



I/O Positioner Communication Protocol

Version 02 Pre-Release

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1.0 Overview

The I/O COM systems comprise individual connectors for a 12 bit I/O parallel communication link, and an RS-232 serial link for programming.

The I/O Positioner Communication Protocol allows the user to move to any one of 128 programmed position points. Position points can be programmed through a Handheld HMI or Windows based GUI.

Upon power up, the Sunstream servo controller will initiate communication with a Handheld HMI or Windows GUI - if either device is connected to the controller (Refer to Interface Manuals). If no connection is present, the software will continue to execute.

To avoid any unexpected motion at power up, it is recommended that all ten (10) inputs on the parallel communication link are actively pulled low through internal logic. A pull-down resistor for each input is recommended.

This manual describes how a Host can communicate via 12 bit I/O link to the Sunstream Servo Actuator to:

- Command the servo actuator to Move to a Position.
- Enable and disable operation of the PSA.
- Determine the operating status of the Sunstream servo controller.

A delay of 2ms is recommended as a buffer between executing read and write logic.

2.0 Hardware

- Connector: Binder Series 723 with 14 pins: INPUTS 0-9, OUTPUTS 0-1, PWR, and GND. The PWR and GND pins are isolated from other power and ground planes in the controller.
- All communication pins have 2.5kV peak galvanic isolation provided by optically coupled isolators. Refer to 4.3 for further details.
- Both the power cable and the communication cable are fully shielded, and the shield for each is terminated (shorted) to the valve chassis. **The power cable shield, shield leads, and earth ground wire (EARTH) should all be terminated to earth ground at the panel. It is *not recommended* to tie shield of the communication cable to earth ground (at the panel) as doing so may create ground loops.**

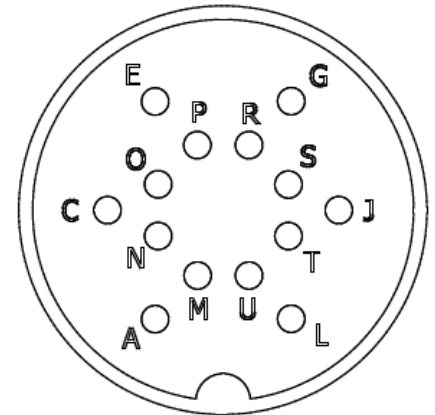
3.0 Programming

The Sunstream servo controller is not programmable through the 12 bit I/O parallel communication link. To learn more about programming the Sunstream servo controller, refer to the GUI Manual.

4.0 Pin Definitions

Table 4.0

Logic Des.	Function	Pin Des.	Cable Wire
Input 0	Bit 0 of pos. input	O	Green/Blk
Input 1	Bit 1 of pos. input	P	Yellow/Blk
Input 2	Bit 2 of pos. input	R	Yellow
Input 3	Bit 3 of pos. input	S	Orange
Input 4	Bit 4 of pos. input	N	Green
Input 5	Bit 5 of pos. input	M	Brown
Input 6	Bit 6 of pos. input	U	Brown/Blk
Input 7	N/C	T	Orange/Blk
Input 8	Trigger	A	Red
Input 9	Enable	L	Red/Blk
Output 0	Status	E	Blue
Output 1	Diagnostic	G	White
N/A	PWR	C	Blue/Blk
N/A	GND	J	White/Blk



4.1 Outputs

Output bits are set and cleared by the Sunstream controller.

Output Bit 0: The Status bit represents the operational status of the servo. When this bit is high (logic 1), the servo is *Busy* executing a move. Once the servo has moved within a positional error window specified by “PSTN RES”, the Status bit will be pulled low (logic 0) to indicate that it’s *Ready* to accept a new input. Refer to the GUI or HOI manuals for further details on programming Positional Resolution.

Output Bit 1: This is a diagnostic bit. If the servo is operating properly, this bit will be pulled to a high logic state. When pulled low, there has been a fault in servo operation.

4.2 Inputs

Input bits are set and cleared by a Host, and read by the Sunstream controller.

Input Bits 0-6: These 7 bits concatenate to form an input value related to a Position Point. See Table 4.1

Input Bit 8: The Trigger Bit signals the Sunstream controller to scan Input bits 0-6 in order to calculate a new position point instruction. If the servo status is *Busy* while the Trigger is set to logic 1, the Sunstream controller will not execute the new Move to Point. If the servo status is *Ready* when the Trigger bit is pushed high, a Move to Point instruction will be executed.

Input Bit 9: When pulled low, the Enable bit restricts the Servo controller from initiating a Move to Point routine, and places the spool in flow mode. Regardless of the state of the Status bit, the servo cannot be triggered to move to a new point if the Enable bit is pulled low. This bit should be set to logic 0 upon applying +24V power to the servo controller. Pull this bit high (logic 1) to enable normal operation.

By pulling the Enable Bit low during operation, the Sunstream servo will transition back to the “stand-by” flow mode. In this mode, the spool will be actively centered, but the position loop will be disengaged. To transition back into an operational mode, pull the Enable Bit high, and transmit a new position command.

Table 4.1

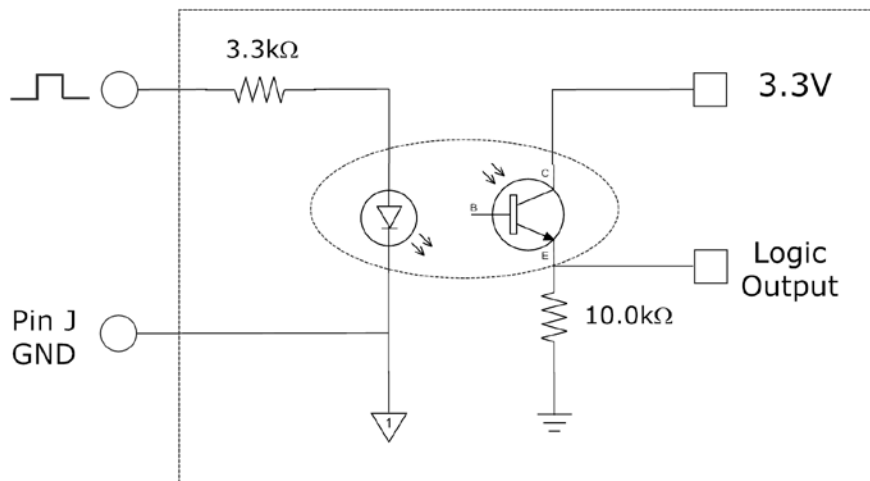
Position Point	Bit 6 (MSB)	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
0	0	0	0	0	0	0	0
...
42	0	1	0	1	0	1	0
...
85	1	0	1	0	1	0	1
...
127	1	1	1	1	1	1	1

4.3 Electrical

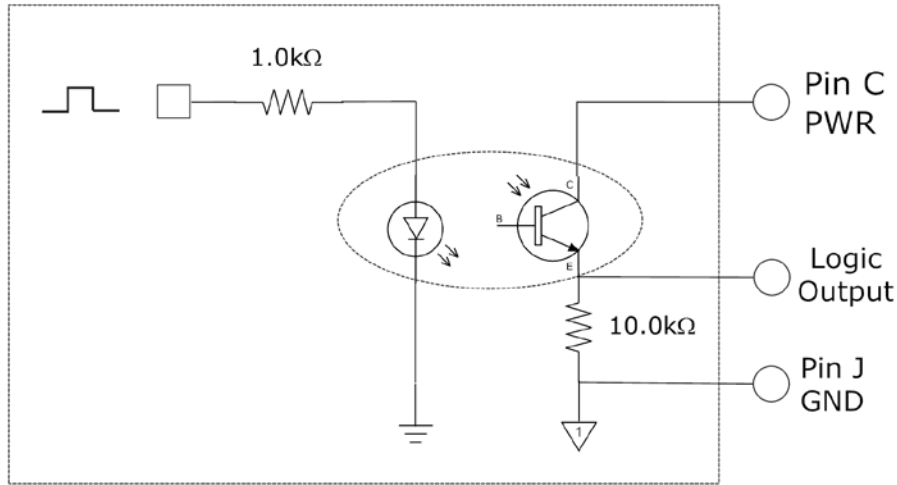
Pin C: GND, Isolated.

Pin J: PWR, Isolated.

Input Pins: All input pins are tolerant of 5-30V logic inputs.



Output Pins: The output voltage level is equivalent to Pin C PWR.



5.0 Operational Protocol

This section describes how a user controller – such as a PLC – herein referred to as the “Host”, may be employed to command the Sunstream pneumatic servo.

All Input bits are set and cleared by the Host, and read by the Sunstream controller.

All Output bits are set and cleared by the Sunstream controller, and read by the Host.

Before applying +24V power to the Sunstream servo controller, ensure that Input bits 8 and 9 are both pulled low by the Host. Failure to ensure that these bits are cleared to logic 0 may result in unpredictable servo behavior.

Once power is applied, Output Bits 0 and 1 will be pulled high by the Sunstream controller’s internal hardware logic. After completing memory initialization, the Sunstream controller polls the Enable Bit awaiting detection of a high state. The Host is required to pull the Enable Bit (Input Bit 8) high in order to activate the servo loop. When logic 1 is detected, the controller will progress through enable routines until the servo loop is fully operational. At this point, the servo will be actively modulating in a “stand-by” flow mode. The Sunstream controller subsequently pulls the Status Bit (Output Bit 0) to logic 0, indicating that it is *Ready* to move to a point.

The servo is able to move to any one of 128 points stored in data memory. Each point can be programmed to 0.001” resolution (see GUI or HOI Manual). The Host selects a specific point by writing a 7 bit word to Input bits 0-6 and subsequently pushing the Trigger bit to logic 1. Once the servo loop is enabled, the Sunstream controller polls the Trigger and Enable bits every 0.00096s. If the servo status is *Ready*, and both the Trigger and Enable bits are read at logic 1, the Sunstream controller will read Input bits 0-6, and concatenate the individual logic states into a 7 bit word representing a position point. The Status bit will be set to *Busy* (logic 1), and the servo will move from its present location to the commanded position with acceleration, deceleration, and velocity limits imposed through programmed values.

Once the servo has completed this Move to Point instruction, the Sunstream controller will clear the Status bit by pulling it to logic 0 – thus indicating that it is ready to move to a new point. This *Ready*

status is not achieved until the differential between measured and desired servo position is within the tolerance band specified by the Position Resolution parameter.

The Sunstream controller continuously polls the Trigger and Enable bits even after the Move to Point instruction has been initiated. After the Trigger bit has been read by the Sunstream controller, and acknowledged by the Status Bit pulled high (logic 1), the Host should clear the Trigger Bit.

5.1 Sequence of Events

- Host pulls Input bits 8 and 9 to logic 0
- Host applies +24V to Sunstream servo controller
- Sunstream controller will pull up the Status and Diagnostic Bits (Output bits 0 and 1) to logic 1.
- Sunstream controller will pull the Diagnostic Bit low after memory initialization.
- Host pulls Enable Bit to logic 1.
- Sunstream controller completes software initialization and enables servo loop.
- The Sunstream servo will now be in a “stand-by” flow mode, waiting for the first position instruction.
- Sunstream controller pulls the Status bit (Output bit 0) low to indicate *Ready*.
- Host writes 7 bit word to Input bits 0-6.
- Host pulls Trigger Bit (Input bit 8) high.
- Sunstream controller acknowledges Trigger by pushing the Status bit high to indicate *Busy*.
- Host may poll Status Bit to ensure that Trigger has been properly read.
- Sunstream controller calculates motion trajectory and moves to point designated by Input bits 0-6.
- Sunstream controller pulls the Status bit low when position has been achieved to indicate *Ready*.
- Host can now instruct a new point.