![Fredericks Company logo]

Operating Manual

0729-1763-XX

Tilt Switch
With Relay Output

- Independent X and Y positive and negative trip angles
- Trip angles ±(1 to 10)°, ±(1 to 25)°, ±(1 to 45)°
- Accuracy to 0.2°
- Automatic software or hardware zeroing after installation
- Relay output, LED status indicator
- Operates from 7 V DC to 40 V DC supply
- All features can be setup via RS232 link

The Fredericks - Tilt Switch with Relay Output has been designed with the ability to be programmed via an RS232 link to be adaptable for many applications. The features can be preset by the factory to customer specifications or by the end product user. With one basic model all features can be preset such as - set trip angles, set zero position, set trip delay (on and off), set polarity of relay (normally on or off), set hysteresis (return from trip point angle) and set filter value (eliminate vibrations). These values will be permanently saved to internal memory. The unit also has a bootloader for potential updates and software modifications while in the field should they be desired or necessary.

Operation:
In the non-tripped position the LED will blink continuously to show that the unit is operational. When the unit is tilted past the programmed trip angle, either in the x axis or the y axis, the LED will remain on. Depending on the trip/return delay time the LED will illuminate indicating that the relay has switched. The polarity of the relay depends on the programmed value. When the unit is returned to the non-tripped position the LED will continue blinking as it was prior to tripping. This also depends on the delay time. The return angle is controlled by the hysteresis value which subtracts additional angle value from the tripped position. The minimum value is 0.25 degrees to eliminate oscillations. There is additional return delay that can be added.

Installation:
When the unit is installed into the user's equipment it may be necessary to zero the unit if the mounting is not at true zero. To set zero using an analog signal, use the following instructions:

1. Ensure that the equipment is level.
2. Prior to starting up your unit, ensure that the **zeroing wire** (pin 7: see the *Inputs and outputs* diagram below) is **grounded**.
3. Power up the unit.
4. With the unit level and powered up, disconnect pin 7 from ground (the LED should illuminate at this time), leave the connection floating (no connection), and wait at least 4 seconds, but no more than 12 seconds, and **then reconnect the wire to ground**.
   a. Performing step 4 in less than 4 seconds will not allow the unit to process the action properly.
   b. Waiting more than 12 seconds to perform step 4 will cause the action to timeout and the zero will not be saved.
5. If the zeroing is successful, the LED will blink 3 times indicating the new zero position is set and saved. Zeroing can also be done through software commands via RS-232 communications.

Bootloader:

The unit comes equipped with a bootloader that allows for easy firmware updates in the field should it be necessary. In order to use the bootloader, please follow the instructions below:

1. Prior to powering the unit, connect the unit to the computer via RS-232 communications (see TFC Application Note 1003 for instructions on how to do this).
2. Prior to starting up your unit, ensure that the **zeroing wire** (pin 7: see the *Inputs and outputs* diagram below) connection is **floating**.
3. Power up the unit.
4. With the unit powered, connected to your PC via RS-232 communications, and pin 7 floating, you should receive the following message to your communications terminal/interface to indicate that your unit is in bootloader mode: "Bootloader Version 1.0" followed by "Waiting for download. . ."
5. Execute firmware update file provided.
6. After the download is complete, shut down the unit.
7. Reconnect the **zeroing wire** to **ground** prior to use in your system.
8. Proceed with normal usage.

Note: Pin 7 should always be connected to ground unless you are performing either of the procedures shown above.

Inputs and outputs:

Power is supplied to the unit through pin 8 of the DB15 connector, and Ground is supplied through pins 1, 9, and 15. The range is 7 to 40 V DC. Typical current is 30-150 milliamps.

Wiring chart:

Description	Color	Pin Number
Power input	red	8
Common	red, black, black	1, 9, 15
Zero wire	orange	7
Relay 1 (IN)	white	2
Relay 1 (COM)	black	10
Relay 2 (IN)	green	3
Relay 2 (COM)	black	11
Relay 3 (IN)	yellow	5
Relay 3 (COM)	black	13
Relay 4 (IN)	blue	4
Relay 4 (COM)	black	12
(Setup via RS232 link)		
RS232 input	black	14
RS232 output	brown	6

The RS232 interface link is thru the black wire (input, 14) and the brown wire (output, 6). Pins 1, 9, and 15 are ground. The connector on the unit is a male DB15 connector.

Typical connections to a PC with a DB-9 connector are as follows,

DB-9 pin #	Tilt Switch wire
2	brown (PIN 6)
3	black (PIN 14)
5	black (PINS 1, 9, 15)

Note: Zeroing after installation

 The zero input wire (orange) is also used to zero the unit after it is installed into the operating equipment. The unit must be within 5 degrees of level to use this feature. See installation above.

Below is a description of the commands to pre-set the unit via the RS232 link.
Command menu (RS232 interface)

' ?'	Show list of all commands
'x'	Output linear 16-bit X value
'y'	Output linear 16-bit Y value
'a'	Output non-linear raw 16-bit X value
'b'	Output non-linear raw 16-bit Y value
'c'	Output X angle in degrees
'd'	Output Y angle in degrees
'n'	Set current position as zero
'z'	Set mechanical/electrical zero
'+'	Increment the filter (up to 255)
'-'	Decrement the filter (down to 1)
'v'	Display product information
'9'	Display current trip points, range, trip delay, return delay, polarity, hysteresis, and baud rate selections
't'	Display the current temperature
'6'	Display all current trip points and relay statuses
'1'	Set the positive X-axis trip point
'2'	Set the negative X-axis trip point
'3'	Set the positive Y-axis trip point
'4'	Set the negative Y-axis trip point
'e'	Change and save trip delay
	Enter 0 to 9 (# times 0.5 seconds)
'f'	Change and save return delay
	Enter 0 to 9 (# times 0.5 seconds)
'g'	Change and save relay polarity
	Enter 0 or 1 (off or on) in non-trip mode
'h'	Change and save hysteresis value
	Enter 1 to 8 (# times 0.25 degrees) return from tripped position
's'	Change the baud rate for communication
'c'	Cancel the current command (during command input)

Refer to the Fredericks Company Application Note 1003 for a guide to connect to Tera Term for communication with the unit.
Note: Trip angle setup in RS232 mode
Trip points must be set in "XX.X" format

Specifications

Operating voltage:	7 V DC to 40 V DC
Power Protection:	Over-voltage and reverse voltage protected (re-settable fuse)
Trip Angle:	Within ±10°, ±25°, ±45° Settable to independent X and Y trip angles
Trip Accuracy:	0.2° (23 °C)
Repeatability:	0.1° (23 °C)
Output:	Relay: 2 A @ 30 V DC resistive load rating Settable to active or non-active in trip or non-trip mode
Delay (to trip):	Settable: 0 to 9 (# times 0.5 s)
Delay (to non-trip):	Settable: 0 to 9 (# times 0.5 s)
Hysteresis:	Settable: 1 to 8 (# times 0.25°) return from tripped position
Filter:	Settable: 1 to 255 readings
Operating Temperature:	-40 °C to 70 °C
Housing dimensions:	(L x W x H) 3.05" x 2.05" x 1.08" (plastic) (L x W x H) 4.04" x 2.07" x 1.00" (metal)
Mounting holes:	0.188" diameter; 3.5" centers