source-ray, inc.

Design Specification

Model: RS-232 Controller
(Command Set)

Document No: DS-RS-232-CS Rev 2

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REVISION CONTROL					
Rev	**Description**	**Initiated By**	**Date**	**Approved By**	**Date**
0	Initial Release	R. Manez	7/24/02	V. Milonas	7/24/02
1	Corrected Typos	R. Manez	10/17/05	V. Milonas	10/17/05
2	Changed DC Input Voltage Monitor Upper Range from 30.00 to 32.55	R. Manez	11/11/05	V. Milonas	11/11/05

0.0 Overview

This document details the PC requirements and command set functionality for the Source-Ray DI series RS232 SourceBlock interfaces. The DI series interface modules are designed to provide a means of controlling Source-Ray SourceBlocks via either the software provided by Source-Ray, or through software developed by the end user. The DI series interface is controlled via a standard three-wire RS232 interface. All controller functions are accessible through simple ASCII commands. These commands can be written to the interface using any programming environment desired, however, it is beyond the scope of this document to provide language specific examples on how to write ASCII commands to the COM port. Please consult the documentation for the programming environment you intend to use.

1.0 PC COM Port Setup

Once connected to the RS232 based host computer, The RS232 port should be configured to the following specifications to allow communications with the DI series RS232 interface.

9600 baud – 8 bit words – 1 stop bit – no parity

2.0 Command Syntax

All commands to the DI Series RS232 hardware interface are in the form of a series of ASCII characters followed by a carriage return character. All numerical values sent to and received from the hardware interface are in ASCII string format of a specific length, 4 characters for most analog values and 1 character for most binary functions. It is important to note that **all commands MUST be followed by a carriage return character in order for the DI series interface to recognize the character string as a command**.

3.0 Host Watchdog Timer

Version 2.0 of the DI Series RS232 hardware (released 8/26/02) now incorporates a host watchdog timer. This timer will force the hardware interface to return to an uninitialized state in the event that communication with the host PC is broken for any reason (i.e. COM port cable becomes disconnected) for a specified period of time. This prevents the hardware interface from continuing the last commands it received indefinitely if it should lose communication with the host PC. The watchdog timer is fully configurable through the following commands:

WE – Enables the Host Watchdog Timer.
WD – Disables the Host Watchdog Timer. This is the default condition at power up.

WR – Returns the status of the Host Watchdog Timer (0=disabled, 1=enabled)
MWddd – Loads the watchdog timer register with a timeout value in seconds in the range of 0-255. (ddd=000 to 255). Default value is one second.
PW – Returns the watchdog timer timeout setting.

Upon timeout the DI-RS232 interface is reset to a power-up state with the watchdog timer disabled and all digital I/O's set to a high impedance state. Therefore, the output registers must be reinitialized as outlined in section 4.0 before proceeding to read the digital I/O's again. The watchdog status bit can be read by the host computer using the WR command to determine if a watchdog timeout has occurred. It is important to note that once the timer is enabled, the program communicating with the DI-RS232 interface MUST maintain communication with the interface at intervals less than the watchdog timer timeout value otherwise the interface will reset. This can be easily accomplished by writing any valid command to the interface at regular intervals, such as continuously polling for kV or uA. Source-Ray strongly recommends that its customers who wish to program their own interface for its Sourceblocks make use of this feature in order to minimize the risk of accidental X-Ray exposure and recommends a timeout value of 1 second in normal operation.

4.0 Initialization

The following commands **MUST** be written to the DI series RS232 interface module before performing any other functions. Failure to perform the following procedure before attempting to operate the SourceBlock will cause erratic operation and possible damage to the SourceBlock or the RS232 interface. The following command string must be written to the RS232 interface before any other action is performed. It is important to note that all commands **MUST** be followed by a carriage return character in order for the DI series interface to recognize the character string as a command.

CPA11111100
This will initialize the digital I/O of the DI series RS232 interface.

RESPA0
RESPA1
This will set the X-Ray command and Fault Reset signals to LOW.

5.0 Digital Output Commands

The following commands provide control of the digital signals to the SourceBlock. Two Digital signals are provided to turn the X-Ray output on or off and to command the SourceBlock to reset a fault condition.

SETPA0 – Set X-Ray command line to HIGH (X-Ray ON)

RESPA0 – Set X-Ray command line to LOW (X-Ray OFF)

SETPA1 – Set Fault Reset line High (Clear faults)
RESPA1 – Set Fault Reset Line Low (Standby)

The Fault Reset line must be pulled high for at least 100ms in order to clear any faults, and then set back to LOW.

6.0 Analog Output Commands

The following commands write the kV and uA program voltages to the DI series RS232 Interface.

VAdddd – Outputs decimal data (dddd) to the kV program line. The decimal data is in the range of 0000 – 4095 where 0000=0kV output and 4095=max kV output of the SourceBlock (I.E. SB-80-250 max output: 4095=80kV).

VBdddd - Outputs decimal data (dddd) to the uA program line. The decimal data is in the range of 0000 – 4095 where 0000=0uA output and 4095=max uA output of the SourceBlock (I.E. SB-80-250 max output: 4095=250uA).

NOTE: All commands **MUST** be followed by a carriage return character in order for the DI series interface to recognize the character string as a command.

7.0 Digital Input Commands

The following commands read the status of the various digital outputs of the SourceBlock. These digital outputs are used by the SourceBlock to report its status to the user. All commands return 2 characters to the RS232 port buffer. The first character is a 0 or 1 representing the status of the digital line in question and the second character is a carriage return. All Digital inputs are Active LOW.

RPA2 – READY Status (0=unit is Ready, 1=unit not ready)
RPA3 – XRAY ON Status (0=X-ray output is ON, 1=X-ray OFF)
RPA4 – FAULT (on some models only)
RPA5 – ARC Status (0= Arc was detected, 1=unit ok)
RPA6 – OVERVOLTAGE Status (0=OV detected, 1= unit ok)
RPA7 – OVERCURRENT Status (0=OC detected, 1=unit ok)

ARC, OVERVOLTAGE, and OVERCURRENT when detected will cause the SourceBlock to shutdown X-Ray output. In order to continue it will be necessary to clear these fault conditions via the Fault Reset procedure outlined in section 4.0

8.0 Analog Output Commands

The following commands are used to read the various analog outputs provided by the SourceBlock such as kV and uA monitoring, line input monitoring and interlock monitoring. All commands return 5 characters of data in the format dddd<carriage return> where (dddd) = 0000-4095 with 0000 being an output of 0 and 4095 being full scale.

RD0 - Returns kV monitor value where full scale is the maximum kV output of the SourceBlock (I.E. SB-80-250 max kV out = 80kV).
RD1 - Returns uA monitor value where full scale is the maximum uA output of the SourceBlock (I.E SB-80-250 max uA out = 250 uA).
RD2 - Input line voltage monitor. Full scale is approximately 32.55 VDC.
RD3 - Interlock monitor. Full scale is approximately 15VDC.
RD4 - Reserved for future expansion.
RD5 - Reserved for future expansion.
RD6 - Reserved for future expansion.
RD7 - Reserved for future expansion.

9.0 Using Hyperterminal with the DI-RS232 Interface

It is possible to communicate with the DI-RS232 Interface hardware manually using Hyperterminal (supplied with most versions of Windows). This is useful as a debugging aid or as a tool to become familiar with the device command interface. The following procedure outlines the necessary steps to configure Hyperterminal to communicate with the DI-RS232 Interface.

1) Open the Windows Device Manager. Under ports, select the port to which the DI-RS232 Interface is to be connected to and click properties. Click on the “Port Settings” tab. Set the baud rate to 9600, 8 data bits, no parity, 1 stop bit, and hardware handshaking. Close the Device Manager.

2) Open Hyperterminal and at the “Connection Description” screen, type a name for your new connection. Click “OK”. At the “Phone Number” screen, select “Direct to COM 1” (or the COM port to which the DI-RS232 is connected) in the “Connect Using” pull down menu.

3) At the “Port Settings” screen, set the parameters as described in step 1 above.

4) In the Hyperterminal menu, select FILE, PROPERTIES, and click on ASCII SETUP. Ensure that the only the following boxes are ticked.

ASCII SENDING
"Echo typed characters locally"

ASCII RECEIVING
"Append Line Feeds to incoming line ends" and,
"Wrap lines that exceed terminal width"

You are now ready to communicate with the DI-RS232 Interface with Hyperterminal.

10.0 Command Summary

Command	Type	Function	Data Sent	Returns Data
WE	Watchdog timer.	Enables the host watchdog timer	none	none
WD	Watchdog timer.	Disables the host watchdog timer	none	none
WR	Watchdog timer.	Returns the status of the watchdog timer.	none	2 ASCII characters in format d<cr> where d=0 or 1. 0 if disabled, 1 if enabled
MWddd	Watchdog timer.	Loads the watchdog timer register with a timeout value in seconds.	ddd=001 to 255. 1 to 255 seconds.	none
PW	Watchdog timer.	Returns the value of the watchdog timer timeout setting.	None	4 ASCII characters in the format ddd<cr> ddd=001-255
CPA11111100	Digital	Initializes Digital I/O Registers	none	none
SETPA0	Digital	X-Ray ON	none	none
RESPA0	Digital	X-Ray OFF	none	none
SETPA1	Digital	Fault Reset	none	none
RESPA1	Digital	Clear Fault Reset	none	none
VAdddd	Analog	KV Program	dddd=0000-4095 *	none
VBdddd	Analog	UA Program	dddd=0000-4095 *	none
RPA2	Digital	Reads READY Bit	none	2 ASCII characters in format d<cr> where d=0 or 1 **
RPA3	Digital	Reads XRAY ON Bit	None	2 ASCII characters in format d<cr> where d=0 or 1 **
RPA5	Digital	Reads ARC Bit	None	2 ASCII characters in format d<cr> where d=0 or 1 **
RPA6	Digital	Reads	None	2 ASCII characters

		OVERVOLTAGE Bit		in format d<cr> where d=0 or 1 **
RPA7	Digital	Reads OVERCURRENT Bit	None	2 ASCII characters in format d<cr> where d=0 or 1 **
RD0	Analog	Reads kV Monitor	None	5 ASCII characters in the format dddd<cr> where dddd = 0000 to 4095 ***
RD1	Analog	Reads uA Monitor	None	5 ASCII characters in the format dddd<cr> where dddd = 0000 to 4095 ***
RD2	Analog	Reads Input Line Voltage – 0-32.55VDC	None	5 ASCII characters in the format dddd<cr> where dddd = 0000 to 4095 ***
RD3	Analog	Reads Interlock Voltage – 0-15VDC	None	5 ASCII characters in the format dddd<cr> where dddd = 0000 to 4095 ***

NOTE: All commands **MUST** be followed by a carriage return character in order for the DI series interface to recognize the character string as a command.

* 0000 – 4095 where 4095 will equal the maximum output of the SourceBlock. Consult your user manual to determine the maximum output of your SourceBlock

** Returns a logical 0 or 1 plus a carriage return. All digital inputs are ACTIVE LOW.

*** Returns 4 data characters plus a carriage return where data is in the range of 0000 – 4095 with 4095 being full-scale output of the SourceBlock in the case of kV and mA monitors. Please consult your user manual to determine the full-scale output of your SourceBlock.