



INSTRUCTION MANUAL

STEADYWEB™ MICROPROCESSOR

AUTOMATIC TENSION CONTROLLER

DOC 801-0674 R1

217 Pickering Road
Rochester, NH 03867 U.S.A.

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READ THIS!

Your SteadyWeb MicroProcessor Controller has been properly configured at our factory. To install it and start it up, it should only be necessary to use these sections of this manual:

Section 2 - Installation

Section 3 - Calibrating and Set-Up

Section 4 -Understanding the Operator Interface

The other sections are for reference and for instruction if you wish to change the configuration at some later time.

U.S.A. F.C.C. STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

CAUTION!

**Changes or modifications not expressly approved by Dover Flexo Electronics
could void the user's authority to operate this equipment.**

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SteadyWeb MicroProcessor Product Code

SW2M V - 90 U - S N - 0250 - X...

<u>Version</u> <i>Note 3</i>	<u>Output</u>	<u>Zone</u>	<u>Chassis</u>	<u>Fittings</u>	<u>Meter Scale</u>	<u>Options</u> <i>Note 1</i>
V	P = Pneumatic	R= Rewind	S= Std Enclosure	N= None	0001= 0-1	X = No Options
P	10 = 10v	U= Unwind	R= Remote Panel	S=Standard	0005= 0-5	XR = Extended range
D	N10 = -10v	I= Intermediate		M= Metric	0010= 0-10	TLS = Tension limit switch
	B10 = -10v to +10v				0025= 0-25	NMS = Non-Standard Meter Scale
	24 = 24v				0050= 0-50	DTI = Dual Transducer Input
	45 = 45v				0100= 0-100	TTD = Taper using DC tachs
	90 = 90v				0150= 0-150	TTP = Taper using pulse tachs
	180 = 180v				0250= 0-250	STT = Speed follow by DC tach
					0500= 0-500	STP = Speed follow by pulse tach
					1000= 0-1000	SDT = Speed follow/diameter comp using DC tach <i>Note 2</i>
						SDP = Speed follow/diameter comp using pulse tach <i>Note 2</i>
						RTA = Remote tension amp
						RPA = Remote pneumatics assembly
						RPE = Remote pneumatics in enclosure
						RO = Reverse output
						APC = Attached power Cord
						230 = 230v Power Input
						Z = Special (SPR)
						* = See Description/Notes

1. When using the Dual Calibration option (DC) add second meter scale to code after first meter scale separated with a slash (/) = 0250/0500.
2. Only used with center shaft rewinds.
3. V = 24v, 45v, 90v, 180v outputs
P = Pneumatic Output.
D = 10v, -10v, -10v to +10v outputs.

1.1 GENERAL DESCRIPTION

The SteadyWeb™ MicroProcessor tension controller automatically maintains tension of any continuous material at the value selected by the machine operator. It consists of three basic functions:

The first function, to provide a readout of actual tension, is performed by the tension amplifier. It supports all of Dover Flexo Electronics tension transducers. (The transducers measure the actual tension in the web). It includes a regulated power supply to excite the transducers, an amplifier to boost the transducer output signal, and a calibration circuit to adjust the tension readout to display actual tension.

The second function is the tension regulator. It compares the tension signal from the transducers with the AUTO Set point as displayed on the front of the SteadyWeb™ MicroProcessor enclosure. If there is a difference, the regulator will either increase or decrease output to equalize them. The tension amplifier connections are located on the Power PCB, while the tension regulator functions are part of the MicroProcessor software.

The third function is performed by the output module. It accepts the output from the tension regulator and actuates a brake, clutch, or variable speed drive system which actually creates the tension in the web.

1.2 OUTPUT MODULES, THREE VERSIONS OF CONTROLLER

Three output modules are available for the SteadyWeb™ controller.

- A) **Pneumatic output module.** This is used to actuate any air operated brake or clutch. It includes a servo valve, a pressure regulator, and an air filter. These items are fitted together into a compact assembly which is normally installed inside the controller enclosure or optionally located remotely. The output range is 0.5 to 75 psi. SteadyWeb™ controllers having this module are designated "**Version P**".
- B) **High Voltage output module.** This module uses an SCR (silicon controlled rectifier) to produce an output of up to 90 volts DC. It can operate any electric brake or clutch, including eddy current clutches. 45 volt and 24 volt outputs are also available by resetting configuration switches. The module is also known as the V-OUT Card. SteadyWeb™ controllers having this output module are designated "**Version V**".
- C) **0 to 10 Volt DC compensated output module.** This module is in the form of a 16 pin DIP Integrated Circuit that plugs into the Power board near the top center (designated U203). (**See Appendix A**). This output is used to control DC drives or other variable speed drive systems. The drives in these cases should be speed regulated, this output is isolated from ground to make it compatible with all drives. SteadyWeb™ controllers having this output are designated "**Version D**".

All SteadyWeb™ controllers may be easily converted from one output to another if desired. There are two locations for plug-in cards for optional features on the Power board. (**See Appendix A**).

1.3 FRONT PANEL AND OPERATOR DEVICES

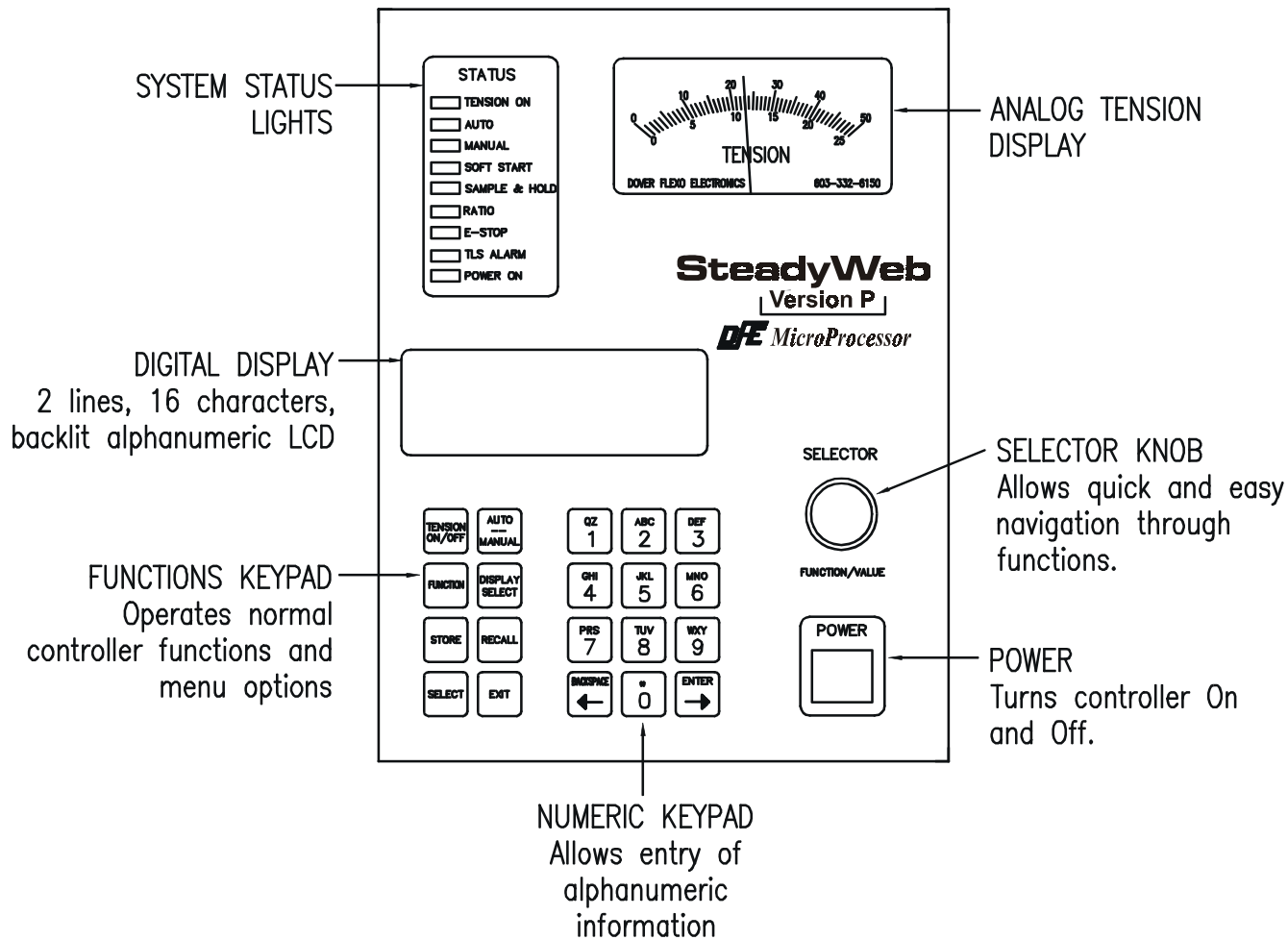


Figure 1 - FRONT PANEL and OPERATOR DEVICES

1.4 SPECIFICATIONS

POWER INPUT: "P" and "D"	120/230 Volts 60/50Hz single phase @ 1 Amp
"V"	120/230 Volts 60/50Hz single phase @ 5 Amp
OUTPUT: "P"	0.5 to 75 psi (.03 to 5.17 bar)
"V"	90 Volts DC, 45 VDC, 24 VDC, all @ 5 Amp
"D"	180 VDC @ 5 Amp and 230 VAC Input
	0-10 Volts DC, compensated and isolated
TENSION SIGNAL OUTPUT	0-10 Volts DC
	4-20 MA into 500 ohm maximum load
ENCLOSURE	Steel, powder resin painted, NEMA 1
WEIGHT	26 lbs. (11,8 KG)
AIR CONNECTIONS: "P"	In: 3/8 inch plastic tubing (5/16", 8mm optional)
	Out: 1/4 inch plastic tubing (6mm)
INTERNAL AIR FILTER: "P"	5 micron, ½ pint bowl, automatic drain
TRANSDUCER SIGNAL	500 mv DC per pair at rated load,
	1.0 Volt with Extended Range option
MATING TRANSDUCER CABLE CONNECTORS	Amphenol MS3106A-10SL-3S
ZERO (TARE) RANGE	95% of transducer rating, minimum
CALIBRATION RANGE	25:1
TEMPERATURE RANGE	32 to 104 deg. F (0-40 deg. C)
SYSTEM ACCURACY	1 - 3% typical
ANALOG TENSION METER	Heavy-duty, 2% accuracy, flame proof front
DIGITAL DISPLAY	2-line, 16-character alphanumeric, back-lit LCD
KEYPAD	20 keys, snap-action, N232/485, function/value selects
OUTPUT RANGE	0-100% (maximum)
MANUAL MODE OUTPUT RANGE	0-100%
OUTPUT RATIO RANGES	0.1* - 10*
SELECTOR KNOB	Rotary encoder
STANDARD TENSION METER SCALES	0 - 1,5,10,25,50,100,150,250,500,1000
TENSION LIMIT SWITCH RELAY CONTACTS (option)	SPDT rated @ 10A/30VDC, 10A/250VAC
TAPER TENSION RANGE	0-100%
TAPER TENSION INPUTS	
Code TTDCT (using DC Tachs)	(option) Switch selected, 3V to 250V
Code TTPT (using Pulse Tachs)	(option) 300Hz to 40KHz at max. line speed
Code TTF (Roll Follower)	(standard) 10K ohm potentiometer minimum
Code TTR (external voltage)	(standard) 0-10VDC core to full roll

1.5 STANDARD FEATURES

SOME OF THESE FUNCTIONS REQUIRE CONFIGURING OR EXTERNAL WIRING. REFER TO SECTION 3 FOR CONFIGURING AND SECTION 2.6 FOR WIRING.

- ! **0-10 VOLT DC TENSION OUT.** Proportional to web tension. Used as an input to other control systems, computers or data collection devices.
- ! **4-20mA TENSION OUT.** Proportional to web tension. Used as an input to other control systems, computers or data collection devices.
- ! **ANALOG TENSION DISPLAY.** Web tension is displayed on an analog meter which is calibrated to read out total tension in pounds, newtons, kilograms, or any other desired units. In the controller's default mode tension is also shown on the digital display.
- ! **ANTI-TAMPER FEATURE.** Limits access to function groups to prevent inadvertent or unauthorized adjustment of programmed settings.
- ! **AUTOMATIC CONTROL MODE.** The controller output is determined by the difference between web tension and the AUTO tension setpoint. The internal regulator automatically varies the output as required to maintain set tension.
- ! **CONTROL VOLTAGE SELECTION.** Choose one of two available Control board outputs. They are 0 to +10 VDC and -10 to +10VDC. The 0 to +10VDC output operates pneumatic (P) and high voltage (V) output modules when used. Either of the two outputs can be used in the D version of the SteadyWeb™.
- ! **DIGITAL DISPLAY.** Large (each character is .38" high by .19" wide) 2-line by 16-character alphanumeric LCD display with LED backlight and Supertwist display technology assure easy viewing under all lighting conditions and viewing angles. The way in which the display provides information (such as default values, timeouts, etc.) can be changed to meet the user's needs.
- ! **EMERGENCY STOP.** Controller immediately goes to full output or zero output (switch selectable) upon closure of an external contact. Normally full output is used on unwinds to stop the roll of material quickly. Zero output is usually used for rewind or intermediate controllers.
- ! **KEYPAD.** 20-key keypad with snap-action allows positive operator feedback. Grouped and color coded into two sections, one for normal functions, and the other for alphanumerics.
- ! **LANGUAGE SELECTION.** User may select the language used for menu items on the digital display readout. Menu items can be shown in French, German, Italian or Spanish. English is the default language.
- ! **MANUAL CONTROL MODE.** The controller output is determined only by the manual setpoint. No change occurs unless the setting is changed.
- ! **METER DAMPING.** Eliminates vibration of the analog tension meter needle.
- ! **SELECTOR KNOB.** Rotary encoder emulates the operation of an analog potentiometer in some modes, and allows quick and easy navigation through functions in other modes.
- ! **OUTPUT DIRECTION.** Select between Standard and Reverse output. Most applications use the Normal selection with the controller output going up as tension falls below the set level. The Reverse selection causes output to go down when tension falls below the set level. Reverse output is used in intermediate tension zones where the transducers are located after the controlled nip, and for driven unwinds.
- ! **INPUT POWER VOLTAGE SELECTION.** The SteadyWeb™ controller is designed to operate on two ranges of AC power; 110-120 Volts 60/50 Hz, and 220-240 Volts 60/50 Hz. A slide switch on the Power board selects between the two.
- ! **RATIO.** Takes a sampled output and multiplies it (unwind applications) or divides it (rewind applications) by a factor adjustable between 1 and 10. Used in splicing applications to help match controller output to roll diameter.
- ! **REMOTE TENSION ON/OFF.** Requires two momentary pushbuttons supplied by the customer and located external to the controller. Enables the machine operator to turn the controller's output on and off at the remote location and at the controller.
- ! **REMOTE TENSION SET.** An input is available to provide a remote tension setpoint. This feature allows the machine operator to locate an auto tension setpoint potentiometer external to the controller instead of using the front panel of the controller. Only one setpoint location can be active at any one time.

- ! **SET-UP STORAGE/RECALL.** Allows the operator to store all operating parameters related to a particular job, material, or process, for later retrieval by customer designated name.
- ! **SOFT START.** Typically used on unwinds. Actuated either automatically upon a loss of tension below the preset trip point (after an adjustable delay), immediately upon an external contact closure, or by machine speed. Controller output is reduced to a preset low level to prevent brake lock-up when the machine starts. When tension rises above the trip point, the controller goes back to the automatic control mode. Does not operate in the MANUAL control mode. Actuation by machine speed requires an optional Tachometer Card (see Options, Section 1.6)
- ! **SPEED FOLLOW.** This is a special function normally used on Version D SteadyWeb™'s controlling tension in an intermediate zone (see Tension Zone drawing, Section 3.9.4) or surface driven rewinds and unwinds. Requires option tach interface board.
- ! **STATUS LIGHTS.** Indicate active functions when lights are illuminated.
- ! **TRANSDUCER VOLTAGE SELECTION.** Choose between 5 VDC and 10VDC excitation for the tension transducers. 5 VDC is standard. 10VDC is used for the extended range option, and always with the Low Tension Transducer.
- ! **TENSION LIMIT SWITCH (TLS).** Provides setpoints above and below preset tension levels. Usually used as a web break detector. Optional TLS relay socket is located on the Power Board.
- ! **SERIAL INTERFACE.** A serial communications option is available either to provide serial data output for a simple terminal device or printer, or to provide remote control of certain controller functions and to facilitate remote computer-based data collection. Standard RS232 or optional RS485 connection.

1.6 OPTIONS

SOME OF THESE OPTIONAL FUNCTIONS REQUIRE CONFIGURING OR EXTERNAL WIRING. REFER TO SECTION 3 FOR CONFIGURING AND SECTION 2.7 FOR WIRING.

- ! **230 VOLT POWER.** 50/60 Hz power input.
- ! **24 VOLT OUTPUT.** For Version V only.
- ! **DC TACHOMETER CARD.** Takes the voltage output from one or two DC tachometers and scales it to 0-10 volts DC. This card is required for the Taper Tension (TTDCT) option, the version of Soft Start which is actuated by machine speed, and the Speed Follow function. This card plugs into the Power Board.
- ! **DUAL CALIBRATION.** Includes dual meter scale for the standard analog tension meter. The meter scale may have any ratio, limited only by the range of the transducers. Used in those cases in which a wide range of materials having very wide tension requirements are being run.
- ! **DUAL TRANSDUCER INPUT.** Controller receives two separate tension signals, one from each of two sets of transducers. Used when a very wide range of tensions must be controlled. A menu function selects the tension signal to use. The option card plugs into the left-hand option socket on the Power board. There are no adjustments on this card.
- ! **EXTENDED RANGE.** The transducers are excited by 10 volts instead of the standard 5 volts. Used for low tension applications. The transducers must also have the XR option.
- ! **METRIC AIR TUBING.** For Version P only. Air fitting for use of 8mm diameter air supply tubing in place of the standard 3/8 inch tubing.
- ! **NONSTANDARD METER SCALE.** Any nonstandard analog meter scale. Either single or dual scale. See Specifications, page 3, for standard scales.
- ! **PULSE TACHOMETER CARD.** Takes the pulse output from one or two rotary encoders, AC tachometers or other types of pulse generators, and converts and scales it to 0-10 volts DC. This card is required for the Taper Tension (TTPT) option, the version of Soft Start which is actuated by machine speed, and the Speed Follow and diameter calculation functions. This card plugs into the Power Board.
- ! **REMOTE OPERATOR DEVICES.** No cover on enclosure. Front panel attached to controller via a 6'(length optional) cable. Allows front panel to be installed in customer's control panel and controller to be installed inside. (See Figure 3)
- ! **REMOTE PNEUMATIC MODULE.** For Version P only. Allows servo valve to be installed close to the brake/clutch while the controller is located elsewhere. Customer to specify cable length.

- ! **REMOTE TENSION AMPLIFIER.** The internal tension amplifier is bypassed and a 0-10 Volt tension signal is provided by an external remote device such as the TI-13. This allows use of special indicator functions, such as intrinsic safety, which are not available in the SteadyWeb™ controller.
- ! **TAPER TENSION.** For rewind applications. Causes tension to decrease as roll diameter increases. Helps produce a better quality roll by eliminating telescoping, crushed cores, tight or loose rolls. The two methods that are available are diameter calculator and rider roll. The diameter calculator method requires machine speed and roll speed signals from the optional DC Tachometer Card or the Pulse Tachometer Card. The rider roll method requires a follower roll in contact with the rewinding roll, or some other roll-sensing device such as a sonic rangefinder to detect the roll diameter. The device must have a 0-10 Volt DC output. Taper is adjustable from 0 to 100%. Three different types of taper are available as follows:
 - (TTDCT) DC Tachometers used for speed signals.
 - (TTPT) Pulse Tach generators used for speed signals.
 - (TTF) Roll Follower or external 0-10VDC source used.

1.7 STEADYWEB™ CONTROLLER EXPLODED VIEW

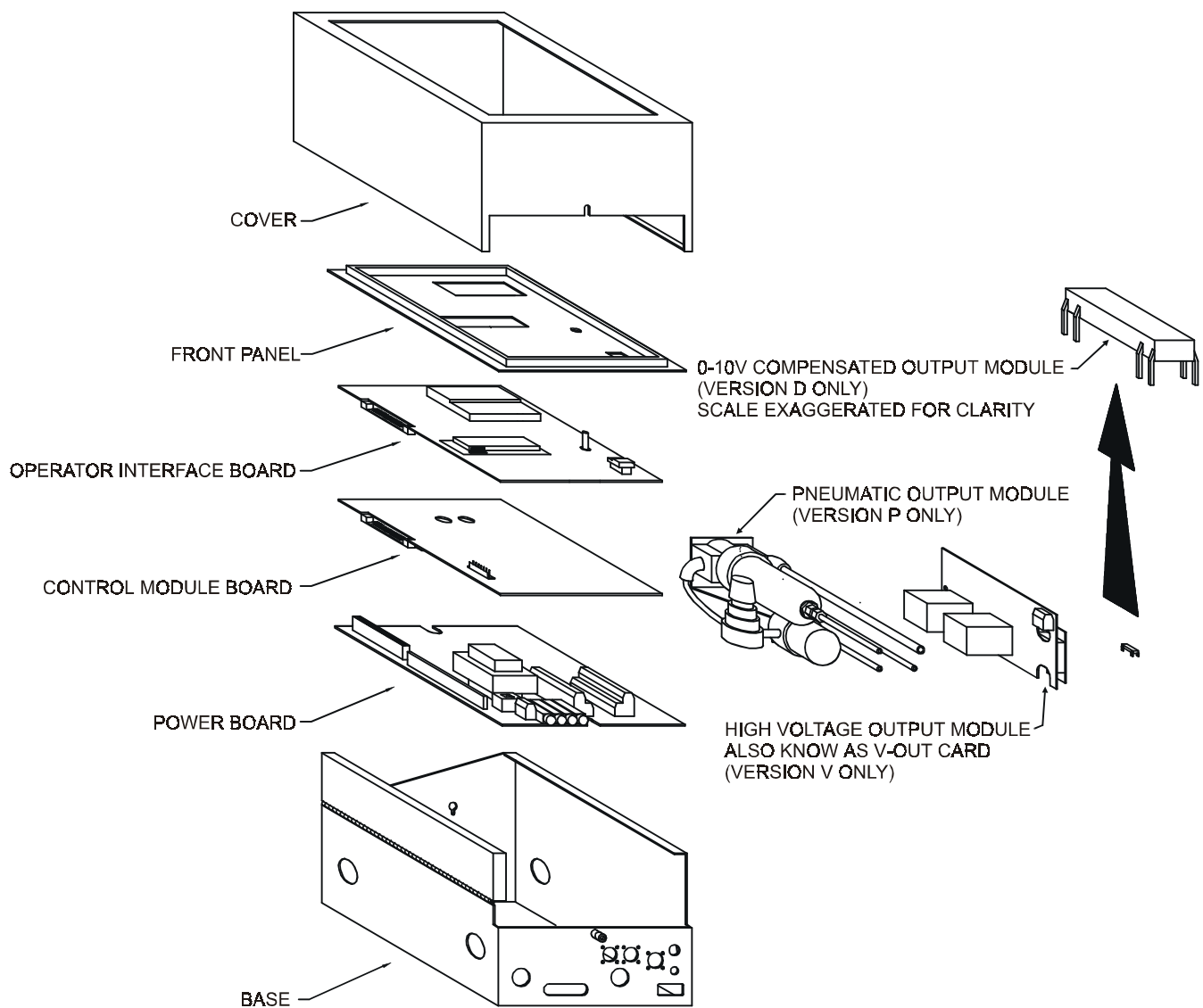


Figure 2 - CONTROLLER EXPLODED VIEW

1.8 REMOTE PANEL CONFIGURATION

In addition to the standard enclosure, the SteadyWeb™ MicroProcessor controller is available in an optional Remote Panel enclosure configuration (also known as an H6). This special configuration is normally used when it is desirable to integrate the controller into existing electrical enclosures.

The H6 (Harness, 6 ft. long) configuration consists of the standard enclosure with the cover omitted, and the front panel removed and connected to the controller by a harness or ribbon cable. A special cover plate takes the place of the front panel on the controller. This arrangement permits installation of the controller inside another enclosure with the front panel mounted in a rectangular cutout.

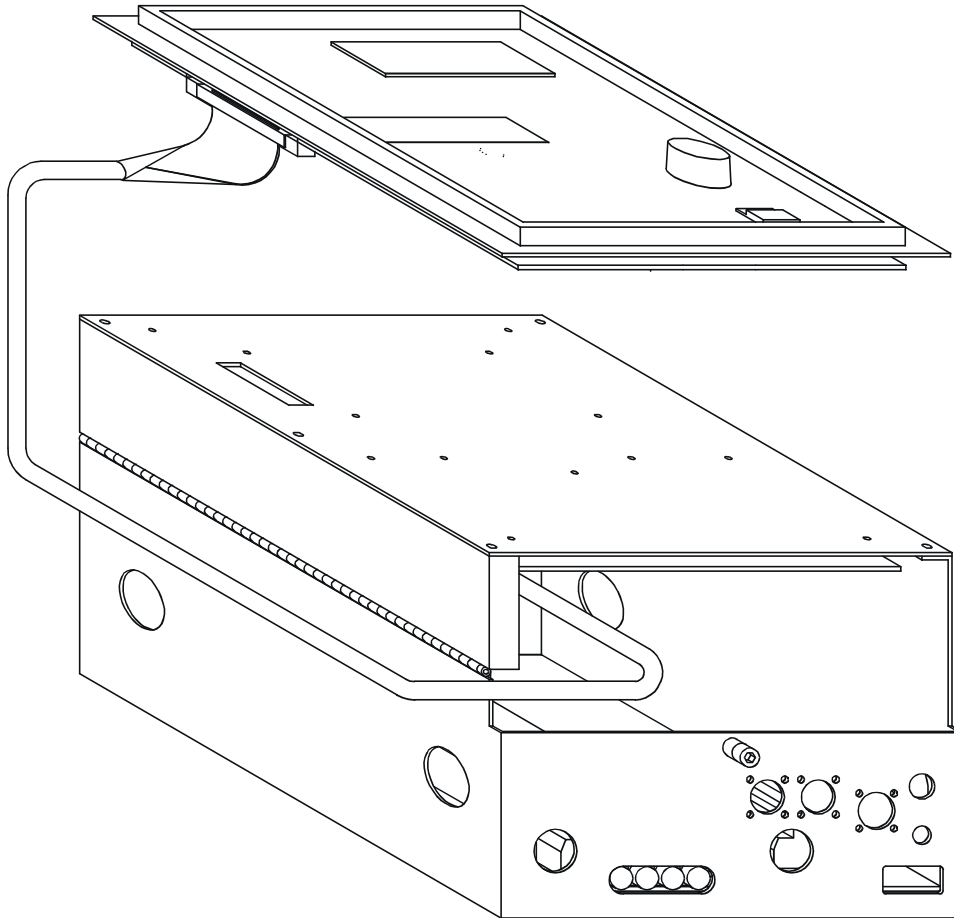


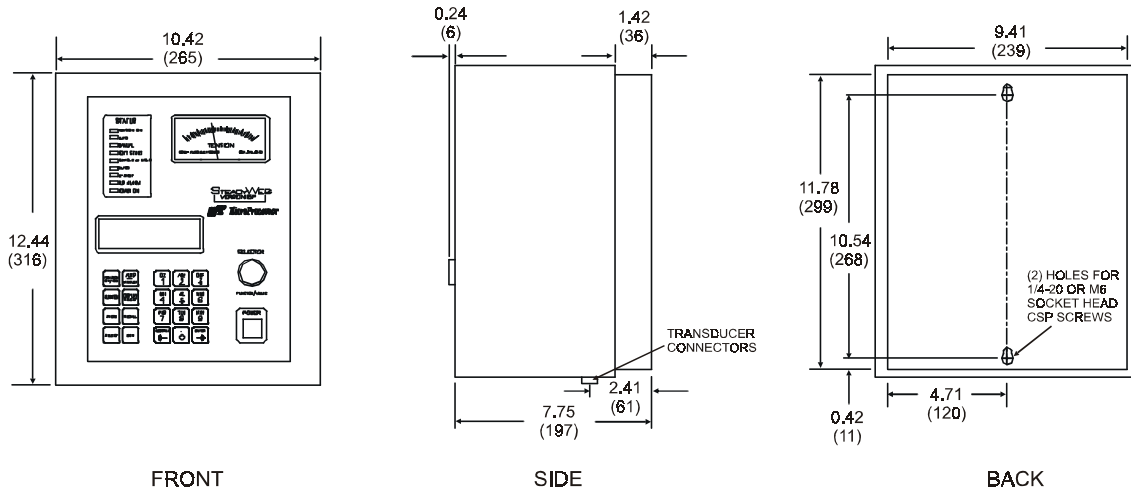
Figure 3 - REMOTE PANEL CONFIGURATION

SECTION 2

INSTALLATION

2.1 DIMENSIONS (inches/mm)

Standard Configuration:



Note: Allow 5" (127mm) clearance on the left side for the controller to open completely.

Remote Panel Configuration:

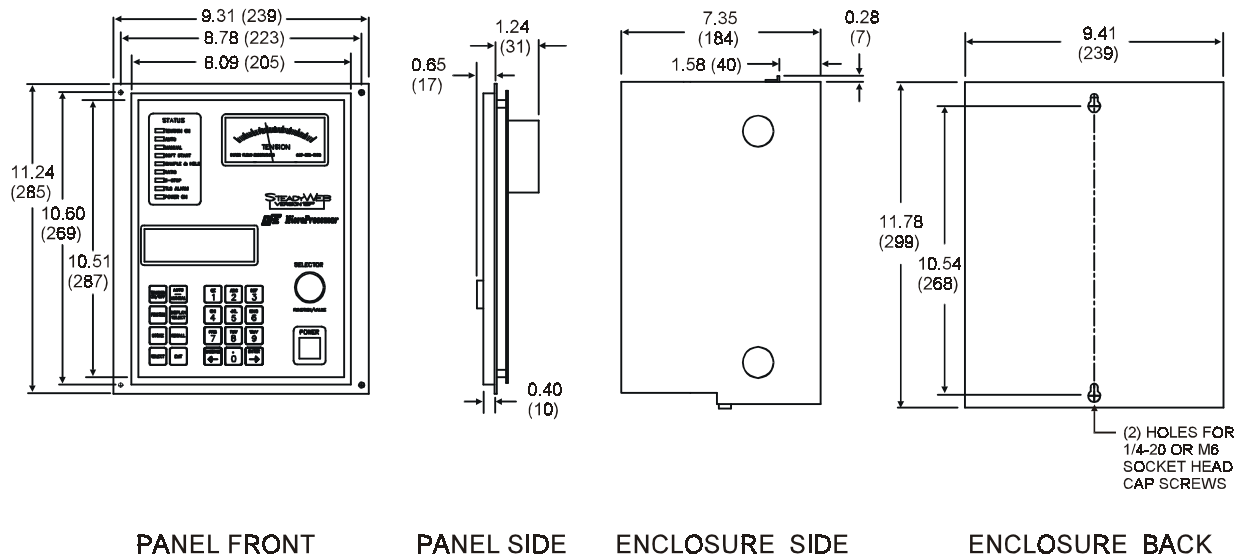


Figure 4 - DIMENSIONS

Remote Pneumatic Assembly Dimensions: inches (mm)

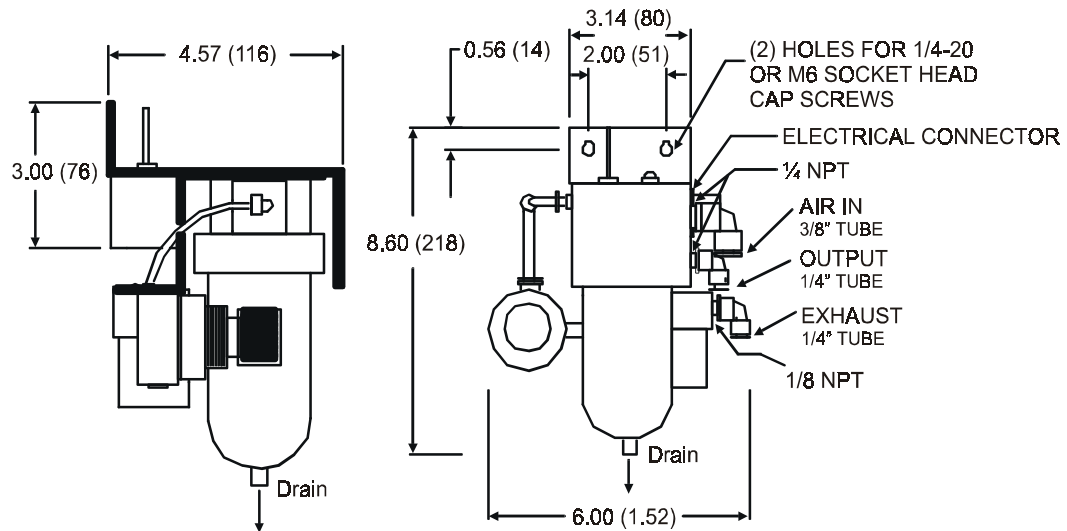


Figure 5 - REMOTE PNEUMATIC ASSEMBLY DIMENSIONS

2.2 SELECTING A MOUNTING LOCATION

Select a location on the machine frame or a wall that will be convenient for the machine operator to operate the controller and to see the tension meter easily. Be sure the location is free of vibration, and is dry and clean. Take care to choose a place that the controller won't be struck and damaged by anything or anyone. Also make sure there is at least 5 inches of clearance on the left side to allow cover to be opened.

The enclosure is fastened to the mounting surface you have chosen by two socket head cap screws. Install the screws in the mounting surface as shown below. Leave them loose about 6 turns. Position the keyholes in the back panel of the enclosure over the screws and slide it down until it locks in place. The cover must be removed to tighten the mounting screws. (See Figure 7 for cover removal)

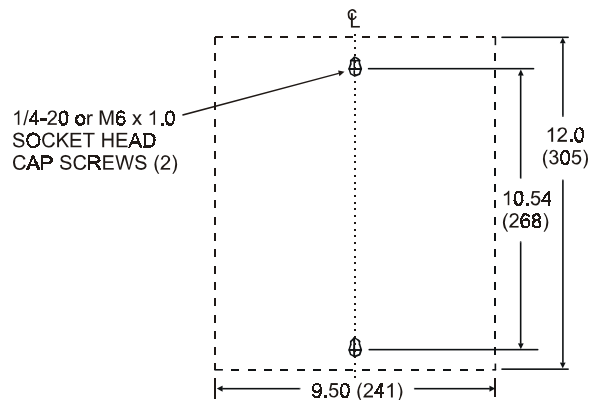


Figure 6 - MOUNTING SCREW LOCATIONS

2.3 OPENING THE CONTROLLER

Listed below are the steps required to remove the SteadyWeb™'s cover. After removing the cover, swing the front panel out by first loosening the two screws on the right side top and bottom corners.

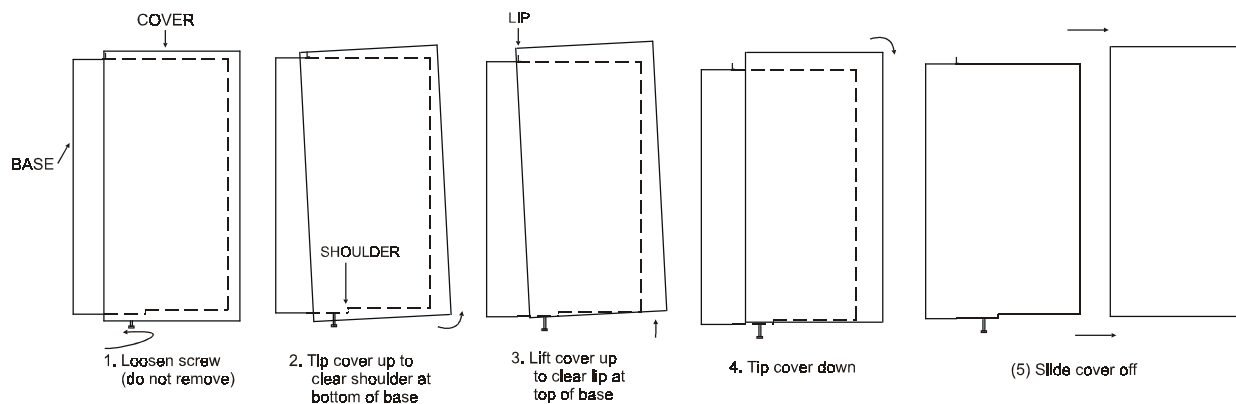


Figure 7 - COVER REMOVAL (Left side view)

2.4 POWER VOLTAGE SELECTION (See Appendix A for location of switch on Power board)

The SteadyWeb™ controller is designed to operate on either 115v-50/60Hz or 230v-50/60Hz power. SELECT the correct voltage for your application with the Power Selector Switch, SW203 on Power Board. The left position selects 230v; the right position selects 115v.

CAUTION! The wrong selection will damage the controller!

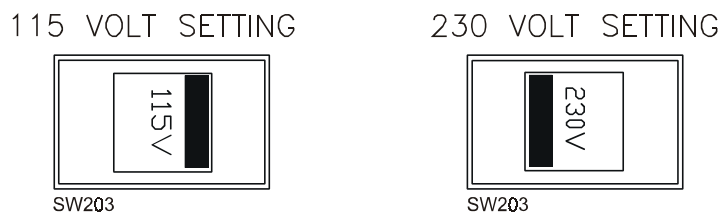


Figure 8 - INPUT POWER SELECT SWITCH

The following items outline procedures necessary either to access features described in section 1.5 STANDARD FEATURES or to adjust setup parameters of the controller. The procedures follow a logical sequence, and most adjustments can be made through the front panel user interface.

2.5 TRANSDUCER VOLTAGE

(See Page 5 for description, Appendix A for Power Board)

The tension transducers are excited by either the standard 5 VDC or, 10VDC with the Extended Range option (XR) or low tension force transducer.

CAUTION!! Do NOT use the 10VDC excitation unless the transducers are low tension force transducers or have the XR (extended range) option! The transducers **WILL** be DAMAGED!

Set the SW202 switch as follows: 5VDC - Slide switch UP 10VDC - Slide switch DOWN

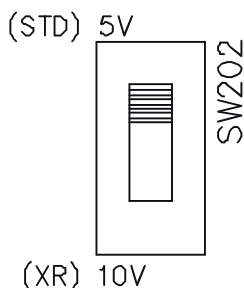


Figure 9 - TRANSDUCER VOLTAGE SWITCH

2.6 ELECTRICAL CONNECTIONS

Refer to the drawing below for electrical connections. If your controller has any optional equipment, refer to Figure 11 on page 12 of this manual for the appropriate connections. TB201, TB203 and TB204 are located on the Power Board.

TB203

TB204

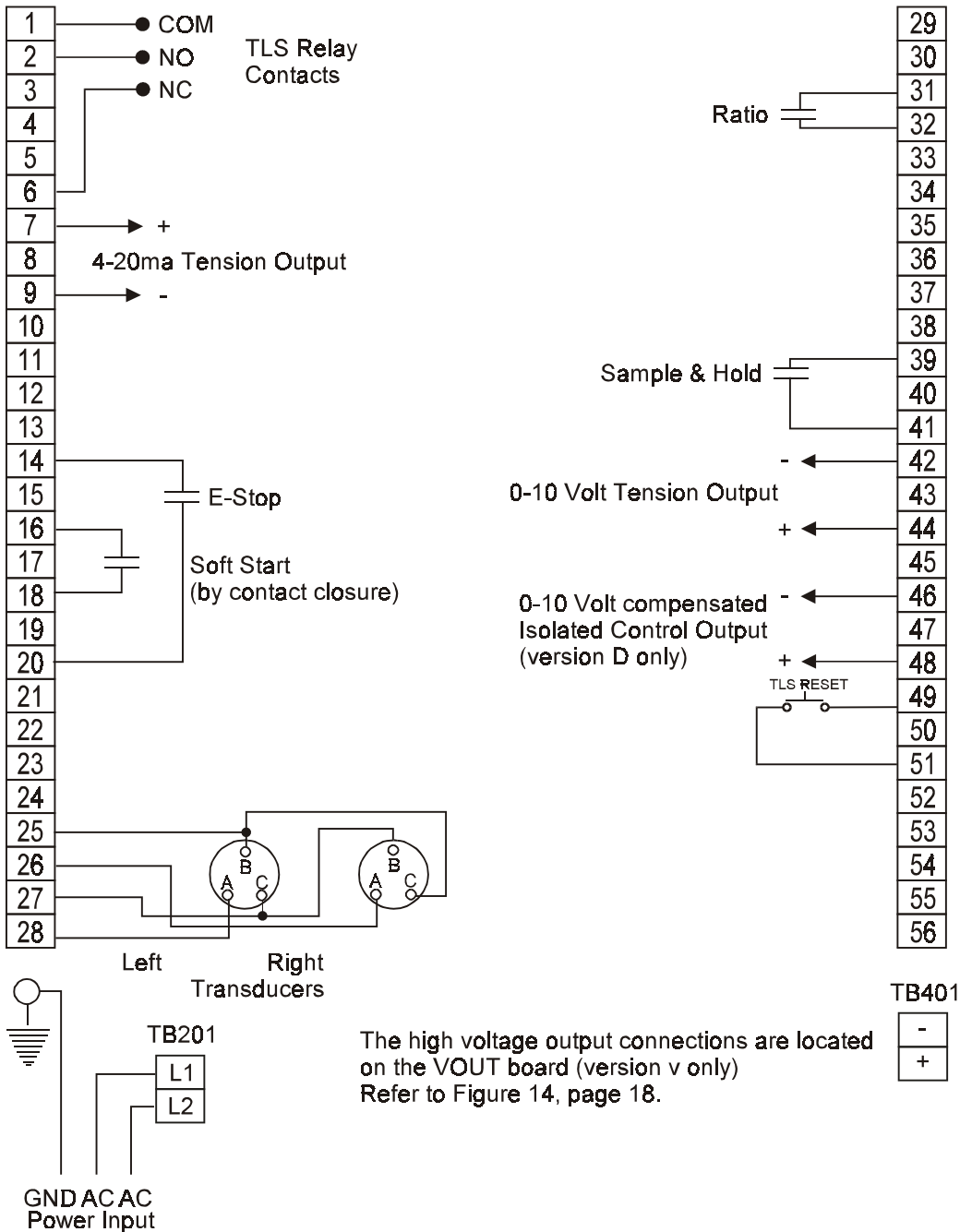


Figure 10 - ELECTRICAL CONNECTIONS

NOTE: The tension transducers are usually connected to the controller by two 3 pin Amphenol connectors mounted on the bottom of the enclosure. However they may be hard-wired directly to the terminal strips as shown above, if desired.

2.7 ELECTRICAL CONNECTIONS OF OPTIONS

TB203

TB204

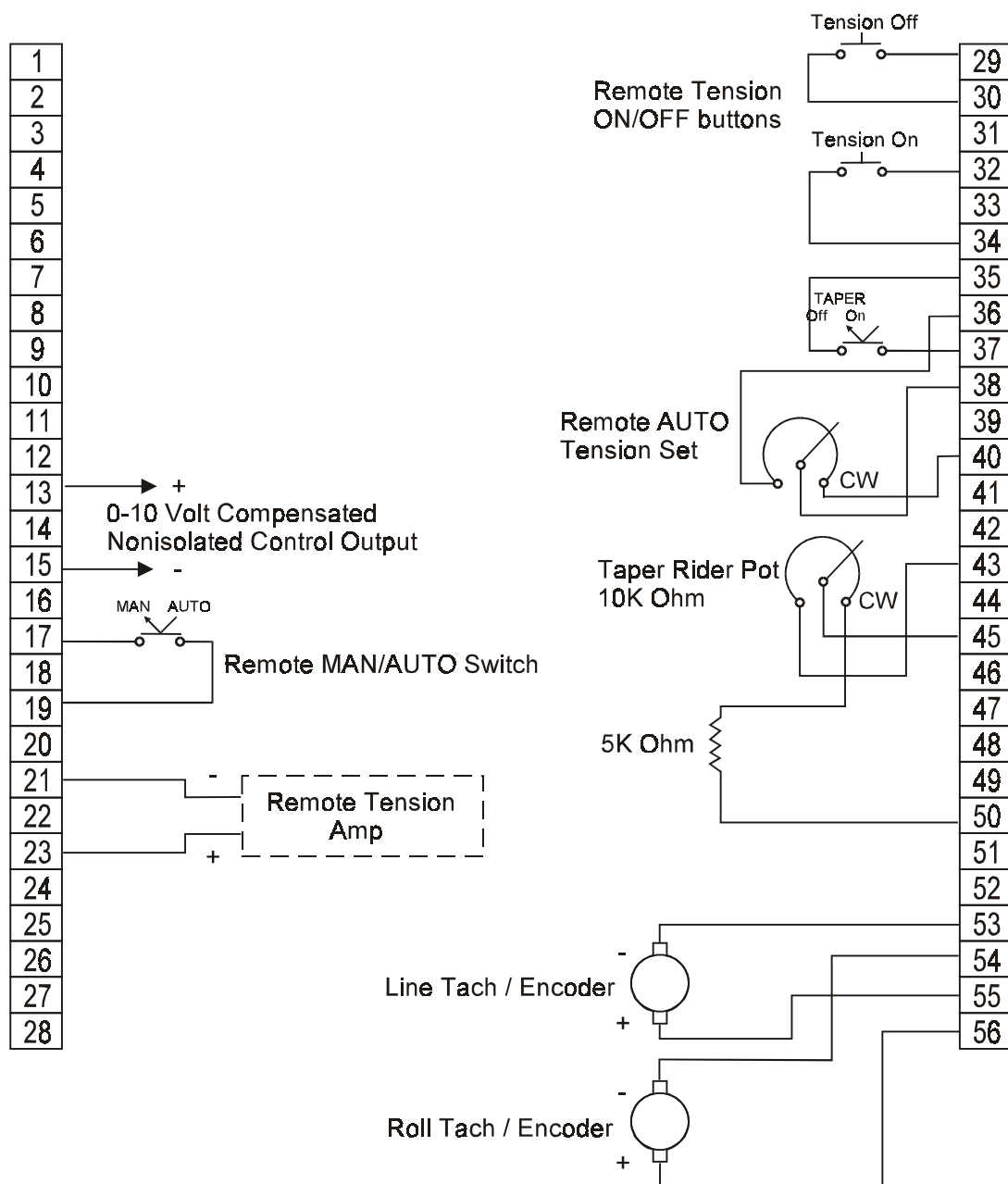


Figure 11 - ELECTRICAL CONNECTIONS OF OPTIONS

Your SteadyWeb™ controller has been properly configured at the factory. It should not be necessary to make any changes. Use this section only to verify the configuration or to reconfigure the controller if your application requirements change. It is recommended that only a qualified service technician make necessary changes

3.1 UNDERSTANDING THE OPERATOR INTERFACE

This section provides information about the SteadyWeb™ MicroProcessor's operator interface that is not essential to set up the controller's primary features, but can be used to gain a better understanding of the controller and use of its functions

1. INITIALIZATION

Each time the controller is turned on, by the POWER switch on the front panel, it undergoes an initialization sequence which tests all of the front panel LED's and the analog meter. It will then display the message:

DFE SteadyWeb™ uP

OIM vX.X CM vX.X

followed by the standard default display

TENSION A

0.0 lb

This is the tension reading for a new unit; otherwise actual tension would be displayed.

2. DISPLAY MODES

Default Mode This is the mode the controller normally defaults to after initialization, or after exiting functions by using the EXIT key. Typically, the system's current tension is displayed in this mode.

Function Select Mode. This is the mode the controller enters after you press the FUNCTION key. First you must select a function group. Then you can choose a function by keying in its number, or by turning the SELECTOR knob until the desired function appears. To activate the function, press the SELECT key. To return to the default mode, press the EXIT key.

Function Mode In this mode a function is active and a setting can be changed. The setting can be changed either by keying in information, by using the arrow keys left or right to scroll through choices, by turning the SELECTOR knob left or right, or by a combination of these. Pressing the EXIT key brings you back to the Function Select Mode.

Display Select Mode This mode allows quick access to certain functions for viewing and changing them. While in Default Mode, pressing the DISPLAY SELECT key causes the Manual and Auto setpoints and the present Output Level to be displayed, along with other desired parameters. While in this mode if you want to change the value of a displayed function, press the SELECT key and you will automatically be in Function Mode for that parameter. Otherwise you can press the EXIT key to return to Default mode.

Store/Recall Mode This is a special mode used to store or recall setup information. While in Default Mode, pressing the STORE key initiates the setup storage procedure, or pressing the RECALL key initiates the setup recall procedure. To exit this mode, press the EXIT key.

3. GROUPING OF FUNCTIONS

There are approximately 70 functions available to the operator. To make it easier to navigate through these, they are arranged into five groups as follows:

CO group (#00-19) COnfiguration group functions are used to configure the controller for basic operation within the customer's machine.

OP group (#20-39) OOptions group functions define how certain optional features, such as diameter input, are to be handled by the controller. Also in this group are settings for communications and optional external switches (if used).

- CA group (#40-59)** The CALibration functions are used to calibrate the output of a variety of sensors (tension transducers, line speed, roll diameter, etc.) so that the controller can use them in the correct scale factor.
- FE group (#60-84)** FEatures functions are used to select which features are to be used, usually for a particular job.
- AD group (#85-99)** The ADjustment functions are those used most frequently when the controller has already been set up. They include the setpoints (Manual and Auto) and the tuning values.

You may also refer to section 3.3 GENERAL USER INTERFACE INSTRUCTIONS for information about these groups. Whether or not the microprocessor is active in Function Select Mode, the most recently active Function Group is still resident for access. Normally, if the controller has been configured and is operating, you will want it to be resident in the AD function group. To change to a different Function group than you are in, go to the first function in that group, "00", "20", "40", "60", or "85", and SELECT it.

3.2 STANDARD OPERATOR INTERFACE FEATURES

1. Display

The controller has a two-line, 16-character-per line display to provide information to the operator. It has large 5/16" characters with long-life LED backlighting, and has an extremely wide viewing angle. You can view the display under various lighting conditions and from a reasonable distance.

2. Function/Value Selector Knob

This knob offers the ability to rapidly sequence through available functions (while in Function Select mode), or while in Function mode, to sequence through menu items within functions, or to easily and intuitively increase or decrease a numeric quantity by simply turning it clockwise or counterclockwise while in Function mode.

3. Operator Keypad

The control panel is divided into two sections, the Control portion and the Alphanumeric portion. The Control portion contains keys regularly required for operation of the unit. Each key is assigned its own function, so no awkward "shift" or "secondary function" keys are used:

TENSION ON/OFF Toggles tension control mode ON and OFF. When OFF, the controller output is set to minimum (zero), as determined by parameters selected during configuration. When ON, the controller output is determined by AUTO or MANUAL mode.

AUTO/MANUAL Toggles between AUTO and MANUAL tension control modes. When tension mode is ON, and the controller is in MANUAL mode, the output level is controlled directly by the manual tension setpoint. When tension mode is ON and the controller is in AUTO mode, the output level is determined by the system's actual Tension, and the controller's AUTO setpoint. If tension mode is OFF, output is determined as described above in "TENSION ON/OFF", but the tension control mode can still be toggled so that when the tension mode is toggled "on" again, the controller will enter either MANUAL or AUTO control mode.

DISPLAY SELECT Toggles the value displayed on the digital display between measured tension, Manual setpoint, Automatic setpoint, and controller output. Other parameters can be added to this list using the f63 - Display Select Values function. Line 1 of the character display will indicate which value is being displayed, and the value will be displayed on Line 2. The DISPLAY SELECT function has a default setting; that is, after toggling between display modes the display function will automatically revert back to a default display (as determined by the setting of the f62 - Default Display function).

FUNCTION Depressing this key activates Function Select Mode. The last function which was accessed is then shown on the display. Any other function can be located either by entering the specific function number on the alphanumeric keypad, by pressing arrow keys to change the function number by one each time they are pressed, or by turning the control knob until the desired function is displayed. Once the desired function is displayed, pressing SELECT activates that function.

SELECT When a desired function is displayed, pressing this key allows the function to be selected and become active for changes. Menu items can then be selected by using arrow keys followed by SELECT, or by turning the control knob until the desired choice appears. Numeric values can be changed by turning the control knob or by entering values from the keypad. If the control knob is used to adjust a setting (clockwise to increase, counterclockwise to decrease), or to make a menu selection, the changes take place as soon as the control knob is rotated. If a numeric value is to be entered

using the numeric keypad, the correct numeric keys should be pressed until the appropriate value is displayed, then the ENTER key must be pressed for the value to take effect. If a selection between choices is to be made, pressing arrow keys moves between the choices, then SELECT is pressed in order for the choice to take effect. When finished, the EXIT key is used to exit Function Active mode.

EXIT Immediately exits you from any of the Display Modes except Default Mode. If in Function mode, it exits to Function Select Mode. If in Function Select mode, it exits to Default Mode. (Thus, no matter where you are in the menu system, pressing this key a maximum of twice returns you to Default Mode).

STORE When it is desired to store a particular controller configuration, the STORE key can be pressed. The operator will be given the opportunity to assign a setup name, and by using the appropriate procedure the setup will be stored for recall at a later time. See **Storing and Recalling Setups** for more information.

RECALL When it is desired to recall a previously-stored controller configuration, pressing the RECALL key allows the user to select between any setups which have previously been stored, by setup number or by setup name. See **Storing and Recalling Setups** for more information.

BACKSPACE/← This key may be used to delete incorrectly-entered characters, one at a time. It may also be used while in Function Select Mode to move to lower-numbered functions, or in Function Mode when menu choices are available to move leftward toward available choices.

ENTER/→ This key is pressed after function numbers or numeric values have been keyed in, so that they may be entered and may take effect. It may also be used while in Function Select Mode to move to higher-numbered functions, or in Function Mode when menu choices are available to move rightward toward available choices.

The 3" x 4" Alphanumeric portion of the keypad is used to enter or change alphanumeric values, such as operating setpoints, calibration values, setup names, or function numbers or letters.

After entering alphanumeric data, it is necessary to press the ENTER key to signify that the number which has been entered (which is also displayed) is correct.

Generally when entering alphanumeric data, if a previous value is displayed, it will disappear when an alphanumeric key is pressed. When the number has been entered and the ENTER key is pressed, that new value takes effect.

Alternate values for each numeric key, printed above the corresponding number, may be accessed by depressing the key multiple times in rapid succession. A decimal point is entered by pressing the "0" key twice in rapid succession; a "Y" is entered by pressing the "9" key four times quickly, and so forth. This is especially useful when naming setups for future recall.

3.3 GENERAL USER INTERFACE INSTRUCTIONS

All of the functions (parameter settings) you will need to use when choosing set-up values and programming changes are accessed through the front panel user interface. There are multiple user functions available for making adjustments, these are organized into five function groups (see section 3.1.3).

- a) Each function has a corresponding two-digit number from the list above. Before a particular function can be activated, its function group must be selected. To select a function group press the FUNCTION key, enter a function group number using the alphanumeric keypad, or rotate the SELECTOR KNOB to the desired function group, and then press the SELECT key.
- b) Once the appropriate function group has been selected, you will activate the function of interest either by entering its number with the numeric keypad and pressing SELECT, or by turning the SELECTOR knob until your choice shows on the display and pressing SELECT.
- c) The function you have selected will instruct you to enter specific information in one of two possible ways. Some functions will request you to select a value from a limited menu of choices, while other functions will request that you enter a specific value.

To select qualitative (typically *non*-numeric) values from a list of choices, you have two options:

- 1) scroll through the list of available parameter values using the SELECTOR knob; when your chosen correct value appears on the display, press EXIT; or,
- 2) scroll through the range of values with the arrow keys, "←" and "→"; when your desired value is reached press SELECT. Then press EXIT. An asterisk beside a value indicates that this value is selected.

NOTE: Changes made with the **SELECTOR** knob take effect immediately--pressing **SELECT** is not required if you are choosing values this way.

To select quantitative values, in the case where your choice is only limited by a range, enter the desired value with the alphanumeric keypad and press **SELECT** to activate your choice.

3.4 MECHANICALLY ZERO THE ANALOG TENSION METER

This step is only necessary if the needle on the analog tension meter does not rest on zero (0) when the controller power is turned off.

Push the **POWER** button to turn off power to the controller. Remove the controller cover. Swing the front panel out so the CM (Control Module) board is accessible. Insert a small screwdriver through the meter zero-screw access hole in the CM board, turn the adjustment screw on the rear of the meter as required to set the meter needle at 0 on the scale.

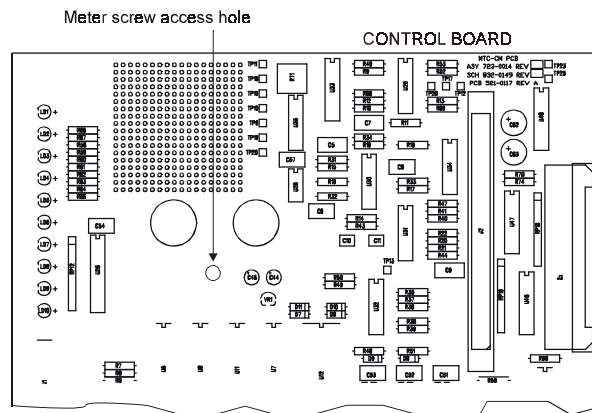


Figure 12 - METER ACCESS HOLE

3.5 CALIBRATE THE CONTROLLER FOR TENSION MEASUREMENT

Follow these steps when calibrating the controller for a pair of transducers. It is necessary to do this once the controller is installed, prior to operation.

- a) Find an object of known weight at least as heavy as 25% of the tension meter full scale number, but not so heavy as to exceed full scale. (A spring scale can also be used). Get a length of rope, wire or cable about 15 ft.(3M) long.
- b) Press the **FUNCTION** key; press "40".
- c) Press **SELECT**. Go to function "41 Select tension source". Press **SELECT**. Select the tension source "XDCR A", "XDCR B", or "REMOTE TENSION AMP" (Remote tension amp does not require additional calibration of the controller). Press **SELECT**, Press **EXIT**. (See manual for your remote amp to calibrate the tension. You may skip to Section 4 to complete set-up after this calibration).
- d) Turn the selector knob (or press right arrow once) to function "42 TENSION UNITS". Press **SELECT**. Choose the units desired and Press **SELECT**, then **EXIT**.
- e) Turn the selector knob (or press right arrow once) to function "43 SET RANGE". Press **SELECT**. Enter the **MAXIMUM** tension (e.g.1000 lbs) that you wish to display. Press **SELECT**, Press **EXIT**.
- f) Turn the selector knob (or press right arrow once) to function "44 ENTER CALIBRATION WEIGHT". Press **SELECT**. Enter the actual weight of the object you will use for calibration (e.g. 654 lbs). Press **SELECT**, press **EXIT**.
- g) Move to function 45 "Calibrate Transducer". Press **SELECT**. The display will instruct you to press **SELECT** again; do this, then follow the scrolling instructions as they are displayed. The controller will first instruct you to "remove web from roll and press **ENTER** to zero." Once the web has been removed press **ENTER**. The display will indicate that the controller is zeroed for your transducers. Press **ENTER** again when instructed. The display will then instruct you to "Apply Cal weight and press **ENTER**."
- h) To apply the calibration weight specified in step f, fasten one end of the rope (from step a) in the machine and thread the other end around the transducer roll and idlers directly before and after it. Thread it in exactly the same path as the web will take. Be sure it does not pass around any driven rolls, drag bars, or anything else that can affect tension. Refer to Figure 11 below. Once the calibration weight is in place, press **ENTER**.

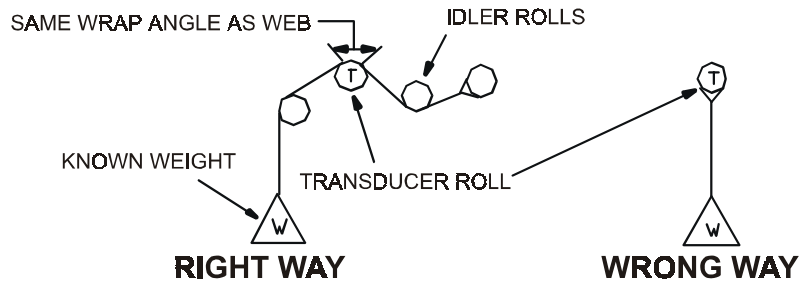


Figure 13 - WEB PATH FOR CONTROLLER CALIBRATION

NOTE If dual calibration is required, SELECT "Xdcr A & B" in function 25. Perform calibration of the first transducer as above, then repeat the procedure for the second transducer calibration.

- i) The display will read "Calibrating..." momentarily, then "Calibrated". Then the display will instruct you to "remove web from roll and press ENTER to rezero". Remove the calibration weight from the machine and press ENTER.
- j) The display will read "Rezeroing..." momentarily, then "Rezeroed" for two seconds. The display will then read "Press STORE to save calibration settings or any other key to abort." If you press STORE, the controller saves your calibration settings for use until the next time a calibration is performed. Either way, the display will read "Done" and the controller will automatically exit the function.

3.6 4 - 20mA or 0-20mA TENSION SIGNAL OUTPUT

(See Section 1.4 for description, Appendix A for location of switches on Power Board)

This output is selectable as a proportional-to-tension signal or as a compensated control output by the setting of J213 (power board). Either output is adjustable between 4-20 or 0-20 milliampere ranges. Typically used as a tension input to data collection systems and computers or as a control signal for drive systems.

Note: This procedure must be done with no external connections made to the 4-20 output. Connect the wires after this process is complete.

- a) The tension controller MUST be correctly calibrated before calibrating this current output.
- b) Verify that the 0-10 volt tension output produces 10 volts DC when the tension meter reads full scale (100%) by measuring terminals 42(-) and 44(+) on terminal strip. If not, calibrate the meter. See Section 3.5. Remove the web from the transducer roll to bring the tension meter to 0.
- c) On the Power Board, connect a digital voltmeter to test points TP212(+) and TP206(-). Close switch 8 on SW201. (This connects a 100 ohm resistor across the current output.)
- d) For 4-20 mA output range, adjust the 4 mA potentiometer (RT204) so the voltmeter reads 0.4 volts when the tension meter reads 0. Then adjust the 20 mA potentiometer (RT203) for 2.0 volts when the tension meter reads 100% (full scale).
- e) For 0-20 mA output range, adjust the 4 mA potentiometer (RT204) so the voltmeter reads 0.0 volts when the tension meter reads 0. Then adjust the 20 mA potentiometer (RT203) for 2.0 volts when the tension meter reads 100% (full scale).
- f) Set the tension meter to 0. Check the low end of the current range. The voltage across the test points should be 0.4 or 0.0 volts as previously set. If not, adjust the 4 mA potentiometer as needed.
- g) Open switch 8 on SW201 to enable the current output.
- h) Select tension or control signal output by the setting of J213 on the power board.

3.7 HIGH VOLTAGE OUTPUT MODULE (Version V only, description on Page 1)

This module, called the V-OUT card, contains the SCR bridge and driver circuitry to produce the output voltage of the controller. It is designed to operate with either 115v or 230v input power and to produce 90vdc, 45vdc, or 24vdc, outputs. (The output is switch selectable.)

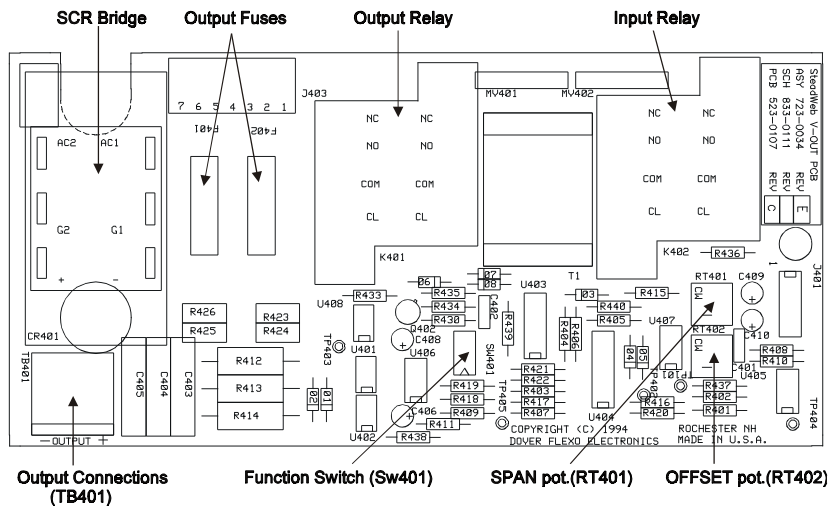


Figure 14 V-OUT MODULE

- a) To select the input and output voltages, set the SW401 switches as follows:

SW401 SWITCHES				
Line Voltage = 120 VAC			Line Voltage = 240 VAC	
90 VDC	45 VDC	24 VDC	90 VDC	45 VDC
1 - Open	1 - Open	1 - Closed	1 - Open	1 - Closed
2 - Closed	2 - Closed	2 - Open	2 - Closed	2 - Open
3 - Open	3 - Open	3 - Open	3 - Open	3 - Open
4 - Open	4 - Closed	4 - Closed	4 - Closed	4 - Closed

The SPAN and OFFSET potentiometers (RT401 and RT402) are set at the factory and should not require any adjustment. If these settings have been changed, reset them as follows.

- Turn power on. Turn Tension on. Switch to MANUAL control mode. Adjust the MANUAL setpoint to zero. Connect a voltmeter to the output terminals on the V-OUT card.
- Turn both SPAN and OFFSET potentiometers fully clockwise. Observe the voltmeter and turn the OFFSET potentiometer (RT402) slowly counter-clockwise until the voltmeter reads 0.
- Turn the MANUAL setpoint to zero. Adjust the SPAN potentiometer (RT401) until the voltmeter reads the output selected in step a) above.
- Repeat steps c and d above until rotating manual potentiometer produces zero and max output as described.

3.8 PNEUMATIC OUTPUT MODULE (Version P only)

(See Page 1 for description)

The air pressure regulator is preset to 80 psi (5,5 bar). No further adjustment is needed. Set the PNEU FS potentiometer (RT201) for 75 psi maximum output as described below.

- Remove the web from the transducer roll so the tension meter reads 0. Install an air pressure gauge at the controller output port.
- Place controller in manual mode and adjust manual setpoint to 100%, turn tension ON.
- Adjust the PNEU FS potentiometer for 75 psi on the pressure gauge.

3.9 SETUP OF FEATURES THROUGH THE GENERAL USER INTERFACE

1. Anti-Tamper

Anti-tamper, when enabled, prohibits entry into selected feature groups.

NOTE: Once activated you must call factory for instructions to deactivate.

- Activate function group "20", (OPTIONS).
- Go to function "24 Anti-Tmpr Mod" (Anti-Tamper mode). Press SELECT. This function is used to select the groups of functions to be rendered inaccessible when the anti-tamper switch is set.

- c) Scroll through the list of function group options, SELECT one of the combinations offered and Press EXIT twice.
- d) Go to function "23 Anti-Tamper". Press SELECT.
- e) SELECT "Enabled" to activate this feature or "Disabled" if you don't wish to use it. Then press EXIT.

2. Display Functions

These functions allow you to select certain default values of the digital readout display.

- a) Activate function group "60", (FEATURES).
- b) Go to function "62 Default Disp". This function allows you to choose the information to be displayed when the controller is in its normal operating mode. Press SELECT.
- c) Scroll through the list of menu options, SELECT the desired display then press EXIT.
- d) Go to function "63 Disp Sel Vals" (DISPLAY SELECT Values). This function allows you to choose which type of additional value is to be displayed after pressing the DISPLAY SELECT key. Press SELECT.
- e) Scroll through the list of menu options. SELECT any of the values you wish to be able to display. An asterisk (*) indicates that a value has already been selected. Press EXIT.
- f) Go to function "64 Disp Timeout" (Display Timeout). This allows you to choose the amount of time which must elapse before the display reverts to the default value. Press SELECT.
- g) The choices include "1 - 10 seconds" and "Off". The default value is "1 second". SELECT one of the values and press EXIT.
- h) Go to function "65 Disp Contrast" (Display Contrast). This allows you to adjust the LCD's display contrast from 0 - 100%. Press SELECT.
- i) SELECT a value between "0%" and "100%"(default is 50%). Press EXIT.
- j) Go to function "66 Func Timeout" (Function Timeout). This allows you to choose the amount of time which must elapse before the display reverts from function mode back to the default value. Press SELECT.
- k) The choices include "1 - 10 seconds" and "Off". The default value is "1 second". SELECT one of the values. Press EXIT twice.

3. Language Selection

English is the controller's default language. Follow these steps to read display phrases in any of four other languages: French, German, Italian or Spanish.

- a) Press the FUNCTION key; then press "00". The display will ask "Chg Config?" (change configuration) Press SELECT to activate the CONFIGURATION function group.
- b) Go to function "01 Display Language". Press SELECT.
- c) SELECT the desired Language from the menu. Press EXIT
- d) Press EXIT again to go back to the original default display.

4. Tension Zone Configuration

TENSION ZONES

Tension zones are created by driven or braked nip rolls, drag bars, braked or driven unwind or rewind shafts, or anything else that can increase or decrease web tension. One of these elements is at each end of every tension zone.

Almost all machines that process a continuous web have more than one tension zone. The SteadyWeb™ controller can be used in any tension zone, however it may need to be configured for the zone it will be used in. The information below will be used to determine the correct configuration.

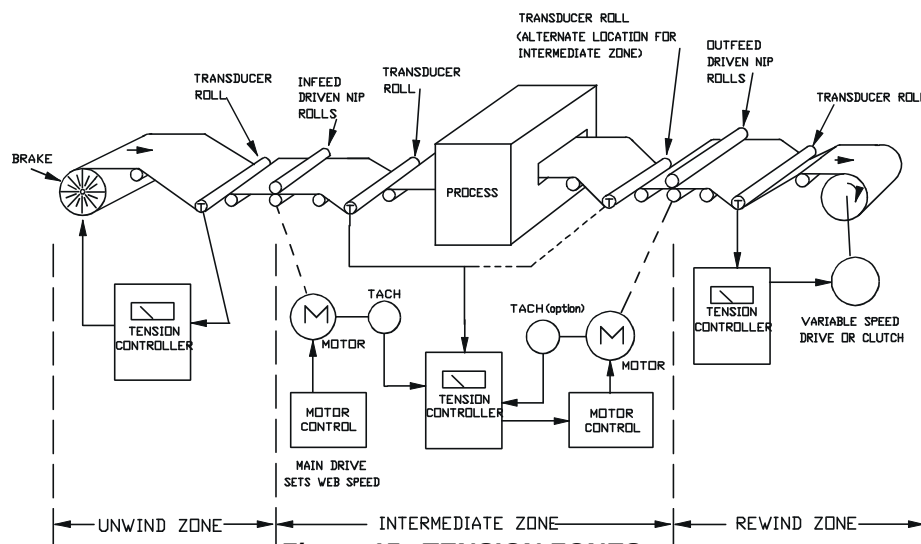


Figure 15 - TENSION ZONES

TENSION ZONE CONFIGURATION PROCEDURE

This feature configures the controller for the appropriate tension zone.

- Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- Go to function "02 Tension Zone". Press SELECT.
- You may scroll through the list of menu options with the arrow keys (or use the selector knob). Tension zone choices will be shown on the digital display as you scroll. These include: "Unwind", "Intermediate", and "Rewind".
- Press SELECT when your desired output selection is shown on the display. Then press EXIT.
- Press EXIT again to go back to the original default display.

5. Output Device Selection

To select the type of device intended for receiving output from the SteadyWeb™ MicroProcessor by accessing the Output Device function from the front panel of the controller. Follow these steps:

- Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- Go to function "03 Output Device". Press SELECT.
- Scroll through the list of menu options with the arrow keys (or use the selector knob). Output device choices will be shown on the digital display and include: "Pneu Brake" (pneumatic brake); "Pneu Clutch" (pneumatic clutch); "Elect Brake" (electric brake); "Elect Clutch" (electric clutch); "Motor drive".

Note: Some of these choices are only available for specific tension zones; i.e. the electric brake is only used in unwind zones.

- Press ENTER when your desired output selection is shown on the display. Then press EXIT.
- Press EXIT again to go back to the original default display.

6. Control Voltage Selection And Adjustment

If your controller has a pneumatic output module (P) or a high voltage output module (V) this selection is automatically set when the output device is selected.

- If you have not already entered the Configuration function group, then do so by pressing the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CO (configuration) function group.
- Go to function "06 Output Level". Press SELECT. "0 to +10V*" will appear on the display. The asterisk (*) indicates that the value shown has been previously selected.
- The second output choice "-10 to +10V" is accessed by pressing the forward arrow key (or by turning the selector knob a small fraction of a turn). When "-10 to +10V" appears in the display, press ENTER to choose -10V to +10V as your output level.

Note: See "Output Limiting Adjustments", next sub-section for other voltages.

- d) Press EXIT.
- e) Press EXIT again to go back to the original default display..

7. Output Limiting Adjustments

This feature allows you to set the amount of controller output as a percentage of total. Follow this procedure to adjust positive and negative percentage limits as desired:

- a) To enter the Configuration function group press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CO (configuration) function group.
- b) Go to function "28 Output Limit +". Press SELECT. "100%" will appear on the second line of the display. Change this value by entering the desired value with the alphanumeric keypad and then press ENTER (or use the selector knob and simply stop at your desired value). Press EXIT.
- c) It will be useful to set the output limit negative only if the -10 to +10 volt output is to be used. If this is the case, select function "29 Output Limit -". Press SELECT. "100%" will appear on the second line of the display. Change this value by entering the desired value with the alphanumeric keypad and then press ENTER (or use the selector knob and simply stop at your desired value). Press EXIT.
- d) Press EXIT again to go back to the default display.

8. Control/Operational Format

DESCRIPTION OF CONTROL FORMATS

There are three different control formats for which the SteadyWeb™ MicroProcessor controller can be configured. You should select the one which approximates your application and control situation.

Format A: Standard closed-loop controller ("Unwind" or "Rewind" applications)

This is the "standard" tension control mode, where the controller measures tension, compares it to the setpoint, computes an error signal, and based upon the PID settings, produces a "dynamics signal" called CONTROL OUT which the system uses to adjust the tension in a direction of zero error. The settings of PROPORTIONAL, DERIVATIVE, AND INTEGRAL (gain, response, and stability) are the only adjustments.

Format B: Line speed follower with tension trim ("Intermediate" applications)

In this mode, the CONTROL OUT is derived primarily from the line speed signal, with a variable amount of a "dynamics" signal mixed in. Therefore as the line speed changes, so does the control output, and the dynamics signal adds or subtracts from this reference signal as required to make the difference between the tension setpoint and the actual tension zero.

Format C: Line speed/diameter follower with tension trim ("Unwind" and "Rewind" applications)

CONTROL OUT is again derived primarily from the line tachometer (as in Format B), but it also increases (or decreases) linearly with roll diameter. For an unwind, as roll diameter decreases, the output increases; and for a rewind, as roll diameter increases, the output decreases.

CONTROL FORMAT SELECTION

You may select between the three available control formats depending on your application. The settings chosen for tension zone configuration (ref. previous setup of function 02) and output device (ref. previous setup of function 03) will cause some choices to be blocked.

- a) To enter the Configuration function group press the FUNCTION key then press "00". The display will ask "Chg Config?" Press SELECT to activate the CO (configuration) function group.
- b) Go to function "04 Ctrl Format". Press SELECT.
- c) Scroll through the list of menu options with the arrow keys (or use the selector knob). Control format configuration choices (labeled A - C) will be shown on the digital display as you scroll. These include: "A Std CloseLp" (standard closed loop), "B LSFol Ttrm" (line speed follow with tension trim), and "C LSFol DCmpTTTrm" (line speed follow with diameter compensated tension trim).
- d) Press SELECT when your desired format is shown on the display. Then press EXIT.
- e) Press EXIT again to go back to the original default display.

9. Output Direction

(Refer to section 1.5 for description.)

This adjustment allows you to select whether an increase in tension results in a decrease (direct-action) or an increase (reverse-action) in the output of the control algorithm. Invalid choices will be inaccessible. Depending on selections made in functions 02, 03, and 04, a choice may not be possible.

- a) Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- b) Go to function "05 Ctrl Action". Press SELECT.
- c) Scroll through the list of menu options. Controller action direction choices will be shown on the digital display as you scroll. These will include: "Direct" and "Reverse".
- d) Press SELECT when your desired output direction is shown on the display. Then press EXIT.
- e) Press EXIT again to go back to the original default display.

10. Auto Setpoint Source Selection

This feature allows you to choose between entering the auto setpoint value through the controller's front panel user interface or through an external source to provide a 0-10V signal at the terminal strip. If you choose to designate an external source as the auto setpoint, you must first connect the source to the proper controller terminal strips as shown in **Figure 11 - ELECTRICAL CONNECTIONS OF OPTIONS**.

- a) Press the FUNCTION key; then press "00". The display will ask "Chg Config?". Press SELECT to activate the CONFIGURATION function group.
- b) Go to function "08 Aut Setpt Src". Press SELECT.
- c) Scroll through the menu options. The two source choices are "Internal" and "External".
- d) Press SELECT when your desired source selection is displayed. Then press EXIT.
- e) Press EXIT again to go back to the original default display.

NOTE: The procedure for selecting a remote source for the *manual* tension setpoint (function "09") is the same as for the auto setpoint source selection, but is not standard and is only available as a special order option requiring custom software and PCB.

11. Automatic/ Manual Mode Switch Source

Allows selection of whether Auto and Manual modes are toggled through the front panel user interface or by using an external switch closure at the terminal strip. If an external switch is to be used it requires an alternate-action switch to first be connected to the controller as shown in figure below.

TB204 (partial view shown)

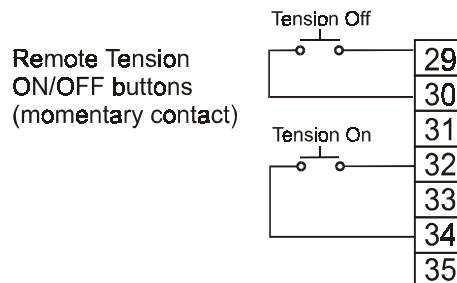


Figure 16 - REMOTE AUTO / MANUAL SWITCH CONNECTIONS

Follow this procedure to make the adjustment from "internal" to "external (remote)" switch source:

- a) Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- b) Go to function "10 A/M Sw Src". Press SELECT.
- c) Scroll through the menu options. The two source choices are "Internal" and "External".
- d) Press SELECT when your desired source is present on the display (i.e. "External" if you have connected the controller for a remote Auto/Manual switch). Then press EXIT.
- e) Press EXIT again to go back to the original default display.

12. Tension On Switch Source

This function allows selection of whether Tension "On" is toggled through internal "software" using the front panel, or by using an external momentary switch closure (not supplied) at the terminal strip. Refer to **Figure 17 - REMOTE TENSION ON/OFF BUTTON CONNECTIONS** on the following page for connecting a momentary switch to the controller.

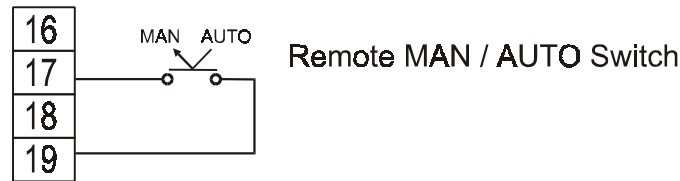


Figure 17 - REMOTE TENSION ON/OFF BUTTON CONNECTIONS

Follow this procedure to activate the external (remote) "Tension On" button:

- Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- Go to function "11 TenOn Sw Src". Press SELECT.
- Scroll through the menu options. The two source choices are "Internal" and "External".
- Press SELECT when your desired source is present on the display. Then press EXIT.
- Press EXIT again to go back to the original default display.

13. Tension Off Switch Source

This function allows the selection of whether Tension "Off" is toggled through internal "software" using the front panel, or by using an external momentary switch closure at the terminal strip. Refer to **Figure 17 - REMOTE TENSION ON/OFF BUTTON CONNECTIONS** for connecting a momentary tension off switch to the controller.

- Press the FUNCTION key; then press "00". The display will ask "Chg Config?" Press SELECT to activate the CONFIGURATION function group.
- Go to function "12 TenOff Sw Src". Press SELECT.
- Scroll through the menu options. The two source choices are "Internal" and "External".
- Press SELECT when your desired source is present on the display. Then press EXIT.
- Press EXIT again to go back to the original default display.

14. Emergency Stop And Tension Off Modes

An external contact is required in order to use the emergency stop feature. The controller will be in the EMERGENCY STOP mode as long as the contact is closed and will return to its previous operating mode as soon as it opens. No adjustments are required. This also works in the MANUAL control mode.

- Choose between zero output and full output upon initial controller actuation. The status light on the front panel will light when Emergency Stop is activated.
- Connect the external contact as shown in figure below.

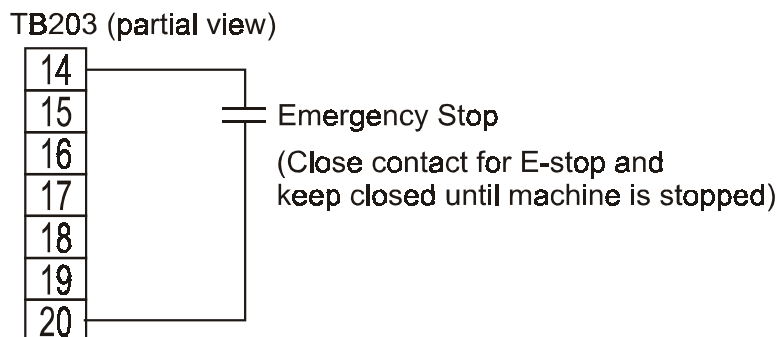


Figure 18 - E-STOP ELECTRICAL CONNECTIONS

- c) Set the SW201 switches as follows:

SW201 SWITCHES (NA = Not Applicable)	
FULL OUTPUT	ZERO OUTPUT
1 - NA	1 - NA
2 - NA	2 - NA
3 - NA	3 - NA
4 - NA	4 - NA
5 - NA	5 - NA
6 - NA	6 - NA
7 - Open	7 - Closed
8 - NA	8 - NA

Using function **“79 Tension Off Modes”** you can select whether an emergency stop condition causes tension to turn OFF. In addition to using the front panel user interface or remote tension OFF inputs, this function allows you to select which conditions turn tension OFF.

- Press the FUNCTION key; then press “60”. The display will ask “Chg Features?” Press SELECT to activate the FEATURES function group.
- Go to function “79 Tenoff By Sw&:”. Press SELECT.
- Scroll through the menu options. Press SELECT when your desired selection is present on the display. Then press EXIT.
- Press EXIT again to go back to the original default display.

15. Meter Calibration

Meter calibration refers to the function of correlating the analog meter to the reading on the digital display.

- Press the FUNCTION key; then press “40”. The display will ask “Chg Cal?”, asking if you would like to change a calibration feature. Press SELECT to activate the CALIBRATION function group.
- Go to function “53 Cal Meter”. Press SELECT. Press SELECT again when instructed to do so.
- When the display readout instructs you to “SELECT 0% Pt.”, turn the selector knob until the needle falls exactly at the “0” reading on the analog meter. Press ENTER.

When the display readout instructs you to “SELECT 20% Pt.”, turn the selector knob until the needle falls exactly at the “20%” reading on the analog meter. Press ENTER.

When the display readout instructs you to “SELECT 40% Pt.”, turn the selector knob until the needle falls exactly at the “40%” reading on the analog meter. Press ENTER.

When the display readout instructs you to “SELECT 60% Pt.”, turn the selector knob until the needle falls exactly at the “60%” reading on the analog meter. Press ENTER.

When the display readout instructs you to “SELECT 80% Pt.”, turn the selector knob until the needle falls exactly at the “80%” reading on the analog meter. Press ENTER.

When the display readout instructs you to “SELECT 100% Pt.”, turn the selector knob until the needle falls exactly at the “100%” reading on the analog meter. Press ENTER.

- “Press STORE To Save Changes” as the display instructs if you wish to save these settings. Press EXIT. Press EXIT again to return to the default display.

16. Meter Damping

This is a standard function which steadies the analog tension meter needle. This only affects the meter. The tension signal to the regulator circuit is not damped.

- Press the FUNCTION key; then press “60”. The display will ask “Chg Features?” Press SELECT to activate the FE (features) function group.
- Go to function “67 Meter Damping”. Press SELECT. “0%” will appear on the second line of the display. Change this value by entering the desired value with the alphanumeric keypad and then press ENTER (or use the selector knob and set your desired value). Press EXIT. Press EXIT again to return to the default display.).

17. Ratio Up/Down

NOTE: The Ratio function is not needed for most applications. Use it only directly after a splice.

When "Ratio" is active, the output of the controller is latched and then multiplied by a selected factor. The output remains at this modified level for as long as the switch (contact) remains closed plus an adjustable time delay. At the time the switch is released, Ratio is still active until the time delay expires, at which time output integrates to the required level.

When the Ratio function is active, both the Sample & Hold and the Ratio lights on the front panel will be illuminated.

RATIO UP/DOWN PROCEDURE:

- a) Press the FUNCTION key; then press "60". The display will ask "Chg Features?" Press SELECT to activate the FE (features) function group.
- b) Go to function "72 Ratio" . Press SELECT.
- c) You may scroll between the two menu options with the arrow keys (or use the selector knob). The two menu choices will appear alternately on the digital display: "Disabled" and "Enabled". Press SELECT when your desired choice is present on the display. Press EXIT.
- d) Go to function "73 Ratio Level" . Press SELECT. This function will allow you to set a ratio multiplier for the controller output when the ratio output is in effect. If the product is greater than the maximum possible, the controller defaults the chosen multiplier so that the output level is at the maximum.
- f) The default value "1.0X" appears on the display. You may scroll through the listed values on the menu with the selector knob or enter your own desired value between "0.1X" and "10.0X" and press ENTER. (NOTE: To get a decimal point press the "0" key twice in rapid succession.) Press SELECT. Press EXIT.
- g) Go to function "74 Ratio Delay" . Press SELECT.
- h) The default value "3.0 sec" appears. You may scroll through the listed values on the menu with the selector knob or enter your own desired value between "0.1 sec" and "10 sec" and press ENTER.
- i) Press SELECT when your desired choice is present on the display. Press EXIT. Press EXIT again to return to the original default display.
- j) Connect the external contact as shown below.

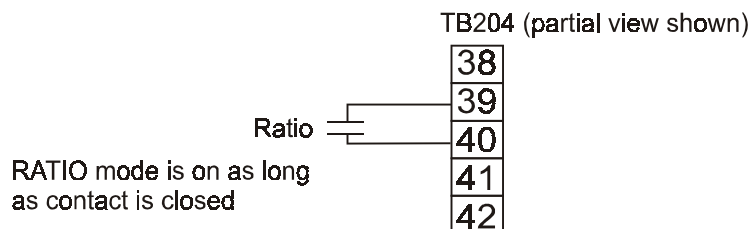


Figure 19 - RATIO CONTACT ELECTRICAL CONNECTIONS

18. Sample And Hold

The output of the controller is measured and then latched at the measured value upon the closure of an external contact. The output remains latched only as long as the contact is closed. The status light on the front panel will light when the output is locked. Connect the contact as shown below.

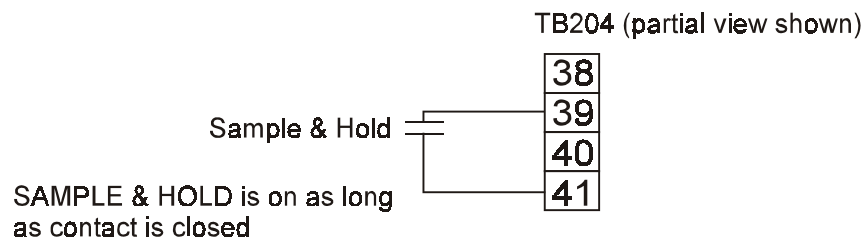


Figure 20 - SAMPLE & HOLD CONTACT

19. Soft Start

Soft start is an operational mode that causes the controller to supply a modified output during specific tension or speed conditions. It is used only in UNWIND applications. The Soft Start mode reduces controller output during machine stops to a preset low level; this is in order to prevent brake lockup when the machine restarts.

Soft Start can be actuated in one of three ways; 1. by sensing a loss of tension, 2. by closure of an external contact, 3. by sensing machine speed. You should choose only one of the following procedures to setup one of these three actuation methods.

1. Actuation by low tension. This is the standard configuration.

- a) Press the FUNCTION key; then press "60". The display will ask "Chg Features?" Press SELECT to activate the FEATURES function group.
- b) SELECT function "68 Soft Start".
- c) Scroll through the menu options. SELECT "By tension" when it shows on the display. Press EXIT.
- d) SELECT function "69 SS Trip Point" (Soft Start Trip Point). This function allows you to set the tension trip (trigger) level below which Soft Start is activated.
- e) Enter a tension trip value of about 10% of your maximum tension. Press EXIT.
- f) SELECT function "70 SS Delay" (Soft Start delay). This function sets the delay time, which is the time the "trip level" selected must be present before Soft Start mode is entered. This eliminates nuisance actuation if tension drops and immediately recovers itself. There is no delay associated with leaving soft start mode, only entering it.
- g) SELECT a time between 1 and 15 seconds. "3 seconds" is the default value which is a typical delay to select time. Press EXIT.
- h) SELECT function "71 SS Outpt Level" (Soft Start output level). This function sets the percentage of output which the controller produces when soft start has been invoked.
- i) SELECT a value between 0 and 100% of maximum output. "20%" is the default value for versions "D" and "V", 25% for version "P" (20psi). Avoid setting the output higher than that required to produce the operating tension. It is best to set it low, but high enough to produce enough tension to exceed the trip point tension or the controller may not be able to get out of Soft Start. Press EXIT.
- j) Press EXIT again to go back to the original default display.

2. Actuation by external contact closure.

- a) Connect the external switch or relay contact as shown in figure below.

TB203 (partial view shown)

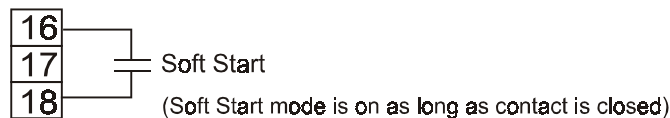


Figure 21 - SOFT START CONNECTIONS

- b) Press the FUNCTION key; then press "60". The display will ask "Chg Features?" Press SELECT to activate the FEATURES function group.
- c) SELECT function "68 Soft Start".
- d) Scroll through the menu options. SELECT "By switch" when it shows on the display. Press EXIT.
- e) SELECT function "70 Soft Start Delay". Select 0 as delay. Press EXIT.
- f) SELECT function "71 SS Outpt Level" (Soft Start output level). This function sets the percentage of output you want the controller to produce when the soft start contact switch is closed (turned ON).
- g) SELECT a value between 0 and 100% of maximum output. Press EXIT.

NOTE: Soft Start actuates immediately upon contact closure. There is no time delay. There are no other adjustments. The controller will remain in the Soft Start mode as long as the contact is closed.

3. Actuation by machine speed.

This requires an optional DC Tachometer card or Pulse Tachometer card to provide a machine speed signal. Calibrate the card as described in Section 3.14 using calibration 1.A or 2.A before proceeding with Soft Start set-up.

- a) Press the FUNCTION key; then press "60". The display will ask "Chg Features?" Press SELECT to activate the FEATURES function group.
- b) SELECT function "68 Soft Start".
- c) Scroll through the menu options. SELECT "By line speed". Press EXIT.
- d) SELECT function "69 SS Trip Point" (Soft Start Trip Point). This function allows you to set the speed (trip level) below which Soft Start is activated.
- e) Enter and SELECT your desired speed value. It is recommended that you choose a value that is about 5% of your maximum line speed. Do NOT set it at "0" or Soft Start will be active all the time. Press EXIT.
- f) SELECT function "70 SS Delay" (Soft Start delay). This function sets a delay time for which the "trip level" selected must be present before Soft Start is actuated. At the expiration of the delay time, Soft Start goes into effect and the Soft Start LED on the controller front panel is lit. There is no delay associated with leaving soft start mode.
- g) SELECT a time between 1 and 15 seconds. "3 seconds" is the default value, but a typical delay to select is 3 seconds. Press EXIT.
- h) SELECT function "71 SS Outpt Level" (Soft Start output level). This function sets the percentage of output which the controller produces when soft start has been invoked.
- i) SELECT a value between 0 and 100%. Press EXIT.
- j) Press EXIT again to go back to the original default display.

20. Tension Unit Selection

Function 42 is used to select what tension units are to be used. Function 47 is used to enter the web width if a force per unit web width is used.

- a) Activate function group "40", the CALIBRATION function group.
- b) Go to function "42 Tension Units". Press SELECT.
- c) Scroll through the list of menu options. SELECT the units of calibration and display you wish to use. Then press EXIT.
- d) If you chose to display tension force per web width, go to function "47 Set Web Width". Press SELECT.
- e) Enter and SELECT the web width you wish to use. Then press EXIT. Press EXIT again to return to default display.

21. Storing and Recalling Set-ups

1. Storing Setups

It is possible to store a unit's entire operating configuration as a "named setup". This allows a set of operating settings which is useful for a particular job or material being run, to be stored for later recall, or to be stored so that additional experimentation may be made to improve operation, without fear of losing intermediate settings. To store a setup including configuration and tuning settings for future recall:

- a) Any time during Default Mode or Function Select mode (but not while adjusting a function), press the STORE key.
- b) The first line of the display will change to "SETUP NAME:"

The second line of the display will contain a two-digit number (the unique "setup sequence number") and 13 underlined character spaces. This value represents the next available setup number out of a possible 25 setups. Enter a desired setup name up to 13 characters long using the alphanumeric entry procedure. As each character is entered, it replaces one of the blank spaces.

Rules of setup name entry:

Characters used for the setup name can be the numerals 0 through 9, letters A through Z, and the period/ decimal point (".") character. "Space" characters are not allowed.

A setup name using valid characters would be considered invalid only if it is identical to an existing setup name, even if the setup sequence number is different.

While keying in a setup name, if the backspace key is pressed, underlined character spaces will reappear. You will move backward from the previously-entered text one position at a time, deleting characters in those positions.

If all 13 character positions have been filled and you attempt to continue adding characters, these additional characters will be ignored.

Pressing the EXIT key at any time during this procedure immediately returns you to Default mode and the default display.

- c) Press ENTER. Then one of two things happens: Either (a) The first display line will change to "CONFIRM STORE:" while the second line stays the same. If you then press the STORE key, the setup will be stored, and you will return to Default Mode and the default display; OR (b) The first display line will change to "Invalid name"; This display persists for approximately three seconds, then the first display line reverts to "SETUP NAME:" as above, to await entry of a new name.

2. Recalling a Stored Setup

- a) Press the RECALL key
- b) The first line of the display will read "RECALL SETUP:" The second line of the display will contain the last two-digit setup sequence number which was either stored or recalled, followed by its setup name.

You may either

- 1) Press the SELECT key, which causes the first line to change to "CONFIRM RECALL:" while the second line stays the same; pressing the RECALL key will then cause the setup to be retrieved and all stored settings to overwrite the present settings. The message "Recalling Setup" appears while setup information is being recalled. When this is complete, the system will be in Default mode in the ADJUSTMENTS menu group (functions 85 to 99). ----- OR: -----
- 2) Find a different setup, either by turning the selector knob or using the left or right arrow keys until the desired setup appears, or by entering the "setup sequence number" and pressing ENTER, so that the desired setup appears. Once the desired setup has been found, the user must proceed as in 1.

3. Erasing a Stored Setup:

- a) First identify the setup you wish to erase from storage using the "RECALL SETUP" procedure outlined above. Once you have selected a setup, the first line of the display will read "CONFIRM RECALL:" The second line will contain the setup sequence number and the setup name.
- b) Press the FUNCTION key. The first display line will read "CONFIRM ERASE:" Press the SELECT key to erase the setup from memory. Pressing any other key returns the controller to the default display.

NOTE: It is not possible to "overwrite" a setup; it is necessary to first erase it if it is no longer needed.

Erasing a stored setup makes the corresponding setup sequence number available for storing a new setup.

3.10 EXTENDED RANGE

The extended range feature should only be activated if your transducers have extended range. See Section 2.5 TRANSDUCER VOLTAGE, to set the transducer voltage selection switch. No adjustments or special electrical connections are needed.

3.11 REMOTE TENSION AMPLIFIER

If the controller is fed a tension signal by the remote device, the remote tension signal may come into the controller via a pre-wired cable connector on the bottom of the enclosure. If the connector is not used, make connections at the terminal strip on the Power board as shown in **Figure 22 - REMOTE TENSION AMPLIFIER ELECTRICAL CONNECTIONS**.

If you wish to have the tension signal provided by an external remote amplifier rather than use the internal tension amplifier of the SteadyWeb™ MicroProcessor, you will need to adjust a function in the controller to designate the external source:

- a) Press the FUNCTION key; press “40”. Press SELECT to activate the CALIBRATION function group.
- b) Go to function “41 Sel TensSrc” (SELECT Tension Source). Press SELECT. Press EXIT.
- c) Go to function “43 Set Range R” (Set Range). Press SELECT.
- d) Enter your desired value with the selector knob or numeric keypad. (Decimals are entered by pressing the “0” key twice in rapid succession.) Press SELECT. Press EXIT.
- e) Press EXIT again to go back to the original default display. Note: External source must be calibrated.

TB203 (partial view shown)

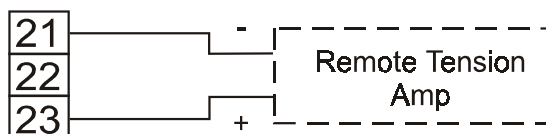


Figure 22 - REMOTE TENSION AMPLIFIER ELECTRICAL CONNECTIONS

3.12 TAPER TENSION

A. CHOOSE TAPER TYPE. Refer to either section 1. or 2. following.

1. **Taper tension by Diameter Calculation**. Requires either a DC Tachometer card or a Pulse Tachometer card. If you are using a DC Tachometer card, first follow the procedure in section **3.16.1 DC Tachometer Card Setup and Calibration**. Use both 1.A. and 1.B. to calibrate. **Or**, if you are using a Pulse Tachometer card, first follow the procedure in section **3.14.2 Pulse Tachometer Card Setup and Calibration**, and use both 2.A. and 2.B. to calibrate.
2. **Taper by Rider Roll (Direct Diameter Input) or external 10 Volt source**. This requires either a rider roll operating a potentiometer or some other device capable of sensing rewind roll diameter and having a 0 to +10 Volt DC output. The rider potentiometer must have a resistance of at least 10,000 Ohms. First, follow setup and calibration instructions in section **3.14.5 Direct Diameter Measuring Device Selection and Calibration**; then adjust the Taper functions described below.

B. TAPER ENABLE

This function allows you to enable and disable taper. If taper is enabled, the controller will enable other functions required to determine the source of diameter information and to calibrate it. Taper is only available when Rewind has been selected in function 02 Tension Zone Selection.

1. Press the FUNCTION key; then press “00”. The display will ask “Chg Config?” Press SELECT to activate the CONFIGURATION function group.
2. Go to function “13 Taper” . Press SELECT.
3. Scroll through the menu options. Press SELECT when “Enabled” is present on the display. Then press EXIT.
4. Press EXIT again to go back to the original default display.

C. TAPER ON/OFF

This function allows the operator to turn taper tension off or on depending on a given situation.

1. Activate the FEATURES function group, function “60”.
2. Go to function “61 Taper” . Press SELECT.
3. The two menu options are “Off” and “On”. Scroll to your choice and Press SELECT. Then press EXIT.
4. Press EXIT again to go back to the original default display.

D. ADJUSTING TAPER

This function allows you to set a “taper percent”. When the taper value is 0%, tension remains constant from core to full roll. When it is at 100%, tension decreases linearly from the set level at core to 0 tension at full roll.

- A. Activate function group "85", the ADJUSTMENTS function group.
- B. Go to function "95 Set Taper" . Press SELECT.
- C. Enter the value desired 0-100%.
- D. Press SELECT when your desired selection is present on the display. Then press EXIT.
- E. Press EXIT again to go back to the original default display.

E. TAPER SWITCH SOURCE

This feature allows you to select whether the Taper function is toggled On and Off through the controller's internal "software", or, as an alternative, by using an external switch closure connected at the terminal strip.

If an external taper switch is to be used you must first connect the switch to the controller as shown in figure below.

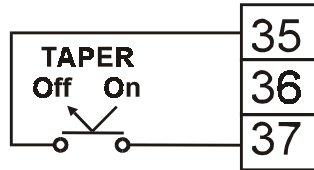


Figure 23 - REMOTE TAPER OFF/ON SWITCH CONNECTIONS

To select between internal or external (remote) taper switch:

1. Activate function group "00", the CONFIGURATION function group.
2. Go to function "14 Taper Sw Src" . Press SELECT.
3. Scroll through the menu options. The two source choices are "Internal" and "External".
4. Press SELECT when your desired selection is present on the display. Then press EXIT.
5. Press EXIT again to go back to the original default display.

3.13 TENSION LIMIT SWITCH

This section explains installation and setup of the tension limit switch (TLS). The TLS feature allows you to set tension trip points above or below which, an alarm mode is activated. You can choose "Momentary" mode, where the alarm condition resets itself if the measured tension returns to the normal range, or "Latched" mode, where the alarm condition remains until it is reset by the operator. The alarm condition causes an LED to light as well as causing the TLS output to be set, activating an optional relay on the Power board.

- a) Verify that the TLS relay (K201) is installed on the Power Board.
- b) Connect any necessary external circuits to the TLS relay contacts as shown in figure 24.
- c) Activate function group "20", the OPTIONS function group.

To select and use either low tension limit or high tension limit follow the **LOW LIMIT TLS** or the **HIGH LIMIT TLS** instructions. Continue with step d when completed:

TB203 (partial view shown)

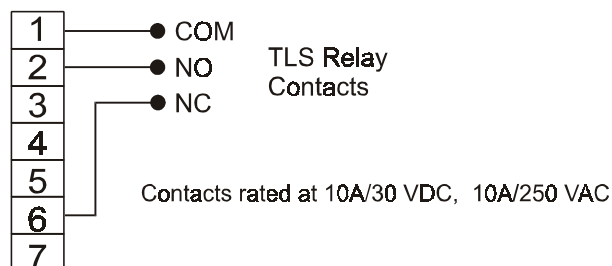


Figure 24 - TLS RELAY CONNECTIONS

LOW LIMIT TLS Procedure

- 1) Go to function "26 TLS Lo Mode". Press SELECT. This function sets the activation of TLS for tension falling below a low acceptable limit.
- 2) Scroll through the list of menu options. SELECT "Off", "Momentary" or "Latched" as desired. Then press EXIT.
- 3) Activate function group "40", the CALIBRATION function group.
- 4) Go to function "51 TLS Lo Setpt". Press SELECT.
This function sets a value that triggers alarm activation should tension fall below this point. The function can be turned off by turning the selector knob fully counterclockwise or by entering "Off" as a value.
- 5) SELECT "Off" or an acceptable tension value. Then press EXIT.

HIGH LIMIT TLS Procedure

- 1) Go to function "27 TLS Hi Mode". Press SELECT. This function sets the activation of TLS for tension exceeding an upper acceptable limit.
- 2) Scroll through the list of menu options. SELECT "Off", "Momentary" or "Latched" as desired. Then press EXIT twice.
- 3) Activate function group "40", the CALIBRATION function group.
- 4) Go to function "52 TLS Hi Setpt". Press SELECT.
This function sets a value that triggers alarm activation, should tension rise above this point.
- 5) Scroll through the list of menu options. SELECT "Off" or an acceptable tension value. Then press EXIT twice.
- d) If you are in "latched" mode and it becomes activated, you may reset it by activating function group "85", the ADJUSTMENTS function group.
- e) Go to function "96 TLS Reset". Press SELECT.
This allows the operator to reset the TLS condition and deactivate the TLS relay when TLS is configured for latched operation in function 26 above.
- f) From the menu options SELECT "Yes" to activate the Reset option. Press EXIT.

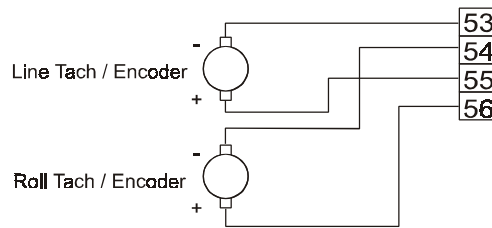
3.14 SPECIAL CALIBRATION AND SETUP PROCEDURES FOR OPTIONS

A Tachometer Interface card is needed with the Taper by diameter calculator, Line speed follow with tension trim, Line speed follow with diameter compensation, and one version of Soft Start. LTACH refers to the line (machine) speed tachometer, RTACH refers to the rewind roll speed tachometer. Both are needed for the Taper or Diameter comp. options, but only LTACH is needed for the speed-actuated Soft Start function or for Line speed follow. If the card has come pre-installed with your controller unit, remove it for the following setup procedure.

SW201 on the Power PCB must be set according to the presence or absence of the tachometer card. Set SW201 as follows:

SW201 SWITCHES		
NO CARD	STD. CARD PRESENT	CUSTOM CARD PRESENT
1 - Open	1 - Open	1 - Closed
2 - Open	2 - Closed	2 - Open
3 - Open	3 - Open	3 - Closed
4 - Open	4 - Closed	4 - Open
5 - NA	5 - NA	5 - NA
6 - NA	6 - NA	6 - NA
7 - NA	7 - NA	7 - NA
8 - NA	8 - NA	8 - NA

Be sure the tachometers are connected to the Power board terminal strip as shown below.

**Figure 25 - TACHOMETER CONNECTIONS****1. DC Tachometer Card Setup and Calibration**

- a) Run the machine at the maximum expected operating speed (and minimum roll diameter in the case of RTACH). Measure the line tachometer voltage between terminals 53 and 55 for LTACH only, and between terminals 54 and 56 for RTACH; note their polarities. You will have an LTACH voltage (and an RTACH voltage for using a roll tachometer). Note the voltages.

NOTE: Instead of running the machine at maximum speed, as suggested above, you may wish to operate it at 50% of maximum operating speed. In this case LTACH and RTACH output voltages will be set at 5.0 volts instead of 10 volts.

- b) Set SW701 switches to accommodate the tach polarity measured at terminals 53,55 (LTACH) and 54,56 (RTACH). Use the following chart to set the switches based on which terminal is positive polarity.

SW701 SWITCHES (NA = Not Applicable)				
	1	2	3	4
LTACH ----- if 55 is + if 53 is +	NA	NA	Open	Closed
	NA	NA	Closed	Open
RTACH ----- if 56 is + if 54 is +	Open	Closed	NA	NA
	Closed	Open	NA	NA

- c) Set SW702 (LTACH) switches and SW703 (RTACH) switches, if applicable, to accommodate the voltages measured in step b) above. Both switches are set in exactly the same way. Use the chart below. If the machine was run at half speed, multiply the voltages you measured by 2 and use those values for the switch-setting chart below.

SW702 and SW703 SWITCHES				
VOLTS DC	1	2	3	4
3 - 4	Closed	Open	Open	Open
4 - 16	Open	Closed	Open	Open
16 - 64	Open	Open	Closed	Open
64 - 250	Open	Open	Open	Closed

- d) Reinstall tachometer interface card in the power board (socket J208, see Appendix A).

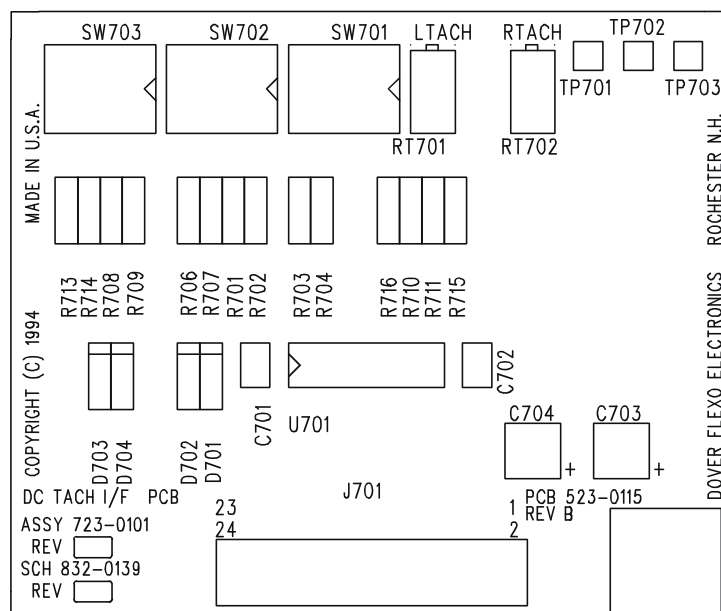


Figure 26 - DC TACH OPTION CARD

2. Pulse Tachometer Card setup and calibration

If the card has come pre-installed with your controller unit, remove it for the following setup procedure. Be sure the pulse tachs are connected to Power board terminal strip as shown in figure 25.

- Determine the maximum amplitude of pulses from the LTACH and the RTACH pulse tachs. The data sheet that came with them should give this data or allow you to calculate it. The amplitude can also be measured using an oscilloscope. Set the SW601 switches according to the maximum amplitude using the chart below.

SW601 SWITCHES				
	RTACH		LTACH	
Pulse Amplitude (volts)	1	2	3	4
.25 - 2.0	Open	Closed	Closed	Open
1.0 - 50.0	Closed	Open	Open	Closed

- Determine the frequency of the LTACH pulse tach at maximum machine speed. Calculation is usually the best method. Look on the pulse tach data sheet for the number of pulses per revolution and multiply by the revolutions per second, considering any gear ratios that may be used.
- Determine the frequency of the RTACH pulse tach at maximum machine speed and at core diameter. Calculation is the best method. Take all gear ratios into account.
- Set the SW602 switches according to the frequencies in steps b) and c) above.

SW602 SWITCHES				
	RTACH		LTACH	
Frequency	1	2	3	4
200 - 5 KHz	Closed	Closed	Closed	Closed
2.5 - 50 KHz	Open	Closed	Closed	Open

Note: Opening switch 2 disables the RTACH output. Opening switch 3 disables the LTACH output.

- Reinstall Tachometer interface board in socket J208 .

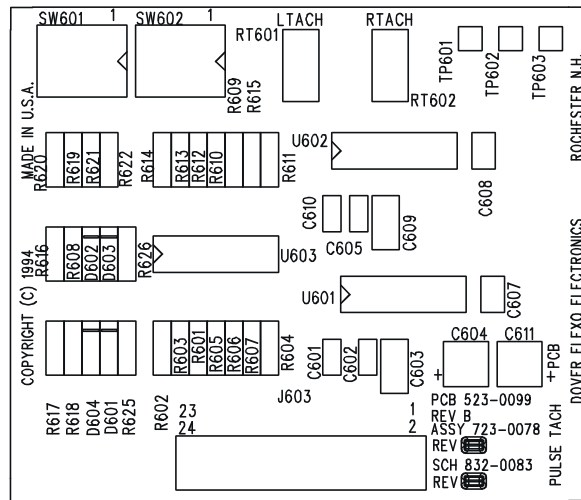


Figure 27 - PULSE TACH OPTION CARD

3. Line Tach Calibration:

- a) Activate function group "40", the CALIBRATION function group.
- b) SELECT function "48 Cal Line Tach" (Calibrate line tachometer). The display will read "UNCAL" or a measured, correlated line speed from a previous calibration.
- c) Press SELECT. "CalSpd: ___ FPM" should appear. Enter the speed (FPM = feet per minute) you wish to use as a calibration speed using either the numeric keypad or the selector knob; then press the ENTER key.
- d) Press SELECT. "MaxSpd: ___ FPM" should appear. Enter the maximum line speed. Press SELECT.
- e) Run the machine at the line speed you chose for calibration in step c). The display will read "(your speed) <Adjust> (your calibration speed)". You will need to match these two speed values by adjusting the RT 701 potentiometer on the DC Tach Card until the speed value on the left side agrees with the calibration speed on the right. Press the ENTER key. This causes the controller to store the reading associated with that line speed. The controller will then display the measured, correlated line speed.
- f) Press SELECT. The display will direct you to "Press STORE to save calibration settings or any other key to abort." Press STORE if you are satisfied with your settings. Press EXIT.

4 Roll Tach Calibration:

- a) Activate function group "20", the OPTIONS function group.
- b) Go to function "21 Dia Input" (Diameter Input). Press SELECT.
- c) SELECT "Tach Ratio Calc". Then press EXIT.
- d) Activate function group "40", the CALIBRATION function group.
- e) SELECT function "49 Cal Roll Tach" (Calibrate Roll Tachometer). The display will read "UNCAL" or a measured, correlated roll diameter speed from a previous calibration.
- f) Press SELECT. "CalDia: 0.1 in" should appear. Enter a diameter you wish to use as a calibration value using either the numeric keypad or the selector knob; then press the ENTER key.
- g) Press SELECT. "CorDia: 0.1 in" should appear. Enter the core diameter with which you will operate.
- h) Press SELECT. "MaxDia: 0.1 in" should appear. Enter the maximum roll diameter with which you will operate. Press Select.
- i) Run the machine at the line speed you selected in step 3. c) above. A roll diameter value will appear on the display. Open the front panel of the controller and adjust potentiometer RT 702 so that the displayed roll diameter corresponds with your chosen "CalDia" (calibration diameter) value. Close the controller front panel.
- j) Press SELECT. The display will direct you to "Press STORE to save calibration settings or any other key to abort." Press STORE if you are satisfied with your settings. Press EXIT.

5. Direct Diameter Measuring Device Selection and Calibration

- a) Setup your diameter measuring device. Connect the rider roll potentiometer or 10 Volt source to the power board as shown in figure 28 or 29 below.
- b) Activate function group "20", the OPTIONS function group.
- c) Go to function "21 Dia Input" (Diameter Input). Press SELECT.
- d) SELECT "Direct". This choice is for a direct diameter measuring device (such as an ultrasonic sensor or a rider roll). Press EXIT.
- e) Activate function group "40", the CALIBRATION function group.
- f) SELECT function "50 Cal Roll Dia" (Calibrate Roll Diameter). The display will read "UNCAL" or a measured, correlated roll diameter from a previous calibration.
- g) Press SELECT. "MaxDia: 0.1 in" should appear. Enter the maximum roll diameter with which you will operate.
- h) Press SELECT. "MinDia: 0.1 in" should appear. Enter the minimum diameter with which you will operate.
- i) Press SELECT. You will now select two intermediate diameters which will act as coordinate points for your calibration line. "Cal_A: 0.1 in" should appear on the display. Enter a diameter you wish to use as a calibration value. Press ENTER.
- j) Adjust the diameter measuring device so that a signal is produced which corresponds to the diameter you just entered.
- k) Press SELECT. "Cal_B: 0.1 in" should appear. Enter another diameter you wish to use as a calibration value. Press ENTER.
- l) Adjust the diameter measuring device so that a signal is produced which corresponds to the diameter you just entered.
- m) Press SELECT. The display will direct you to "Press STORE to save calibration settings or any other key to abort." Press STORE if you are satisfied with your settings. Press EXIT.

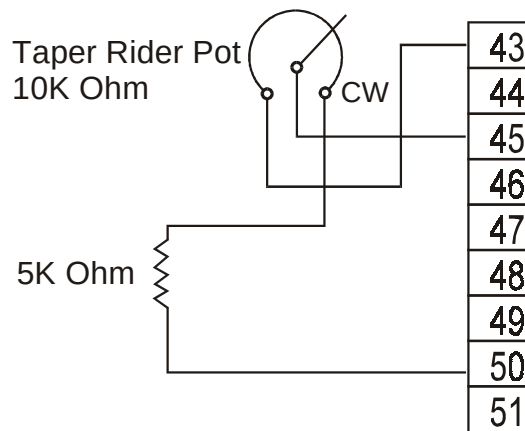


Figure 28 - RIDER ROLL CONNECTIONS



Figure 29 - 10 VOLT SOURCE CONNECTIONS

These instructions are for experienced personnel and assumes that the controller has been previously installed and calibrated. These Quick Start instructions are also provided as an adhesive sticker with the unit for quick mounting near the controller

4.1 QUICK START OPERATOR INSTRUCTIONS

1. Initial Setup

- a) Press POWER to turn unit on. The status lights will cycle then end with POWER ON and MANUAL lit. Analog tension meter will cycle across then show tension. Digital display will cycle from SteadyWeb™ up to TENSION on first line and show actual tension on second line of display. Controller is now in MANUAL mode with TENSION OFF.
- b) Press TENSION ON/OFF to turn tension On. Status light for TENSION ON will light. Pressing the key a second time will turn tension off.
- c) Press AUTO/MANUAL pad to switch between manual and auto modes. Status will display AUTO after pressing key. Press again to switch back to manual mode, Manual is default upon power on with MANUAL status light on.

2. Adjust Auto Setpoint (May be set while running in AUTO or MANUAL mode)

- a) Press DISPLAY SELECT and cycle sequentially through the selections until the LCD display reads AUTO SETPOINT.
- b) Press SELECT. Display will read Set Aut Setpt on line one and the current tension set point on line two.
- c) Turn the Selector knob to increase or decrease the Auto set point. Desired set point has now been chosen and will take effect if the controller is in auto mode.

3. Adjust manual set point. (May be set in auto or manual mode.)

- a) Press DISPLAY SELECT and cycle sequentially through the selections until the LCD display reads MANUAL SETPOINT
- b) Press SELECT. Display will read Set Man Setpt on line one and the current manual settings on line two.
- c) Turn the Selector knob to increase or decrease the manual set point. Desired setting has now been chosen and will take effect, or type the desired value in on the alphanumeric. Press SELECT or the enter key on the alphanumeric key pad and then press EXIT. The new manual set point is now effective and will be active if the controller is in the manual mode.

WARNING: Large changes should be made gradually to avoid web damage if running in manual.

4. Store controller parameters.

- a) When the controller has been set for the optimum results for a specific process press STORE. The LCD display line one will read SETUP NAME:. Line two will display a two digit number from 00 to 20 and 13 character spaces. Enter the setup name in the 13 spaces provided by selecting the numbers or letters from the alphanumeric key pad. The key pad is multi-functional in that each key is used for more than one character. To select a number press the key one time, for the alpha characters press the key multiple times quickly. For an example to enter the letter U press the 8 key rapidly three times, once for the 8 again for the T and the third time for the U. Incorrect entries can be erased by use of the back space key.
- b) When the name has been entered press ENTER. The LCD top line will display CONFIRM STORE:, the bottom line will retain the number and name of the parameters to be stored.
- c) Press STORE to confirm. The LCD will return to the default display.

5. Recall Stored parameters.

- a) To recall previously stored controller parameter setups press RECALL pad. The LCD top line will display RECALL SETUP, the bottom line will display a two digit number and setup name corresponding to the most recently selected parameters. The setup menus can be cycled by rotating the SELECTOR knob.
- b) When the desired setup is displayed by name press SELECT, the top line of the display will change to CONFIRM RECALL.
- c) Press RECALL. Display will change to RECALLING SETUP. When the recall is complete the LCD will return to the default display.

6. Output signal display.

- a) The controller output can be displayed in % by pressing DISPLAY SELECT until the LCD reads OUTPUT PERCENT. The percent of output is displayed on line two. This is a short term display and will return to default automatically.

4.2 TUNING FOR RUNNING STABILITY

The procedures in this section apply to all versions of SteadyWeb™ MicroProcessor controllers used in all tension zones. Unlike most of the adjustments for standard features and options, tuning adjustments can not be preset at the factory for every application.

1. DESCRIPTION OF ADJUSTMENTS

There are three tuning adjustments; GAIN/PROPORTIONAL, STABILITY/INTEGRAL, and RESPONSE/DERIVATIVE.

The GAIN/PROPORTIONAL function (f91) determines the sensitivity of the controller. A low setting will produce a small output change upon a tension error and a high setting will produce a large output change. Thus, if GAIN/PROPORTIONAL is set too low the running tension may be different from the set tension. If set too high, the controller may be unstable.

The STABILITY/INTEGRAL function (f92) provides variable amounts of damping. If set too low, the controller may be unstable. If set too high, the controller may ignore some tension variations instead of correcting for them. The controller may also appear to be very slow to react.

The RESPONSE/DERIVATIVE (f93) function adjusts the controller's reaction time when a tension variation occurs. If set too high, the controller will be unstable. Low settings are not a problem.

2. TUNING PROCEDURE

- a) Be sure the controller is calibrated properly (see Section 3). The controller will not operate properly if it has not been calibrated.
- b) Turn the controller on. Web-up the machine with a typical web material and switch to the AUTO mode. Run the machine at normal operating speed. Use the AUTO Setpoint function to set the tension at a normal value for the material.
- c) Adjust the STABILITY/INTEGRAL function slowly up and down while watching the tension meter. Wait for a short time after each adjustment for tension to stabilize. Choose the setting where tension fluctuations are the least.

Note: If the controller is controlling rewind tension, try to make these adjustments at or near core diameter. For an unwind controller, make it at or near full roll diameter. These are the points where the setting is most critical.

- d) Accelerate and decelerate the machine while watching the tension meter. If tension oscillates, readjust the STABILITY/INTEGRAL function. Then, adjust the RESPONSE/DERIVATIVE function to minimize the time needed for tension to return to the set value.
- e) Run a full roll of material starting at the core (rewind) or full roll (unwind) to verify smooth operation throughout.

3. TUNING THE SPEED FOLLOW FUNCTION

The following procedure applies to the Speed Follow function only. This uses only the line speed signal. No nip roll speed signal is needed or desired.

- a) Be sure the DC Tach card (or Pulse Tach card), if used has been properly calibrated.
- b) Be sure the appropriate functions have been properly set up.
- c) Adjust the tension trim adjustment to 0.

- d) Remove the web and run the machine at normal speed. Using a hand-held tachometer, measure the surface speed of a driven roll running at machine speed. Then measure the surface speed of the driven nip roll that is controlled by the SteadyWeb™. Adjust the LTACH Span potentiometer on the TACH card to match the nip roll speed to the machine speed.
- e) Reset the TEN TRIM function (f94).

Note: The TEN TRIM should not be set high. It could cause tension transients at start up and instability while running. A setting of 10 to 20% is usually ideal.

- f) Go back to Section 4.2.2, to continue tuning. Do not set INTEGRAL to 0. The controller will not work. If it was set to 0, reset to 1 or higher, then power your controller OFF and back ON. This will reset the necessary variables.

The serial communications option is available either to provide serial data output for a simple terminal device or printer (in Statistics mode), or to provide remote control of certain controller functions and facilitate remote computer-based data collection (in Remote Control mode).

5.1 INSTALLING INTERFACE ICS FOR RS232 OR RS422/RS485

The correct interface IC should be factory-installed for the type of interface you will be using. Verify that this device is installed as follows:

RS232 - Install MAX233 (DFE P/N 104-0044) in socket U19

(Also verify that no device is installed in socket U22)

RS422/RS485 - Install MAX491 (DFE P/N 104-0042) in socket U22

(Also verify that no device is installed in socket U19)

5.2 SETTING UP DIP SWITCHES FOR RS232, RS422, AND RS485

You must configure SW2 and SW3 correctly for the type of interface you will be using, as follows:

RS232: SW2: 5 and 7 open, SW2: 6 and 8 closed, SW3: 5 and 6 open

RS422: SW2: 5 - 8 open, SW3: all open

RS485 two-wire: SW2: 5 and 7 closed, SW2: 6 and 8 open, SW3: 5 and 6 closed

RS485 four-wire: SW2: 5 and 7 closed, SW2: 6 and 8 open, SW3: 5 and 6 open

5.3 MAKING YOUR CONNECTION TO THE SteadyWeb™

A 9-pin D subminiature connector is located on the bottom right side of the enclosure. The pin assignments are as follows:

- 1 RxD
- 2 /RxD
- 3 /TxD
- 4 TxD
- 5 Ground

NOTE: For RS232 connections, use only pins 2, 3, and 5.

For two-wire RS485 connections, use only pins 1, 4, and 5.

Do not make connections to pins other than those required for the interface you have chosen.

5.4 SELECTING COMMUNICATION PARAMETERS

In order to use any of the SteadyWeb™'s serial options, it is necessary to set its serial port as follows:

A. Access FEATURES function group (function 60)

1. Select function 75 "Comm Baudrate", select correct baudrate for receiving device.
2. Select function 76 "Comm Format", select correct format for receiving device.

5.5 STATISTICS MODE

In Statistics Mode the controller will periodically output specified parameters to a receiving device. Select statistics mode as follows:

1. Go to function group 20 (OPTIONS). Select function 22 "Comm Mode" and choose "Statistics" from the menu.

2. Go to function group 60 (FEATURES). Select function 77 "Stat Data", and select the parameters you would like the controller to output. Any or all of the parameters can be selected.
3. Select function 78 "Stat Timebase" and select how often you would like this data to be output.

NOTE: Be sure that your choice of timebase is long enough or message garbling will occur.

5.6 SELECTING AND USING REMOTE CONTROL MODE

In Remote Control mode the SteadyWeb™ utilizes a simple command protocol to control some modes and functions. A command must be transmitted by the host before the SteadyWeb™ responds, the SteadyWeb™ cannot initiate a communications sequence.

Select Remote Control as follows:

1. Go to function group 20 (OPTIONS). Select function 22 "Comm Mode" and choose "Remote Control" from the menu.

All commands include a unit address for those applications which have multiple units on a single RS485 serial communications link. In the following command descriptions, "#" indicates the SteadyWeb™'s one-byte ASCII address from 1 through 9 or A through Z. This provides 35 possible addresses for multiple unit installations. In multiple unit installations all units respond the "0" address. The factory default ("1") is usually satisfactory unless multiple units are to be connected to the same loop using an RS485 interface. If this is the case, each controller must be assigned a unique address as follows:

2. Go to function 80 "Network Addr", in the FEATURES function group (function 60) and change the address of each controller to an address different from any of the other controllers. The choices of addresses are as described above.

Whenever the controller receives a command which requires a specific response to that command, it responds with a prefix specific to that command, its address, and then the requested information. In this way the host has confirmation that the SteadyWeb™ processed the command correctly and that the data is valid. If the SteadyWeb™ receives a command which only requires the SteadyWeb™ to process the command, the SteadyWeb™ still acknowledges receipt of that command with the ACK (acknowledge) response, "%#A". If the SteadyWeb™ receives a command but does not recognize it, or for any reason cannot process the command, the SteadyWeb™ will acknowledge the receipt of these undefined or inappropriate commands or command arguments with the negative acknowledge response, "%#?".

The user must constrain command arguments, including numeric ranges, to be valid entries, otherwise unpredictable results may occur.

Host-To-SteadyWeb™ Command Summary

\$#N	Turn Tension On
\$#F	Turn Tension Off
\$#M	Go to Manual mode
\$#A	Go to Auto Mode
\$#D(+5)	Set roll diameter
\$#m(+5)	Set Manual setpoint
\$#O	Inquire tension mode (Tension On / Off)
\$#C	Inquire controller mode (Manual / Auto)
\$#t	Inquire tension value
\$#d	Inquire roll diameter
\$#s	Inquire line speed
\$#a(+6)	Set Auto setpoint

SteadyWeb™-to-Host Response Summary

%#A	Command receipt acknowledged; command processed correctly
%#d(+5)	Roll diameter value is contained in the next five bytes
%#t(+5)	Tension value is contained in the next five bytes
%#s(+5)	Line speed value is contained in the next five bytes
%#O(+1)	Tension mode is contained in the next byte
%#C(+1)	Controller mode is contained in the next byte
%#?	Command receipt acknowledged; command not processed

The SteadyWeb™ MicroProcessor controller requires very little maintenance. If necessary, clean the overlay on the front panel using a small amount of a gentle solvent like Windex®. Do not use strong petroleum-based solvents - these could damage the panel material. Do not use large amounts of water.

Monitor the tension meter any time there is no web in the machine. It should read near zero. Periodically (at least annually) re-calibrate the unit to verify accuracy.

1. Most problems are caused by incorrect installation and misapplication of the equipment. So it is very important to be sure these factors are correct before making any changes to potentiometer and switch settings.

If you would like assistance evaluating your installation, please call Technical Service at (603) 332-6150 (Fax: (603) 332-3758). We have experienced technicians who can walk you through your application. They will be pleased to help.

2. The most common source of improper operation of tension equipment is incorrect installation of the tension transducers or using transducers of the wrong load rating. Refer to your transducer instruction manual and check the sizing and installation procedures to verify the installation. NOTE: Avoiding pre-loading is very important for the "C" and "UPB" type transducers.
3. Verify the electrical connections to the SteadyWeb™ controller. Refer to Appendices D and E. Also Section 2 or 3.
4. Proper calibration of the SteadyWeb™ MicroProcessor Controller is very important to its operation. Be sure the calibration is correct. Refer to Section 3. Improper calibration may cause unstable operation.
5. If your controller has a pneumatic output (SteadyWeb™ Version P), check the following factors:
 - A. The output pressure should not fall below 5 psi at core diameter. If it does, the controller may be unstable. This is caused by the compressibility of air which creates a time delay when the controller calls for a change of output pressure. At low pressures, the delay becomes long.
 - B. The air connection between the controller and the brake or clutch should be 1/4 inch O.D. tubing, no more than 25 ft. long. Larger or longer tubing creates excessive volume which causes a time delay when output pressure changes. This can cause instability. If a greater distance is unavoidable, you should use the remote pneumatic module option to install the servo valve near the brake or clutch. Use of a volume booster is an alternative. Call Technical Service at (603) 332-6150 for details.

If you get unexpected results in any step, call Technical Service at (603) 332-6150 for assistance.

Listed with Dover Part Numbers

8.1 STANDARD CIRCUIT BOARDS

Operator Interface (Front) board.	723-1008
Control Module board.	723-0014
Power board.	723-1333

8.2 OPTIONAL CIRCUIT CARDS

DC Tachometer Card.	723-0101
Dual Transducer Input Card.	723-0089
Pulse Tachometer Card.	723-0078
Tension On/Off Relay Card	723-0107

8.3 OPERATOR DEVICES

Encoder	149-0000
Power Pushbutton, maintained cap	111-0005
Power Pushbutton switch	111-0004
Tension meter, analog.	722-1385 (specify scale)

8.4 OUTPUT MODULES

V-OUT board	723-0034 (High voltage output module for version V)
Pneumatic module	723-0111 (For version P only)
0-10 Volt Compensated module	104-0001 (For version D only)
Remote Pneumatic module	723-0957 (For version P with 2E option only)

8.5 FUSES

Power board -1A/250V	108-0002 (All versions of controller)
5A/250V	108-0003 (For version V only)
V-OUT card-5A/250V	108-0003 (For version V only)

8.6 RIBBON CABLES

7 Conductor	723-0835 (For version V only)
14 Conductor	131-0000 (For version V only)
34 Conductor	723-0833 (Control board to Front board)
60 Conductor	723-0827 (Power board to Control board)
3 Conductor	721-1217 (Control to front cable)

8.7 RELAYS

Power	105-0000 (on Power board)
Tension Limit Switch	105-0028 (option), (on Power board)
V-OUT card	105-0001 (For version V only)
Dual Transducer Input card	105-0020 (option)

8.8 MISCELLANEOUS

Air filter	119-0002 (For version P only)
Air pressure regulator	119-0004 (For version P only)
Enclosure cover	323-0126
Servo valve	119-0003 (For version P only)

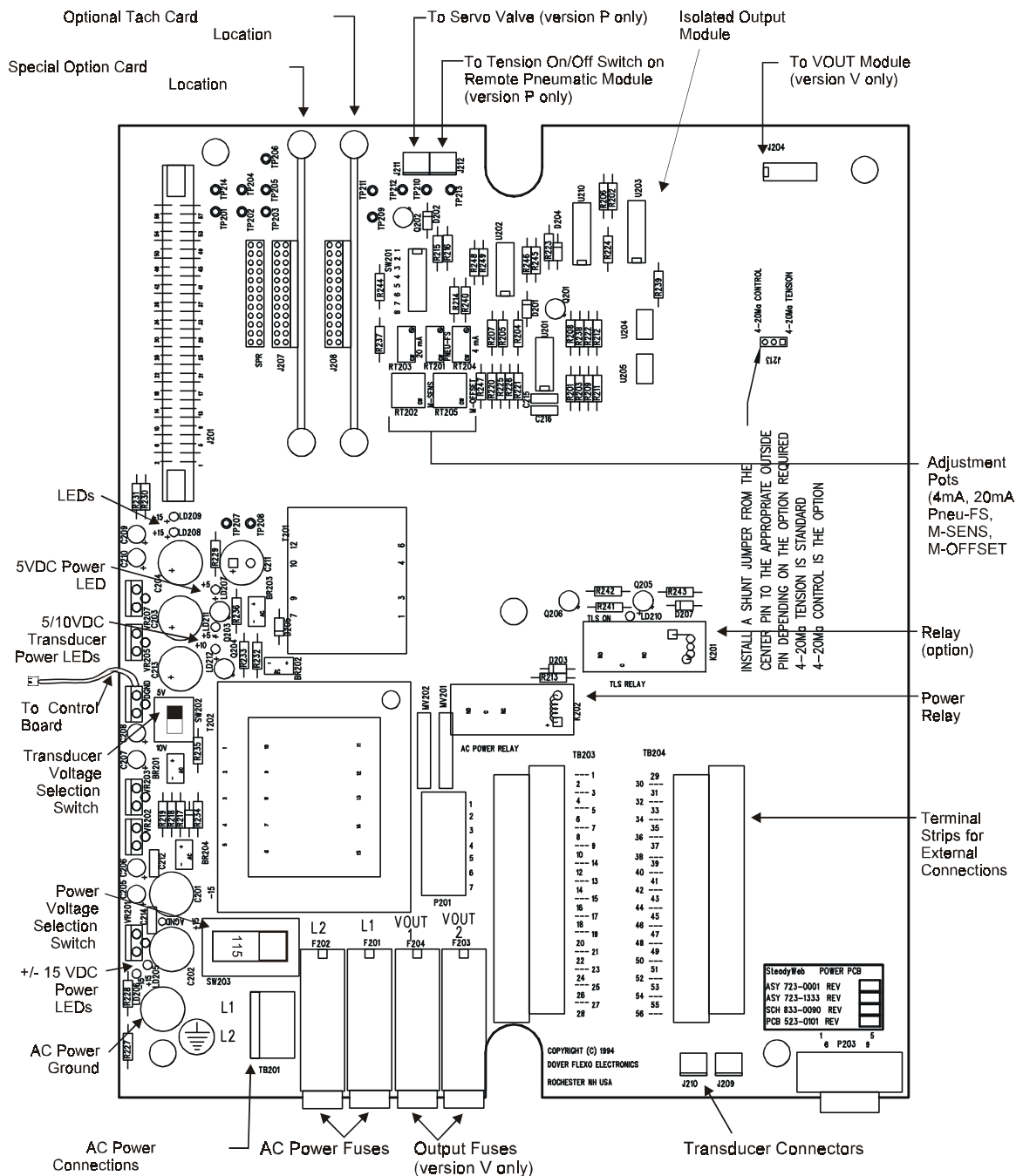


Figure 30 - POWER BOARD

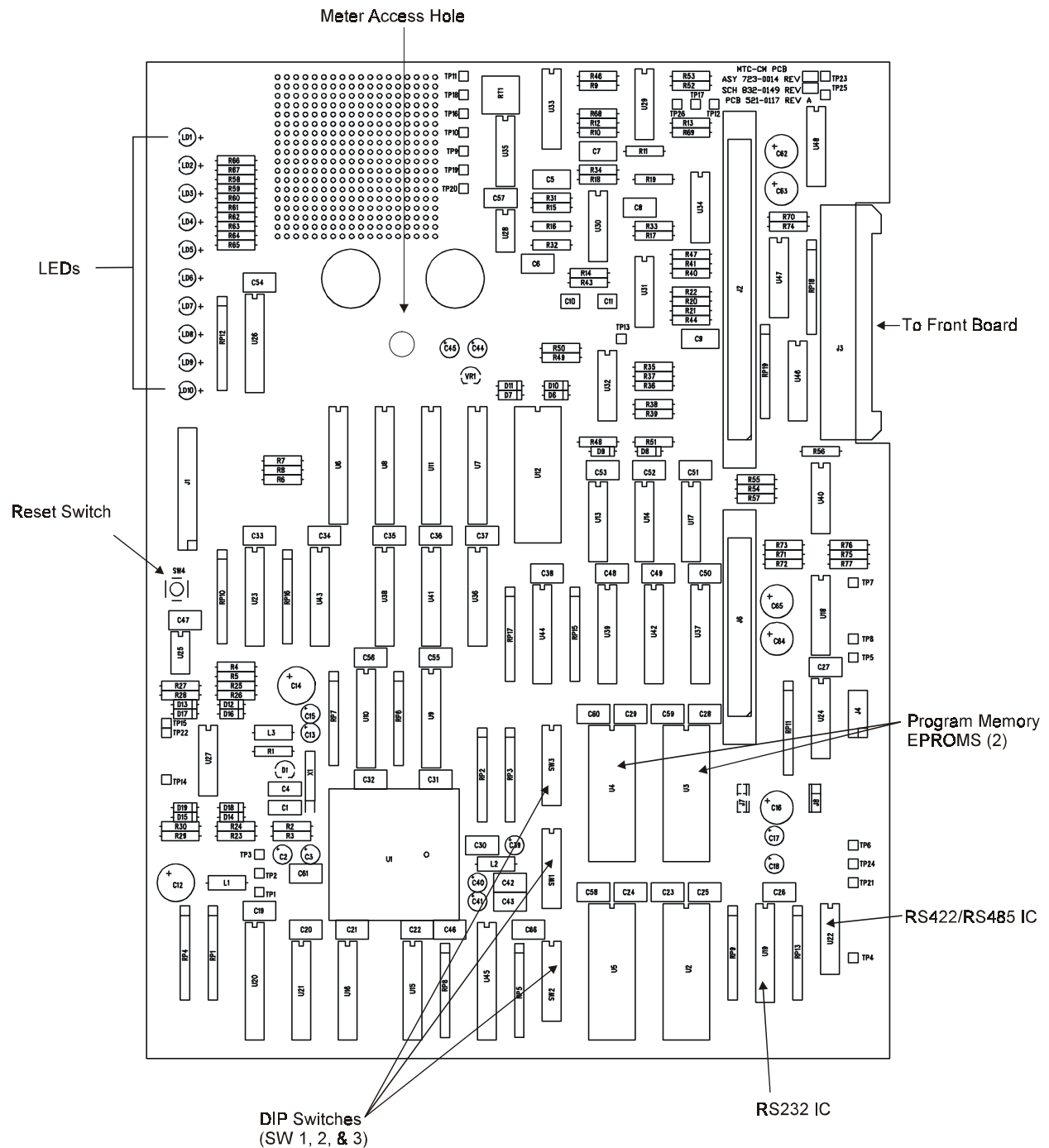


Figure 31 - CONTROL BOARD

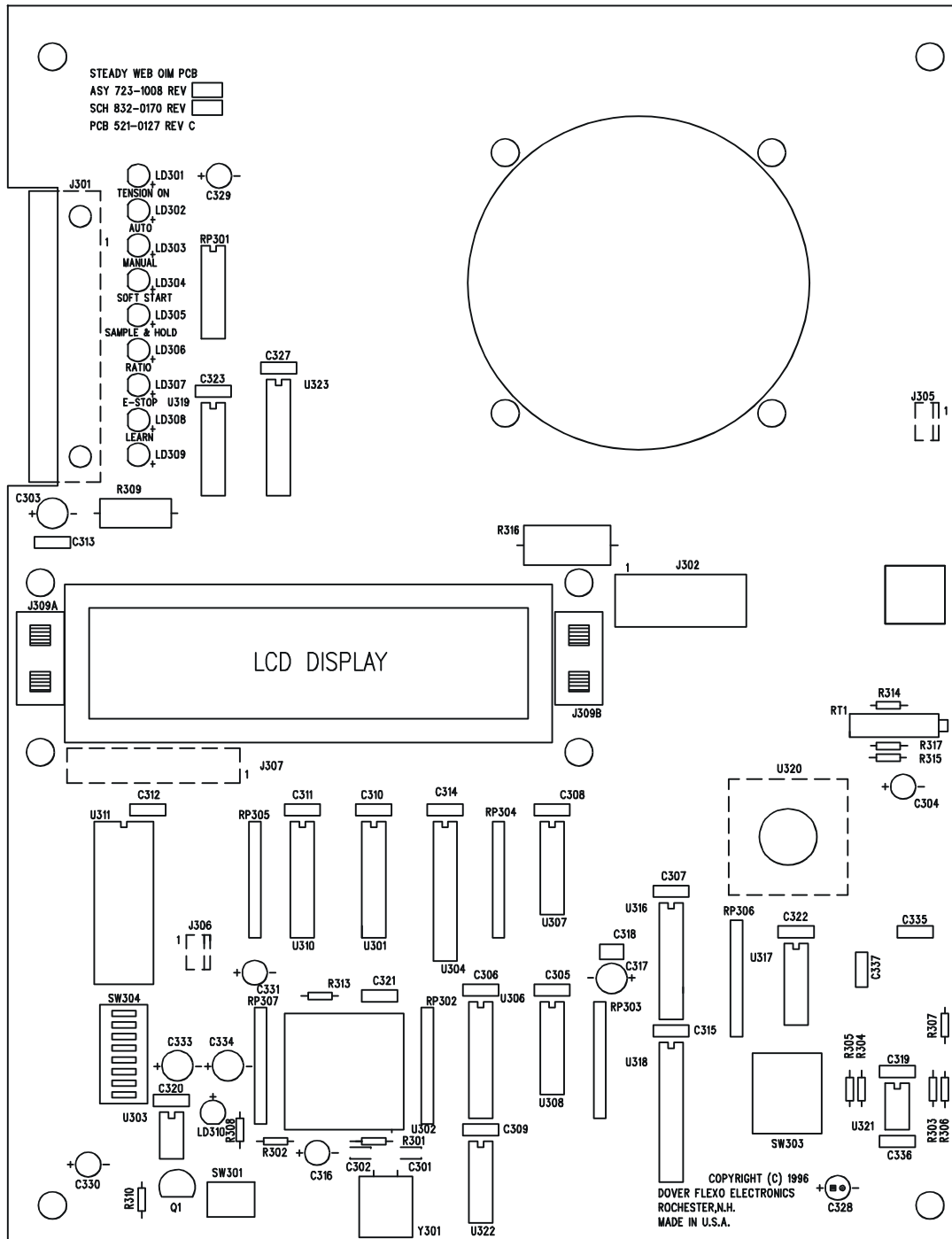


Figure 32 - OPERATOR INTERFACE BOARD

MODELS C, RS, AND UPB TRANSDUCERS

THE TENSION (T) AND COMPRESSION STRAIN GAGES ARE CONNECTED IN A BRIDGE CONFIGURATION. AS THE BEAMS BEND SLIGHTLY UNDER WEB TENSION, THE GAGE RESISTANCES CHANGE PRODUCING AN OUTPUT SIGNAL WHICH IS DIRECTLY PROPORTIONAL TO THE WEB TENSION.

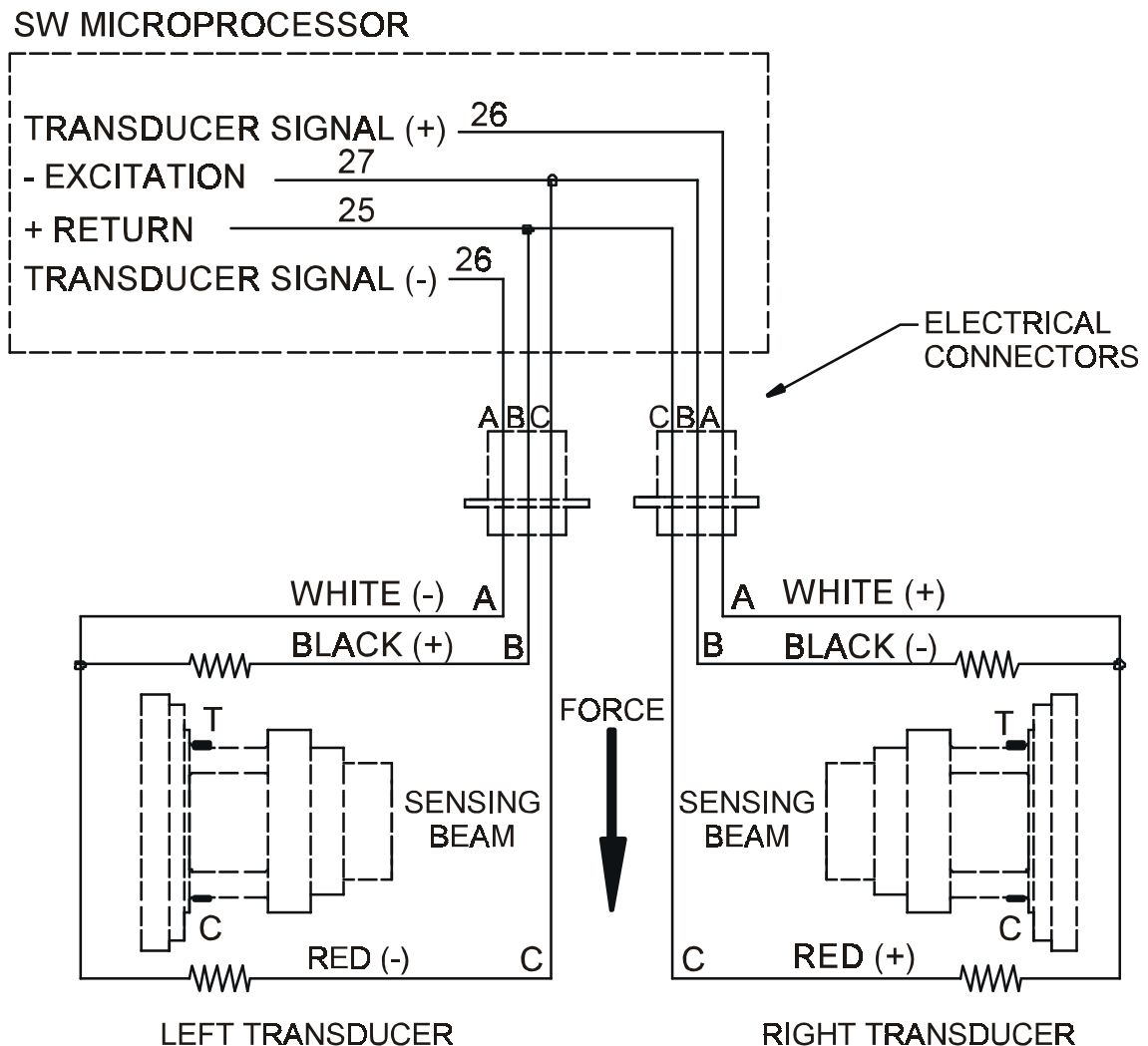


Figure 33 - MODEL C & UPB TRANSDUCER WIRING

RIBBON FILAMENT (RF) TRANSDUCERS

THE TENSION (T) AND COMPRESSION STRAIN GAGES ARE CONNECTED IN A BRIDGE CONFIGURATION. AS THE BEAMS BEND SLIGHTLY UNDER WEB TENSION, THE GAGE RESISTANCES CHANGE PRODUCING AN OUTPUT SIGNAL WHICH IS DIRECTLY PROPORTIONAL TO THE WEB TENSION

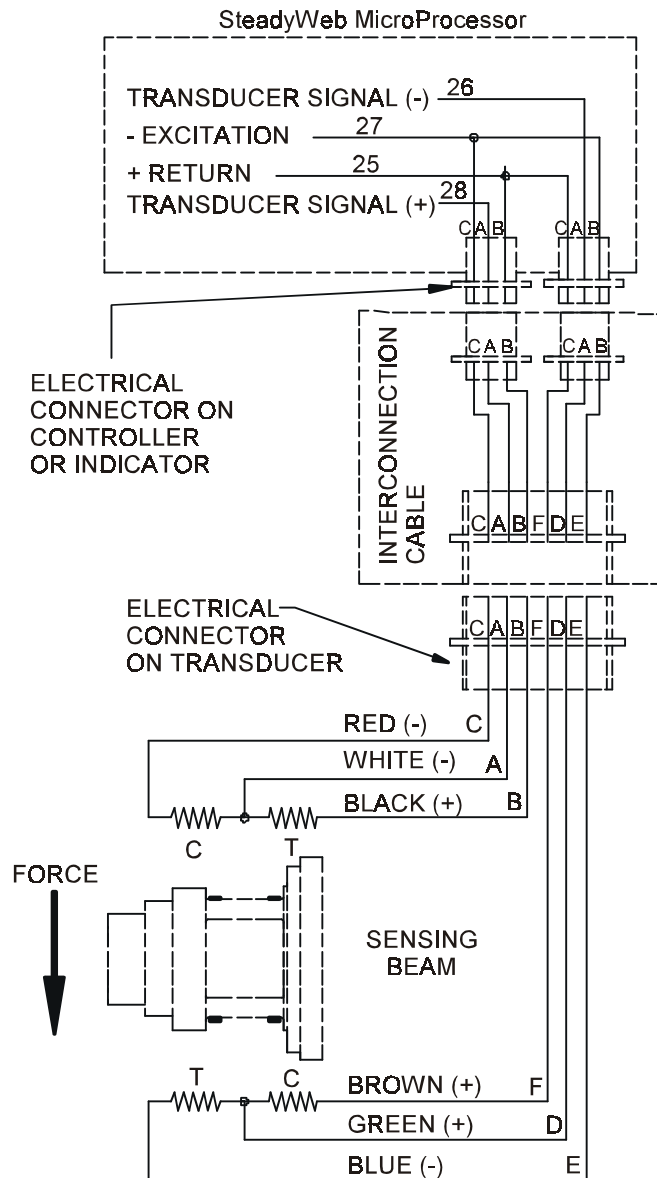


Figure 34 - RF TRANSDUCER WIRING

TENSION ROLL (TR) AND NARROW WEB (NW) TRANSDUCERS

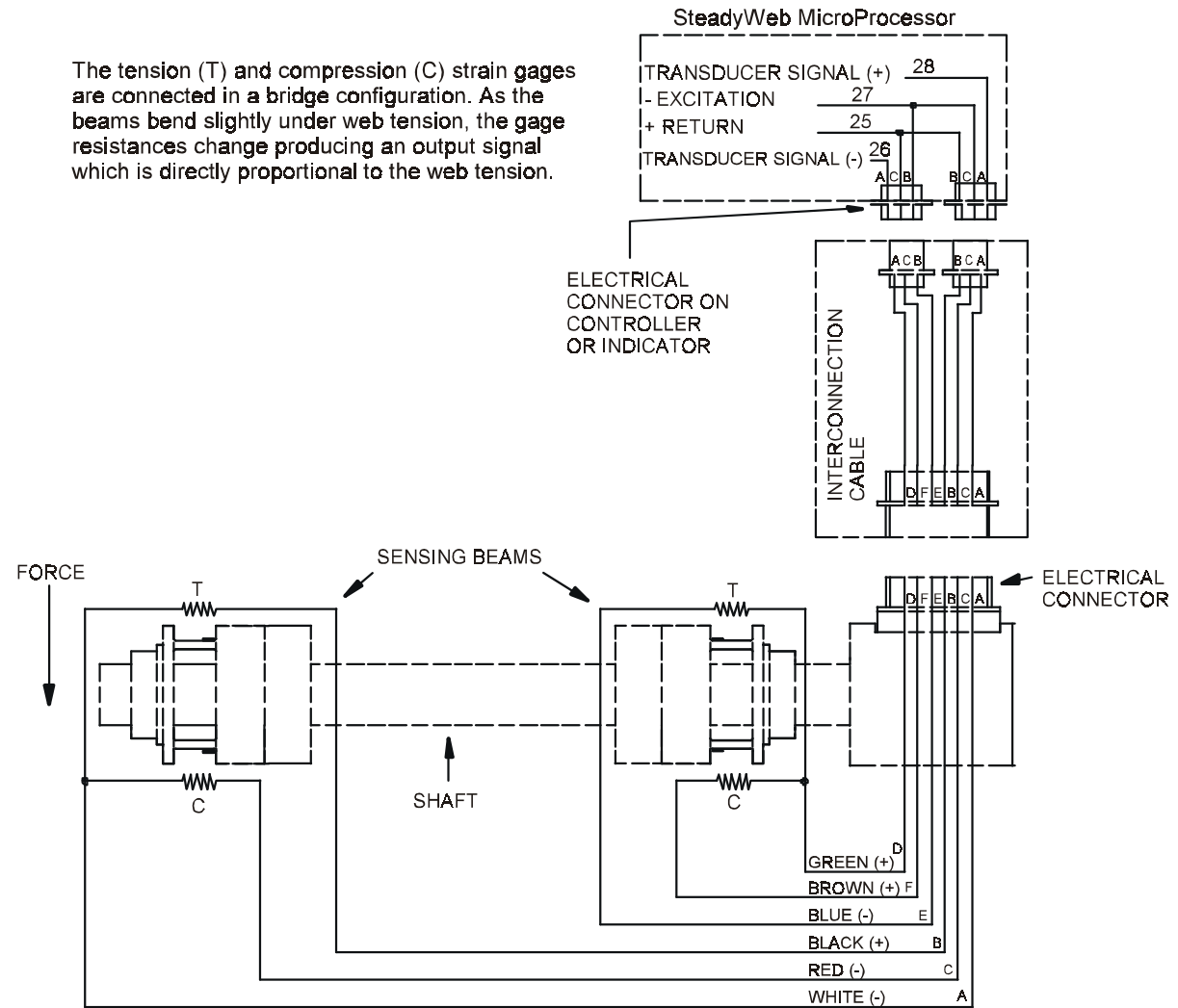


Figure 35 - TR & NW TRANSDUCER WIRING

LOW TENSION (LT) TRANSDUCERS

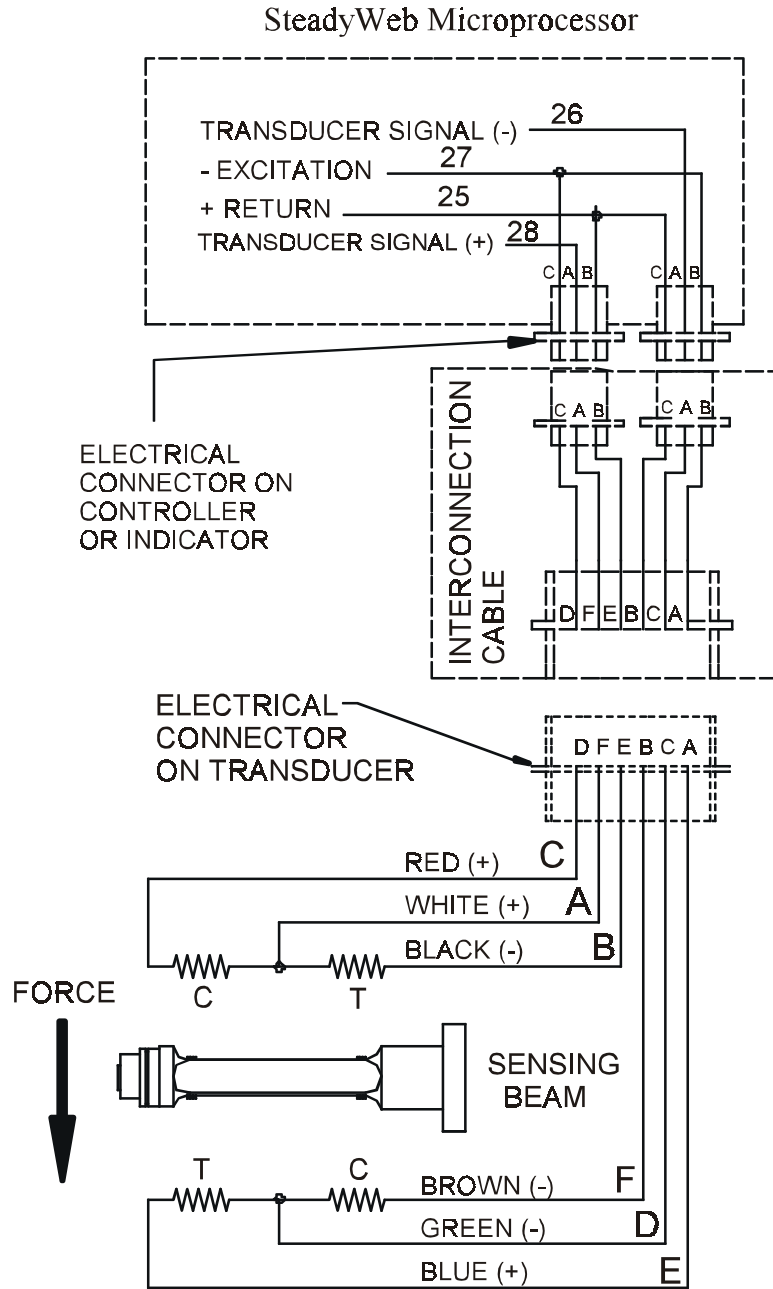


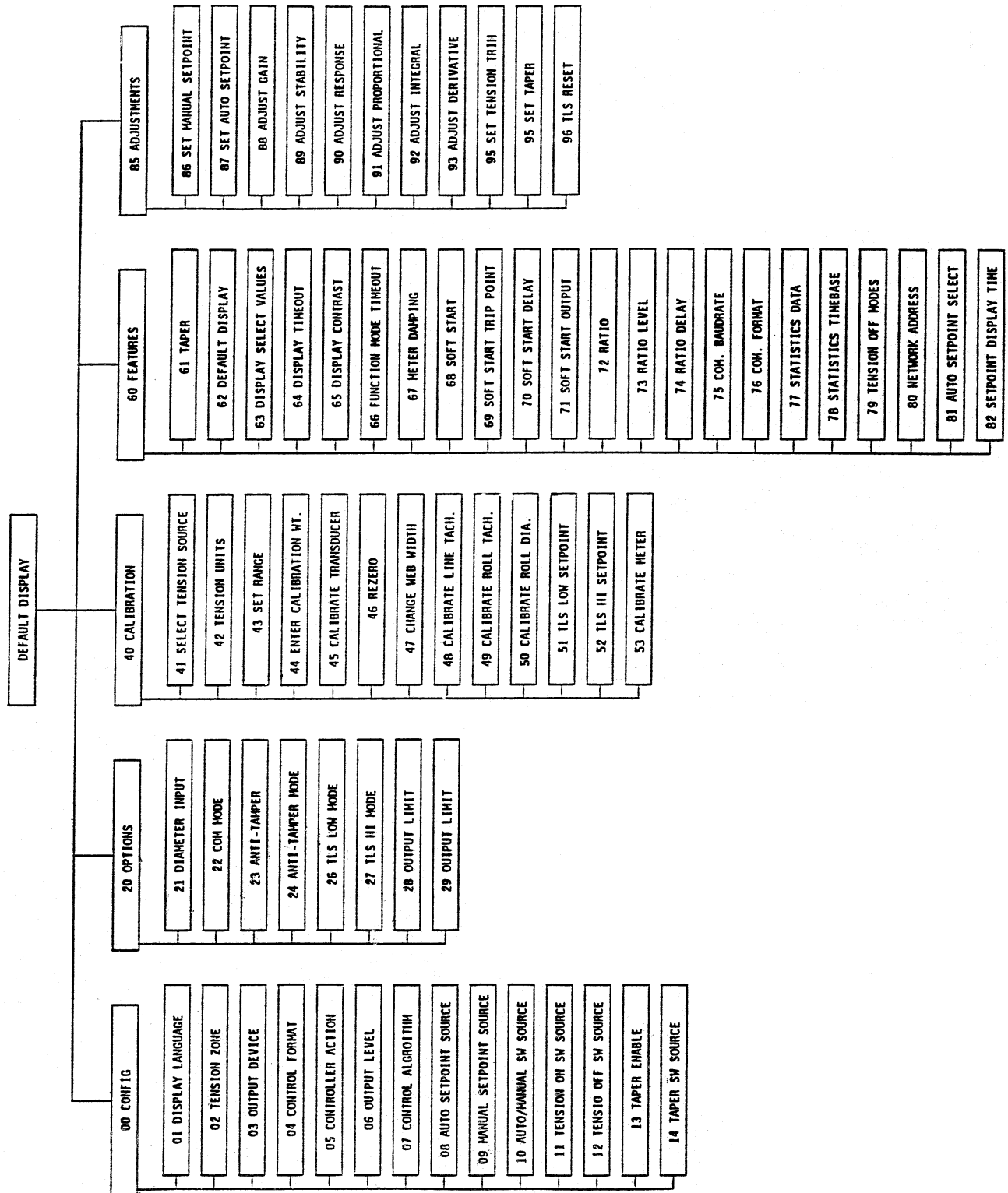
Figure 36 - LT TRANSDUCER WIRING

Appendix C:

Typical Tensions for Various Materials

TYPICAL TENSIONS FOR WEB MATERIALS			
ACETATE		.5 lb. per mil per inch of width	
FOIL	Aluminum	.5 lb. per mil per inch of width	
	Copper	.5 lb. "	
CELLOPHANE		.75 lb. per mil per inch of width	
NYLON		.25 lb. per mil per inch of width	
PAPER	15 lb *	.4 lb. per inch of width	
	20 lb	.5 lb.	"
	30 lb	.75 lb.	"
	40 lb	1.25 lb.	"
	60 lb	2.0 lb.	"
	80 lb	3.0 lb.	"
	100 lb	4.0 lb.	"
* based on 3000 sq. ft. ream			
PAPERBOARD	8pt	3.0 lb. per inch of width	
	12pt	4.0 lb.	"
	15pt	4.5 lb.	"
	20pt	5.5 lb.	"
	25pt	6.5 lb.	"
	30pt	8.0 lb.	"
POLYETHYLENE		.12 lb. per mil per inch of width	
POLYESTER (Mylar)		.75 lb. per mil per inch of width	
POLYPROPYLENE		.25 lb. per mil per inch of width	
POLYSTYRENE		1.0 lb. per mil per inch of width	
RUBBER	<u>GAUGE</u>	<u>AT 25% STRETCH</u>	<u>AT 50% STRETCH</u>
	10 mil	1.75	3.68
	12 mil	1.10	2.03
	16.5 mil	4.09	8.17
	26 mil	2.47	4.97
SARAN		.15 lb per mil per inch of width	
STEEL	<u>GAUGE - INS</u>	<u>UNWIND-PSI</u>	<u>REWIND-PSI</u>
	.001 -.005	1000	4000
	.006 -.025	850	3500
	.026 -.040	750	3000
	.041 -.055	650	2600
	.058 -.070	550	2200
	.071 -.090	450	1800
	.091 -.120	450	1400
	.121 -.140	400	1200
	.141 -.165	400	1000
	.166 -.200	400	900
	.201 -.275	400	800
	.276 -.380	300	700
VINYL		.05 lb. per mil per inch of width	

*** For laminated webs, sum the tension for the individual webs and add 0.1 lb per inch of width.



TERMS AND CONDITIONS OF SALE AND SHIPMENT

1. THE COMPANY

Dover Flexo Electronics, Inc. is hereinafter referred to as the Company.

2. CONFLICTING OR MODIFYING TERMS

No modification of, additions to or conflicting provisions to these terms and conditions of sale and shipment, whether oral or written, incorporated into Buyer's order or other communications are binding upon the Company unless specifically agreed to by the Company in writing and signed by an officer of the Company. Failure of the Company to object to such additions, conflicts or modifications shall not be construed as a waiver of these terms and conditions nor an acceptance of any such provisions.

3. GOVERNING LAW

This contract shall be governed by and construed according to the laws of the state of New Hampshire, U.S.A. The parties agree that any and all legal proceedings pursuant to this contract shall take place under the jurisdiction of the courts of the State of New Hampshire in the judicial district of Strafford County.

4. PENALTY CLAUSES

Penalty clauses of any kind contained in orders, agreements or any other type of communication are not binding on the Company unless agreed to by an officer of the Company in writing.

5. WARRANTY

Dover Flexo Electronics, Inc. warrants its' products to be free of defects in material and workmanship for five years from date of original shipment. Warranty is valid on products purchased on or after April 2, 1999. During the warranty period the Company will repair or replace defective products free of charge if such products are returned with all shipping charges prepaid and if, upon examination, the product is shown to be defective. This warranty shall not apply to products damaged by abuse, neglect, accident, modification, alteration or mis-use. All repairs and replacements under the provisions of this warranty shall be made at Dover Flexo Electronics or at an authorized repair facility. The Company shall not be liable for expenses incurred to repair or replace defective products at any other location or by unauthorized persons or agents. This warranty contains all of the obligations and warranties of the Company. There are no other warranties, either expressed or implied. No warranty is given regarding merchantability or suitability for any particular purpose. The Company shall not be liable in either equity or law for consequential damages, losses or expenses incurred by use of or inability to use its' products or for claims arising from same. No warranty is given for products of other manufacturers even though the Company may provide these products with its' own or by themselves. The provisions of this warranty can not be changed in any way by any agent or employee of the Company. Notice of defects must be received within the warranty period or the warranty is void.

6. PAYMENTS

Standard terms of credit are net 30 days from date of shipment, providing satisfactory credit is established with the Company. Amounts past due are subject to a service charge of 1.5% per month or portion thereof or 18% per annum. The Company reserves the right to submit any unpaid late invoices to a third party for collection and Buyer shall pay all reasonable costs of such collection in addition to the invoice amount. All quoted prices and payments shall be in U.S. Dollars.

If the Company judges that the financial condition or payment practices of the Buyer does not justify shipment under the standard terms or the terms originally specified, the Company may require full or partial payment in advance or upon delivery. The Company reserves the right to make collection on any terms approved in writing by the Company's Finance Department. Each shipment shall be considered a separate and independent transaction and payment therefore shall be made accordingly. If the work covered by the purchase order is delayed by the Buyer,

upon demand by Company payments shall be made on the purchase price based upon percentage of completion.

7. TAXES

Any tax, duty, custom, fee or any other charge of any nature whatsoever imposed by any governmental authority on or measured by any transaction between the Company and the Buyer shall be paid by the Buyer in addition to the prices quoted or invoiced.

8. RETURNS

Written authorization must be obtained from the Company's factory before returning any material for which the Buyer expects credit, exchange, or repairs under the Warranty. Returned material (except exchanges or repairs under the Warranty) shall be subject to a minimum re-stocking charge of 15%. Non-standard material or other material provided specially to the Buyer's specification shall not be returnable for any reason. All material returned, for whatever reason, shall be sent with all freight charges prepaid by the Buyer.

9. SHIPPING METHOD AND CHARGES

All prices quoted are F.O.B. the Company's factory. The Company shall select the freight carrier, method and routing. Shipping charges are prepaid and added to the invoice of Buyers with approved credit, however the Company reserves the right to ship freight-collect if it prefers. Shipping charges will include a charge for packaging. Company will pay standard ground freight charges for items being returned to Buyer which are repaired or replaced under the Warranty.

10. CANCELLATION, CHANGES, RESCHEDULING

Buyer shall reimburse Company for costs incurred for any item on order with the Company which is canceled by the Buyer. Costs shall be determined by common and accepted accounting practices.

A one-time hold on any item ordered from the Company shall be allowed for a maximum of 30 days. After 30 days, or upon notice of a second hold, Company shall have the right to cancel the order and issue the appropriate cancellation charges which shall be paid by Buyer. Items held for the Buyer shall be at the risk and expense of the Buyer unless otherwise agreed upon in writing. Company reserves the right to dispose of canceled material as it sees fit without any obligation to Buyer.

If Buyer makes, or causes to make, any change to an order the Company reserves the right to change the price accordingly.

11. PRICES

Prices published in price lists, catalogs or elsewhere are subject to change without notice and without obligation. Written quoted prices are valid for thirty days only.

12. EXPORT SHIPMENTS

Payment for shipments to countries other than the U.S.A. and Canada or to authorized distributors shall be secured by cash in advance or an irrevocable credit instrument approved by an officer of the Company. An additional charge of 10% will apply to any letter of credit. There will be an extra charge for packaging and documentation.

13. CONDITION OF EQUIPMENT

Buyer shall keep products in good repair and shall be responsible for same until the full purchase price has been paid.

14. OWNERSHIP

Products sold are to remain the property of the Company until full payment of the purchase price is made.

4/02/99