FAQ: How do I Test an SSI system?

There are four components in an SSI system; a SSI sensor, a SSI interface module, the cable between them, and an external power supply.

Setting up the SSI system is a simple process. You connect the cable from the SSI sensor to the SSI module by simply matching the signals on the encoder with the signals on the module. The external power supply is then connected to both the sensor and to the module.

SSI Sensor Signal	SSI Module Terminal
+Clock	+Clock
-Clock	-Clock
+Data	+Data
-Data	-Data
+Vdc	+Vdc
Common	Common

On most AMCI SSI interface modules, it is necessary to connect +Vdc (usually 24Vdc) and the power supply common to both the module and to the sensor.

You should start seeing data in the SSI module's input registers as soon as these connections are made and power is applied. However, the data may not be valid, or it may appear to jump around as the sensor is moved, until the SSI module is programmed to match both your sensor and your application. (The most likely cause of jumping data is if you connect a gray code sensor to a module that has been configured to interface to a binary sensor, or vice versa.)

If the data does not appear, or does not change when you move the SSI sensor, you have to determine if it is the module, the cable, or the sensor that is the source of the problem. The easiest way to do this is to remove the cable from the SSI interface module and wire the +Clock terminal to the +Data terminal, and the –Clock terminal to the –Data terminal. It will also be necessary to connect +Vdc and the power supply common to the module's connector.

Every AMCI SSI interface module has an input register(s) called Actual SSI Data. This register(s) contain the unmodified data from the sensor. That is, before any offset, scalars, or data conversion operations are performed.

The following table shows what values you should see in the SSI modules Actual SSI Data Input registers with the Clock terminals wired to the Data terminals. For comparison purposes, the values with no connections made, and with the Clock terminals connected to the Data terminals, are both shown.

AMCI SSI Module	Actual SSI Data No connections on the module's connector	Actual SSI data +Clock to +Data -Clock to –Data +Vdc and common connected
7161 and 7162	$2^{(\#Clock\ Bits)}$ -1 (Divided in two words)	0
7262 and 7264	$2^{(\#Clock\ Bits)}$ -1	0
7361	Input Word 5 = -1 Input Word 6 = 511 As Double Word = 33554431	Input Word 5 = 1 Input Word 6 = 0 As Double Word = 1
7561	Input Word 5 = 511 Input Word 6 = -1	Input Word 5 = 0 Input Word 6 = 1
7662	$2^{(\#Clock\ Bits)}$ -1 (Divided in two words)	0
7761H	$2^{(\#Clock\ Bits)}$ -1 (Divided in two words)	$2^{(\#Clock\ Bits)}$ -1 (Divided in two words)
NX2E4(X) (Do not connect external power to connector)	0	0

With the exception of the 7761H and the NX2E4(X) modules, if the Actual SSI register(s) show the value in the right column of the above table when +Clock is connected to +Data and –Clock is connected to –Data, then both the SSI module's outputs (the clock signals) and its inputs (the data signals) are working correctly and you have a problem with either your SSI sensor or with your cable.

The **#Clock Bits** shown in the above table is one of the programmable parameters of that module. The default value of the #Clock Bits for these modules is 24. (2^{24} -1) is 16,777,215 or 16#00ff ffff.

Using an Oscilloscope to Test an SSI System

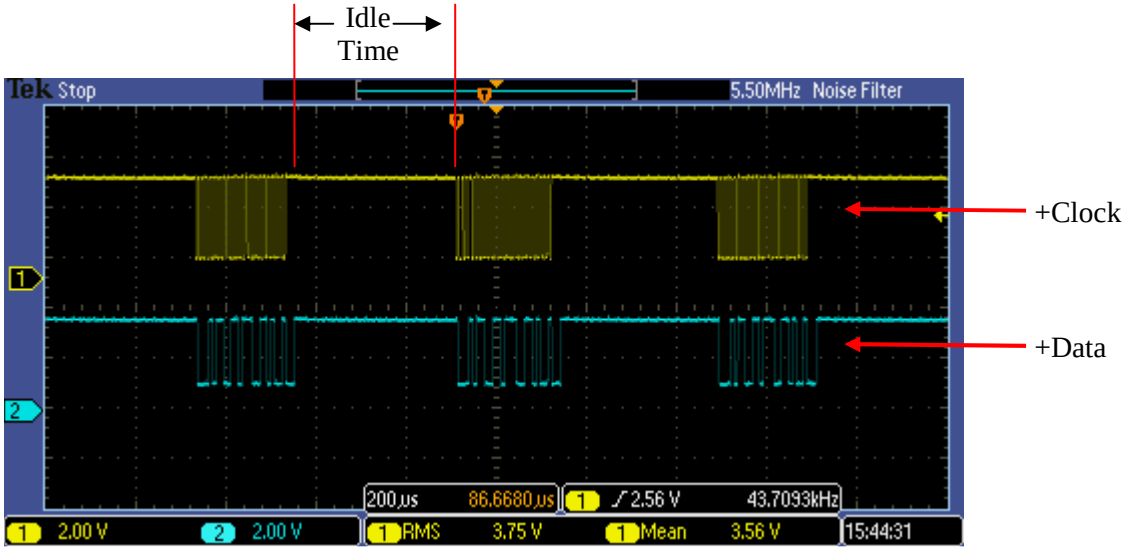
Another way to test an SSI system is to use a two channel oscilloscope to measure both the clock and data signals. Please consider the following when connecting your oscilloscope to your SSI system.

- SSI signals have an amplitude of approximately 4Vdc.
- Connect the ground leads of your oscilloscope probes to the common terminal of the external power supply being used to power the SSI Sensor. Do not connect it to the –Clock or –Data terminals.
- Set your oscilloscope to trigger off of channel 1 and use this channel to measure Clock Signals. Use channel 2 to measure the Data signals.
- The length of the Idle Time, the time between read cycles, will vary depending on which SSI module you are using and on how you have configured the module. The modules user manuals contain the idle time values based on the module's setup.

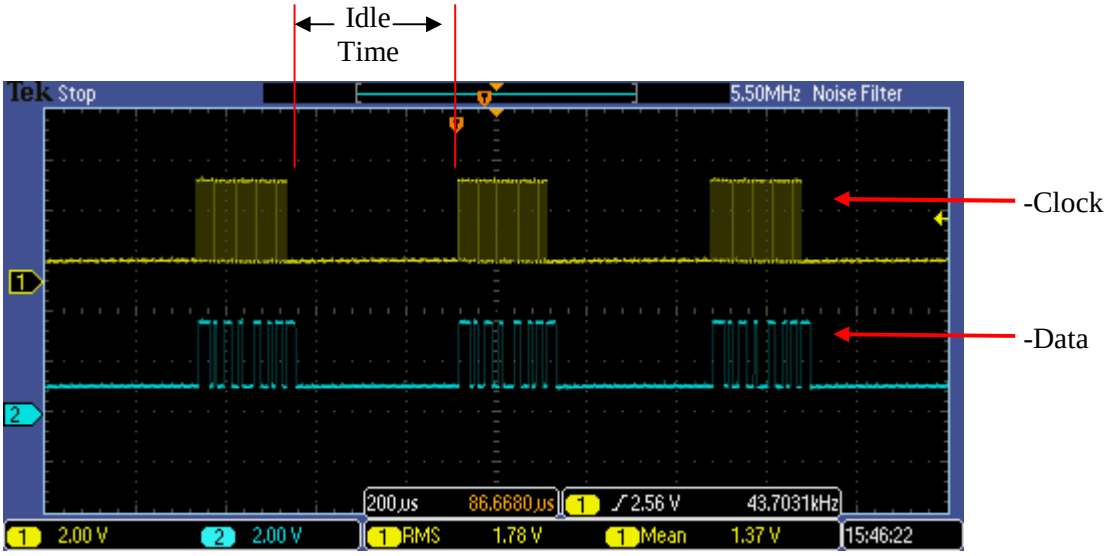
The following images were captured from a SSI system made up of a SSI module configured for a clock frequency of 125kHz, 24 clock pulses, 24 data bits, and connected to an AMCI multiturn SSI DuraCoder.

A table located after the images shows how to interpret the results of your measurements.

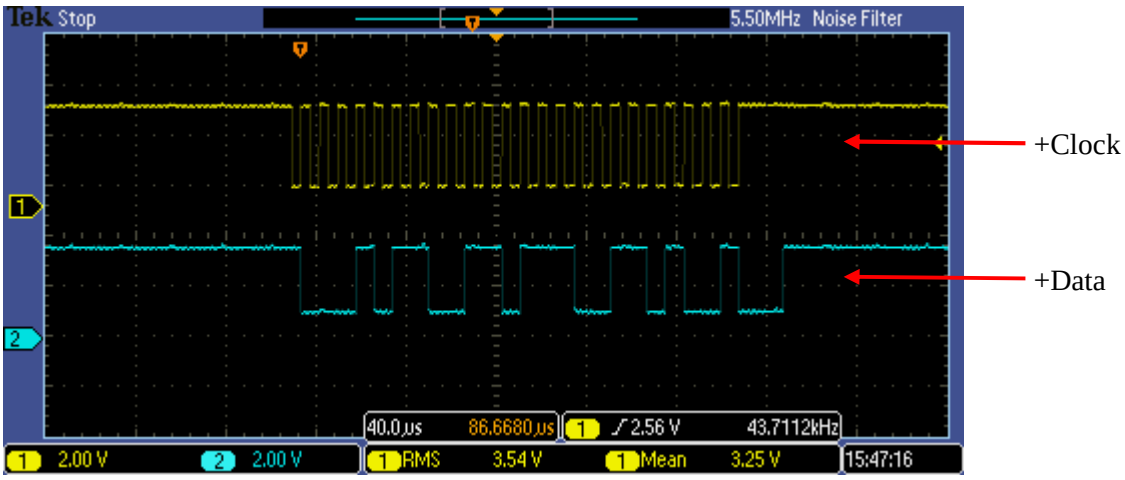
The following image shows three data read cycles of the +Clock and +Data signals. Please note that both the +Clock and +Data signals will be high during the Idle Time.



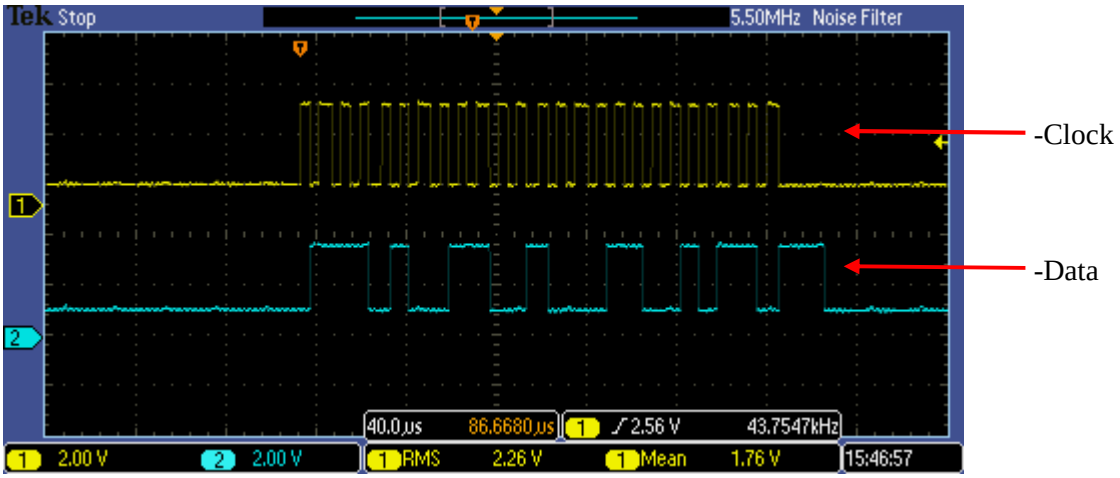
The following image shows three data read cycles of the -Clock and -Data signals. Please note that both the -Clock and -Data signals will be low during the Idle Time.



The following image has zoomed in on the +Clock and +Data signals of one interrogation cycle.



The following image has zoomed in on the -Clock and -Data signals of one interrogation cycle.



Interpreting the Results

Problem	Cause
The plus and or minus Clock signals are not present.	There is a problem with the SSI module or with the external power supply.
The Clock Signals are present, but the plus and or minus Data signals are missing.	There is a problem with the encoder, the cable, or the external power supply.
Both the plus and minus Clock and Data signals are present.	There is a problem with the SSI module's inputs.

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