WHAT IS THE CTPS (CONSTANT TENSION PAYOFF SYSTEM)?

When paying out media from a spool, hold back tension is required. The CTPS (Constant Tension Payoff System) provides this tension, regardless of the spool diameter or media speed. The media may be just about anything (i.e. wire, fiber optic cable, cloth, etc.). The tension is provided by a frictionless magnetic brake which delivers precision and repeatable resistive torque. The controller is designed to be user-friendly and allows the operator to see both the set tension (controlled by a knob) and the measured tension.

The CTPS was designed to economically replace existing payoff systems that do not provide a constant tension upon a changing spool diameter or systems that perform poorly overall.

MBS offers two types of systems; both consist of a brake mounted on a cradle, a controller, and a spool measuring device.

THE LASER SYSTEM
This CTPS system utilizes a laser to measure the diameter of a spool. Knowing the spool diameter, the controller can provide the set tension (within a few percent) prior to feeding media and/or using feedback.

THE METERING ROLLER SYSTEM
This CTPS system utilizes a metering roller to measure the linear speed of the media. By comparing the linear speed to the spool speed, the controller may calculate the spool diameter. This is an optimal system when working in an environment where a laser cannot be used.
The tension may be set using the potentiometer on the front of the controller or through the remote cable supplied with the system. The tension is provided by an MBS frictionless magnetic brake. The brake torque is produced by a magnetic field, and thus, with no friction, there is no wear, no dust being generated and virtually no maintenance. The microprocessor, located in the controller, controls the brake tension based on the following inputs: the set tension, brake speed, and spool diameter and/or the speed of the media. The brake is coupled to a payoff spool through a belt and pulleys. A load cell measures the torque of the brake. The user may define if the system operates in an open or closed loop.
How Does the CTPS Work?

The controller provided with the CTPS offers two tension control modes:

1. **Manual mode**, where the operator may control the system directly from the controller.
2. **Remote mode**, where the system may be controlled by a computer or remote 0-10 VDC signal.

The spool speed is measured by the brakes' encoder. The transmission information is factory set but may also be changed in the field.

The controller uses one of two methods to determine the spool diameter:

1. Laser: the initial set-up requires two steps: mounting the laser and aiming it towards the center-line of the spool.
2. Metering Roller: the controller compares the spool speed to the media speed. The media speed may be measured by:
   - Using an existing idler roller in the system, equipped with an encoder.
   - Adding a roller with an encoder.
   - Adding magnets and a hall effect sensor to an existing roller.

From the set tension and calculated spool diameter, the controller calculates what the resistive torque should be.

The resistive torque is provided by a frictionless magnetic brake. The brakes are manufactured by MBS and the size is determined by the continuous power dissipation required; performance curves may be found in the section, **Magnetic Brakes**. The transmission is based on the torque requirements of the payoff spools.

Where Can Our CTPS Be Used?

The CTPS may be adapted to just about any system that requires tension on a payoff spool; from controlling ounces of tension on a fiber optic cable to hundreds of pounds of tension on a cable from spools that weight thousands of pounds.

Accuracy of the System

The load cell that comes with the system has an accuracy of better than 1%; as it is a common accuracy on the market. The question that needs to be asked when selecting a system is **what does this accuracy mean?**
A transducer with an accuracy of 1% means that error can be 1% off from full-scale value. So if you have a transducer that measures 100 pounds of force, the error in measurement can be 1 pound. It is alright if your system operates at 100 lbs. But what does it mean when you are operating at 10 pounds? Since the 1% is for the full scale, your accuracy has now decreased from 1% to 10%. The point being, there is no perfect system on the market that can measure extreme accuracy through a large-scale range, and this should be taken into account when purchasing a system.

The CTPS comes with a load cell; the load cell measures the torque provided by the brake. Depending on how the system was configured at the factory, the load cell signal may be fed-back (closed-loop system) or just be a reference (open-loop system) to display the measured tension. In some cases, it may be desirable to have an open-loop system to avoid stability issues. In this case, the operator may still set a tension but may have to slightly compensate by setting the tension higher or lower so that the measured tension matches the desired one.

REQUIRED INFORMATION TO SIZE A SYSTEM

In order to select the correct size brake and transmission, MBS needs to know the following:

1. The maximum tension required for the media
2. The minimum tension required for the media
3. The maximum linear speed of the media
4. The starting diameter of spool
5. The core diameter of the spool

The controller and brakes are standard components. However, each system is sized according to customer requirements. Based on the answers to the questions above, the brake, transmission, load cell size and scale factors are usually selected by engineers from MBS.

CONTROL PANEL - FRONT

The CTPS Control Panel is the primary control for the system. The secondary control is through the remote cable. The control panel is comprised of the following:
1. AC power switch
3. L.E.D.
4. LCD Display
5. Manual Tension Control
6. Balance and Gain Potentiometers
7. Remote Tension control
8. Load Cell Signal Test Points
9. De-cog Button and Cogging

**SWITCH - MANUAL SETTING**

With the switch set to “Manual,” setting the tension and de-cog control are strictly limited to the control panel.
The E-Stop signal, located only on the remote cable, is still active.

**SWITCH - REMOTE SETTING**

If the switch is set to “Remote,” the tension control knob and de-cog switch are no longer active on the control panel. The tension setting and de-cog switch are strictly limited to the remote cable.
The E-Stop signal is still active.

**LED**

There is a green LED on the face of the control panel; it acts as a status signal. The function is to provide the operator with feedback that the system is powered on and working properly.

- If solid green, the system is in normal operation.
- If flashing while paying out media, the rate of flashing will tell the operator which signal is not being received by the system.

The status signal, optically provided by the LED is also available from the remote cable; this allows for the remote monitoring.
CONTROL PANEL - BACK

MBS uses Amphenol style connectors which are keyed and report with a “snap” when fully screwed in. In addition to using keys in the pin holes, port names are machined into the panels and the cables are labeled. These features help guarantee that cables are connected correctly and fully engaged.

J1 through J4 are the inputs and outputs to connect all the components of the system to the controller. J2 is for the Remote Cable which gives remote access for the tension command, de-cock button, provides a remote signal for the LED and is the only input for the Emergency Stop (or E-stop) signal. Unless otherwise specified, the standard cable length is six (6) feet.

INERTIAL COMPENSATION

The CTPS takes into account the inertia of the spool when ramping up or down in speed. It is of particular importance when applying tension to very heavy spools where inertial tension (the tension required to ramp the spool up in speed) can add substantial tension (when accelerating) or reduce significant tension (when decelerating) on the media.

The spools may vary in size and weight. To compensate for changes in the spools inertia, some basic dimensions, such as core diameter, max media diameter, traverse width, and empty spool weight may be programmed into the controller. Currently the data may be only entered from the control panel; however, development is underway for data entry and operations through the use of a PC, making the system even easier to use.

EMERGENCY STOP

The CTPS has an Emergency Stop (or E-Stop) function. When the E-Stop wire is grounded, the microprocessor control is bypassed, and full current is applied to the brake, regardless of the tension commanded. Though it is possible to overheat the brake with using the E-Stop function, it is intended to be a function to stop, no matter what, due to an emergency. If there is a loss of power, the E-Stop function will not work.
CALIBRATION

Even though the CTPS is calibrated at the factory, the system comes with a calibration weight. Though very minimal, the calibration may drift slightly due to a naturally occurring drift in analog amplifiers that boost a strain gauge signal. The calibration may also drift due to large temperature changes in the atmosphere or rogue heat provided from the sun, heater, lamp, nearby machinery, etc. Or, perhaps one just wishes to verify that the system is properly calibrated.

Calibrating the system takes only a minute or two. First, the zero or “Balance” must be set. Secondly, the “gain” may be set, by placing the calibration weight on one of the platforms (tension or compression).

The LCD display may be used for calibration, or if more precision is desired, a voltmeter plugged into the “CAL” ports may also be used.

OVERLOAD PROTECTION

The load cell is sized for the requirements of the system. Consequently, for the required torque range of the payoff spool, an off-the-shelf load cell is selected to accurately measure up to the maximum load, the system is designed for. The load cell measures the tension of the media by bending (or deflecting) under load. Hard stops are present to prevent accidental overload of the load cell. The stops allow the load cell to deflect to full tension but limit this deflection to prevent damage.
OPERATING THE CTPS

The operational procedures are as follows:

1. Power on the system and let the load cell amplifier stabilize (warm up) for a few minutes.
2. If desired, calibrate or check the calibration of the load cell. This should take approximately a minute or less.
3. Select the source of the tension command signal with the selector switch (i.e. Manual or Remote).
4. Set the tension of the system.
5. Start the take-up and monitor the LED for proper system operation. Initially, the start-up tension will be low because the CTPS needs a few input pulses (less than one revolution of the spool) to calculate the coil diameter. The controller will ramp up to the set torque while compensating for inertial tension due to acceleration.
6. If the system is stopped before the tension command is reduced to zero, and the brake is too coggled to start or thread the system, press the de-cog button to manually de-cog the brake. If starting the system back up with the same spool and same set tension, de-cogging is not necessary.