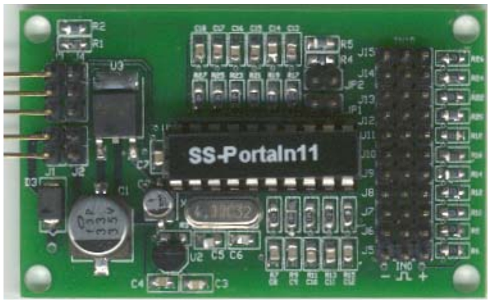
SS-IN11 Manual

A Super Stepper Command Bus Architecture Product

For a Quick Start Tutorials, visit out web pages at www.superstepper.com

Avayan
Electronics

6/9/04



Super Stepper 11 Input Controller (SS-IN11):

Gather digital input sensor information from your surrounding.
Two Pulse Accumulator Functions
One Period Timing function
Perfect to interface up to 11 sensors.
Sensors can be switches, optical sensors, or any other TTL compatible digital input source.

The SS-IN11 Input controller gives the user the ability to gather outside information from many typical sources such as switches, optical sensors, etc. This controller makes it easy for the programmer. All inputs are continually sampled and debounced. All the user has to do is read a word and gain the input information. The board works with 9V to 12V.

Extra functions such as dual Pulse Accumulators and a 32KHz compliant Period Timing function are specially suitable for robotic applications such as odometry and tachometry. Use the tachometer to determine how fast a shaft encoder is rotating. The Pulse accumulators offer the ability to measure distance by counting shaft encoder pulses.

The module receives command through the SSB (Super Stepper Bus). Two jumpers, JMP1 and JMP2, configure the controller UART for either 8 or 9 bit communication and a different range of BAUD Rates and addresses.

Commands received through the bus are executed immediately. Available commands for the SS-IN11 are shown on Table 1.

Super Inputs							
Opcode	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Description	# of Bytes
0	-	-	-	-	-	Reserved	1
1	-	-	-	-	-	Reserved	1
2	-	-	-	-	-	Reserved	1
3	-	-	-	-	-	Reserved	1
4	-	-	-	-	-	Reserved	1
5	-	-	-	-	-	Reserved	1
6	Mem Sel	Address	Data	-	-	Write	4
7	Mem Sel	Address	-	-	-	Read	3

Table 1

Commands:

Write RAM/EEPROM: (Opcode 6) Writes to internal RAM or EEPROM memory. The MEM SEL parameter specifies which type of memory will be accessed. Logic Low (0) accesses RAM while Logic High (1) accesses EEPROM. All writes are done to byte memory spaces. Writing to a word is not supported, so user must do two consecutive word writes to write to a word memory allocation, if needed.

SS ADDRESS	6	X	X	X	X	X	X	X	R*/E	Data Address	Data

Figure 2

Read RAM/EEPROM: (Opcode 7) Reads from internal RAM or EEPROM memory. The MEM SEL parameter specifies which type of memory will be read and if the read request will return a word or a byte. Only reads to RAM can return a word. EEPROM reads always returns a byte.

SS ADDRESS	7	X	X	X	X	X	X	B*/W	R*/E	Data Address

Figure 3

B*/W	R*/E	Description
0	0	Read a RAM Byte from ADDRESS
0	1	Read an EEPROM Byte from ADDRESS
1	0	Read a RAM Word (16bit) from ADDRESS*
1	1	Read an EEPROM Byte from ADDRESS

Table 2

* In this controller, the Read RAM Word is useful to read double byte values such as Pulse Accumulator 1 Count, Pulse Accumulator 2 Count and Time Period.

Debounced Inputs

The SS-PortaIn11 main feature is to allow the user to gather external information from TTL compatible sensors such as push buttons, optical switches, position switches, reed relays, hall effect sensors, and others. The controller contains 11 inputs capable of continuously sampling digital signals from said sensors and storing the value in RAM so that the user can read it later.

The 11 bit data is stored in a double byte (Word) register called the Debounced Inputs Register. As can be seen on the picture below, the less significant eight bits corresponds to the first eight sensor inputs. On the High Byte, the less significant three bits, correspond to the last three sensor inputs.

Word at 0x00 (Debounced Inputs)

Inputs (High)	Inputs (Lo)
0x00	0x01

Figure 4

The user can read the entire register by using the Read Word RAM instruction at address 0x00. It is also possible to read each byte by itself when using the Read Byte RAM instruction. Depending on the bit to be polled, the user can decide whether a word or a byte is read. We recommend reading the entire word at once since the serial message will still be 5 bytes long regardless of the memory access.

The inputs are sampled at an internal clocked rate and then debounced by a proprietary algorithm in which glitches are eliminated. For the signal to be acknowledge as a correct level, it must be be stable for at least 5 ms. Once the input stabilizes at one level, the bit value is transferred into the respective bit on the Debounced Inputs Register. This way, the user can be certain that noise is not interpreted by the application as valid data.

To connect a sensor to an input, select the connector from J5 to J15 on the SS-PortaIn11 controller. The table below how each connector is mapped to a particular bit on the Debounced Input Register. Reading the particular byte on said register yields the last stable value sampled on the particular input.

Debounced Inputs Register (Bit Names)

0	0	0	0	0	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	I0
NC	NC	NC	NC	NC	J15	J14	J13	J12	J11	J10	J9	J8	J7	J6	J5

Hardware Connection J5 to J15

Figure 5

Period as a Frequency Counter

The SS-PortaIn11 contains a very powerful resource perfect to add a tachometric function. Tachometry is the ability to measure the angular velocity of a rotating device (i.e. revolutions per second or revolutions per minute). By measuring the amount of shaft encoder ticks per unit of time, better known as frequency, the angular velocity can be easily computed.

Word at 0x02 (Time Period Register)

Period (High)	Period (Lo)
0x02	0x03

Figure 6

In the SS-PortaIn11 controller frequency is one step away as it provides its inverse on a 16 bit register called the Time Period Register. The Time Period Register offers a measure of how many clock ticks are between a transition and the next. The inverse of this is the frequency of the signal.

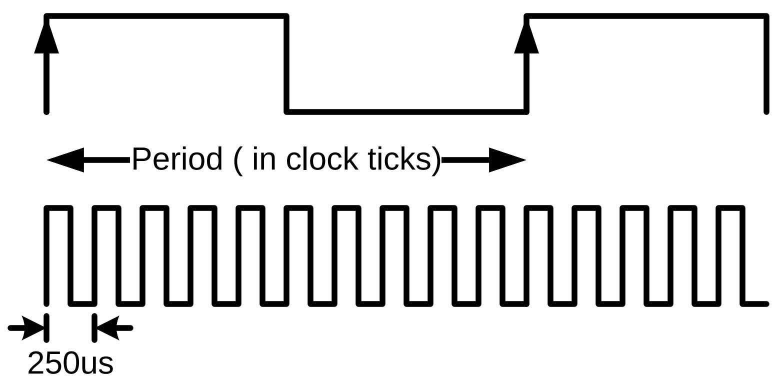


Figure 7

In the picture above, we can see the pulse being sampled at Input 4 (connector J9) on the controller. From one rising edge to the next there were 10 clock ticks. Ten is the number read from the Time Period Register at address 0x02. Each clock pulse is 250 micro seconds long. Hence, multiply the number of clock ticks by 250E-6 yields the time in seconds for the pulse sampled. The result is 250E-5. The inverse of 250E-5 is 400,000, or 400KHz. (The preceding example is meant for instructional purposes only. The Time Period Engine can’t sample frequencies larger than 32 KHz.)

NOTE: Frequency is an always enabled feature. However, for the frequency to be meaningful, the frequency must be between 100 and 32,000 pulses per second.

Pulse Accumulators 1 and 2

The SS-PortaIn11 controller contains another powerful feature intended for robotic applications such as odometry. Odometry is the ability to measure distance by counting pulses on a shaft encoder. As a shaft encoder rotates as part of a wheel, each pulses counts a fraction of the wheel diameter. If the wheel diameter is known, the linear distance it has translated can be computed.

Note: There are many inherent factors for odometry to not work. Avayan Electronics is not providing a panacea solution. The user must utilize the data and add all error correction techniques to avoid misinterpreting data related to odometry.

The registers Pulse Accumulator 1 and Pulse Accumulator 2 hold the number of steps for the sensory inputs Input 0 (J5) and Input 1 (J6) respectively.

The pulse accumulator function is always available. Any signal switching on Inputs 0 and 1 will increase the respective accumulator registers. To clear each, simply write a 0 to the respective RAM locations.

◄—Word at 0x03 (Pulse Accumulator 1 Register)—►

Pulse Acc 1 (High)	Pulse Acc 1 (Lo)
0x03	0x04

Figure 8

◄—Word at 0x05 (Pulse Accumulator 2 Register)—►

Pulse Acc 2 (High)	Pulse Acc 2 (Lo)
0x05	0x06

Figure 8

BAUD Rate Selection:

The SS-IN11 board communicates through the Super Stepper Serial Communication Protocol. Since the board has been implemented with a 4MHz crystal, certain BAUD Rates can be obtained. Programming the EEPROM with one of the values found on Table 3 will configure the UART to operate with the selected BAUD Rate after the device comes out of power on reset next time. This feature is of course available if the JMP1 is closed.

Baud Rate	EEPROM
2400	103
4800	51
9600	25
14400	16
19200	12
28800	8
38400	6
57600	3
76800	2
115200	1

Table 3

EEPROM Memory Map:

The user must refer to this section whenever the EEPROM is to be programmed. Programming the EEPROM memory on the device may result on non proper functionality.

EEPROM Address	Contents
0x00	SS BAUD Rate
0x01	SS Address
0x02 to 0xFF	User defined

Table 4

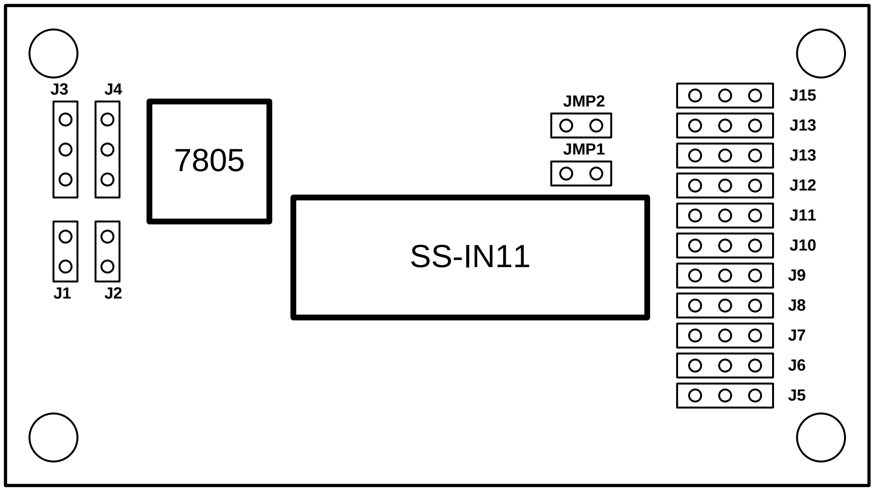
RAM Memory Map:

The user must refer to this section whenever the RAM is to be read or written. Modifying RAM memory on the device could result on non proper functionality.

RAM Address	Contents	RAM Address	Contents
0x00	Input Register Hi	0x06	Pulse Acc 1 High
0x01	Input Register Lo	0x07	Pulse Acc 2 High
0x02	Frequency High	0x08 to 0x017	User Defined
0x03	Frequency Lo	0x18 to 0x1F	Do not Use
0x04	Pulse Acc 1 High		
0x05	Pulse Acc 1 Low		

Table 5

11 Input Controller - Super Stepper Architecture



J1 and J2 Power Connector. Connect a power source from 9V to 15V. J2 is a bypass to another Porta Board piggy backed on top.

Pin1: Positive Power Source
Pin2: Ground

J3 and J4 Serial Communications Connector: Connect the TTL level serial communication signal as obtained from a PC through an RS-232 driver or any microcontroller UART output.

Pin1: Module Receive (Rx)
Pin2: Module Transmit (Tx)
Pin3: Ground

J5 through J15 Sensor Inputs. Connect the three pin connector found on most optical sensors. Watch polarity as shown below. Notice Input 0 is the connector found on the lowest section while Input 10 is the upper most.

Pin1: Input Sensor Vcc (as marked with a + sign)
Pin2: Input Sensor Signal (as marked with a pulse symbol)
Pin3: Input Sensor Ground (as marked with a - sign)

NOTE: All inputs are asserted low and have a pull up resistor. If single pole switches are desired, it is recommended that they are connected with respect to ground in order for the transition to be visible. Dual throw switches are not necessary thanks to the pull up resistor.

JP1 MOD1 Jumper. Selects from UART hardwired parameters or EEPROM stored parameters.

Open: BAUD Rate is 2400 and SS-ADDRESS is 0.
Closed: BAUD RATE is stored on EEPROM address 0 and SS-ADDRESS is stored on EEPROM address 1.

JP2 MOD0 Jumper. Selects from 8 bit or 9 bit communications.

Open: 8 bit communications selected.
Closed: 9 bit communications selected.