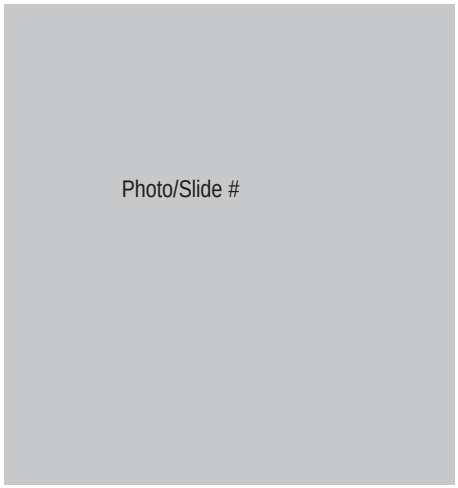
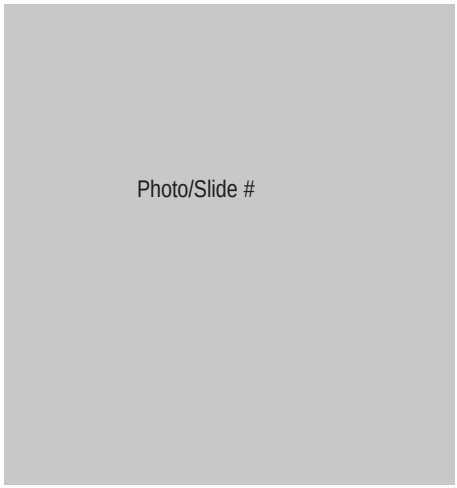
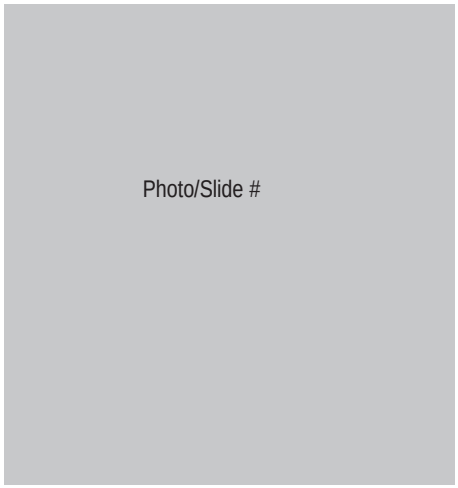
# SLC Servo Control System

**(Cat. No. 1746–HSRV)**

***Product Data***




The 1746-HSRV, SLC Servo Control Module, is a low cost Allen-Bradley motion solution for a single-axis servo application. This module provides an analog velocity command with programmable limits up to ±10V DC to interface with a variety of Allen-Bradley servo drives.

Rockwell Automation
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The SLC Servo Control Module, catalog number 1746-HSRV, is compatible with the SLC 500 family and can only be used with the SLC 5/03 FRN 5.0 Processor/Firmware and above.

The Ladder Logic in RSLogix 500, AI500 or APS (5.0 or later) controls all of the motion and it can be programmed for either incremental or absolute and speed moves, depending on the application.

## SLC Servo Control Module Operation

The SLC Servo Control Module is compatible with the SLC family. It is designed to be used with an SLC 5/03 FRN 5.0 and later processor. You can program and commision the system using RSLogix 500, AI 500 or APS (5.0 or Later). Once the SLC Processor is initiated, block execution is independent of the scan time of the processor. Blended motion allows for complicated move profiles consisting of two to 32 segments. The blended move profiles are stored in the SLC Servo Control Module's internal memory as a series of absolute moves. Since the sequence of moves is stored in internal memory, it can be executed more than once. Other move or homing operations can be performed between blended move profiles.

The SLC Servo Control Module is capable of controlling absolute position over a range of 32 bits. The SLC Servo Control Module is able to perform an origin search (also called homing) and automatically reset the absolute position to home position when an encoder marker pulse is detected and the SLC Processor requests an origin search function.

The SLC Servo Control Module operates in two different modes:

- Configuration
- Command

### Configuration Mode

You can configure the SLC Servo Control Module by using M files containing data provided by the SLC processors. All the configuration parameters of the SLC Servo Control Module are on-line.

Configuration mode allows you to select the proper setup configuration to match the servo drive and motor without setting any switches and without special software. If you do not set up your own configuration, the configuration will equal the default setting.

**Important:** You can only enter configuration mode if the system is in E-stop.

### Command Mode Operation

All motor operations are preformed in command mode. To get to this mode, set the mode flag (Bit 15 in output Word 0) to 0.

In command mode, the SLC Processor can issue commands and activate different operations or moves. The actions you can command are:

- Absolute moves
- Incremental moves
- Speed moves
- Monitor moves
- Hold moves
- Unhold moves
- Blend moves
- Emergency stop operations
- Homing operations
- Preset operations
- Clear faults
- Alternate home moves

When operating in either the configuration or the command mode, the status of the module is reported to the SLC Controller.

## SLC Servo Control Module Specifications and Compatibility

The SLC Servo Control Module has the following specifications:

- Compatible with SLC 5/03 FRN 5.0 and later processors.
- Compatible with APS software release 5.0 and later or AI 500 software.
- Class 3 device with twelve inputs and twelve outputs. Selection for the SLC Servo Control Module configuration is OTHER with the number specified as 10114.
- Class 3 device that uses M files for the configuration mode.
- The SLC Servo Control Module is UL Listed, CSA Certified and CE Marked.

**Note:** The SLC Servo Control Module does not function in a remote I/O rack.

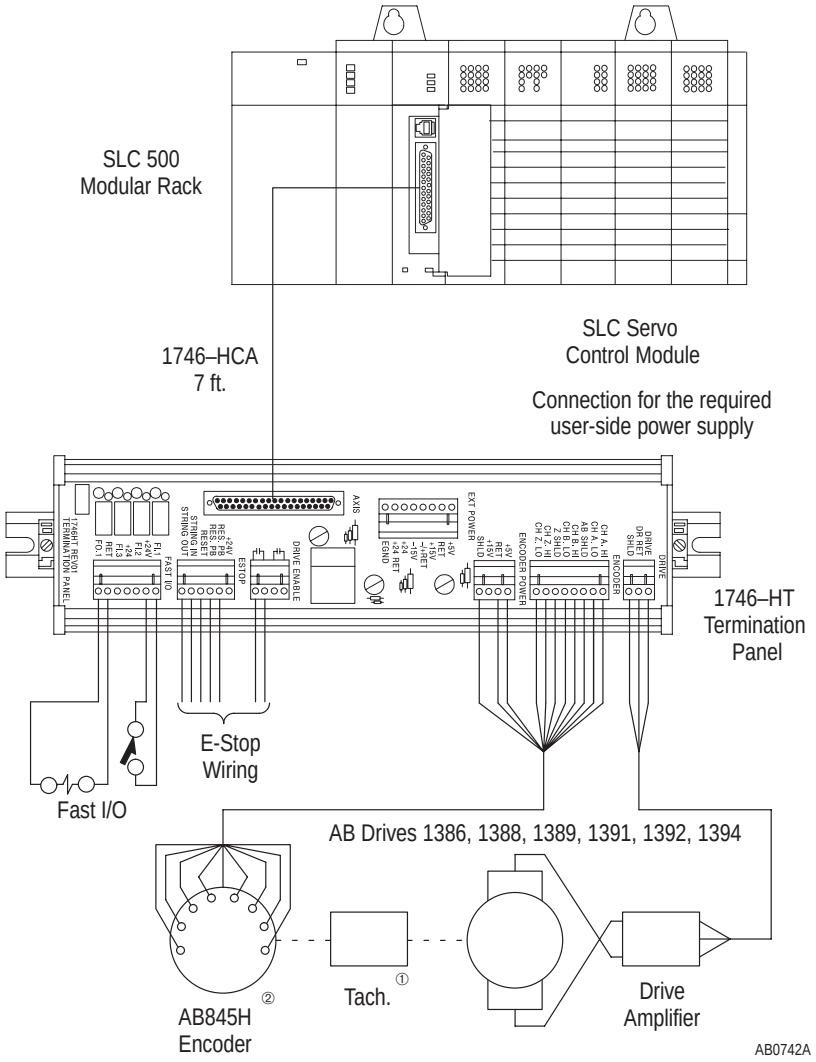
- The SLC Servo Control Module must be configured in the lowest numbered I/O slot in order to use an SLC application's module interrupt option. There should be no other modules that generate module interrupts. Also, the STI and FAULT routines execute at a higher priority than the module interrupt routine that is linked to the SLC Servo Control Module interrupt.

## Typical SLC Servo Control System Configuration

Figure 1 shows a typical SLC Servo Control System configuration. This configuration includes:

- One SLC 500 modular rack (SLC 5/03 FRN 5 or later)
- One SLC Servo Control Module
- One 1746-HCA cable
- One termination panel
- Wiring for a servo system

**Figure 1**
**Typical SLC Servo Control System Configuration**




① AC drives do not require a tachometer.

② When supplying the +5V encoder with an external power supply, connect the return line from the power supply to the encoder power on the termination panel.

## Components of the SLC Servo Control System

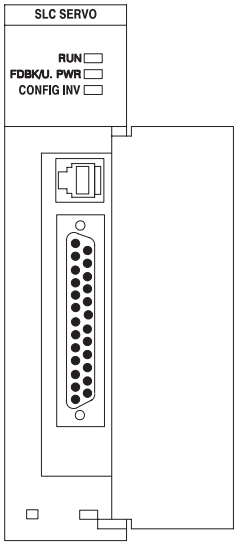
This section describes the components of the SLC Servo Control System.

### SLC Servo Control Module

The SLC Servo Control Module, shown in Figure 2, is the focal point of the SLC Servo Control System. The SLC Control Module:

- Monitors encoder feedback on one channel up to 300kHz at 0 degrees quadrature error
- Monitors position and following error at any time after initial power-up and homing
- Provides one fast output
- Monitors three fast inputs
- Uses discrete transfer to communicate with compatible Allen-Bradley SLC 500 system components through the backplane of the SLC 500

**Figure 2**
**SLC Servo Control Module with Door Open**



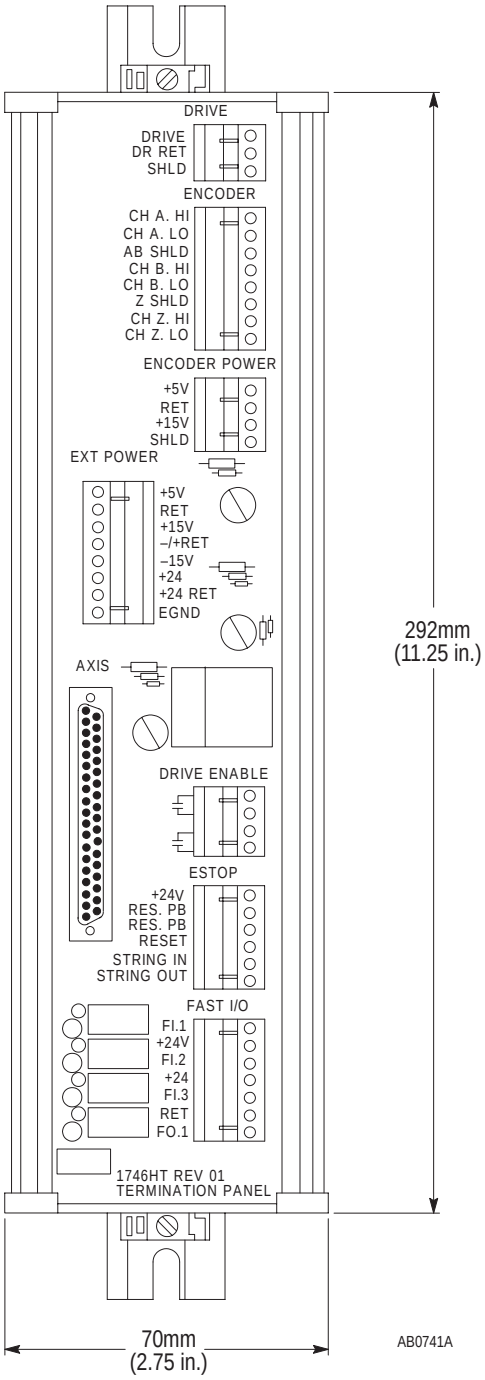

### SLC Servo Termination Panel

To provide you with more flexibility, the SLC Servo Control System features a termination panel (shown in Figure 3). You can mount the panel on a DIN-type rail. The features of the termination panel include:

- E-stop connections for customer E-stop string
- Fast I/O connections for three fast inputs and one fast output. LEDs show status of each I/O point

- Encoder which supports encoder feedback for one axis
- Drive connections to analog drive
- External power connections for +5V, 15V and +24V power from user power supply

**Figure 3**
**1746-HT Termination Panel**



### System Power Supply

You will need to supply a power source for the SLC Servo Control System. The power supply must be:

- +5V, 15V, and +24V
- Able to meet the minimum voltage requirements of the encoders and other circuitry

## Axis Control

The SLC Servo Control Module controls one axis per module. These axes can be linear or rotary (with rollover programmed in degrees or revolutions).

Allen-Bradley reserves the right to revise these specifications without prior notice.

Rectangular acceleration and deceleration is programmable.

### SLC Servo Control Module

You are required to provide a +5V DC, ±15V DC power supply.

### Velocity Command (Analog Output)

The SLC Servo Control Module creates an output with the following specifications:

| | |
|---|---|
| Output voltage swing | ±10V DC |
| Resolution | 12 bits DAC (including sign bit) at 4.88mV per bit |
| Load range | 2K – 20K ohm |
| Conversion time | 100µs |
| Differential linearity | ±1 LSB maximum (monotonic over entire temperature range) |
| Output offset voltage | 500µs maximum |
| Gain error drift | ±7 LSB maximum |

## Feedback Circuitry

The feedback circuitry has:

- One feedback channel per module
- Differential incremental encoder with gated marker support
- Minimum channel frequency of 300kHz at 0° quadrature error
- The following formula determines channel frequency:
  - $F_{chan} = 3334 (90° – E_Q°)$
  - Where $F_{chan}$ = channel's frequency in Hz
  - Where $E_Q$ = quadrature error in degrees (from 90°)
- Input Signal
  - Encoder feedback on channels A, B and Z must be differential with 5V compatible output signals (8830 line driver or equivalent)
  - Input sink current (DC): 6.8mA (typical), 7.5mA maximum
  - Input sink current (AC): 42mA (maximum).
    The value of 42mA represents the peak current that occurs as the differential switches state due to the AC termination, with a 4V differential swing. The current will decay per the RC time constant resulting from the 0.01µF capacitor and the 221 ohm resistor.
- Voltage for the common mode input of ±7V

## Operating Conditions

The SLC Servo Control Module requires the following operating conditions:

| | |
|---|---|
| Temperature (inlet air) | 0° to 60° C (32 to 150°F) |
| Altitude | up to 2000m (6562 ft) |
| Humidity | 5 to 95%, non-condensing atmosphere |
| Storage Temperature | -40° to 85°C (-40° to 185°F) |

## Emergency Stop (E-stop) Characteristics

The SLC Servo Control Module E-stop characteristics include:

- Detection and control of E-stop conditions provided on the board
- Each module provides a separate and independent E-stop circuit
- Hardware E-stop activated by:
  - User-defined E-stop circuit (refer to the SLC Servo User Manual)
  - Broken wire in the user power supply cable
  - Powerfail signal from the SLC 500 backplane
- Software E-stop is activated by:
  - Initiated watchdog timeout
  - Detected quadrature error
  - Detected broken feedback wire
  - Detected excess following error
  - Lost communication with SLC
  - Lost user power supply
  - Filled fast-input queue
- Software E-stop can only be released if no hardware faults are present
- Specifications for the E-stop relay contacts are:

| | |
|---|---|
| Switching volts | 80V DC (maximum) |
| Operational time | 500µs (typical) |
| Contact bounce | <200µs (typical) |
| Contact resistance | 150 milliohm (typical) |
| Resistive contact rating | 4VA at 0.25A (maximum) |

## General Local Fast Outputs (Source Drivers)

Specifications for the General Local Fast outputs are:

- One fast output (compatible with a customer-equipped +24V DC power supply)
- High-level, on-state output voltage (refer to the specifications for the user-side power supply)
- High-level, on-state output current

| | |
|---|---|
| Without termination panel | +5V (maximum) and 0V (minimum) at 24mA |
| With termination panel | +24V (maximum) at 400mA |

## General Purpose Local Fast Inputs

Specifications for the General Purpose Local Fast inputs are:

| | |
|---|---|
| Number of fast inputs | 3 (compatible with a customer-equipped +24V DC power supply) |
| Low-high trip threshold | 14.61V DC (maximum) 12.5V DC (typical), 10.51V DC (minimum) |
| High-low trip threshold | 10V DC (maximum), 8.3V DC (typical), 6.4V DC 9 (minimum) |
| $V_{HYST}$ | 6.5 V DC (maximum), 4.1 V DC (typical), 1.9V DC (minimum) |
| Low-high trip debounce filter | 0.2 ms (typical) |
| High-low trip debounce filter | 0.2 ms (typical) |
| Input voltage | ±75V (maximum) |
| Input current (at 27V) | 50mA (maximum) |

## SLC 500 Backplane Communications

The SLC 500 Application program sends:

- Status information to the SLC 500 once each I/O scan, including:
  - Discreet bit input status
  - Actual position, following error or current speed
- All configuration and programming data to the SLC Servo. All sequencing of this data is the responsibility of the programmer.

Current Requirements are 0.300 A +5V.

A Version 2.0 memory pack is required to support SLC 500 and SLC Servo capabilities.

### Effect on SLC Processor Scan Time

Scan time effect is the amount of time consumed in the SLC processor to process the overhead associated with each module. Scan time effect is summed with the time required to scan the application logic in the processor. In other words, the more modules in your rack, the slower the application scan rate.

Use the following data to determine the scan time effect on the SLC processor. To calculate the total scan time effect of all modules in the rack, refer to Appendix D, *Estimating Scan Time*, in the SLC processor manual (publication number 1747–6.15).

| SLC Processor | Input Scan | Output Scan |
|---|---|---|
| 5/03 | 700 microseconds | 700 microseconds |
| 5/04 | 680 microseconds | 680 microseconds |

## Termination Panel

The termination panel easily mounts up to 2.1 m (7 ft) from the motion control module, requiring only a screwdriver and a wirestripper.

The E-stop relay contacts are rated at 120V AC at 3A continuous; 15µs operating time.

The E-stop relay coil is rated for +24V at .05A.

## System Power Supply

The SLC Servo has no input requirements for the system power supply.

**Table A**
**Output Capability**

| Supply | Tolerance | Current | Maximum Ripple Allowed Peak-to-Peak (P-P) |
|---|---|---|---|
| User +5V | ±5% | at 0.150A not including encoder | 100mV at 5A |
| User +15V | ±5% | at 0.030A not including encoder | 100mV at 1A |
| User –15V | ±5% | at 0.030A not including encoder | 100mV at 1A |
| User +24V | ±5% | at 0.060A not including FOUT current | 400mV at 2A |

## Ordering the SLC Servo Control System

Table B lists the catalog numbers you use to order the components of the SLC Servo Control System.

**Table B**
**Ordering the SLC Servo Control System**

| Component | Catalog Number | What You Receive |
|---|---|---|
| Control module | 1746-HSRV | Control module<br>User Manual |
| Termination panel | 1746-HT | Termination panel<br>Mounting brackets<br>Termination Panel Installation Data Sheet |
| Cable that connects the control module to the termination panel | 1746–HCA | Cable |
| Documentation | 1746-6.1.2 | SLC Servo Control Module User Manual |

## Where to Find More Information

Refer to the SLC Servo Control Module User Manual for more information about the the following for the SLC Servo Control System:

- Selecting encoders, power supplies, and drives
- Installing the control module, termination panel, and handheld pendant
- Wiring fast I/O, E-stop, power supplies, encoders, and drives
- Integrating the axis
- Recovering from an error message



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