MAXCESS®

MAGPOWR

# Spyder–Plus–S1 Tension Control

## Instruction Manual



**Figure 1. Spyder-Plus-S1**

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# ABOUT THE SPYDER-PLUS-S1

The MAGPOWR Model Spyder-Plus-S1 (hereafter referred to as Spyder) is a microprocessor-based control designed for precise closed loop control of either web tension, dancer position, or open loop tension control proportional to a diameter input for unwinds and rewinds. The Spyder has a diameter input to compensate for large roll builds in the dancer modes and provide for inertia compensation in *Load Cell* and *Dancer, Torque* modes.

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 1 mA or 0-10 VDC meter output proportional to measured tension. Inertia compensation during stopping is available. Hold Level Output during Hold mode can be a fixed level, or vary with last running output, or vary based on diameter and or 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 0-1 mA or 0-1 VDC meter output is proportional to measured tension. With *Diameter* selected in *Dancer* mode, the diameter input is available to compensate for large roll builds. Inertia compensation during stopping is available in Torque mode. In Torque mode, Hold Level Output during Hold mode can vary with last running output, or vary based on diameter and or tension. In Speed mode, the output during Hold is always zero.

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 0-1 mA or 0-10 VDC 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.

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## 1.1     LOAD CELL

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 850B352 as an aid to navigation.

1.  Required connections for the basic Spyder system are:
    - 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.

    ***See Sections 2.0, 6.0 and Figure 5 for specific wiring requirements.***

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 and clutch or brake user manuals 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 $\downarrow$ (down arrow) to begin stabilizing. Use the $\leftarrow$ (left arrow) and $\rightarrow$ (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.

# 1.0 SPYDER-PLUS-S1 BASIC SETUP

## 1.2 DANCER

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 flowcharts drawing number 850B352 for a navigation aid.

1. Required connections for the basic Spyder system are:
   - 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.
   ***See Sections 2.0, 7.0 and Figure 11 for specific wiring requirements.***

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 and clutch or brake user manuals 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. For large roll builds to use the gain compensated dancer control select **Diameter Used** to **YES**. See Section 7.2.2 for the Configure menu.

5. If using the diameter input connect a 0-10V signal proportional to diameter to Term.35 and 36. See section 5.4.4. The diameter input voltage should be zero diameter at zero volts. See section 8.3 for calibrating diameter.

6. 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.

7. 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**.

8. 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.

9. 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. When using the gain compensated dancer go to the Tuning Menu (Section 7.6). If using the gain compensated dancer feature (Dancer, Torque with Diameter) go to the Tuning menu (Section 7.6).

10. For tuning methods that will optimize responsiveness, refer to Section 7.5.2 (Dancer, Torque, no Diameter and Dancer, Speed with or without Diameter) or Section 7.6 (Dancer, Torque, with Diameter).

11. 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.

# 1.0  SPYDER-PLUS-S1 BASIC SETUP

## 1.3  OPEN LOOP TENSION BASED ON DIAMETER

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

Refer to the *Open Loop Tension* screen flowchart drawing number 850B352 for a navigation aid.

1. Required connections for the basic Spyder system are:
   - 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 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.

   ***See Sections 2.0, 8.0 and figure 16 for specific wiring requirements.***

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 and clutch or brake user manuals 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 = 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 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.

# 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 IP20 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**
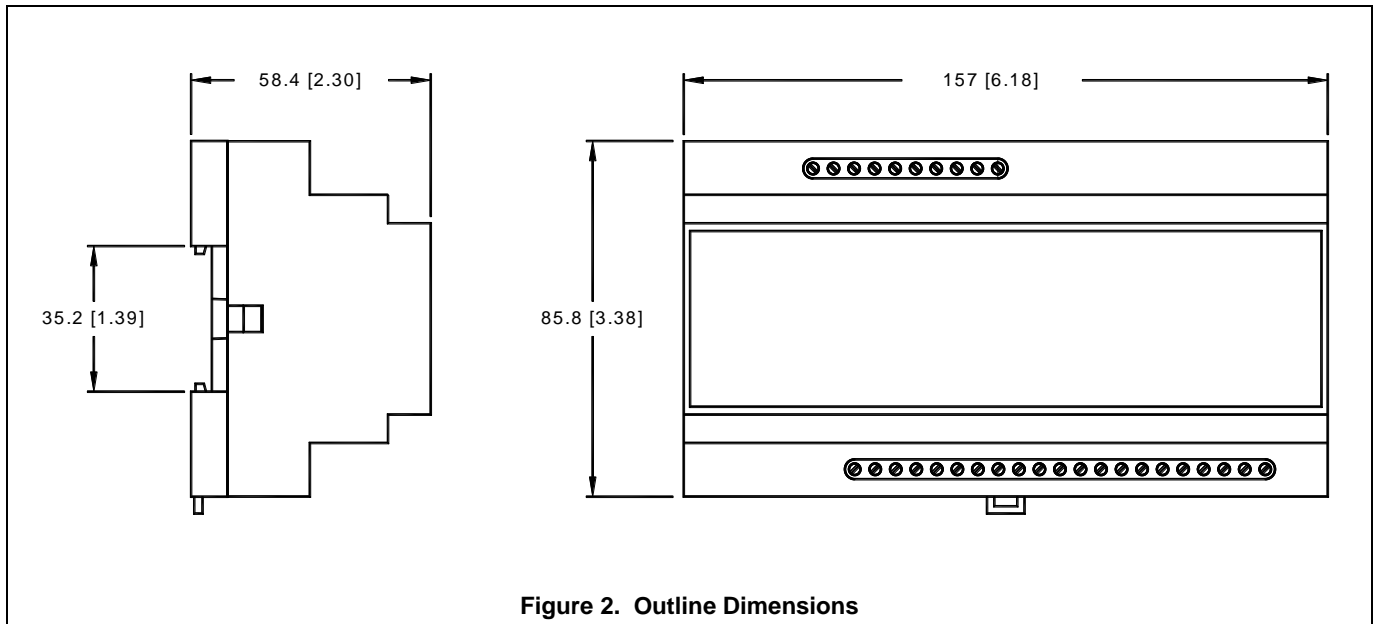
# 3.0　　MAINTENANCE

The only maintenance that may be required on the 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.
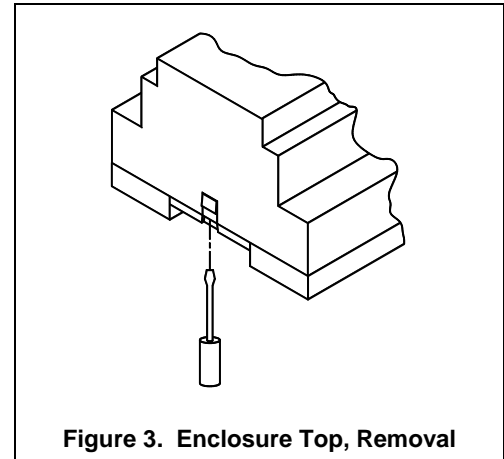


**Figure 3.  Enclosure Top, Removal**

 **WARNING: DISCONNECT POWER BEFORE OPENING ENCLOSURE**

# 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 (for example, 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.

## 5.1 HARDWARE CONFIGURATION

The Spyder has configuration jumpers for:

        Control Inputs can be either active high or low,
        Control Inputs can be either 5 V DC or 24 VDC logic levels
        Main Control Output can be either 0 to 10 VDC, -10 VDC to +10 VDC, or 4 mADC to 20 mADC.
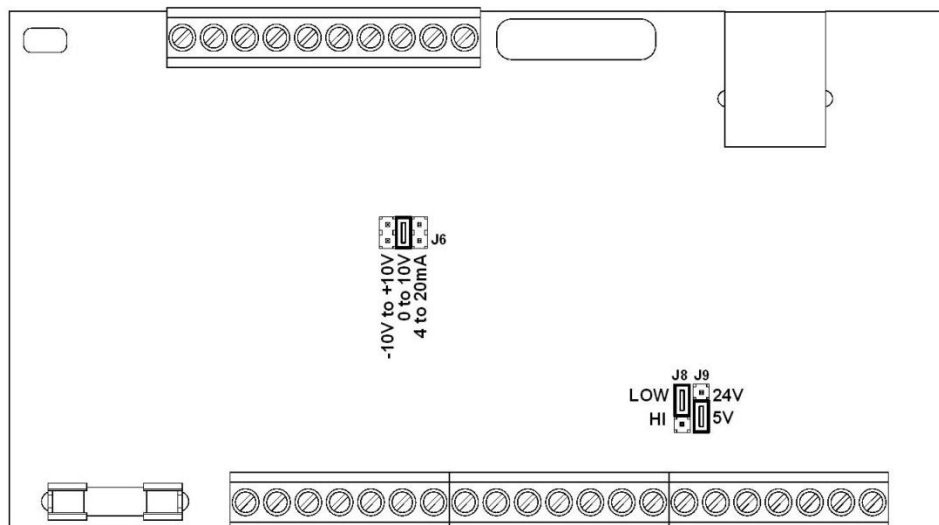


**Figure 4.  Configuration Jumpers**

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 5 V or 24 V 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 and inertia compensation is also activated. During STOP TIME the inertia compensation is added to the output and 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)

# 5.0     SYSTEM SETUP

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 0-10 VDC, -10 to +10 VDC, or 4-20 mADC. See Figure 4 for jumper settings. When using the -10 V to +10 V range be sure to configure the software for -10 V to +10 V 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.

```
OUTPUT RANGE
←     NORMAL      →
```

```
OUTPUT RANGE
←   -10 TO +10V   →
```

### 5.3.2    METER OUTPUT (Load cell systems and Dancers with Load Cells Enabled and Open Loop Tension)
A zero 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. For Open Loop Tension systems 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 (All system types)
The actual Diameter is input as a voltage between Term.38 and Term.39 for Open Loop Tension systems and Term. 35 and Term. 36 for Load Cell and Dancer systems. 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 6.6 (Load Cell), 7.4.3 (Dancer) or 8.3 (Open Loop Tension) for calibrating diameter.

# 6.0 TENSION CONTROL

## 6.1 ELECTRICAL CONNECTIONS

Figure 5 shows the simplest and minimal connections 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 Ethernetport. 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.

## 6.2.1.3     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     PRESENT DIAMETER
This screen shows the actual diameter.

## 6.2.1.6     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 6.2.1.1 for description of the status character.
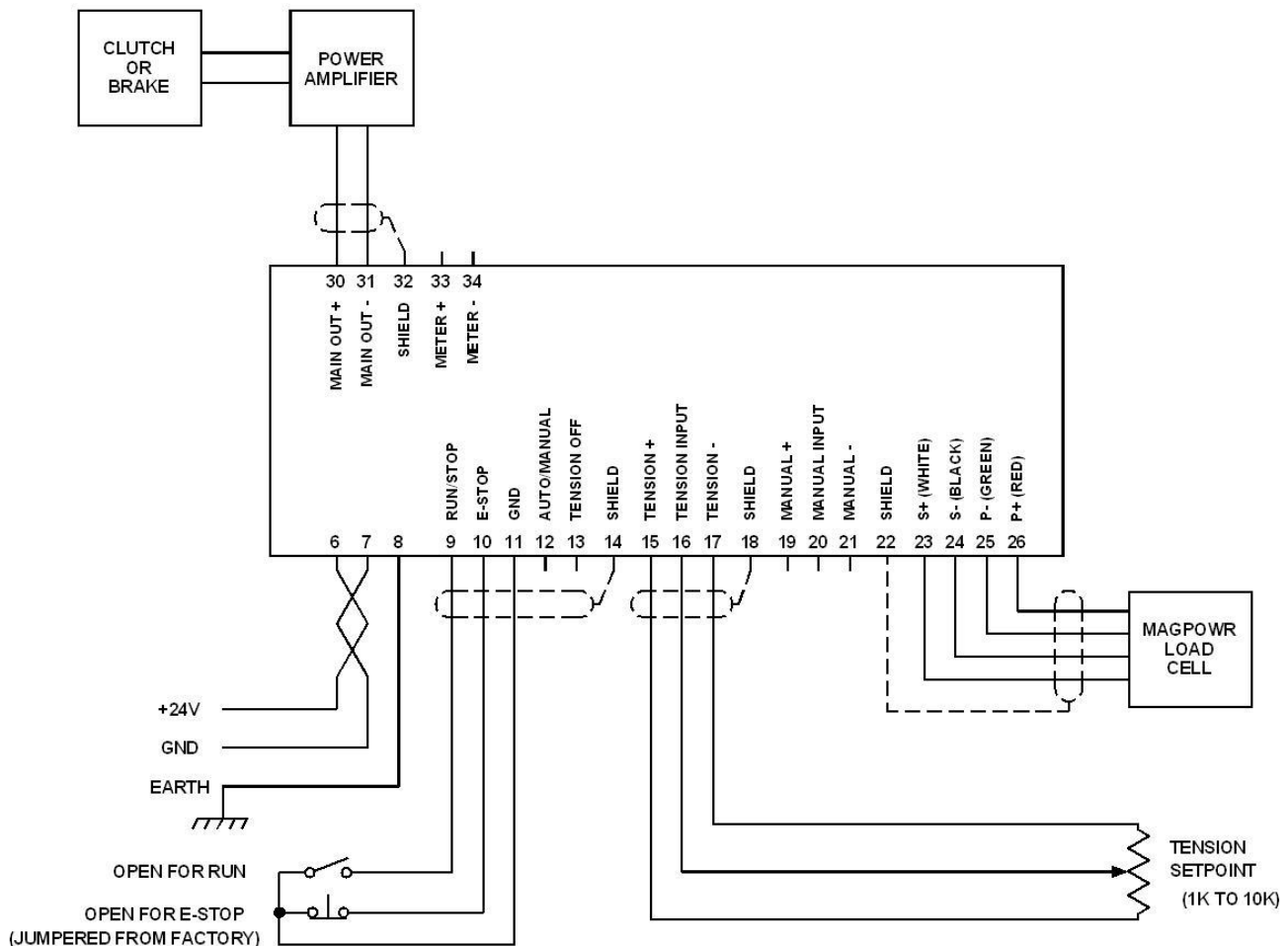
**Figure 5.  Basic Load Cell System Connections**

### 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.

```
┌─────────────────────┐
│CONFIGURE          ↓ │
│←                  → │
└─────────────────────┘
```
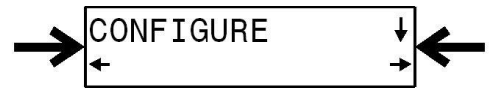
### 6.2.2.1 CONTROL TYPE

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 DIAMETER USED

Select the diameter type either estimated or an external voltage proportional to diameter. For calibrating diameter see section 6.5 if diameter type is **Voltage** and section 9.2 if diameter type is **Estimated**.

### 6.2.2.4 INERTIA COMPENSATION USED

Select whether inertia compensation is used during stopping. This helps to keep the tension constant during stopping. See section 6.6 on setting up and using inertia compensation.

### 6.2.2.5 HOLD LEVEL CHANGE WITH

Hold Level Output during Hold mode can be a fixed value, or can vary with last running output multiplied by the Hold Level Multiplier, or can vary based on diameter and or tension. Select the choice needed for the application; None, Output, Diameter, Tension, or Diameter and Tension. See section 9.6.13 to calibrate hold level changes when the choice is Diameter, Tension, or Diameter and Tension. See section 9.6.14 to enter the Hold level multiplier when the choice is Output.

### 6.2.2.6 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 **–10 V to +10 V**. 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.
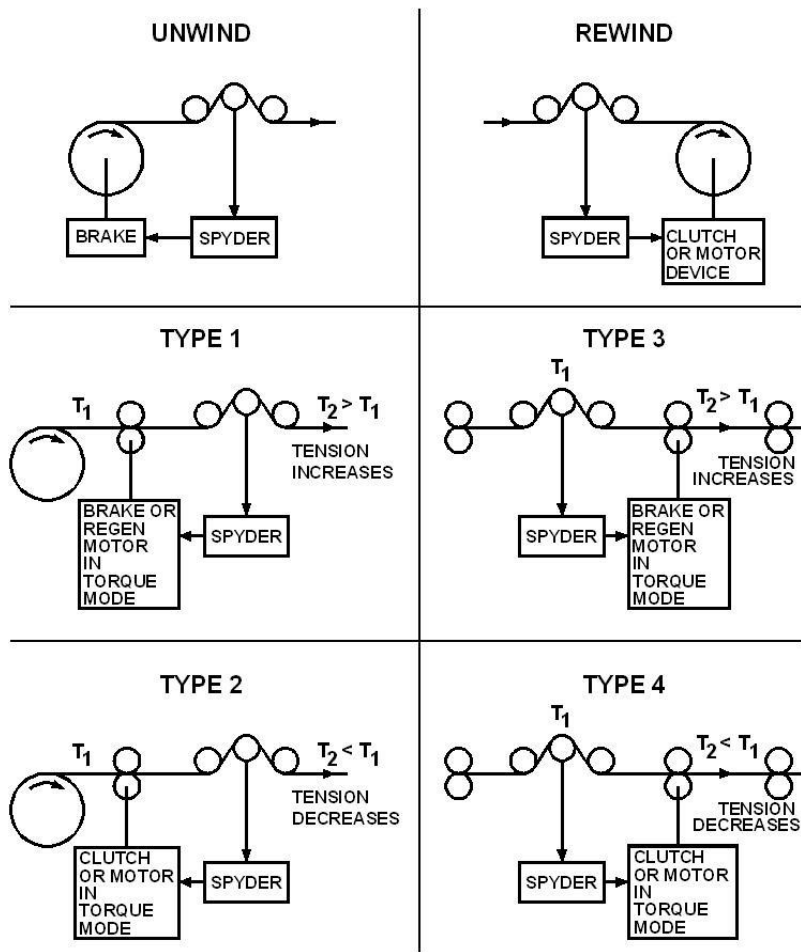
**Figure 6.  Load Cell System Types**

### 6.2.2.7    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.

### 6.2.2.8    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.

### 6.2.2.9    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.

### 6.2.2.10    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.

### 6.2.2.11    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.

### 6.2.2.12    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 ↓ .

```
CAL SENSORS      ↓
←                →
```

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

```
CAL SENSORS
←       YES      →
```

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

```
UNLOAD SENSING
ROLL. PRESS      ↓
```

When **Maximum Tension** appears, press ↵ to enter the maximum tension that will be used on this system (if different than that displayed. This is the upper limit of the tension range as read by the load cells. 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 ↓**.**

```
MAXIMUM TENSION
            XXXX LB
```

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

```
APPLIED TENSION
            XXXX LB
```

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 ↓.

```
APPLY TENSION
AND PRESS        ↓
```

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

```
CALIBRATION
SUCCESSFULL      ↓
```
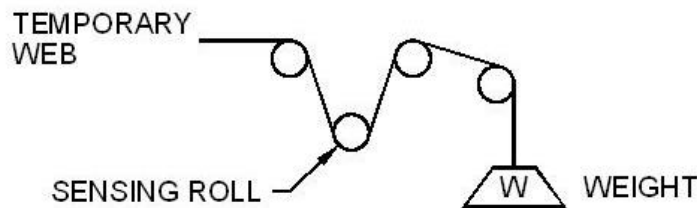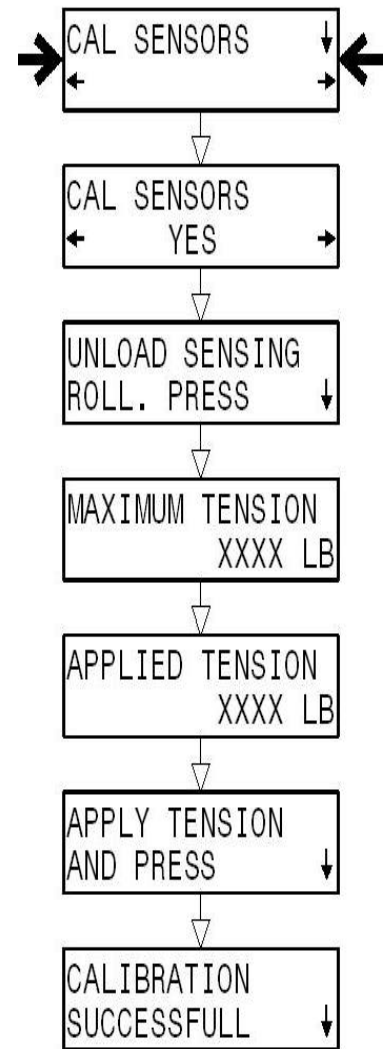


**Figure 7.  Applied Calibration Tension**

## 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.

```
QUICK STAB       ↓
←                →
```
```
TUNING           ↓
←                →
```
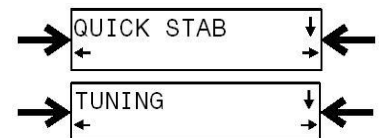
# 6.0  TENSION CONTROL

### 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:

```
█   IF UNSTABLE→
█■←DONE       P35
```
Bar Graph of tension ⌐                          └ Parameter being tuned
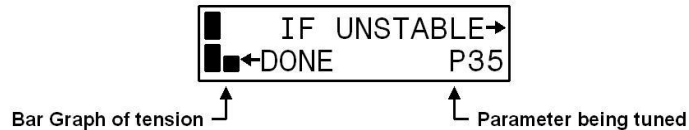
In addition to **P,** the parameter being tuned can also be **E** or **I**. The number next to this letter is not the value of the parameter. It is there to show the progress of the tuning. Its values can be between 00 and 99. 00 is displayed when that parameter is as stable as it can be. When the system is stable press ←**Done.** The Spyder will tell you which parameter should be retuned such as:

```
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) 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:

```
←FIRST I AT FULL
  THEN P AT CORE→
```

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:

```
←TUNE I FIRST
  THEN P SECOND→
```

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:
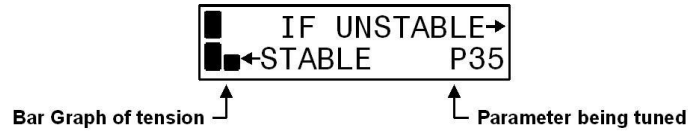
```
■  IF UNSTABLE→
■■←STABLE    P35
```

Bar Graph of tension ⌐                    ⌐ Parameter being tuned

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 set-up of the load cell control system is now complete. See Section 9.0 for optional settings.

There is a table in section 9.6.6 showing default values of proportional, integrator, derivative, error limit and stop torque ratio for each type control type.

## 6.5 DIAMETER CALIBRATION

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

This section only applies if diameter is selected to be **Voltage**. For estimated diameter see section 9.2 Taper setup to calibrate the estimated diameter.

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.

```
CAL DIAMETER    ↓
←
→

PRESENT DIA     ↵
        XXXX IN

PRESENT DIA
     XXXX.XXX IN
```
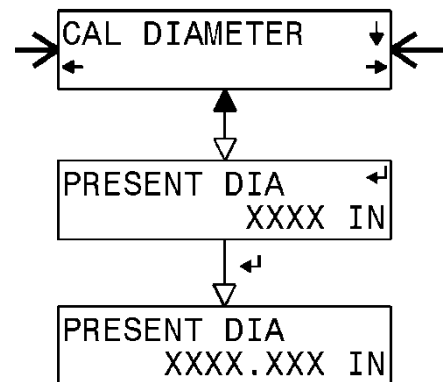
# 6.0   TENSION CONTROL

## 6.6 INERTIA COMPENSATION

The **Inertia Set-up** menu is used to configure and calibrate inertia.

The parameters in these screens apply to a full roll of web material.

**Roll weight** is the weight of a full roll of web material.

**Full roll** diameter is the diameter of the full roll of web material.

**Roll width** is the width of the full roll of web material. This is only for calibration. For rolls with other widths there is a screen in the parameters menu to enter the present web width.

**Core diameter** is the diameter of the core.

**Core WK^2** is the inertia of the core. The units for inertia are either lb-ft^2 or kg-m^2. The selection depends on the units for tension.

Run the system, and when the system is stable, select **Cal Inertia** to be **Yes** and press ↓ key to calibrate output versus torque. Any diameter roll of material may be used when calibrating the output versus torque.

Diameter and Tension must be calibrated before calibrating inertia.

There are two parameters in the Parameters menu to set the maximum line speed and the present roll width. See sections 9.6.9 and 9.6.10. The inertia compensation is computed for slowing down the roll from maximum line speed to zero in the stop time.

If the web material changes then the roll weight, full roll diameter and roll width parameters will need to be changed in the Inertia Set-up menu. If the core diameter changes or the core changes material then the Core Inertia and Core Diameter parameters must be changed in the Inertia Set-up menu. The calibration for output versus torque does not need to be calibrated again.
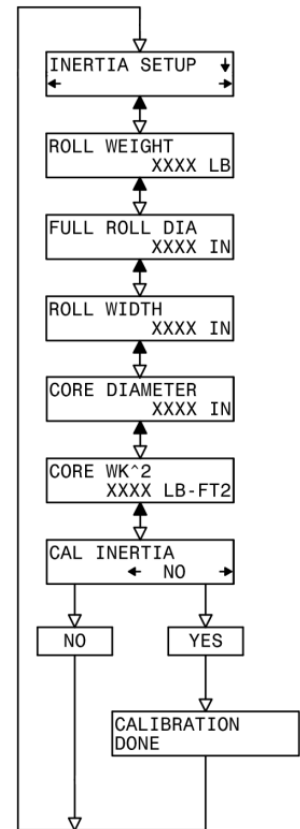
## 6.7 LOAD CELL CONNECTIONS
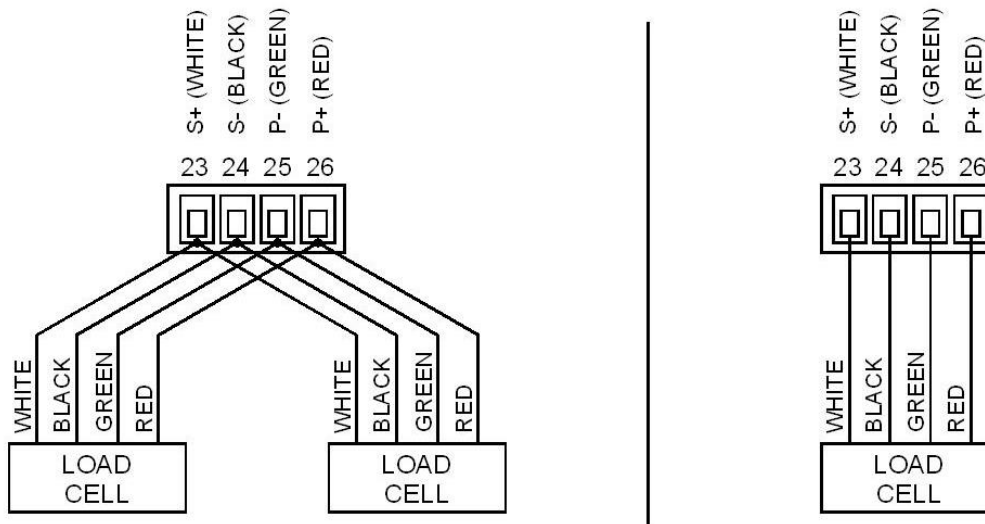
**Figure 8.  Load Cell Connections for One or Two Load Cells**

# 6.0   TENSION CONTROL

## 6.8 LOAD CELL SYSTEM COMPLETE WIRING
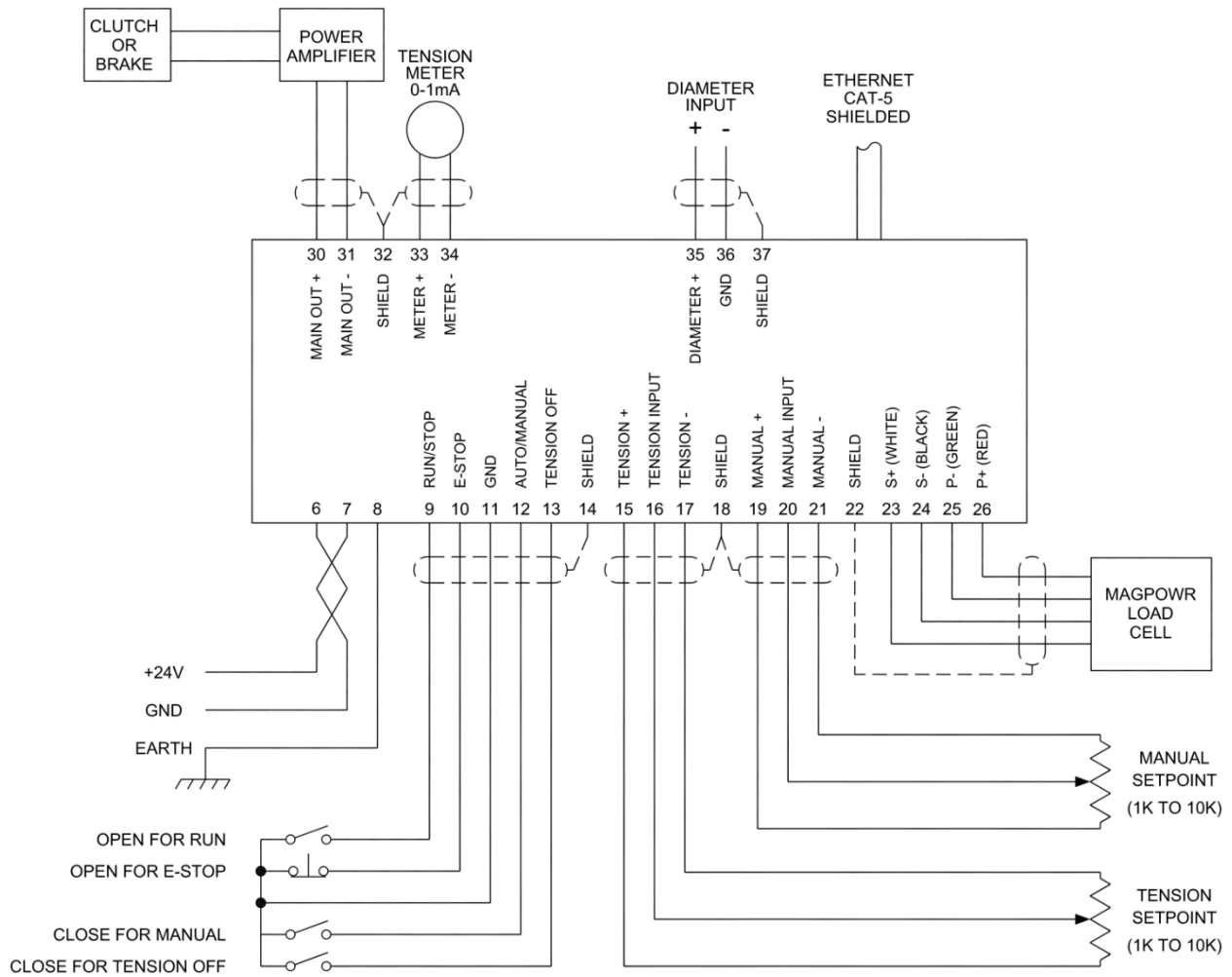


**Figure 9.  Complete Load Cell System Wiring**

## 6.9 LOAD CELL CONTROL DIAGRAM
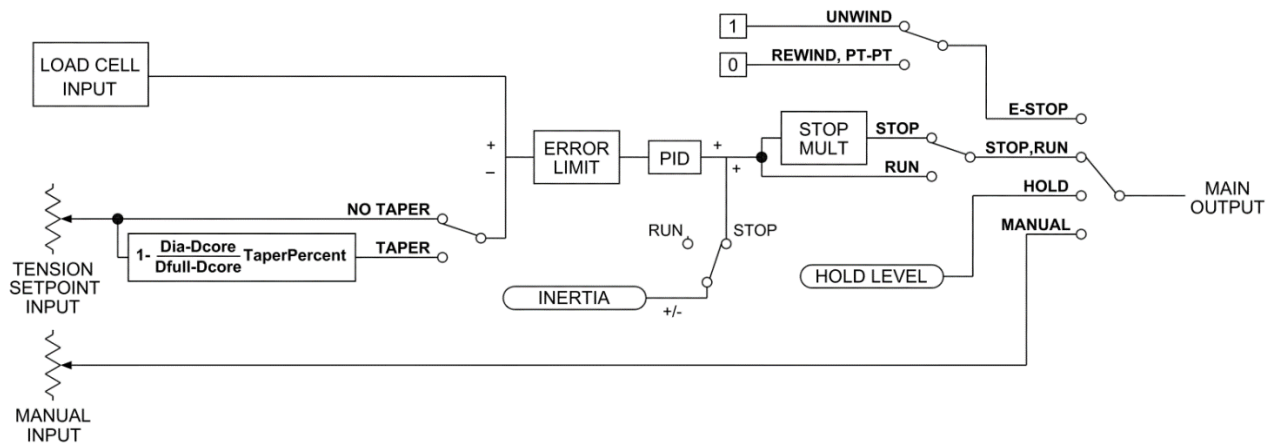


**Figure 10.  Load Cell Control Diagram**

# 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.
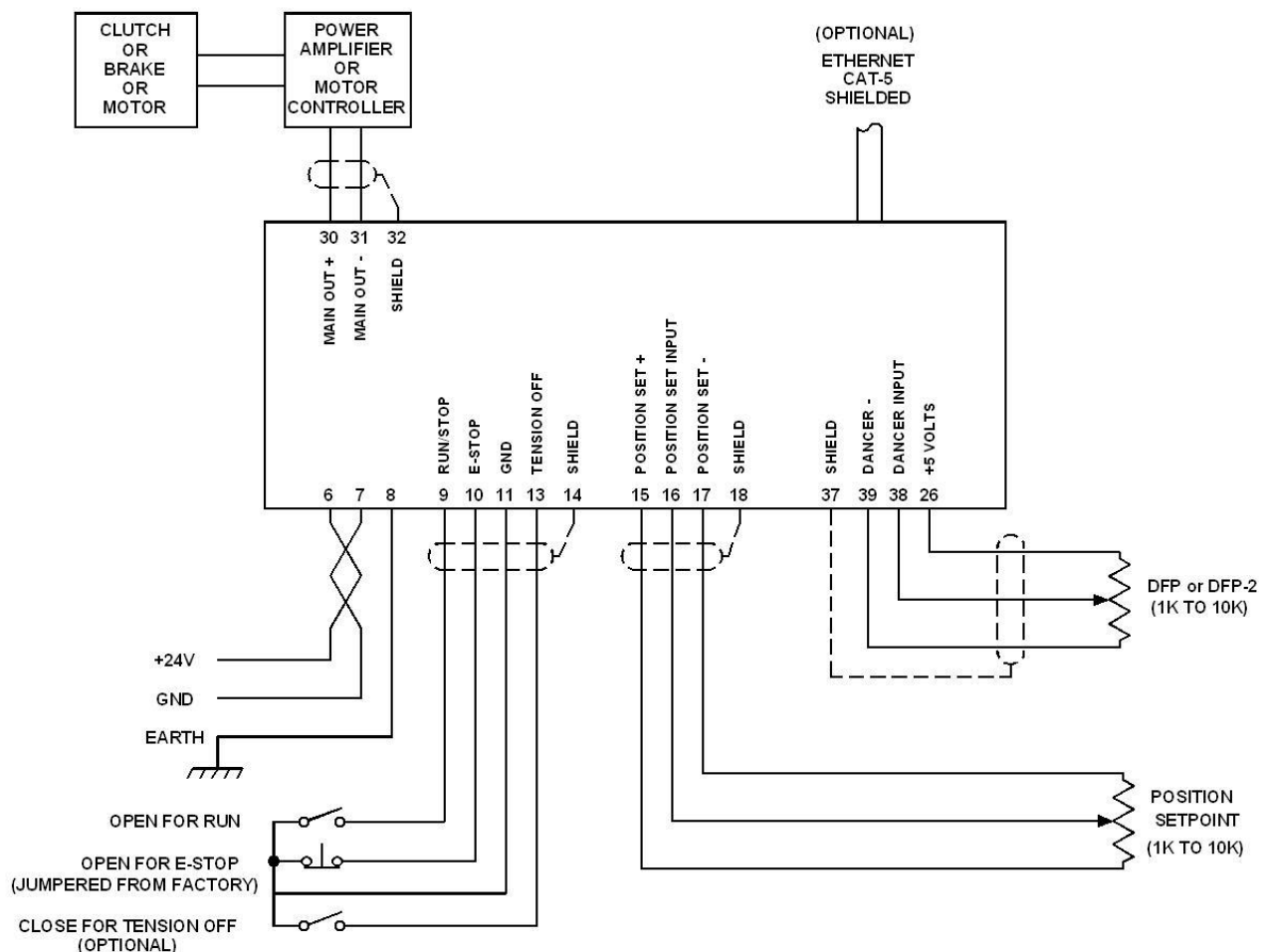


**Figure 11.  Basic Dancer Wiring**

# 7.0   DANCER CONTROL

## DFP Voltage Change with Dancer Movement

### Dancer, Torque, Unwind

DFP Max Voltage
DFP Min Voltage
Torque
Brake

### Dancer, Speed, Unwind

DFP Min Voltage
DFP Max Voltage
RPM
Regen Motor

### Dancer, Torque, Rewind

DFP Max Voltage
DFP Min Voltage
Torque
Clutch

### Dancer, Speed, Rewind

DFP Max Voltage
DFP Min Voltage
RPM
Motor
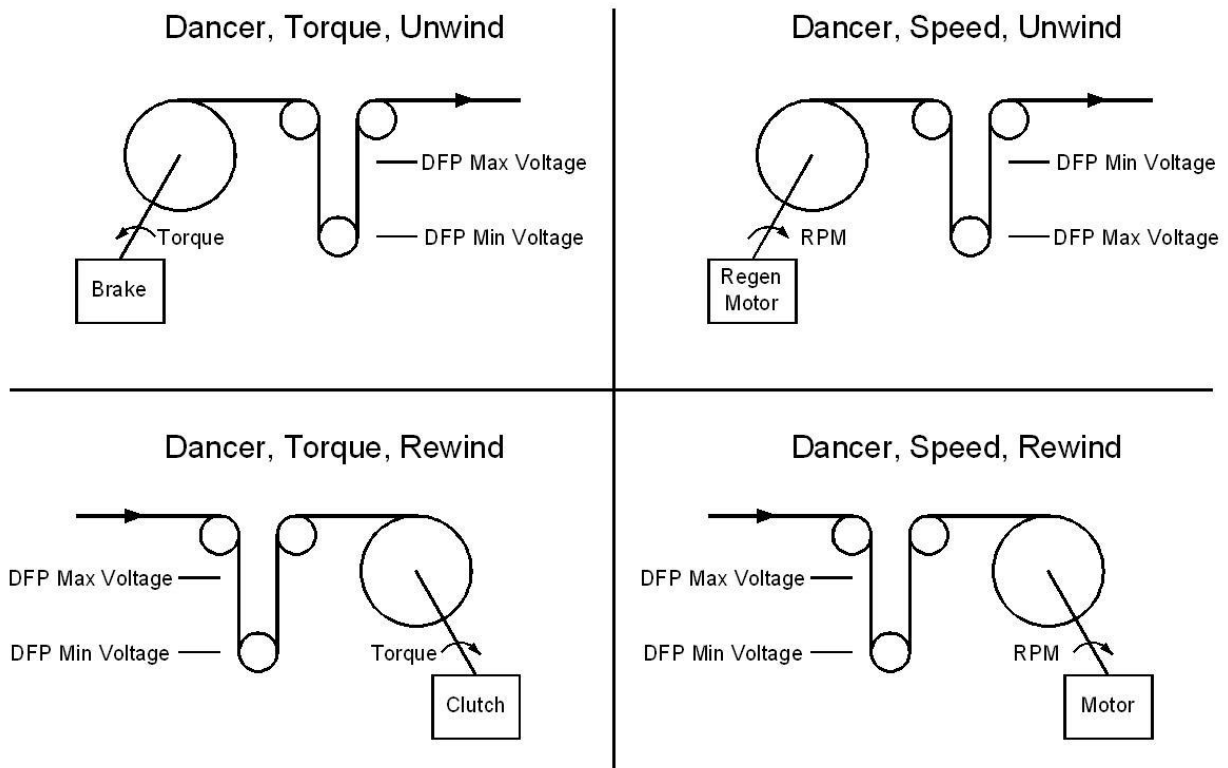
DFP Voltage measured between Term 38 and 39 with Term 39 negative.

**Figure 12.  DFP Connections**

## 7.2 SOFTWARE CONFIGURATION FOR DANCER SYSTEM

Refer to the **Dancer, Torque or Dancer, Speed** screen flowcharts in drawing number 850B352 for a navigation aid.

### 7.2.1    OPERATOR LOOP MENU
This section describes all of the screens in the **Operator Loop** menu.
All screens are display only.

```
OPERATOR LOOP    ↓
```

#### 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.
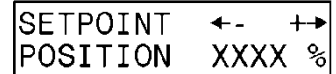
| | |
|---|---|
| E | = E-Stop |
| H | = Hold |
| S | = Start |
| A | = Automatic (Run) |
| S | = Stop |
| OFF | = Tension OFF |

```
█ POSITION
H        58.3 %
```

### 7.2.1.2 SETPOINT POSITION

**Setpoint Position** is set by the voltage on Term.16. When Setpoint Source is Ethernet, use this screen to enter a desired setpoint by pressing the ↵ key or using the ← and → 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.
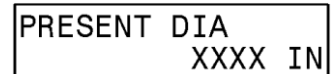
### 7.2.1.4 TENSION

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
```
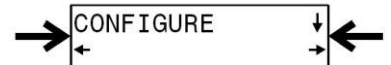
### 7.2.1.5 PRESENT DIAMETER

This screen shows the **actual measured diameter** if Diameter is enabled in the Configuration menu. See Section 7.4.3 to calibrate the diameter input.

```
PRESENT DIA
        XXXX IN
```

### 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 that configure various options.

```
→ ┌─────────────────┐ ←
  │CONFIGURE      ↓ │
  │←             → │
  └─────────────────┘
```

### 7.2.2.1 CONTROL TYPE

Select the control type either **Dancer, Torque** or **Dancer, Speed**. Dancer, Torque is for dancers using a torque device (clutch or brake or motor in torque mode), 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 controlled by a regenerative drive that is configured for torque mode. To select the gain compensated dancer mode select **Diameter Used** to be **Yes**. A voltage proportional to diameter is required for the gain compensated dancer to work.

### 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 some-times more difficult to stabilize. Integrator control is selected by choosing **PID** in Torque mode or **PI** in Speed mode. In the gain compensated dancer control the tuning type is always **PID** or **PI** and the integrator cannot be turned off.

### 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 DIAMETER

Selects whether the Diameter input is used. Diameter is used by the control routines and inertia compensation in Dancer, Torque with Diameter control. Diameter can be used for hold level changes with Diameter in Dancer, Torque with Diameter control. Diameter can be used for gain compensation in both Dancer Torque and Speed modes. See section 7.4.3 to calibrate diameter.

### 7.2.2.5 USE INERTIA COMPENSATION

Enables **Inertia Compensation** in Dancer, Torque mode. Dancer, Speed does not have inertia compensation. See section 9.6.12 for calibrating inertia compensation. Inertia compensation can be used with and without a diameter input signal.

---

# 7.0   DANCER CONTROL

### 7.2.2.6     HOLD LEVEL CHANGE WITH
Allows the output during Hold to vary by last running Output, Diameter, Tension, or Diameter and Tension. Load cells must be enabled to read tension. See section 9.6.14 to enter hold level multiplier when choice is Output. See section 9.6.13 for calibrating Hold level when the choice is Diameter, Tension, or Diameter and Tension.

### 7.2.2.7     USE LOAD CELLS
Enables reading of the load cells while in Dancer mode. See Section 6.3 to calibrate load cells.

### 7.2.2.8     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.

### 7.2.2.9     SETPOINT SOURCE
Select the source for the dancer setpoint. When set to ANALOG the Spyder will use the voltage on 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.

### 7.2.2.10     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.

### 7.2.2.11     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 or the **Diameter Display** screen.

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

### 7.2.2.13     BAR GRAPH UPDATE RATE
This parameter controls filtering for the bar graph actual position and the actual output displays. Default values work well in most applications.

### 7.2.2.14     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.

# 7.0 DANCER CONTROL

## 7.4 DANCER CALIBRATION (REQUIRED)

Navigate to the **Cal Dancer** menu**.** Press the ↓ key and the screen shows:

```
◄DANCER INPUT
    POS SETPOINT►
```

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.

### 7.4.1 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 ↓.

```
APPLY MINIMUM
DANCER VOLTAGE ↓
```

#### 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 ↓.

```
APPLY MAXIMUM
DANCER VOLTAGE ↓
```

#### 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.

```
MOVE DANCER BACK
TO MINIMUM STOP↓
```

#### 7.4.1.4 Dancer Calibration Done
Dancer Input calibration is now complete. Press ↓.

```
DANCER
CALIBRATE DONE ↓
```
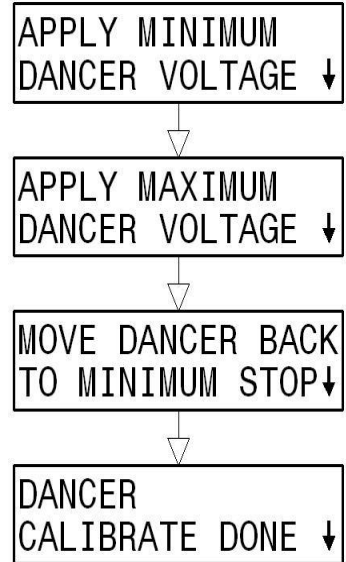
### 7.4.2 POSITION SETPOINT CALIBRATION
During normal operation, applying the minimum voltage to the position setpoint input will command the dancer to its minimum voltage position. Applying the maximum voltage will command the maximum voltage position.
This calibration is not required when the setpoint source is Ethernet.

#### 7.4.2.1 Apply Minimum Setpoint Voltage
Adjust the position setpoint input to the minimum voltage. Press ↓.

```
APPLY MIN SET
POSITION VOLTS ↓
```

#### 7.4.2.2 Apply Maximum Setpoint Voltage
Adjust the position setpoint input to the maximum voltage. Press ↓.

```
APPLY MAX SET
POSITION VOLTS ↓
```

#### 7.4.2.3 Setpoint Input Calibration Done
Setpoint Input calibration is now complete. Press ↓.

```
POSITION SET
CALIBRATE DONE ↓
```
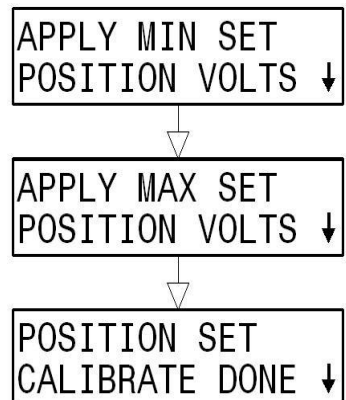
### 7.4.3 Diameter input CALIBRATION (Required for Diameter options)
Diameter must be calibrated when using the Diameter based options of inertia, hold level changes with, and gain compensated control.

---

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.

```
┌─────────────────────┐
│CAL DIAMETER      ↓  │
│←                 →  │
└─────────────────────┘
          ↑
          ▽
┌─────────────────────┐
│PRESENT DIA       ↵  │
│          XXXX IN    │
└─────────────────────┘
          ↵
          ▽
┌─────────────────────┐
│PRESENT DIA          │
│        XXXX.XXX IN  │
└─────────────────────┘
```

The Present Diameter screen actively displays the diameter. The Present Diameter screen is also available from the **Operator** menu.
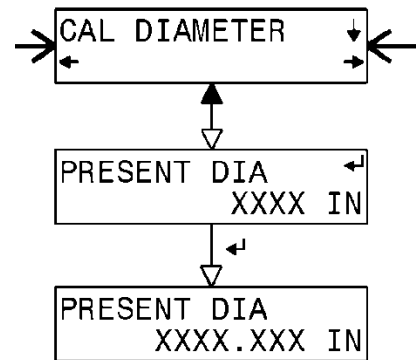
### 7.4.3.1    Core Diameter (Required for gain compensation in Torque and Speed modes)
Enter the core diameter in the Parameters menu.

### 7.4.3.2    Full Roll and Core Diameter (Required for gain compensation in Torque mode only)
Enter the full roll diameter in the Parameters menu.

## 7.5 TUNING (REQUIRED)

Use section 7.5 for tuning Dancer, Torque with no diameter and Dancer, Speed controls. Use section 7.6 for Tuning Dancer, Torque with Diameter control.

### 7.5.1    TUNING STEPS (Dancer, Torque no diameter, and Dancer Speed with/without diameter control)
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 7.5.2.

```
┌─────────────────────┐
│QUICK STAB        ↓  │
│←                 →  │
└─────────────────────┘
```

  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 7.5.3.

```
┌─────────────────────┐
│TUNING            ↓  │
│←                 →  │
└─────────────────────┘
```

**NOTE:  Applies to Setpoint Source is Analog.** The position setpoint input is not active during tuning. The ↑ and ↓ 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 exit 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 ↑ and ↓ keys. The dancer does not need to be stopped to exit the Tuning screens.

### 7.5.2    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 types of screens will appear while performing the Quick Stabilize tuning:

```
┌─────────────────────┐
│■    IF UNSTABLE↓    │
│■←IF NOW STABLE      │
└─────────────────────┘
```
See 7.5.1.1  Quick Stabilize, Integrator Test

---

# 7.0   DANCER CONTROL
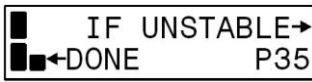
```
┌─────────────────┐
│█   IF UNSTABLE→ │        See 7.5.1.2   Quick Stabilize, Parameter Adjustment
│█■←DONE     P35  │
└─────────────────┘
```

### 7.5.2.1     Quick Stabilize, Integrator Test

```
        ┌─────────────────┐
        │█   IF UNSTABLE↓ │
        │█■←IF NOW STABLE │
        └─────────────────┘
Bar Graph of Position ┘
```

This screen is entered if the system is not yet stable, and the integrator was <u>on</u>. The integrator was turned <u>off</u> 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.

```
┌─────────────────┐
│INTEGRATOR MODE  │
│(I) IS UNSTABLE↓ │
└─────────────────┘
         ▽
┌─────────────────┐
│I IS NOW OFF     │
│TURN ON TO TUNE↓ │
└─────────────────┘
         ▽
┌─────────────────┐
│EXPECT UNSTABLE  │
│WHEN I TURNS ON↓ │
└─────────────────┘
```
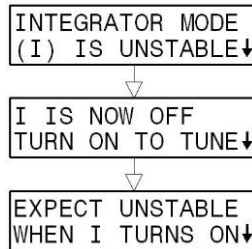
Press ↓ to turn on the integrator and quick stabilize **I.** A screen similar to 7.5.1.2 will be used to stabilize **I.**

### 7.5.2.2     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:

```
        ┌─────────────────┐
        │█   IF UNSTABLE→ │
        │█■↕←DONE    P35↵ │
        └─────────────────┘
Bar Graph of Position ┘    │        │    └ Use ↵ to exit screen
Adjust Setpoint Position ┘           └ Parameter being tuned
```

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.

### 7.5.3    OPTIMIZE TUNING - SECOND STEP

#### 7.5.3.1        Dancer, Torque, no Diameter

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 │      PD Tuning
│ THEN D AT FULL→ │
└─────────────────┘
```

```
┌─────────────────┐
│◄FIRST P AT CORE │      PID Tuning
│THEN ID AT FULL→ │
└─────────────────┘
```

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 7.5.3.3 for a typical tuning screen.

#### 7.5.3.2        Dancer, Speed, with and without Diameter

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 │      PI Tuning
│ THEN I AT CORE→ │
└─────────────────┘
```

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.

### 7.5.3.3 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 in order to perform Tuning. A typical tuning screen looks like this:
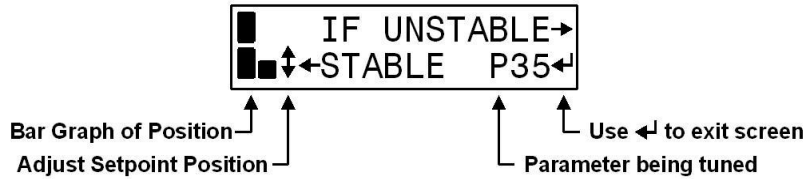
```
■  IF UNSTABLE→
■■↕←STABLE  P35↵
```

Bar Graph of Position ⌐
Adjust Setpoint Position ⌐                 Use ↵ to exit screen
                                           Parameter being tuned

Press ↑ or ↓ 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. In addition to **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 ← until the system starts to become unstable. Then press → until stability is again obtained. When finished tuning press ↵ to exit the screen. The web must be stopped in order to exit 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 ↑ and ↓ 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 exit 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 ↑ and ↓ keys. The dancer does not need to be stopped to exit the Tuning screens.

There is a table in section 9.6.6 showing default values of proportional, integrator, derivative, error limit and stop torque ratio for each type control type.

## 7.6 TUNING (Dancer, Torque with diameter)

This is the tuning for the Dancer, Torque with Diameter dancer control.

The dancer position should be set to midpoint. Run the dancer system at a slow speed until the system is stabilized to prevent breaking the web due to large oscillations. Make sure the parameters Core Diameter and Full Roll Diameter and set before running the system.

Proportional gain and a minimum gain at core (called Stop Torque Ratio, Mc) are the only parameters requiring tuning for most systems. In the parameters menu the proportional gain, integrator time, derivative time and stop torque ratio are available to view and modify. See section 9.6.6 for defaults for these parameters.

This dancer control is a PID control with the integrator always active.

Navigate to the **Tuning** menu and press ↓. For a Dancer in Torque mode with diameter the following screen will be displayed:

```
←FIRST P AT FULL
THEN Mc AT CORE→
```
                                            **PID** Tuning

The Spyder should be optimized at or near full roll first. Press ← to optimize **P** at full roll.

The Spyder should be optimized at core only after it has been optimized at full roll. Press → to optimize Mc, (Stop Torque Ratio) at core.

# 7.0   DANCER CONTROL

## 7.6.1   TUNING SCREENS
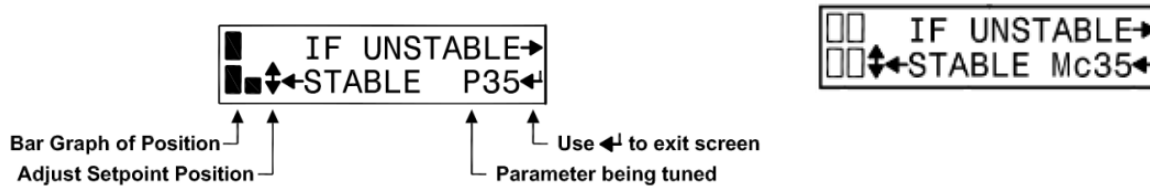


Press the up or down button to reposition the dancer if necessary. The analog position setpoint is not active during tuning, but is an internal software parameter. In these screens there is number next to the parameter being tuned which is not the value of the parameter, but shows the progress of tuning. Its value can be between 00 and 99. 00 is displayed when a parameter is as stable as it can be. Press the → key until the system is stable. Press the ← key until the system starts to become unstable. Then press the → key until stability is regained. When finished tuning press ↵ to exit the screen.

**NOTE:**  Applies to Setpoint Source is Analog. The position setpoint input is not active during tuning. The ↑ and ↓ 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 ↑ and ↓ keys. The dancer does not need to be stopped to exit the Tuning screens.

Since the controller gain is a product of proportional gain and a function of the diameter ratio (present diameter / full diameter) at small diameters there may not be enough gain to correct for position errors. The stop torque ratio, Mc, is essentially a gain offset near core. Tune this parameter near core. Since this affects controller gain it may be necessary to retune proportional gain at full roll if the control is now unstable at full roll after tuning Mc at core. If while running from full roll to core for the first time and the control does not have enough gain to make position corrections, it may be necessary to tune stop torque ratio, Mc, before core is reached.

Stop torque ratio, Mc, provides a control gain offset near core diameter and is used to provide enough gain at core diameter to correct for position changes.

There is a table in section 9.6.6 showing default values of proportional, integrator, derivative, error limit and stop torque ratio for each type control type.

## 7.7 CONTROL DIAGRAM – DANCER, TORQUE WITH NO DIAMETER
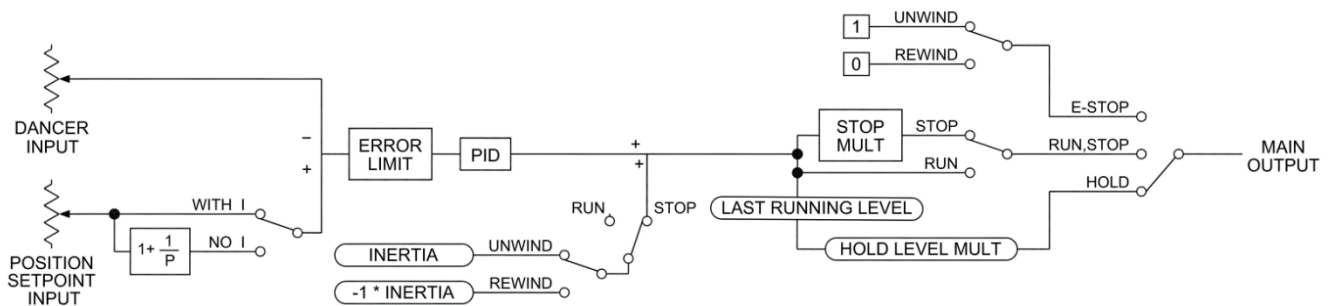


**Figure 13.  Dancer, Torque with No Diameter Control Diagram**

# 7.0   DANCER CONTROL

## 7.8 CONTROL DIAGRAM – DANCER, TORQUE WITH DIAMETER
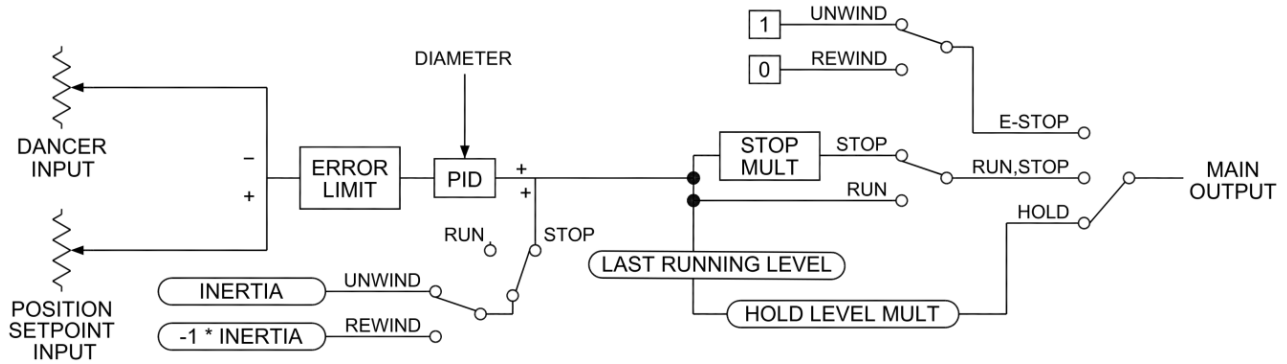


**Figure 14.  Dancer, Torque with Diameter Control Diagram**

## 7.9 CONTROL DIAGRAM – DANCER, SPEED
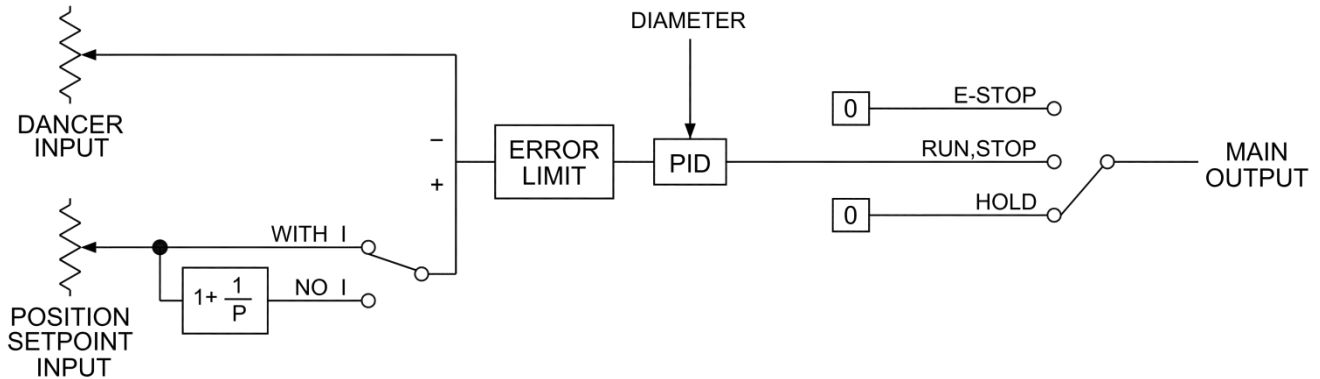


**Figure 15.  Dancer, Speed Control with or without Diameter Diagram**

# 7.0   DANCER CONTROL

## 7.10   Dancer System Complete Wiring
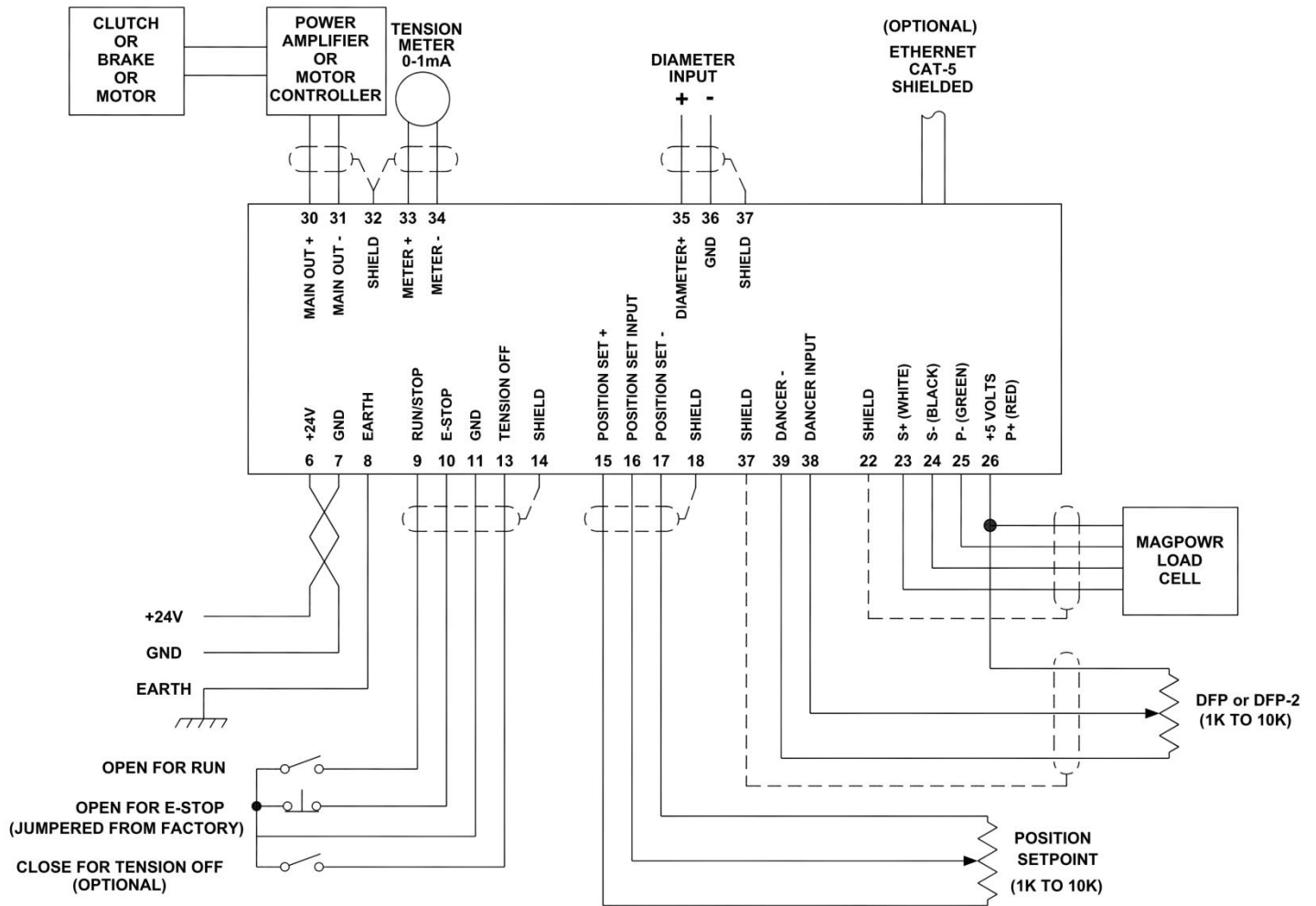


**Figure 16.  Complete Dancer System Wiring**

# 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 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 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.
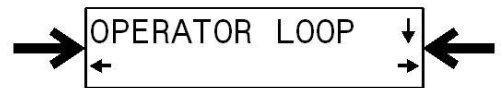


### 8.2.1.1  TENSION
This screen shows the actual tension in numeric and bar graph form. This will be different from the setpoint tension when taper is enabled. The lower left character displays the status of the Spyder.

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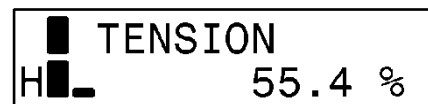


### 8.2.1.2  PRESENT DIAMETER
Present diameter displays the current diameter being input on Term. 38. See Section 8.3 for calibrating diameter.

### 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.

### 8.2.1.4 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.
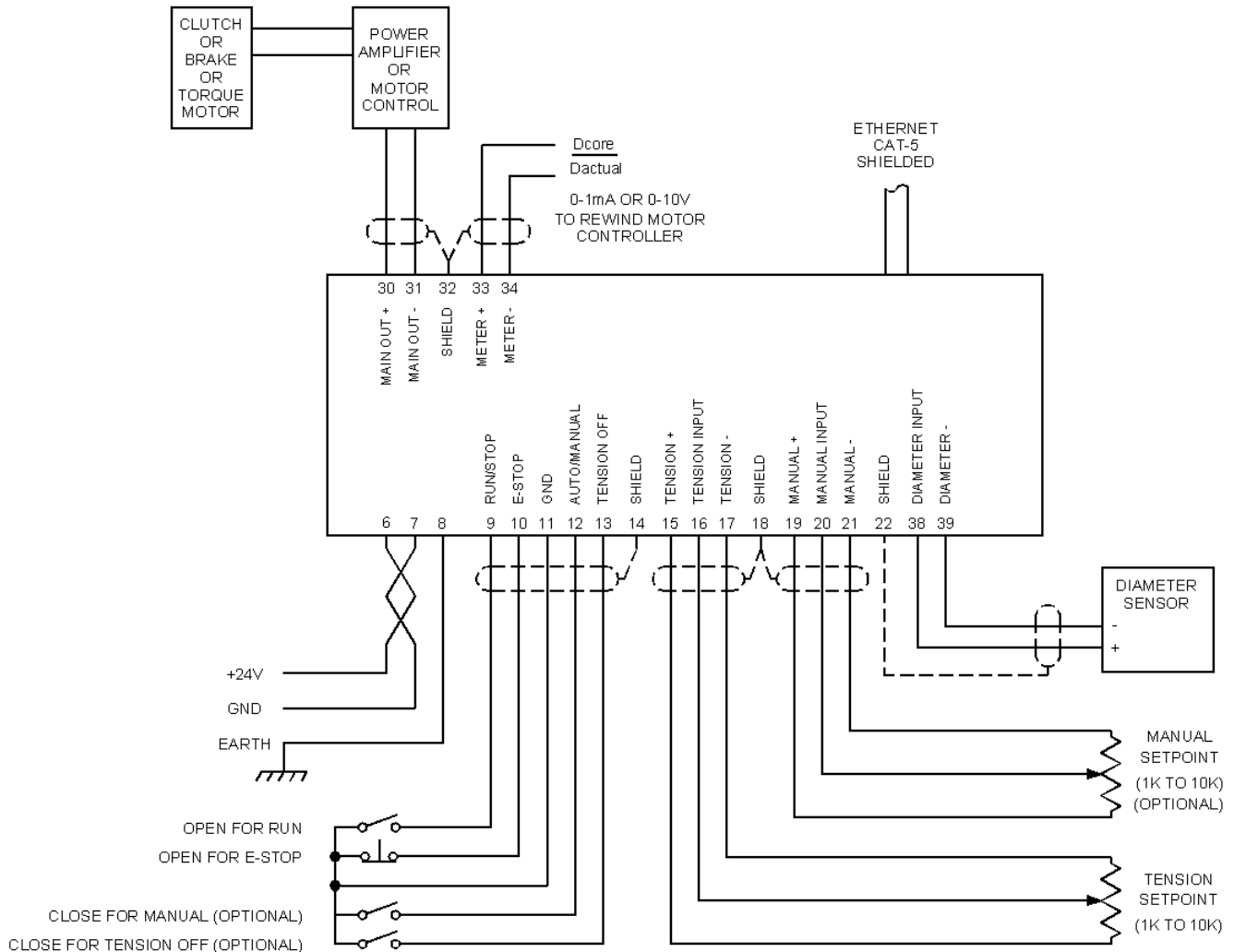


**Figure 17. Complete Open Loop Tension System Wiring**

## 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.

```
CONFIGURE        ↓
←
                 →
```
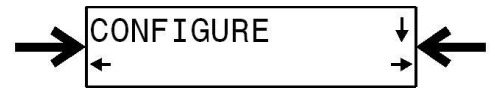
### 8.2.2.1 CONTROL TYPE

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.

```
┌─────────────────────┐
│ CAL DIAMETER    ↓   │
│ ←                 → │
└─────────────────────┘

┌─────────────────────┐
│ PRESENT DIA     ↵   │
│           XXXX IN   │
└─────────────────────┘

┌─────────────────────┐
│ PRESENT DIA         │
│       XXXX.XXX IN   │
└─────────────────────┘
```

## 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.

```
┌─────────────────────┐
│ CORE DIAMETER       │
│           XXXX IN   │
└─────────────────────┘

┌─────────────────────┐
│ FULL ROLL DIA       │
│           XXXX IN   │
└─────────────────────┘

┌─────────────────────┐
│ USE TAPER           │
│          YES        │
└─────────────────────┘
```

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 18.  Open Loop Tension Control Diagram**

# 9.0  OPTIONAL FUNCTIONS

## 9.1 PREFERENCES MENU

This section describes all the screens in the Preferences menu.
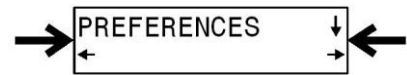
Navigate to the **Preferences** menu and Press ↓.

### 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. For load cells using inertia, sets the units for the core inertia parameter in the Inertia Setup menu.

### 9.1.3   DISTANCE UNITS
Select the Distance units.

### 9.1.4   VELOCITY UNITS (Load cell only)
Select the Velocity 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 or read from a voltage input proportional to diameter and must be calibrated to use taper tension.

Taper Percent, Section 6.2.1.3 must be set to **0** (zero) 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.

If diameter is Voltage, go to the Calibrate Diameter menu screen to calibrate diameter. If diameter is Estimated, use the next three screens to calibrate the present diameter.

**For Estimated Diameter:**

The Present Diameter 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** (zero) 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.
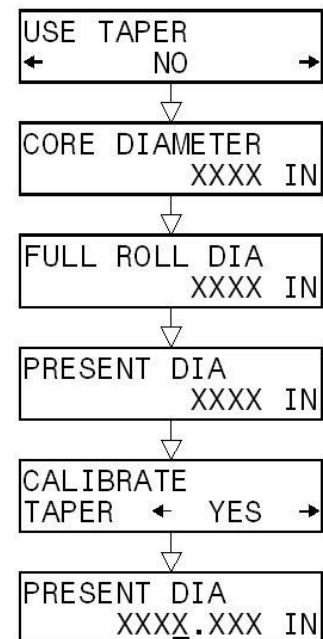
# 9.0 OPTIONAL FUNCTIONS

### 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 ↓ key.

```
→ RECAL INPUTS    ↓ ←
  ←              →
```

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.

```
CAL SETPOINT
INPUT ←TENSION →
```
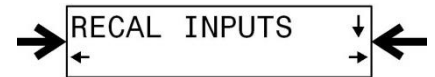
### 9.3.2 Apply Minimum Setpoint Tension or Manual Voltage
Apply the minimum Setpoint Tension or Manual voltage. Press ↓.

```
APPLY MIN SET
TENSION VOLTAGE↓
```

### 9.3.3 Apply Maximum Setpoint Tension or Manual Voltage
Apply the maximum Setpoint Tension or Manual voltage. Press ↓.

```
APPLY MAX SET
TENSION VOLTAGE↓
```
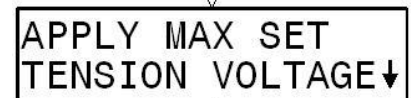
### 9.3.4 Calibration Done
The selected input calibration is now complete. Press ↓. This will return to the
**Recal Inputs** menu.

```
CALIBRATION
DONE            ↓
```

## 9.4 CALIBRATE OUTPUTS

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

```
→ RECAL OUTPUTS   ↓ ←
  ←              →
```

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 to 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.
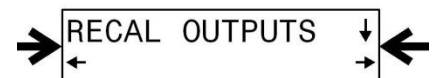
### 9.4.1 OUTPUT 0% CAL
← and →
Use the ← and → keys to adjust the main output on Term.30 and Term.31 to 0
volts or 4 mADC. Press ↓ when finished.

```
OUTPUT  0% CAL
USE ←-    +→
```
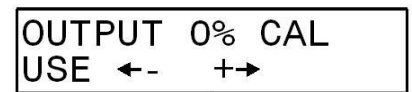
### 9.4.2 OUTPUT 100% CAL
Use the ← and → keys to adjust the main output on Term.30 and Term.31 to
+10vdc or 20 mADC. Press ↓ when finished.

```
OUTPUT  100% CAL
USE ←-    +→
```
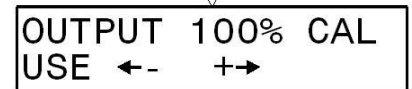
### 9.4.3 METER 100% CAL
Use the ← and → keys to adjust the meter output on Term.33 and Term.34 to
1 mADC or 10 VDC. Press ↓ when finished.

```
METER  100% CAL
USE ←-    +→
```
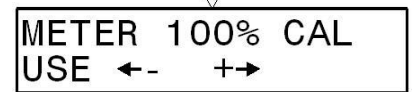
# 9.0   OPTIONAL FUNCTIONS

## 9.5 SECURITY LOCKOUT

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.

```
    SECURITY        ↓
 →  ← NOT SECURED →  ←
```
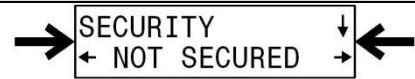
This function allows you to lock all tuning, calibration and configuration parameters to prevent unauthorized tampering. Operators will still have access to tension/position setpoint, tension on/off, auto/manual, manual output and taper percent (NOTE:  When selecting a security code be sure to record it.)

## 9.6 PARAMETERS MENU

This section describes all the screens in the Parameters menu. Navigate to the **Parameters** menu and Press ↓.

```
    PARAMETERS      ↓
 →  ←             →  ←
```

### 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 dependent 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    STOP TORQUE RATIO (Dancer Torque with Diameter only)
In Dancer Torque with Diameter mode this parameter provides a control gain offset near core diameter. Enter a value for the stop torque ratio which provides a response that provides enough gain at core diameter to correct for position changes. Too high a value will cause the dancer to be unstable at or near full roll diameter.

### 9.6.5    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.

### 9.6.6    CONTROL PARAMETERS FACTORY DEFAULTS

| Factory Defaults | Load Cell System | Dancer, Torque without Diameter System | Dancer, Torque, with Diameter System | Dancer, Speed System |
|---|---|---|---|---|
| Proportional | 0 | 1.0 | 1.0 | 1.0 |
| Integrator | 2.0 Seconds | 2.0 Seconds | 2.5 Seconds | 2.0 Seconds |
| Derivative | N/A | 1.25 Seconds | 0.625 Seconds | N/A |
| Error Limit | 100% | 100% | 100% | 100% |
| Stop Torque Ratio | N/A | N/A | 1.0% | N/A |

### 9.6.7  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.

### 9.6.8  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.

### 9.6.9  MAXIMUM VELOCITY (Load Cell Only)
Used by inertia compensation to compute the stopping torque required to stop the roll from the entered maximum velocity in the stop time.

### 9.6.10  ROLL WIDTH (Load Cell Only)
Used by inertia compensation to compute the stopping torque required to stop the roll of this entered width in the stop time.

### 9.6.11  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 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 MULITPLIER 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 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.

### 9.6.12  INERTIA COMPENSATION PERCENT (Used on Dancer Torque)
The value in percent added or subtracted to the output during stopping. This value is modified by tension and last running level when diameter is not used and is modified by the diameter ratio of present diameter divided by full roll diameter when diameter is used. This value must be calibrated with the system running and by entering a value that will be added to the last running output during the stop time to stop the roll at the present diameter, torque and tension.

### 9.6.13  HOLD LEVEL (Load Cell and Dancer Torque)
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. This value is also used to calibrate hold level when hold level varies with Diameter and or Tension. To calibrate hold level enter the desired hold level for the present diameter and or tension. The present reading of diameter, tension and last running output (Dancer) is used during the calibration so the system may need to be running to get diameter, tension and last running output readings when performing the calibration.

### 9.6.14  HOLD LEVEL MULTIPLIER (Load Cell and Dancer Torque)
This parameter is used when hold level is selected to vary with Output. The output of the control in hold mode is the last running output multiplied by the Hold Level Multiplier.

### 9.6.15  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%.

### 9.6.16  CORE DIAMETER (Load Cell, Dancer Torque with Diameter, Dancer Speed with Diameter, and Open Loop Tension only)
In the parameters menu, enter the core diameter of the roll. Used by the control loop and for taper tension.

### 9.6.17  FULL ROLL DIAMETER (Dancer Torque and Open Loop Tension only)
In the parameters menu, enter the full roll diameter of the roll. Used by the control loop and for taper tension.

# 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 ↵.<br><br>The Spyder will sweep through the contrast settings repeatedly until ↵ is pressed. The contrast can be refined in the **Screen Contrast** screen.<br><br>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.<br><br>**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. |

## 10.2   TUNING PROBLEMS (Load Cell Control)

| Problem | Possible Cause | Solution or Diagnostic |
|---------|----------------|------------------------|
| Tension unstable | Control not optimally tuned. | Use Quick Stabilize.<br><br>Navigate to the **QuickStab** menu. Press the ↓ key and then press **If Unstable→** to immediately try to stabilize.<br><br>Review **Tuning** once stability is obtained. See Section 6.4. |
| "Cannot be stabilized." Appears while using quick stabilize. | To diagnose: | 1) Go to the **Output Level** screen to read the average output while running in AUTO mode.<br><br>2) Set the **Manual Level** to the average value.<br><br>3) Go to the **Tension** screen.<br><br>4) Toggle between AUTO and MANUAL modes.<br><br>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. |

## 10.3   TUNING PROBLEMS (Dancer Control)

| Problem | Possible Cause | Solution or Diagnostic |
|---|---|---|
| Position unstable | Control is not optimally tuned. | Use Quick Stabilize<br><br>Navigate to the **QuickStab** menu. Press the ↓ key and then press    **If Unstable→** to immediately try to stabilize.<br><br>Review "**Tuning**" once stability is obtained. See Section 7.5.<br><br>For Dancer, Torque with Diameter systems go to the Tuning menu in section 7.6. |
| "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. |
| Diameter not correct. | Diameter is not calibrated. | Calibrate diameter per section 7.4.3. |
| 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). Follow the tuning procedures in section 7.5 or 7.6.<br><br>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.<br><br>Use PID (torque) or PI (speed). These can be selected on the **Configure** menu following selection of the **Control Type**.<br><br>For Dancer, Torque with Diameter systems (gain compensated dancer) the control is always in PID mode. Increase the stop torque ratio if position does not correct near core diameter. |

## 10.4   LOAD CELL CALIBRATION PROBLEMS

| Problem | Possible Cause | Solution or Diagnostic |
|---|---|---|
| Cannot calibrate load cells. | Load cells wired incorrectly. | Table 1 below gives voltages for various wiring errors. All voltages are measured with respect to Term.21. 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. |
| Message "Sensing roll too heavy" | | The roll supported by the load cells must weigh less than ½ of the total load cell rating (the sum of the two). This message also appears when there are load cell wiring errors. See "Cannot calibrate load cells" above. |
| Message "Out of range at Max Tension" | | 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. |
| Message "Signal too small at Max Tension" | | 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. |
| Message "Load cells are overloaded." | | The load applied to the sensing roll during calibration has exceeded the rating of the load cell. |
| Message "Load very small. Maybe shorted." | | The signal read by the Spyder after load was applied is very small. There may be a short between Term.23 and Term.23. This message also appears if the calibration load was never applied to the sensing roll. |

## 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.24 (S-)** \ **TERM.23 (S+)** | -5.0 | -1.7 | -1.0 | 0.00 | 1.0 | 1.7 | 2.5 | 5.0 |
| -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) |

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<br><br>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<br>Dancer Voltage<br>       Or<br>Apply Maximum<br>Dancer Voltage | From the **Cal Dancer** menu.<br><br>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 ↓<br>       Or<br>Apply Max Set Position volts ↓ | From the **Cal Dancer** menu.<br><br>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 ↓<br>       Or<br>Apply Max Set Tension voltage ↓<br>       Or<br>Apply Min Set Manual voltage ↓<br>       Or<br>Apply Min Set Manual voltage ↓ | From **Recal Inputs** menu.<br><br>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.<br><br><br>Apply the Min or Max voltage to the appropriate input and press ↓ |
| Apply tension and press ↓ | From **Cal Sensors** menu.<br><br>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.<br><br>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. |
| Cal Inertia ↓ | From the Inertia Setup menu for Load Cell systems. Select "Yes" and press the ↓ key to calibrate output versus torque. This is used by the inertia compensation calculation. |
| Cal Sensors ↓ | One of the top level menu screens. Used to calibrate the load cells. |
| Cal Setpoint<br>Input ← Tension →<br>       Or<br>Cal Setpoint<br>Input ← Manual → | From the **Recal Inputs** menu.<br><br>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.<br><br>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.<br><br>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. |
| Control Type<br>← Load Cell→<br>or<br>Control Type<br>← Dancer, Torque→<br>or<br>Control Type<br>← Dancer, Speed→<br>or<br>Control Type<br>← Tension, Diameter→ | From the **Configure** Menu.<br><br>Used to choose the type of control that will be used.<br><br>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.<br><br>In Dancer, Torque mode a clutch or brake should be controlled.<br><br>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. |
| Core Diameter | From the **Taper Setup** menu for load cell system and the **Parameter** menu for Dancer Torque and Open Loop Tension systems.<br><br>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. From the **Inertia Setup** menu for Load Cell system. Enter the core diameter of the full roll used for inertia setup. See Section 6.6. |
| Core Tension | In the **Operator Loop** with taper tension enabled.<br><br>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.<br><br>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. |
| Core WK^2 | From the **Inertia Setup** menu for load cell systems. Enter the core inertia used for inertia setup. |

| | |
|---|---|
| ←Dancer Input<br><br>        Pos Setpoint→ | From **Cal Dancer** menu.<br><br>Used to select whether the Dancer Input or the Position Setpoint input will be calibrated. |
| Derivative Time | From the **Parameters** menu<br><br>Set the derivative time. Derivative time is only used for Control Type **Dancer, Torque**. See Section 9.6.6 for defaults. |
| Error Limit | From the **Parameters** menu.<br><br>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%. |
| First I at Full. Then P at core | From the **Tuning** menu for Unwinds and Rewinds.<br><br>Selects which parameter to optimize.<br><br>The Spyder should be optimized at or near full roll first. On rewinds "Quick Stab" may be needed while a full roll is wound.<br><br>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.<br><br>See tuning procedure in section 6.4 or 7.5. |
| First P at Full. Then Mc at core. | From the Tuning menu for Dancer, Torque, with Diameter systems.<br><br>Selects which parameter to optimize.<br><br>See tuning procedure in section 7.6 |
| FTP Address | From the **Network** menu.<br><br>Enter the address of the FTP site that will be used to obtain Spyder update programs. |
| Full Roll Diameter | From the **Taper Setup** menu for load cell system and the **Parameter** menu for Dancer Torque and Open Loop Tension systems. Enter the value of the diameter of the full roll.<br><br>From the Inertia Setup menu for load cell system. Enter the full roll diameter of the roll used in inertia setup. |
| Full roll tuning is optimal | From the **Tuning** menu for unwinds and rewinds.<br><br>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. |
| Gateway Address | From the **Network** menu.<br><br>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. |
| Hold Level | From the **Parameters** menu.<br><br>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. |

| | |
|---|---|
| Hold Change With | From the **Configure** menu.<br><br>Selects how hold level changes happen. Hold level change choices are None, Output, Diameter, Tension, and Diameter and Tension. |
| Hold Level Multiplier | From the **Parameters** menu.<br><br>Used for Load Cell and Dancer Torque systems when hold level changes with output is selected. The output of the control during hold mode is the last running output multiplied by the Hold Level Multiplier. |
| If Unstable →<br><br>←Stable  Pxx<br><br><br>(Tuning) | From the **Tuning** menu.<br><br>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. |
| If Unstable →<br><br>←Done   Pxx<br><br><br>(Quick Stab) | From the **Quick Stab** menu.<br><br>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**. |
| If Unstable↓<br><br>←If Now Stable | From the **Quick Stab** menu (dancers only).<br><br>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. |
| Inertia Comp % | From the **Parameters** menu. (Dancer Torque only)<br><br>The value added to the output during stop time to help stop the roll. This value needs to be calibrated by entering the output needed to stop the roll at the present diameter and tension. |
| "Integrator mode (I) is unstable"<br><br>"I is now off. Turn on to tune"<br><br>"Expect unstable when I turns on" | These message screens explain that the integrator is the cause of the instability. |
| Integrator Time | From the **Parameters** menu.<br><br>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. See Section 9.6.6 for defaults. |
| IP Address | From the **Network** menu.<br><br>The IP address assigned to the Spyder to connect to a network. If DHCP is enabled this address is ignored. |
| Load applied wrong way | From **Cal Sensors** menu<br><br>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. |
| Load cells are overloaded. | A load cell calibration error message. *See Load Cell Calibration Problems* in Section 10.4. |

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|---|---|
| Load very small. Maybe shorted. | From the **Cal Sensors** menu.<br><br>This is a warning message during load cell calibration. See *Load Cell Calibration Problems* in Section 10.4. |
| Manual Level | In the **Operator Loop**.<br><br>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. |
| Maximum Tension | From **Cal Sensors** menu.<br><br>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. |
| Maximum Velocity | From the Parameters menu for load cell. Sets the maximum line speed velocity for use in the inertia compensation calculation. |
| Meter 100% CAL | From the **Recal Outputs** menu.<br><br>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.<br><br>Sets the Modbus address of this Spyder. |
| Modbus Byte Order | From the **Network** menu.<br><br>Determines whether Modbus data is sent with the most significant byte first or last. |
| Modbus Word Order | From the **Network** menu.<br><br>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.<br><br>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.<br><br>This is the default entry point for all operator displays. |
| Out of range at Max Tension | Error message during load cell calibration. See *Load Cell Calibration Problems* in Section 10.4. |
| Out of Range at Max Tension | From the **Cal Sensors** menu.<br><br>See *Load Cell Calibration Problems* in Section 10.4. |
| Output 0% CAL | From the **Recal Outputs** menu.<br><br>Used to calibrate the control output (Term.30 to Term.31) when 0% output is commanded. |

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|---|---|
| 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 diameter if diameter has been calibrated. |
| | In **Cal Diameter** menu for Dancer and Open loop tension system. Used to calibrate the diameter. Diameter calibration is required. |
| | Also shows in the **Operator Loop** menu. |
| Primary tuning is optimal | From the **Tuning** menu for point to point systems. |
| | 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. |
| Program Number | From the **Network** menu. |
| | The number of the program that will be downloaded from the FTP site to update the Spyder software. |
| Proportional Gain | From the **Parameters** menu. |
| | 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. |
| Quick Stab | 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. |
| Recal Inputs | 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). |
| Recal Outputs | One of the top level menu screens. Used to recalibrate the control output and the tension meter output. |
| Retune I now, then retune 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. |
| Retune I now. Then P at core. | 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. |

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|---|---|
| Retune P at core. | 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. |
| | 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. |
| Retune P now. | 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. |
| Roll Weight | From the Inertia Setup menu for Load Cell systems. Enter the full roll weight for use in inertia setup. |
| Roll Width | From the **Parameters** menu. Sets the current roll width to be used in the inertia compensation calculation for load cells. |
| | From the **Inertia Setup** menu. Sets the roll width for the inertia setup parameters. |
| Screen Contrast | From the **Configure** menu. |
| | Used to adjust the screen contrast. Use ← and → to adjust. |
| Secondary tuning is optimal | From the **Tuning** menu for point to point systems. |
| | 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. |
| 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<br><br>Or<br><br>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. *See Load Cell Calibration Problems* 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. |

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|---|---|
| Setpoint Position | In the **Operator Loop**.<br><br>For dancer with Setpoint = Analog this is only a display of the current setpoint input between Term.16 and Term.17.<br><br>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.<br><br>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.<br><br>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.<br><br>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 | From the **Parameters** menu.<br><br>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. |
| Stop Time | From the **Parameters** menu.<br><br>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. |
| Stop Torque Ratio | From the **Parameters** menu.<br><br>Enter a value which increases the response of a Dancer, Torque with Diameter system near core. Too low a value could cause poor position control at core. Too high a value could cause diameters near full roll to oscillate. |
| Subnet Mask | From the **Network** menu.<br><br>Determines the range of addresses in a subnet. Consult your system administrator. If DHCP is enabled this parameter is ignored. |
| Switch to Quick Stab | From the **Tuning** menu.<br><br>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. |

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|---|---|
| Taper Percent | From the **Operator Loop**. |
| | 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. |
| Taper Setup | One of the top level menu screens. Used to calibrate diameter and to edit Core Diameter and Full Roll Diameter. |
| Tension | In the **Operator Loop**. |
| | Displays the actual tension in both numeric and bar graph forms. |
| Try larger Max | From the **Cal Sensors** menu. |
| | 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. |
| Try smaller Max | From the **Cal Sensors** menu. |
| | The Spyder will suggest a Max Tension that will keep the load cells from being out of range at Max Tension |
| Tune I First. Then P second | From the **Tuning** menu for point to point systems. |
| | The Spyder should be optimized in the order shown. |
| 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 Diameter | From the **Configure** menu. |
| | In load cell mode, selects either Estimated or Voltage diameter. |
| | In Dancer mode, selects whether diameter is used in the control (gain compensated dancer). |
| 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, IP Address, Gateway Address and Subnet Mask must be configured. |
| Use Inertia Comp | From the **Configure** menu. |
| | Select "Yes" to enable inertia compensation during the stop time. |

| | |
|---|---|
| Use Load Cells? | From the **Configure** menu.<br><br>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.<br><br>Select **Yes** to enable taper tension. |
| Velocity Units | From the **Preferences** menu for Load Cell control.<br><br>Select the desired units for Maximum Velocity. |

# 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 **"http://"** 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 that 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

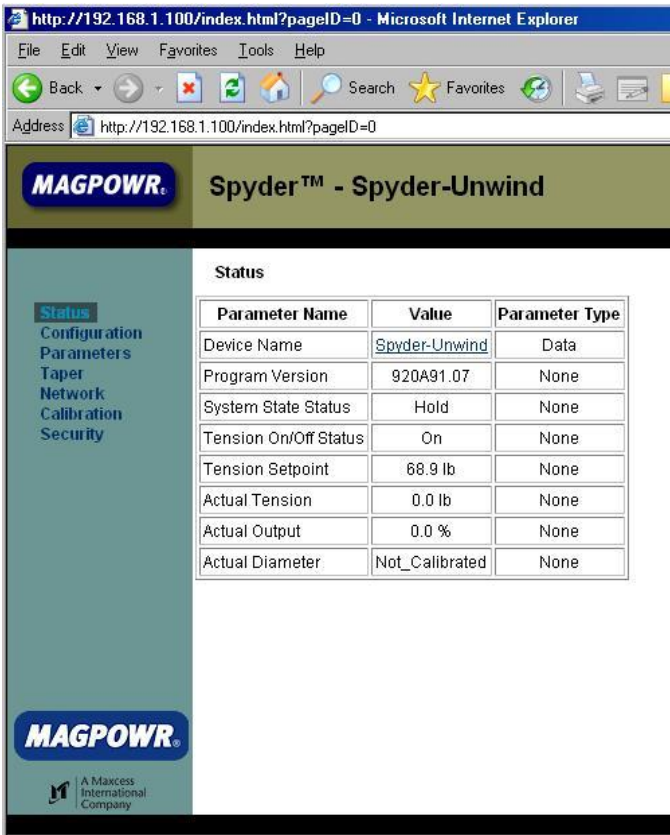# 12.0    COMMUNICATION (OPTIONAL)



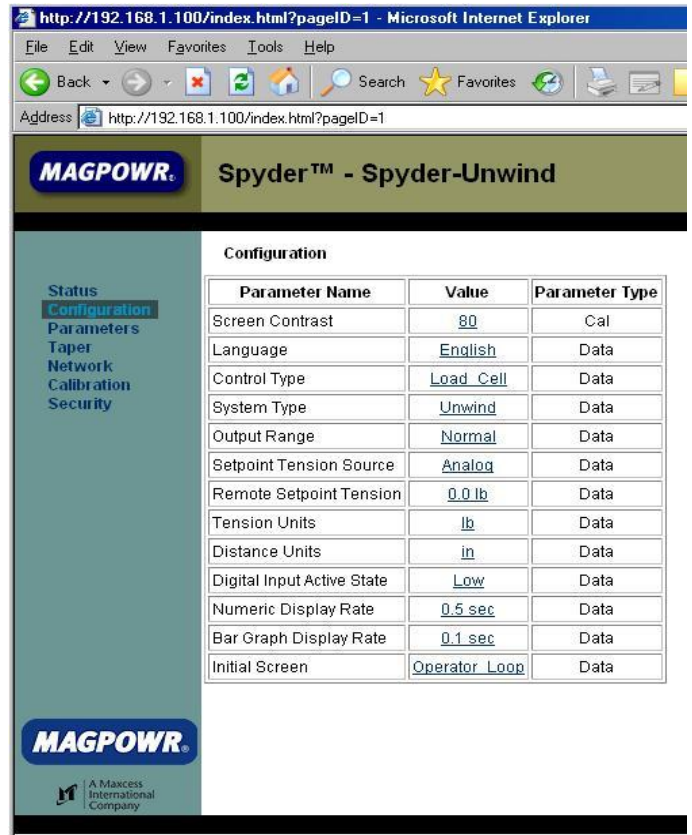**Figure 19.  Spyder Status web page.**



**Figure 20.  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.
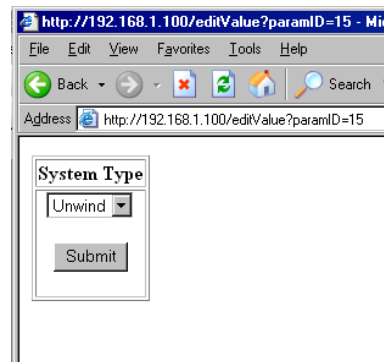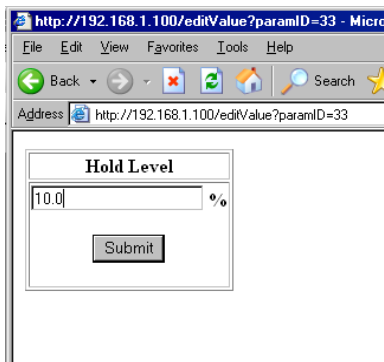
Examples:



**Figure 21.  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 ↑ and ↓ keys while turning on power. The display should show the Update Software menu. Press the ↓ key. The display will show the program number it is about to download. To edit the program number, Press the ↵ key and enter the program number of the software you need to download. Press the ↓ key to start downloading the software.

When the display shows **Update Successful**, press the ↓ key 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.

1. Go to *www.maxcessintl.com.*
2. Type the keywords "spyderware " in the Search field and press the Enter key.
3. When displayed, click on SpyderWare Installation Kit file, which links to a zip file.
4. 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

1. Go to *www.maxcessintl.com.*
2. Type the keywords "spyder config" in the Search field and press the ENTER key.
3. When the results are displayed, select Software in the filter list on the left – do not click Search a second time.
4. When results are displayed, click on Spyder Configuration Tool, which links to a zip file.
5. Save the zip file to a directory on your computer.
6. 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.

Operator interface can be installed in a convenient location.

# 12.0 COMMUNICATION (OPTIONAL)

## 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 228 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.

| 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.

# 12.0 COMMUNICATION (OPTIONAL)

## 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, DTND = Dancer Torque Control No Diameter, DTD = Dancer Torque Control with Diameter, DS = Dancer Speed Control, OPT = Open Loop Tension based on Diameter Control.

| Starting Modbus Register | Parameter Name | Parameter Format | Parameter Type | Used with Control Types | Read / Write | Range |
|---|---|---|---|---|---|---|
| 0x01 | Use DHCP | BYTE | Data | LC, DTND, DTD, DS, OPT | Read / Write | 0 = No, 1 = Yes |
| 0x02 | IP Address | UINT32 | Cal | LC, DTND, DTD, DS, OPT | Read / Write | {0.0.0.0 - 255.255.255.255} |
| 0x04 | Subnet Mask | UINT32 | Data | LC, DTND, DTD, DS, OPT | Read / Write | {0.0.0.0 - 255.255.255.255} |
| 0x06 | Gateway Address | UINT32 | Data | LC, DTND, DTD, DS, OPT | Read / Write | {0.0.0.0 - 255.255.255.255} |
| 0x08 | FTP Address | UINT32 | Data | LC, DTND, DTD, DS, OPT | Read / Write | {0.0.0.0 - 255.255.255.255} |
| 0x0A | FTP Program Number | UINT32 | Data | LC, DTND, DTD, DS, OPT | Read / Write | 920Axxx.yyy xxx,yyy={0 - 999} xxx = High Word yyy = Low Word |
| 0x0C | FTP Directory | STRING | Data | LC, DTND, DTD, DS, OPT | Read / Write | 31 Characters Maximum |
| 0x1C | FTP User Name | STRING | Data | LC, DTND, DTD, DS, OPT | Read / Write | 31 Characters Maximum |
| 0x2C | FTP Password | STRING | Data | LC, DTND, DTD, DS, OPT | Read / Write | 31 Characters Maximum |
| 0x3C | Screen Contrast | BYTE | Cal | LC, DTND, DTD, DS, OPT | Read / Write | { 0 - 255 } |
| 0x3D | Language | BYTE | Data | LC, DTND, DTD, DS, OPT | Read / Write | 0 = English 1 = French 2 = German 3 = Italian 4 = Spanish |
| 0x3E | Remote Setpoint Tension | FLOAT | Data | LC | Read / Write | { 0.0 - 99999.0 } lb. |
| 0x40 | Setpoint Source | BYTE | Data | LC, DTND, DTD, 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 |
| 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 | DTND, DTD, DS | Read / Write | 0 = Unwind 1 = Rewind |
| 0x46 | Control Type | BYTE | Data | LC, DTND, DTD, DS, OPT | Read / Write | 0 = Load Cell 1 = Dancer, Torque 2 = Dancer, Speed 3 = Tension, Diameter |
| 0x47 | Output Range | BYTE | Data | LC, DTND, DTD, DS | Read / Write | 0 = Normal 1 = -10V to +10V |
| 0x48 | Maximum Tension | FLOAT | Cal | LC, DTND, DTD, DS | Read / Write | { 0.0 - 99999.0 } lb. |
| 0x4A | Applied Tension | FLOAT | Cal | LC, DTND, DTD, DS | Read / Write | { 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 |
|---|---|---|---|---|---|---|
| 0x4C | Core Diameter | FLOAT | Data | LC, DTD, DS, OPT | Read / Write | { 0.0 - 999.0 } in. |
| 0x4E | Full Roll Diameter | FLOAT | Data | LC, DTD, OPT | Read / Write | { 0.0 - 999.0 } in. |
| 0x50 | Diameter Calibration Constant | FLOAT | Cal | LC, DTD, DS, OPT | Read / Write | { 0.0 - 99999.0 } |
| 0x52 | Tension Units | BYTE | Data | LC, DTND, DTD, DS | Read / Write | 0 = pound<br>1 = ounce<br>2 = Kilogram<br>3 = Newton<br>4 = gram |
| 0x53 | Distance Units | BYTE | Data | LC, DTD, DS, OPT | Read / Write | 0 = inch<br>1 = feet<br>2 = millimeter<br>3 = centimeter<br>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 | DTND, DTD | Read / Write | { 0.0 - 60.0 } seconds |
| 0x5A | Error Limit | FLOAT | Data | LC, DTND, DTD, 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, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 60.0 } seconds |
| 0x60 | Stop Multiplier | FLOAT | Data | LC, DTND, DTD, OPT | Read / Write | { 0.0 - 99.0 } |
| 0x62 | Hold Level | FLOAT | Data | LC, DTND, DTD | Read / Write | { 0.0 - 100.0 } % |
| 0x64 | Torque Output 0% Calibration Point (0-10V, 4-20mA) | FLOAT | Cal | LC, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 1.0 } |
| 0x66 | Torque Output 100% Calibration Point (0-10V, 4-20mA) | FLOAT | Cal | LC, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 1.0 } |
| 0x68 | Torque Output 0% Calibration Point (-10V to +10V) | FLOAT | Cal | LC, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 1.0 } |
| 0x6A | Torque Output 100% Calibration Point (-10V to +10V) | FLOAT | Cal | LC, DTND, DTD, OPT | Read / Write | { 0.0 - 1.0 } |
| 0x6C | Tension Meter 100% Calibration Point | FLOAT | Cal | LC, DTND, DTD, DS, OPT | Read / Write | { 0 - 511 } |
| 0x6E | Tension Setpoint 0% Calibration Point | FLOAT | Cal | LC, OPT | Read / Write | { 0 - 4095 } |
| 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, DTND, DTD, DS | Read / Write | { 0 - 511 } |
| 0x77 | Load Cell Negative Bias | UINT16 | Cal | LC, DTND, DTD, DS | Read / Write | { 0 - 511 } |
| 0x78 | Load Cell Gain Reference | UINT16 | Cal | LC, DTND, DTD, DS | Read / Write | { 0 - 511 } |
| 0x79 | Load Cell Offset | UINT16 | Cal | LC, DTND, DTD, DS | Read / Write | { 0 - 4095 } |
| 0x7A | Applied Tension Binary | UINT16 | Cal | LC, DTND, DTD, DS | Read / Write | { 0 - 4095 } |

# 12.0    COMMUNICATION (OPTIONAL)

| Starting Modbus Register | Parameter Name | Parameter Format | Parameter Type | Used with Control Types | Read / Write | Range |
|---|---|---|---|---|---|---|
| 0x7B | Digital Input Active State | BYTE | Data | LC, DTND, DTD, DS, OPT | Read / Write | 0 = Active Low<br>1 = Active High |
| 0x7C | Security State | BYTE | None | LC, DTND, DTD, DS, OPT | Read Only | 0 = Not Locked<br>1 = Locked |
| 0x7D | Security Code | UINT16 | None | LC, DTND, DTD, DS, OPT | Write Only | { 0 - 9999 } |
| 0x7E | Numeric Display Rate | FLOAT | Data | LC, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 60.0 } seconds |
| 0x80 | Bar Graph Display Rate | FLOAT | Data | LC, DTND, DTD, DS, OPT | Read / Write | { 0.0 - 60.0 } seconds |
| 0x82 | Position Setpoint 0% Calibration Point | FLOAT | Cal | DTND, DTD, DS | Read / Write | { 0 - 4095 } |
| 0x84 | Position Setpoint 100% Calibration Point | FLOAT | Cal | DTND, DTD, DS | Read / Write | { 0 - 4095 } |
| 0x86 | Dancer 0% Calibration Point | FLOAT | Cal | DTND, DTD, DS | Read / Write | { 0 - 4095 } |
| 0x88 | Dancer 100% Calibration Point | FLOAT | Cal | DTND, DTD, DS | Read / Write | { 0 - 4095 } |
| 0x8A | Tuning Type (Dancer Torque) | BYTE | Data | DTND | Read / Write | 0 = PD<br>1 = PID |
| 0x8B | Tuning Type (Dancer Speed) | BYTE | Data | DS | Read / Write | 0 = P<br>1 = PI |
| 0x8C | Proportional Gain (Dancer) | FLOAT | Data | DTND, DTD, DS | Read / Write | { 0.0 - 999.0 } |
| 0x8E | Integrator Time (Dancer) | FLOAT | Data | DTND, DTD, DS | Read / Write | { 0.0 - 60.0 } seconds |
| 0x90 | Initial Screen (Load Cell) | BYTE | Data | LC | Read / Write | 0 = Operator Menu<br>1 = Tension<br>2 = Output Level |
| 0x91 | Initial Screen (Dancer) | BYTE | Data | DTND, DTD, DS | Read / Write | 0 = Operator Menu<br>1 = Position<br>2 = Output Level |
| 0x92 | Use Taper? | BYTE | Data | LC, OPT | Read / Write | 0 = No<br>1 = Yes |
| 0x93 | System State Status | UINT16 | None | LC, DTND, DTD, DS, OPT | Read Only | 0 = Hold<br>1 = Start<br>2 = Run<br>3 = Stop<br>4 = E-Stop<br>5 = Manual |
| 0x94 | Tension On/Off Status | UINT16 | None | LC, DTND, DTD, DS, OPT | Read Only | 0 = Tension Off<br>1 = Tension On |
| 0x95 | Tension Setpoint | FLOAT | None | LC | Read Only | { 0.0 - 99999.0 } lb. |
| 0x97 | Actual Tension | FLOAT | None | LC, DTND, DTD | Read Only | { 0.0 - 99999.0 } lb. |
| 0x99 | Actual Output | FLOAT | None | LC, DTND, DTD, DS, OPT | Read Only | { 0.0 - 100.0 } % |
| 0x9B | Actual Diameter | FLOAT | None | LC, DTD, DS, OPT | Read Only | { 0.0 - 999.0 } in. |
| 0x9D | Position Setpoint | FLOAT | None | DTND, DTD, DS | Read Only | { 0.0 - 100.0 } % |
| 0x9F | Actual Position | FLOAT | None | DTND, DTD, DS | Read Only | { 0.0 - 100.0 } % |
| 0xA1 | Device Name | STRING | Data | LC, DTND, DTD, DS, OPT | Read / Write | 31 Characters Maximum |
| 0xB1 | Program Version | UINT32 | None | LC, DTND, DTD, DS, OPT | Read Only | 920Axxx.yyy<br>xxx,yyy={0 - 999}<br>xxx = High Word<br>yyy = Low Word |
| 0xB3 | Modbus Address | UINT16 | Data | LC, DTND, DTD, DS, OPT | Read / Write | { 0 - 255 } |

| Starting Modbus Register | Parameter Name | Parameter Format | Parameter Type | Used with Control Types | Read / Write | Range |
|---|---|---|---|---|---|---|
| 0xB4 | Modbus Byte Order | BYTE | Data | LC, DT, DS, OPT | Read / Write | 0 = MSB First<br>1 = LSB First |
| 0xB5 | Modbus Word Order | BYTE | Data | LC, DTND, DTD, DS, OPT | Read / Write | 0 = MSB First<br>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 | DTND, DTD, DS | Read / Write | 0 = Load Cells Not Enabled<br>1 = Load Cells Enabled |
| 0xB9 | Remote Dancer Setpoint | FLOAT | Data | DTND, DTD, DS | Read / Write | No Integrator, mode: P or PD, range = { 0.0 – 5.0 }<br>With Integrator, mode PI or PID, range = { 0.0 – 1.0 }.<br>Torque with Diameter, range = {0.0 – 1.0}.<br>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<br>1 = Rewind |
| 0xBE | Core Offset | FLOAT | Data | OPT | Read/Write | { -20.0 – 100.0 } % |
| 0xC0 | Actaul 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<br>1 = Tension<br>2 = Output Level<br>3 = Diameter |
| 0xC5 | Hold Level Multiplier (Dancer) | FLOAT | Data | DTND, DTD | Read/Write | { 0.0 - 99.0 } |
| 0xC7 | Dancer Diameter Used | BYTE | Data | DTND, DTD, DS | Read/Write | 0 = No Diameter<br>1 = Diameter Used |
| 0xC8 | Load Cell Diameter Used | BYTE | Data | LC | Read/Write | 0 = Diameter Estimated<br>1 = Diameter Voltage |
| 0xC9 | Inertia Compensation Used | BYTE | Data | LC, DTND, DTD | Read/Write | 0 = Inertia Comp not used<br>1 = Inertia Comp used |
| 0xCA | Inertia Compensation Percent | FLOAT | Data | DTND, DTD | Read/Write | { 0.0 – 100.0 } % |
| 0xCC | Inertia Calibration Constant | FLOAT | Cal | DTND, DTD | Read/Write | { 0.0 – 999999.0 } |
| 0xCE | Inertia Output versus Torque constant | FLOAT | Cal | LC | Read/Write | { 0.0 – 999999.0 } |
| 0xD0 | Dancer Stop Torque Ratio | FLOAT | Data | DTD | Read/Write | { 0.0 – 100.0 } % |
| 0xD2 | Maximum Velocity | FLOAT | Data | LC | Read/Write | { 0.0 – 9999.0 } |
| 0xD4 | Inertia Roll Weight | FLOAT | Data | LC | Read/Write | { 0.0 – 9999.0 } |
| 0xD6 | Inertia Roll Width | FLOAT | Data | LC | Read/Write | { 0.0 – 9999.0 } |
| 0xD8 | Inertia Core Diameter | FLOAT | Data | LC | Read/Write | { 0.0 – 9999.0 } |
| 0xDA | Inertia Core WK^2 | FLOAT | Data | LC | Read/Write | { 0.0 – 99999.0 } |
| 0xDC | Inertia Full Roll Diameter | FLOAT | Data | LC | Read/Write | { 0.0 – 9999.0 } |

# 12.0    COMMUNICATION (OPTIONAL)

| Starting Modbus Register | Parameter Name | Parameter Format | Parameter Type | Used with Control Types | Read / Write | Range |
|---|---|---|---|---|---|---|
| 0xDE | Velocity Units | BYTE | Data | LC | Read/ Write | 0 = ft/min<br>1 = in/min<br>2 = mm/min<br>3 = cm/min<br>4 = m/min |
| 0xDF | Present Roll Width | FLOAT | Data | LC | Read/ Write | { 0.0 – 9999.0 } |
| 0xE1 | Hold Level Change With (Load Cell) | BYTE | Data | LC, DTND, DTD | Read/ Write | 0 = None<br>1 = Output<br>2 = Diameter<br>3 = Tension<br>4 = Diameter and Tension |
| 0xE2 | Hold Level change With (Dancer) | BYTE | Data | LC, DTND, DTD | Read/ Write | 0 = Output<br>1 = Diameter<br>2 = Tension<br>3 = Diameter and Tension |
| 0xE3 | Hold Level Change Calibration Constant | FLOAT | Data | LC, DTND, DTD | Read/ Write | { 0.0 – 999999.0 } |

## 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.

1. Go to *www.maxcessintl.com*.
2. Type the keywords "spyder modbus" in the Search field and press the Enter key.
3. When the results are displayed, select "software" in the list on the left – **do not click Search a second time**.
4. 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.
5. 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 that are activated by holding down keys while turning on power.
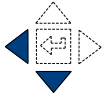
## 13.1 Automatic Contrast Adjust

The automatic contrast adjustment is activated by holding down the ← and ↓ 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 ↵ key is pressed. When the display is readable, press the ↵ key to exit contrast adjustment.
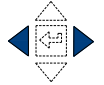
## 13.2 Reset All Parameters Except Calibrations to Defaults

All parameters except calibrations will be reset to defaults by holding down the ← and → keys while turning on the power. Hold the keys until the screen shows **"Resetting Parameters"**.
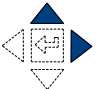
## 13.3 Reset All Parameters to Defaults (Including Calibrations)

All parameters will be reset to defaults by holding down the → and ↑ 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.**
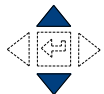
## 13.4 Download Software

To download new software hold down the ↑ and ↓ 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 | 24 VDC, ±10%, 250 mADC, 6 VA |
|    Fuse: F1 | 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®