

1. Overview

Bias is sometimes utilized with RS485-2W communications. A bias is a dc offset voltage (typically several hundred milli-volts) applied across the RS-485-2W data (+) to data (-) I/O port. This bias is used to provide noise immunity and/or guarantee the logic state to the receiver when the data line is idle.

Interfacing a fiber optic link in an RS485-2W installation with bias will remove the bias from one side of the copper equipment. The fiber module will need to re-establish this bias. Otherwise, the RS485 may not operate properly especially when daisy chaining to multiple copper equipment interfaces. Usually the bias is established at the controller (hub) side of the communications link. Therefore, the bias would need to be re-established the (remote) fiber unit. The side with the bias may be determined by measuring the dc voltage across the data (+) to data (-) on the copper equipment without any connections to the terminal block and without and data being transmitted. Only one side should have a dc bias of several hundreds of millivolts (several volts if there is no internal termination).

Virtually all of AFI's data products have the option to set up a bias. This typically requires setting several internal data switches. See the specific product instruction manual for details.

2. Detail

Below is an example of the bias setup documentation:

SWITCH S2 LEGEND			
	ON-DOWN	OFF-UP	FACTORY SHIPPED
1	INPUT BIAS ON	INPUT BIAS OFF	OFF
2	INPUT TERM. ON	INPUT TERM. OFF	OFF
3	INPUT BIAS ON	INPUT BIAS OFF	OFF
4	OUTPUT BIAS ON	OUTPUT BIAS OFF	OFF
5	OUTPUT TERM. ON	OUTPUT TERM. OFF	OFF
6	OUTPUT BIAS ON	OUTPUT BIAS OFF	OFF

INTERNAL DATA BIAS / TERMINATION SWITCHES

Multi-Protocol data products are normally shipped with the data bias and termination switches in the off position. Switches are available (sometimes internally) that allow offset bias and termination features to be activated when using RS485 data. These switches also allow terminations to be activated when using RS422 or Manchester data. When transmitting RS232 data, the bias and termination switches must remain in the off (up) position. Refer to the table for these switch settings and default positions.

OFFSET BIAS – RS485 DATA

The RS485 specification requires receivers to detect input signals down to 200mVp-p of voltage level. In many cases this can cause systems to be sensitive to noise on the data wires. In an effort to eliminate the effects of low levels of noise, some manufacturers of equipment that communicate using RS485 have introduced a small voltage bias to the data lines. This is usually accomplished using a 470 Ohm resistance to +5V on the positive line and 470 Ohm resistance to ground on the negative line. When used in conjunction with the appropriate termination resistors referred to in the previous section, this introduces about a 300 mV offset, improving noise immunity.

When using offset bias switches that they must be used in pairs. If switch # 1 is down then switch # 3 must also be down. The same situation applies for switch # 4 and switch # 6. Also, if using offset bias, it is important that the corresponding termination resistor switch be in the on (down) position. Using offset bias without a termination on the line will cause communications to fail. An explanation follows on general bias and termination guidelines.

For RS485-2W applications, use the bias switches for the RS485 I/O port which is typically the data input line for RS485-4W.

Another potential issue may occur at the hub if the bias is too high. The fiber unit could falsely interpret the bias as data and lock up the link. Under this condition the data TX LED for the fiber unit at hub would be on continuously as well as the RX LED on the remote fiber unit.

RS485 DATA TERMINATION

The RS485 protocol is an expanded version of the original RS422 protocol. RS485 differs from RS422 in the ability of the transmitter devices to go into a high impedance (Hi-Z) state. This allows multiple transmitter devices to reside on the same wire pair. The software must dictate a protocol that allows only one device to transmit at any one time to prevent data crashes. In many cases the system head end controller will continuously poll data from all remote devices. The remote devices all respond back to the head end (one at a time) as they are addressed. The driver chips that are used in RS485 communications are capable of changing into their high impedance state very rapidly. On even short lengths of wire there can exist a residual voltage after a driver circuit turns off. This can interfere with circuits that are used to detect the Hi-Z state. It is very important that the copper communications lines be terminated with resistors across the data wire pair. The best place to locate such resistors is at the furthest electrical devices at the ends of the wire pair. For instance, if several RS485 devices are connected in a daisy chain fashion, the wire connection would loop across all devices in a chain. The furthest two points in the chain should then be terminated.