feed back loop to the tension control by sensing dancer roll position.

- TCS-605-1 is a single turn potentiometer with a resistance of 1KΩ for normal dancer operating ranges within 60° of arm rotation.
- TCS-605-2 is a single-turn potentiometer with a resistance of 5KΩ for normal dancer operating within a 60° range used with AC & DC drives.
- TCS-605-5 is a five-turn potentiometer with a resistance of 1KΩ for festooned dancer systems, with a 300° rotational range.

Load Cell Sensors

These devices are used in tension systems to provide closed loop feedback of the actual tension on the web.

FM – Foot Mounted

The foot mounted style load cells (used with pillow blocks) provide easy and convenient mounting to the roll that is being measured. It is a strain gauge style unit that is ideal for heavy tension applications.

- Load ratings: 22, 56, 112, 225, 562, 1122, 2248 lbs.
- Sensitivity (output): 1 mV/V at nominal load
- Power Supply: 10 to 15 VDC

ES – End Shaft Mounted

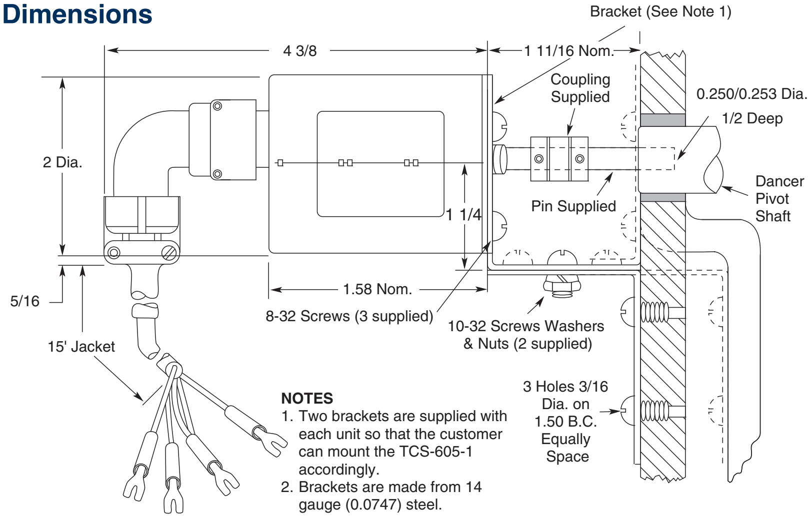
The end shaft style load cells mount to the end of the roll that is being measured. It is a LVDT (Linear Variable Differential Transformer) style which can withstand overloads up to 10 times its rated load capacity. There are several models offered: dead shaft (no bearing), live shaft and cantilever where a single load cell can be used to measure the tension on the roll. Some units are powered with DC voltage and other units are powered with AC voltage. The AC units offer a price advantage over the DC.

- Load Ratings: 20, 50, 90, 200, 500
- Sensitivity (output): 3VDC at nominal load
- Power Supply: ±12 to ±15 VDC, ±5%

TCS-605-1
TCS-605-2
TCS-605-5

Warner Electric pivot point sensor is a precision electronic positioning device which is used with the MCS-203, MCS-207, TCS-210 or TCS-310 dancer control system to provide smooth control of unwind stands operating at any speed. The sensor is mounted at one end of the dancer roll pivot shaft where it monitors the angular position, direction of travel and relative speed of dancer arm movement. TCS-605-2 used with drive systems.

Dimensions



Intermittent Motion Sensor Coupling

The Intermittent Motion Sensor Coupling is a two part coupling designed for applications where the web is started and stopped by intermittent motion. The design allows for an adjustable deadband so that the dancer arm can move before motion is translated to the pivot point sensor. This allows for smoother control of the tensioning device and prevents unwanted hunting and instability in the system. If your application requires this type of coupling, contact your Warner Electric tension specialist to determine if it is right for you.

Figure 1

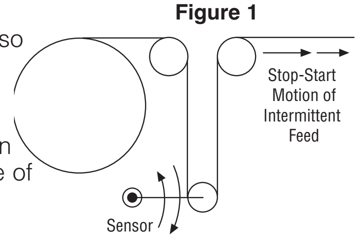
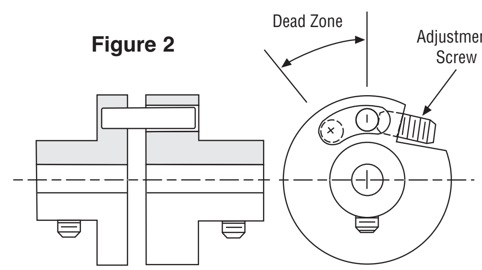


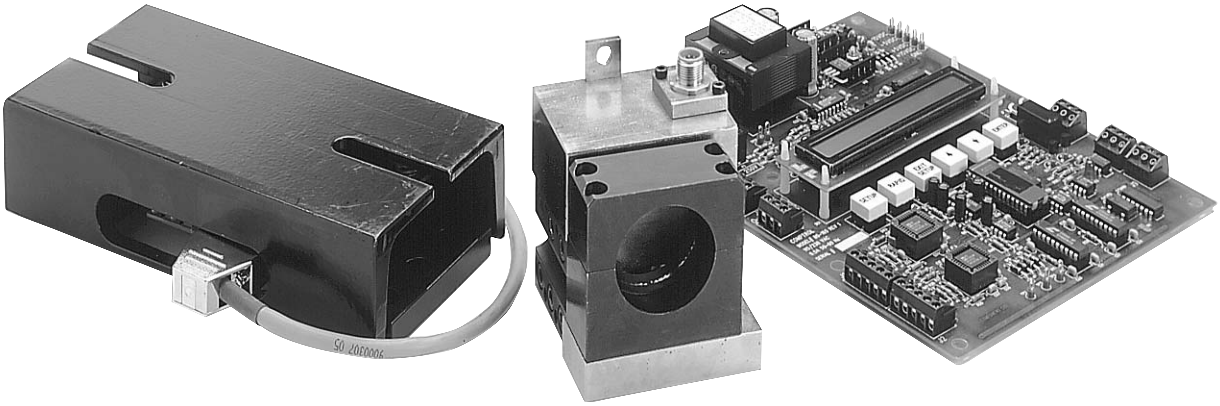
Figure 2



Specifications

Model No.	Part No.	Description
TCS-605-1	7330-448-002	Single turn potentiometer for dancer arm systems where the range of rotary motion from full-up to full-down dancer position is normally maintained within 60° (1KΩ)
TCS-605-2	7330-448-004	Single turn potentiometer for drive systems (5KΩ)
TCS-605-5	7330-448-003	Five turn potentiometer for festooned dancer systems (1KΩ)
Accessories		
	6910-101-001	Intermittent motion sensor coupling
	284-8000-003	Coupling for Pivot Point Sensors
	7330-101-001	TCS-605 Cable Assembly Only
	7330-101-002	TCS-605-1 Sensor Assembly Only
	7330-101-003	TCS-605-5 Sensor Assembly Only

Load Cell Sensors



Foot Mounted and End Shaft Mounted Series

FM Series Sensors

The foot mounted style load cells (used with pillow blocks) provide easy and convenient mounting to the roll that is being measured. It is a strain gauge style unit that is ideal for heavy tension applications.

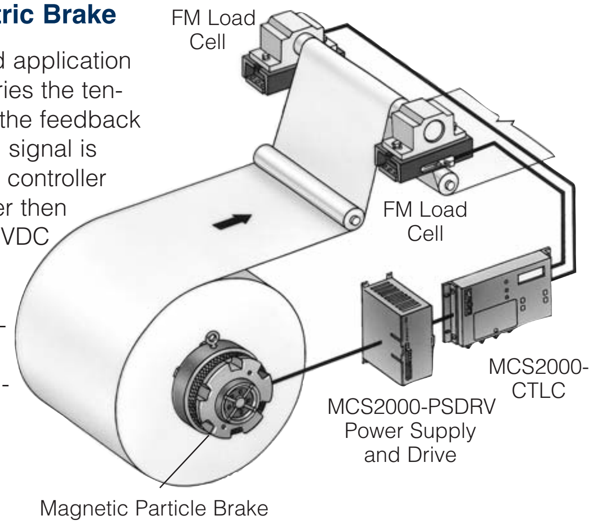
ES Series Sensors

The end shaft style load cells mount to the end of the roll that is being measured. It is a LVDT (Linear Variable Differential Transformer) style that can withstand overloads up to 10 times its rated load capacity. Several models are offered: dead shaft (no bearing), live shaft and cantilever where a single load cell can be used to measure the tension on the roll. Some units are powered with DC voltage and others are powered with AC. The AC units offer a price advantage over the DC.

Typical System Configuration Examples

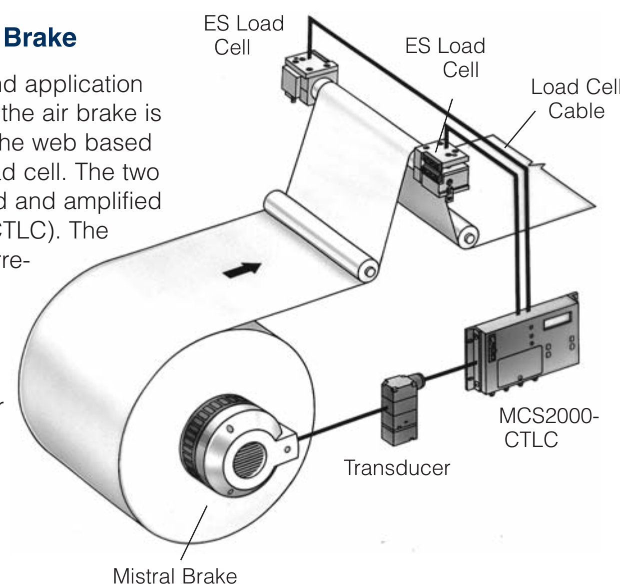
FM Load Cell with an Electric Brake

This is a single load cell unwind application example. The electric brake varies the tension on the web depending on the feedback from the load cell. The load cell signal is amplified and interpreted in the controller (MCS2000-CTLC). The controller then puts out a corresponding 0–10 VDC signal to the power supply and drive (MCS2000-PSDRV). The PSDRV then amplifies and interprets the signal from the controller and puts out a corresponding 0–24 VDC signal to the brake to apply either more or less braking.



ES Load Cell with a Pneumatically Operated Brake

This is a dual load cell unwind application example. In this application, the air brake is used to vary the tension on the web based on the feedback from the load cell. The two load cell signals are summed and amplified in the controller (MCS2000-CTLC). The controller then puts out a corresponding 0–20 mA signal to the transducer, which converts this signal from current to pressure to command the brake to apply either more or less braking.



Specifications

FM Series Foot Mounted Load Cells

Load Ratings	**N**	100	250	500	1,000	2,500	5,000	10K
	(lbs.)	(22)	(56)	(112)	(225)	(562)	(1,124)	(2,248)
Size		01	01	01	01	01	01	02

Input Power ±12 to ±15 VDC, ±5%

Output Signal 5 VDC factory setting at nominal load (can be rescaled for 25% load at +10 VDC output)

Deflection: 6mm at full load rating

Ambient Temperature 0–70°C (F)

Temperature Drift 0.1% of rating per °C

Non-Linearity & Repeatability <0.5%

Power Consumption 1 watt

Cable 16 ft. provided with load cell.

FM Series Model Numbers FM 01 – 1000 – AC

Model (FM) · Size (01) · Load in N (1000) · Amplifier built in (AC)

ES Series End Shaft Mounted Load Cells

AC10 requires a power supply/amplifier

Load Ratings 60 lbs., 170 lbs., 500 lbs.

Deflection: 6mm at full load rating

Input Power 15 Vrms @ 5 KHz

Output Signal 3.2 volts AC/inch displacement/volt excitation

Output Impedance 780 ohms ±30%

Ambient Temperature –60° to +250°F (–50° to +620°C)

Temperature Drift 0.02%

Linearity & Repeatability 0.1% of full scale

Overload Protection 10 times maximum rated load of unit

Cable Two 30 ft. cables provided with load cells.

ES AC10 Series Load Ratings

A	60 lbs.
B	170 lbs.
C	500 lbs.

ES AC10 Series Model Numbers AC 10 A 12 S _

Model (AC 10) · Load Rating (A) · Shaft dia.* (12) · Shaft Mounting Configurations (S _)

*See below for shaft diameters

Shaft Mounting Configurations

W1 = split bushing

W2 = solid bushing

S = system which includes one W1 load cell, one W2 load cell, two 30 ft. cables and a power supply (PSAC10)

PSAC10 Power Supply/Amplifier

Input Power 115/230 VAC, 50–60 Hz

Output Signal –10 to +10 VDC scaleable

Ambient Temperature 32°F to +160°F (0°C to +70°C)

Maximum cable distance between load cell and power supply board 100 feet

Part Number PSAC10 (For a 10 x 8 x 4 Housing add –H)

*ES, A30, B30 & C30 Series

Load Ratings	**A30**	8 lbs., 20 lbs., 50 lbs., 90 lbs.
	B30	8 lbs., 20 lbs., 50 lbs., 90 lbs., 140 lbs., 200 lbs., 300 lbs., 500 lbs.
	C30	8 lbs., 20 lbs., 50 lbs., 90 lbs., 140 lbs., 200 lbs., 300 lbs., 500 lbs.

Input Power 24 VDC at .040 amps (12 to 30 VDC acceptable, with LVDT output proportional)

Output Signal 3 VDC/unit

Ambient Temperature –60° to +250°F (–50° to +120°C)

Overload Protection 10 times rated load range

Deflection: 6mm at full load rating

Note: Tension cells are factory adjusted to provide an offset voltage with no load applied (no deflection). Using an input of 24 volts DC, the LVDT is set to provide an output of 3.5 volts into a resistive load of not less than 100,000 ohms. The voltage resulting from the maximum rated load then adds to or subtracts from the 3.5 volt offset. This results in an output of 6.5 volts in Compression.

ES A30, B30 & C30 Series Model Numbers B A30 P 12 K W1

MS Connector (B) · Model (A30) · Load Rating (P) · Shaft Dia. Code (12) · DC LVDT (K) · Shaft Mounting Configurations (W1)

*Other sizes available if needed.

Shaft diameter

inches	¾	1	1¼	1⁷⁄₁₆
code	12	16	20	23

– Other diameters are available

Shaft Mounting Configurations

W1 = split bushing

W2 = solid bushing

ES A30 & C30 Series Load Ratings

M*	8 lbs.	**U**	90 lbs.	**Y**	300 lbs.
P	20 lbs.	**X**	200 lbs.	**Z**	500 lbs.
T	50 lbs.	**W**	140 lbs.		*shaft size 70 3/4 only

Load Cell Selection

The following steps should be followed to determine the proper load cell size and style for your application.

1. Determine whether you will be using one or two load cells.

It is best for two sensing heads to be used, one at each end of the sensing roll. The two individual web tension inputs are averaged in the controller, which takes care of non-central alignment of the web over the sensing roll and slack edges from a non-uniform reel. The AC10 and C30 can only be used in dual load cell applications. The FM Series and A30 can be used in single load cell applications. The A30 is designed to be used with a single pulley or sheave mounting with a projection of 1 or 2 inches. An ES style cantilever unit is also available in lengths to 18”. Consult the factory for more information.

2. Choose the load cell model that fits dimensionally.

The FM style is a foot mounted load cell (used with pillow blocks) that mounts perpendicular to the roll being measured. The ES style is an end shaft model where the mounting bolt centerline is on the axis of the measuring roll. There are two shaft mounting configurations with the ES style load cells. The “W1” cell clamps to the shaft while the “W2” cell allows for thermal expansion of the shaft. Both units have self aligning features. When using the dual load cell units (B30, C30 or AC10 series) one of each shaft mounting configuration must be used. It is recommended that a system be ordered in the AC10, B30 or C30 series (ex. AC10A12S) which will insure one “W1” load cell and one “W2” load cell is supplied as a matched pair.

The AC10 is an AC version load cell that is economically priced when compared with the other ES models, even with the added power supply board that is required to power it.

Available sizes and dimensions are listed on pages 42 & 43 for the ES or FM style units. Choose the unit(s) that will best fit the machine construction.

3. Load Cell Force Calculations

The FM style load cell can be mounted regardless of orientation, but has to work in compression. Only the perpendicular force (resultant) is measured by the load cell. The perpendicular force can be at a maximum permitted angle of ±30°. The FM style is a strain gauge load cell and the maximum tension in the web used (T) should be the potential overload force.

The ES style load cells can be mounted at any angle around the axis of the measuring roll with any wrap angle. They work equally well in either tension or compression making it easy to adapt them to any new, retrofit, or replacement application. The mechanical structure and primary conversion element is designed to handle overloads at ten times the rated load range. Therefore, these units don't need to be oversized to provide adequate overload protection.

The following selection information is required to select a load cell:

T = maximum tension in the web (lbs.)

W = weight of the sensing roll (lbs.) acts vertically

X = wrap angle (degrees), 180° max.

Y = angle between resultant force of tension and vertical (degrees)

SF = Safety factor. Use 1 for ES style load cells and 2 for FM style load cells.

RF = Resulting force (lbs.)

4. Choose the load cell rating that is equal to or greater than the force calculation.

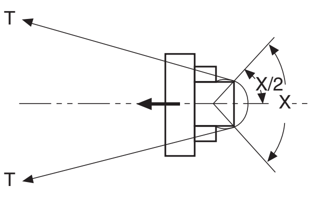
– Minimum rating of each cell should exceed 7% of maximum rating.

5. Choose accessories

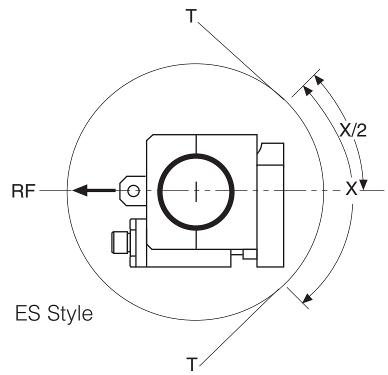
a. For ES style load cells choose shaft diameter. Chart is on page 43.
b. For the A30, B30 or C30 models choose cables L1A25 or L1A99 which are 25 or 99 ft. cables. Other lengths are available. A cable is needed for each load cell ordered.
c. For the AC10 model the PSAC10 (power supply amplifier) is needed. Specify without or PSAC10-H with housing.

Case 1: Resultant force points horizontal

Load = SF x T(lbs.) x sin (X/2)



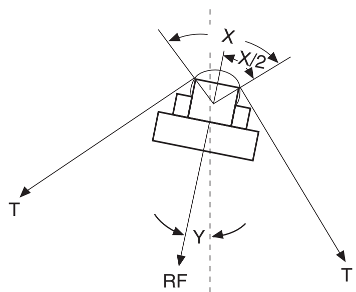
FM Style



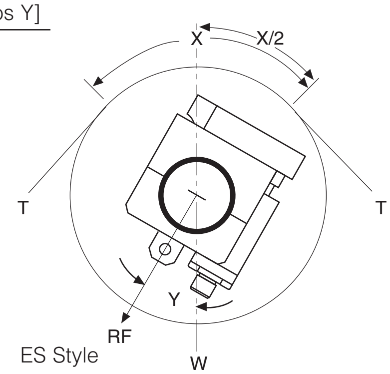
ES Style

Case 2: Resultant force points down

$$\text{Load} = [SF \times T(\text{lbs.}) \times \sin (X/2)] + \frac{[W(\text{lbs.}) \times \cos Y]}{2}$$



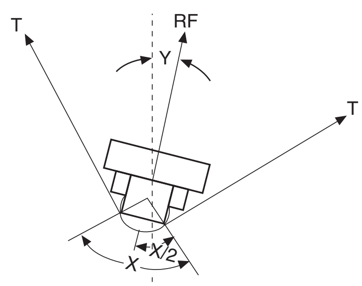
FM Style



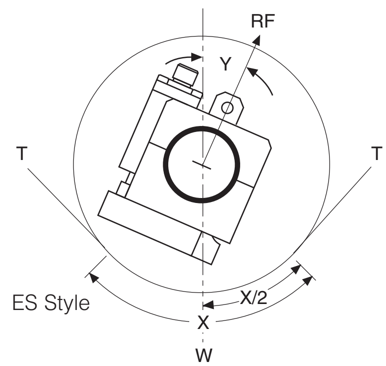
ES Style

Case 3: Resultant force points upward

$$\text{Load} = [SF \times T(\text{lbs.}) \times \sin (X/2)] - \frac{[W(\text{lbs.}) \times \cos Y]}{2}$$



FM Style



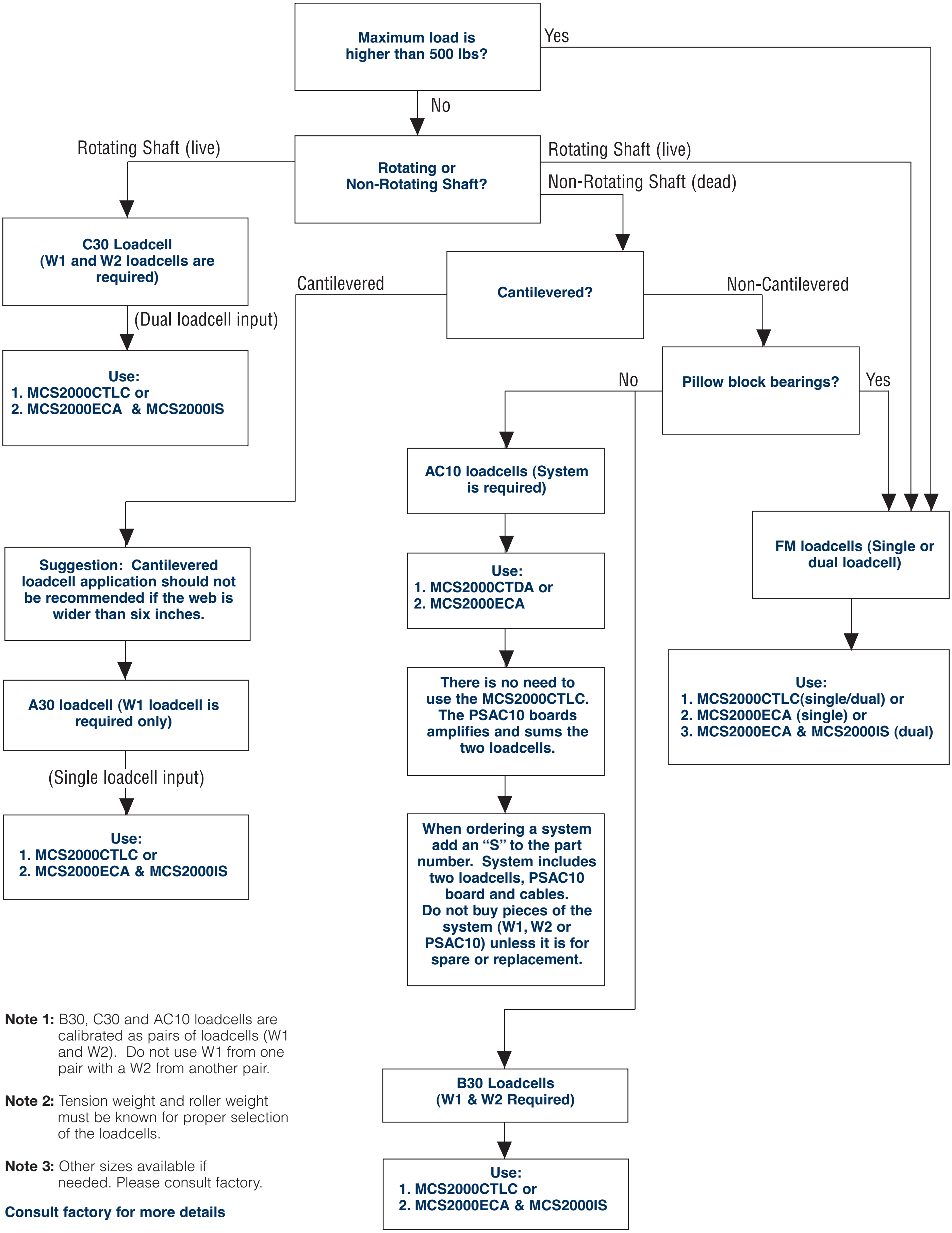
ES Style

Sin/Cos Table

Degrees	Sin	Cos
0°	.0000	1.000
5°	.0872	.9962
10°	.1736	.9848
15°	.2588	.9659
20°	.3420	.9397
25°	.4226	.9063
30°	.5000	.8660

Degrees	Sin	Cos
35°	.5736	.8192
40°	.6428	.7660
45°	.7071	.7071
50°	.7660	.6428
55°	.8192	.5736
60°	.8660	.5000
65°	.9063	.4226

Degrees	Sin	Cos
70°	.9397	.3420
75°	.9659	.2588
80°	.9848	.1736
85°	.9962	.0872
90°	1.000	.0000



Note 1: B30, C30 and AC10 loadcells are calibrated as pairs of loadcells (W1 and W2). Do not use W1 from one pair with a W2 from another pair.

Note 2: Tension weight and roller weight must be known for proper selection of the loadcells.

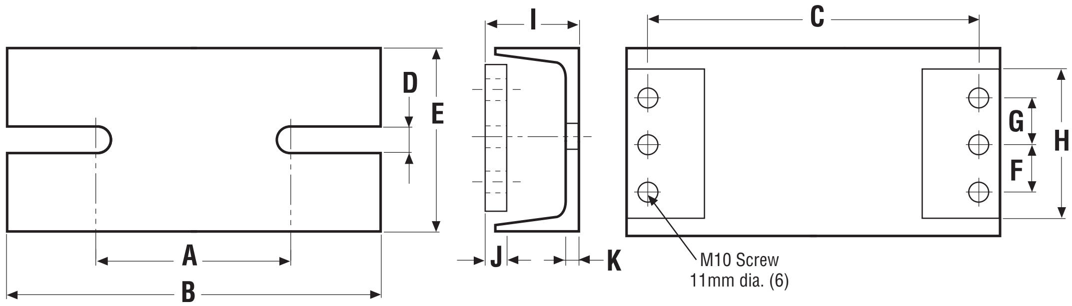
Note 3: Other sizes available if needed. Please consult factory.

Consult factory for more details

Dimensions

FM Series

Foot mounted load cells



inches/(mm)

Size	Part Number	Load Ratings (lbs.)	A	B	C	D	E	F	G	H	I	J	K
1	6910-840-100 6910-840-102 6910-840-104 6910-840-106 6910-840-108 6910-840-110	**22** **56** **112** **225** **562** **1124**	4.055 (103)	7.874 (200)	6.890 (175)	.512 (13)	4.016 (102)	.984 (25)	.984 (25)	3.150 (80)	2.047 (52)	.472 (12)	.236 (6)
2	6910-840-112	**2248**	5.591 (142)	8.858 (225)	7.677 (195)	.669 (17)	5.00 (127)	.984 (25)	.984 (25)	3.937 (100)	2.165 (55)	.709 (18)	.236 (6)
	6910-101-089	Cable Assembly 16 ft.											

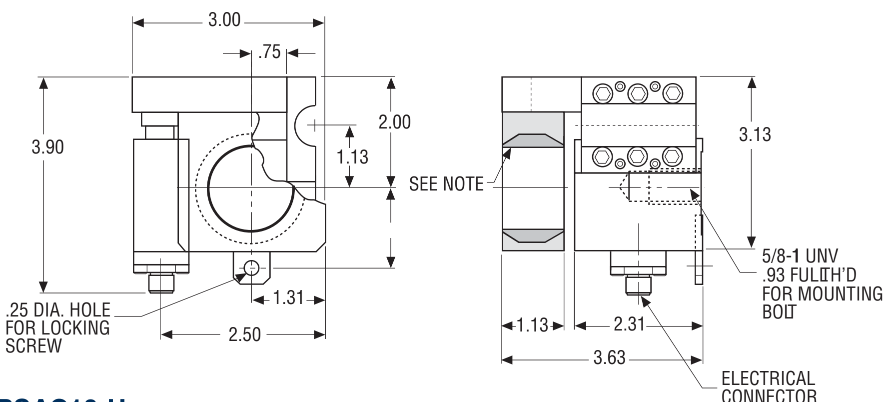
ES Series

End Shaft Mounted Load Cells

AC10

Dual Load Cell, Non-Rotating Shaft Load ratings 60 lbs., 170 lbs., 500 lbs.

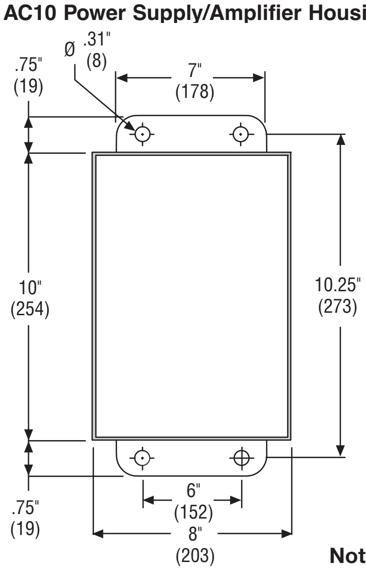
Cable Assembly
L1A30 30 ft. Cables

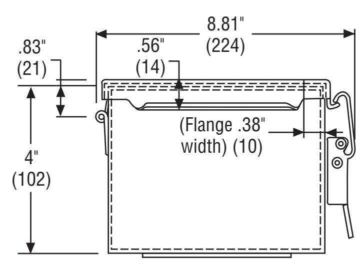


Note:
Stainless steel self-aligning bushing provided for shaft sizes 3/4", 1", 1-1/4" and 1-7/16" diameters. Other shaft diameters available on special order.

PSAC10-H

AC10 Power Supply/Amplifier Housing

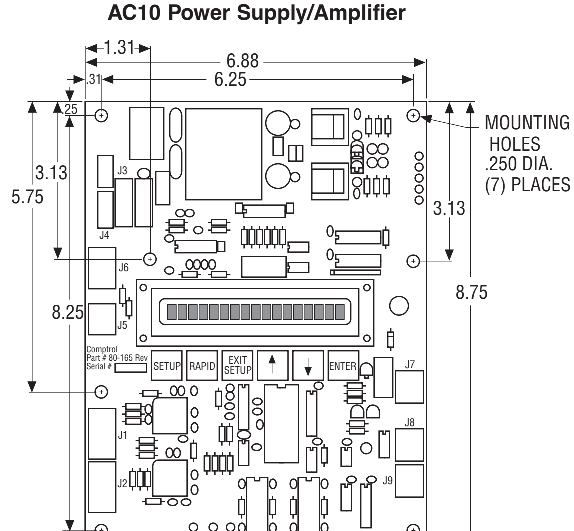




Note: Panels are 14-gauge steel NEMA type 12 and 13.

PSAC10

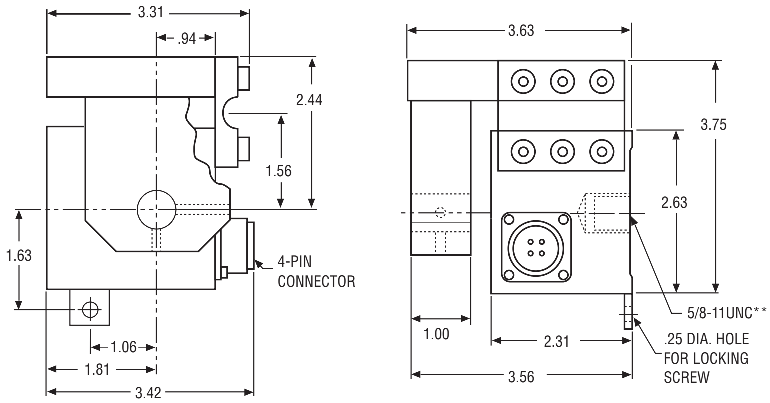
AC10 Power Supply/Amplifier



A30

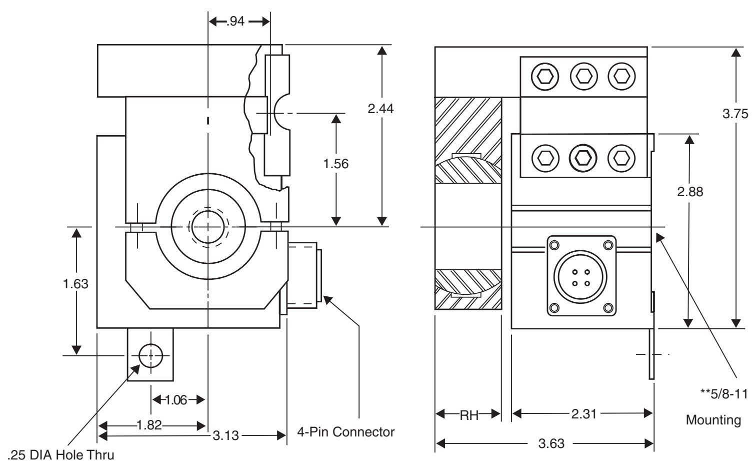
Single Load Cell, Non-Rotating Shaft

Sheave or pulley mounting with projection of 1 or 2 inches.



Load Ratings: 20 lbs., 50 lbs., 90 lbs.
Note: Other load ratings available - consult factory.

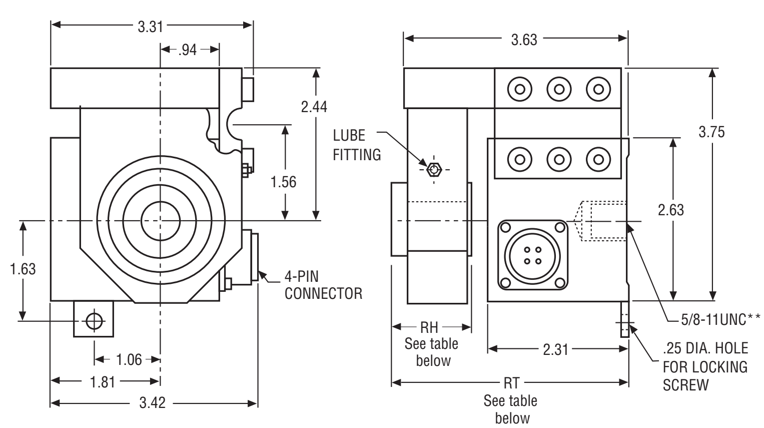
B30



Load Ratings: 20 lbs., 50 lbs., 90 lbs., 200 lbs., 500 lbs.
Note: Other load ratings available - consult factory.

C30

Dual Load Cell, Rotating Shaft



Load Ratings: 20 lbs., 50 lbs., 90 lbs., 200 lbs., 500 lbs.
Note: Other load ratings available - consult factory.

Cable Assemblies– For All 30 Series

L1A25	25 ft. with Connector
L1A99	99 ft. with Connector

RH and RT dimensions based on shaft diameter

Inches	3/4	1.0	1-1/4	1-7/16
Code	12	16	20	23
RH	1.31	1.38	1.69	
RT	3.88		4.13	

Standard Shaft Diameters

Shaft Diameter	Standard
0.75"	3/4"
1.00"	1"
1.25"	1-1/4"
1.4375"	1-7/16"

Other shaft sizes available on special order - consult factory

Selecting the Correct Tension Control

Selecting the correct tension control is as important as selecting the proper tension clutch or brake. As the control is the heart of the system which provides the necessary controlling function in the application, selecting the wrong control or inadequate control can be as bad as incorrectly sizing the mechanical portion of the system.

Normally control selection can be very simple if a few simple questions can be answered regarding the application. By doing so, selection can be very easy and painless.

Selection Steps

The following steps outline a simple way of selecting the proper control system for the application.

1. Determine the type of system that is to be used. Will the system be load cell, dancer, or open loop analog control?
2. Next, determine the type of brake or clutch system that the control will be used with. Will this be an electric or pneumatic system?
3. Using the Quick Selection Chart, determine which models may be suitable for the application.

Once the determination of the control/controls has been made for the application, review the specifications for the various controls to determine the characteristics and features that best suit the application and your requirements.

Mechanical Elements

Once the control has been selected, be sure to check that it will work with the brake or clutch previously selected. This can be determined from the specific technical specification for the control selected. Remember, not all controls will work with all clutches and brakes.

If the control selected will not operate the controlling device selected, i.e., clutch or brake, then a different control must be selected.

Control – Quick Selection Guide

		System Type					
		Open Loop		Closed Loop			
Model Number	Output Voltage	Manual Adjust	Analog Input Adjust	Dancer	Load Cell	Air or Electric	Page
MCS2000	0±10 (2 channel) (0–20mA)	●	●	●	●	Air/Electric	46
***TCS-200**	0–24	●	●			Electric	56
TCS-200-1	0–24	●	●			Electric	56
TCS-200-1H	0–24	●	●			Electric	56
MCS-203	0–24			●		Electric	61
MCS-204	0–24	●	●			Electric	57
MCS-207	0–10 (1–50mA)			●		Air	63
MCS-208	0–10 (1–50mA)	●	●			Air	59
TCS-210	0–24 (48)			●		Electric	62
TCS-220	0–24 (48)	●	●			Electric	58
TCS-310	0–24 (48) (2 channel)			●		Electric	64
TCS-320	0–24 (48) (2 channel)	●	●			Electric	60

*For new applications, we recommend the TCS-200-1 or TCS-200-1H.

Control	Description	Page Number
MCS2000 	Fully digital control, PLC compatible, which can operate in both open (analog input follower) or closed (dancer or load cell) mode. Directly controls electric clutches and brakes, and air brakes via an electric/pneumatic transducer. Control has two output channels with fully programmable splice logic. Can also be used as a digital front end to an analog drive.	46
TCS-200 	Inexpensive analog control with manual or remote follower adjust for electric brakes. Also accepts roll follower potentiometer input. Requires 24-30 VAC input. For use with MTB Series electric brakes (page 68).	56
TCS-200-1 **TCS-200-1H** 	Extremely versatile and economical open loop control for all 24V electric brakes and clutches. Can be used for manual adjust, or will follow an analog (0–10V, 4–20mA) input, such as from an ultrasonic sensor or PLC. For use with MTB, TB and ATTB Series and magnetic particle electric brakes. (page 68)	56
MCS-203 	Closed loop dancer control for 24V electric clutches and brakes. For use with TB Series, ATTC and ATTB Series and Magnetic Particle clutches and brakes (page 68).	61
MCS-204 	Analog control for 24V electric clutches and brakes. Manual control, or analog (0–10V or 4–20mA) signal. For use with TB Series, ATTC and ATTB Series and Magnetic Particle clutches and brakes (page 68).	57
MCS-207 	Economical closed loop dancer control especially configured for air brakes. Provides a 0–10V or 4–20mA output to E/P transducers. For use with Pneumatic brakes (page 68).	63
MCS-208 	Economical open loop analog control especially configured for air brakes. Provides manual control, or accepts analog input (0–10V or 4–20mA). Same output as MCS-207. For use with Pneumatic brakes (page 68).	59
TCS-210 	Economical closed loop dancer control for all 24V brakes and clutches. Has reserve 48V supply for enhanced E-stop torque with certain brakes. For use with MTB Series electric brakes (page 68).	62
TCS-220 	Analog control for 24V electric clutches and brakes. Manual adjust, or follows analog (0–10V or 4–20mA) input. Reserve 48V overexcite for E-stops. For use with MTB Series electric brakes (page 68).	58
TCS-310 	Dancer splicer control (two output channels) for 24V electric brakes. Full splicing logic, and 48V overexcite for E-stops. For use with MTB Series electric brakes (page 68).	64
TCS-320 	Analog splicer control (two output channels) for 24V electric brakes. 48V overexcite for E-stops. For use with MTB Series electric brakes (page 68).	60

Flexible modular design is the key to trouble-free web tension control!

The MCS2000 Digital Web Tension Controller handles all winding and unwinding applications, either brake or motor operated.

Difficult setups with potentiometer adjustments are no longer a problem. The MCS2000 Web Tension Controller is easily programmed with only four push buttons on a panel-mounted programmer; a handheld programmer; or a Windows driven software package. All programmers employ a simple menu driven format. The unit can also “talk” to a PLC via the RS232 cable.

The power supply AC input auto-ranges from 95 to 264 VAC to avoid any match-up problems. The unit can be used in both open-loop and closed-loop systems. It can also be configured in an “open plus super-imposed/ closed-loop design for very precise tension control applications.

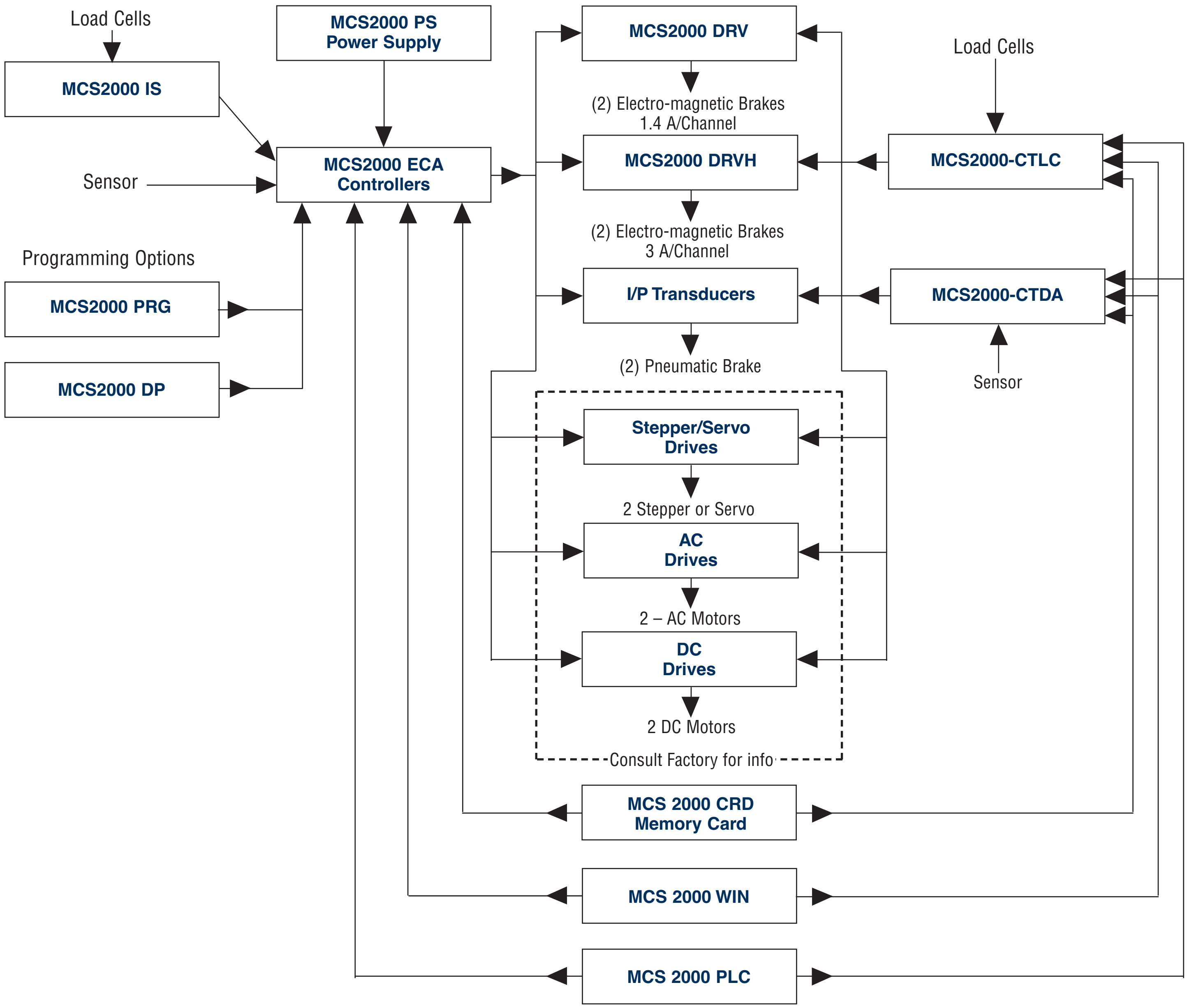
Two types of amplifiers are available for powering electro-magnetic brakes. The amplifiers have outputs for controlling two high-power brakes at 1.4 or 3 Amps per channel, continuous for each brake.

The MCS2000 modules are housed in metal enclosures designed for snap-fit assembly, eliminating screw attachment (patent applied for). All components are on printed circuit boards. Wiring connections are made with quick-disconnect screw terminals.

Features

- Modular system
- Easy to program
- Plug-in memory card for saving parameters
- Programmable in English or French
- PLC compatible
- Optically isolated inputs and outputs
- Dual output in either current or voltage operation mode
- Auto scaling of sensors
- Capable of open-loop operation with an ultrasonic sensor
- Splicing capability
- Windows programming software
- Automatic voltage range of AC input (95-264 VAC)
- Short-circuit protection
- Quick-disconnect wiring terminals
- Capable of controlling dual channel rewind or unwind
- Automatic PID correction - from analog inputs
- 2 x 16 backlit LCD display for programming and parameter readout

Modular Configurations



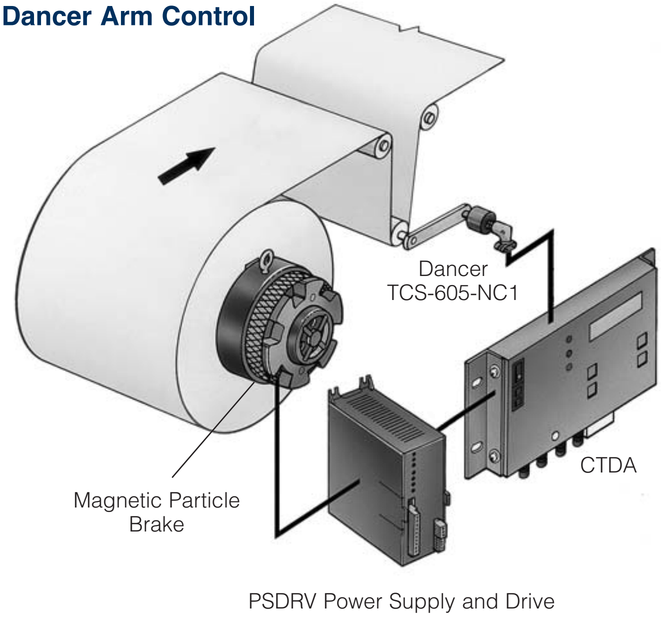
Ordering Information

Model	Feature	Part Number
MCS2000-CTDA	Closed loop dancer arm controller	6910-448-120
MCS2000-CTLC	Closed loop load cell controller	6910-448-121
MCS2000-ECA	Digital programmable controller	6910-448-096
MCS2000-WIN	Windows software	6910-101-096
MCS2000-PS	24 VDC power supply	6910-448-091
MCS2000-DRV	Dual channel 24 VDC driver	6910-448-092
MCS2000-DRVH	Dual channel 48 VDC driver	6910-448-095
MCS2000-PSDRV	24 VDC Power supply & 24 VDC driver	6910-448-093
MCS2000-PSDRVH	24 VDC Power supply & 48 VDC driver	6910-448-094
MCS2000-PSH	48 VDC Power supply, 6 AMP	6910-448-098
MCS2000-PSHA	48 VDC Power supply, 12 AMP	6910-448-088
MCS2000-IS	Dual load cell amplifier	6910-101-092

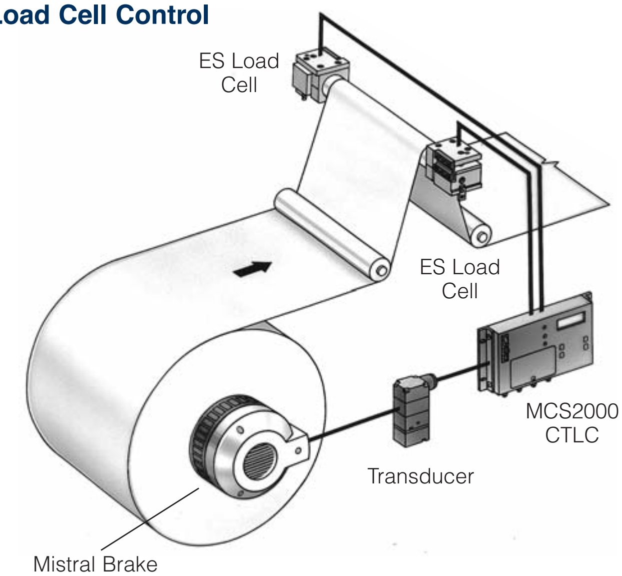
Model	Feature	Part Number
MCS2000-PRG	Handheld programmer	6910-101-090
MCS2000-CRD	Memory card	6910-101-091
MCS2000-DP	Panel mount programmer	6910-101-093
MCS2000-CBL	RS232 cable	6910-101-095
I/P Transducer	0-120 PSI	6910-101-066
Static Switch	Solid state switch	6910-101-007
TCS-605-1	1 turn pivot point sensor (1K)	7330-448-002
TCS-605-5	5 turn pivot point sensor (1K)	7330-448-003
Coupling	Intermittent motion sensor coupling	6910-101-001
Ultrasonic Sensor	4-40" sensing distance	7600-448-001
Ultrasonic Sensor	8-80" sensing distance	7600-448-002

Application Examples

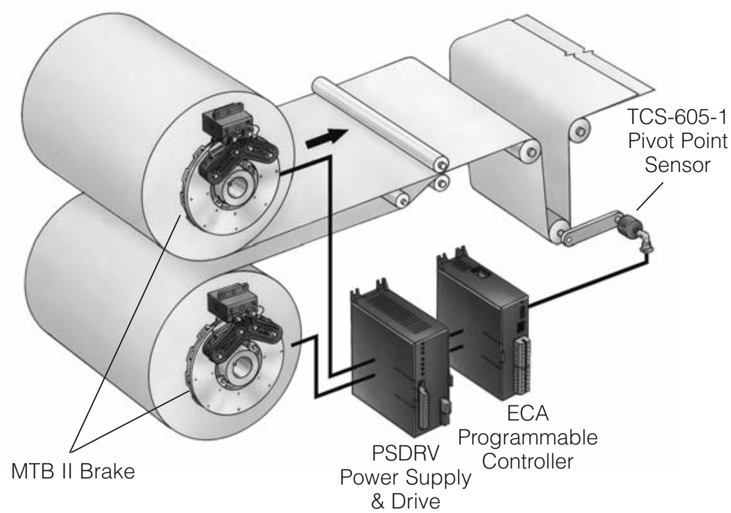
Dancer Arm Control



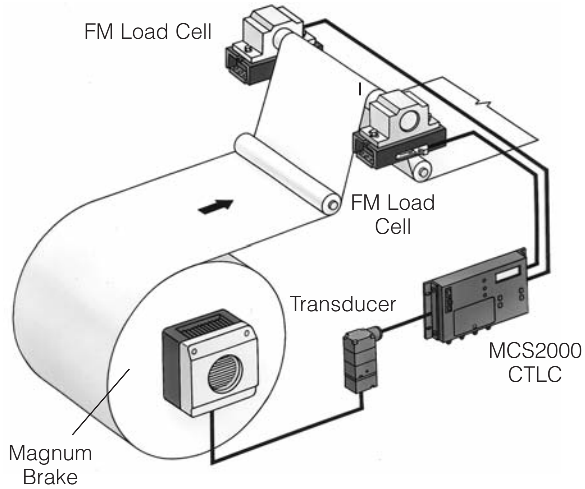
Load Cell Control



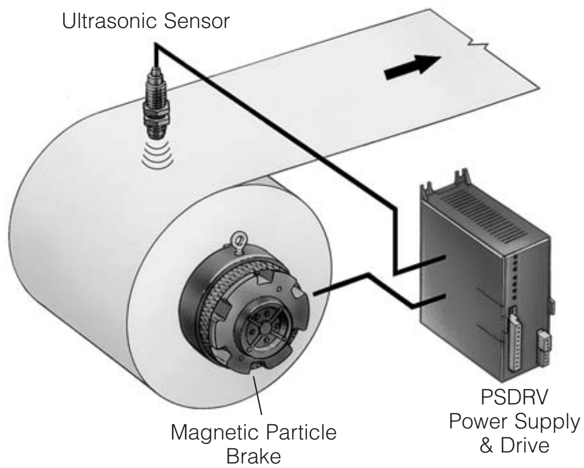
Closed Loop (Dancer Arm) Dual Unwind



Closed Loop (Load Cell) Unwind



Open Loop (Ultrasonic Sensor) Unwind



Closed Loop Control

MCS2000-CTDA
Dancer arm feedback
(P/N 6910-448-120)

MCS2000-CTLC
Load cell feedback
(P/N 6910-448-121)

Both units have especially been designed for user applications. They include all functions for web tension control. The units are equipped with standard power supply, controller front face keyboard and display. The CTLC unit is provided with 2 load cell inputs with selectable sensitivity from 10 mV to 10 V, compatible with most sensors on the market.

Applications
For every web or wire tension control application. Applicable regardless of controlling device (air brake, electric brake or motor).

Common Features
- Scaleable tension readout
- Password protected
- 8 different output options
- Fully digital
- Multi-purpose
- RS232 communications
- Memory card for storing up to 2 full programs
- Windows programming software
- Integral terminal reset
- 2 output channels
- Automatic sensor scaling
- External set point change
- Programmable output configuration
- Output sensor information
- Automatic or imposed PID correction
- Taper Tension Available on other models
- Manual/Auto Operation per front panel pushbutton

Specifications

Input Power/Output Power

Input supply	110-240 VAC, switch selectable
Ref. Output	10 VDC, 10mA max.
Sensor Output	±15 VDC, 100mA max.

Performance

Analog input/output resolution	12-bit ADC/DAC, 4096 steps

Analog Inputs

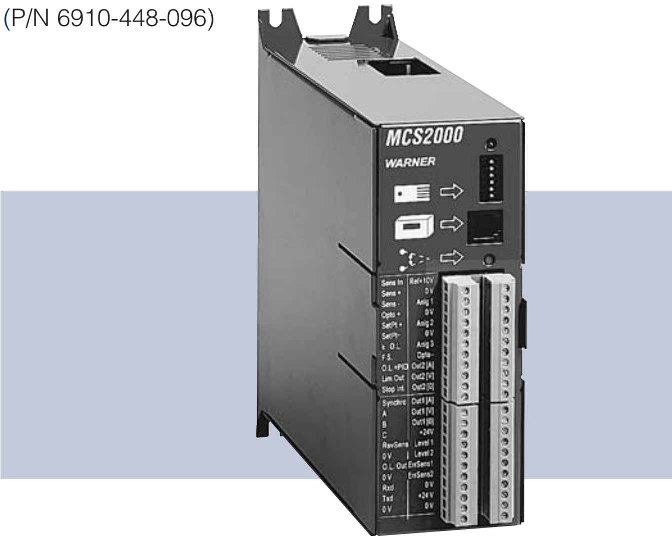
2 analog inputs	0–10 VDC, can be increased upon request (consult factory)
Sensor input	Range: ±10 VDC, delta min. of 4 VDC

Analog Outputs

2 output channels	0–±10 VDC or 0–20mA software adjustable
Brake Power Supply	For use with brake systems, requires power supply/driver module. (See page 51)
Open loop signal output	0–10 VDC, 10mA max.
Digital Inputs	(Activated by connecting the input to ground. Inputs are optically isolated if a separate external 24 VDC supply is used.) Set point adjustment Signal multiplier Open & closed-loop Limit output Integral reset Synchronize ABC input change ABC binary inputs
Digital Outputs	2 binary outputs for sensor error indication
Programming Options	Personal computer or PLC through RS232 cable
Display Options	(Can display 2 parameters on any of the programming options listed.) Set point / Output 1 Sensor value / Output 2 Analog 1 input / Error sensor 1 Analog 2 input / Error sensor 2 PID adaptation IN# for state of digital inputs
Indicator	Green power LED indicator on switch Output 1, 2: Green: 0 + 10 DC Red: 0 - 10 DC Out Window Indication Green: out of limits
Adjustments	Setpoint + Setpoint – Auto/Manual

Saving Options	**Switching Inputs**
Controller stores one full program. Memory card stores two full programs.	Electro-mechanical, rated 24 VDC Solid state, rated 40 VDC, minimum

MCS2000-ECA
(P/N 6910-448-096)



Digital Controller

The MCS2000-ECA is a digital tension controller that can be used in both open-loop and closed-loop systems. It can also be configured as an “open plus superimposed closed-loop” for very precise tension control.

Features

- Programmable output options
- Fully digital
- RS232 communications
- Memory card for storing up to 2 full programs
- Windows programming software
- Integral terminal reset
- 2 output channels
- Automatic sensor scaling
- External set point change
- Digital outputs from sensor input value

Specifications

Input Power/Output Power	
Input Supply	24 VDC
Ref. Output	10 VDC, 10mA max.
Sensor Output	±15 VDC, 100mA max.
Performance	
Analog input/output resolution	12-bit ADC/DAC, 4096 steps
Analog Inputs	
2 analog inputs	0–10 VDC, can be increased upon request (consult factory)
Sensor input	Range: ±10 VDC, delta min. of 4 VDC
Analog Outputs	
2 output channels	0–±10 VDC or 0–20mA software adjustable
Open loop signal output	0–10 VDC, 10mA max.
Digital Inputs	(Activated by connecting the input to ground. Inputs are optically isolated if a separate external 24 VDC supply is used.) Set point adjustment Signal multiplier Open & closed-loop Limit output Integral reset Synchronize ABC input change ABC binary inputs Inverse sensor polarity
Digital Outputs	2 binary outputs for sensor error indication
Programming Options	Personal computer or PLC through RS232 cable
Display Options	(Can display 2 parameters on any of the programming options listed.) VIA MCS2000-DP or MCS2000-PRG Set point Sensor value Analog 1 input Analog 2 input Output 1 Output 2 IN# for state of digital inputs Error sensor 1 Error sensor 2 PID adaptation
Indicator	Green power LED indicator
Saving Options	**Switching Inputs**
Controller stores one full program.	Electro-mechanical, rated 24 VDC
Memory card stores two full programs.	Solid state, rated 40 VDC, minimum

MCS2000-PS
(P/N 6910-448-091)

Power Supply

The MCS2000-PS Power Supply is designed to provide +24 VDC to the MCS2000-ECA Programmable Controller and/or the MCS2000-DRV module. If your system requires a 24 VDC power supply and an electro-magnetic brake driver, these components are available as a single package (MCS2000-PSDRV).

The packaged unit has the same features and specifications as the MCS2000-PS and MCS2000-DRV units alone.

Features

- Auto-ranging AC input
- Short circuit and overload protection
- Quick-disconnect terminals

Specifications

Input Power/Output Power

Input supply	110-230 VAC, ±15%, 50/60 Hz
Output supply	+24 VDC, 3.1A

MCS2000-PSH

Input supply	95-264 VAC, ±10%,
Output supply	48 VDC @ 6 Amps, 6910-448-098

MCS2000-PSHH

Input supply	95-264 VAC, ±10%,
Output supply	48 VDC @ 12 Amps, 6910-448-088

MCS2000-DRV, -DRVH, -PSDRV
(P/N 6910-448-092, 6910-448-095, 6910-448-093)

MCS2000-PSDRVH
(P/N 6910-448-094)

Drivers

MCS2000-DRV

This module serves as a dual-channel 24 VDC driver for two electro-magnetic brakes at 1.4 amps per channel. This module requires a separate 24 VDC power source for operation.

MCS2000-DRVH

This module serves as a high voltage dual channel 48 VDC driver for two electro-magnetic brakes at 3.0 amps per channel steady state, 6 amps peak for overcurrent. This module requires a separate 48 VDC power source for operation.

Power Supply/Drivers

MCS2000-PSDRV

Single package module with both power supply and dual channel driver in a single enclosure. This module can be used to power the MCS2000-ECA and operate two electro-mechanical brakes up to 1.4 amps/channel for closed-loop operation. For open-loop operation the module can be operated as a stand alone power supply driver.

MCS2000-PSDRVH

Single package module consisting of a 24VDC power supply and dual channel 48VDC driver. This module can be used to power the MCS2000-ECA and requires a separate 48VDC power supply to operate two electro-mechanical brakes up to 3.0 amps/channel for closed-loop operation. For open-loop operation the module can be operated as a stand alone power supply/driver with a separate 48VDC power supply.

Specifications

Input Power/Output Power	
Input supply	
DRV	+24VDC, ±10%, 1.4 Amps per channel
DRVH	+48VDC, ±10%, 3 Amps per channel
Ref. output	10 VDC, 10mA max.
Analog Inputs	
DRV, DRVH	Two 0–10 VDC inputs Two scalable inputs
DRVH	Additional two 0–20mA inputs
Analog Outputs	
DRV	Two 0–24 VDC 1.4A cont. 3A peak/channel
DRVH	Two 0–48 VDC, 3A cont., 6A peak/channel w/o scaled outputs, 0–10DC, 10mA max.
Indicators	Two LED output indicators for channels A and B.
Adjustments	Anti-residual adjustment for each channel Offset adjustment for scalable input for each channel Gain adjustment for scalable input
Common Features	Short circuit and overload protection Quick disconnect terminals

MCS2000-DP
(P/N 6910-101-093)

Panel Mounted Programmer

A panel-mounted programming unit for the MCS2000-ECA Programmable Controller. A 6-foot shielded cable (provided with the unit) plugs into the 9-pin connector on top of the MCS2000-ECA.

Features

- 2 x 16 character backlit LCD display
- Powered by MCS2000-ECA Programmable Controller
- Easy-to-use menu-driven programming
- Requires only four push buttons for operation
- Can be used to display two different operating parameters while the system is running.

MCS2000-PRG
(P/N 6910-101-090)

Handheld Programmer

A handheld programming unit for use with the MCS2000-ECA Programmable Controller. A quick-disconnect cable (provided with the unit) plugs into a 4-position jack on the ECA.

Features

- 2 x 16 character backlit display
- Powered by MCS2000-ECA Programmable Controller
- Easy-to-use menu-driven programming
- Requires only four push buttons for operation
- Can be used to display two different operating parameters while the system is running.

MCS2000-CRD
(P/N 6910-101-091)

Memory Card

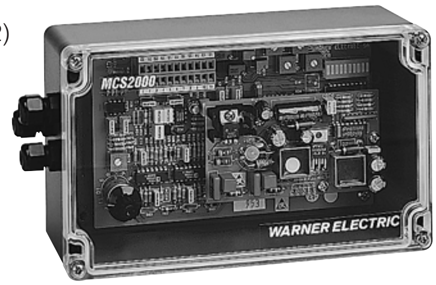
1 9/16" x 9/16" memory card for storing up to two full programs (port A or port B). Plugs into a slot in the MCS2000-ECA Programmable Controller.

Features

- Program memory (port A) can be downloaded off the card simply by cycling power to the MCS2000-ECA Programmable Controller.
- Card memory is protected against inadvertent erasures by a stray magnetic field.

MCS2000-IS

(P/N 6910-101-092)



Load Cell Interface

The interface sensor will sum and amplify the input signals from two load cells, and can be used with a number of different load cells. The interface should be positioned close to the load cells to ensure that no noise is injected into the low voltage signal before it is amplified.

Specifications

Input Power/Output Power	
Input supply	+24 VDC, ±10%, 300mA
Load cell supply	±15 VDC or ±5 VDC, 100mA max.
Analog Inputs	
2 load cell inputs	Range: Any voltage between 20 mV and 10 VDC, 5KΩ input impedance
Ultrasonic input	Range: 0–10 VDC, delta min. of 1 V, 10KΩ input impedance, Maximum gain: 1000
3 inputs for line speed	Range: 0–10 VDC, 10KΩ impedance
Analog Outputs (Short circuit protected)	
Calibrated load cell/ ultrasonic-sensor output	0–10 VDC, 10mA max.
Power for ultrasonic sensor	+24 VDC
Voltage reference	10 VDC, 10mA
Adjustments	Select polarity of ultrasonic sensor output, SW1 Select polarity of voltage reference, SW2 Setup min. & max. values for the load cell or ultrasonic input, SW3 Adjust gain of load cell inputs (p1, p2), 450 min., 1000 max. Adjust load cell offset (p3, p4), ±5 V Adjust gain of summed load cell (p5), 1 min., 2 max. Adjust gain on line speed (p6), 0–10 V Adjust offset for ultrasonic input (p7), 2.5 V max. Adjust gain for ultrasonic input (p8), 1 min., 5 max. Adjust gain for selected output (p9), 0.2 min., 1.1 max.
Indicators	Green power indicator Red 10-digit display indicates W3 setting

Electro-Pneumatic Transducer

(P/N 6910-101-066)

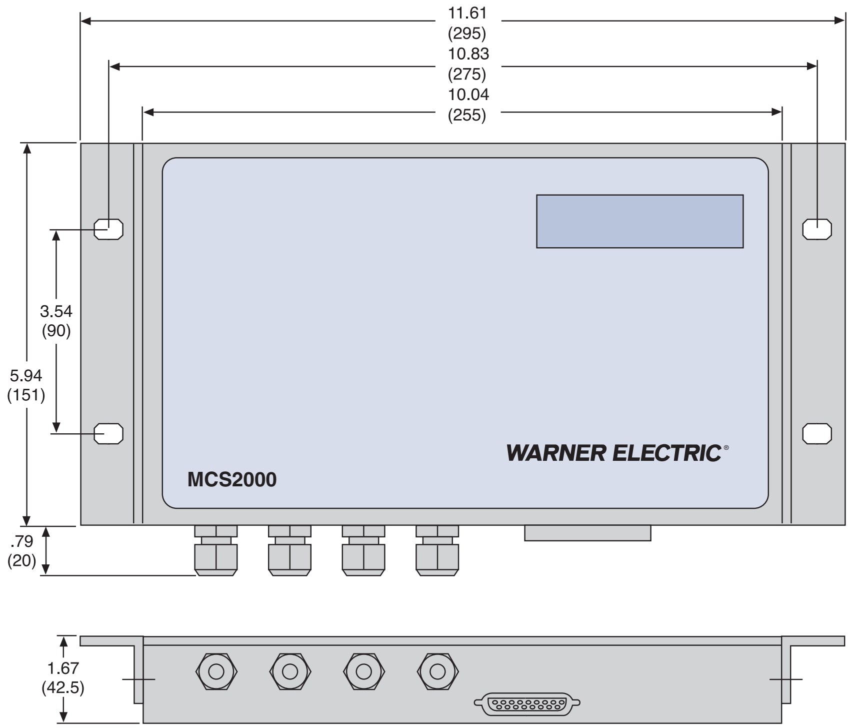
Used for interfacing with pneumatic brakes. Warner Electric offers a convenient package that consists of an air filter with automatic moisture drain, together with one I/P (current-pressure) transducer.

Specifications

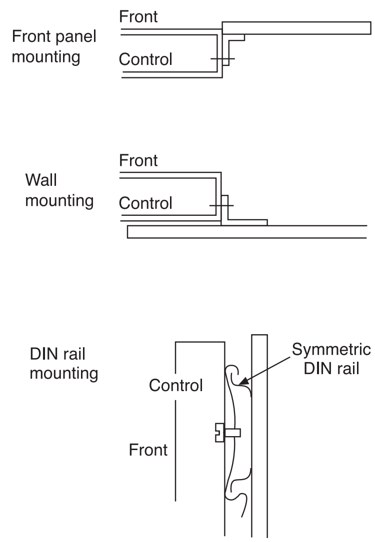
Input signal	4–20mA
Output range	0–120 Psig.
Supply pressure	20–150 Psig. **Note:** Supply pressure to the transducer must always be at least 5 Psig. above the maximum output pressure required for the brake.
Temperature range	-20˚F to 150˚F
Minimum air consumption	6.0 (SCFH) at 15 Psig.
Supply pressure effect	1.5 Psig. for 25 Psig. supply change
Pipe size	1/4” NPT (transducer and filter)

Dimensions

Closed Loop Controls

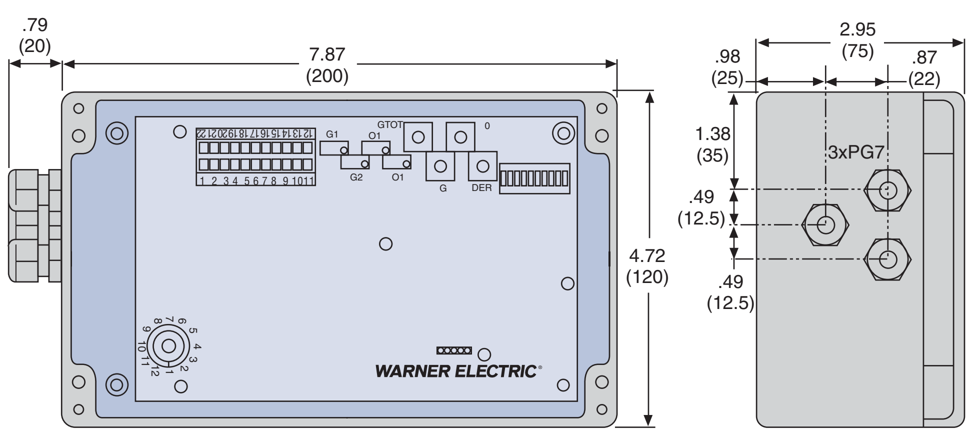


-CTDA, -CTLC

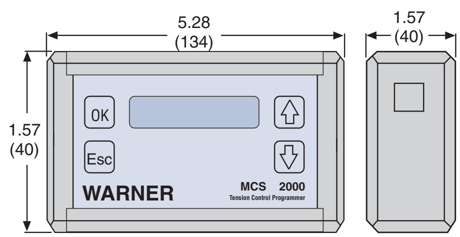


Mounting

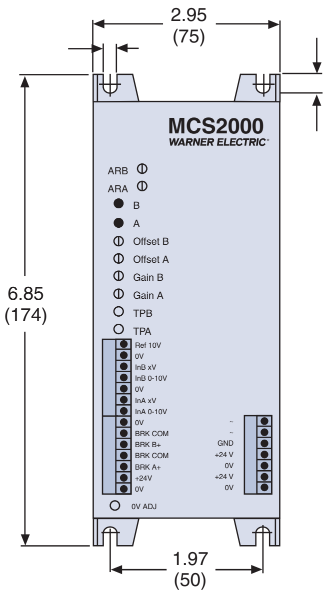
Load Cell Interface



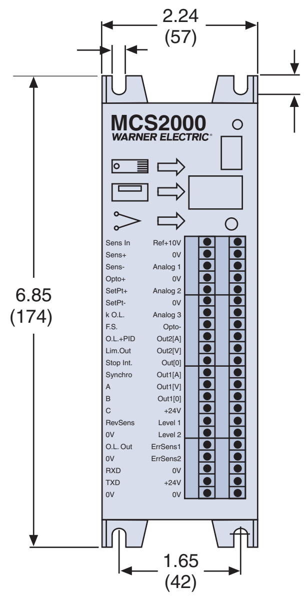
-IS



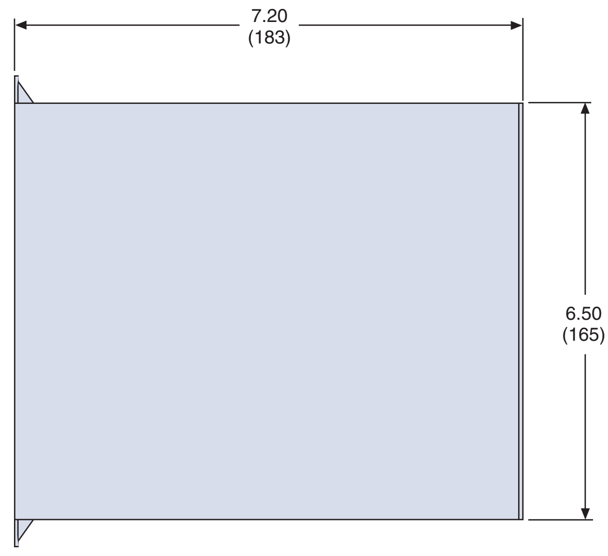
-PRG



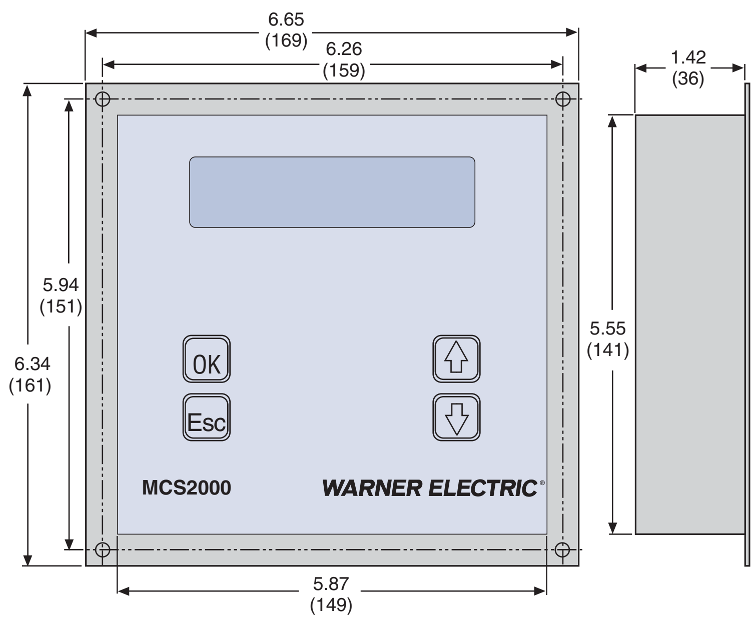
-PS
-DRV/DRVH
-PSDRV/PS DRVH



-ECA



Typical



-DP

Weight

MCS2000	Lbs.
-ECA	2.00
-PS	2.00
-DRV	2.00
-DRV8	2.00
-DRVH	2.00
-PSDRV	2.00
-PSDRV8	2.00
-PRG	0.50
-DP	1.50
-IS	1.50
-CTDA	4.50
-CTLC	4.50

Tension Controls

Analog/Manual Control for Electric Brake Systems

TCS-200-1
(P/N 6910-448-086)

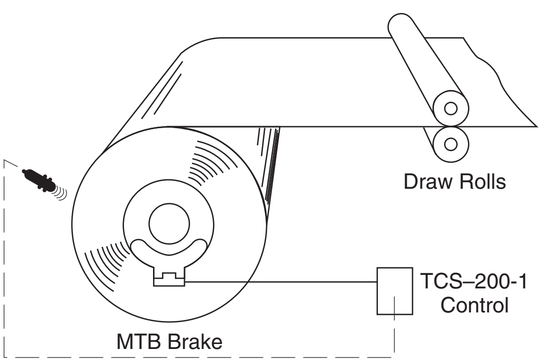
TCS-200-1H
(P/N 6910-448-087)

TCS-200
(P/N 6910-448-055)

Analog/Manual Control

The Analog/Manual Control is a basic, low cost, open loop control for manual type operation of Electro Disc tension brakes. A remote torque control function is available that enables the operator to control the desired tension from any convenient location. A roll follower feature provides automatic adjustment of brake torque proportional to roll diameter change. For the TCS-200-1 and TCS-200-1H analog inputs can be followed.

Typical System Configuration



The complete system consists of:

1. Tension brake
2. Analog tension control
3. Control power supply
4. Optional sensor inputs (customer supplied)

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

Specifications

Input	
TCS-200	24–30 VAC, ±10%, 56/60 Hz, single phase
TCS-200-1, TCS-200-1H	115/230 VAC, ±10%, 50/60 Hz, single phase
Output	
TCS-200	PWM full wave rectified, 0–3.24 amps current controlled
TCS-200-1	Adjustable 0–24 VDC, 4.25 amps maximum continuous
TCS-200-1H	Adjustable 0–24 VDC Maximum of 5.8 amps continuous
	Can be used with any 24 VDC tension brake. TCS-200 requires sense coil for operation. Sense Coil – 275-3893 TCS-200-1 and TCS-200-1H can be used with or without sense coil.
Ambient Temperature	
TCS-200	–20° to +115°F (–29° to +46°C)
TCS-200-1, TCS-200-1H	–20° to +125°F (–29° to +51°C)
Sensor Inputs	
Remote Torque Adjust	
TCS-200, TCS-200-1, TCS-200-1H	1000 ohms
Roll Follower	
TCS-200	10K ohms
TCS-200-1, TCS-200-1H	1000 ohms
Analog Voltage Input	
TCS-200-1, TCS-200-1H	0–10 VDC (optically isolated when used with an external 15–35 VDC supply)
Analog Current Input	
TCS-200-1, TCS-200-1H	4–20 mA (optically isolated when used with an external 15–35 VDC supply)
Auxiliary Inputs	
Brake Off (all models)	Removes output current to the brakes. Puts the brake at zero current.
Brake On (all models)	Applies full voltage to the connected brake.
Front Panel Adjust	
Tension Adjust (all models)	Provides current adjust to the brake from 0–100%. In the remote mode, provides for maximum output level set to the brake.
Brake Mode Switch (all models)	Allows for full brake on, run, or brake off modes of operation to the brake.
Indicators (all models)	Green LED power indicator showing AC power is applied to the control. Red LED short circuit indicator showing shorted output condition. Resettable by going to brake off mode with front panel switch.
General (all models)	The control chassis must be considered NEMA 1 and should be kept clear of areas where foreign material, dust, grease, or oil might affect control operation.

Note: When used with other than MTB magnets, inductive load must be supplied – PN 275-3843. Consult factory for details.

MCS-204
(P/N 6910-448-017)

(Shown with Housing)

Remote/Analog control
The MCS-204 control, also completely solid state, is designed for manual or analog input control. The MCS-204 can control two 24 VDC tension brakes in parallel. It also has an antiresidual (magnetism) circuit, a brake on and a highly accessible terminal strip for rapid connection. It is designed for use with the MCS-166 power supply.

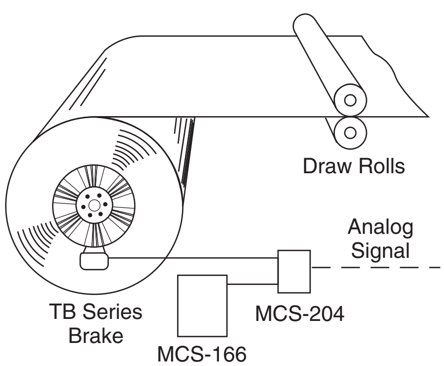
MCS-166 Power Supply (page 65).

Specifications

Input	24-28 VDC @ 3 Amps (from MCS-166, 1.5 amps for single MCS-166; 3.0 amps from dual MCS-166's) or other power source.
Output	Pulse with modulated 0-24 VDC for 24 volt Warner Electric tension brakes.
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Torque Adjust	Controls tension by applying the desired amount of current to the brake.
Brake On	Applies full current to tension brake.
Brake Off	Removes brake current and applies antiresidual voltage to eliminate brake drag. Useful when changing rolls.
Operating Modes	
Local Torque Adjust	Knob on front panel.
Remote Torque Adjust	Via remote potentiometer.
Roll Follower	Using external potentiometer.
Current Loop	1–5 mA, 4–20 mA, 10–50 mA. Voltage Input: 0–14.5 VDC.
Mounting	Available for panel mounting with exposed wiring or wall/shelf mounting with conduit entrance. Must be ordered with either wall/shelf or panel enclosures.

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of:

1. Tension brake
2. Analog tension control
3. Control power supply
4. Analog signal input (customer supplied)

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

TCS-220

(P/N 6910-448-027)

(Shown with Housing)

The remote analog input control is an open loop system designed to allow easy interface with existing or specially designed customer controls to complete a closed loop system. The system also offers complete operator controllability for manual tensioning control.

TCS-167 Power Supply, (page 65).

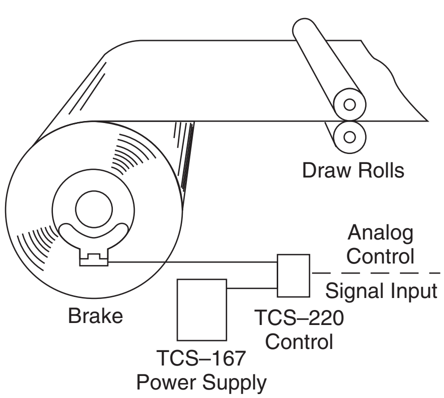
Note: When used with other than MTB magnets, a resistor, 68 ohms, 25 watts, must be added. Consult factory for details.

Specifications

Input	**TCS-220** – 48 VDC @ 1.6 Amps continuous, 48 VDC @ 6 Amps intermittent, 1.6% duty cycle, 30 sec. on time, 8–12 VDC @ 1.5 Amps. **TCS-167** – 120 VAC, 50/60 Hz or 240 VAC, 50/60 Hz (Switch selectable).
Output	**TCS-220/TCS-167** – 0–270 mA/magnet (running); 270–500 mA/magnet (stopping).
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Torque Adjust	Controls tension by applying the desired amount of current to the brake.
Emergengy Stop	Applies full current to tension brake.
Brake Off	Removes brake current and applies antiresidual current to eliminate brake drag. Useful when changing rolls.
Operating Modes	
Local Torque Adjust	Knob on front panel.
Remote Torque Adjust	Via 1K to 10K ohm potentiometer.
Roll Follower	Via 1k to 10k ohm potentiometer.
Current Loop	1–5 mA, 4–20 mA, 10–50 mA current source.
Voltage Input	0–14.5 VDC.
Adjustments	
Torque Adjust/Span	Controls output manually in local torque mode. Sets maximum control span in remote torque adjust, roll follower, current loop; or voltage input mode.
Zero adjust	Potentiometer adjustment for setting zero output level. Front panel access.
Brake off input	Terminal strip connection which provides for removal of brake current and applies antiresidual current to eliminate brake drag. Used primarily when changing rolls.
Brake on input	Terminal strip connection applies full current to brake when activated regardless of input control signal. Used for emergency stops.
Mounting	**TCS-220** – available as panel mounted with exposed wiring, or wall/shelf mounted with conduit entrance. **TCS-167** – Available with open frame or wall/shelf mounted enclosure with conduit

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of:

1. Tension brake
2. Analog tension control
3. Control power supply
4. Analog signal input (customer supplied)

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

MCS-208

(P/N 6910-448-067)

(Shown with Housing)

The MCS-208 control, also completely solid state, is designed for manual or analog input control. The MCS-208 features a highly accessible terminal strip for rapid connection, and it is designed for use with the MCS-166 Power Supply.

The remote analog input control is an open loop system designed to allow easy interface with existing or specially designed customer controls to complete a closed loop system. The system also offers complete operator controllability for manual tensioning control.

MCS-166 Power Supply, (page 65).

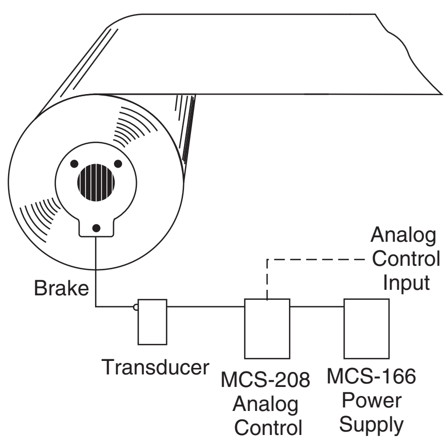
Note: When used with other than MTB magnets, a 68 ohm, 25 watt resistor must be added. Consult factory for details.

Specifications

Input Power	24–28 VDC, 0.5 amps maximum (from MCS-166 power supply or other source)
Outputs	Switch selectable current or voltage Voltage: 0–10 VDC Current: 1–5 mA, 4–20 mA, 10–50 mA Will operate most electric to pneumatic transducers available.
Ambient Temperature	+32° to +120°F (0° to +49°C).
External Inputs	
Brake On	Applies maximum output signal (voltage or current) to the transducer
Brake Off	Removes output from the transducer and applies minimum levels
Adjustments	
Front Panel	**Zero Adjust:** Provides for adjustment of minimum input to correspond to minimum output levels **Torque Adjust/Span:** Provides for manual adjust in manual mode, or span adjustment when in other operating modes
Operating Modes	Local torque adjust Remote torque adjust Roll follower Analog voltage input Analog current input
Mounting	Available with panel mounting with exposed wiring or wall/shelf mounting with conduit entrances. **Note:** Must be ordered with wall/shelf enclosure or with panel mount enclosure.

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of:

1. Pneumatic tension brake
2. Analog tension control
3. Control power supply
4. Analog signal input (customer supplied)
5. E to P transducer

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

Analog Splicer Control for Electric Brake Systems

TCS-320
(P/N 6910-448-043)

The analog splicer control provides dual brake functions with manual operator or analog input control requiring simultaneous brake tensioning and holding.

The system also offers complete operator controllability for manual tensioning control.

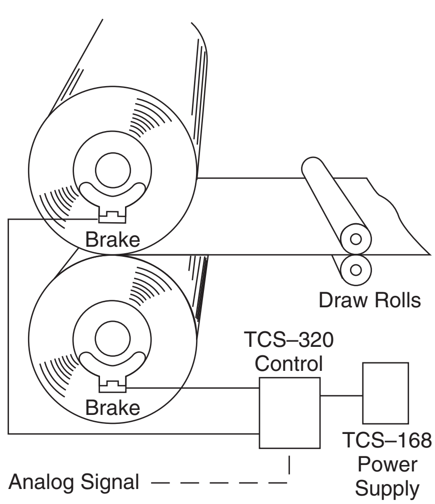
TCS-168 Power Supply, (page 65).

Note: When used with other than MTB magnets, a 68 ohm, 25 watt resistor must be added. Consult factory for details.

Specifications

Input	**TCS-320** – 48 VDC @ 3.2 Amps continuous, 48 VDC @ 12 Amps intermittent, 1.6% duty cycle, 30 sec. on time, 8–12 VDC @ 3.0 Amps. **TCS-168** – 120 VAC, 50/60 Hz or 240 VAC, 50/60 Hz (Switch selectable).
Output	**TCS-320/TCS-168** – 0–270 mA/magnet (running); 270–500 mA/magnet (stopping) on controlled output channel, 0 to 90 mA/magnet (typ.) on holding output channel.
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Torque Adjust	Controls tension by applying the desired amount of torque to the brake.
Brake On	Applies full current to tension brake.
Brake Off	Removes brake current and applies antiresidual current to eliminate brake drag. Useful when changing rolls.
Operating Modes	
Local Torque Adjust	Knob on front panel.
Remote Torque Adjust	Via 1K to 10K ohm potentiometer.
Roll Follower	Via 1k to 10k ohm potentiometer.
Current Loop	1–5 mA, 4–20 mA, 10–50 mA current source.
Voltage Input	0–14.5 V DC.
Adjustments	
Torque Adjust/Span	Controls output manually in local torque mode. Sets maximum control span in remote torque adjust, roll follower, current loop, or voltage input mode.
Zero adjust	Potentiometer adjustment for setting zero output level. Front panel access.
Brake off input	Terminal strip connection which provides for removal of brake current and applies antiresidual current to eliminate brake drag.
Brake on input	Terminal strip connection applies full current to brake when activated regardless of input control signal. Used for emergency stops.
Mounting	**TCS-168** – available with open frame or wall/shelf mounted enclosure with conduit entrance. **TCS-320** – available as open frame or a NEMA 4 enclosure with remote control station.

Typical System Configuration



The complete system consists of:

1. Two tension brakes
2. Analog splicer control
3. Control power supply
4. Analog signal input (customer supplied)

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

The TCS-320 can function as a splicer control or a dual brake control. With the use of the jumper board (included), the TCS-320 can control up to 24 magnets.

MCS-203

(P/N 6910-448-014)

(Shown with Housing)

The completely solid state MCS-203 Dancer Control Module is designed for automatic web tensioning through the use of a dancer roll. The MCS-203 can control two 24 VDC tension brakes in parallel. It works on the concept of a P-I-D controller and has internal P, I & D adjustments for optimum performance regardless of brake size.

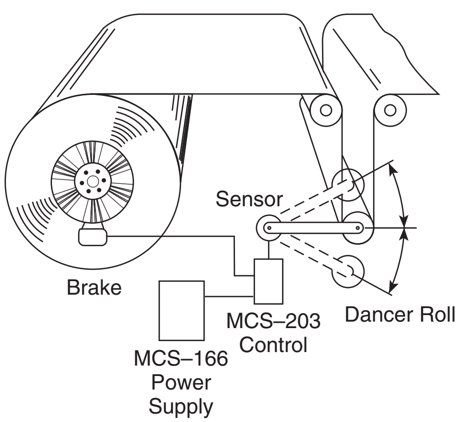
MCS-166 Power Supply, (page 65).

Specifications

Input	24–28 VDC @ 3 Amps (from MCS-166, 1.5 amps for single MCS-166; 3.0 amps from dual MCS-166's) or other power source.
Output	Pulse width modulated 0–24 VDC for 24 volt Warner Electric tension brakes.
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Dancer Potentiometer	Provides the feedback signal of dancer position and movement for input to the control.
Brake On	Applies full current to tension brake.
Brake Off	Removes brake current and applies antiresidual current to eliminate brake drag. Useful when changing rolls.
Antidrift Input	Nullifies integrator portion of control for faster brake response. Important for splicing and mid-roll starting.
Mounting	Available for panel mounting with exposed wiring or wall/shelf mounting with conduit entrance. Must be ordered with either wall/shelf or panel enclosures.

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of:

1. Tension brake
2. Dancer tension control
3. Control power supply
4. Pivot point sensor
5. Dancer roll assembly (customer supplied)

The control unit maintains a current output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the current from the control creates more or less brake torque for tension adjustability.

TCS-210

(P/N 6910-448-026)

(Shown with Housing)

This closed loop tension control system automatically controls tension on unwinding materials such as paper, film, foil, cloth and wire.

TCS-167 Power Supply, (page 65).

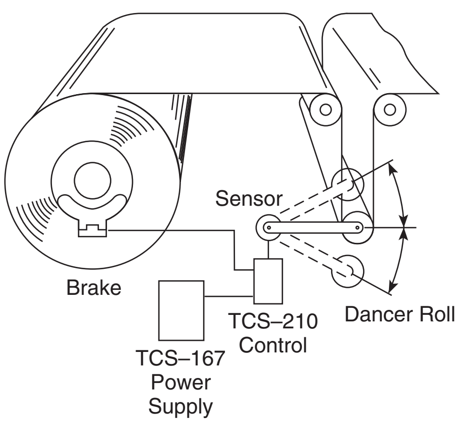
Note: When used with other than MTB magnets, a 68 ohm, 25 watt resistor must be added. Consult factory for details.

Specifications

Input	**TCS-210** – 48 VDC @ 1.6 Amps continuous, 48 VDC @ 6 Amps intermittent, 1.6% duty cycle, 30 sec. on time, 8–12 VDC @ 1.5 Amps. **TCS-167** – 120 VAC, 50/60 Hz or 240 VAC, 50/60 Hz (Switch selectable).
Output	**TCS-210/TCS-167** – 0–270 mA/magnet (running); 270–500 mA/magnet (stopping).
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Dancer Potentiometer	Provides the feedback signal of dancer position and movement for input to the control.
Brake On	Applies holding brake voltage.
Anti-Drift Input	Nullifies integrator portion of control for faster brake response. Important at startup and for mid-roll starts.
Brake Off	Removes brake current and applies antiresidual current to eliminate brake drag. Useful when changing rolls.
Mounting	**TCS-210** – available as panel mounted with exposed wiring, or wall/shelf mounted with conduit entrance. **TCS-167** – available with open frame or wall/shelf mounted enclosure with conduit entrance.

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of five components:

1. Tension brake
2. Dancer tension control
3. Control power supply
4. Pivot point sensor
5. Dancer roll assembly (customer supplied)

The weight of the dancer roll or loading on the dancer determines the tension on the web and the remainder of the system operates to hold the dancer roll as steady as possible. When the dancer position changes, the Warner Electric pivot point sensor tracks the direction and speed of the change and sends an electric signal to the closed loop control, which, in turn, relays a corrective signal to the Electro Disc tension brake. Increasing current to the Electro Disc increases braking torque to elevate the dancer to the desired position, while reducing brake current lowers the dancer.

The closed loop dancer control system is completely automatic, limiting the need for operator involvement and the potential for inaccurate tension control. The system offers exceedingly rapid response that, in effect, corrects tension errors before they reach the work area of the processing machine.

MCS-207

(P/N 6910-448-066)

(Shown with Housing)

The dancer control, MCS-207 is designed for automatic web tensioning through the use of a dancer roll.The MCS-207 can control either a voltage to pneumatic or current to pneumatic transducer with an air operated clutch or brake. It works on the concept of a P-I-D controller and has internal adjustments of the P-I-D loops for optimum performance regardless of the brake size.

MCS-166 Power Supply, (page 65).

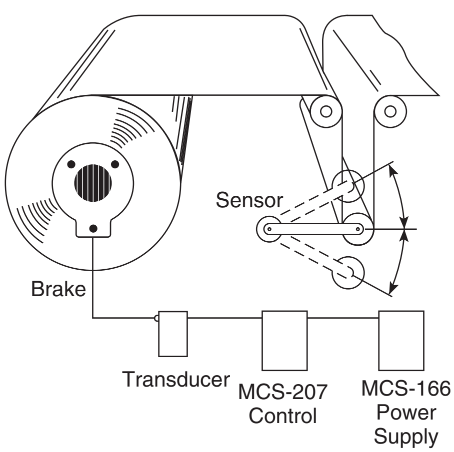
Note: When used with other than MTB magnets, a 68 ohm, 25 watt resistor must be added. Consult factory for details.

Specifications

Input	24–28 VDC, 0.5 amps maximum (from MCS-166 or other power source)
Output	Switch selectable current or voltage Voltage: 0–10 VDC Current: 1–5 mA, 4–20mA, 10–50mA Will operate most electric to pneumatic transducers available.
Ambient Temperature	+32° to +120°F (0° to +49°C).
Control Input	Pivot point sensor, MCS-605-1 or TCS-605-5
External Inputs	
Brake On	Applies maximum output signal (voltage or current) to the transducer
Brake Off	Removes output from the transducer and applies minimum level
Anti-Drift	Provides integrator reset function for mid-roll starting
Adjustments	
Front Panel	**Dancer Position:** sets dancer operating position **Gain:** Controls overall system response based on change of dancer input signal
Mounting	Available as panel mounted with exposed wiring, or wall/shelf mounted with conduit entrance. **Note:** Must be ordered with wall/shelf enclosure or with panel mount enclosure.

Requires enclosure, see page 66.

Typical System Configuration



The complete system consists of:

1. Pneumatic tension brake
2. Dancer tension control
3. Control power supply
4. Pivot point sensor
5. E to P transducer
6. Dancer roll assembly (customer supplied)

The control unit maintains an output to the tension brake based on an analog input or the manual setting of the control tension adjustment dials. Varying the signal from the control creates more or less brake torque for tension adjustability.

Tension Controls

Dancer Splicer Control for Electric Brake Systems

TCS-310

(P/N 6910-448-042)

This closed loop tension control system automatically controls tension on unwinding materials such as paper, film, foil, cloth and wire.

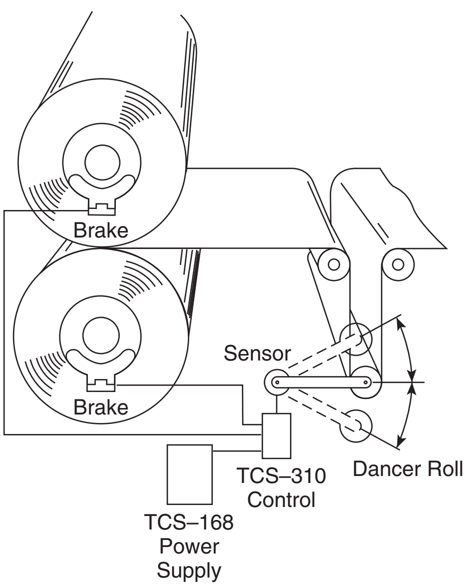
TCS-168 Power Supply, (page 65).

Note: When used with other than MTB magnets, a 68 ohm, 25 watt resistor must be added. Consult factory for details.

Specifications

Input	**TCS-310** – 48 VDC @ 3.2 Amps continuous, 48 VDC @ 12 Amps intermittent, 1.6% duty cycle, 30 sec. on time, 8–12 VDC @ 3.0 Amps. **TCS-168** – 120 VAC, 50/60 Hz or 240 VAC, 50/60 Hz (Switch selectable).
Output	**TCS-310/TCS-168** – 0–270 mA/magnet (running); 270–500 mA/magnet (stopping) on controlled output channel 0 to 90 mA holding channel.
Ambient Temperature	–20° to +113°F (–29° to +45°C).
External Inputs	
Dancer Potentiometer	Provides the feedback signal of dancer position and movement for input to the control.
Brake On	Applies holding brake voltage.
Anti-Drift Input	Nullifies integrator portion of control for faster brake response. Important for start-ups.
Brake Off	Removes brake current and applies antiresidual current to eliminate brake drag. Useful when changing rolls.
Mounting	**TCS-310** – available as open frame or as NEMA 4 enclosure with remote control station. **TCS-168** – available with open frame or wall/shelf mounted enclosure with conduit entrance.

Typical System Configuration



The complete system consists of five components:

1. Two tension brakes
2. Dancer splicer control
3. Control power supply
4. Pivot point sensor
5. Dancer roll assembly (customer supplied)

The weight of the dancer roll or loading on the dancer determines the tension on the web and the remainder of the system operates to hold the dancer roll as steady as possible. When the dancer position changes, the Warner Electric pivot point sensor tracks the direction and speed of the change and sends an electric signal to the closed loop control, which, in turn, relays a corrective signal to the Electro Disc tension brake. Increasing current to the Electro Disc increases braking torque to elevate the dancer to the desired position, while reducing brake current lowers the dancer.

The closed loop dancer control system is completely automatic, limiting the need for operator involvement and the potential for inaccurate tension control. The system offers exceedingly rapid response that, in effect, corrects tension errors before they reach the work area of the processing machine.

MCS-166
(P/N 6910-448-013)

(Shown with Housing)

Power Supply for MCS-203, MCS-204, MCS-207, and MCS-208 Controls

Warner Electric's MCS-166 is the companion power supply module to be used with MCS-203 and MCS-204 tension controls. The MCS-166 supplies the 24–28 VDC that these systems require. The MCS-166 is a modular unit designed to couple with its respective control or it can be mounted separately. It is also fused for overload protection, has a voltage indicator light, and is internally protected against 240 VAC input when set for 120 VAC.

Specifications

Input

120 VAC 50/60 Hz or 240 VAC 50/60 Hz (switch selectable).

Output

24–28 VDC (1.5 Amps).

Note: For dual brake application, two MCS-166's are required, 3.0 amps output.

Ambient Temperature

–20° to +113°F (–29° to +45°C).

Mounting

Available for panel mounting with exposed wiring or wall/shelf mounting with conduit entrance. Must be ordered with either wall/shelf or panel enclosures.

Requires enclosure, see page 66.

TCS-167
(P/N 6910-448-025)

The TCS-167 power supply is designed to provide the correct power input to MCS-207, TCS-210, and TCS-220 tension controls. Its switch selectable input allows the user to adapt to 120 or 240 VAC. It has dual voltage circuits to provide low voltage power and anti-residual output as well as power to operate a brake. The TCS-167 is available with an enclosure or open frame for control panel mounting.

Specifications

Input

120 VAC or 220/240 VAC, ± 10%, 50/60 Hz, 1 phase. (switch selectable)

Output

Unregulated 9-12 VDC @ 1.5 Amps

Unregulated 48 VDC @ 1.6 Amps continuous, 48 VDC @ 6 Amps intermittent, 1.6% duty cycle, 30 seconds on time.

Ambient Temperature

-20°F. to +113°F. (-29°C. to +45°C.)

Mounting

Open frame or enclosed wall/shelf mount with conduit entrance

TCS-168
(P/N 6910-448-032)

The TCS-168 power supply is designed to provide the correct power input to the TCS-310 Dancer Splicer Control and the TCS-320 Analog Splicer Control. Its switch selectable input allows the user to adapt to 120 or 240 VAC. It has dual voltage circuits to provide low voltage power and anti-residual output as well as power to operate two brakes. The TCS-168 is available with an enclosure or open frame for control panel mounting.

Specifications

Input

120 VAC or 220/240 VAC, +_ 10%, 50/60 Hz, 1 phase. (switch selectable)

Output

Unregulated 9-12 VDC @ 3 Amps

Unregulated 48 VDC @ 3.2 Amps continuous, 48 VDC @ 6 Amps intermittent, 1.6% duty cycle, 30 seconds on time.

Ambient Temperature

-20°F. to +113°F. (-29°C. to +45°C.)

Mounting

Open frame or enclosed wall/shelf mount with conduit entrance

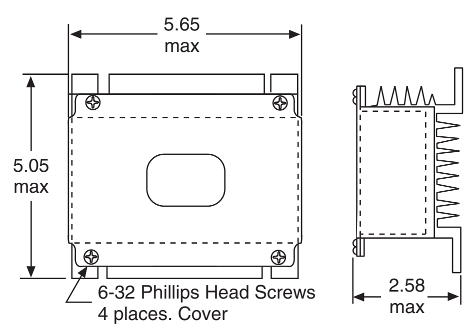
Magnet Selector Static Switch

The magnet selector switch allows magnets to be dynamically or statically added or removed from the tension system to be tailored to the application need. Examples include shedding magnets for narrow, light webs near core or adding magnets for emergency stops.

Each selector switch provides two circuits, each capable of switching up to four magnets.

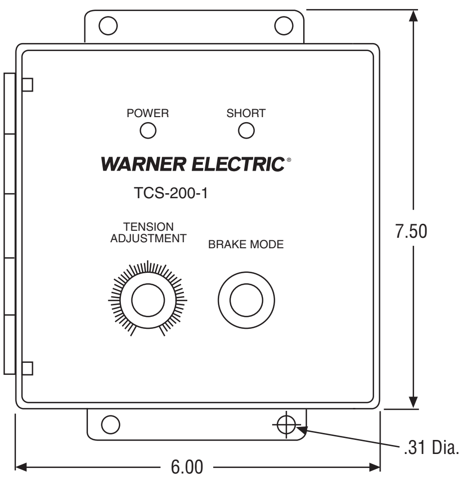
How to Order

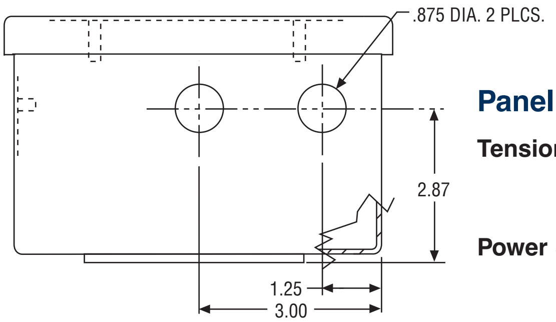
To order, specify Magnet Selector Static Switch 6910-101-007.



Dimensions

TCS-200-1

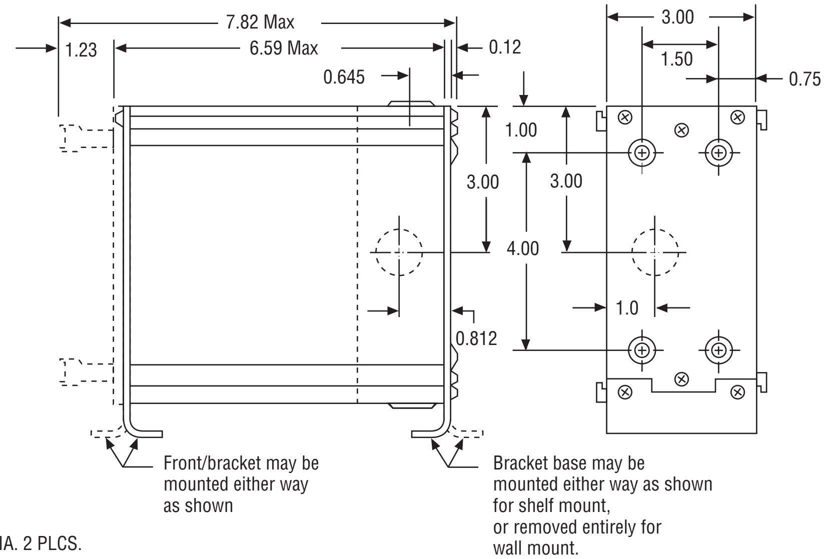




Wall/Shelf Mount

Tension Controls – For use with MCS-203, MCS-204, MCS-207 or MCS-208 order part number 6910-448-016.
For use with TCS-210 or 220, order part number 6910-448-029.

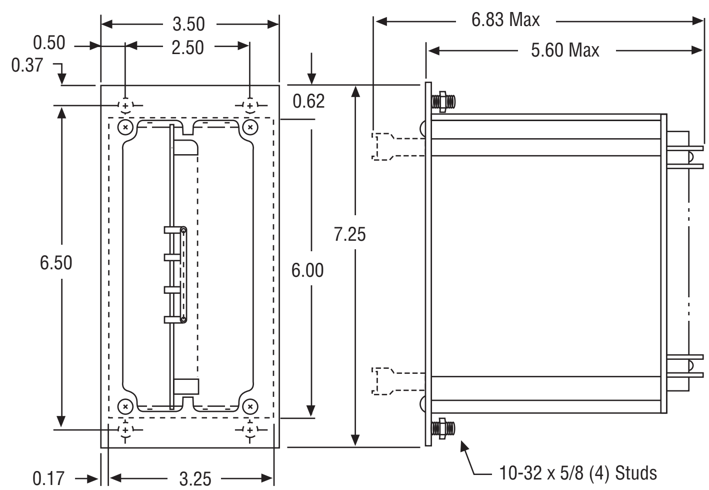
Power Supplies – For use with MCS-166, order part number 6910-448-019.



Panel Mount

Tension Controls – For use with MCS-203, MCS-204, MCS-207 or MCS-208 order part number 6910-448-015.
For use with TCS-210 or 220, order part number 6910-448-028.

Power Supplies – For use with MCS-166, order part number 6910-448-018.

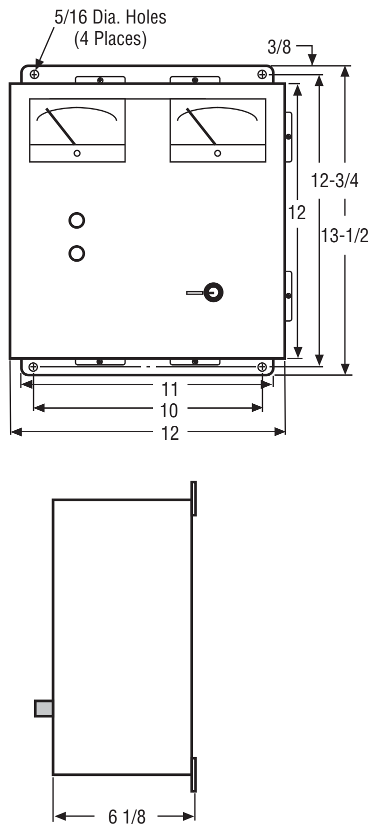


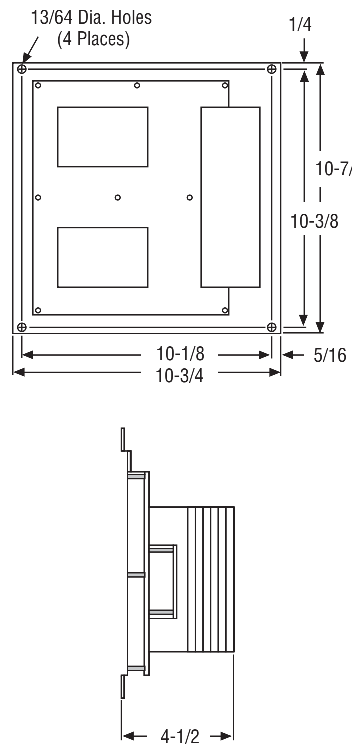
Ribbon Cable

A ribbon cable has been added to the rear terminal board of the MCS-203/204/207/208 and MCS-166 enclosures to improve performance and reliability. The upgrade is fully retrofitable and enclosure part numbers have not changed.

Dual Brake Controls

TCS-310, TCS-320

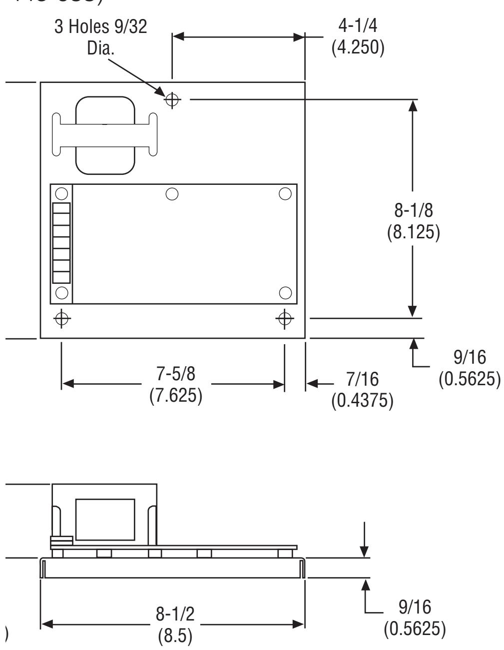


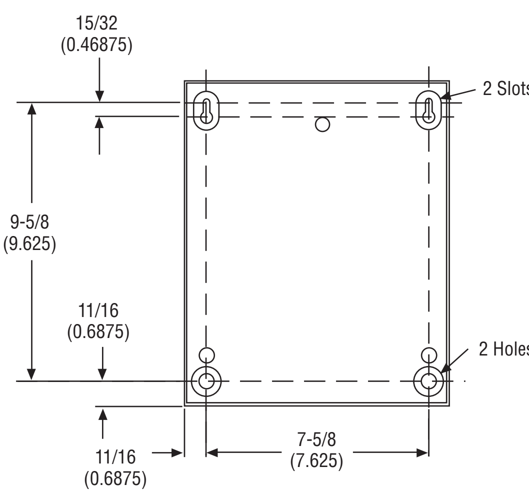


Power Supplies

TCS-167, TCS-168

(P/N 6910-448-033)





A range measurement sensor works in a very precise, easily controllable way. Precise distance of an object moving to and from the transducer is measured via time intervals between transmitted and reflected bursts of ultrasonic sound. The internal circuit reads this time and then proportionately provides an output in either MAs or volts to that distance.

General Installation Information

Target Angle

This term refers to the "tilt response" limitations of a given sensor. Since ultrasonic sound waves reflect off the target/object, target angles indicate acceptable amounts of tilt for a given sensor. If an application requires a target angle beyond the capabilities of a single sensor, two sensors can be teamed to provide even a broader angle of tilt.

Beam Spread

This term is defined as the area in which a round wand will be sensed if passed through the target area. This is the maximum spreading of the ultrasonic sound as it leaves the transducer.

Introduction

Ultrasonic signals are like audible sound waves, except the frequencies are much higher.

Ultrasonic transducers have piezoelectric crystals which resonate to a desired frequency and convert electric energy into acoustic energy and vice versa.

Diagram A shows how sound waves transmitted in the shape of a cone are reflected back to the transducer. At this stage, an output signal is produced to perform some kind of indicating or control function.

A minimum distance from the sensor is required to provide a time delay so that the "echoes" can be interpreted. Variables which can affect the operation of an ultrasonic sensor include: target surface angle, reflective surface roughness, change in temperature or humidity. The targets can have any kind of reflective form and even round objects are an acceptable target.

Advantages of Ultrasonic Sensors

- Discrete distances to moving objects can be detected and measured
- Less affected by target materials and surfaces
- Not affected by color
- Solid state – virtually unlimited maintenance-free life
- Small objects can be detected over longer distances
- Resistance to external disturbances such as vibration, infrared radiation, ambient noise, and EMI radiation

Applications for Ultrasonic Sensors

- Loop control
- Roll diameter, tension control, winding and unwind
- Web break detection
- Level detection/control
- Presence detection

UT30 Series

The Warner Electric UT30 Series Ultrasonic Sensors feature three types of sensors:

- Range measurement with analog output
- Proximity detection with range and hysteresis control
- Long range measurement with analog output
- CE Approved

Range Measurement with Analog Output

This type of sensor is capable of both 4–20mA and/or 0–10V output signals, with an added feature of inverting these signals to 20–4mA and for 10–0V by means of simply wiring the units in the instructed way. Long range sensors come with current (mA) output signals only.

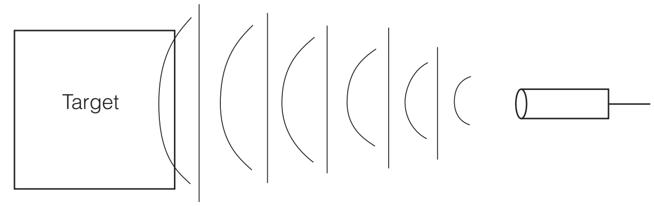


Diagram A

Analog Output

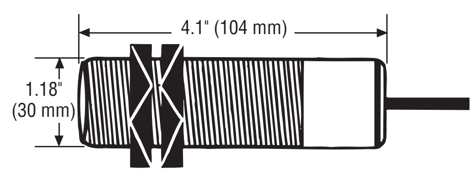
- 4–20mA and 0–10V
- Wire selectable inverted or non-inverted outputs

Threaded plastic barrel
M 30 x 1.5

Specifications

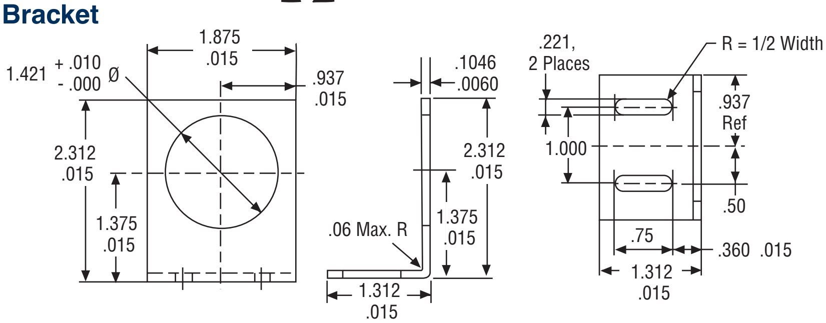
Sensing Range	4–40" (101..1016mm)	8–80" (203..2032mm)
Ordering Information		
Model Description	UT30UP-DCA4-1016-CSI	UT30UP-DCA4-2032-CSI
Part Number	7600-448-001	7600-448-002
Electrical Data		
Voltage Range (min./max.)	20–30 VDC reverse polarity protected	20–30 VDC reverse polarity protected
Input Current	50mA	50mA
Transducer Frequency	212 KHz	150 KHz
Short Circuit Protected	Yes	Yes
LED – (strength indicator)	Yes – green to red; Page 152	Yes – green to red; Page 152
Response Time	30 mSec	50 mSec
Range Control	Zero and span (2 potentiometers)	Zero and span (2 potentiometers)
Mechanical Data		
Temperature Range (min./max.)	–25°F to +140°F (–31.7°C to +60°C)	–25°F to +140°F (–31.7°C to +60°C)
Degree of Protection	IP65/NEMA12	IP65/NEMA12
Body Material	Valox plastic	Valox plastic
Termination Cable 6 ft. (2m)	PVC 4 x 22 gauge	PVC 4 x 22 gauge
Plug/socket	Versions available to order	Versions available to order
Accessories	1) Brackets	1) Brackets
Humidity	0–95% non-condensing	0–95% non-condensing

Dimensions



Mounting Bracket

M 30 ST



Accessories

Brackets for M 30 x 1.5

Ordering Information

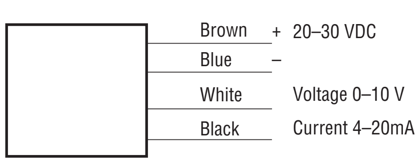
Plastic – BK5-D34PA
Part Number: 596-0223-041

Metal – M 30 ST
Part Number: 7430-448-003

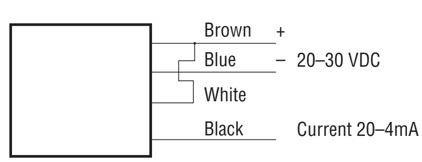
***Power Supply** - NG24 110/220 VAC Input
24 VDC @ 300mA Output
Part Number: 7500-448-020

Note: Provides output to appropriate analog input control. (Ex. TCS-200-1)

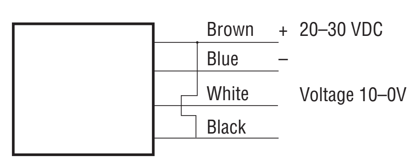
Wiring Data



Non-Inverted Output



Current Output Inverted



Voltage Output Inverted

***Note:** Some controls do not have 24 VDC outputs for the ultrasonic sensor power. These controls require the use of the NG 24 power supply

Operation and Setup

Minimum Analog Ranging

Minimum analog ranging is when you desire to have the full 4–20 mA or 0–10V output over the minimum 5-inch sensing span. Five inches of minimum sensing span can be adjusted anywhere in the sending range. For example 10"–15" or 25"–30". To make this adjustment, place the target at the minimum sensing range and adjust P1 to 4mA. Then move the target to the maximum sensing range and adjust P2 to 20mA. Recheck the ratings and make appropriate adjustments, if necessary. See Diagram A.

Maximum Analog Ranging

Analog sensing in the maximum range means utilizing the entire 36" span (4"–40") and 72" span (8"–80"). To adjust, set the target at the minimum range, either 4" or 8", and adjust P1 to 4mA. Move the target to the maximum range and adjust P2 to 20mA. Recheck readings and make appropriate adjustments, if necessary. See Diagram B.

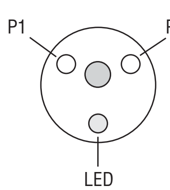
Inverted Analog Outputs

Inverted outputs means that the 4–20mA or 0–10V output signal will decrease proportionally with distance. To adjust, place the target at the minimum sensing distance and adjust P1 to 20mA. Place the target at the maximum sensing distance and adjust P2 to 4mA. Re-check readings and make appropriate adjustments, if necessary. See Diagram C.

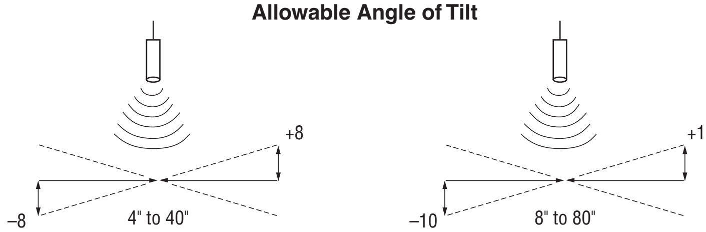
LED Operation (Note D)

The LED is green when the unit is powered. It will fade to red as a target is detected with increased intensity as more signal is being reflected from the target. **Note:** Any color other than green equals a workable signal level.

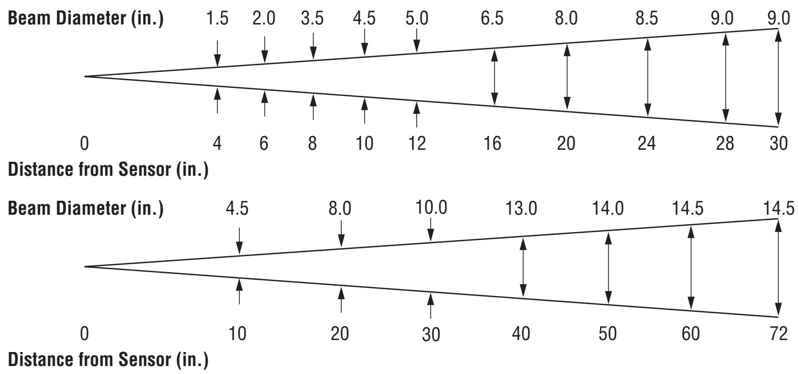
Adjustment Pots
Zero and Span Control



Allowable Angle of Tilt



Beam Spread vs. Target Distance



Minimum Analog Ranging

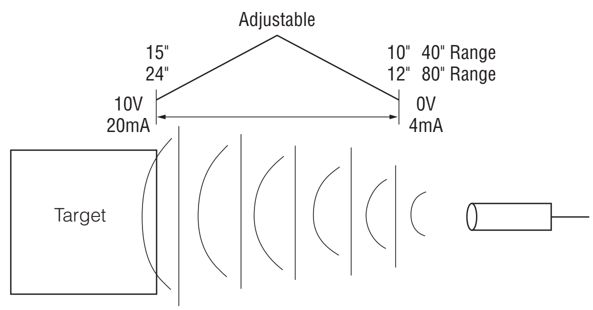


Diagram A

Maximum Analog Ranging

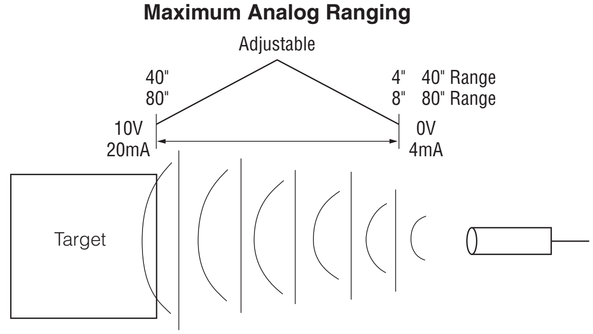


Diagram B

Inverted Analog Ranging

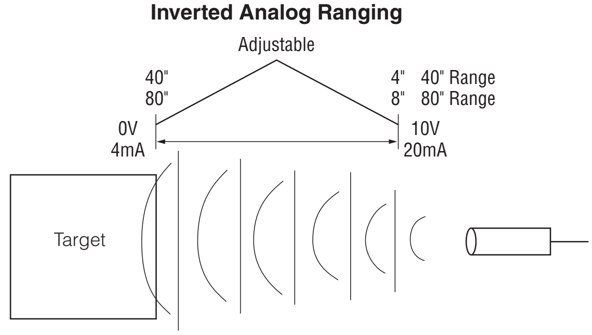


Diagram C