source-ray, inc.

Design Specification

Model: DI-RS232A Controller
(Command Set)
Firmware: 4.01 and greater
PCB: 950097

Document No: DS-232A-CS REV4.DOC

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REVISION CONTROL					
Rev	**Description**	**Initiated By**	**Date**	**Approved By**	**Date**
0	Initial Release				
1	Add Undocumented Commands RD RPA	M.Ed er	5/18/10	V. Milonas	5/18/10

1.0 Overview

This document details the PC requirements and command set functionality for the Source-Ray DI series DI-RS232A 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-RS232A interface is controlled via a standard three-wire RS232 interface.

All RS-232 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.

This command set applies to firmware versions 3.1 and higher, And DI-RS232A interfaces with the 950097 pcb assembly.

2.0 DI-RS232 Compatible commands

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.

Default Com settings:
9600 baud – 8 bit words – 1 stop bit – No parity
eg; 9600 8N1

See **Section 3.0** for Baud rate Jumper Settings.

2.1 Command Syntax

All commands to the DI Series RS 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**.

2.2 Host Watchdog Timer

The Watchdog timer will force the Xray-ON Output state ‘OFF’ 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-RS232A interface XRAY-ON output is turned OFF.
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-RS232A interface MUST maintain communication with the interface at intervals less than the watchdog timer timeout value otherwise the XRAY-ON output 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.

2.3 Initialization

The DI-RS232A has a default initialization for use with Source-Ray's SourceBlocks.

The following commands are required after a power on reset:
CPA11111100<cr>
RESPA0<cr>
RESPA1<cr>
This will set the X-Ray command and Fault Reset signals to LOW.

2.4 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<cr>	Set X-Ray command line to HIGH (X-Ray ON)
RESPA0<cr>	Set X-Ray command line to LOW (X-Ray OFF)

SETPA1<cr> Set Fault Reset line High (Clear faults)
RESPA1<cr> 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.

2.5 Analog Output Commands

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

VAdddd<cr> 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<cr> 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.

2.6 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<cr> READY Status (0=unit is Ready, 1=unit not ready)
RPA3 <cr> XRAY ON Status (0=X-ray output is ON, 1=X-ray OFF)
RPA4 <cr> FAULT (on some models only)
RPA5 <cr> ARC Status (0= Arc was detected, 1=unit ok)
RPA6 <cr> OVERVOLTAGE Status (0=OV detected, 1= unit ok)
RPA7 <cr> OVERCURRENT Status (0=OC detected, 1=unit ok)
RPB0<cr> OVERTEMP Status (0=OT 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

Additional Port commands

RPA<cr> Returns all Port pin states (See Command Summary for Details)
(Note, the RPA command reads the port directly, Port data is not latched)

RPB<cr> Returns all Port pin states (See Command Summary for Details)
(Note, the RPB command reads the port directly, Port data is not latched)

2.7 Analog Input 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<cr> 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<cr> 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<cr> Input line voltage monitor. Full scale is approximately 32.55 VDC.

RD3<cr> Interlock monitor. Full scale is approximately 15VDC.

Additional Analog Input commands

RD<cr> Returns all 8 Analog channels, delimitated by a 0x20 character and Terminated with a 0x0d

2.8 DI-RS232A Extended commands

The DI-RS232A interface has an extended command set as follows:

XCMDSET<cr> Returns the version of the Extended command set. 3000<cr>
All command sets include the previous versions commands, unless otherwise noted.

For proper compatibility you should check for the command set and use a greater than or equal to comparision. Eg
If (serial("xcmdset") >= 3000) then ….

Event Counters (EEPROM)

Each Event counter command returns 6 characters in the format: ddddd<cr>
Each counter value is stored in the DI-RS232A EEPROM.

ECA7<cr>	Reads the OC (Overcurrent) counter
ECA6<cr>	Reads the OV (OverVoltage) counter
ECA5<cr>	Reads the ARC counter
CLREC<cr>	Clears the Event counters. (No args required)

Pulse mode commands

PE<cr>	Enables Pulse mode. (Pulse mode can only be enabled if a RESPA0 command was issued. 'XRAY off')
PD<cr>	Disables pulse mode. (Pulse mode can only be disabled if a RESPA0 command was issued. 'XRAY off')
PPxxxxx<cr>	Set Pulse period in ms, where xxxxx is 00000 to 65535
PTxxxxx<cr>	Set Pulse width in ms (PT cannot exceed PP)
PCxxxxx<cr>	Set pulse number where xxxx is 00000 to 65536
PI<cr>	Returns Pulse Configuration in 16 characters: xxxxxyyyyyzzzzz<cr> Where x = Pulse period y = Pulse width z = Pulse count
PS<cr>	Returns Pulse Enable state. x<cr> Where: x = 0 Disabled, x = 1 Enabled

Analogue Inputs

RAIN*x*<*cr*>	Returns the Analogue channel *x* in the format*:* yyyy<cr> ADC values are 12 bit and range from 0000 to 4095. Channel range is 0 - 9

DataDirection Registers

DDR*xbbbbbbbb*<cr>

Change the port data direction register.
x is the Port, A, B
b is the 8 bit Direction. 1 = input, 0 = output

Eg; DDRA11110000<cr>
Will set PortA so that PA0-PA3 are outpus and PA4-PA7 are inputs
(Note: Port Lettering is the PIC port Designation)

Set Port Bit
SETB*xb*<cr>

Set the Bit b on port x.
x Specifies the port A, B
b Specifies the bit number, 0, 1, 2, 3, 4, 5, 6, 7
(Note: Port Lettering is the PIC port Designation)

Clear Port Bit
CLRB*xb*<cr>

Clear the Bit b on port x.
x Specifies the port A, B
b Specifies the bit number, 0, 1, 2, 3, 4, 5, 6, 7
(Note: Port Lettering is the PIC port Designation)

Read Port Bit
RDBxb<cr>

Read Bit b on port x
x Specifies the port A, B
b Specifies the bit number, 0, 1, 2, 3, 4, 5, 6, 7
(Note: Port Lettering is the PIC port Designation)

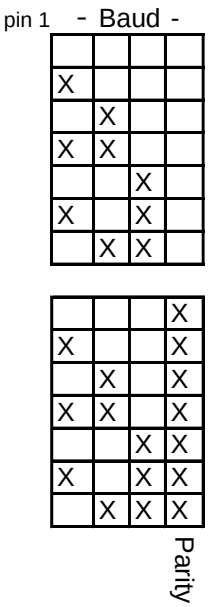
3.0 Baud Rate Jumper Settings

The Baud rate can be configured Via the J6 Header on the 950097 PCB assembly. With out any Shunt Jumpers, the baud rate defaults to 9600, 8N1.

Parity can be selected to be either Even or None.

The Following table Shows the supported baud rates and parity jumper settings:

Baud Rate Jumper Settings



Baud	Parity
9600	None
2400	None
9600	None
19200	None
38400	None
57600	None
115200	None
9600	Even
2400	Even
9600	Even
19200	Even
38400	Even
57600	Even
115200	Even

4.0 RS232 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	Supported	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 OVERVOLTAGE Bit	None	2 ASCII characters 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 **
RPB0	Digital	Reads OVERTEMP Bit	None	2 ASCII characters in format d<cr> where d=0 or 1 **
RPA	Digital	Port A	none	Returns 16 ASCII characters in format: d\sd\sd\sd\sd\sd\sd\sd<cr> \s = space d = 0 or 1 Order: OC,OV,ARC,FAULT,XRAYON,READY, N/A, N/A
RPB	Digital	Port B	none	Returns 16 ASCII characters in format: d\sd\sd\sd\sd\sd\sd\sd<cr> \s = space d = 0 or 1 Order: N/A, N/A, N/A, N/A, N/A, N/A, N/A, OT
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 ***

RD	Analog	Reads all Analog Channels	None	Returns 40 ASCII characters in format dddd\s dddd\s dddd\s dddd\s dddd\s dddd\s dddd\s dddd<cr> \s = space d = 0 or 1 Order: CH1…7
ECA7	Digital	Reads OC counter 0 - 65535	None	5 ASCII characters in the format ddddd<cr> where ddddd = 0000 to 65535
ECA6	Digital	Reads OV counter 0 – 65535	None	5 ASCII characters in the format ddddd<cr> where ddddd = 0000 to 65535
ECA5	Digital	Reads ARC counter 0 - 65535	None	5 ASCII characters in the format ddddd<cr> where ddddd = 0000 to 65535
CLRC	Digital	Clears Counters	None	None
PE	Digital	Enables Pulse mode	None	None
PD	Digital	Disables Pulse mode	None	None
PP	Digital	Set the Pulse Period (ms) 00000 – 65535	None	None
PT	Digital	Sets the Pulse Width (ms), must be Less than PP. 00000-65535	None	None
PCxxxxx	Digital	Set pulse count. 00000–continuous. 00001 - 65535	None	None
PI	Digital	Reads Pulse Configuration	None	16 ASCII characters xxxxxyyyyyzzzzz<cr> x = Pulse Period y = Pulse width z = Pulse count
PS	Digital	Reads Pulse mode State	None	2 ASCII Characters x<cr> where x , 0 = OFF ,1 = ON

	Analog	Reads ADC input x 0000 - 4095	x Channel Number	5 ASCII characters in the format dddd<cr> where dddd = 0000 to 4095 ***
DDRxyyyyyyy y	Digital	Set the Port Direction register. Mapping is to the actual PORT. **** A = PAx	x – PORT A-B y – Bit 1=input 0=output	None
RDBxy	Digital	Reads Port Bit Mapping is to the actual PORT. **** A = PAx	x = PORT A-B y = Bit number	2 ASCII chars in format d<cr> where d=0 or 1 **
SETBxy	Digital	Sets Port Bit Mapping is to the actual PORT. **** A = PAx	x = PORT A-B y = Bit number	None
CLRBxy	Digital	Clear the Port Bit Mapping is to the actual PORT. **** A = PAx	x = PORT A-B y = Bit number	None

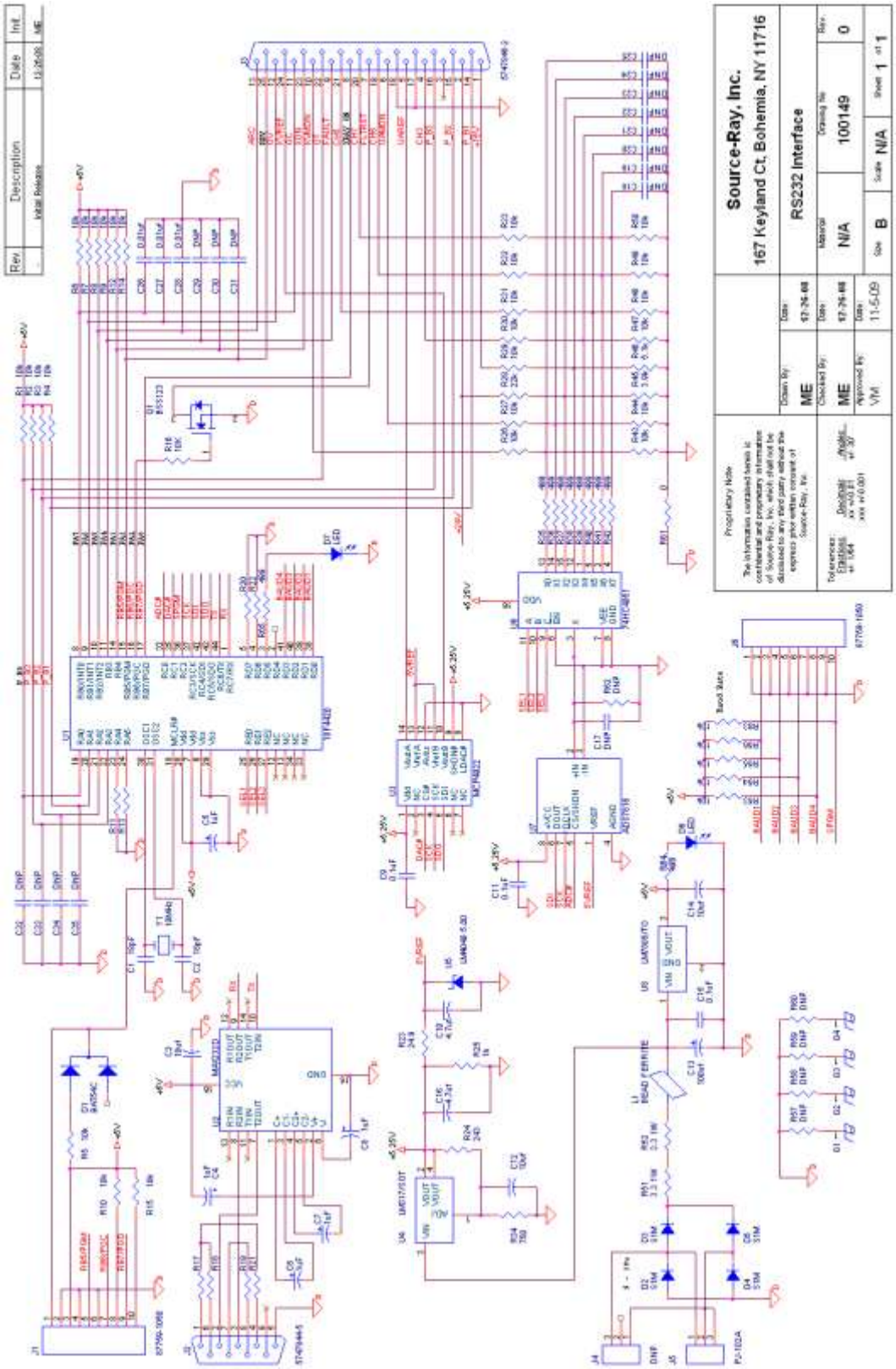
NOTE: All commands **MUST** be followed by a carriage return character in order for the DI series interface to recognize the character string as a command.

* 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.

**** The Extended Port bit commands are mapped to the corresponding PIC port. In other words, writing to PA0 will affect the PA0 port pin. The SETP and RESP commands have a reversed bit order eg; writing to PA0 changes PA7 of the PIC port designation.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RS232 Interface
100149
N/A
ME
VM
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