



## RS232 CONTROL INTERFACE SPECIFICATION (for All units other than SC & ST switches)

<p><b>REMOTE CONNECTION</b> The RS232 Interface is designed to meet the RS232C standard and can be controlled from any host computer or other controller with an RS232 communications port. The pinout for the DB-9 connector(s) on the unit is as follows:</p>	<p style="text-align: center;"><b>RS232 INPUT (DB-9 FEMALE)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>PIN</th> <th>SIGNAL</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr><td>1</td><td>-</td><td>no connection</td></tr> <tr><td>2</td><td>TXD</td><td>transmit data (RXD at host)</td></tr> <tr><td>3</td><td>RXD</td><td>receive data (TXD at host)</td></tr> <tr><td>4</td><td>DTR</td><td>data terminal ready</td></tr> <tr><td>5</td><td>GND</td><td>signal ground</td></tr> <tr><td>6</td><td>DSR</td><td>data set ready</td></tr> <tr><td>7</td><td>RTS</td><td>request to send</td></tr> <tr><td>8</td><td>CTS</td><td>clear to send</td></tr> <tr><td>9</td><td>-</td><td>no connection</td></tr> </tbody> </table>	PIN	SIGNAL	FUNCTION	1	-	no connection	2	TXD	transmit data (RXD at host)	3	RXD	receive data (TXD at host)	4	DTR	data terminal ready	5	GND	signal ground	6	DSR	data set ready	7	RTS	request to send	8	CTS	clear to send	9	-	no connection	<p style="text-align: center;"><b>RS232 OUTPUT (DB-9 MALE)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>PIN</th> <th>SIGNAL</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr><td>1</td><td>-</td><td>no connection</td></tr> <tr><td>2</td><td>RXD</td><td>receive data</td></tr> <tr><td>3</td><td>TXD</td><td>transmit data</td></tr> <tr><td>4</td><td>-</td><td>no connection</td></tr> <tr><td>5</td><td>GND</td><td>signal ground</td></tr> <tr><td>6</td><td>-</td><td>no connection</td></tr> <tr><td>7</td><td>-</td><td>no connection</td></tr> <tr><td>8</td><td>-</td><td>no connection</td></tr> <tr><td>9</td><td>-</td><td>no connection</td></tr> </tbody> </table>	PIN	SIGNAL	FUNCTION	1	-	no connection	2	RXD	receive data	3	TXD	transmit data	4	-	no connection	5	GND	signal ground	6	-	no connection	7	-	no connection	8	-	no connection	9	-	no connection
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On the DB-9 female connector, pins 4 (DTR) and 6 (DSR) are shorted and pins 7 (RTS) and 8 (CTS) are shorted. Therefore, host handshaking is bypassed and TXD and RXD are the only active signals. A straight through DB-9 cable (not null modem) will work for most computers. To daisy chain multiple units, the host drives the input port on the first unit and output port is connected to the input port on the next unit etc (see Fig 1). The last unit will have no connection on its output port and should have DIP switch 1 ON (see below).

<p><b>BAUD RATE</b> The baud rate can be changed by powering down the unit, changing the DIP switch, and then powering back up. This table shows how to set the baud rate.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">DIP SWITCH</th> <th>BAUD RATE</th> </tr> <tr> <th>4</th> <th>3</th> <th>2</th> <th></th> </tr> </thead> <tbody> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>300</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>600</td></tr> <tr><td>OFF</td><td>ON</td><td>OFF</td><td>1200</td></tr> <tr><td>OFF</td><td>ON</td><td>ON</td><td>2400</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>4800</td></tr> <tr><td>ON</td><td>OFF</td><td>ON</td><td>9600</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>9600</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>9600</td></tr> </tbody> </table>	DIP SWITCH			BAUD RATE	4	3	2		OFF	OFF	OFF	300	OFF	OFF	ON	600	OFF	ON	OFF	1200	OFF	ON	ON	2400	ON	OFF	OFF	4800	ON	OFF	ON	9600	ON	ON	OFF	9600	ON	ON	ON	9600
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<p><b>DIP SWITCH</b> The unit powers up with a default baud rate of 9600 and a fixed data protocol of 8 data bits, no parity, and 1 stop bit. To change the baud rate, unit address, and loop back (more on the unit address and loop back later), an 8-SPST DIP switch on the panel near the DB-9 connectors can be used. This table shows the DIP switch functions and their default positions.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SWITCH</th> <th>FUNCTION</th> <th>DEF-AULT</th> </tr> </thead> <tbody> <tr><td>1</td><td>loop back</td><td>ON</td></tr> <tr><td>2</td><td>baud rate 0</td><td>ON</td></tr> <tr><td>3</td><td>baud rate 1</td><td>ON</td></tr> <tr><td>4</td><td>baud rate 2</td><td>ON</td></tr> <tr><td>5</td><td>unit address 0</td><td>ON</td></tr> <tr><td>6</td><td>unit address 1</td><td>OFF</td></tr> <tr><td>7</td><td>unit address 2</td><td>OFF</td></tr> <tr><td>8</td><td>unit address 3</td><td>OFF</td></tr> </tbody> </table>	SWITCH	FUNCTION	DEF-AULT	1	loop back	ON	2	baud rate 0	ON	3	baud rate 1	ON	4	baud rate 2	ON	5	unit address 0	ON	6	unit address 1	OFF	7	unit address 2	OFF	8	unit address 3	OFF
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<p><b>UNIT ADDRESS AND LOOP BACK</b> To allow multiple units to be controlled from a single host port, the remote interface is designed to allow "daisy chaining" of up to 15 units. By setting the appropriate DIP switches, each unit can be given a unique address (1-15). Then the unit will only respond to commands on the bus if its address is embedded in the command. The "loop back" DIP switch should be ON for the last unit in the chain, and OFF for all other units. If only one unit is being controlled, the loop back DIP switch should be left ON. This table shows how to set the unit address.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4">DIP SWITCH</th> <th>UNIT ADDRESS</th> </tr> <tr> <th>8</th> <th>7</th> <th>6</th> <th>5</th> <th></th> </tr> </thead> <tbody> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>0 (not valid)</td></tr> <tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>1</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>2</td></tr> <tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>3</td></tr> <tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>4</td></tr> <tr><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>5</td></tr> <tr><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>6</td></tr> <tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>7</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>8</td></tr> <tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>9</td></tr> <tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>10</td></tr> <tr><td>ON</td><td>OFF</td><td>ON</td><td>ON</td><td>11</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>12</td></tr> <tr><td>ON</td><td>ON</td><td>OFF</td><td>ON</td><td>13</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>14</td></tr> <tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>15</td></tr> </tbody> </table>	DIP SWITCH				UNIT ADDRESS	8	7	6	5		OFF	OFF	OFF	OFF	0 (not valid)	OFF	OFF	OFF	ON	1	OFF	OFF	ON	OFF	2	OFF	OFF	ON	ON	3	OFF	ON	OFF	OFF	4	OFF	ON	OFF	ON	5	OFF	ON	ON	OFF	6	OFF	ON	ON	ON	7	ON	OFF	OFF	OFF	8	ON	OFF	OFF	ON	9	ON	OFF	ON	OFF	10	ON	OFF	ON	ON	11	ON	ON	OFF	OFF	12	ON	ON	OFF	ON	13	ON	ON	ON	OFF	14	ON	ON	ON	ON	15
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## COMMAND PROTOCOL

Host controller commands supported by the unit are defined below. All commands should be terminated with a <CR> (carriage return). When a command is sent, the entire string is echoed back to the host along with a response from the addressed unit as shown in the command definitions. All characters should be upper case, and all numbers below 10 should have a leading 0 (ex: 1 = 01).

NOTE: For units with one output or user port, use 01 for the output select.

### RS - reset unit(s) to default power-up configuration

FORMAT: RS AA<CR>  
 RS = "reset unit" command followed by at least one space  
 AA = unit address; if 00, all units on the bus will be reset  
 and no response will be returned

RESPONSE: \*<CR> if command received and executed OK  
 ?<CR> if syntax or transmission error occurred

### CS - change single output channel

FORMAT: CS AA,XX,YY<CR>  
 CS = "change single output" command followed by at least one space  
 AA = unit address  
 XX = input to connect  
 YY = output to change

RESPONSE: \*<CR> (command received and executed OK)  
 ?<CR> (syntax or transmission error occurred)

### CA - change all output channels

FORMAT: CA AA,XX<CR>  
 CA = "change all outputs" command followed by at least one space  
 AA = unit address  
 XX = input to connect to all outputs

RESPONSE: \*<CR> (command received and executed OK)  
 ?<CR> (syntax or transmission error occurred)

### RO - read single output channel

FORMAT: RO AA,XX<CR>  
 RO = "read output" command followed by at least one space  
 AA = unit address  
 XX = output to read

RESPONSE: 1) \*<CR> (command received and executed OK)  
 ?<CR> (syntax or transmission error occurred)  
 2) XX<CR> (XX = input channel connected)

### RU - read unit size

FORMAT: RU AA<CR>  
 RU = "read unit size" command followed by at least one space  
 AA = unit address

RESPONSE: 1) \*<CR> (command received and executed OK)  
 ?<CR> (syntax or transmission error occurred)  
 2) XX,YY<CR> (XX = # of inputs, YY = # of outputs)

**Fig 1**

