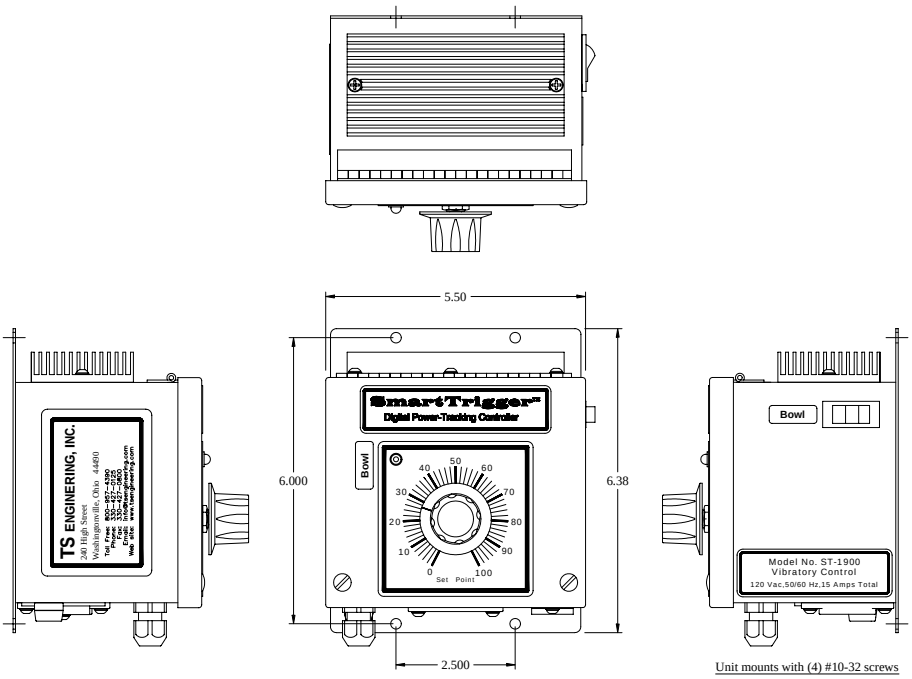
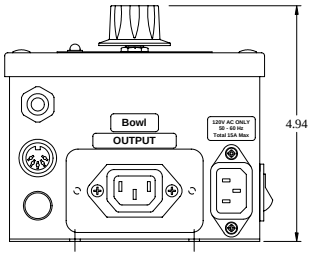
SmartTrigger™

Digital Power-Tracking Controller

ST-1900 and **ST-2900**

By **TS ENGINEERING, INC.**





Provided:

(1) Input Cable Connector
(1) Output Cable Connector
(1) Strain Relief
(1) Manual

Optional:

(1) Sensor Connector
(1) Sensor
(1) Cable Grip

Operations Manual

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Notations in this Manual

This manual uses two symbols to draw attention to or denote actions, which should be performed cautiously, or avoided altogether.

Means TAKE NOTE of this statement, or BE CAUTIOUS when performing this action.

Means DO NOT DO THIS, or DO NOT ALLOW THIS TO HAPPEN.

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Introduction

The **SmartTrigger™** by TS Engineering, Inc. is an intelligent vibratory feeder controller that is capable of delivering a uniform level of drive voltage to the feeder coils regardless of fluctuations in the source line. By monitoring both the amplitude and frequency of the input line the controller can perform on-the-fly adjustments to the trigger timing of the output alternistor and maintain the desired vibration intensity level. The unit can correct for input line fluctuations. The standard unit without sensor is considered a voltage regulating controller. The **SmartTrigger™** with the sensor option is considered an amplitude regulating control.

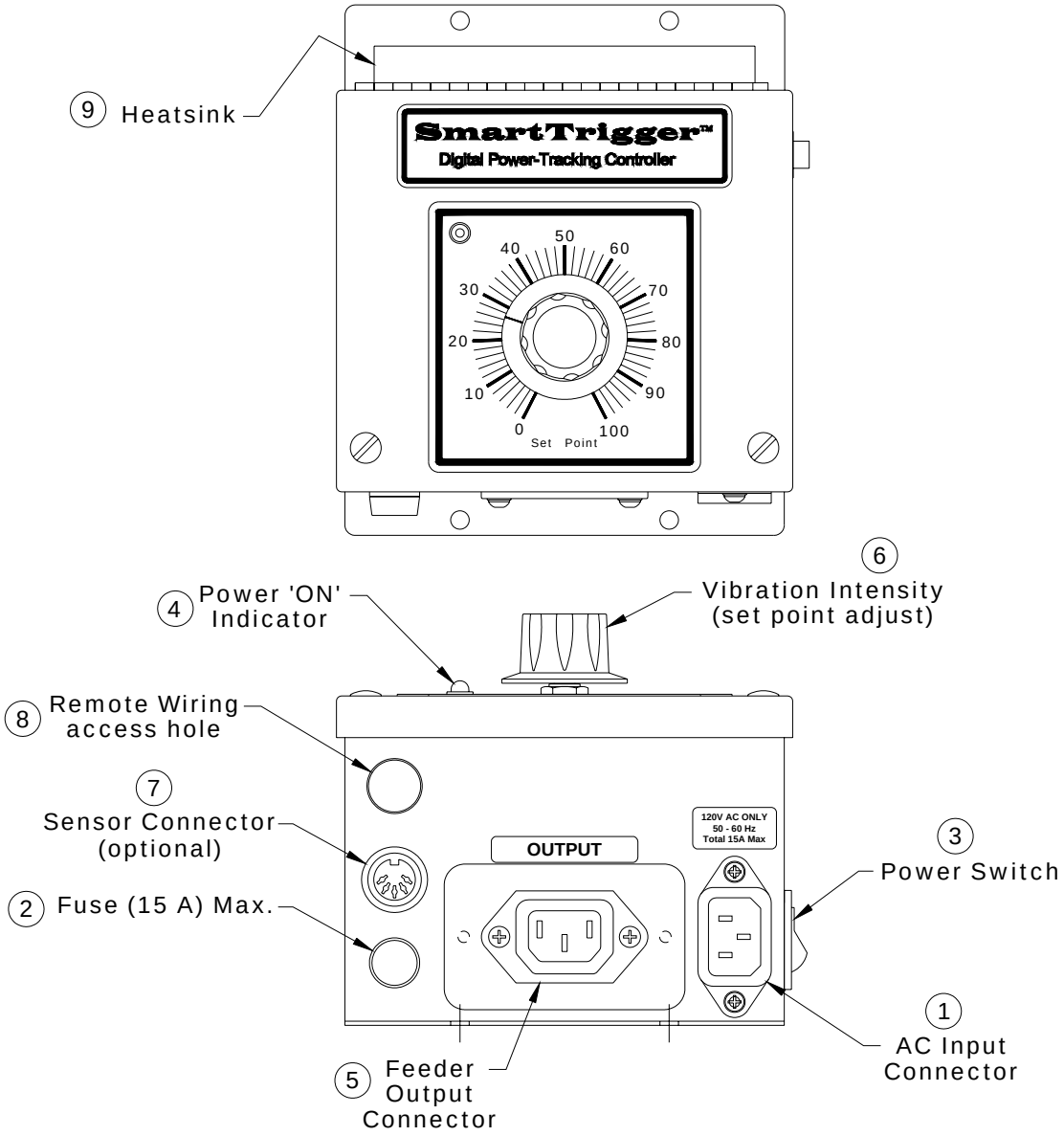


Figure 1. SmartTrigger™ Digital Power-Tracking Controller

External Controls and Connections

1. **AC Input Connector** - *(see Figure 1)* A quick disconnect cord plugs into a standard 110 or 220 Volt AC outlet to power the controller. The controller requires between 95-140 Volts AC, 50/60 Hertz for the 110 volt unit and 190–250 Volts AC, 50/60 Hertz for the 220 volt unit.

   ☒ **USE OF AN INPUT VOLTAGE HIGHER THAN THE RATED MAXIMUM (140 VOLTS RMS FOR THE 110 UNIT AND 250 VOLTS RMS FOR THE 220 VOLT UNIT) CAN DAMAGE THE CONTROLLER AND VOID YOUR WARRANTY!**

2. **Fuse** – *(see Figure 1)* The Input fuse should be sized to accommodate the feeder requirements, but not to exceed 15 amps maximum.

3. **Power Switch** – (*see Figure 1*) Upon power up there is a 0.2-second pause for internal calibration that may be followed by a soft start delay of 0.8 seconds, depending on **DIP Sw**itch settings.

   ! **ALWAYS TURN POWER OFF BEFORE CONNECTING OR DISCONNECTING A FEEDER OR REPLACING THE INPUT FUSE!**

4. **Power 'ON' Indicator** – *(see Figure 1)* Upon power on with the power switch, the power 'ON' lite will illuminate indicating that power is on providing the input fuse is good.

5. **Feeder Output Connector** – (*see Figure 1*) Supplies the output to drive the feeder coils. This is a variable power output. (connectors are different for 110 or 220 version)

   ! **ONLY A FEEDER'S MAGNET COILS SHOULD BE PLUGGED INTO THIS OUTLET!**

   ☒ **USE OF AN INPUT VOLTAGE HIGHER THAN THE RATED MAXIMUM (140 VOLTS RMS FOR THE 110 UNIT AND 250 VOLTS RMS FOR THE 220 VOLT UNIT) CAN DAMAGE THE CONTROLLER AND VOID YOUR WARRANTY!**

6. **Vibration Intensity (set point adjust)** – *(see Figure 1*) Selects the desired amplitude of vibration intensity.

7. **Sensor Connector** – (*see Figure 1*) The Sensor connector is used to connect the Smart Trigger to a (optional) sensor unit if required for a tighter control of the output.

8. **Remote Wiring access hole** – (*see Figure 1*) The unit is factory delivered with this hole covered by a metal snap-in cap. A cord grip may be installed for securing external wiring at this location. This is very useful when utilizing features such as interlocking, coupling of the Universal Input to a photocell or PLC output, etc.

9. **Heatsink** – (*see Figure 1*) Dissipates the heat generated by the electronics. It is specified for a continuous 15 Amp RMS bowl current in an ambient temperature environment of 45° Celsius.

   ! **AT HIGH VALUES OF CONTINUOUS LOAD CURRENT THE HEAT SINK MAY BE HOT TO THE TOUCH DO NOT BLOCK AIRFLOW AROUND THE HEATSINK DURING OPERATION! THE UNIT SHOULD BE MOUNTED WITH THE HEATSINK FINS UPRIGHT TO ALLOW FOR PROPER COOLING.**

Motion Sensor (Optional)

The motion sensor tells the **SmartTrigger™** controller how the feeder is performing. The sensor must be mounted so that the ***axis of sensitivity*** is parallel with the motion of the feeder. That is, the sensor must vibrate along its ***axis of sensitivity***, **Figure 2**. For a bowl feeder, the sensor should be mounted near the perimeter of the bowl with the direction of the mounting screws (***axis of sensitivity***) pointing in the direction of parts flow.

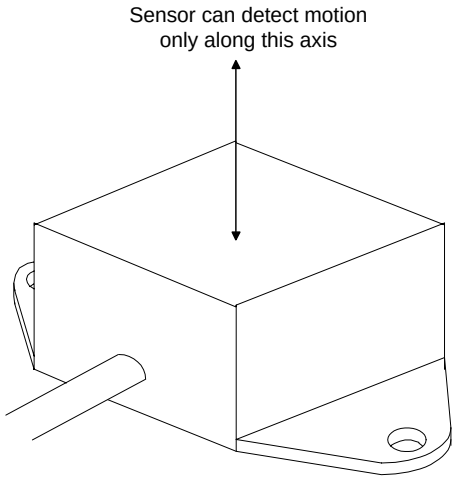


Figure 2. Motion Sensor Axis of Sensitivity

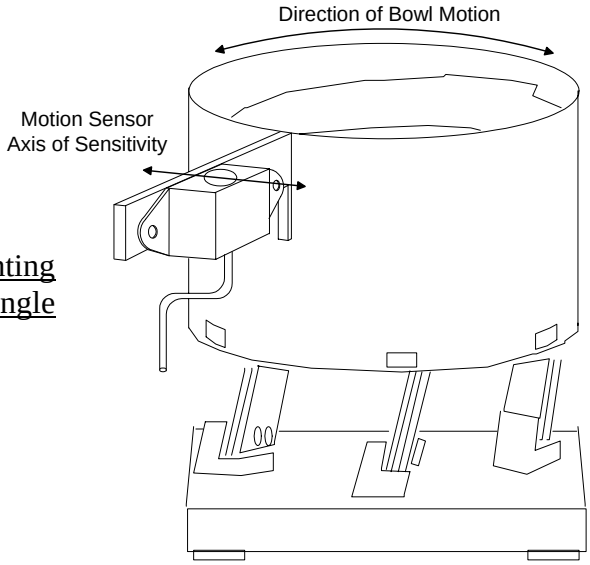


Figure 3. Illustration of proper mounting orientation on a bowl feeder utilizing a right-angle bracket secured to the bowl perimeter

Figure 3 depicts an example of a mounting strategy for bowl feeders using a right-angle bracket mounted to the exterior of the bowl. While the use of such a bracket is not required, the motion sensor *must* be mounted so that its orientation with respect to bowl motion is the same as that shown in Figure 3, regardless of the mounting method used.

At the other end of the motion sensor cable is a 5 pin male DIN connector. This fits into the 5 pin female DIN connector located on the bottom side of the **SmartTrigger™** controller.

Operation Setup

The controller is designed and factory preset to require very few adjustments. On most feeders only the following setup procedure should be required.

1. Plug the feeder power cord into the output connector on the bottom of the unit. At this time you may wish to replace the controller fuse (15 amps factory value) with one which is specific to the drive coils current rating to prevent accidentally over driving your feeder. ***Do not use a fuse rated over 15 Amps!***
2. Plug the controller into a standard outlet rated to deliver 95-140 Volts RMS AC @ 50/60 Hertz for the 110 volt unit and 190-250 Volts RMS AC @ 50/60 Hertz for the 220 volt unit.).

   ☒ **USE OF AN INPUT VOLTAGE HIGHER THAN THE RATED MAXIMUM (140 VOLTS RMS AC OR 250 VOLTS RMS AC) CAN DAMAGE THE CONTROLLER AND VOID YOUR WARRANTY!**
3. Turn on the unit via the Power switch located on the right side of the unit.
4. Upon power up there is a 0.2-second pause for internal calibration that may be followed by a soft start delay of 0.8 seconds (depending on **DIP Sw**itch settings), after which the controller will begin normal operation.

   At this point simply adjust the **Vibration Intensity (amplitude adjust)** knob to achieve the desired amplitude of vibration. The controller will then maintain this vibration intensity level independent of any line voltage fluctuations.

The Circuit Board

TO INSURE OPERATOR SAFETY, INTERNAL ADJUSTMENTS AND/OR FUSE SERVICING SHOULD ALWAYS BE DONE WITH THE SMARTTRIGGER TURNED OFF AND UNPLUGGED!

Located on the circuit board are four user serviceable trim-pots labeled **R6** (10 to 24 volts power supply adj.), **R14** (on delay), **R23** (off delay), **R34** (max. amplitude). The SW1 **DIP** Switches are for setting up the controller operating parameters. The Micro Controller has the stored operating program.

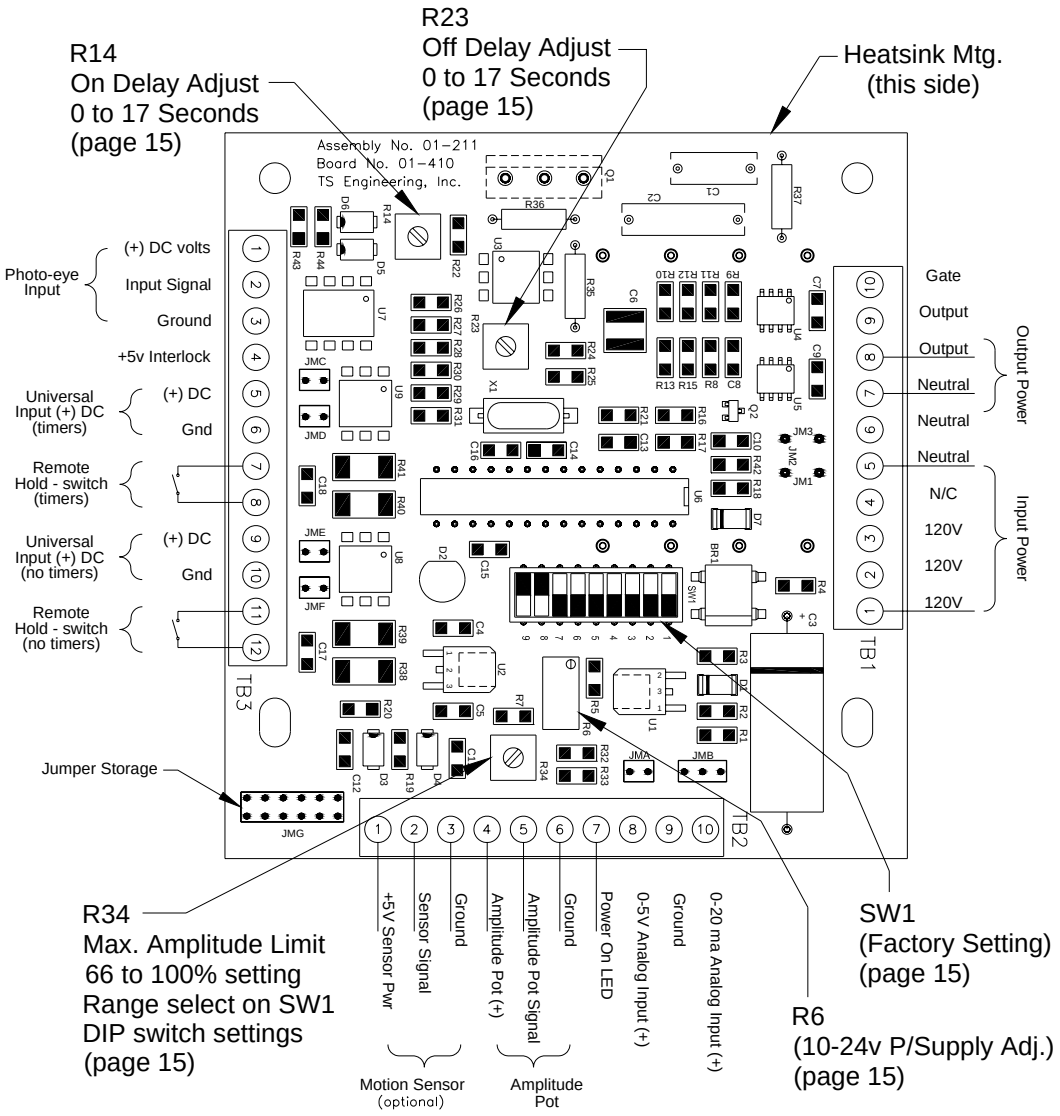


Figure 4. Diagram of the circuit board showing location of the DIP switches, and trim pots.

Operating the controller

This section describes some of the advanced features that are available for use with the unit as well as suggested adjustments to enhance feeder performance.

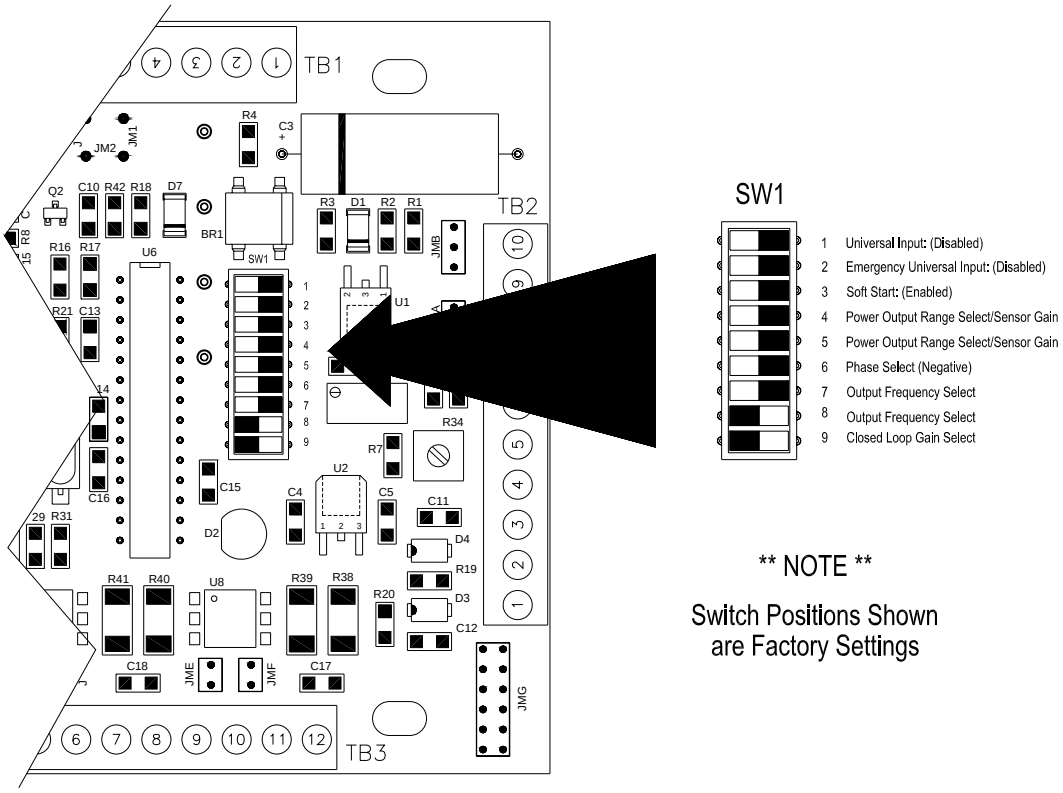


Figure 5. Dip Switch Location and Settings

Universal Input Enable for Operate / Hold *(see Figure 4)*

This enables the **Universal Input**. Any voltage, AC or DC, from 5 Volts RMS minimum to 120 Volts RMS maximum applied to terminals **5** and **6** of **TB3** will put the unit in **Operate** mode. A dry contact closure applied to terminals **7** and **8** of **TB3** will put the unit into **Hold** mode. The **ON** and **OFF** delay times will function normally**.** ***(see Warning)***

Switch 1 = **OFF** Universal Input enabled
Switch 1 = **ON** **Universal Input disabled** *****

Universal Input Enable for Emergency Operate / Hold *(see Figure 4)*

This enables the **Emergency Universal Input**. Any voltage, AC or DC, from 5 Volts RMS minimum to 120 Volts RMS maximum applied to terminals **9** and **10** of **TB3** will put the unit in **Operate** mode. A contact closure on terminals **11** and **12** of **TB3** will put the unit into **Hold** mode. All hold delay settings specified by trimpots **R14** (on delay) and **R23** (off delay) will be bypassed, and the controller will change operational states immediately. ***(see Warning)***

Switch 2 = **OFF**	Emergency Universal Input enabled
Switch 2 = **ON**	**Emergency Universal Input disabled** *

Soft Start *(see Figure 5)*

Enabling the **Soft Start** causes power to the feeder bowl to ramp up to the setpoint over a period of approximately 0.8 seconds when switching from **Hold** to **Operate** mode. This is useful in preventing surges associated with state changes while running at high levels of current. Disabling the **Soft Start** causes the controller to return directly to the setpoint with no delay when switching from **Hold** to **Operate**.

Switch 3 = **OFF**	Soft Start disabled
Switch 3 = **ON**	**Soft Start enabled** *

Power Output Range Select *(see Figure 5)*

In open-loop mode **DIP** Switches **SW4** and **SW5** control the maximum power to the feeder reducing from 100% to 75% to 50% to 37.5% of normal full scale. This improves resolution of the **Amplitude Adjust** potentiometer, as well as safely limits output power to devices that operate at much lower power requirements than what the controller is capable of delivering.

Switch 4 = **ON** Switch 5 = **ON**	**(100% - 66%)** *
Switch 4 = **ON** Switch 5 = **OFF**	(75% - 50%)
Switch 4 = **OFF** Switch 5 = **ON**	(50% - 33%)
Switch 4 = **OFF** Switch 5 = **OFF**	(37.5% - 25%)

Sensor Gain Selection *(see Figure 5)*

In the closed-loop mode **DIP Sw**itches **SW4** and **SW5** control the sensor gain. This is to allow matching of the selectable range of the front panel POT (***Amplitude Adjust***) to the physical motion of the feeder device. Available gain multipliers are 1, 2, 4 and 8. For devices that move a lot with very low power input, a gain of 1 may be sufficient. For feeder devices that require a lot of power to generate motion, higher gains may be required. Try different settings to find the setting that causes the front panel POT (***Amplitude Adjust***) to span between 0 and full motion. If the span cannot be achieved through sensor gain adjustments, select a gain that hits full motion slightly before maximum front panel POT setting. Then turn the front panel POT to full **ON** and turn trim-pot **R34** counterclockwise until the motion just begins to taper off.

Switch 4 = **ON** Switch 5 = **ON**	**Gain multiplier of 1 ***
Switch 4 = **ON** Switch 5 = **OFF**	Gain multiplier of 2
Switch 4 = **OFF** Switch 5 = **ON**	Gain multiplier of 4
Switch 4 = **OFF** Switch 5 = **OFF**	Gain multiplier of 8

Phase Select *(see Figure 5)*

This feature enables selection of which side (**phase**) of the line voltage the controller triggers off of on the 30 Hz and 60 Hz frequency output settings (25 Hz and 50 Hz on 50 Hz source lines). For example, if four 60 Hz feeders were being run simultaneously, it would be recommended to set two to the positive phase and two to the negative phase to effectively balance source utilization. This switch has no effect on 40 and 120 Hz output settings (33.3 Hz and 100 Hz on 50 Hz source lines).

Switch 6 = **OFF**	Positive phase of line
Switch 6 = **ON**	**Negative phase of line ***

Output Frequency *(see Figure 5)*

Selects the frequency of the output to the feeder. Output frequencies are dependent on the frequency of the input line, as illustrated below.

Switch 7 = **ON** Switch 8 = **ON**	60 Hz, Output = 120 Hz 50 Hz, Output = 100 Hz
Switch 7 = **ON** Switch 8 = **OFF**	**60 Hz, Output = 60 Hz *** 50 Hz, Output = 50 Hz
Switch 7 = **OFF** Switch 8 = **ON**	60 Hz, Output = 40 Hz 50 Hz, Output = 33.3 Hz
Switch 7 = **OFF** Switch 8 = **OFF**	60 Hz, Output = 30 Hz 50 Hz, Output = 25 Hz

Closed Loop Gain Selection *(see Figure 5)*

In the closed loop mode **DIP Sw**itch **SW9** controls the loop gain. This switch is not used in the open loop mode. Try the high loop gain setting for maximum response to the front panel POT. If the device oscillates, cut the gain back to the low setting.

Switch 9 = **OFF**	**High** *
Switch 9 = **ON**	Low

Factory Preset DIP Switch Values *(see Figure 5)*

Switch 1 = ON
Switch 2 = ON
Switch 3 = ON
Switch 4 = ON
Switch 5 = ON
Switch 6 = ON
Switch 7 = ON
Switch 8 = OFF
Switch 9 = OFF

+10 to 24 Volt Power Supply Adj. (R6) *(see Figure 4)*

Adjusting **R6** determines the voltage value used for the operation of the photo eye supply voltage. The range of adjustment is from +10 volts DC to +24 volts DC. The photo eye connection is made at TB3 terminals 1, 2 and 3. The plus DC voltage can be monitored at TB3 terminals 1 and 3 for value adjusted.

On Delay (R14) *(see Figure 4)*

Adjusting **R14** determines the amount of time from when the Remote Operate / Hold feature is switched from ***Hold*** *to* ***Run*** and the feeder begins to operate. The delay can be adjusted between 0 and 17 seconds. Rotating **R14** fully counterclockwise gives a delay of 17 seconds, and rotating **R14** fully clockwise gives no delay. This is a single turn pot. If the unit is placed from run to hold (either direction) the internal timers will reset and restart the countdown.

Off Delay (R23) (*see Figure 4)*

Adjusting **R23** determines the amount of time from when the Remote Operate / Hold feature is switched from ***Run*** *to* ***Hold*** and the feeder ceases operation. The delay can be adjusted between 0 and 17 seconds. Rotating **R23** fully counterclockwise gives a delay of 17 seconds, and rotating **R23** fully clockwise gives no delay. This is a single turn pot. If the unit is placed from run to hold (either direction) the internal timers will reset and restart the countdown.

Max Amplitude Limit (R34) (*see Figure 4)*

Adjusting **R34** limits the maximum amount of drive the unit can deliver to the feeder device. The adjustment range as a percentage of normal full scale is dependent on the settings of **DIP Sw**itches **SW4** and **SW5** (see ***Power Output Range Select****,* page 11, for adjusting the set point range). Rotating **R34** fully counterclockwise sets the maximum at 100% of the **DIP Sw**itch selected range, and rotating **R34** fully clockwise cuts the maximum to 66% of the **DIP Sw**itch selected range. This is a single turn pot.

Using the Remote Operate / Hold Feature

Contact Closure Activation *(see Figure 4)*

☒ **CONTACT CLOSURE IS A NON-POWERED DRY CONTACT. IF VOLTAGE IS APPLIED TO THE CONTACT CLOSURE INPUTS, SEVERE DAMAGE MAY OCCUR TO UNIT AND WILL VOID THE WARRANTY**

Connecting a normally open switch across terminals **7** and **8** of **TB3** will provide the ability to switch between Operate and Hold conditions remotely. A switch closure will put the unit into **Hold** mode after the time delay (if any) determined by **R23**. A switch opening will put the unit into **Operate** mode after the time delay (if any) determined by **R14**. (*See page 13 for setting delay time*.) **DIP Sw**itch **SW1** must be ON to enable the Operate/Hold Contact Closure activation.

☒ **CONNECTING ANY VOLTAGE ACROSS THE CONTACT CLOSURE OPERATE / HOLD INPUTS (TERMINALS 7 and 8, TB3) MAY DAMAGE THE CIRCUIT AND VOID YOUR WARRANTY! THIS IS MEANT TO BE A SWITCH, CONTACT OR OTHER NON-POWERED CLOSURE.**

Universal Input *(see Figure 4)*

The Universal Input enables remote operation of the Operate / Hold feature via a switchable voltage source. Any voltage, AC or DC, from 5 Volts RMS minimum to 120 Volts RMS maximum applied to terminals **5** and **6** of **TB3** will put the unit in **Operate** mode after the time delay (if any) specified by **R14**. A contact closure input applied to terminals **7** and **8** of **TB3** will put the unit into **Hold** mode after the time delay (if any) specified by **R23**. (*See page 13 for setting delay time*). **DIP Sw**itch **SW1** must be OFF to enable the Universal Input.

NOTE: If no voltage is applied to this input and Switch 1 is in the Off position, upon power up the unit will run until the off delay times out and the unit will then go into Hold mode. The contact closure input (terminals 7 and 8, TB3) will still function normally.

It is important to note that if either consecutive state changes occur on the contact closure or the **Universal Input** before the last delay timer has timed out, the previous request will be canceled. For example, suppose the OFF delay is set to 10 seconds and the unit is currently running. If the operator flips the switch to the **Hold** position, then to the **Operate** position within 5 seconds, the unit will continue to run without interruption.

Operate/Hold Out (Interlocking/Slaving) *(see Figure 4)*

By providing an output signal for **Operate** or **Hold** modes, several controllers may be connected together for interlocked operation. The output signal is +5V Dc for Operate mode, and 0V Dc for Hold mode on terminal **4** with respect to **3** of **TB3**. This output follows the actual status of the unit, which will include any delay in changing states as set by the **On** and **Off** delay settings (**R14** and **R23**). These connections can be used to the **Universal Hold** input or **Emergency Hold** input to control several different control units.

Using the Remote Emergency Operate / Hold Feature

Emergency Contact Closure Activation *(see Figure 4)*

☒ **CONTACT CLOSURE IS A NON-POWERED DRY CONTACT. IF VOLTAGE IS APPLIED TO THE CONTACT CLOSURE INPUTS, SEVERE DAMAGE MAY OCCUR TO UNIT AND WILL VOID THE WARRANTY**

Connecting a normally open switch across terminals **11** and **12** of **TB3** will provide the ability to instantly switch between Emergency Operate and Hold conditions remotely. A switch closure will put the unit into **Hold** immediately, ignoring any time delays set by **R23**. A switch opening will put the unit into **Operate** mode immediately, ignoring any delays set by **R14**. **DIP Sw**itch **SW2** must be ON to enable the Emergency Operate/Hold contact closure activation.

☒ **CONNECTING ANY VOLTAGE ACROSS THE CONTACT CLOSURE EMERGENCY OPERATE / HOLD INPUTS (TERMINALS 11 AND 12, TB3) MAY DAMAGE THE CIRCUIT AND VOID YOUR WARRANTY! THIS IS MEANT TO BE A SWITCH, CONTACT OR OTHER NON-POWERED CLOSURE.**

Emergency Universal Input *(see Figure 4)*

The Universal Input enables remote operation of the Emergency Operate/Hold feature via a switchable voltage source. Any voltage, AC or DC, from 5 Volts RMS minimum to 120 Volts RMS maximum applied to terminals **9** and **10** of **TB3** will put the unit into **Operate** mode. A contact closure input applied to terminals **11** and **12** of **TB3** will put the unit into **Hold** mode. **DIP Sw**itch **SW2** must be OFF to enable the Emergency Universal Input.

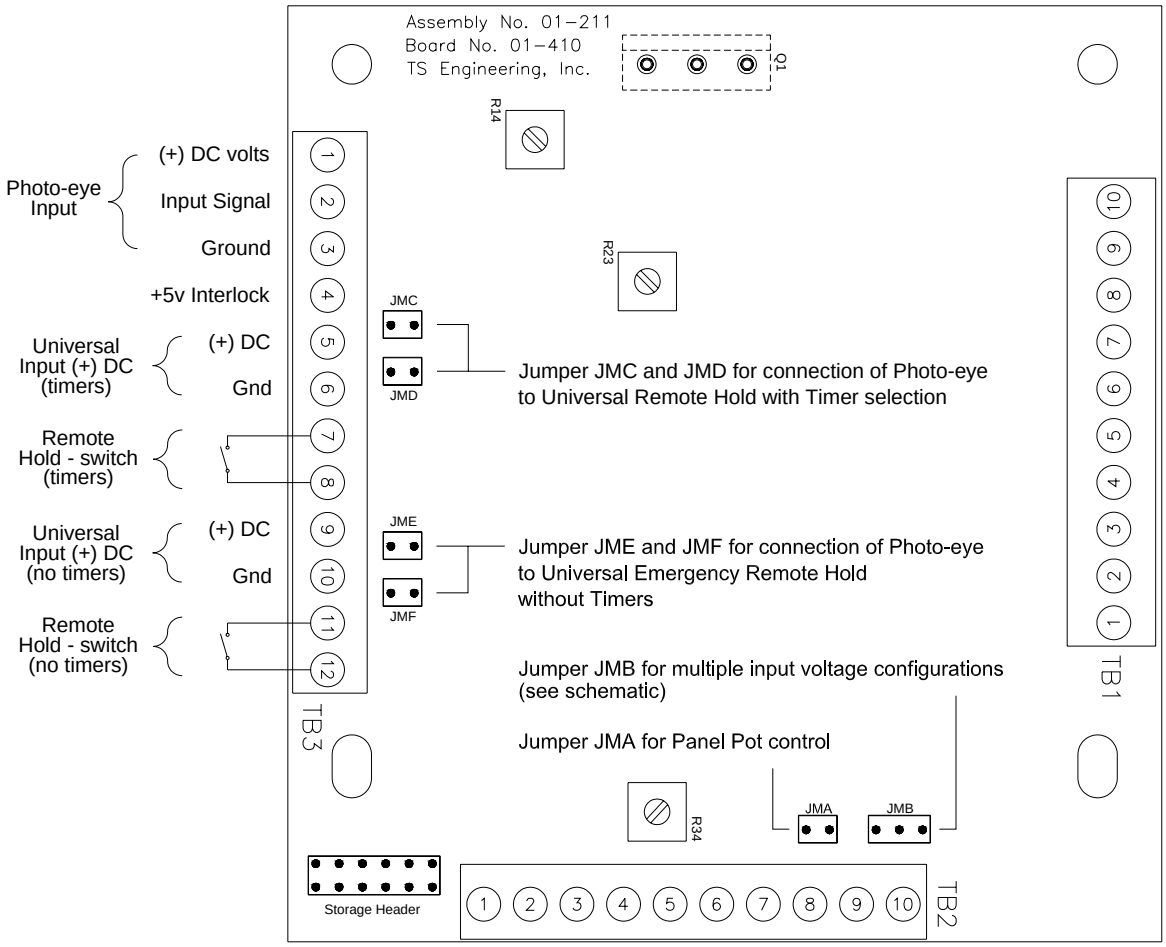
Note that the Emergency Operate/Hold function automatically bypasses all **On** and **Off** delay time settings. This means that the unit will change states immediately following an Emergency Hold or Operate request. The **Soft Start** feature ***is not*** automatically bypassed however, and if it is enabled switching from **Hold** to **Operate** will still cause the voltage to ramp up gradually over 0.8 seconds to the set point.

Jumper Settings JMA thru JMF

Jumper **JMA** allows the selection of either the panel pot connection as provided from the factory or the connection of an external analog input of 0 to 5 volts or 0 to 20 ma's depending on jumper **JMB** selection. Jumper **JMA** should be removed if an external source is provided and placed on the storage header.

Jumper **JMB** is used for multiple input voltage configurations. When **JMB** is placed for the ground connection this permits a 0 to 5 volt external analog signal to be connected to TB2 terminals 8 and 9 or a self powered 0 to 20 ma signal to be connected to TB2 terminals 9 and 10. Jumper **JMA** should be removed and placed on the storage header.

Jumpers **JMC** thru **JMF** provide options for interfacing the Photo Eye input into the different **Operate/ Hold** function circuits available.

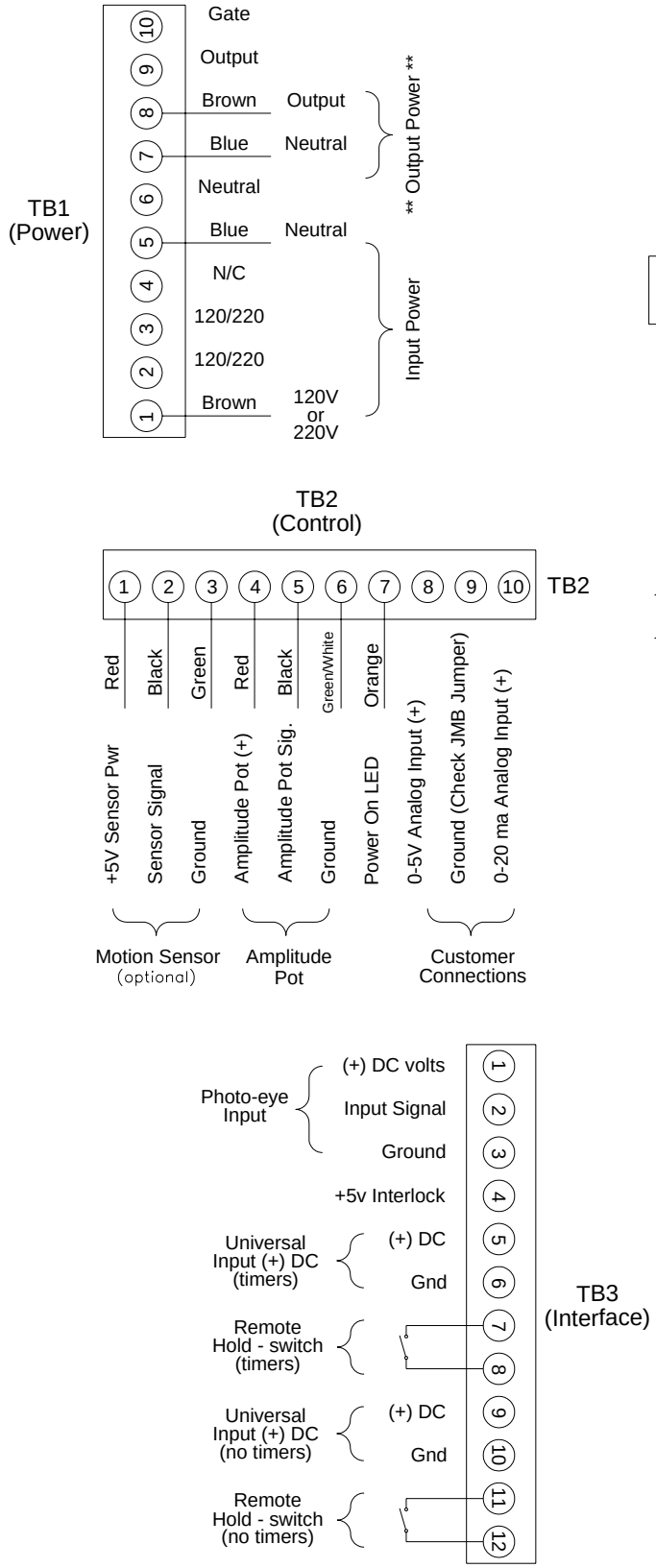


Interface Jumper Selections

Smart Trigger Wiring Diagram

The wiring of the controller is as shown in **Figure 6**. The power connections for Line and Neutrals should be of sufficient gauge to handle the current being used by the controller and supplied to the feeder. The minimum wire gauge used should be 14 AWG. But this will depend on local codes and regulations. The power connections are intended to use a screw terminal style connection. This is pre-wired from the factory in **ST-1900** and **ST-2900** units.

Terminals 1,2, and 3 of TB2 are for the motion sensor interface connection. This may or may not appear on the unit as ordered.
Terminals 4, 5, 6 and 7 of TB2 are pre-wired in **ST-1900** and **ST-2900** units with a 20-22 gauge three conductor cable. It should be shielded, but the shield does not need to be connected to ground. The remaining wires are all customer connections. The connectors will accept a wire size from 18 to 24 awg. The wire size will depend on local codes and restrictions.



Customer Connections

Shown for ST-1900 and ST-2900 Units

Figure 6. Circuit board wiring diagram and pin reference

SW1-1 **Universal Input for Operate/Hold**

Switch 1 - Off Universal Input Enable
Switch 1 - On Universal Input Disable

SW1-2 **Emergency Universal Input for Operate/Hold**

Switch 2 - Off Emergency Universal Input Enable
Switch 2 - On Emergency Universal Input Disable

SW1-3 Soft Start

Switch 3 - Off Soft Start Disable
Switch 3 - On Soft Start Enable

SW1-4 **Power Output Range Select**
SW1-5 **Power Output Range Select**

Switch 4 - On Switch 5 - On	(Range: 100% - 66%)
Switch 4 - On Switch 5 - Off	(Range: 75% - 50%)
Switch 4 - Off Switch 5 - On	(Range: 50% - 33%)
Switch 4 - Off Switch 5 - Off	(Range: 33% - 25%)

SW1-6 **Phase Select**

Switch 6 - Off Positive Line Phase
Switch 6 - On Negative Line Phase

SW1-7 **Output Frequency Select**
SW1-8 **Output Frequency Select**

Switch 7 - On Switch 8 - On	Source: 50 - 60 Hz, Output: 100 - 120 Hz
Switch 7 - On Switch 8 - Off	Source: 50 - 60 Hz, Output: 50 - 60 Hz
Switch 7 - Off Switch 8 - On	Source: 50 - 60 Hz, Output: 33.3 - 40 Hz
Switch 7 - Off Switch 8 - Off	Source: 50 - 60 Hz, Output: 25 - 30 Hz

SW1-9 **Not Functional**

Potentiometer Adjustments

R6 +10 to 24 Vdc Photo Eye Voltage Adjust

R14 On Delay Adjust
(0 to 17 Seconds)

R23 Off Delay Adjust
(0 to 17 Seconds)

R34 Maximum Limit Adjust
(66 to 100%)

Jumper Selections

JMA - Installed Panel Pot Connected
Not Installed External Reference Connected

JMB - Used for selection of (0-20 ma) Input
Allows setup for powered or nonpowered input

JMC thru JMF - Used for selection of Photoeye Input
Allows selection of Operate/Hold circuit to activate

Figure 13. ST-1900 and ST-2900 Switches and Adjustments

Input Voltage 95 to 140 Vac = 120 Vac
190 to 250 Vac = 220 Vac

Universal Input - Remote Off/On (Note 3)

SW1	Status
On	Disabled
Off	Enabled

Emergency Universal Input (Note 4)

SW2	Status
On	Disabled
Off	Enabled

Power Output Range (Note 1)

SW4	SW5	100 to 66	75 to 50	50 to 33	37.5 to 25
On	On	X			
On	Off		X		
Off	On			X	
Off	Off				X

Output Current 15 Amps

Output Frequency

SW7	SW8	120/100	60/50	40/33	30/25
On	On	X			
On	Off		X		
Off	On			X	
Off	Off				X

Sensor Gain (Note 2)

		Multiplier			
SW4	SW5	1	2	4	8
On	On	X			
On	Off		X		
Off	On			X	
Off	Off				X

Amplifier Gain (Note 2)

SW9	High	Low
Off	X	
On		X

Note 1 - Open Loop Mode, Accelerometer NOT in use.
Note 2 - Closed Loop Mode, Accelerometer IN use.

Factory Settings

SW1	On	Universal Input - Disabled
SW2	On	Emergency Input - Disabled
SW3	On	Soft Start - Enabled
SW4	On	Output Range 100% to 66 %
SW5	On	" " "
SW6	On	Fire on Negative Phase
SW7	On	Output Frequency 60 Hz (DC)
SW8	On	" " "
SW9	Off	Closed Loop Mode Gain - High

Control Inputs

Terminals	Action
TB2-8 and 9	Remove potentiometer and use 0-5V DC signal voltage to control output

Universal Input - Enabled SW1 Off / SW2 On

A	TB3-5 and 6	Voltage, 5 to 120 Vac or DC	Voltage = Operate No Voltage = Hold
B	TB3-7 and 8	Contacts	Open = Operate Closed = Hold

Emergency Universal Input - Enabled SW1 On / SW2 Off

A	TB3-9 and 10	Voltage, 5 to 120 Vac or DC	Voltage = Operate No Voltage = Hold
B	TB3-11 and 12	Contacts	Open = Operate Closed = Hold

Control Outputs

TB3-3 and 4	+5 Vdc Output	Operate = 5 Vdc Hold = 0 Vdc

Note 3 - When using the Universal Input for remote Off/On cycling of the controller the timing of the turn Off is a function of the Off time delays in use when a photocell is connected.

Note 4 - When the Emergency Universal Input is used the timing circuits are bypassed and the Off time is instantaneous.

Figure 19. ST-1900 and ST-2900 Quick Setup