



MAGPOWR Spyder™ Tension Control

Instruction Manual



Figure 1

COPYRIGHT

All of the information herein is the exclusive proprietary property of Maxcess International, and is disclosed with the understanding that it will be retained in confidence and will neither be duplicated nor copied in whole or in part nor be used for any purpose other than for which disclosed.

Copyright 2009, all rights reserved.

Periodically there will be updates to this manual. The latest version is available on our website or by calling the number on the back page of this publication.

SPYDER LOAD CELL BASIC SET-UP

This page provides a summary of the basic set-up and calibration of the Spyder™ control in load cell mode. Additional features and options of the Spyder control are described later in this manual.

Refer to the Load Cell screen flowchart drawing number 850B327 for a navigation aid.

1. The connections that are required for the basic Spyder system are the following: (see Sections 2.0, 6.0 and Figure 5 for specific wiring requirements.)
 - 24 VDC power (Term.6 and Term.7)
 - Earth ground (Term. 8)
 - One or two load cells (Term.23 through Term.26)
 - RUN/STOP using the Spyder internal logic supply between Term.9 and Term.11 (this is typically accomplished by using a switch between these terminals)
 - E-Stop jumper in place between Term.10 and Term.11. (This is supplied by default from the factory)
 - Analog control output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc. (Term.30 to Term.31, refer to Sections 5.1 and 5.3 for output configuration). The Spyder inputs and outputs are referenced to Earth ground and the negative of the 24 VDC power.
2. When using a power amplifier, set the current range jumper to the proper setting for the clutch or brake being used (refer to amplifier User's Manual and the clutch or brake User's Manual for proper settings). The following is also required:
 - Power amplifier input (if used), 115 VAC for PS-90 or 24 VAC or VDC for PS-24
 - Output from power amplifier to clutch or brake.
 - The Spyder output is referenced to Earth ground and the negative of the 24 VDC power.
3. Close the RUN/STOP circuit (Term.9 and Term.11) to put the Spyder into HOLD mode (see Section 5.2.1).
4. Using the Configure menu select "Control Type = Load Cell" and appropriate system type. See Section 6.2.2 for the Configure menu and Figure 6 for an explanation of the point-to-point types.
5. Calibrate the load cells (refer to Section 6.3).
6. Turn tension on by opening the TENSION ON/OFF circuit (Term.13 and Term.11), put the Spyder into AUTO mode by opening the AUTO/MANUAL circuit (Term.12 and Term.11), and put the Spyder in RUN mode by switching open the RUN/STOP circuit. Adjust the tension setpoint using a potentiometer (Term. 15 through Term.17). Run the machine at a reduced line speed and observe the system.
7. If the system is unstable, go to the Quick Stabilize menu (Section 6.4.1) and press the ↓ (down arrow) to begin stabilizing. Use the ← (left arrow) and → (right arrow) in the following screens to tune the system.
8. Refer to Section 6.4.2 for tuning methods that will optimize the responsiveness.
9. Basic set-up is complete. Additional features and options are described later in this manual. Always use the RUN/STOP feature to put the Spyder into HOLD mode whenever the machine is stopped to avoid a possible high-tension condition during start-up.

SPYDER DANCER BASIC SET-UP

This page provides a summary of the basic set-up and calibration of the Spyder control in dancer mode. Additional features and options of the Spyder control are described later in this manual.

Refer to either the Dancer, Torque or the Dancer, Speed screen flowchart drawing number 850B327 for a navigation aid.

1. The connections that are required for the basic Spyder system are the following: (see Sections 2.0, 7.0 and Figure 11 for specific wiring requirements.)
 - 24 VDC power (Term.6 and Term.7)
 - Earth ground (Term. 8)
 - Dancer position signal (Term.38, Term.39 and Term.26, see Sections 7.3 and 7.4 and Figures 11 and 12 for connections.)
 - Dancer setpoint signal (Term. 15 through Term.17)
 - RUN/STOP using the Spyder internal logic supply between Term.9 and Term.11 (this is typically accomplished by using a switch between these terminals)
 - E-Stop jumper in place between Term.10 and Term.11. (This is supplied by default from the factory)
 - Analog control output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc. (Term.30 to Term.31, refer to Sections 5.1 and 5.3 for output configuration). The Spyder inputs and outputs are referenced to Earth ground and the negative of the 24 VDC power.
2. When using a power amplifier, set the current range jumper to the proper setting for the clutch or brake being used (refer to amplifier User's Manual and the clutch or brake User's Manual for proper settings). The following is also required:
 - Power amplifier input (if used), 115 VAC for PS-90 or 24 VAC or 24 VDC for PS-24
 - Output from power amplifier to clutch or brake.
 - The Spyder output is referenced to Earth ground and the negative of the 24 VDC power.
3. Close the RUN/STOP circuit (Term.9 and Term.11) to put the Spyder into HOLD mode (see Section 5.2.1).
4. Using the Configure menu select "Control Type = Dancer, Torque" if a clutch or brake is being controlled or "Control Type = Dancer, Speed" if a motor is being controlled. In the Configuration menu also select if integrator control will be used and select the appropriate system type. See Section 7.2.2 for the Configure menu.
5. Using the Configure menu select "Setpoint Source = ANALOG" if the dancer setpoint will be read from the analog voltage on terminal 16. Selecting "Setpoint Source = ETHERNET" will use a software setpoint position which can be changed either through the Setpoint Position screen, or the Web page, or Modbus/TCP.
6. Calibrate the dancer input and the setpoint position input (refer to Sections 7.3 and 7.4). The setpoint position input does not need to be calibrated if "Setpoint Source = ETHERNET".
7. Turn tension on by opening the TENSION ON/OFF circuit (Term.13 and Term.11), and put the Spyder in RUN mode by switching open the RUN/STOP circuit. Adjust the position setpoint using a potentiometer (Term. 15 through Term.17). Run the machine at a reduced line speed and observe the system.
8. If the system is unstable, go to the Quick Stabilize menu (Section 7.5.1) and press the ↓ (down arrow) to begin stabilizing. Use the ← (left arrow) and → (right arrow) in the following screens to tune the system.
9. Refer to Section 7.5.2 for tuning methods that will optimize the responsiveness.
10. Basic set-up is complete. Additional features and options are described later in this manual. Always use the RUN/STOP feature to put the Spyder into HOLD mode whenever the machine is stopped to avoid a possible high-tension condition during start-up. For Dancer, Torque use the Hold Level screen to output a value of torque to prevent the dancer arm from moving during Hold.

SPYDER-PLUS OPEN LOOP TENSION BASED ON DIAMETER BASIC SET-UP

This page provides a summary of the basic set-up and calibration of the Spyder-Plus control in Open Loop Tension mode. Additional features and options of the Spyder-Plus control are described later in this manual.

Refer to the Open Loop Tension screen flowchart drawing number 850B327 for a navigation aid.

1. The connections that are required for the basic Spyder-Plus system are the following: (see Sections 2.0, 8.0 and figure 16 for specific wiring requirements.)
 - 24 VDC power (Term.6 and Term.7)
 - Earth ground (Term. 8)
 - Diameter signal (Term.38, and Term.39, see Section 5.4.4 and Figure 16 for connections.)
 - Tension setpoint signal (Term.15 through Term.17)
 - RUN/STOP using the Spyder-Plus internal logic supply between Term.9 and Term.11 (this is typically accomplished by using a switch between these terminals)
 - E-Stop jumper in place between Term.10 and Term.11. (This is supplied by default from the factory)
 - Analog control output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc. (Term.30 to Term.31, refer to Sections 5.1 and 5.3 for output configuration). The Spyder-Plus inputs and outputs are referenced to Earth ground and the negative of the 24 VDC power.
2. When using a power amplifier, set the current range jumper to the proper setting for the clutch or brake being used (refer to amplifier User's Manual and the clutch or brake User's Manual for proper settings). The following is also required:
 - Power amplifier input (if used), 115 VAC for PS-90 or 24 VAC or 24 VDC for PS-24
 - Output from power amplifier to clutch or brake.
 - The Spyder-Plus output is referenced to Earth ground and the negative of the 24 VDC power.
3. Close the RUN/STOP circuit (Term.9 and Term.11) to put the Spyder-Plus into HOLD mode (see Section 5.2.1).
4. Using the Configure menu select "Control Type = Tension, Diameter". In the Configuration menu select the appropriate system type. See Section 8.2.2 for the Configure menu.
5. Using the Configure menu select "Setpoint Source = ANALOG" if the tension setpoint will be read from the analog voltage on terminal 16. Selecting "Setpoint Source = ETHERNET" will use a software setpoint tension which can be changed either through the Web page, or Modbus/TCP.
6. Calibrate the diameter input and the setpoint tension input (refer to Sections 8.3 and 9.3). The setpoint tension input does not need to be calibrated if "Setpoint Source = ETHERNET".
7. Using the Parameters menu enter the Core diameter and the Full Roll diameter.
8. Turn tension on by opening the TENSION ON/OFF circuit (Term.13 and Term.11), and put the Spyder-Plus in RUN mode by switching open the RUN/STOP circuit. Adjust the tension setpoint using a potentiometer (Term. 15 through Term.17).
9. Basic set-up is complete. Additional features and options are described later in this manual. Always use the RUN/STOP feature to activate inertia compensation during stopping. See Section 9.6.8.

TABLE OF CONTENTS

Section	Description	Page
1.0	Introduction	7
2.0	Installation	8
3.0	Maintenance	9
4.0	Keypad Navigation	9
5.0	System Setup	10
5.1	Hardware Configuration	10
5.2	Digital Control Inputs	10
5.3	Analog Outputs	11
5.4	Analog Inputs	11
6.0	Tension Control	12
6.1	Electrical Connections	12
6.2	Software Configuration	12
6.3	Load Cell Calibration	15
6.4	Tuning	16
6.4.1	Quick Stabilize	17
6.4.2	Optimize Tuning	17
6.5	Load Cell Connections	18
6.6	Load Cell System Complete Wiring	19
6.7	Load Cell Control Diagram	19
7.0	Dancer Control	20
7.1	Electrical Connections	20
7.2	Software Configuration	21
7.3	Dancer Input Setup	23
7.4	Dancer Calibration	23
7.5	Tuning	25
7.5.1	Quick Stabilize	26
7.5.2	Optimize Tuning	26
7.6	Dancer, Torque Control Diagram	27
7.7	Dancer, Speed Control Diagram	28
7.8	Dancer Complete System Wiring	28
8.0	Open Loop Tension Control based on Diameter	29
8.1	Electrical Connections	29
8.2	Software Configuration	29
8.3	Diameter Calibration	32
8.4	Core, Full Roll, and Taper Setup	32
8.5	Open Loop Tension Control Diagram	32
9.0	Optional Functions	33
9.1	Preferences Menu	33
9.2	Taper Tension (Load Cell only)	33
9.3	Calibrate Inputs Menu (Load Cell and Open Loop Tension Control)	34
9.4	Calibrate Outputs Menu	34
9.5	Security Menu	35
9.6	Parameters Menu	35
10.0	Troubleshooting	37
10.1	General Problems	37
10.2	Tuning Problems (Load Cell Control)	38
10.3	Tuning Problems (Dancer Control)	39
10.4	Load Cell Calibration Problems	40
10.5	Load Cell Diagnostic Voltages	41
11.0	Alphabetical List of Screen Definitions	42
12.0	Communication	51
12.1	Network Setup	51
12.2	Parameters Available Only from the Web Page or Modbus/TCP	51
12.3	Spyder Web Page	51
12.4	Update Software via FTP Site	53
12.5	Spyder Configuration Tool	53
12.6	Modbus/TCP Communicatiion	53
12.7	Modbus Parameter List	54
12.8	Modbus Master Program	57
13.0	Reset Functions	58
14.0	Specifications	59

LIST OF FIGURES

Figure	Description	Page
Figure 1	Spyder Picture	1
Figure 2	Outline Dimensions	8
Figure 3	Enclosure Top Removal	8
Figure 4	Configuration Jumper	10
Figure 5	Basic Load Cell System Connections	13
Figure 6	Load Cell System Types	14
Figure 7	Applied Calibration Tension	16
Figure 8	Load Cell Connections for One or Two Load Cells	18
Figure 9	Complete Load Cell System Wiring	19
Figure 10	Load Cell Control Diagram	19
Figure 11	Basic Dancer Wiring	20
Figure 12	DFP Connections	21
Figure 13	Dancer, Torque Control Diagram	27
Figure 14	Dancer, Speed Control Diagram	28
Figure 15	Complete Dancer System Wiring	28
Figure 16	Complete Open Loop Tension System Wiring	30
Figure 17	Open Loop Tension Control Diagram	32
Figure 18	Spyder Status Web Page	52
Figure 19	Spyder Configuration Web Page	52
Figure 20	Example Edit Value Web Pages	52

1.0 INTRODUCTION

The MAGPOWR Model Spyder is a microprocessor based control designed for precise closed loop control of either web tension or dancer position. The Model Spyder-Plus also has an Open Loop Tension control proportional to a diameter input for unwinds and rewinds.

The web tension control is capable of controlling web tension in unwind, rewind, or point-to-point applications in any web press. The Spyder measures tension from one or more MAGPOWR load cells and outputs a corrective analog signal to control a torque device. The tension setpoint for the Spyder is set by an analog voltage signal or by a parameter from an Ethernet port. The Spyder provides an analog input for Manual Level setpoint, control inputs for Run/Stop, Auto/Manual, Tension On/Off and E-Stop, and a 0-1mA or 0-10V DC meter output proportional to measured tension.

The dancer control is capable of controlling a dancer in unwind or rewind applications in any dancer system. The dancer control output can be connected to a torque device (Brake or Clutch), or a speed device (Motor). The Spyder measures the dancer position using a MAGPOWR DFP potentiometer connected to the dancer arm and outputs a corrective analog signal to control a torque or speed device that keeps the dancer position constant. The dancer setpoint for the Spyder is set by an analog voltage signal or by a software setpoint which can be changed on the Spyder or from the Ethernet port. The Spyder provides control inputs for Run/Stop, Tension On/Off, and E-Stop. The tension in the web is fixed by the dancer loading. Additionally load cells may be read while in Dancer mode and the 0-1mA or 0-10V DC meter output is proportional to measured tension.

The open loop tension control is capable of controlling the tension on an Unwind or Rewind based on an analog diameter input including Taper tension and inertia compensation during stopping. The tension setpoint is set by an analog voltage signal or by a parameter from an Ethernet port. The control provides an analog input for Manual Level setpoint, control inputs for Run/Stop, Auto/Manual, Tension On/Off and E-Stop, and a 0-1mA or 0-10V DC meter output proportional to Diameter at Core divided by Present Diameter to slow down Rewind motors to reduce clutch power dissipation.

The Spyder provides an Ethernet port for programming and data collection using either a web page or Modbus/TCP.

2.0 INSTALLATION

The Spyder is intended for installation on a vertical or horizontal panel with a DIN35 rail. See Figure 2 for dimensions. The Spyder provides an IP-20 environmental degree of protection.

Wiring to and from the enclosure must be done with double or reinforced insulation or protective screening which provides protective separation. All wiring outside of the Spyder should comply with the essential requirements of the appropriate local standard(s) and is the responsibility of the installer.

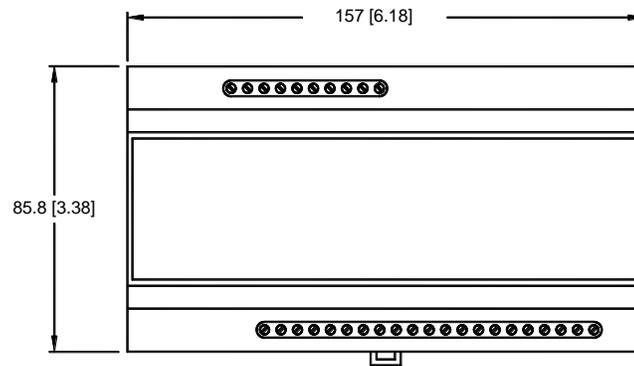
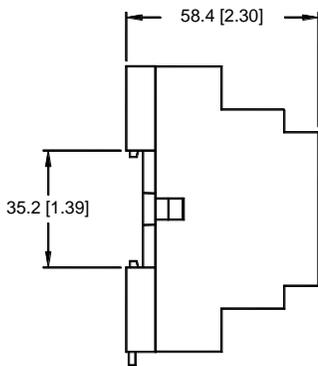


Figure 2
Outline Dimensions

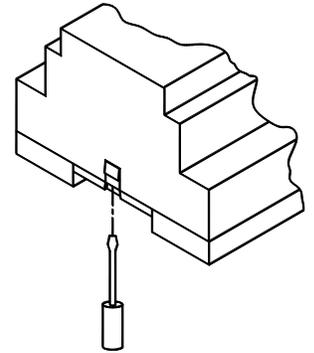


Figure 3
Enclosure Top Removal



WARNING: DISCONNECT POWER BEFORE OPENING ENCLOSURE

3.0 MAINTENANCE

The only maintenance that may be required on Spyder is fuse replacement. Replacement of the fuse requires opening the enclosure, which circumvents the enclosure IP rating. To replace a fuse:

1. Disconnect the power supply.
2. Open the enclosure by inserting a flat blade screwdriver under the retaining tabs in the base. See Figure 3
3. Lift and rotate the cover being careful not to unplug the keyboard connector.
4. Replace the fuse with the recommended fuse type. (See Section 14.0, Specifications)
5. Re-install cover.

4.0 KEYPAD NAVIGATION

The use of the various keys is generally self explanatory.

The LEFT, RIGHT, UP, and DOWN arrow keys are used in menus to move to other screens.

The LEFT and RIGHT arrow keys are used to edit selection choices (e.g. to select system type).

In the tuning screens for dancer modes the UP and DOWN arrow keys are used to adjust the position of the dancer. On these screens ↵ appears in the bottom right hand corner of the screen, and the ENTER key is used to exit the screen. (When the setpoint is Analog, the position setpoint input is not active during tuning.)

When a numeric screen is shown, the value may be edited by pressing the ENTER key to start editing. A numeric edit screen will have a cursor under the digit being edited. The UP and DOWN arrows will increment and decrement the digit, while the LEFT and RIGHT arrows will move the cursor. When finished editing the numeric value, press the Enter key.

The DOWN arrow key will generally move to the next screen in a sub menu. For example, when the Configure menu is displayed press the DOWN arrow key to scroll through System Type, Output Range, Setpoint Source, Digital Input Active, Numeric Rate, Bar Graph Rate, and Contrast.

The UP arrow key usually returns to the previous screen.

5.0 SYSTEM SETUP

5.1 HARDWARE CONFIGURATION

The Spyder has configuration jumpers for:

Control Inputs can be either active high or low,

Control Inputs can be either 5 VDC or 24 VDC logic levels

Main Control Output can be either 0 to 10 VDC, -10 VDC to +10 VDC, or 4 mA to 20 mA.

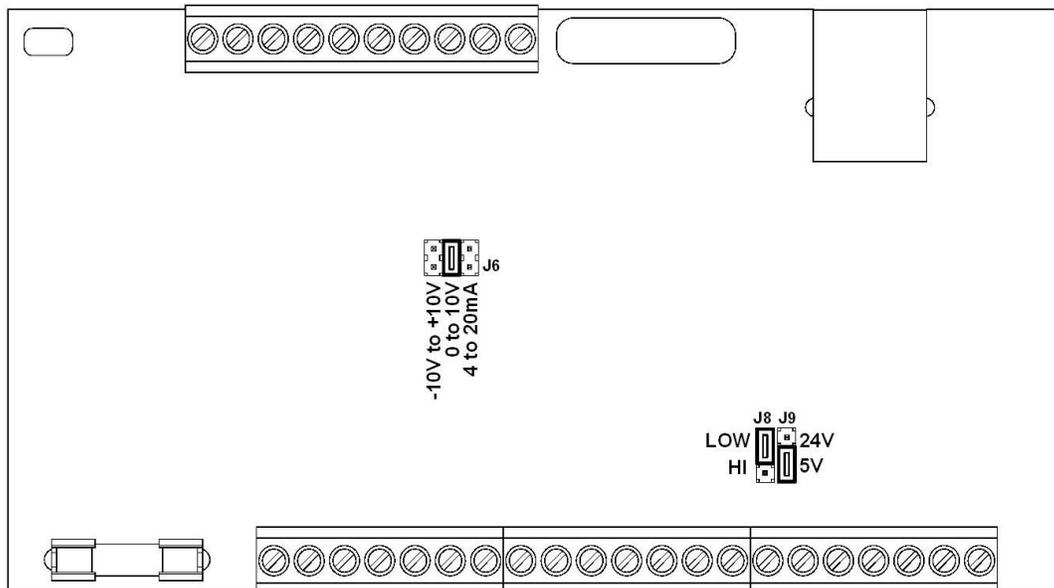


Figure 4. Configuration Jumpers

The Spyder is configured from the factory for 0-10 VDC main output and 5 VDC Logic Low control inputs.

To open the enclosure to provide access to the jumper settings:

1. Open the enclosure by inserting a flat blade screwdriver under the retaining tabs in the base. See Figure 3
2. Lift and rotate the cover being careful not to unplug the keyboard connector.
3. Grasp the display mounting standoffs and pull up while rocking until the shield top is open.

To Close the enclosure after changing the jumper settings:

1. Replace the shield top onto the shield fence. Be careful to keep the display cable wires from being pinched.
2. Replace the cover.

5.2 DIGITAL CONTROL INPUTS

J9 configures the control inputs for either 5V or 24V operation. J8 configures the control inputs for either logic High or logic Low operation. See Figure 4 for jumper settings. Make sure to configure the software for the selected logic type. See Section 6.2.2.5 or 7.2.2.7 or 8.2.2.7. The Spyder is configured from the factory for 5 VDC, logic Low control inputs.

5.2.1 RUN/STOP

Connect TERM.9 to TERM.11 to initiate the stopping function. During STOP TIME the Spyder continues to control as a closed loop system but STOP MULTIPLIER is also activated. During STOP TIME the output is multiplied by STOP MULTIPLIER. See Section 9.6.8 for a description of each control type.

5.2.2 E-STOP (E-STOP IS AN AUXILIARY FUNCTION NOT INTENDED TO PROVIDE CATEGORY 1 SAFETY PROTECTION)

Open the connection between Term.10 and Term.11 to initiate E-STOP. On torque device unwinds the output goes to 100%. On all other systems the output goes to zero. E-STOP overrides Manual mode and Tension Off.

5.2.3 AUTO/MANUAL (Load cell systems and Open Loop Tension systems)

Connect Term.12 to Term.11 to switch to Manual mode. During Manual mode, the main output is directly controlled by the Manual setpoint analog input (Term.20).

5.2.4 TENSION ON/OFF

Connect Term.13 to Term.11 to set the main output to 0 volts (4mA). Tension Off is always allowed for Load Cell and Open Loop Tension systems. For Dancer systems, Tension Off is only allowed when in Hold mode (Run/Stop Input = Stop). Tension Off overrides Manual mode.

5.3 ANALOG OUTPUTS

5.3.1 MAIN OUTPUT

J6 configures the main output range for 0-10VDC, -10 to +10 VDC, or 4-20mA DC. See Figure 4 for jumper settings. When using the -10V to +10V range be sure to configure the software for -10V to +10V output, use Normal for the other two ranges. See Section 6.2.2.3 or 7.2.2.5 or 8.2.2.5. The Spyder is configured from the factory for 0-10 VDC.



5.3.2 METER OUTPUT (Load cell systems and Dancers with Load Cells Enabled and Open Loop Tension)

A 0 to 1 mADC signal proportional to Tension (Scaled to Max Tension) is available between Term.33 and Term.34 with Load Cell Systems and Dancers with Load Cells Enabled. This signal is a 0 to 1 mADC signal proportional to the Diameter at Core divided by the Present Diameter to provide a relative speed signal to a motor on a rewind to keep the clutch power dissipation small. This output is driven by a 0 to 10 VDC source in series with a 10K ohm resistor and can be used as a 0 to 10 VDC output when connected to a high impedance input.

5.4 ANALOG INPUTS

5.4.1 SETPOINT TENSION OR POSITION

By default the Setpoint Tension or Position is input as a voltage between Term.16 and Term.17. Use the Configuration menu to change the setpoint to remote from the Ethernet port. As shipped from the factory, the input is calibrated for a pot between Term.15 and Term.17 with the wiper connected to Term.16.

5.4.2 MANUAL SETPOINT (Load cell systems and Open Loop Tension systems)

The Manual Setpoint is input as a voltage between Term.20 and Term.21. As shipped from the factory, the input is calibrated for a pot between Term.19 and Term.21 with the wiper connected to Term.20.

5.4.3 DANCER POSITION (Dancer systems only)

The actual Dancer Position is input as a voltage between Term.38 and Term.39. As shipped from the factory, the input is calibrated for a pot between Term.26 and Term.39 with the wiper connected to Term.38. See Section 7.3 and Figure 12 for proper dancer potentiometer voltage with dancer movement.

5.4.4 DIAMETER INPUT (Open Loop Tension systems only)

The actual Diameter is input as a voltage between Term.38 and Term.39. The input can take a voltage proportional to diameter up to 10 VDC. An input voltage of 0 volts is equal to a diameter of 0. See Section 8.3 for calibrating diameter.

6.0 TENSION CONTROL

6.1 ELECTRICAL CONNECTIONS

Figure 5 shows the simplest and minimal connections that are required for the basic Spyder load cell tension control system. They are:

- 24 VDC power
- Earth ground
- One or two MAGPOWR load cells
- RUN/STOP switch using the Spyder internal logic supply
- E-Stop jumper between Term.10 and Term.11 (This is supplied by default from the factory)
- Potentiometer (1K to 10K ohm) for tension setpoint. Alternately, Setpoint Tension can be set using the Ethernet port. Choose the Setpoint Source from the Configure menu.
- Output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc.

Route power wiring away from sensor and control wiring. Run all wiring in shielded cable, except for the 24 VDC power which may be twisted pair. Connect cable shields to the terminals provided. Maximum shield length and maximum length of wires outside of the shield is 1.5 inches (38 mm).

The load cell connections and signal inputs and outputs are Earth ground referenced. The power input circuit is not isolated, since the negative lead of the 24 VDC power input is Earth ground referenced.

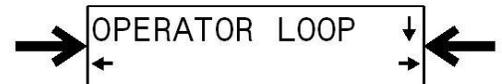
See Figure 9 for complete connections. See Figure 8 for connecting two MAGPOWR load cells. Other load cells may also be used; contact Fife customer service for details.

6.2 SOFTWARE CONFIGURATION FOR LOAD CELL SYSTEM

Refer to the Load Cell screen flowchart at the end of this manual for a navigation aid.

6.2.1 OPERATOR LOOP MENU

This section describes all the screens in the Operator Loop menu. All screens are display only except for Percent Taper.



6.2.1.1 TENSION

This screen shows the actual measured tension in numeric and bar graph form. The bar graph shows measured tension and is scaled to the maximum tension set during calibration of the load cells. The lower left character displays the status of the Spyder.

- E = E-Stop
- H = Hold
- s = Start
- A = Automatic (Run)
- S = Stop
- M = Manual mode
- OFF = Tension OFF



6.2.1.2 SETPOINT TENSION OR CORE TENSION

Setpoint Tension (or Core Tension with taper) is set by the voltage on Term.16 (Setpoint Source = Analog) or via the Ethernet port (Setpoint Source = Ethernet). Setpoint Source is set in the Configure menu.

6.2.1.2.1 SETPOINT TENSION (No taper tension)

Display only.

6.2.1.2.2 CORE TENSION (With taper tension)

Display only. This is the setpoint at core diameter only. At other diameters the setpoint is less than the core setpoint if Taper Percent > 0.

6.0 TENSION CONTROL

6.2.1.3 TAPER PERCENT

Enter the desired taper percentage. This screen will only be shown when taper has been enabled. See Section 9.2, Taper Setup.

Commanded tension at core = Core Tension.

Commanded tension at full roll = (Core Tension) * (1 – TaperPercent/100)

NOTE: The desired “% Taper” is dependent on material and machine type and is totally subjective. Determination of the correct amount of taper for your application is a trial and error process.

6.2.1.4 MANUAL LEVEL

This screen shows the manual level being input on Term.20.

6.2.1.5 OUTPUT LEVEL

This screen shows the actual output level of the Spyder in numeric form. The bar graph also shows actual output level in analog form. The lower left character displays the status of the Spyder. See Section 6.2.1.1 for description of the status character.

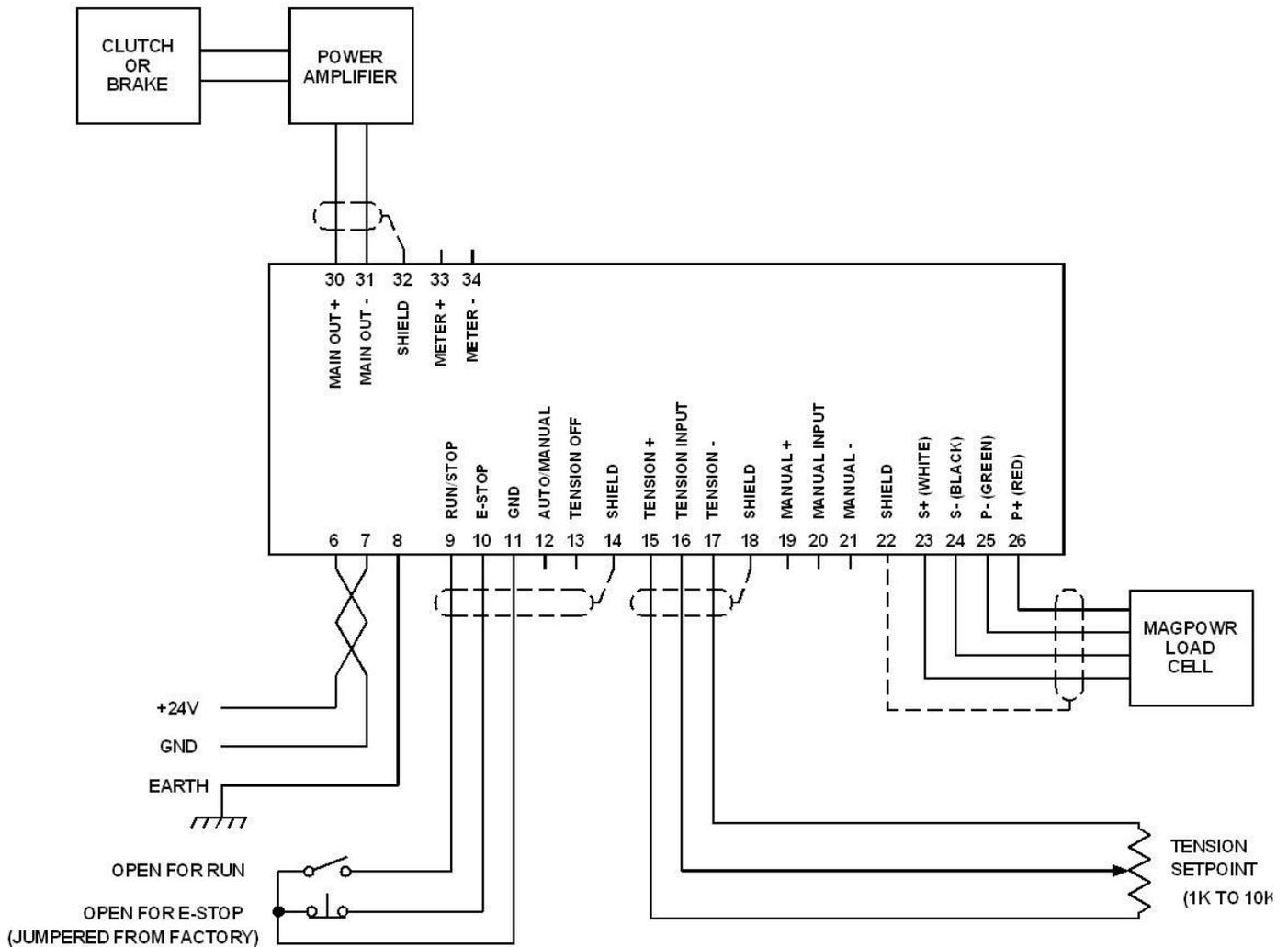
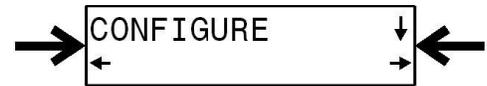


Figure 5. Basic Load Cell System Connections

6.0 TENSION CONTROL

6.2.2 CONFIGURE MENU

Navigate to the **Configure** menu. Press ↓. This section describes all the screens in the Configure menu. This menu contains screens which configure various options.



6.2.2.1 CONTROL TYPE

Select the "Load Cell" control type. Load cell systems must use a torque device; which can be a motor in torque mode.

6.2.2.2 SYSTEM TYPE

Select the appropriate system type for the application, rewind, unwind, or one of the point to point types. See Figure 6 for information on the point to point types.

6.2.2.3 OUTPUT RANGE

Select the main output range. For a main output range of either 0-10 VDC or 4-20 mA DC select NORMAL. For the -10 to +10 VDC range select "-10V to +10V". The software is factory calibrated for the 0-10 VDC and the -10 to +10 VDC output ranges. See Section 9.4 for recalibrating the output when using the 4-20 mA DC range. See Figure 4 for jumper settings.

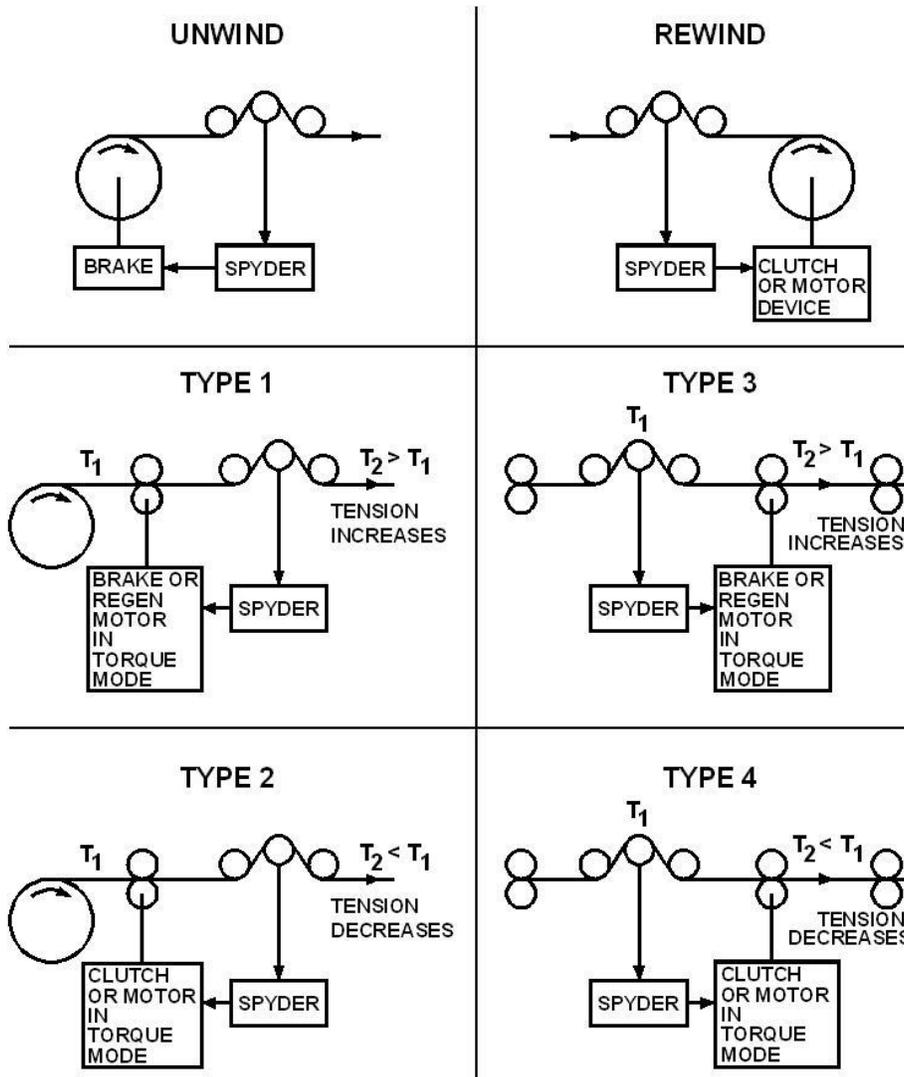


Figure 6 Load Cell System Types

6.0 TENSION CONTROL

6.2.2.4 SETPOINT SOURCE

Select the tension setpoint source. The tension setpoint is either the tension input (Term.16) or the Ethernet. The software is factory calibrated for using a 1K to 10K potentiometer on Term.15 through Term.17 with the wiper on Term.16. When using an external 0-10 VDC voltage source see Section 9.3 for recalibrating the tension setpoint input.

6.2.2.5 DIGITAL INPUT ACTIVE LEVEL

The digital control inputs may be either Active Low or Active High. The software is factory configured for Active Low inputs. See Section 5.2 and Figure 4.

6.2.2.6 INITIAL SCREEN

The first screen after power-up is the "Operator Loop" screen. This parameter allows the initial power-up screen to be changed to either the "Tension" screen, Section 6.2.1.1 or the "Output Level" screen, Section 6.2.1.5.

6.2.2.7 NUMERIC UPDATE RATE

This parameter controls the filtering for the numeric actual tension and the actual output displays. Default values work well in most applications.

6.2.2.8 BAR GRAPH UPDATE RATE

This parameter controls the filtering for the bar graph actual tension and the actual output displays. Default values work well in most applications.

6.2.2.9 SCREEN CONTRAST

Adjusts the screen contrast. See Section 10.1, General Problems, when screen shows no characters.

6.0 TENSION CONTROL

6.3 LOAD CELL CALIBRATION (REQUIRED)

Navigate to the **Cal Sensors** menu. Press ↓.

Select **YES** to calibrate sensors. Press ↓.

Unload the sensing roll. Remove all web and weight from the sensing roller before pressing ↓. Pressing ↓ will overwrite previous calibrations.

When **Maximum Tension** appears enter the maximum tension that will be used on this system (if different than that displayed) by pressing ↵. This is the upper limit of the tension range as read by the load cells. You should choose a value for the Max Tension that will have room for the highest setpoint tension you plan to run plus any tension errors that may occur during operation within the limits of the load cell load rating. This setting also scales the analog bar graph. (Usually it is best to set **Maximum Tension** to approximately twice the value of the normal running tension.) When finished press ↓.

Enter the **Applied Tension** you will use to calibrate the load cells. Press ↓.

Apply the tension to the sensing roll. This tension should be applied to the sensing roll using a rope or narrow web that is routed around the sensing roll in the same way as the normal web. See Figure 7. This tension is best applied using a weight, but a spring scale can also be used. Press ↓.

Calibration has been performed. Remove the calibration load from the sensing roll.

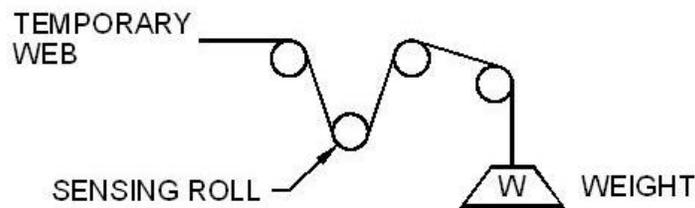
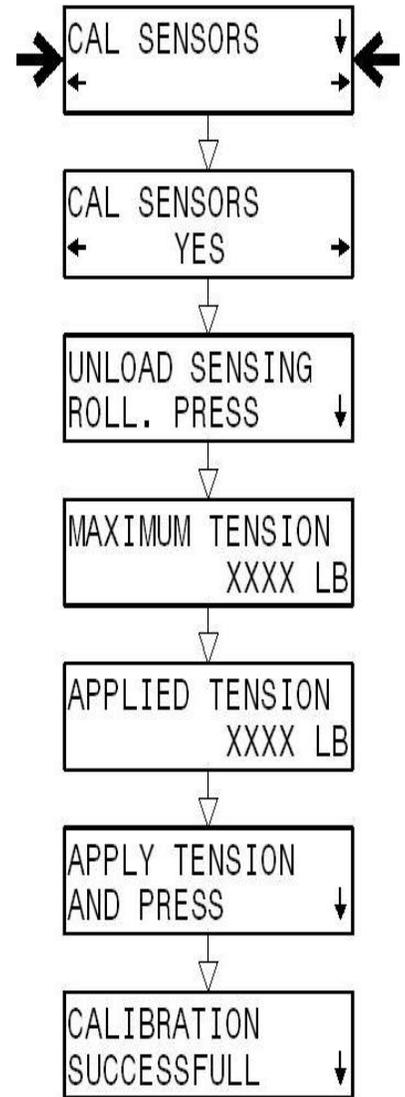


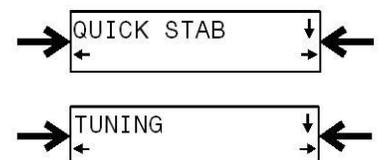
Figure 7. Applied Calibration Tension

6.4 TUNING (REQUIRED)

Two steps are involved

1) "Quick Stab" to get the control loop stable if upon start-up the default parameters do not provide a stable closed loop. See Section 6.4.1.

2) "Tuning" optimizes the Spyder by first tuning to make the system slightly unstable; then adjusting the tuning parameters to make it stable. By doing so the system is tuned to be as responsive as possible and still remain stable throughout its range of operation. See Section 6.4.2.



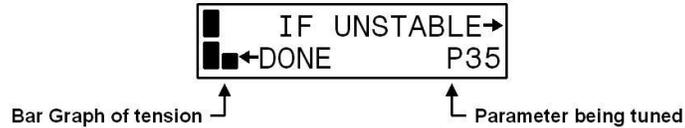
6.0 TENSION CONTROL

6.4.1 QUICK STABILIZE – FIRST STEP

Default tuning parameters are embedded in the Spyder and were selected to minimize instability. If the system is exhibiting extreme fluctuations at start-up, perform the following procedure to quickly stabilize it. Fine-tuning using “Tuning” will still be required. NOTE: The system must be running to Quick Stabilize.

Navigate to the **Quick Stab** menu and press ↓. Press **If Unstable**→ to immediately try to stabilize. The Spyder automatically steps through three separate stages in an attempt to stabilize the process.

The Quick Stab screens are all similar to this one:



Besides “P” the parameter being tuned can also be “E” or “I”. The number next to this letter is not the value of the parameter. It is there to show the progress of the tuning. Its values can be between 00 and 99. 00 is displayed when that parameter is as stable as it can be. When the system is stable press ←**Done**. The Spyder will tell you which parameter should be retuned such as:

The screenshot shows a rectangular screen with the text "RE-TUNE P" on the top line and "AT CORE" on the bottom line. A downward-pointing arrow is located at the bottom right corner of the screen.

Pressing ↓ will automatically take you to the correct parameter to be retuned. This particular message needs some comment. Retune **P** at the present diameter (not at core) if P was previously tuned at core and this message repeatedly comes up. For large roll builds the system may need to be Quick Stabilized a few times while a roll is being wound or unwound for the first time.

Note that Error Limit may have been reduced during Quick Stabilize. Decreasing Error Limit can sometimes stabilize a system, but increasing it will not usually cause a system to become unstable. Therefore, "Optimizing" does not work for Error Limit. The system can be made more responsive by increasing Error Limit in the Parameters menu.

6.4.2 OPTIMIZE TUNING - SECOND STEP

6.4.2.1 Unwinds and rewinds.

Navigate to the **Tuning** menu and press ↓. For unwinds and rewinds this yields the screen:

The screenshot shows a rectangular screen with the text "←FIRST I AT FULL" on the top line and "THEN P AT CORE→" on the bottom line.

The Spyder should be optimized at or near full roll first. On rewinds “Quick Stab” may be needed while a full roll is wound before optimizing at full roll.

The Spyder should be optimized at core only after it has been optimized at full roll. On unwinds “Quick Stab” may be needed to keep the system stable while an initial roll is unwound.

See Section 6.4.3 for a typical tuning screen.

6.4.2.2 Point to point systems.

Navigate to the **Tuning** menu and press ↓. For point to point systems this yields the screen:

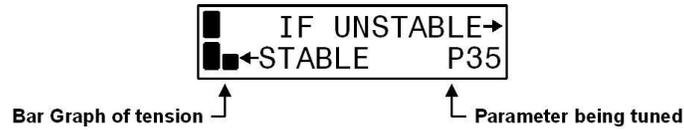
The screenshot shows a rectangular screen with the text "←TUNE I FIRST" on the top line and "THEN P SECOND→" on the bottom line.

The Spyder should be optimized in the order shown. See Section 6.4.3 for a typical tuning screen.

6.0 TENSION CONTROL

6.4.3 Tuning Screens

Tuning allows the operator to optimize tuning parameters by using one button to destabilize the system and another button to stabilize the system. NOTE: The system must be running to perform Tuning. A typical tuning screen looks like this:



Besides "P" the parameter being tuned can also be "I". The number next to this letter is not the value of the parameter. It is there to show the progress of the tuning. Its values can be between 00 and 99. 00 is displayed when that parameter is as stable as it can be. To optimize press ← until the system starts to become unstable. Then press → until stability is again obtained. When finished tuning press ↓.

Basic setup of the load cell control system is now complete. See Section 9.0 for optional settings.

6.5 Load Cell Connections

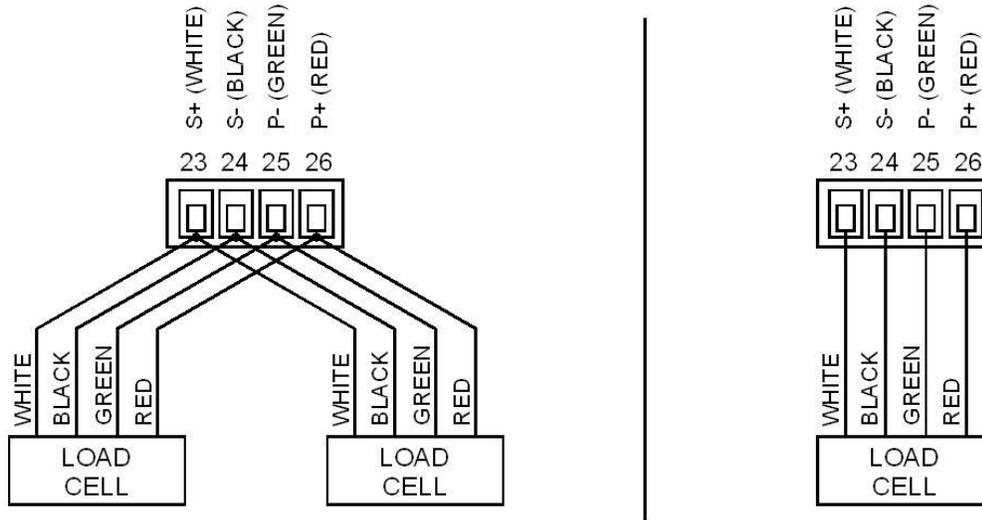


Figure 8. Load Cell Connections for One or Two Load Cells

6.0 TENSION CONTROL

6.6 Load Cell System Complete Wiring

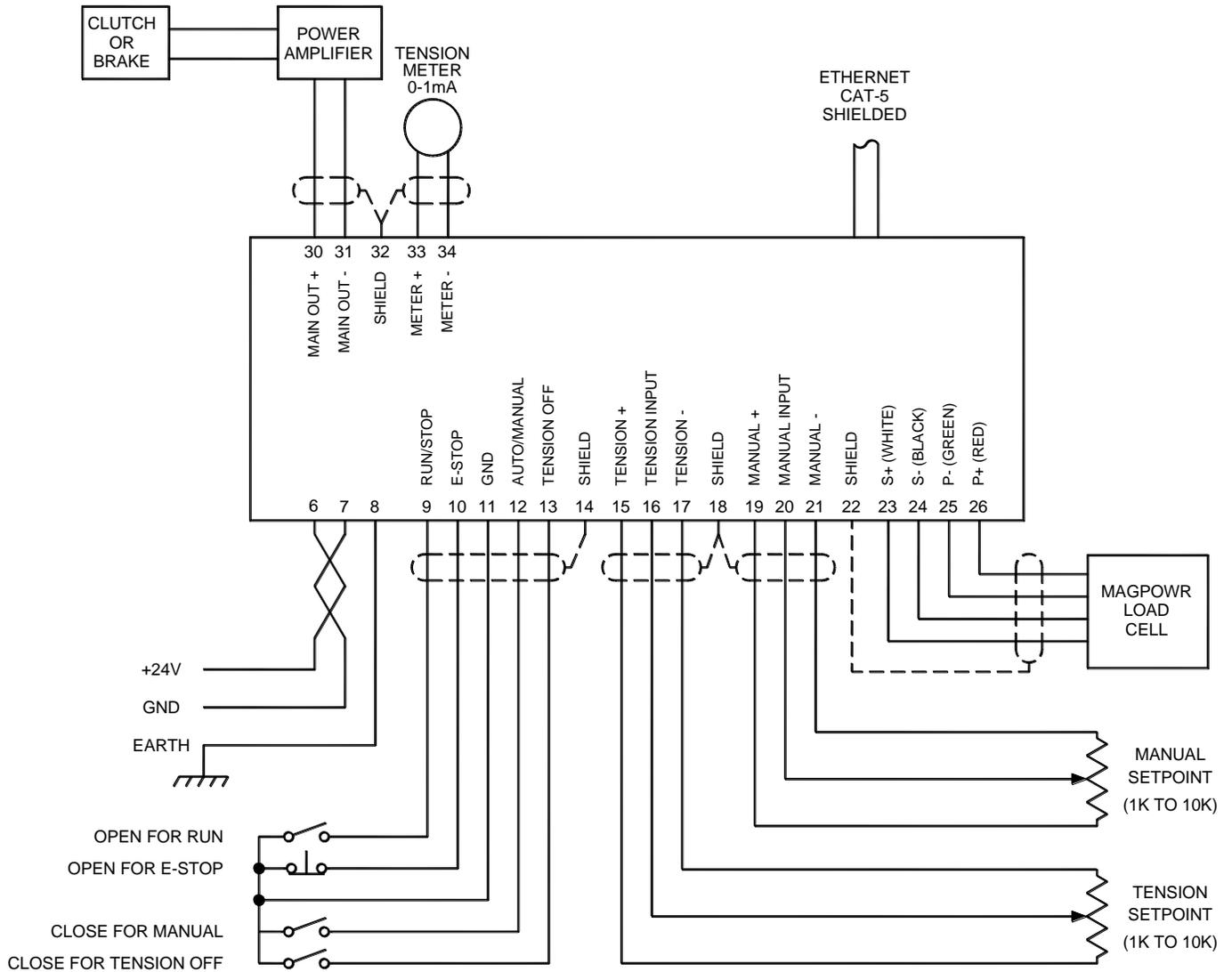


Figure 9. Complete Load Cell System Wiring

6.7 Load Cell Control Diagram

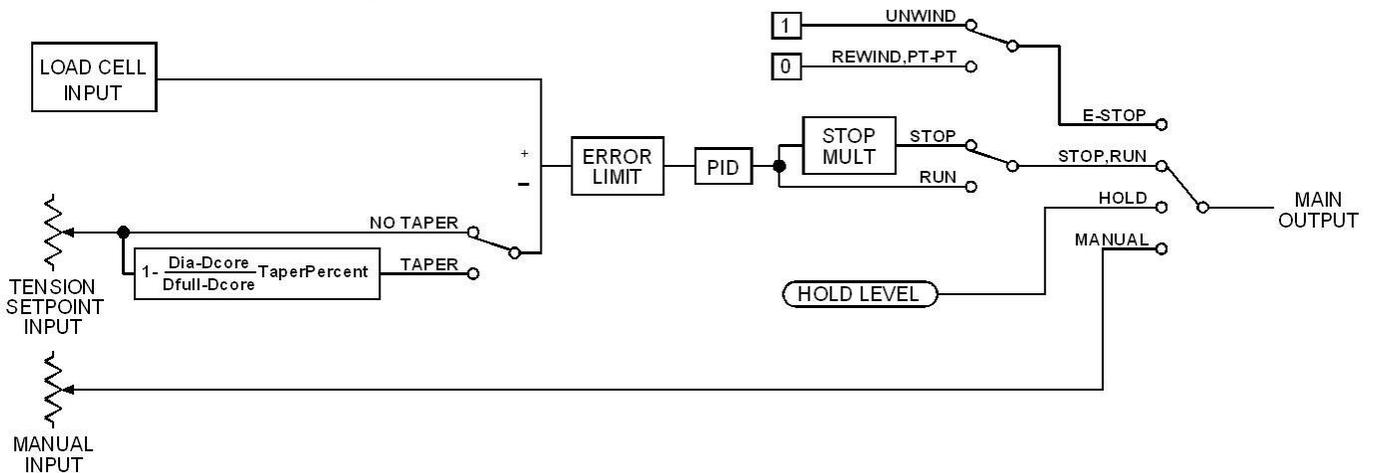


Figure 10. Load Cell Control Diagram

7.0 DANCER CONTROL

7.1 ELECTRICAL CONNECTIONS

Figure 11 shows the basic connections for the Spyder Dancer control system. See Figure 15 for complete connections. The "Tension Off" connection is not required. The simplest and minimal connections are:

- 24 VDC power
- Earth ground
- MAGPOWR DFP or DFP-2 dancer position potentiometer
- RUN/STOP switch using the Spyder internal logic supply
- E-Stop jumper between Term.10 and Term.11 (This is supplied by default from the factory)
- Potentiometer (1K to 10K ohm) for position setpoint. Alternately Setpoint can be set using the Ethernet port or the Setpoint screen. Choose the Setpoint Source from the Configure menu.
- Output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc.

Route power wiring away from sensor and control wiring. Run all wiring in shielded cable except for the 24 VDC power which may be twisted pair. Connect cable shields to the terminals provided. Maximum shield length and maximum length of wires outside of the shield is 1.5 inches (38 mm).

The load cell connections and signal inputs and outputs are Earth ground referenced. The power input circuit is not isolated, since the negative lead of the 24 VDC power input is Earth ground referenced.

See Figure 12 and Section 7.3 for connecting the DFP or DFP-2 (Dancer Follower Potentiometers) according to the Dancer system types.

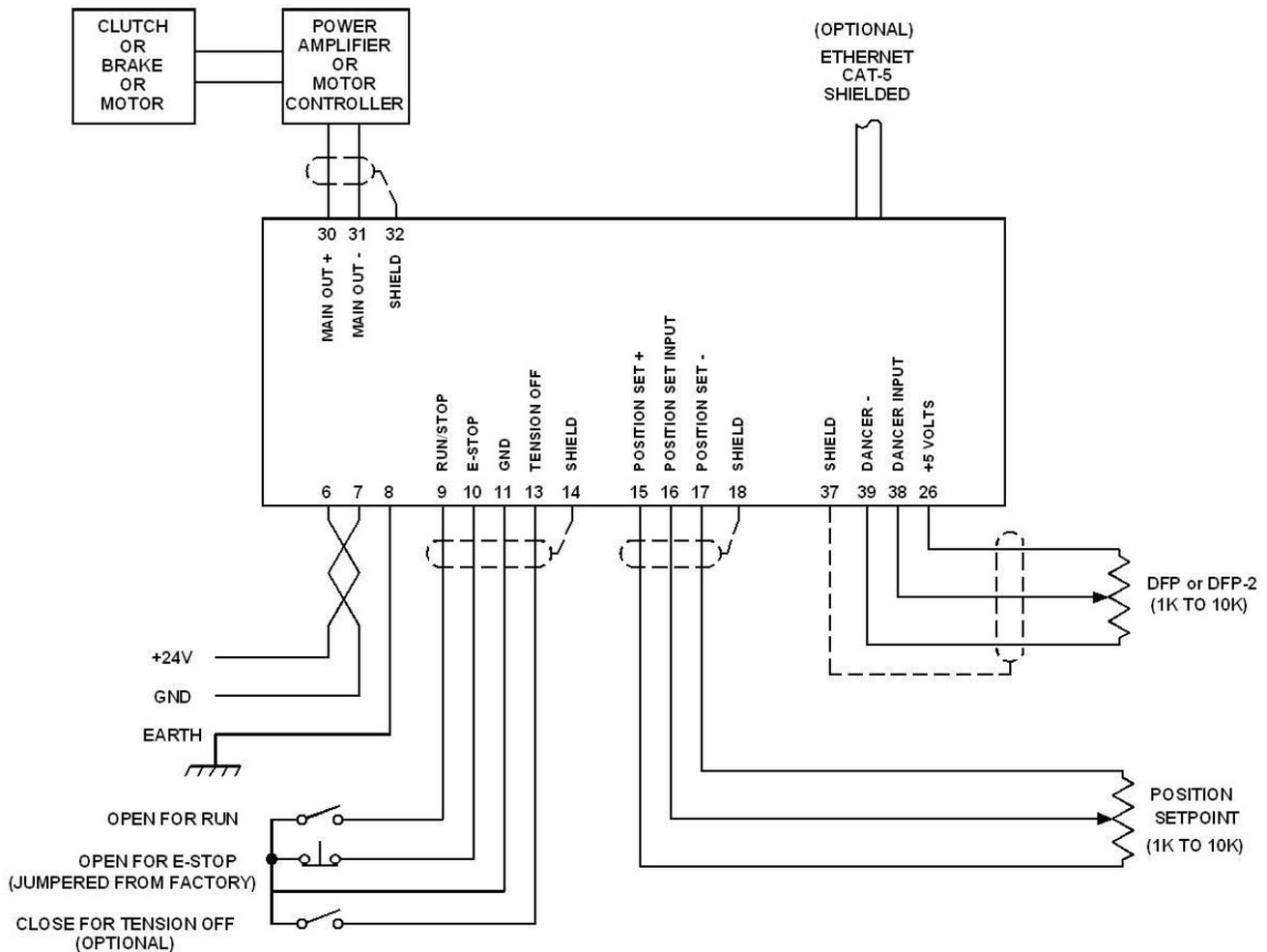
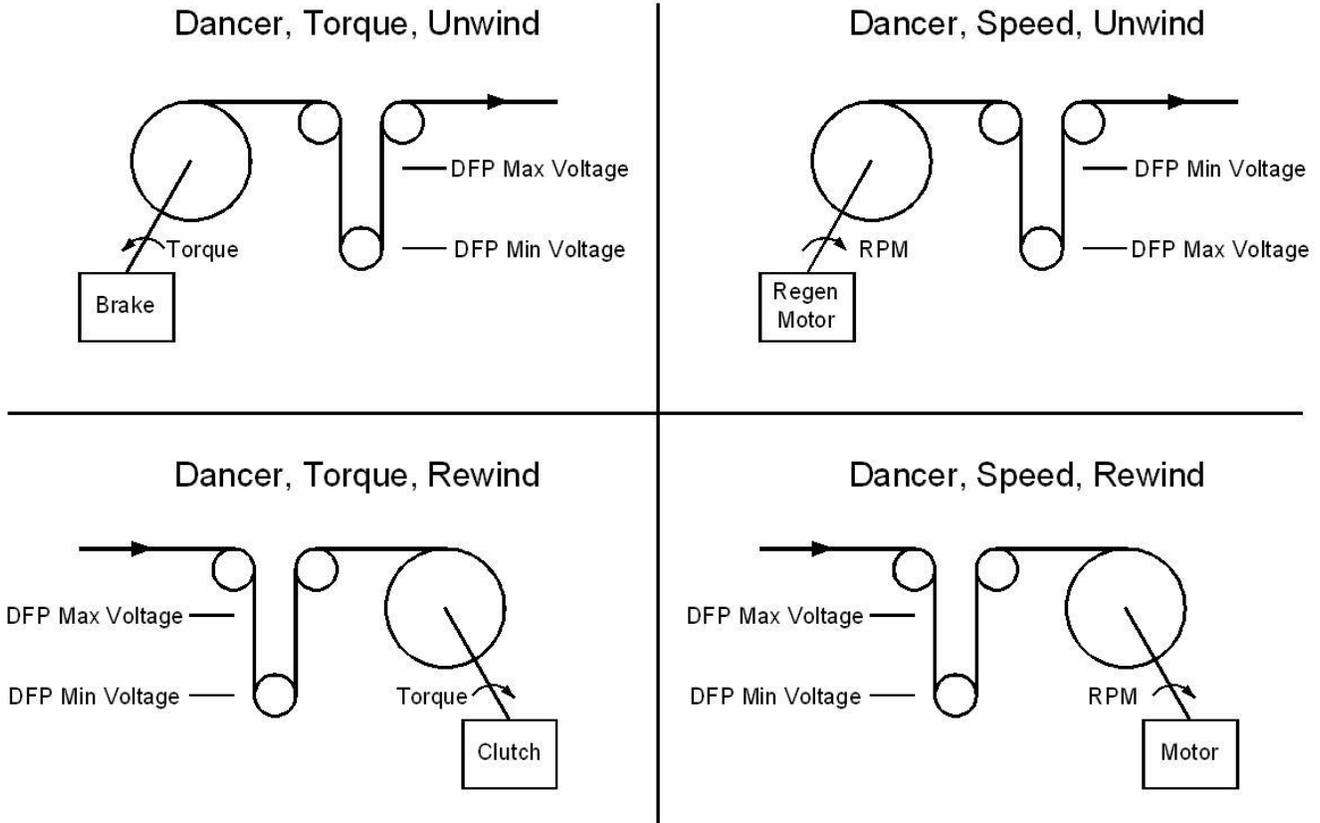


Figure 11. Basic Dancer Wiring

7.0 DANCER CONTROL

DFP Voltage Change with Dancer Movement



DFP Voltage measured between Term 38 and 39 with Term 39 negative.

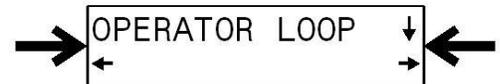
Figure 12. DFP Connections

7.2 SOFTWARE CONFIGURATION FOR DANCER SYSTEM

Refer to the Dancer, Torque or Dancer, Speed screen flowcharts in drawing number 850B327 for a navigation aid.

7.2.1 OPERATOR LOOP MENU

This section describes all the screens in the Operator Loop menu. All screens are display only.



7.2.1.1 POSITION

This screen shows the actual measured position in numeric and bar graph form. The bar graph shows the dancer arm position and is scaled from 0 to 100%. The lower left character displays the status of the Spyder.

- E = E-Stop
- H = Hold
- s = Start
- A = Automatic (Run)
- S = Stop
- OFF = Tension OFF



7.0 DANCER CONTROL

7.2.1.2 SETPOINT POSITION

Setpoint Position is set by the voltage on Term.16. When Setpoint Source is Ethernet this screen may be used to enter a desired setpoint by pressing the ENTER key or using the LEFT and RIGHT ARROW keys. Note: for P or PD type control the dancer position will not be the same as the position setpoint. If Proportional Gain is high enough the dancer position will be approximately equal to the position setpoint. When Setpoint source is Ethernet and control type is P or PD the setpoint may exceed 100%.

SETPOINT	←-	→
POSITION	XXXX	%

7.2.1.3 OUTPUT LEVEL

This screen shows the actual output level of the Spyder in numeric form. The bar graph also shows actual output level in analog form. The lower left character displays the status of the Spyder. See Section 7.2.1.1 for description of the status character.

7.2.1.4 TENSION

This screen shows the actual measured tension in numeric and bar graph form if the load cells are enabled in the Configure menu. The bar graph shows measured tension and is scaled to the maximum tension set during calibration of the load cells. The lower left character displays the status of the Spyder. See Section 6.3 to calibrate the load cells.

	TENSION
H	36.5 LB

7.2.2 CONFIGURE MENU

Navigate to the **Configure** menu. Press ↓. This section describes all the screens in the Configure menu. This menu contains screens which configure various options.



7.2.2.1 CONTROL TYPE

Select the control type either "Dancer, Torque" or "Dancer, Speed". Dancer, Torque is for dancers using using a torque device (clutch or brake), and Dancer, Speed is for dancers using a speed device (motor). If a motor is used for a dancer system, speed mode is recommended. If a motor is used on an unwind system for dancers, it must be regenerative so that energy is removed from the system.

7.2.2.2 TUNING TYPE

When controlling a dancer in either torque or speed mode, an integrator can optionally be used in the control. The integrator will keep the dancer in the same position as the roll builds or as dancer loading is adjusted. Many systems do not need the integrator since the gain of the system is very high. Systems with integrators are sometimes more difficult to stabilize. Integrator control is selected by choosing PID in torque mode or PI in speed mode.

7.2.2.3 SYSTEM TYPE

Select the appropriate system type for the application either rewind or unwind. See Figure 12 and Section 7.3 for proper connection of the dancer potentiometer voltage based on the System Type and Control Type.

7.2.2.4 USE LOAD CELLS

Enables reading of the load cells while in Dancer mode. See Section 6.3 to calibrate load cells.

7.2.2.5 OUTPUT RANGE

Select the main output range. For a main output range of either 0-10 VDC or 4-20 mA DC select NORMAL. For the -10 to +10 VDC range select "-10V to +10V". The software is factory calibrated for the 0-10 VDC and the -10 to +10 VDC output ranges. See Section 9.4 for recalibrating the output when using the 4-20 mA DC range. See Figure 4 for jumper settings.

7.2.2.6 SETPOINT SOURCE

Select the source for the dancer setpoint. When set to ANALOG the Spyder will use voltage on the terminal 16 as the dancer position setpoint. When set to ETHERNET the Spyder will use the software value of setpoint position. This value may be changed either at the keypad, the web page or by Modbus/TCP. Use the "Setpoint Position" screen in the "Operator Loop" to change the software setpoint.

7.0 DANCER CONTROL

7.2.2.7 DIGITAL INPUT ACTIVE LEVEL

The digital control inputs may be either Active Low or Active High. The software is factory configured for Active Low inputs. See Section 5.2 and Figure 4.

7.2.2.8 INITIAL SCREEN

The first screen after power-up is the "Operator Loop" screen. This parameter allows the initial power-up screen to be changed to either the "Position" screen, Section 7.2.1.1 or the "Output Level" screen, Section 7.2.1.3.

7.2.2.9 NUMERIC UPDATE RATE

This parameter controls the filtering for the numeric actual position and the actual output displays. Default values work well in most applications.

7.2.2.10 BAR GRAPH UPDATE RATE

This parameter controls the filtering for the bar graph actual position and the actual output displays. Default values work well in most applications.

7.2.2.11 SCREEN CONTRAST

This screen allows adjustment of the screen contrast. See Section 10.1, General Problems, when screen shows no characters.

7.3 DANCER INPUT SETUP (REQUIRED)

7.3.1 Setup DFP or DFP-2

7.3.1.1 DFP

Install the DFP sensor so that its keyway is pointing towards the top cover when the dancer is half way through its travel. This is an approximate adjustment, and is intended to center the sensor position to allow maximum rotation in both directions during operation.

7.3.1.2 DFP-2

To find the electrical center point of pot rotation, use a digital multimeter type ohm meter to measure from the white wire (wiper), to the red or black wire. Turn the potentiometer shaft until the meter reads 500 ohm. Install the DFP-2 sensor so that at the 500 ohm meter reading, the dancer is halfway through its travel.

7.3.1.3 Check DFP or DFP-2 voltage

Verify the dancer voltage between Term. 38 and Term. 39 matches the voltage change with dancer movement as shown in Figure 12. If the dancer voltage is opposite that shown in the figure, simply swap the wires on Term. 39 and Term. 26. This will reverse the dancer voltage change.

7.4 DANCER CALIBRATION (REQUIRED)

Navigate to the **Cal Dancer** menu. Press the ↓ arrow and the screen should show:



This screen allows the selection for calibrating either the Dancer Input or the Position Setpoint input. The input from the dancer position sensor and from the position setpoint should both be calibrated. Both are calibrated in the same way. Press either the ← or → key to begin a calibration.

7.0 DANCER CONTROL

7.4.1 DANCER INPUT CALIBRATION

7.4.1.1 Apply Minimum Dancer Voltage

Move the dancer arm so that it is against the stop in the direction that provides the minimum voltage. Maximum and minimum input voltages are defined as shown in Figure 12. Press ↓.

7.4.1.2 Apply Maximum Dancer Voltage

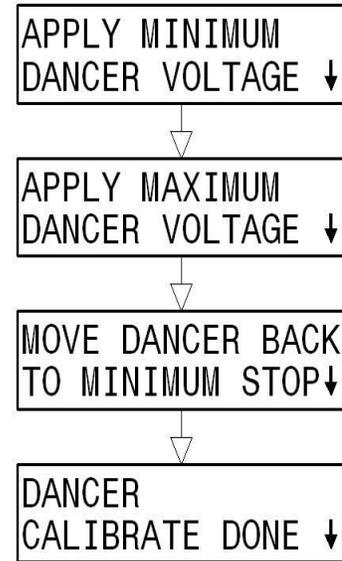
Move the dancer arm so that it is against the stop in the direction that provides the maximum voltage. Maximum and minimum input voltages are defined as shown in Figure 12. Press ↓.

7.4.1.3 Move Dancer Back

Move the dancer arm back to the stop with the minimum voltage. This step verifies that the dancer potentiometer does not move past the end of the resistance element. When the software determines the pot is wired correctly the Dancer Calibrate Done screen will appear.

7.4.1.4 Dancer Calibration Done

Dancer Input calibration is now complete. Press ↓.



7.4.2 POSITION SETPOINT CALIBRATION

During normal operation, applying the minimum voltage to the position setpoint input will command the dancer to its minimum voltage position. Applying the maximum voltage will command the maximum voltage position. This calibration is not required when the setpoint source is Ethernet.

7.4.2.1 Apply Minimum Setpoint Voltage

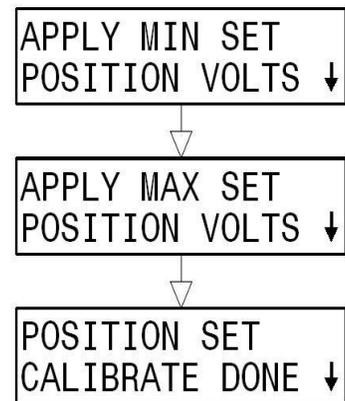
Adjust the position setpoint input to the minimum voltage. Press ↓.

7.4.2.2 Apply Maximum Setpoint Voltage

Adjust the position setpoint input to the maximum voltage. Press ↓.

7.4.2.3 Setpoint Input Calibration Done

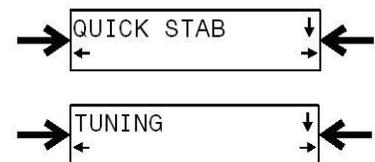
Setpoint Input calibration is now complete. Press ↓.



7.5 TUNING (REQUIRED)

Three steps are involved

- 1) Set the position setpoint potentiometer to the midpoint.
- 2) “Quick Stab” to get the control loop stable if upon start-up the default parameters do not provide a stable closed loop. See Section 7.5.1.
- 3) “Tuning” optimizes the Spyder by first tuning to make the system slightly unstable; then adjusting the tuning parameters to make it stable. By doing so the system is tuned to be as responsive as possible and still remain stable throughout its range of operation. See Section 7.5.2.



NOTE: Applies to Setpoint Source is Analog. The position setpoint input is not active during tuning. The UP and DOWN arrow keys are used to change dancer position instead. For this reason, the web must be stopped (Run/Stop = Stop) and restarted (Run/Stop = Run) to leave the tuning screens. A screen is provided to warn the

7.0 DANCER CONTROL

operator of this. Since tuning cannot be done while the web is stopped, the Spyder automatically returns to the

Tuning Menu when the web is stopped. Make sure to set the position setpoint potentiometer to the midpoint before restarting after tuning.

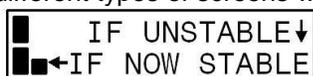
NOTE: Applies to Setpoint Source is Ethernet. The position setpoint can always be changed during tuning either by Ethernet or by the UP and DOWN arrow keys. The dancer does not need to be stopped to exit the Tuning screens.

7.5.1 QUICK STABILIZE – FIRST STEP

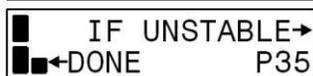
Default tuning parameters are embedded in the Spyder and were selected to minimize instability. If the system is exhibiting extreme fluctuations at start-up, perform the following procedure to quickly stabilize it. Fine-tuning using "Tuning" will still be required. **NOTE:** The system must be running to Quick Stabilize.

Navigate to the **Quick Stab** menu and press ↓. If the system is unstable then press the arrow key associated with the "If Unstable" text until the system is stable. If the system is stable then press the arrow key associated with the text "If Now Stable" or "Done".

Two different types of screens will appear while performing the Quick Stabilize tuning:

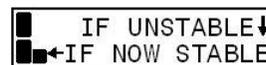


See 7.5.1.1 Quick Stabilize, Integrator Test



See 7.5.1.2 Quick Stabilize, Parameter Adjustment

7.5.1.1 Quick Stabilize, Integrator Test

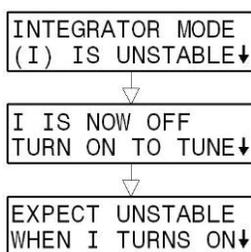


Bar Graph of Position ↑

This screen is entered if the system is not yet stable, and the integrator was on. The integrator was turned off as this screen was entered. This checks to see if the integrator is causing the instability.

If the system is still unstable, the integrator is not causing the instability. Pressing ↓ will switch to a screen similar to 7.5.1.2 to stabilize the proportional gain.

If the system is now stable, then the integrator is the cause of the instability (it is now off.) Pressing ← provides a series of screens explaining this.

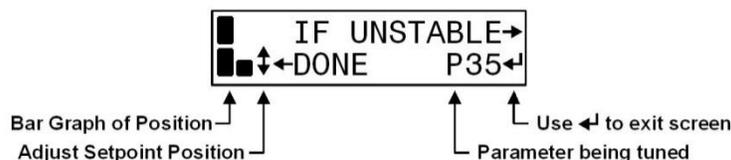


Press ↓ to turn on the integrator and quick stabilize "I". A screen similar to 7.5.1.2 will be used to stabilize "I".

7.5.1.2 Quick Stabilize, Parameter Adjustment

If this screen appears press **If Unstable**→ to immediately try to stabilize. Press ↑ or ↓ to reposition the dancer if necessary. The position setpoint input is not active during tuning. The Spyder automatically steps through several separate stages in an attempt to stabilize the process.

The Quick Stab screens are all similar to this one:



7.0 DANCER CONTROL

Besides “P” the parameter being tuned can also be “I”. The number next to this letter is not the value of the parameter. It is there to show the progress of the tuning. Its value can be between 00 and 99. 00 is displayed when that parameter is as stable as it can be. When the system is stable, press ←**Done**. The Spyder will tell you which parameter should be retuned such as:

RE - TUNE P AT CORE	↓
------------------------	---

Pressing ↓ will automatically take you to the correct parameter to be retuned. This particular message needs some comment. Retune **P** at the present diameter (not at core or full roll) if P was previously tuned at core (full roll) and this message repeatedly comes up. For large roll builds the system may need to be Quick Stabilized a few times while a roll is being wound or unwound for the first time.

Note that Error Limit is not tuned by the tuning screens. Decreasing Error Limit can sometimes stabilize a system, but increasing it will not usually cause a system to become unstable. If the tuning procedures fail to produce a stable system it may be necessary to manually decrease the Error Limit parameter. The system can be made less responsive by decreasing the Error Limit.

7.5.2 OPTIMIZE TUNING - SECOND STEP

7.5.2.1 Dancer, Torque

Navigate to the **Tuning** menu and press ↓. For a Dancer in Torque mode one of the following screens will be displayed depending on the tuning type selected:

←FIRST P AT CORE THEN D AT FULL→	PD Tuning
←FIRST P AT CORE THEN ID AT FULL→	PID Tuning

The Spyder should be optimized at or near core first. On unwinds “Quick Stab” may be needed while an initial roll is unwound.

The Spyder should be optimized at full roll only after it has been optimized at core. On rewinds “Quick Stab” may be needed to keep the system stable while a roll is wound.

See 7.5.2.3 for a typical tuning screen.

7.5.2.2 Dancer, Speed

Navigate to the **Tuning** menu and press ↓. For a Dancer in Speed mode one of the following screens will be displayed depending on the tuning type selected:

←TUNE P AT FULL	P Only Tuning
←FIRST P AT FULL THEN I AT CORE→	PI Tuning

The Spyder should be optimized at or near full roll first. On rewinds “Quick Stab” may be needed while a full roll is wound.

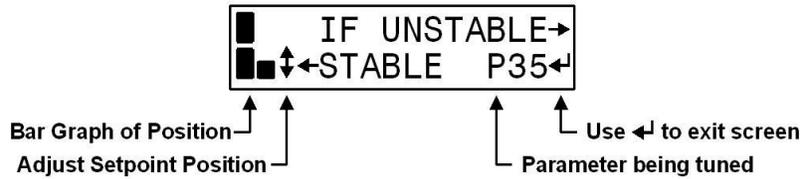
The Spyder should be optimized at core (PI tuning) only after it has been optimized at full roll. On unwinds “Quick Stab” may be needed to keep the system stable while an initial roll is unwound.

See 7.5.2.3 for a typical tuning screen.

7.0 DANCER CONTROL

7.5.2.3 Tuning Screens

Tuning allows the operator to optimize tuning parameters by using one button to destabilize the system and another button to stabilize the system. NOTE: The system must be running to perform Tuning. A typical tuning screen looks like this:



Press \uparrow or \downarrow to reposition the dancer if necessary. The position setpoint analog input is not active during tuning. For setpoint source equal to Ethernet the setpoint can be changed over Ethernet while in tuning mode. Besides "P" the parameter being tuned can also be "I" or "D". The number next to this letter is not the value of the parameter. It is there to show the progress of the tuning. Its value can be between 00 and 99. 00 is displayed when that parameter is as stable as it can be. To optimize press \leftarrow until the system starts to become unstable. Then press \rightarrow until stability is again obtained. When finished tuning press \downarrow to exit the screen. The web must be stopped in order to exit back to the "Tuning" menu when the setpoint source is set to Analog.

NOTE: Applies to Setpoint Source is Analog. The position setpoint input is not active during tuning. The UP and DOWN arrow keys are used to change dancer position instead. For this reason, the web must be stopped (Run/Stop = Stop) and restarted (Run/Stop = Run) to leave the tuning screens. A screen is provided to warn the operator of this. Since tuning cannot be done while the web is stopped, the Spyder automatically returns to the Tuning Menu when the web is stopped. Make sure to set the position setpoint potentiometer to the midpoint before restarting after tuning.

NOTE: Applies to Setpoint Source is Ethernet. The position setpoint can always be changed during tuning either by Ethernet or by the UP and DOWN arrow keys. The dancer does not need to be stopped to exit the Tuning screens.

7.6 Dancer, Torque Control Diagram

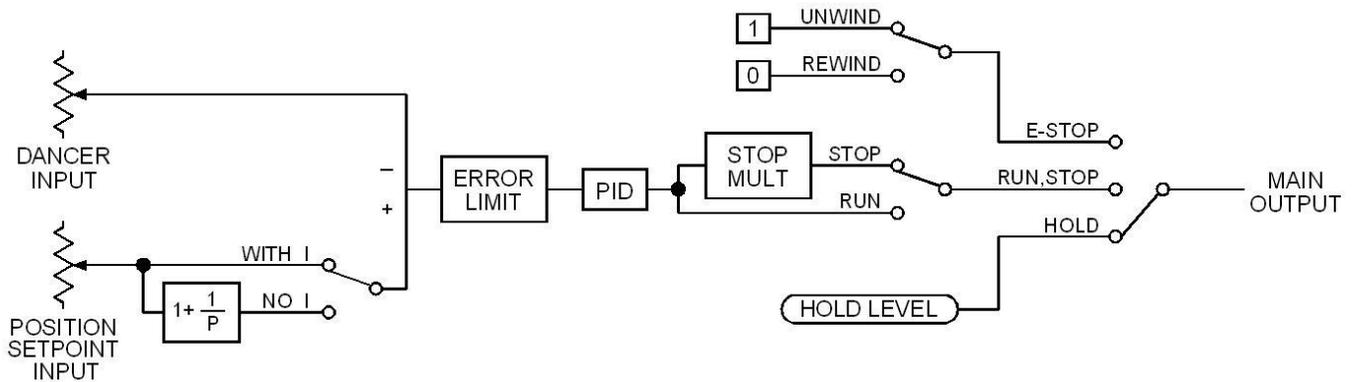


Figure 13. Dancer, Torque Control Diagram

7.0 DANCER CONTROL

7.7 Dancer, Speed Control Diagram

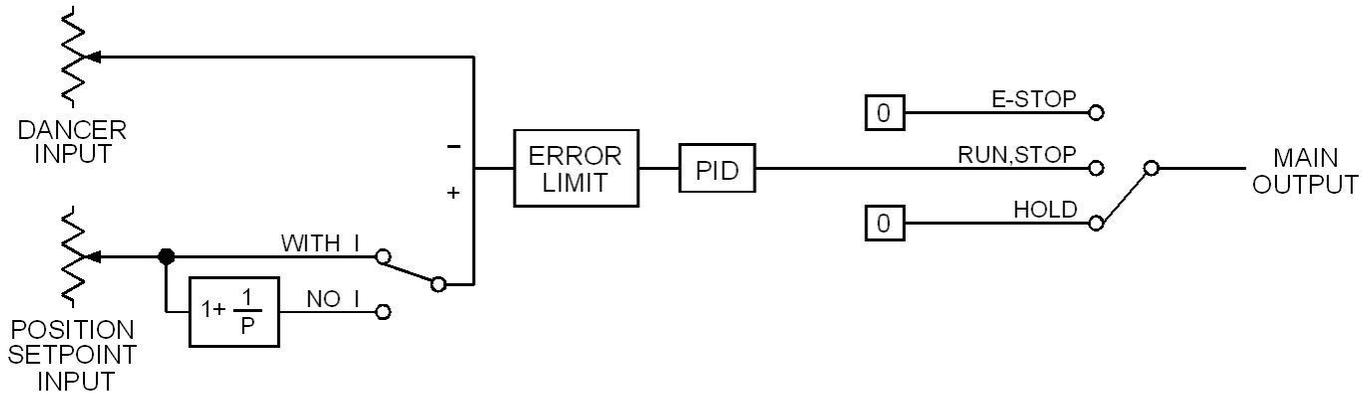


Figure 14. Dancer, Speed Control Diagram

7.8 Dancer System Complete Wiring

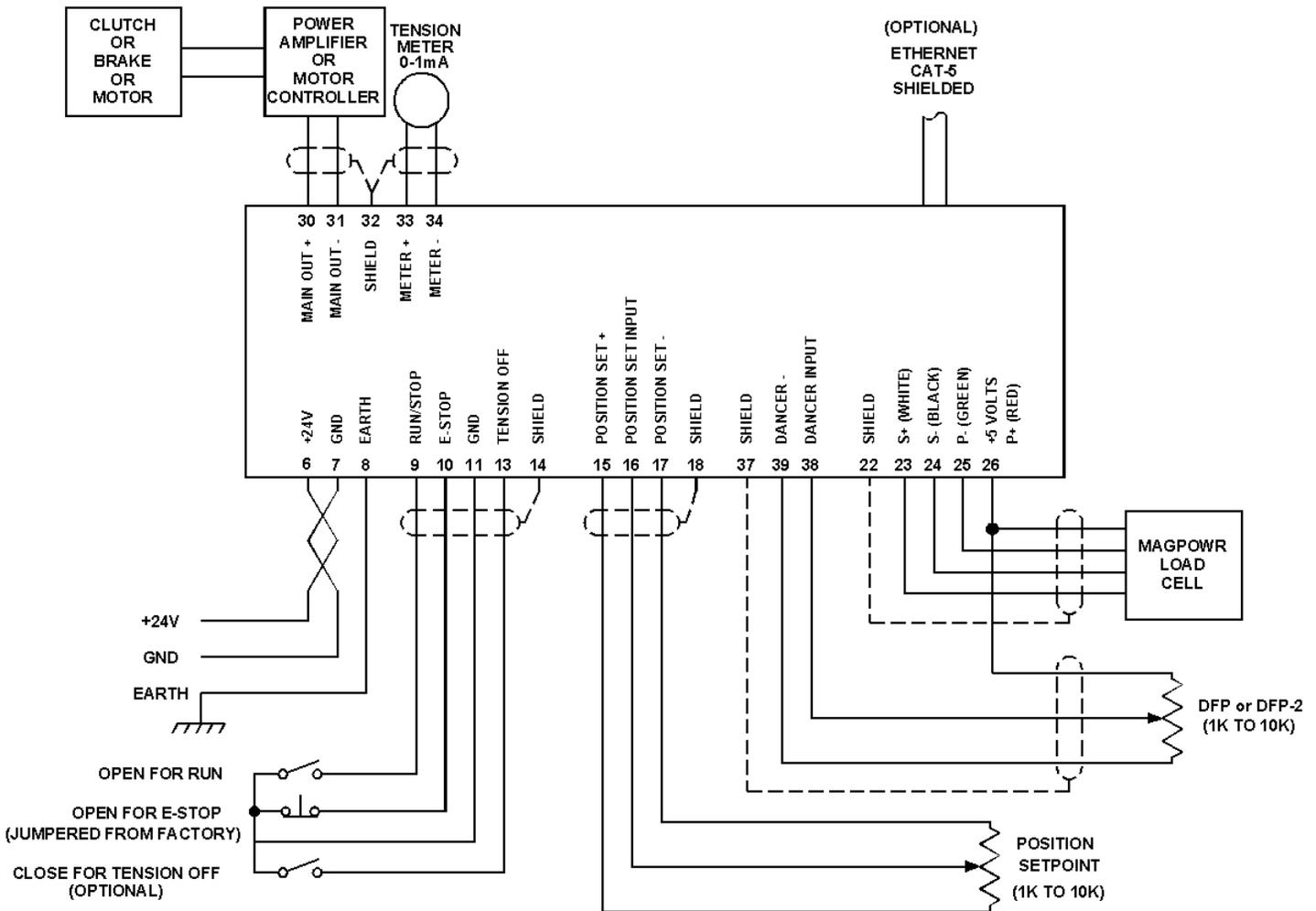


Figure 15. Complete Dancer System Wiring

8.0 OPEN LOOP TENSION CONTROL BASED ON DIAMETER

8.1 ELECTRICAL CONNECTIONS

Figure 16 shows the complete connections that are required for the Spyder-Plus open loop tension control system. The minimum connections are:

- 24 VDC power
- Earth ground
- Diameter sensor with voltage output proportional to diameter. Input between Term.38 and 39. For unwinds the diameter sensor should monitor the unwind diameter and for rewinds the rewind diameter.
- RUN/STOP switch using the Spyder-Plus internal logic supply
- E-Stop jumper between Term.10 and Term.11 (This is supplied by default from the factory)
- Potentiometer (1K to 10K ohm) for tension setpoint. Alternately, Setpoint Tension can be set using the Ethernet port. Choose the Setpoint Source from the Configure menu.
- Output to clutch or brake amplifier, current-to-pressure transducer, motor controller, etc.

Route power wiring away from sensor and control wiring. Run all wiring in shielded cable, except for the 24 VDC power which may be twisted pair. Connect cable shields to the terminals provided. Maximum shield length and maximum length of wires outside of the shield is 1.5 inches (38 mm).

The signal inputs and outputs are Earth ground referenced. The power input circuit is not isolated, since the negative lead of the 24 VDC power input is Earth ground referenced.

An inverse diameter output is available on the meter output to control the speed of rewinds to reduce the heat dissipation in a rewind clutch. See Figure 16.

8.2 SOFTWARE CONFIGURATION FOR OPEN LOOP TENSION SYSTEM

Refer to the Open Loop Tension screen flowchart in drawing number 850B327 for a navigation aid.

8.2.1 OPERATOR LOOP MENU

This section describes all the screens in the Operator Loop menu. All screens are display only except for Percent Taper.



8.2.1.1 TENSION

This screen shows the actual tension in numeric and bar graph form. This will be different from the setpoint tension when taper is enabled. The lower left character displays the status of the Spyder.

- E = E-Stop
- H = Hold
- s = Start
- A = Automatic (Run)
- S = Stop
- M = Manual mode
- OFF = Tension OFF



8.2.1.2 PRESENT DIAMETER

Present diameter displays the current diameter being input on Term. 38. See Section 8.3 for calibrating diameter.

8.2.1.3 SETPOINT TENSION OR CORE TENSION

Setpoint Tension (or Core Tension with taper) is set by the voltage on Term.16 (Setpoint Source = Analog) or via the Ethernet port (Setpoint Source = Ethernet). Setpoint Source is set in the Configure menu.

8.2.1.3.1 SETPOINT TENSION (No taper tension)

Display only.

8.2.1.3.2 CORE TENSION (With taper tension)

Display only. This is the setpoint at core diameter only. At other diameters the setpoint is less than the core setpoint if Taper Percent > 0.

8.0 OPEN LOOP TENSION CONTROL BASED ON DIAMETER

8.2.1.4 TAPER PERCENT

Enter the desired taper percentage. This screen will only be shown when taper has been enabled. See Section 8.4, Taper Setup.

Commanded tension at core = Core Tension.

Commanded tension at full roll = (Core Tension) * (1 – TaperPercent/100)

NOTE: The desired “% Taper” is dependent on material and machine type and is totally subjective. Determination of the correct amount of taper for your application is a trial and error process.

8.2.1.5 MANUAL LEVEL

This screen shows the manual level being input on Term.20.

8.2.1.6 OUTPUT LEVEL

This screen shows the actual output level of the Spyder in numeric form. The bar graph also shows actual output level in analog form. The lower left character displays the status of the Spyder. See Section 8.2.1.1 for description of the status character.

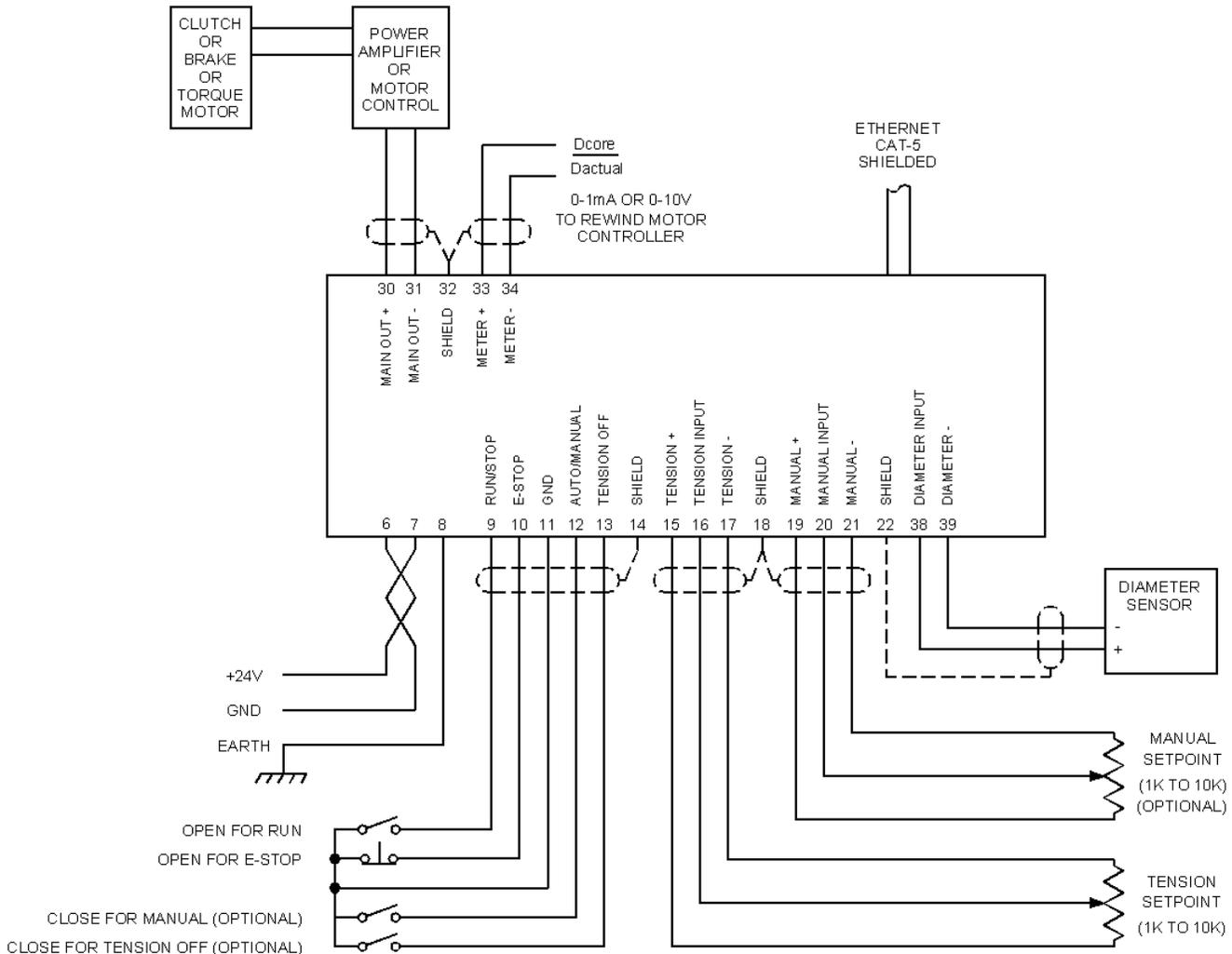
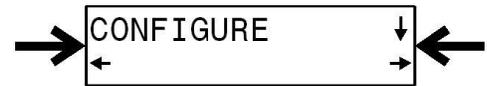


Figure 16. Complete Open Loop Tension System Wiring

8.0 OPEN LOOP TENSION CONTROL BASED ON DIAMETER

8.2.2 CONFIGURE MENU

Navigate to the **Configure** menu. Press ↓. This section describes all the screens in the Configure menu. This menu contains screens which configure various options.



8.2.2.1 CONTROL TYPE

Select the control type “Tension, Diameter”. Open Loop Tension systems must use a torque device; which can be a clutch or brake or motor in torque mode.

8.2.2.2 SYSTEM TYPE

Select the appropriate system type for the application, rewind or unwind.

8.2.2.4 USE TAPER

Enables tapering of tension as the roll diameter increases. See Section 8.4 for setup of taper.

8.2.2.5 OUTPUT RANGE

Select the main output range. For a main output range of either 0-10 VDC or 4-20 mADC select NORMAL. For the -10 to +10 VDC range select “-10V to +10V”. The software is factory calibrated for the 0-10 VDC and the -10 to +10 VDC output ranges. See Section 9.4 for recalibrating the output when using the 4-20 mADC range. See Figure 4 for jumper settings.

8.2.2.6 SETPOINT SOURCE

Select the source for the tension setpoint. When set to ANALOG the Spyder will use voltage on the terminal 16 as the tension setpoint. When set to ETHERNET the Spyder will use the software value of setpoint tension percent. This value may be changed either at the keypad, the web page or by Modbus/TCP. Use the “Setpoint Tension” screen in the “Operator Loop” to change the tension setpoint.

8.2.2.7 DIGITAL INPUT ACTIVE LEVEL

The digital control inputs may be either Active Low or Active High. The software is factory configured for Active Low inputs. See Section 5.2 and Figure 4.

8.2.2.8 INITIAL SCREEN

The first screen after power-up is the "Operator Loop" screen. This parameter allows the initial power-up screen to be changed to either the "Tension" screen, Section 8.2.1.1, the "Output Level" screen, Section 8.2.1.6, or the "Present Diameter" screen, Section 8.2.1.2.

8.2.2.9 NUMERIC UPDATE RATE

This parameter controls the filtering for the numeric actual tension and the actual output displays. Default values work well in most applications.

8.2.2.10 BAR GRAPH UPDATE RATE

This parameter controls the filtering for the bar graph actual tension and the actual output displays. Default values work well in most applications.

8.2.2.11 SCREEN CONTRAST

This screen allows adjustment of the screen contrast. See Section 10.1, General Problems, when screen shows no characters.

8.0 OPEN LOOP TENSION CONTROL BASED ON DIAMETER

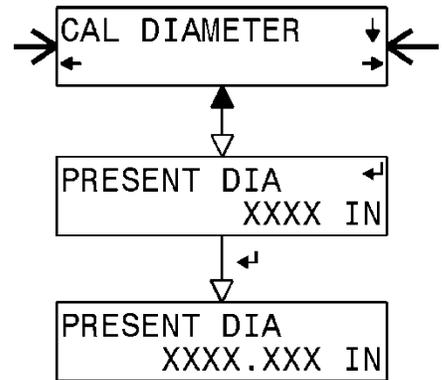
8.3 DIAMETER CALIBRATION (REQUIRED)

Navigate to the **Cal Diameter** menu and Press ↓.

The diameter calibration is a single point diameter calibration. Only the large diameter point is calibrated. The lower diameter calibration point is implied to be 0 volts input equals 0 diameter.

Input a voltage into the diameter input and press the ↵ key on the Present Diameter screen and enter a diameter that corresponds to the voltage input. Press the ↵ key to finish diameter calibration.

The Present Diameter screen actively displays the diameter. The Present Diameter screen is also available from the **Operator** menu.

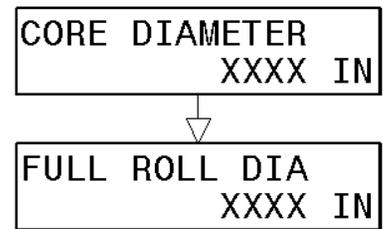


8.4 Core, Full Roll Diameter, and Taper Setup

8.4.1 Core and Full Roll Diameter (REQUIRED)

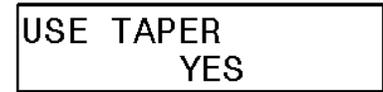
Navigate to the **Parameters** menu and Press ↓ to get to Core Diameter and Full Roll diameter. Enter the diameters.

Core Diameter is required for the inverse diameter output and Full Roll Diameter is required for normal operation.



8.4.2 Taper Setup

Navigate to the **Configure** menu and Press ↓ until **Use Taper** is displayed. Select “Yes” to enable Taper. Press ↓.



Taper percent is set in the **Operator** menu. See Section 8.2.1.4.

Basic setup of the open loop tension system is now complete. See Section 9.0 for optional settings.

8.5 Open Loop Tension Control Diagram

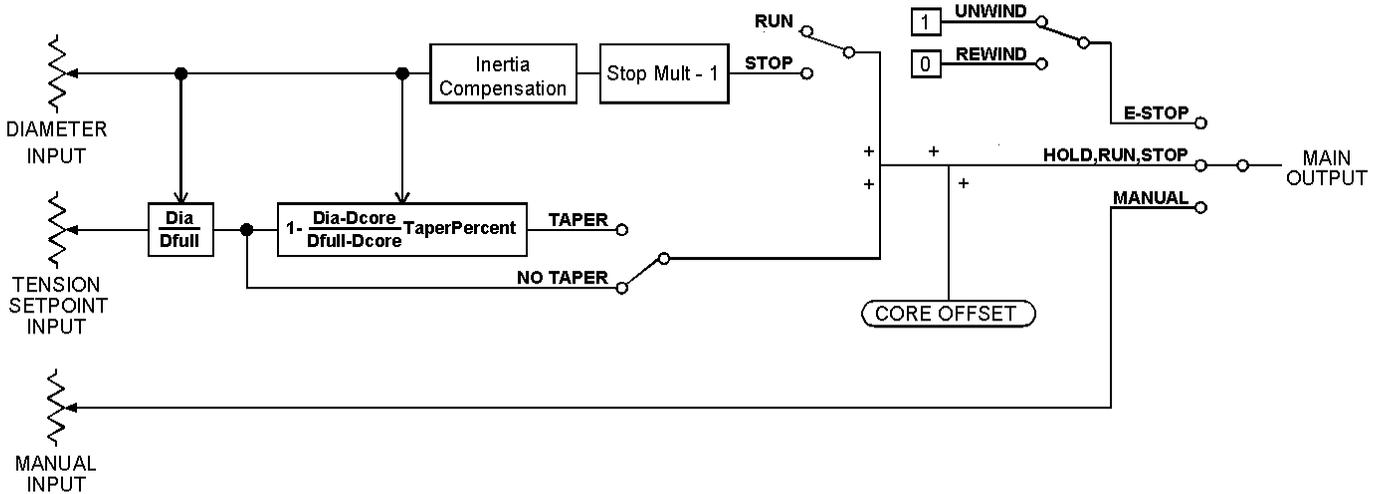


Figure 17. Open Loop Tension Control Diagram

9.1 PREFERENCES MENU

This section describes all the screens in the Preferences menu.



Navigate to the **Preferences** menu and Press ↓.

9.1.1 LANGUAGE

Select the language.

9.1.2 TENSION UNITS (Load cell systems and Dancer systems with Load Cells Enabled)

Select the Tension Units

9.1.3 DISTANCE UNITS (Load cell and Open Loop Tension systems only)

Select the Distance units.

9.2 TAPER TENSION SETUP

This section describes all the screens in the Taper menu.

Taper Tension is the reduction of tension as the diameter increases on a rewind. Taper Tension is desired on rewinds to prevent crushed cores and telescoping rolls caused by excess tension build up.

9.2.1 Taper with Load Cell Control

Diameter is estimated and must be calibrated to use taper tension.

Taper Percent, Section 6.2.1.3 must be set to "0" to calibrate taper.

Navigate to the **Taper Setup** menu and Press ↓.

Select "**Yes**" to enable Taper. Press ↓.

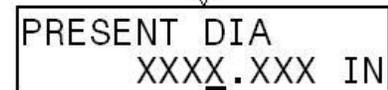
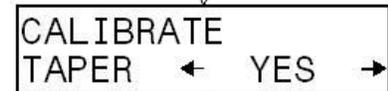
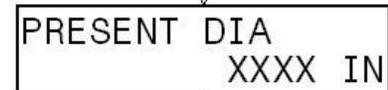
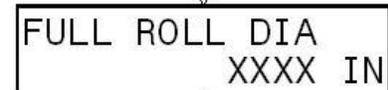
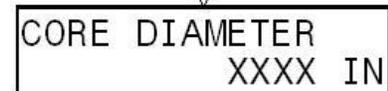
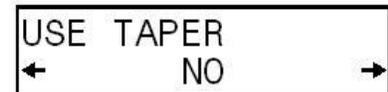
Enter the core diameter. The operator sets the setpoint tension only at core. The tension at all diameters greater than core is less than the Core Tension. Press ↓ when finished.

Enter the diameter of the full roll. The Core Tension and Percent Taper determine the tension at the full roll diameter. Press ↓ when finished.

This screen actively displays the diameter as estimated by the Spyder when in Run mode. Press ↵ to calibrate taper.

Select "**Yes**" and press ↓ to enter the Present Diameter. This screen defaults to "**No**" and helps prevent accidentally overwriting a previous calibration. Taper Percent, Section 6.2.1.3 must be set to "0" to calibrate taper.

Enter the present diameter. This should be the present diameter of the roll. The Spyder must be in Run mode. Press ↵ to finish the calibration.



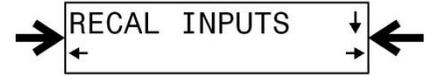
9.0 OPTIONAL FUNCTIONS

9.2.2 Taper with Open Loop Tension Control

See Section 8.4.

9.3 CALIBRATE INPUTS (Load cell and Open Loop Tension only)

Navigate to the **Recal Inputs** menu. Press the ↓ arrow.



Inputs for Dancers are calibrated in Section 7.4.

9.3.1 Select Setpoint Tension or Manual Voltage

When using an external voltage source for either Tension setpoint or Manual Level the inputs must be calibrated for the external voltage source minimum and maximum. These inputs are calibrated at the factory for use with a potentiometer connected across the appropriate terminals of the Spyder. Select either "Tension" or "Manual" and then Press ↓ key to begin a calibration.



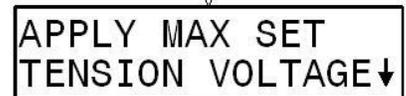
9.3.2 Apply Minimum Setpoint Tension or Manual Voltage

Apply the minimum Setpoint Tension or Manual voltage. Press ↓.



9.3.3 Apply Maximum Setpoint Tension or Manual Voltage

Apply the maximum Setpoint Tension or Manual voltage. Press ↓.



9.3.4 Calibration Done

The selected input calibration is now complete. Press ↓. This will return to the "Recal Inputs" menu.



9.4 CALIBRATE OUTPUTS

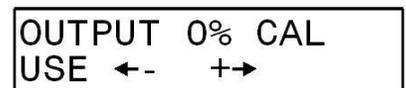
Navigate to the **Recal Outputs** menu. Press the ↓ arrow to begin calibration.



The tension meter output is calibrated at the factory and no adjustment should be required. The main output is calibrated at the factory for the 0-10 VDC and -10V to +10V output range. The main output will need to be recalibrated when choosing the 4-20 mADC range. See Section 6.2.2.3 or 7.2.2.5 or 8.2.2.5 and Figure 4 for configuring the output range.

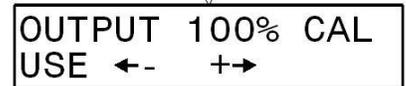
9.4.1 OUTPUT 0% CAL

Use the LEFT and RIGHT arrow keys to adjust the main output on Term.30 and Term.31 to 0 volts or 4 mADC. Press ↓ when finished.



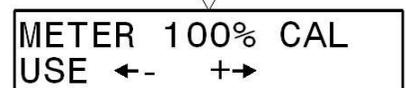
9.4.2 OUTPUT 100% CAL

Use the LEFT and RIGHT arrow keys to adjust the main output on Term.30 and Term.31 to +10vdc or 20 mADC. Press ↓ when finished.



9.4.3 METER 100% CAL (Load Cell systems and Dancer with Load Cells Enabled and Open Loop Tension systems)

Use the LEFT and RIGHT arrow keys to adjust the meter output on Term.33 and Term.34 to 1 mADC or 10 VDC. Press ↓ when finished.



9.0 OPTIONAL FUNCTIONS

9.5 SECURITY LOCK OUT

Navigate to the **Security** menu. The present state of security is shown (Not Secured or Secured). Press ↓ to enter the security code to either enable or disable the security lock.



This function allows you to lock all tuning, calibration and configuration parameters to prevent unauthorized tampering. Operators will still have access to tension/position setpoint, tension on/off, auto/manual, manual output and taper percent (NOTE: When selecting a security code be sure to record it.)

9.6 PARAMETERS MENU

This section describes all the screens in the Parameters menu.



Navigate to the **Parameters** menu and Press ↓.

9.6.1 PROPORTIONAL GAIN (Load Cell and Dancer Only)

Enter a value for the proportional gain. This tuning parameter adds a correction factor that is proportional to the deviation from the tension or position setpoint. A higher value will make the system more responsive but a proportional gain that is too high will result in an unstable system.

9.6.2 INTEGRATOR TIME (Load Cell and Dancer only)

Enter a value for the integrator time, which sets the basic response time of the system. A value that is too high will make the system less responsive to tension or setpoint errors, while a value that is too low will make the system quick but unstable.

9.6.3 DERIVATIVE TIME (Dancer Torque only)

Enter a value for the derivative time, which provides a response dependant on the rate of change of the position. A value that is too high will make the system sluggish, while a value that is too low will make the system unstable or cause the position to overshoot.

9.6.4 ERROR LIMIT (Load Cell and Dancer only)

Enter a value for the error limit between 10% and 100%. The error limit aids the tuning process by setting a boundary for the actual tension or position error that Spyder will recognize during control corrections. Smaller values for the error limit will lengthen the amount of time necessary for Spyder to correct large tension or position transients. Decreasing Error Limit can sometimes stabilize a system, but increasing it will not usually cause a system to become unstable. Therefore, "Optimizing" does not work for Error Limit.

Load Cell System

Error Limit may have been reduced during Quick Stabilize. The system can be made more responsive by increasing Error Limit in the Parameters menu.

Dancer System

Error Limit is not tuned by the tuning screens in Dancer mode. If the tuning procedures fail to produce a stable system it may be necessary to manually decrease the Error Limit parameter. The system can be made less responsive by decreasing the Error Limit.

9.6.5 CONTROL PARAMETERS FACTORY DEFAULTS

Factory Defaults	Load Cell System	Dancer, Torque System	Dancer, Speed System
Proportional	0	1.0	1.0
Integrator	2.0 Seconds	2.0 Seconds	2.0 Seconds
Derivative	N/A	1.25 Seconds	N/A
Error Limit	100%	100%	100%

9.6.6 START TIME (Load Cell Only)

Enter a value based upon the amount of time it takes your machine to ramp up from stopped to steady state operation. If the tension spikes during this time, try increasing this START TIME value.

9.6.7 STOP TIME

Enter a value based upon the amount of time it takes your machine to ramp down from steady state operation to a complete stop. When this time has expired, Spyder will automatically proceed into HOLD mode.

9.6.8 STOP MULTIPLIER (Not used on Dancer Speed)

Enter a value that will dictate the control output during STOP mode. Spyder will use the last control output sent during RUN mode before the STOP signal is received and multiply it by the value set here for the duration of the Stop Time. The control continues to control tension during the Stop Time. When the stop multiplier value is correctly set, it will automatically boost output to the braking device and decrease output to a clutch device during stops to keep the tension constant. For Load Cell systems only, STOP MULTIPLIER values less than 1.0 are used on unwinds when additional torque devices are activated during stop. For example, if the number of active actuators on a MAGPOWR Double Disk Pneumatic Brake is increased from 1 to 2 during stopping, set STOP MULTIPLIER to a value of 0.5. For a dancer system controlling a speed device the STOP MULTIPLIER is not used. For an open loop tension system Stop Multipliers less than 1.0 are used on Rewinds to decrease the torque to stop the roll and values greater than 1.0 are used on Unwinds to increase the torque to stop the roll.

9.6.9 HOLD LEVEL (Not used on Dancer Speed, or Open Loop Tension)

The output level of the Spyder will go to this value in Hold Mode. The Spyder switches to Hold Mode when the Run/Stop Input is closed. Hold Mode only occurs while in Auto. Hold mode is delayed Stop Time seconds after the Run/Stop input is closed.

9.6.10 CORE OFFSET (Open Loop Tension only)

The core offset will add or subtract a fixed value of torque from the output to allow adjustment of tension at core diameter. If tension is too high at core use a negative value for core offset. If tension is too low at core use a positive value for core offset. The range of this parameter is from -20% to 100%. The default is 0%.

10.0 TROUBLESHOOTING

Separate tables are provided for:

- 10.1 General Problems
- 10.2 Tuning problems (Load Cell Control)
- 10.3 Tuning problems (Dancer Control)
- 10.4 Load cell calibration problems
- 10.5 Load Cell Diagnostic Voltages

10.1 General Problems

Problem	Possible Cause	Solution or Diagnostic
Screen blank or all dark.	Contrast grossly misadjusted.	Remove power. Reapply power while holding down the keys ↓ and ←. The Spyder will be sweep through the contrast settings. When the contrast is at or near the desired level, press ↵. The Spyder will sweep through the contrast settings repeatedly until ↵ is pressed. The contrast can be refined in the Screen Contrast screen. See Section 13.1.
	Power supply is low.	See Section 14.0, Specifications.
Screen difficult to read	Contrast misadjusted	Adjust contrast in the Screen Contrast screen. This screen is the last screen in the Configure menu.
Output always high	E-Stop Active (unwinds)	For safety reasons E-Stop occurs with an open circuit. The logic is therefore different than the other digital inputs. E-Stop can also be mistakenly activated by selecting Digital Input Mode Active High when it is wired active low (and the other way around). See Section 5.2 and Figure 4.
	Process not running, but Spyder is in AUTO mode rather than in HOLD mode.	When the process is not running the tension/position control system is open loop. If the tension/position is even slightly below Setpoint, the Spyder will turn full ON attempting to correct the tension/position.
Output always low	Tension ON/OFF set to OFF	One or more of the external Tension On/Off switches is active. “Active” depends upon the Digital Input Mode. See Section 5.2 and Figure 4.
	E-Stop Active (All control types except unwind)	For safety reasons E-Stop occurs with an open circuit. The logic is therefore different than the other digital inputs. E-Stop can also be mistakenly activated by selecting Digital Input Mode Active High when it is wired active low (and the other way around). See Section 5.2 and Figure 4.
	Process not running, but Spyder is in Auto mode.	When the process is not running the tension/position control system is open loop. If the tension/position is even slightly above Setpoint, the Spyder will turn full off attempting to correct the tension/position.

10.0 TROUBLESHOOTING

10.2 Tuning Problems (Load Cell Control)

Problem	Possible Cause	Solution or Diagnostic
Tension unstable	Control not optimally tuned.	Use Quick Stabilize. Navigate to the QuickStab menu. Press the ↓ key and then press If Unstable→ to immediately try to stabilize. Review " Tuning " once stability is obtained. See Section 6.4.
"Cannot be stabilized." Appears while using quick stabilize.	To diagnose:	<ol style="list-style-type: none"> 1) Go to the Output Level screen to read the average output while running in AUTO mode. 2) Set the Manual Level to the average value. 3) Go to the Tension screen. 4) Toggle between AUTO and MANUAL modes. If the tension in MANUAL mode is NOT more stable than the tension in AUTO mode, the tension variations being observed are not caused by dynamic instability. They are disturbances generated by your process.
The message "Re-Tune P at core" repeatedly appears	The system is less stable at some intermediate roll diameter than it is at core.	When the message appears retune P at the present diameter rather than at core.

10.0 TROUBLESHOOTING

10.3 Tuning Problems (Dancer Control)

Problem	Possible Cause	Solution or Diagnostic
Position unstable	Control is not optimally tuned.	Use Quick Stabilize Navigate to the QuickStab menu. Press the ↓ key and then press If Unstable→ to immediately try to stabilize. Review " Tuning " once stability is obtained. See Section 7.5.
"Cannot be stabilized." Appears while using quick stabilize.	The dancer position sensor is "phased" incorrectly.	The dancer position sensor must be set up per Section 7.4 and Figure 12.
	The DFP or DFP-2 passes through its "dead" zone.	The dancer position sensor must be set up per Section 7.3 so that its voltage varies smoothly from min to max as defined in Figure 12. Verify that the dancer position signal varies smoothly using the Position screen in the Operator Loop.
The messages "Re-Tune P at core" or "Re-Tune P at full" repeatedly appear.	The system is less stable at some intermediate roll diameter than it is at core or full roll.	When the message appears retune P at the present diameter rather than at core or full roll.
Dancer position does not match the Setpoint	Low proportional gain	Optimize the proportional gain (P). This is done at core for torque systems and at full roll for speed systems. For P and PD control there must always be an error between the actual position and the setpoint position to produce an output. Adjust the position setpoint until the desired dancer position is achieved. Use PID (torque) or PI (speed). These can be selected on the Configure menu following selection of the Control Type .

10.0 TROUBLESHOOTING

10.4 Load Cell Calibration Problems

Problem	Possible Cause	Solution or Diagnostic
Cannot calibrate load cells.	Load cells wired incorrectly.	<p>Table 1 below gives voltages for various wiring errors. All voltages are measured with respect to Term.21.</p> <p>Opens on Term.23 and Term.24 cannot be found by measuring voltages. Remove power from the Spyder and measure resistance between (Term.23 and Term.25) and again between (Term.24 and Term.25). For one load cell both readings should be about 260 ohms. For two load cells both readings should be about 130 ohms.</p>
Message "Sensing roll too heavy"		<p>The roll supported by the load cells must weigh less than 1/2 of the total load cell rating (the sum of the two).</p> <p>This message also appears when there are load cell wiring errors. See "Cannot calibrate load cells" above.</p>
Message "Out of range at Max Tension"		<p>The Spyder has calculated that the load cell will be overloaded if the Maximum Tension specified is applied to the sensing roll. The Spyder will recommend a lower Maximum Tension to avoid this problem.</p>
Message "Signal too small at Max Tension"		<p>The Spyder has calculated that the load cell will have very light loading even when Maximum Tension is applied. The Spyder will recommend a higher Maximum Tension to avoid this problem. However, there is a strong possibility that a load cell was chosen with too high of a rating. Spyder will not calibrate if the force applied to the load cell at Maximum Tension is less than 1/8 of the total load cell rating.</p>
Message "Load cells are overloaded."		<p>The load applied to the sensing roll during calibration has exceeded the rating of the load cell.</p>
Message "Load very small. Maybe shorted."		<p>The signal read by the Spyder after load was applied is very small. There may be a short between Term.23 and Term.24.</p> <p>This message also appears if the calibration load was never applied to the sensing roll.</p>

10.0 TROUBLESHOOTING

10.5 LOAD CELL DIAGNOSTIC VOLTAGES

**TABLE 1
LOAD CELL DIAGNOSTICS**

21 mV Load Cells Measure all voltages with respect to TERM.21 Voltages are approximate. All voltages without a code that are not in the Normal Range are unspecified faults. Normal Range is 0.00 VDC +/- 0.25 VDC									
	TERM.23 (S+)	-5.0	-1.7	-1.0	0.00	1.0	1.7	2.5	5.0
TERM.24 (S-)									
-5.0		A			D				
-1.7			J		M		G		
-1.0						P			
0.00		C	L		Normal		O		E
1.0				Q					
1.7			H		N		K		
2.5								I	
5.0					F				B

CODE	One or Both 21 mV Load Cells (Could be either load cell or cable) Probable Fault
A	TERM.25 (P+) open
B	TERM.26 (P-) open
C	TERM.25 (P+) to TERM.23 (S+) leg open
D	TERM.25 (P+) to TERM.24 (S-) leg open
E	TERM.26 (P-) to TERM.23 (S+) leg open
F	TERM.26 (P-) to TERM.24 (S-) leg open
G	(TERM.25 (P+) and TERM.23 (S+) reversed) or (TERM.26 (P-) and TERM.24 (S-) reversed)
H	(TERM.25 (P+) and TERM.24 (S-) reversed) or (TERM.26 (P-) and TERM.23 (S+) reversed)
I	P- is wired to Ground. Should be wired to TERM.26.

CODE	One of Two 21 mV Load Cells (Could be either load cell or cable) Probable Fault
J	TERM.25 (P+) open
K	TERM.26 (P-) open
L	TERM.25 (P+) to TERM.23 (S+) leg open
M	TERM.25 (P+) to TERM.24 (S-) leg open
N	TERM.26 (P-) to TERM.23 (S+) leg open
O	TERM.26 (P-) to TERM.24 (S-) leg open
P	(TERM.25 (P+) and TERM.23 (S+) reversed) or (TERM.26 (P-) and TERM.24 (S-) reversed)
Q	(TERM.25 (P+) and TERM.24 (S-) reversed) or (TERM.26 (P-) and TERM.23 (S+) reversed)

11.0 ALPHABETICAL LIST OF SCREEN DEFINITIONS

11.0 The descriptions of individual screen functions are provided to aid the understanding of the control operation. Calibration and tuning procedures included in this manual must be used for proper operation. The information contained in this section is not sufficient to allow proper set-up.

Applied Tension	From Cal Sensors menu Enter a value corresponding to the amount of known weight to be used to calibrate the load cell(s). See also Section 6.3
Apply Minimum Dancer Voltage Or Apply Maximum Dancer Voltage	From the Cal Dancer menu. Calibration of the dancer position signal. The voltage must be between 0 VDC and 10 VDC. Minimum must be less than Maximum as defined in Figure 12
Apply Min Set Position volts ↓ Or Apply Max Set Position volts ↓	From the Cal Dancer menu. Calibration of the Position Setpoint analog input. The voltage must be between 0 VDC and 10 VDC. Minimum must be less than Maximum.
Apply Min Set Tension voltage ↓ Or Apply Max Set Tension voltage ↓ Or Apply Min Set Manual voltage ↓ Or Apply Max Set Manual voltage ↓	From Recal Inputs menu. Calibration of the Tension Setpoint and Manual Level analog inputs. Either input must be between 0 VDC and 10 VDC. Min must be less than Max. Apply the Min or Max voltage to the appropriate input and press ↓
Apply tension and press ↓	From Cal Sensors menu. Load cell calibration happens in two steps. In this second step the weight used to calibrate the load cells should be applied at this time. The weight should be applied near the center of the sensing roll using a rope or narrow web.
Bar Graph Rate	From Configure menu. Sets the update rate for the bar graphs on both the Tension/Position screens and the Output Level screen.
Cal Dancer ↓	One of the top level menu screens. Used to calibrate the dancer inputs.
Cal Diameter ↓	One of the top level menu screens. Used to calibrate diameter for Open Loop Tension systems.
Cal Sensors ↓	One of the top level menu screens. Used to calibrate the load cells.
Cal Setpoint Input ← Tension → Or Cal Setpoint Input ← Manual →	From the Recal Inputs menu. Used to select whether the Tension input or the Manual input will be calibrated. Use ← or → to select the input to calibrate.
Calibrate Taper (Yes/No)	From Taper Setup menu. When ↓ is pressed on the Present Dia screen, the operator is asked if taper should be calibrated. If “Yes” is selected the present diameter is entered next.

Cannot be stabilized	From Quick Stab or Tuning menus. See Tuning Problems above in Section 10.2 or 10.3.
Configure	One of the top level menu screens. Used to configure various parameters such as System Type, Output Range, Setpoint Source, Digital Input Active, Numeric Rate, Bar Graph Rate, and Screen Contrast.
Core Diameter	From the Taper Setup menu for load cell system and the Parameter menu for Open Loop Tension system. Enter the value for the diameter of the core.
Core Offset	From the Parameters menu for Open Loop Tension system. Enter a value to offset the torque output when at core diameter. See Section 9.6.10.
Core Tension	In the Operator Loop with taper tension enabled. This is a display only of the tension setpoint at core. This is not the setpoint at diameters other than core. The setpoint at diameters other than core is reduced by taper tension. The tension setpoint at core is set by either the Tension Input (Term.16 to Term.17) or by the Ethernet connection. The source of the setpoint at core tension is determined by Setpoint Source in the Configure menu.
Core tuning is optimal	From the Tuning menu for unwinds and rewinds. This screen announces that Proportional Gain has been increased to the maximum allowed during tuning (50). Proportional Gain can be set higher than this using the Parameters menu, but that is not recommended.
Control Type ← Load Cell→ or Control Type ← Dancer, Torque→ or Control Type ← Dancer, Speed→ or Control Type ← Tension, Diameter→	From the Configure Menu. Used to choose the type of control that will be used. When using load cells a torque device must be used. The torque device can be a clutch or brake or a motor in regenerative mode. In Dancer, Torque mode a clutch or brake should be controlled. If a motor is used in a dancer system, then Dancer, Speed should be used. For Open Loop Tension system a torque device must be used.
←Dancer Input Pos Setpoint→	From Cal Dancer menu. Used to select whether the Dancer Input or the Position Setpoint input will be calibrated.
Derivative Time	From the Parameters menu Set the derivative time. Derivative time is only used for Control Type "Dancer, Torque". The factory default is 1.25 sec.

Error Limit	<p>From the Parameters menu.</p> <p>Enter a value for the error limit between 10% and 100%. The error limit aids the tuning process by setting a boundary for the actual tension/position error that the Spyder will recognize during control corrections. Smaller values for the error limit will lengthen the amount of time necessary for Spyder to correct large tension/position transients. The factory default is 100%.</p>
First I at Full. Then P at core	<p>From the Tuning menu for Unwinds and Rewinds.</p> <p>Selects which parameter to optimize.</p> <p>The Spyder should be optimized at or near full roll first. On rewinds “Quick Stab” may be needed while a full roll is wound.</p> <p>The Spyder should be optimized at core only after it has been optimized at full roll. On unwinds “Quick Stab” may be needed to keep the system stable while an initial roll is unwound.</p>
FTP Address	<p>From the Network menu.</p> <p>Enter the address of the FTP site that will be used to obtain Spyder update programs.</p>
Full Roll Diameter	<p>From the Taper Setup menu for load cell system and the Parameter menu for Open Loop Tension system.</p> <p>Enter the value of the diameter of the full roll.</p>
Full roll tuning is optimal	<p>From the Tuning menu for unwinds and rewinds.</p> <p>This screen announces that Integrator Time has been decreased to the minimum allowed during tuning (0.01 seconds). Integrator Time can be set lower than this using the Parameters menu, but that is not recommended.</p>
Gateway Address	<p>From the Network menu.</p> <p>Enter the IP address of the gateway. The gateway is normally your router. If DHCP is enabled this address is ignored. This address is only needed if access to the world wide web is needed for updating the Spyder program.</p>
Hold Level	<p>From the Parameters menu.</p> <p>The output level of the Spyder will go to this value in Hold Mode. The Spyder switches to Hold Mode when the Run/Stop Input is opened. Hold Mode only occurs in while in Auto. Hold mode is delayed Stop Time seconds after the Run/Stop input is opened.</p>
<p>If Unstable →</p> <p>←Stable Pxx</p> <p>(Tuning)</p>	<p>From the Tuning menu.</p> <p>Two different screens look like this one. They are used to optimize the given parameter by first pressing → until the system becomes slightly unstable and then press ← to stabilize. See Section 6.4.2 or 7.5.2, Tuning.</p>

<p>If Unstable → ←Done Pxx</p> <p>(Quick Stab)</p>	<p>From the Quick Stab menu.</p> <p>Three different screens look like this one. They are used to quickly stabilize the system by pressing → until the system stabilizes. The Spyder automatically switches to the next screen if the most stable value of the parameter being tuned has not stabilized the system. The parameter being tuned is indicated by either a “P”, or an “I”.</p>
<p>If Unstable↓ ←If Now Stable</p>	<p>From the Quick Stab menu (dancers only).</p> <p>The screen appears if the integrator was originally on and is now off. If the system is now stable, the instability was caused by the integrator. A following series of screens explains this before the integrator is turned back on to stabilize the integrator.</p>
<p>“Integrator mode (I) is unstable” “I is now off. Turn on to tune” “Expect unstable when I turns on”</p>	<p>These message screens explain that the integrator is the cause of the instability.</p>
<p>Integrator Time</p>	<p>From the Parameters menu.</p> <p>Enter a value for the integrator time, which sets the basic response time of the system. A value that is too high will make the system less responsive to tension errors, while a value that is too low will make the system quick but unstable. Factory default setting is 2 seconds. Use of the integrator is optional on dancer systems.</p>
<p>IP Address</p>	<p>From the Network menu.</p> <p>The IP address assigned to the Spyder to connect to a network. If DHCP is enabled this address is ignored.</p>
<p>Load applied wrong way</p>	<p>From Cal Sensors menu</p> <p>The load applied to the load cell (during calibration and during normal operation) should be in the direction shown by arrows on the load cells. See load cell manual.</p>
<p>Load cells are overloaded.</p>	<p>A load cell calibration error message. See <i>Load Cell Calibration Problems</i> in Section 10.4.</p>
<p>Load very small. Maybe shorted.</p>	<p>From the Cal Sensors menu.</p> <p>This is a warning message during load cell calibration. See <i>Load Cell Calibration Problems</i> in Section 10.4.</p>
<p>Manual Level</p>	<p>In the Operator Loop.</p> <p>When Manual Mode is selected by the Auto/Manual input (Term.12) the Spyder control output is determined solely by the Manual Level input Term.20 to Term.21. This value is display only.</p>
<p>Maximum Tension</p>	<p>From Cal Sensors menu.</p> <p>Enter a value to set the upper limit of the tension range as read by the load cells. You should choose a value for the max tension that will have room for the highest setpoint tension you plan to run plus any tension errors that may occur during operation within limits of the load cell load rating. This setting also determines the scale for the analog displays.</p>

Meter 100% CAL	From the Recal Outputs menu. Used to calibrate the tension meter output (Term.33 to Term.34).when the tension is at Maximum Tension.
Modbus Address	From the Network menu. Sets the Modbus address of this Spyder.
Modbus Byte Order	From the Network menu. Determines whether Modbus data is sent with the most significant byte first or last.
Modbus Word Order	From the Network menu. Determines whether Modbus data is sent with the most significant word first or last.
Network	One of the top level menu screens. Used to set IP addresses, and other network parameters.
Numeric Rate	From the Configure menu. Use to adjust the update and filter rate of the numeric displays of tension/position and output.
Operator Loop	One of the top level menu screens. All screens in this menu are display only except for Taper Percent. This menu provides numeric and bar graph displays of setpoint and actual tension, position and output level. This is the default entry point for all operator displays.
Out of range at Max Tension	Error message during load cell calibration. See <i>Load Cell Calibration Problems</i> in Section 10.4.
Out of Range at Max Tension	From the Cal Sensors menu. See <i>Load Cell Calibration Problems</i> in Section 10.4.
Output 0% CAL	From the Recal Outputs menu. Used to calibrate the control output (Term.30 to Term.31) when 0% output is commanded.
Output 100% CAL	From the Recal Outputs menu. Used to calibrate the control output (Term.30 to Term.31) when 100% output is commanded.
Output Level	In the Operator Loop Actively displays the present output (Term.30 to Term.31) of the Spyder.
Parameters	One of the top level menu screens. Used to change parameters such as Proportional Gain, Integrator Time, Error Limit, Start Time, Stop Time, Stop Multiplier, and Hold Level.
Preferences	One of the top level menu screens. Used to select Language (English, Francais, Deutsche, Italiano, Espanol), Tension Units(lb, oz, Kg, N, g,), and Distance Units (in, ft, mm, cm, m)
Present Dia	In the Taper Setup menu for load cell system. Used to calibrate the diameter for use in taper tension. Displays the estimated diameter if diameter has been calibrated. In Cal Diameter menu for Open loop tension system. Used to calibrate the diameter. Diameter calibration is required.

Primary tuning is optimal	<p>From the Tuning menu for point to point systems.</p> <p>This screen announces that Integrator Time has been decreased to the minimum allowed during tuning (0.01 seconds). Integrator Time can be set lower than this using the Parameters menu, but that is not recommended.</p>
Program Number	<p>From the Network menu.</p> <p>The number of the program that will be downloaded from the FTP site to update the Spyder software.</p>
Proportional Gain	<p>From the Parameters menu.</p> <p>Enter a value for the proportional gain. This tuning parameter adds a correction factor that is proportional to the deviation from the tension setpoint. A higher value will make the system more responsive but a proportional gain that is too high will result in an unstable system. Factory default setting is 0 for load cell systems and 1.0 for dancer systems.</p>
Quick Stab	<p>One of the top level menu screens. Used to quickly stabilize an unstable system. After stabilizing, the system should be tuned using the Tuning menu.</p>
Recal Inputs	<p>One of the top level menu screens. Used to recalibrate the Tension setpoint input (Term.16 to Term.17) and the Manual setpoint input (Term.20 to Term.21).</p>
Recal Outputs	<p>One of the top level menu screens. Used to recalibrate the control output and the tension meter output.</p>
Retune I now, then retune P	<p>Part of Quick Stabilize on point to point systems. This screen appears when Quick Stabilize has stabilized the system while I is being adjusted. Immediately retune I. When I is optimum retune P.</p>
Retune I now. Then P at core.	<p>Part of Quick Stabilize on unwinds or on rewinds. This screen appears when Quick Stabilize has stabilized the system while I is being adjusted. Retune the system at the present diameter and then retune P when the system is again at core.</p>
Retune P at core.	<p>Part of Quick Stabilize on unwinds or on rewinds. This screen appears when Quick Stabilize has stabilized the system while P is being adjusted. If the present diameter is not the core diameter, retune P when the system is at core.</p> <p>Rarely, the system will be more stable at core than at some other diameter. Retuning at core will then cause the system to be unstable again when the less stable diameter is reached. In this case retune at the less stable diameter rather than at core.</p>
Retune P now.	<p>Part of Quick Stabilize on point to point systems. This screen appears when Quick Stabilize has stabilized the system while P is being adjusted. Immediately retune P.</p>
Screen Contrast	<p>From the Configure menu.</p> <p>Used to adjust the screen contrast. Use ← and → to adjust.</p>
Secondary tuning is optimal	<p>From the Tuning menu for point to point systems.</p> <p>This screen announces that Proportional Gain has been increased to the maximum allowed during tuning (50). Proportional Gain can be set higher than this using the Parameters menu, but that is not recommended.</p>

Secondary tuning is optimal.	From Cal Sensors menu for point to point systems. Informs the operator that the most aggressive value allowed for secondary manual tuning has been reached. Secondary tuning should only be performed after primary tuning is optimized.
Security Code	From the Security menu. Use to enter the security code to secure or unsecure the Spyder. When secured only Remote Setpoint Tension and Percent Taper can be changed.
Security Secured Or Security Not Secured	One of the top level menu screens. This screen also displays the present state of security. When secured only Remote Setpoint Tension and Percent Taper can be changed.
Sensing Roll is too heavy.	A load cell calibration error message. <i>See Load Cell Calibration Problems</i> in Section 10.4.
Setpoint Tension	In the Operator Loop . This is a display only of the tension setpoint. The tension setpoint is set by either the Tension Input (Term.16 to Term.17) or by the Ethernet connection. The source of the setpoint tension is determined by Setpoint Source in the Configure menu.
Setpoint Tension	In the Operator Loop without taper tension This is a display only of the tension setpoint. The tension setpoint is set by either the Tension Input (Term.16 to Term.17) or by the Ethernet connection. The source of the setpoint tension is determined by Setpoint Source in the Configure menu.
Setpoint Position	In the Operator Loop . For dancer with Setpoint = Analog this is only a display of the current setpoint input between Term.16 and Term.17. For dancer with Setpoint = Ethernet the position setpoint may be entered on this screen by pressing the ENTER key or using the LEFT and RIGHT keys to increment and decrement the position.
Setpoint Source	In the Configure menu. Selects the setpoint source for either Tension or Position. The choice is either Analog or Ethernet. The Spyder defaults to Analog input as the setpoint source.
Signal too low at Max Tension	From the Cal Sensors menu. The Spyder will not calibrate if the loading of the load cells at Maximum Tension is less than 1/8 of the load cell rating.
Start Time	From the Parameters menu. Enter a value based upon the amount of time it takes your machine to ramp up from stopped to steady state operation. If the tension spikes during this time, try increasing this START TIME value.

Stop Multiplier	<p>From the Parameters menu.</p> <p>Enter a value that will dictate the control output during STOP mode. Spyder will use the last control output sent during RUN mode before the STOP signal is received and multiply it by the value set here for the duration of the Stop Time. The control continues to control tension during the Stop Time. When the stop multiplier value is correctly set, it will automatically boost output to the braking device during stops to keep the tension constant.</p>
Stop Time	<p>From the Parameters menu.</p> <p>Enter a value based upon the amount of time it takes your machine to ramp down from steady state operation to a complete stop. When this time has expired, Spyder will automatically proceed into HOLD mode.</p>
Subnet Mask	<p>From the Network menu.</p> <p>Determines the range of addresses in a subnet. Consult your system administrator. If DHCP is enabled this parameter is ignored.</p>
Switch to Quick Stab	<p>From the Tuning menu.</p> <p>When a tuning parameter is adjusted to its most stable value and the system is still unstable, the Spyder automatically switches to Quick Stab so that the other parameters are tuned in the correct order.</p>
Taper Percent	<p>From the Operator Loop.</p> <p>When REWIND or UNWIND type is selected, you may enter a value here that will taper off the output as the roll progresses from core to full. This feature is useful for reducing the inward forces that develop in rolls with a large differential between core and full diameters. If you are experiencing crushed cores, telescoping or starring rolls, try increasing taper in steps until you reach a value that works well for your process. See Section 6.2.1.3 or 8.2.1.4.</p>
Taper Setup	<p>One of the top level menu screens. Used to calibrate diameter and to edit Core Diameter and Full Roll Diameter.</p>
Tension	<p>In the Operator Loop.</p> <p>Displays the actual tension in both numeric and bar graph forms.</p>
Try larger Max	<p>From the Cal Sensors menu.</p> <p>The Spyder will suggest a Max Tension that will make sure that the load cells are loaded to at least 1/8 of their Maximum Tension. This may mean that a load cell with too large of a rating has been installed.</p>
Try smaller Max	<p>From the Cal Sensors menu.</p> <p>The Spyder will suggest a Max Tension that will keep the load cells from being out of range at Max Tension</p>
Tune I First. Then P second	<p>From the Tuning menu for point to point systems.</p> <p>The Spyder should be optimized in the order shown.</p>

Tuning	One of the top level menu screens. Used to optimize the dynamic tuning of the system.
Unload sensing roll.	From the Cal Sensors menu. Load cell calibration happens in two steps. In this first step all loading must be removed from the sensing roll mounted on the load cells so that the roll weight can be zeroed out.
Use DHCP	From the Network menu. Determines if the Spyder will try to get a dynamic IP address from a DHCP server. If "NO" is selected then IP Address, Gateway Address and Subnet Mask must be configured.
Use Load Cells?	From the Configure menu. Select "Yes" to enable reading of load cells when the Spyder is configured for a Dancer system.
Use Taper?	From the Taper Setup menu for Load Cell control or the Configure menu for Open Loop Tension control. Select "Yes" to enable taper tension.

12.0 COMMUNICATION (OPTIONAL)

The Spyder provides communication over Ethernet using the following methods:

- Spyder provides web pages to a browser to read and change parameters. Section 12.3
- Spyder can update software by using an FTP server and downloading a new program. Section 12.4.
- Spyder can communicate with the Spyder Configuration Tool PC program which allows all parameters to be retrieved and saved in a PC file. Section 12.5.
- Spyder can communicate as a Modbus/TCP slave device. Section 12.6.

12.1 NETWORK SETUP:

There are 4 parameters in the **Network** menu which must be set up: Use DHCP, IP Address, Subnet Mask, and Gateway Address.

If your network contains a DHCP server, leave the Use DHCP setting to "Yes". The IP Address, Subnet Mask, and Gateway Address will automatically be configured correctly.

If your network needs the Spyder to have a static address, set Use DHCP to "No" and configure IP Address, Subnet Mask and Gateway Address to match your network.

After changing any of these 4 network parameters, the Spyder will need to be restarted for the settings to take effect.

12.2 PARAMETERS AVAILABLE ONLY FROM THE WEB PAGE OR MODBUS/TCP

The following parameters are text strings which are only available from the web page. Text strings are limited to 31 characters.

Parameter Name	Description
Device Name	Name of this Spyder. Each Spyder can be given a name. This name appears on the list of available Spyder's in the Spyder Configuration Tool program.
FTP Username	FTP Username for connecting to the FTP site to get software updates.
FTP Password	FTP Password for connecting to the FTP site to get software updates.
FTP Directory	FTP Directory on FTP site where software updates are contained.
Program Version	The program version in this Spyder. Also shows on the display for 3 seconds after power-up.

12.3 SPYDER WEB PAGE:

The Spyder web page allows all parameters to be viewed and edited using a standard web browser. The parameters are grouped into pages that correspond to the main menu items found on the Spyder display.

Type into the address bar of a browser "**Error! Hyperlink reference not valid.**" followed by the IP Address of the Spyder. The Spyder will display the web page "index.html". The index page displays the status parameters and provides a menu on the left hand side to see all the other parameters. Parameter values which are editable will be shown with a standard web page link. Parameters which are not editable will not have a link.

Example: <http://192.168.1.100>

12.0 COMMUNICATION (OPTIONAL)

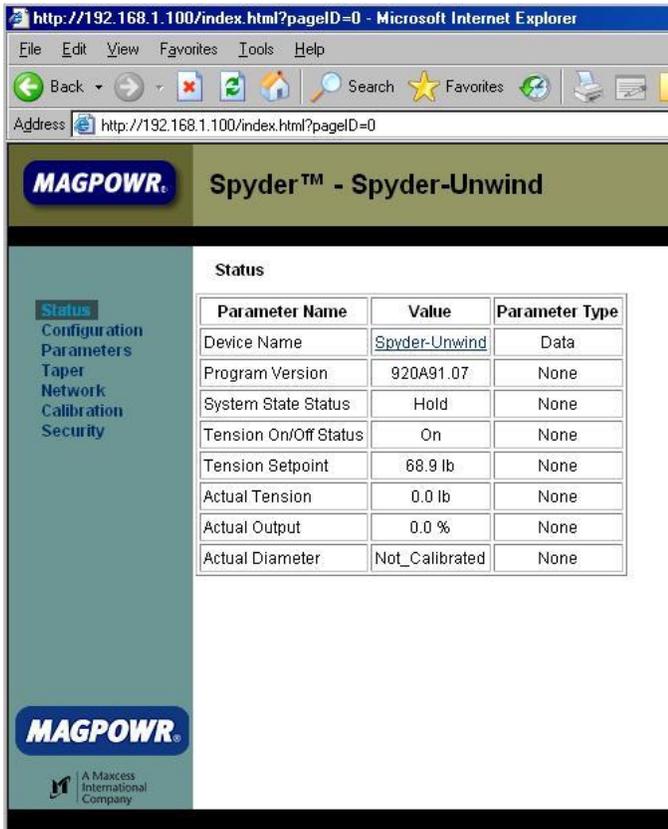


Figure 18. Spyder Status web page

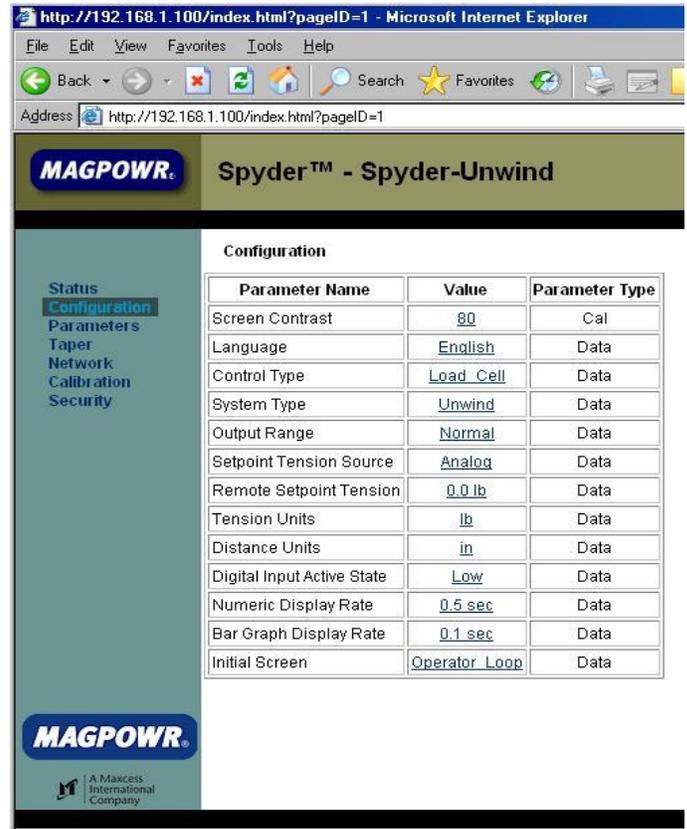


Figure 19. Spyder Configuration web page

To change the value of a parameter, click on the link for the data value. The Spyder will return a page with an input box to allow entering a new value. When the new value has been entered click on the "Submit" button.

Examples:

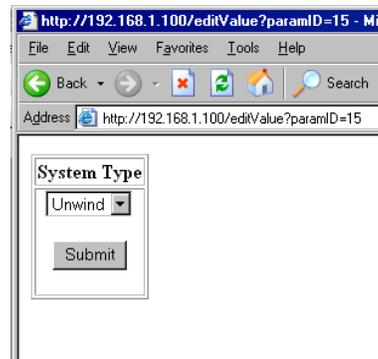
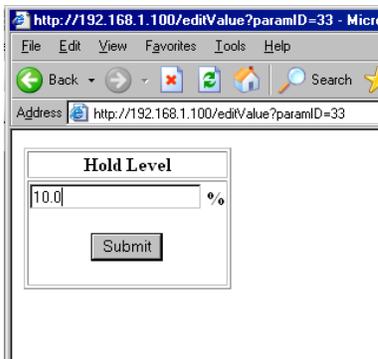


Figure 20. Example Edit Value Web Pages

12.0 COMMUNICATION (OPTIONAL)

12.4 UPDATE SOFTWARE VIA FTP SITE

The Spyder can update its software from an FTP server.



WARNING: DOWNLOAD OF SOFTWARE IS ONLY REQUIRED FOR SPECIAL SOFTWARE OR SOFTWARE PATCHES. CONTACT FACTORY.

Turn off power to the Spyder. Hold down the "Up" and "Down" arrow keys while turning on power. The display should show the Update Software menu. Press the "Down" arrow. The display will show the program number it is about to download. To edit the program number, Press the "Enter" key and enter the program number of the software you need to download. Press the "Down" arrow key to start downloading the software.

When the display shows "Update Successful", press the "Down" arrow to reboot the Spyder. The Spyder will reboot with the new program. The original software remains valid if any download results in an error and an error screen is shown.

The following parameters must be set up for the software download to work:

IP Address, Subnet Mask, Gateway Address, FTP Address, FTP directory, FTP username, FTP password, and FTP Program Number.

The factory defaults are as follows:

FTP Address:	192.168.1.200
FTP Username:	ftpmag.ftpusers
FTP Password:	fghj5678^\$
FTP Directory:	ProductSoftware

For downloading Spyder software from a local FTP server running on a local PC you can get the SpyderWare installation kit from the Maxcess website. This kit will install an FTP server on a Windows PC which can be used to download software to the Spyder.

Go to www.maxcessintl.com. Type the keywords "spyderware" in the Search field and press the Enter key. When displayed, click on *SpyderWare Installation Kit* file, which links to a zip file. Save the zip file to a directory on your computer. Unzip this file and follow the directions in the 850A324 user manual to install and use the software. This software has only been tested on a Windows XP computer.

12.5 SPYDER CONFIGURATION TOOL

To get the Spyder Configuration Tool, go to www.maxcessintl.com. Type the keywords "spyder config" in the Search field and press the Enter key. When displayed, click on *Spyder Configuration Tool*, which links to a zip file. Save the zip file to a directory on your computer. Unzip this file and follow the directions in the 850A325 user manual to install and use the software. This software has only been tested on a Windows XP computer. The Spyder Configuration Tool allows sending only Data, only Calibration, or both Data and Calibration type parameters back to the Spyder. The column labeled Parameter Type in the Parameter List in Section 12.7 specifies whether a parameter is considered a Data or Calibration parameter.

12.6 MODBUS/TCP COMMUNICATION

The Spyder acts as a Modbus/TCP slave device. It supports the function codes Read Holding Registers (code 03), Read Input Registers (code 04), Write Single Register (code 06), and Write Multiple Registers (code 16). Either Read Holding Registers or Read Input Registers may be used to read data, there is no difference between them.

The Spyder data size on Modbus is 180 Modbus registers of input and output starting at Modbus register address 1. The table in Section 12.7 shows how all the Spyder parameters are mapped onto Modbus registers.

There are three parameters in the Network menu to configure the Modbus communications, Modbus Address, Modbus Byte Order, and Modbus Word Order. Modbus Address specifies the Modbus address of this slave device and ranges from 0 to 255.

The Spyder contains data which does not fit into the standard Modbus register size of 16-bits (2 bytes). Some Spyder data consists of multiple consecutive Modbus registers. The following table shows the correspondence between the Spyder data types and the number of Modbus registers used to represent the data.

12.0 COMMUNICATION (OPTIONAL)

Spyder Data		Number Modbus Registers	Comments
BYTE	8-bit Unsigned Byte	1	High byte forced to 0
UINT16	16-bit Unsigned Integer	1	
UINT32	32-bit Unsigned Integer	2	
FLOAT	4-byte Floating Point	2	
STRING	32-byte Strings	16	

Since some data values are contained in multiple Modbus registers the function code 16, Write Multiple Registers must be used to write these data values. If a write occurs to only one of the Modbus registers corresponding to a two-word parameter then the Spyder will ignore the write. If a write to a 16 word string does not write all 16 registers then the Spyder will ignore the write. This prevents the Spyder from receiving only part of a data value. This could be problematic if Setpoint Tension or other control parameter was corrupted by only writing a portion of the new data value. Reads do not have this restriction.

The Modbus standard specifies data as being transmitted Most Significant Byte first. To support master devices which transmit data Least Significant Byte first the Spyder allows switching between the two. For multiple register data there is a configuration parameter to specify whether words (registers) are transmitted Most Significant Word first or last. These two configuration parameters are in the Network menu. The default is Most Significant Byte first and Most Significant Word first. Note: Strings are always transmitted left most character first.

12.7 MODBUS PARAMETER LIST

This table lists all the Spyder parameters and their minimum and maximum values. Modbus register addresses are shown in hexadecimal format in the table. Control type abbreviations are LC = Load Cell Control, DT = Dancer Torque Control, DS = Dancer Speed Control, OPT = Open Loop Tension based on Diameter Control. Open Loop Tension control is only available on Spyder-Plus.

Starting Modbus Register	Parameter Name	Parameter Format	Parameter Type	Used with Control Types	Read / Write	Range
0x01	Use DHCP	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = No, 1 = Yes
0x02	IP Address	UINT32	Cal	LC, DT, DS, OPT	Read / Write	{0.0.0.0 - 255.255.255.255}
0x04	Subnet Mask	UINT32	Data	LC, DT, DS, OPT	Read / Write	{0.0.0.0 - 255.255.255.255}
0x06	Gateway Address	UINT32	Data	LC, DT, DS, OPT	Read / Write	{0.0.0.0 - 255.255.255.255}
0x08	FTP Address	UINT32	Data	LC, DT, DS, OPT	Read / Write	{0.0.0.0 - 255.255.255.255}
0x0A	FTP Program Number	UINT32	Data	LC, DT, DS, OPT	Read / Write	920Axxx.yyy xxx,yyy={0 - 999} xxx = High Word yyy = Low Word
0x0C	FTP Directory	STRING	Data	LC, DT, DS, OPT	Read / Write	31 Characters Maximum
0x1C	FTP User Name	STRING	Data	LC, DT, DS, OPT	Read / Write	31 Characters Maximum
0x2C	FTP Password	STRING	Data	LC, DT, DS, OPT	Read / Write	31 Characters Maximum
0x3C	Screen Contrast	BYTE	Cal	LC, DT, DS, OPT	Read / Write	{ 0 - 255 }
0x3D	Language	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = English 1 = French 2 = German 3 = Italian 4 = Spanish
0x3E	Remote Setpoint Tension	FLOAT	Data	LC, OPT	Read / Write	{ 0.0 - 99999.0 } lb.
0x40	Setpoint Source	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = Analog 1 = Ethernet/Software
0x41	Taper Percent	FLOAT	Data	LC, OPT	Read / Write	{ 0.0 - 100.0 } %
0x43	Is Taper Setup	BYTE	Cal	LC	Read / Write	0 = No 1 = Yes

12.0 COMMUNICATION (OPTIONAL)

Starting Modbus Register	Parameter Name	Parameter Format	Parameter Type	Used with Control Types	Read / Write	Range
0x44	System Type (Load Cell)	BYTE	Data	LC	Read / Write	0 = Unwind 1 = Rewind 2 = Type 1 3 = Type 2 4 = Type 3 5 = Type 4
0x45	System Type (Dancer)	BYTE	Data	DT, DS	Read / Write	0 = Unwind 1 = Rewind
0x46	Control Type	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = Load Cell 1 = Dancer, Torque 2 = Dancer, Speed 3 = Tension, Diameter
0x47	Output Range	BYTE	Data	LC, DT, DS	Read / Write	0 = Normal 1 = -10V to +10V
0x48	Maximum Tension	FLOAT	Cal	LC, DT, DS	Read / Write	{ 0.0 - 99999.0 } lb.
0x4A	Applied Tension	FLOAT	Cal	LC, DT, DS	Read / Write	{ 0.0 - 99999.0 } lb.
0x4C	Core Diameter	FLOAT	Data	LC, OPT	Read / Write	{ 0.0 - 999.0 } in.
0x4E	Full Roll Diameter	FLOAT	Data	LC, OPT	Read / Write	{ 0.0 - 999.0 } in.
0x50	Diameter Calibration Constant	FLOAT	Cal	LC, OPT	Read / Write	{ 0.0 - 99999.0 }
0x52	Tension Units	BYTE	Data	LC, DT, DS	Read / Write	0 = pound 1 = ounce 2 = Kilogram 3 = Newton 4 = gram
0x53	Distance Units	BYTE	Data	LC, OPT	Read / Write	0 = inch 1 = feet 2 = millimeter 3 = centimeter 4 = meter
0x54	Proportional Gain (Load Cell)	FLOAT	Data	LC	Read / Write	{ 0.0 - 999.0 }
0x56	Integrator Time (Load Cell)	FLOAT	Data	LC	Read / Write	{ 0.0 - 60.0 } seconds
0x58	Derivative Time (Dancer)	FLOAT	Data	DT	Read / Write	{ 0.0 - 60.0 } seconds
0x5A	Error Limit	FLOAT	Data	LC, DT, DS	Read / Write	{ 0.0 - 100.0 } %
0x5C	Start Time	FLOAT	Data	LC	Read / Write	{ 0.0 - 60.0 } seconds
0x5E	Stop Time	FLOAT	Data	LC, DT, DS, OPT	Read / Write	{ 0.0 - 60.0 } seconds
0x60	Stop Multiplier	FLOAT	Data	LC, DT, OPT	Read / Write	{ 0.0 - 99.0 }
0x62	Hold Level	FLOAT	Data	LC, DT	Read / Write	{ 0.0 - 100.0 } %
0x64	Torque Output 0% Calibration Point (0-10V, 4-20mA)	FLOAT	Cal	LC, DT, DS, OPT	Read / Write	{ 0.0 - 1.0 }
0x66	Torque Output 100% Calibration Point (0-10V, 4-20mA)	FLOAT	Cal	LC, DT, DS, OPT	Read / Write	{ 0.0 - 1.0 }
0x68	Torque Output 0% Calibration Point (-10V to +10V)	FLOAT	Cal	LC, DT, DS, OPT	Read / Write	{ 0.0 - 1.0 }
0x6A	Torque Output 100% Calibration Point (-10V to +10V)	FLOAT	Cal	LC, DT, DS, OPT	Read / Write	{ 0.0 - 1.0 }
0x6C	Tension Meter 100% Calibration Point	FLOAT	Cal	LC, DT, DS, OPT	Read / Write	{ 0 - 511 }
0x6E	Tension Setpoint 0% Calibration Point	FLOAT	Cal	LC, OPT	Read / Write	{ 0 - 4095 }

12.0 COMMUNICATION (OPTIONAL)

Starting Modbus Register	Parameter Name	Parameter Format	Parameter Type	Used with Control Types	Read / Write	Range
0x70	Tension Setpoint 100% Calibration Point	FLOAT	Cal	LC, OPT	Read / Write	{ 0 - 4095 }
0x72	Manual Setpoint 0% Calibration Point	FLOAT	Cal	LC, OPT	Read / Write	{ 0 - 4095 }
0x74	Manual Setpoint 100% Calibration Point	FLOAT	Cal	LC, OPT	Read / Write	{ 0 - 4095 }
0x76	Load Cell Positive Bias	UINT16	Cal	LC, DT, DS	Read / Write	{ 0 - 511 }
0x77	Load Cell Negative Bias	UINT16	Cal	LC, DT, DS	Read / Write	{ 0 - 511 }
0x78	Load Cell Gain Reference	UINT16	Cal	LC, DT, DS	Read / Write	{ 0 - 511 }
0x79	Load Cell Offset	UINT16	Cal	LC, DT, DS	Read / Write	{ 0 - 4095 }
0x7A	Applied Tension Binary	UINT16	Cal	LC, DT, DS	Read / Write	{ 0 - 4095 }
0x7B	Digital Input Active State	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = Active Low 1 = Active High
0x7C	Security State	BYTE	None	LC, DT, DS, OPT	Read Only	0 = Not Locked 1 = Locked
0x7D	Security Code	UINT16	None	LC, DT, DS, OPT	Write Only	{ 0 - 9999 }
0x7E	Numeric Display Rate	FLOAT	Data	LC, DT, DS, OPT	Read / Write	{ 0.0 - 60.0 } seconds
0x80	Bar Graph Display Rate	FLOAT	Data	LC, DT, DS, OPT	Read / Write	{ 0.0 - 60.0 } seconds
0x82	Position Setpoint 0% Calibration Point	FLOAT	Cal	DT, DS	Read / Write	{ 0 - 4095 }
0x84	Position Setpoint 100% Calibration Point	FLOAT	Cal	DT, DS	Read / Write	{ 0 - 4095 }
0x86	Dancer 0% Calibration Point	FLOAT	Cal	DT, DS	Read / Write	{ 0 - 4095 }
0x88	Dancer 100% Calibration Point	FLOAT	Cal	DT, DS	Read / Write	{ 0 - 4095 }
0x8A	Tuning Type (Dancer Torque)	BYTE	Data	DT	Read / Write	0 = PD 1 = PID
0x8B	Tuning Type (Dancer Speed)	BYTE	Data	DS	Read / Write	0 = P 1 = PI
0x8C	Proportional Gain (Dancer)	FLOAT	Data	DT, DS	Read / Write	{ 0.0 - 999.0 }
0x8E	Integrator Time (Dancer)	FLOAT	Data	DT, DS	Read / Write	{ 0.0 - 60.0 } seconds
0x90	Initial Screen (Load Cell)	BYTE	Data	LC	Read / Write	0 = Operator Menu 1 = Tension 2 = Output Level
0x91	Initial Screen (Dancer)	BYTE	Data	DT, DS	Read / Write	0 = Operator Menu 1 = Position 2 = Output Level
0x92	Use Taper?	BYTE	Data	LC, OPT	Read / Write	0 = No 1 = Yes
0x93	System State Status	UINT16	None	LC, DT, DS, OPT	Read Only	0 = Hold 1 = Start 2 = Run 3 = Stop 4 = E-Stop 5 = Manual
0x94	Tension On/Off Status	UINT16	None	LC, DT, DS, OPT	Read Only	0 = Tension Off 1 = Tension On
0x95	Tension Setpoint	FLOAT	None	LC	Read Only	{ 0.0 - 99999.0 } lb.
0x97	Actual Tension	FLOAT	None	LC, OPT	Read Only	{ 0.0 - 99999.0 } lb.

12.0 COMMUNICATION (OPTIONAL)

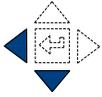
Starting Modbus Register	Parameter Name	Parameter Format	Parameter Type	Used with Control Types	Read / Write	Range
0x99	Actual Output	FLOAT	None	LC, DT, DS, OPT	Read Only	{ 0.0 - 100.0 } %
0x9B	Actual Diameter	FLOAT	None	LC, OPT	Read Only	{ 0.0 - 999.0 } in.
0x9D	Position Setpoint	FLOAT	None	DT, DS	Read Only	{ 0.0 - 100.0 } %
0x9F	Actual Position	FLOAT	None	DT, DS	Read Only	{ 0.0 - 100.0 } %
0xA1	Device Name	STRING	Data	LC, DT, DS, OPT	Read / Write	31 Characters Maximum
0xB1	Program Version	UINT32	None	LC, DT, DS, OPT	Read Only	920Axxx.yyy xxx,yyy={0 - 999} xxx = High Word yyy = Low Word
0xB3	Modbus Address	UINT16	Data	LC, DT, DS, OPT	Read / Write	{ 0 - 255 }
0xB4	Modbus Byte Order	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = MSB First 1 = LSB First
0xB5	Modbus Word Order	BYTE	Data	LC, DT, DS, OPT	Read / Write	0 = MSB First 1 = LSB First
0xB6	Actual Manual Level	FLOAT	None	LC, OPT	Read Only	{ 0.0 – 100.0 } %
0xB8	Enable Load Cell Reading (Dancer)	BYTE	Data	DT, DS	Read / Write	0 = Load Cells Not Enabled 1 = Load Cells Enabled
0xB9	Remote Dancer Setpoint	FLOAT	Data	DT, DS	Read / Write	No Integrator, mode: P or PD, range = { 0.0 – 5.0 } With Integrator, mode PI or PID, range = { 0.0 – 1.0 }. Multiply this value by 100 to get percent.
0xBB	Setpoint Tension Percent	FLOAT	Data	OPT	Read/Write	{ 0.0 – 100.0 } %
0xBD	System Type (Open Loop Tension)	BYTE	Data	OPT	Read/Write	0 = Unwind 1 = Rewind
0xBE	Core Offset	FLOAT	Data	OPT	Read/Write	{ -20.0 – 100.0 } %
0xC0	Actual Tension Setpoint Percent	FLOAT	None	OPT	Read Only	{ 0.0 – 100.0 } %
0xC2	Actual Tension Percent	FLOAT	None	OPT	Read Only	{ 0.0 – 100.0 } %
0xC4	Initial Screen (Open Loop Tension)	BYTE	Data	OPT	Read/Write	0 = Operator Menu 1 = Tension 2 = Output Level 3 = Diameter

12.8 MODBUS MASTER PROGRAM

There is a Modbus master program available to test communications with the Spyder that runs on a PC with Windows. This program was written as an engineering debugging tool for Modbus software development and is provided as is. Go to www.maxcessintl.com. Type the keywords “spyder modbus” in the Search field and press the Enter key. When displayed, click on *Spyder Modbus TCP Master Software*, which links to a zip file. Save the zip file to a directory on your computer. Unzip this file and run the SMM.exe file. Use the Configure screen to set up IP address of the Spyder, update rate and Spyder Program Number. The Spyder program number is displayed on the Spyder for a few seconds after applying power.

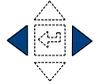
13.0 RESET FUNCTIONS

The Spyder has functions which are activated by holding down keys while turning on power.



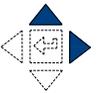
13.1 Automatic Contrast Adjust

The automatic contrast adjustment is activated by holding down the "Left" and "Down" arrow keys while turning on the power. Hold the keys for at least 6 seconds after power is on. The display will repeatedly sweep through the full contrast range until the "Enter" key is pressed. When the display is readable, press the "Enter" key to exit contrast adjustment.



13.2 Reset All Parameters Except Calibrations to Defaults

All parameters except calibrations will be reset to defaults by holding down the "Left" and "Right" arrow keys while turning on the power. Hold the keys until the screen shows "Resetting Parameters".

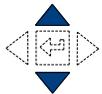


13.3 Reset All Parameters to Defaults (Including Calibrations)

All parameters will be reset to defaults by holding down the "Right" and "Up" arrow keys while turning on the power. Hold the keys for at least 6 seconds after power is on. This reset will erase all calibrations. See Section 7.3, 7.4, or 8.4 for recalibrating inputs, Section 9.4 for recalibrating outputs, Section 6.3 for recalibrating load cells, Section 13.1 for setting contrast, and Section 6.4 or 7.5 for tuning the Spyder.



WARNING: THIS RESET WILL ERASE ALL CALIBRATIONS.



13.4 Download Software

To download new software hold down the "Up" and "Down" arrow keys while turning on power and hold the keys until the display shows "Update Software". See Section 12.4 for software updating.

14.0 SPECIFICATIONS

Supply Voltage Fuse: F1	24 VDC, $\pm 10\%$, 250 mADC, 6 VA 2.5 amp, Littlefuse Part No. 21602.5, or Wickmann Part No. 19194-058-FS
Enclosure	IP20 (IEC529)
Climatic Class:	3K3 (EN60721)
Temperature Range:	
Operating	0° C to 50° C
Storage	-30° C to +80° C
Relative Humidity	5% to 85%
Pollution Degree:	2 (IEC664-1)
Altitude:	0 to 2000 m
Compatible Residual Current Device Types:	A or B (IEC755)
Worst Case Fault Current:	2.5 amp
Inputs:	
Load cell	2.1 millivolts/volt using +5 and -5 VDC (10 VDC) across one 350 ohm sensor or two 350 ohm sensors in parallel. 65 mADC maximum excitation current.
Tension Setpoint	0 to +10 VDC, 0.25 mADC maximum, or 1K to 10K ohm potentiometer
Manual Setpoint	0 to +10 VDC, 0.25 mADC maximum, or 1K to 10K ohm potentiometer
Position Setpoint	0 to +10 VDC, 0.25 mADC maximum, or 1K to 10K ohm potentiometer
Dancer Input	0 to +10 VDC, 0.25 mADC maximum, or 1K to 10K ohm potentiometer
Diameter Input	0 to +10 VDC, 0.25 mADC maximum
E-Stop	switch closure or 5 VDC or 24 VDC active High/Low logic, 8 mADC maximum
Run/Stop	switch closure or 5 VDC or 24 VDC active High/Low logic, 8 mADC maximum
Tension Off	switch closure or 5 VDC or 24 VDC active High/Low logic, 8 mADC maximum
Auto/Manual	switch closure or 5 VDC or 24 VDC active High/Low logic, 8 mADC maximum
Outputs:	
Torque (Main Output)	0 to +10 VDC., 1 mADC maximum, 4 to 20 mADC, 500 ohms maximum, -10 to +10 VDC, 1 mADC maximum
Tension meter or Inverse Diameter output	0 to 1 mADC or 0 to +10 VDC analog
Communications:	
Ethernet	TCP/IP Web server interface FTP Client Modbus/TCP Slave

MAXCESS[®]

WEBEX  **TIDLAND** **MAGPOWR**

**NORTH, CENTRAL
AND SOUTH AMERICA**

Tel +1.405.755.1600
Fax +1.405.755.8425
sales@maxcessintl.com
www.maxcessintl.com

INDIA

Tel +91.22.27602633
Fax +91.22.27602634
india@maxcessintl.com
www.maxcess.in

**EUROPE, MIDDLE EAST
AND AFRICA**

Tel +49.6195.7002.0
Fax +49.6195.7002.933
sales@maxcess.eu
www.maxcess.eu

JAPAN

Tel +81.43.421.1622
Fax +81.43.421.2895
japan@maxcessintl.com
www.maxcess.jp

CHINA

Tel +86.756.881.9398
Fax +86.756.881.9393
info@maxcessintl.com.cn
www.maxcessintl.com.cn

**KOREA, TAIWAN,
AND SE ASIA**

Tel +65.9620.3883
Fax +65.6235.4818
asia@maxcessintl.com