



PLC Communication Protocol

Version 01 Pre-Release

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1.0 Overview

The PLC Communication Protocol allows the user to execute any one of 3 internally stored motion programs directly through a handheld or panel mount HMI, or through external switching logic. Position points can be programmed through the HMI or Windows based GUI.

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

Upon power up, the Sunstream servo controller will initiate communication with the Handheld Operator Interface or Windows GUI - if either device is connected to the controller (Refer to Interface Manuals). If neither device is connected, the software will continue to execute, and all communication will defer to the I/O cable.

To avoid any unexpected motion at power up, it is recommended that Input 2 is actively pulled high. All eight (8) inputs employ an internal pull-down resistor (see 4.3). Consequently, any unconnected pins will pull up internally as Logic 0.

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

- Command the PSA to run an internally stored program through I/O logic.
- Command the PSA to run an internally stored program through the HMI.
- Enable and disable operation of the PSA.
- Determine the diagnostic status of the Sunstream servo controller.

2.0 Hardware

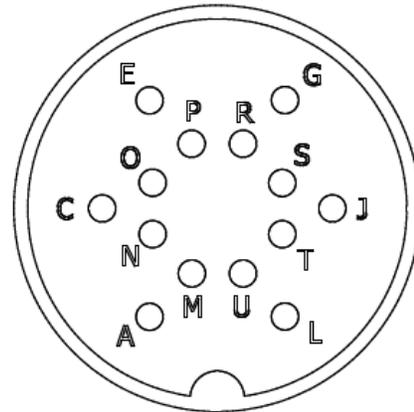
- Connector: Binder Series 723 with 14 pins: INPUTS 0-7, OUTPUTS 0-3, PWR, and GND. The PWR and GND pins are isolated from other power and ground planes in the controller.
- All communication pins have 2.5kV peak galvanic isolation provided by optically coupled isolators. Refer to 4.3 for further details.
- 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

To learn more about programming the Sunstream servo controller, refer to the GUI Manual.

4.0 Pin Definitions

Input Bit 0:	Bit 0 of program code	Pin O
Input Bit 1:	Bit 1 of program code	Pin N
Input Bit 2:	Enable	Pin A
Input Bit 3:	General Input	Pin M
Input Bit 4:	General Input	Pin U
Input Bit 5:	General Input	Pin L
Input Bit 6:	General Input	Pin T
Input Bit 7:	General Input	Pin S
Output Bit 0:	General Output	Pin E
Output Bit 1:	General Output	Pin P
Output Bit 2:	General Output	Pin R
Output Bit 3:	Diagnostics	Pin G
PWR		Pin C
GND		Pin J



4.1 Outputs

Output bits are set and cleared by the Sunstream controller.

Output Bit 0-2: These pins are delegated to general output handling. Turn Output pins on and off through the TOGGLE instruction (see the GUI manual).

Output Bit 3: This is a diagnostic bit, and reserved for internal logic. 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 (except during the start up procedure).

4.2 Inputs

Input bits are set and cleared by a Host, and read by the Sunstream controller. Unconnected pins will pull up internally as Logic 0.

Input Bits 0-1: These 2 bits concatenate to form the value of the desired position point, for a total of 3 programs. Immediately after application of power to the Sunstream controller, the controller will poll Input bits 0 and 1. These bits are concatenated to create a Program Code. If the program code is 00, or if these pins are left not connected (N/C), then the program must be selected through the HMI.

Input Bit 0	Input Bit 1	Program
0 or N/C	0 or N/C	No program selected
0 or N/C	1	Run program 1
1	0 or N/C	Run program 2
1	1	Run program 3

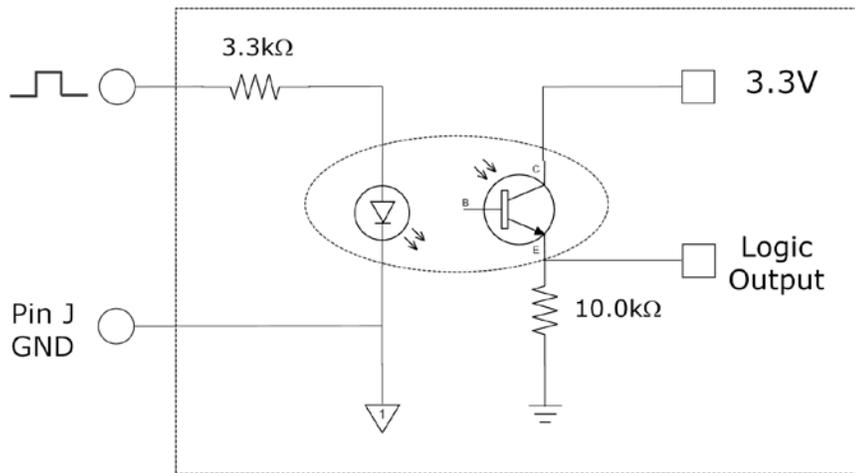
Input Bit 2: When pulled high, the Enable bit restricts the Servo controller from executing a program routine, and places the spool in flow mode. This bit should be set to logic 1 upon applying +24V power to the servo controller. Pull this bit low (logic 0) to enable normal operation.

By pulling Input 2 high 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 or force loop will be disengaged. To transition back into an operational mode, and resume program execution, pull the Enable Bit low.

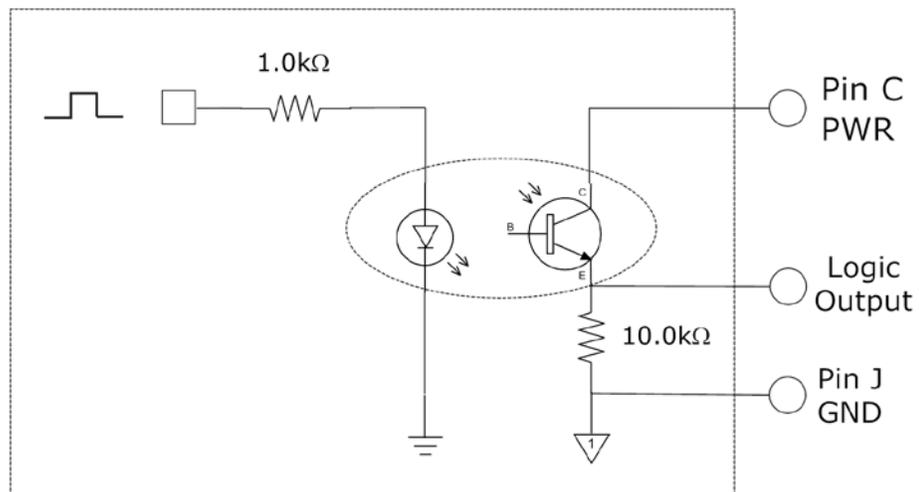
Input Bit 3-7: These 5 bits are reserved for general input logic. For example, the program instructions Conditional Branch and Conditional Halt instructions are dependent upon the logic state of a specific Input bit (selected from a pulldown menu in the GUI).

4.3 Electrical

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

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, we recommend that Input bit 2 is pulled high by the Host for proper initialization handling.

The enable pin (Input 2) must be pulled low for the Sunstream controller to execute a program.

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).

Once the servo has completed a programmed instruction, the Sunstream controller will index to the next line in the program. In order to indicate to an external host that execution of a particular instruction has completed, the program instruction "TOGGLE" can be added following said instruction. The TOGGLE instruction will pull an output pin high or low as programmed.

5.1 Sequence of Events, Program set through I/O

- Host sets Input Bits 0-1 according to desired program to be executed.
- Host pulls Input bit 2 to logic high.
- Host applies +24V to Sunstream servo controller.
- Sunstream controller will pull Output bits 0-2 to logic 0.
- Sunstream controller will pull up the Diagnostic Bit (Output 3) high.
- HMI will display the program to be executed (1, 2, or 3)
- Host pulls Enable Bit (Input 2) to logic 0.
- Sunstream controller pulls Output 3 to logic 0 to indicate that the Enable bit has been successfully read, and that initialization will continue.
- When initialization is complete, and the selected program begins to execute, the Sunstream controller will pull Output 3 high.

5.2 Sequence of Events, Program set through HMI

- Host sets both Input Bits 0 and 1 to Logic 0, or leaves them unconnected.
- Host pulls Input bit 2 to logic high.
- Host applies +24V to Sunstream servo controller.
- Sunstream controller will pull Output bits 0-2 to logic 0.
- Sunstream controller will pull up the Diagnostic Bit (Output 3) high.
- HMI will display a MAIN MENU of user selections, giving the user an opportunity to set gains and parameters, and choose the program to be executed (please see Handheld Operator Interface Manual).
- User selects program, and the HMI will write to the screen the program to be executed (1, 2, or 3).
- Host pulls Enable Bit (Input 2) to logic 0.
- Sunstream controller pulls Output 3 to logic 0 to indicate that the Enable bit has been successfully read, and that initialization will continue.
- When initialization is complete, and the selected program begins to execute, the Sunstream controller will pull Output 3 high.