



Handheld Operator Interface

Version 01 Pre-Release

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1.0 Overview

This is a guide for programming select variables, stored within the Sunstream servo controller, by employing the Sunstream Handheld Operator Interface Terminal. Communication between the servo controller and handheld terminal occurs via RS-232 protocol. Please refer to the Windows GUI Manual when programming through Sunstream's Windows based GUI interface.

Within this environment, the user can set limits to state parameters such as acceleration and velocity, define physical parameters such as weight, tune gains and select filters, program position points, and when done, flash changes into permanent memory.

Startup: Before power up of the Sunstream servo, ensure that the OI Terminal is connected to the controller. After applying +24V power, the MAIN MENU options will be written to the terminal screen after a brief delay. If this power up sequence isn't followed properly, the Sunstream controller will bypass the programming feature, and branch directly into an operational mode

Setting Communication Parameters: The handheld operator interface terminal is pre-programmed with the proper communication parameters. Baud rate is set to 9600 bps, with 1 stop bit, and no parity.

Menu Selection: Navigating through the selection menus is not dependant on cursor position, and requires only a numerical entry by the user to jump from screen to screen. Pressing the F4 on any screen will result in the program branching back one menu screen. Pressing F5 on any screen will result in the program branching back to the Main Menu.

General Notes for Data Entry:

←, ↑, →, and ↓ keys will move the cursor between columns and rows. The ENTER key will jump the cursor between rows.

NOTE: Any numerical entries are stored immediately into the controller's volatile memory (RAM).

Pressing the ENTER key is not required to store data, and any changes to the RAM will remain in effect as long as the controller is powered. However, these changes are not stored into permanent memory until the Flash routine is executed.

2.0 Parameter Programming

The MAIN MENU screen, shown directly below, will be accessible momentarily after the servo controller is powered up. This section illustrates the viewable screens, and provides details on the available selections:

MAIN MENU		
EDIT MEMORY		1
FLASH MEMORY		2
OPERATE		3

Press (1) to Edit values, both parameters and gains, to be stored in permanent memory.

Press (2) to Flash values into permanent memory.

Press (3) to Operate Pneumatic Servo from an internal program or an external device.

SUBCATEGORY: EDIT MEMORY

MAIN MENU > EDIT MEMORY

EDIT	LMTS/MODE	1
EDIT	GAINS/FILTS	2
EDIT	POINT	3
EDIT	PROGRAM	4

Press (1) to Edit values for Axial Load, Max. Weight, Min. Weight, Desired Positional Resolution, Maximum allowable Velocity, and Maximum allowable Acceleration and Deceleration.

Press (2) to Edit Proportional, Integral, and Derivative gains, and Friction compensation.

Press (3) to Edit a point

Press (4) to Edit a program. This feature is not currently accessible through the handheld terminal. All internal programs must be compiled at the factory, or accessed through the Windows GUI interface.

MAIN MENU > EDIT MEMORY > EDIT LMTS/MODE

CONTROL MODE	0
FRCTN COMP	1
SYSTEM LIMITS	2
STATE LIMITS	3

Press (0) to Select between control modes (soft or stiff)

Press (1) to Edit friction compensation.

Press (2) to Edit values for Axial Load, Max. Weight, Min. Weight, Supply Pressure

Press (3) to Edit Desired Positional Resolution, Maximum allowable Velocity, and Maximum allowable Acceleration and Deceleration.

MAIN MENU > EDIT MEMORY > EDIT CONTROL MODE

CONTROL MODE	<u>0</u>
SOFT	0
STIFF	1

Press (0) to Select the SOFT control mode (default).

Press (1) to Select the STIFF control mode. Compared to the soft mode, the stiff control mode performs better in the presence of friction or other unknown load disturbances, but is more noisy, and more sensitive to machine frame resonance.

MAIN MENU > EDIT MEMORY > EDIT FRCTN COMP

FRCTN COMP	
STICTION	000
FRICTION	000

i) Stiction is a parameter which will compensate for stiction induced error. Enter a non-dimensional value between 0 and 999. Stiction compensation can be added in systems where high levels of stiction cause limit cycling. Fully tune all gains and any filters before adjusting this parameter.

ii) Friction is a parameter which will compensate for friction induced error. Enter a non-dimensional value between 0 and 999. Stiction compensation can be added in systems where high levels of stiction cause limit cycling. Fully tune all gains and any filters before adjusting this parameter.

MAIN MENU > EDIT MEMORY > EDIT LIMITS > SYSTEM LIMITS

AXIAL LOAD	+000.0
MAX WEIGHT	0100.0
MIN WEIGHT	030.0
AIR PRESS	80.0

i) AXIAL LOAD: This is the average axial offset load that the servo will be expected to drive (in pounds). A positive (+) value represents a load which extends the cylinder, and a negative (-) value represents a load which retracts the cylinder. This feature is primarily used in vertical applications to zero out the effects of the weight of the load.

ii) MAXIMUM WEIGHT: This is the maximum inertial load that the servo will be expected to drive in lbfm. Enter this value to the highest accuracy practicable.

iii) MINIMUM WEIGHT: This is the minimum inertial load that the servo will be expected to drive in lbfm. Enter this value to the highest accuracy practicable.

iv) SUPPLY AIR PRESSURE: Enter the gage pressure, in psi, at valve inlet.

MAIN MENU > EDIT MEMORY > EDIT LIMITS > STATE LIMITS

PSTN RES	030.0
MAX VEL	35.0
MAX ACCEL	0.7
ACCEL MODE	0.0

i) PSTN RES: This is the positional error band, in thousandth's of an inch. A point to point movement is complete when:

$$\text{PSTN RES} > | \text{commanded cylinder position} - \text{measured cylinder position} |$$

ii) MAX VEL: This is the maximum velocity, in inches per second, desired for the pneumatic servo.

iii) MAX ACCEL: This is the maximum acceleration, in g's, desired for the pneumatic servo. This setting defines the rate at which the servo accelerates from rest to peak velocity – whether retracting or extending.

iv) ACCEL MODE: This feature dictates whether the position trajectory is calculated with a square or trapezoidal acceleration profile. A zero (0.0) value corresponds to a trapezoidal profile. Any non-zero entry corresponds to a square profile.

MAIN MENU > EDIT MEMORY > EDIT GAINS/FILTS

EDIT	GAINS/FILTS:	
EDIT	GAINS	1
EDIT	FILTS	2

Press (1) to Edit controller gains

Press (2) to Select filters

MAIN MENU > EDIT MEMORY > EDIT GAINS

P Gain	<u>100</u>
S Gain	100
D Gain	100
Frc Gain	350

i) Choose a value between 1 and 200 for P Gain. Increasing Proportional Gain results in a higher system bandwidth, and a smaller positional error. However, a value which is too high will result in overshoot and possible instability. The default value is 100.

ii) S Gain is a parameter which will smooth the effects of the high frequency noise. Higher values of S Gain will also improve tracking in systems with low inertia and high external disturbance forces. Incrementally increase this value until high frequency harmonics are observed. The default value is 100.

iii) The D Gain parameter is a non-dimensional feed forward setting. Increasing D Gain accelerates the servo's response to an input command, and reduces following error. However, D Gain values which are too high may result in undesirable overshoot. Choose a value between 0 and 100 for D Gain. The default value is 01.

iv) Choose a value between 1 and 999 for Frc Gain. This parameter is a non-dimensional value which sets the loop gain for the actuator in Thrust mode. When the actuator is operating in a positional mode, this value has no effect. The default value is 350.

MAIN MENU > EDIT MEMORY > EDIT FILTERS

EDIT FILTERS:	
FILTER A	000
FILTER B	000

Filter A and B not yet accessible to user editing.

MAIN MENU > EDIT MEMORY > EDIT POINT

EDIT POINT:	
	–
PROGRAM POINT	1
TEACH POINT	2

The Sunstream controller has memory allocated for 128 position points. These points are pre-programmed at increments of 0.2 inches. For example, POINT 000 is pre-programmed to correspond to a position of 00.000 in., POINT 001 is pre-programmed to correspond to a position of 00.200 in, POINT 050 is pre-programmed to correspond to a position of 10.000 in. etc.

Press (1) to modify internal points by using the keypad to enter a numerical value for the selected point.

Press (2) to modify internal points by manually moving the cylinder rod to the desired location for the selected point.

MAIN MENU > EDIT MEMORY > EDIT POINT > PROGRAM POINT

PROGRAM POINT:	
	–
POINT(0-127)	011
DIST	02.200

Use keypad to select the desired point to be modified, and press Enter. Type in numerical value for position in inches. Hit Enter to select another point.

MAIN MENU > EDIT MEMORY > EDIT POINT > TEACH POINT

TEACH POINT	
POINT	000
DIST	05.203

Use keypad to select the desired point to be modified, and press Enter. The current position of the piston will be written to the screen, and is continuously updated as the rod is pulled to its desired location. Hit Enter to lock in the desired point.

SUBCATEGORY: FLASH MEMORY

MAIN MENU > FLASH MEMORY

FLASH MEMORY	F1
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Press (F1) to permanently store changes to Flash Memory. A successful flash operation will return the text DONE. An unsuccessful flash operation will return the text ERROR.

SUBCATEGORY: OPERATE

MAIN MENU > OPERATE

EXTERNAL	F4
PROGRAM 1-3	F1-F3
NULL SPOOL	S
TUNE SERVO	T

Press (F4) to run Servo with an external device (CAN, I/O, RS-232)

Press (F1) to run Internal Program #1

Press (F2) to run Internal Program #2

Press (F3) to run Internal Program #3

Press (S) to null spool

Press (T) to tune servo (not yet available)