SPC Web Gateway Specification

Revision 1.2

lundix it

History Record

Revision	Date	Author	Comment
0.9	5-Jan-2014	Göran Lundquist, Lundix IT	Draft
1.0	27-Jan-2014	Göran Lundquist, Lundix IT	First edition
1.1	14-Mar-2014	Göran Lundquist, Lundix IT	Added support for EDP and https encryption. Added support for authentication control.
1.2	November 2020	Lundix IT	Added description of undocumented door control commands

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Contents

1 Introduction

1.1 Purpose of the document

The purpose of this document is to describe Lundix IT SPC Web Gateway that is providing a generic web interface to Siemens SPC intrusion panels.

1.2 Scope

The SPC Web Gateway is based on the functionality in EDP protocol version 2.0 and SPC panel firmware 3.2. In this version of the software the scope is limited to only support TCP as transport layer and following EDP functions are **not supported**:

- UDP as transport layer to SPC
- EDP version 1 frame layout
- EDP over GPRS
- EDP Audio Commands
- Set Clock Command
- Set User Pin Command

1.3 Document References

Id	Description	Revision
[EDP_SPEC]	Siemens EDP Protocol Specification	>=2.0
[SPC_INST_CONF]	Siemens SPC42xx/43xx/52xx/53xx/63xx, Installation & Configuration Manual	>=3.2

1.4 Terminology and Abbreviations

Term	Description
EDP	Siemens Enhanced Datagram Protocol
JSON	JavaScript Object Notation
REST	Representational State Transfer
RCD	Remote Communications Device
SIA	Security Industry Association
SPC panel	Siemens SPC intrusion panel
TCP	Transmission Control Protocol
URL	Uniform Resource Locator
WebSocket	Two-way TCP protocol RFC 6455
XML	Extensible Markup Language

1.5 JSON Element Data Types

All values in the JSON messages are sent as double-quoted UTF-8 strings of different ”data types”. Following data types will be used in this document:

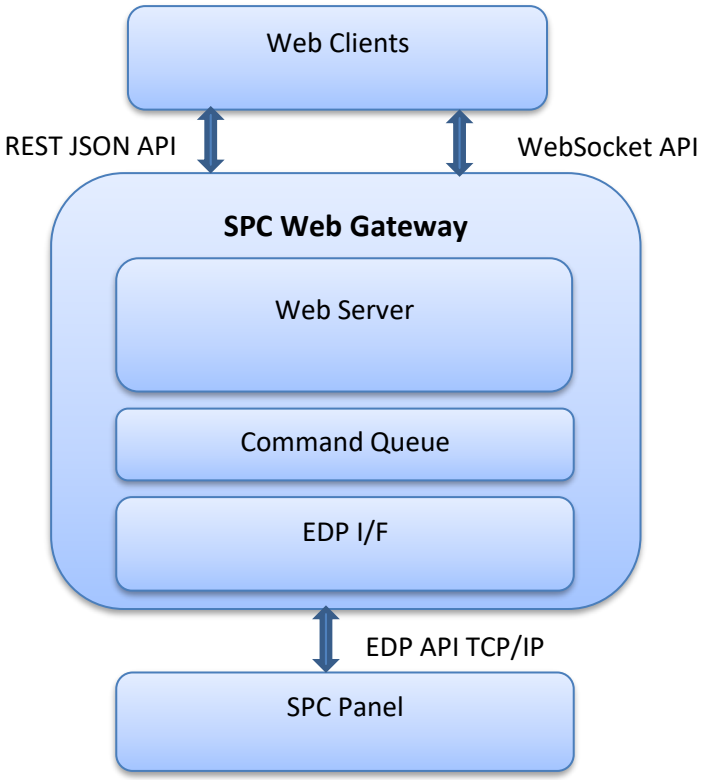
Data Type	Description	Example
Integer	Integer value, zero or positive, unless stated otherwise	“0”, “1”, “999”
Float	Float value	”0.1”, ”1.99”, ”-999.99”
String	UTF-8 String value	”User 1”, ”Area 1”
Hexadecimal	Hexadecimal string	”0123456789ABCDEF”
Timestamp	POSIX time defined as the number of seconds that have elapsed since 00:00:00 Coordinated Universal Time (UTC), Thursday, 1 January 1970	”1367404200” (= 1 May 2013 10:30:00 GMT)

2 General Presentation of the SPC Web Gateway

2.1 Overview

The SPC Web Gateway is providing a generic web interface to Siemens SPC panels. The main purpose is to simplify SPC integration with third party applications and products such as Home and Building Automation Systems, Smartphone App's and Web applications. The Web API is using HTTP and REST principles (RESTful) for requests to SPC panel and WebSocket to reporting events from the SPC panel.

2.2 Software Architecture



The SPC Web Gateway communicates (southbound) to the SPC panel over network using Siemens EDP protocol and offers a northbound interface - referred as Web Server - used by applications or web pages - referred as Web Clients - to operate and get information from the SPC panel. A REST JSON API is used for requests and commands and a WebSocket API for sending SIA events to the Web Clients.

The SPC Web Gateway supports multiple concurrent clients. In case the clients simultaneously send requests, the requests will be queued in the SPC Web Gateway waiting for the reply from the SPC panel. (The SPC panel is restricted to process only one request at a time). Events from the SPC panel (SIA events) are broadcasted to all "subscribing" recipients.

The SPC Web Gateway has following main features:

- Web Server. This is the core of the SPC Web Gateway.
- EDP I/F. Interface for communication to the SPC panel.
- Command Queue. Is managing the queue of pending commands and requests.

All features are embedded in one single multithreaded application with a very small footprint.

3 REST JSON API

The SPC Web Gateway REST JSON API provides access to the SPC panel resources via URL paths. The API uses JSON as its communication format, and the standard HTTP methods GET and PUT (see API descriptions below for which methods are available for each resource). URLs for the REST API resources have the following structure:

```
http[s]://<spc_web_gateway_host>:<port>/spc/<resource>
```

Default <port> is 8088 for remote access and 8089 for local access, but it is configurable. <resource> can be divided in several parts separated by slashes (/).

3.1 Response Format

All response messages consist of a status and a data part with following JSON structure:

```
{
   "status":"<return status>",
   "data":{
      "element1":"value1",
       "element2":"value2",
       …
       "elementN":"valueN"
     }
}
```

Encoding is UTF-8.

3.2 Response Status

Response status is returned using standard HTTP error code syntax in the header and additional info in the body of the return call, JSON-formatted.

3.2.1 success

If all went well the response status will be **success** and some valid data will be returned in the data part.

```
Header
HTTP/1.1 200 OK
Content-Type: application/json; charset=utf-8

Body
{
       "status": "success",
       "data": {
              <valid data>
       }
}
```

3.2.2 error

If an error occurred in processing the request the response status will be **error** and the data part will contain an error code and error message.

```
Header
```

```
HTTP/1.1 404 Not Found
Content-Type: application/json; charset=utf-8

Body
{
       "status": "error",
       "data": {
              "code": "<error_code>",
              "message": "<error_message>"
       }
}
```

Error Code	Error Message
242	Invalid parameters
252	Panel is in full engineer mode
253	Command is not possible now
254	Command is not permitted
255	Command is not implemented

3.3 Area Resources

3.3.1 Area Requests

Method	Resource	Description
GET	area	Returns the status of all areas
GET	area/<ID>	Returns the status of area <ID>.
GET	area/<ELEMENT>	Returns <ELEMENT> value of all areas.

Resource Parameters

Parameter	Description
ID	The area id. (1 – number of defined areas)
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each area.

Element	Type	Description
id	Integer	Area ID (1 to maximum number of areas)
name	String	Area name.
mode	Integer	Area mode: 0 – area is unset 1 – area is part set A 2 – area is part set B 3 – area is full set
last_set_time	Timestamp	Last time the area was full set. Present only if available.
last_set_user_id	Integer	ID of user that last full set the area, 1 to 515. Present only if available.

last_set_user_name	String	Name of user that last full set the area. Present only if available.
last_unset_time	Timestamp	Last time the area was unset. Present only if available.
last_unset_user_id	Integer	ID of user that last unset the area, 1 to 515. Present only if available.
last_unset_user_name	String	Name of user that last unset the area. Present only if available.
last_alarm	Timestamp	Timestamp of last alarm. Present only if available.

Example: GET area


```
{
	"status":"success",
	"data":{
		"area": [
			{
				"id": "1",
				"name": "Area 1",
				"mode": "0",
				"last_set_time": "1390068017",
				"last_set_user_id": "1",
				"last_set_user_name": "User 1",
				"last_unset_time": "1390068017",
				"last_unset_user_id": "2",
				"last_unset_user_name": "User 2",
				"last_alarm":"1389030757"
			},
			{
				"id":"2",
				"name":"Area 2",
				"mode":"0",
				"last_set_time":"1390068017",
				"last_set_user_id":"1",
				"last_set_user_name":"User 1",
				"last_unset_time":"1390068017",
				"last_unset_user_id":"2",
				"last_unset_user_name":"User 2"
			}
		]
	}
}
```


Example: GET area/1


```
{
	"status":"success",
	"data":{
		"area": [
			{
				"id": "1",
				"name": "Area 1",
				"mode": "0",
				"last_set_time": "1390068017",
				"last_set_user_id": "1",
				"last_set_user_name": "User 1",
				"last_unset_time": "1390068017",
				"last_unset_user_id": "2",
```

```
                        "last_unset_user_name": "User 2",
                        "last_alarm":"1389030757"
                }
        ]
    }
}
```

Example: GET area/name

```
{
    "status":"success",
    "data":{
        "area":[
            {
                "name":"Area 1"
            },
            {
                "name":"Area 2"
            }
        ]
    }
}
```

3.3.2 Area Commands

Method	Resource	Description
PUT	area/<ID>/set	Full sets area <ID>
PUT	area/<ID>/set_a	Part sets A area <ID>
PUT	area/<ID>/set_b	Part sets B area <ID>
PUT	area/<ID>/unset	Unsets area <ID>

Resource Parameters

Parameter	Description
ID	The area id. (1 – number of defined areas)

Example: PUT area/1/set

```
{
   "status":"success",
   "data": "null"
}
```

3.4 Zone Resources

3.4.1 Zone Requests

Method	Resource	Description

GET	zone	Returns the status of all zones
GET	zone/<ID>	Returns the status of zone <ID>.
GET	zone/<ELEMENT>	Returns <ELEMENT> value of all zones.

Resource Parameters

Parameter	Description
ID	The zone id. (1 – number of defined zones)
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each zone.

Element	Type	Description
id	Integer	Zone ID (1 to maximum number of zones)
type	Integer	Zone type, as follows: 0 - Alarm 1 - Entry/Exit 2 - Exit Terminator 3 - Fire 4 - Fire Exit 5 - Line 6 - Panic 7 - Hold-up 8 - Tamper 9 - Technical 10 - Medical 11 - Keyarm 12 – Unused 13 - Shunt 14 - X-shunt 15 - Fault 16 - Lock Supervision 17 - Seismic 18 - All Okay
zone_name	String	Zone name
area	Integer	Area number (1 – max number of areas)
area_name	String	Area name
input	Integer	Zone input as follows: 0 - Closed 1 - Open 2 - Short 3 - Disconnected 4 - PIR Masked 5 - DC Substitution 6 - Sensor Missing 7 - Offline
status	Integer	Zone status as follows: 0 - OK 1 - Inhibit 2 - Isolate 3 - Soak

		4 - Tamper 5 - Alarm 6 – (OK but not used recently) 7 - Trouble

Example: GET zone


```
{
	"status": "success",
	"data": {
		"zone": [
			{
				"id": "1",
				"type": "0",
				"zone_name": "Entrance",
				"area": "1",
				"area_name": "Area 1",
				"input": "0",
				"status": "0"
			},
			{
				"id": "2",
				"type": "0",
				"zone_name": "Kitchen",
				"area": "1",
				"area_name": "Area 1",
				"input": "1",
				"status": "0"
			},
			{
				"id": "3",
				"type": "0",
				"zone_name": "Living Room",
				"area": "1",
				"area_name": "Area 1",
				"input": "3",
				"status": "2"
			}
		]
	}
}
```


Example: GET zone/1


```
{
	"status": "success",
	"data": {
		"zone": [
			{
				"id": "1",
				"type": "0",
				"zone_name": "Entrance",
				"area": "1",
				"area_name": "Area 1",
				"input": "0",
				"status": "0"
```

```
                        }
                ]
        }
}
```

Example: GET zone/input

```
{
        "status": "success",
        "data": {
                "zone": [
                        {
                                "input": "0"
                        },
                        {
                                "input": "1"
                        },
                        {
                                "input": "3"
                        }
                ]
        }
}
```

3.4.2 Zone Commands

Method	Resource	Description
PUT	zone/<ID>/inhibit	Inhibit zone <ID>
PUT	zone/<ID>/deinhibit	Deinhibit zone <ID>
PUT	zone/<ID>/isolate	Isolate zone <ID>
PUT	zone/<ID>/deisolate	Deisolate zone <ID>

Resource Parameters

Element	Description
ID	The zone id. (1 – number of defined zones)

Example: PUT zone/1/inhibit

```
{
   "status":"success",
   "data": "null"
}
```

3.5 Output Resources

3.5.1 Output Requests

Method	Resource	Description

GET	output	Returns the status of all outputs
GET	output/<ID>	Returns the status of output <ID>.
GET	output/<ELEMENT>	Returns <ELEMENT> value of all outputs.

Resource Parameters

Parameter	Description
ID	The output id. (1 – number of defined outputs)
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each output.

Element	Type	Description
id	Integer	Output ID (1 to maximum number of outputs)
name	String	Name of output
state	Integer	Output state as follows: 0 – Not set 1 - Set

Example: GET output

```
{
	"status": "success",
	"data": {
		"output": [
			{
				"id": "1",
				"name": "Output 1",
				"state": "0"
			},
			{
				"id": "2",
				"name": "Output 2",
				"state": "1"
			}
		]
	}
}
```

Example: GET output/state

```
{
	"status": "success",
	"data": {
		"output": [
			{
				"state": "0"
			},
			{
				"state": "1"
```

```
                    }
                ]
            }
}
```

3.5.2 Output Commands

Method	Resource	Description
PUT	output/<ID>/set	Set output <ID>
PUT	output/<ID>/reset	Reset output <ID>

Resource Parameters

Element	Description
ID	The output id. (1 – number of defined output)

Example: PUT output/1/set

```
{
   "status":"success",
   "data": "null"
}
```

3.6 Bell Resources

3.6.1 Bell Commands

Method	Resource	Description
PUT	bell/silence	Silence all bells

Example: PUT bell/silence

```
{
   "status":"success",
   "data": "null"
}
```

3.7 Basic Panel Info Resources

3.7.1 Basic Panel Info Requests

Method	Resource	Description
GET	panel	Returns basic panel info

GET	panel/<ELEMENT>	Returns <ELEMENT> value

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

Element	Type	Description
type	String	Panel type
variant	String	Panel subtype
version	String	Firmware version of panel
device-id	Integer	Installation ID
sn	Hexadecimal	Serial number of panel
cfgtime	Timestamp	Timestamp of last configuration change. Present only if available.
hw_ver_major	Integer	Major hardware version of panel
hw_ver_minor	Integer	Minor hardware version of panel
license_key	String	Encrypted license key, presented as a string encoded in Base-32.

Example: GET panel

```
{
	"status": "success",
	"data": {
		"panel": {
			"type": "SPC4000",
			"variant": "4300",
			"version": "3.2.5",
			"device-id": "1",
			"sn": "123ABC99",
			"cfgtime": "1390248400",
			"hw_ver_major": "1",
			"hw_ver_minor": "4",
			"license_key": "XXXXXXXXXXXXX"
		}
	}
}
```

Example: GET panel/version

```
{
	"status": "success",
	"data": {
		"panel": {
			"version": "3.2.5"
		}
	}
}
```

3.8 System Info Resources

3.8.1 System Info Requests

Method	Resource	Description
GET	system	Returns system info
GET	system/<ELEMENT>	Returns <ELEMENT> value

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

Element	Type	Description
time	Timestamp	Panel time
engmode	Integer	Engineer mode: 0 – no 1 - yes
rf_type	Integer	Type of wireless module fitted on panel, as follows: 0 - Not fitted 1 - Visonic 2 - SiWay
rf_version	Integer	Wireless module firmware version

Example: GET system

```
{
	"status": "success",
	"data": {
		"system": {
			"time": "1390635628",
			"engmode": "0",
			"rf_type": "2",
			"rf_version": "10"
		}
	}
}
```

3.9 Power Supply Resources

3.9.1 Power Supply Requests

Method	Resource	Description
GET	psu	Returns power supply info
GET	psu/<ELEMENT>	Returns <ELEMENT> value

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

Element	Type	Description
batt_volt	String	Battery voltage
aux_volt	String	Voltage at auxiliary output
aux_curr	String	Current drawn from auxiliary output
ac_freq	String	Main frequency

Example: GET psu

```
{
	"status": "success",
	"data": {
		"psu": {
			"batt_volt": "9.8V",
			"aux_volt": "13.4V",
			"aux_curr": "120mA",
			"ac_freq": "50Hz"
		}
	}
}
```

3.10 System Alerts Resources

3.10.1 System Alerts Requests

Method	Resource	Description
GET	alert	Returns system alerts
GET	alert/<ELEMENT>	Returns <ELEMENT> value

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

System alerts bit definition

The system alert states are presented as 8-digit hexadecimal bitmasks, and all have the following bit assignments:

Bit	Description
0	Mains power fault (running on battery)
1	Battery fault
2	Auxiliary fuse
3	External bell fuse
4	Internal bell fuse
5	Bell tamper input
6	Cabinet Tamper switch open
7	Auxiliary Tamper 1
8	Auxiliary Tamper 2
9	Wireless antenna tamper detected
10	Wireless jamming detected
11	Modem 1 fault state
12	Modem 1 phone line fault
13	Modem 2 fault state
14	Modem 2 phone line fault
15	Cable fault
16	Fail to communicate
17	User duress
18	Date/Time lost (SPC 4000 only)
19	User RF Panic button pressed
20	User Man Down Transmitter alarm
21	Panel power supply problem

Return Values

Element	Type	Description
input	Hexadecimal	Input state per the bit definition above
alert	Hexadecimal	Alert state per the bit definition above
inhibit	Hexadecimal	Inhibit state per the bit definition above
isolate	Hexadecimal	Isolate state per the bit definition above

Example: GET alert

```
{
	"status": "success",
	"data": {
		"alert": {
			"input": "00000002",
			"alert": "00000000",
			"inhibit": "00000000",
			"isolate": "00000002"
		}
	}
}
```

3.10.2 System Alerts Commands

Method	Resource	Description

PUT	alert/restore	Restores all alerts.

Example: PUT alert/restore

```
{
   "status":"success",
   "data": "null"
}
```

3.11 Modem Info Resources

3.11.1 Modem Info Requests

Method	Resource	Description
GET	modem	Returns modem info
GET	modem/<ELEMENT>	Returns <ELEMENT> value of all modems

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each fitted modem (up to two).

Element	Type	Description
port	Integer	Modem ID: 1 – primary, 2 - backup
enabled	Integer	Modem enabled: 0 – no, 1 - yes
status	Integer	Modem status as follows: 0 - Disabled 1 - OK 2 - No Response 3 - Fault 4 - Bad PIN 5 - Line Fault 6 - Bad SIM 7 - Unsupported country code
state	Integer	Modem state as follows: 0 - Not Applicable(because modem is disabled) 1 - Ready 2 - Detecting 3 - Initializing 4 - Dialling 5 - Answering 6 - Connected 7 - Disconnecting 8 - Busy 9 - GPRS (dial, connected or disconnecting)

type	Integer	Type of modem fitted as follows: 0 - None 1 - PSTN 2 - GSM 3 - Redcare
id_type	String	Modem type ID.
id_fw	String	Modem firmware ID
id_hw	String	Modem hardware ID
capabilities	Hexadecimal	Modem capabilities is a bitmask, as follows: Bit 0 - slow dial Bit 1 - fast dial Bit 2 - SMS Bit 3 - Fast Format Bit 4 - Contact ID Bit 5 - SIA Bit 6 - SMS Incoming Bit 7 - GPRS Bit 8 - Multiple SIA events in a single call. Bit 9 - Multiple ContactID events in a single call
gsm_signal	Integer	GSM signal strength, applicable only to GSM modems. The range is 2 – 9, 2 is lowest.
status_raw	Hexadecimal	Raw modem status. Bitmask as follows: Bit 0 - modem is detected Bit 1 - modem is not responding (fault) Bit 2 - line fault
last_call	Timestamp	Time of last call. Present only if available
last_direction	Integer	Direction of last call: 0 – in, 1 – out. Present only if available
incoming_time	Integer	Total time connected for incoming calls, in seconds.
incoming_count	Integer	Number of incoming calls
outgoing_time	Integer	Total time connected for outgoing calls, in seconds.
outgoing_count	Integer	Number of outgoing calls.
outgoing_failed	Integer	Number of failed dial attempts.
incoming_sms_count	Integer	Number of received SMS.
outgoing_sms_count	Integer	Number of sent SMS.

Example: GET modem


```
{
	"status": "success",
	"data": {
		"modem": [
			{
				"port": "1",
				"enabled": "1",
				"status": "1",
				"state": "1",
				"type": "2",
				"id_type": "IntelliModem GSM",
				"id_fw": "3.07 [28MAY12]",
				"id_hw": "2",
				"capabilities": "03FF",
				"gsm_signal": "3",
				"status_raw": "0001",
				"incoming_time": "0",
				"incoming_count": "0",
```

```
                        "outgoing_time": "0",
                        "outgoing_count": "0",
                        "outgoing_failed": "0",
                        "incoming_sms_count": "2",
                        "outgoing_sms_count": "0"
                },
                {
                        "port": "2",
                        "enabled": "0",
                        "status": "0",
                        "state": "0",
                        "type": "1",
                        "id_type": "",
                        "id_fw": "0.00 []",
                        "id_hw": "",
                        "capabilities": "0000",
                        "gsm_signal": "0",
                        "status_raw": "0000",
                        "incoming_time": "0",
                        "incoming_count": "0",
                        "outgoing_time": "0",
                        "outgoing_count": "0",
                        "outgoing_failed": "0",
                        "incoming_sms_count": "0",
                        "outgoing_sms_count": "0"
                }
        ]
    }
}
```


3.12 Ethernet Info Resources

3.12.1 Ethernet Info Requests

Method	Resource	Description
GET	ethernet	Returns ethernet interface info
GET	ethernet/<ELEMENT>	Returns <ELEMENT> value

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

Element	Type	Description
fitted	Integer	Ethernet circuit fitted. 0 – no, 1 - yes
state	Integer	Ethernet state. 0 - down, 1 - up
dhcp_enabled	Integer	DHCP enabled. 0 – no, 1 - yes

mac_address	String	MAC address
ip_address	String	IP address
netmask	String	Netmask
gateway	String	Gateway IP address
tx_packets	Integer	Count of packets transmitted
tx_bytes	Integer	Count of octets transmitted
rx_packets	Integer	Count of packets received
rx_bytes	Integer	Count of octets received

Example: GET ethernet


```
{
	"status": "success",
	"data": {
		"ethernet": {
			"fitted": "1",
			"state": "1",
			"dhcp_enabled": "0",
			"mac_address": "FF:FF:FF:FF:FF:FF",
			"ip_address": "192.168.0.2",
			"netmask": "255.255.255.0",
			"gateway": "192.168.0.1",
			"tx_packets": "348988889",
			"tx_bytes": "2061242289",
			"rx_packets": "392464246",
			"rx_bytes": "2417087670"
		}
	}
}
```


3.13 User Info Resources

3.13.1 User Info Requests

Method	Resource	Description
GET	user	Returns info about all users
GET	user/<ID>	Returns info about user <ID>
GET	user/<ELEMENT>	Returns <ELEMENT> value of all users

Resource Parameters

Parameter	Description
ID	User ID
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each user.

Element	Type	Description
id	Integer	User ID
name	String	User name

Example: GET user

```
{
	"status": "success",
	"data": {
		"user": [
			{
				"id": "1",
				"name": "User 1"
			},
			{
				"id": "2",
				"name": "User 2"
			},
			{
				"id": "3",
				"name": "User 3"
			}
		]
	}
}
```

3.14 X-BUS Node Info Resources

3.14.1 X-BUS Node Info Requests

Method	Resource	Description
GET	xbusnode	Returns info about all X-BUS nodes
GET	xbusnode/<ELEMENT>	Returns <ELEMENT> value of all X-BUS-nodes

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each connected X-BUS nodes.

Element	Type	Description
id	Integer	X-BUS node ID

sn	Hexadecimal	Serial number
name	String	Name of the node
type	Integer	Node type as follows: 1 - Standard Keypad 2 - Standard I/O 3 - Analysed I/O 4 - IntelliPower PSU Interface (hardware version 1 only) 5 - Wireless (hardware version 1 only) 6 - Two reader door controller 7 - Multi Area Keypad 8 - Indicator 9 - Key Switch 10 - Audio Expander
hardware_id	Integer	Hardware version: 1 - Original version. 2 - Version with rotary switches.
icount	Integer	Number of physical inputs
ocount	Integer	Number of physical outputs
version	String	Firmware version
rf_type	Integer	Type of wireless module piggybacked on a node of hardware version 2, as follows: 0 - Not fitted 1 - Visonic 2 - SiWay
rf_version	Integer	Firmware version of wireless module.
reader_type	Integer	Type of card reader, as follows (this applies only to keypads): 0 - None fitted 1 - EM4100 2 - MIFARE
status	Hexadecimal	Node status. Bitmask, as follows: Bit 0 - Node was reset Bit 1 - Node 12V supply is low Bit 2 - Node Lid is open Bit 3 - Node Back tamper is open Bit 4 - Battery fault Bit 5 - Mains fault Bit 6 - Over current Bit 7 - RF Jamming detected Bit 8 - External antenna not connected. Bit 9 - Node fuse 1 blown Bit 10 - Node fuse 2 blown Bit 11 - Node fuse 3 blown Bit 12 - Node fuse 4 blown Bit 13 - PSU fault
position_1	Integer	Node position on cable 1
position_2	Integer	Node position on cable 2.
psu_type	Integer	Type of PSU. This applies to hardware of version 2 and greater, as follows: 0 - No PSU is attached to this node. 1 - PSU attached (3 A)
psu_fw_version	Integer	Firmware version of PSU attached to this node. Applicable only if PSU_TYPE is not zero
psu_mode	Integer	Battery mode, as follows: 1 - no battery jumper fitted (fault condition) 2 - battery jumper set for output voltage limited to 12 V (that is, battery will not be charged) 3 - battery jumper set for 7 Ah battery 4 - battery jumper set for 17 Ah battery
psu_out1_volt	String	Voltage at PSU output 1. Present only if PSU_TYPE is not zero.

psu_out1_curr	String	Current at PSU output 1. Present only if PSU_TYPE is not zero.
psu_out2_volt	String	Voltage at PSU output 2. Present only if PSU_TYPE is not zero.
psu_out2_curr	String	Current at PSU output 2. Present only if PSU_TYPE is not zero.
psu_out3_volt	String	Voltage at PSU output 3. Present only if PSU_TYPE is not zero.
psu_out3_curr	String	Current at PSU output 3. Present only if PSU_TYPE is not zero.
psu_batt_volt	String	Battery current. Present only if PSU_TYPE is not zero or TYPE is 4.
psu_batt_curr	String	Current at PSU output 1. Present only if PSU_TYPE is not zero or TYPE is 4.
aux_volt	Sting	Voltage at auxiliary output (to power relays, for example). For TYPE 4 (IntelliPower PSU) this is the voltage supplied.
aux_curr	String	Current at auxiliary output. For TYPE 4 (IntelliPower PSU) this is sum of current supplied on outputs 1 and 2
input	Hexadecimal	Input state. Bitmask as follows: Bit 0 - Configured node is no longer communicating Bit 1 - Node cabinet tamper Bit 2 - Node fuse fault Bit 3 - Node Mains fault Bit 4 - Node Battery fault Bit 5 - Node has detected RF jamming Bit 6 - Node has detected antenna tamper Bit 7 - Node Panic button is pressed Bit 8 - Node Fire button is pressed Bit 9 - Node Medical button is pressed Bit 10 - Node PSU fault
alert	Hexadecimal	Alert state per the description above
inhibit	Hexadecimal	Inhibit state per the description above.
isolate	Hexadecimal	Isolate state per the description above.
key_position	Integer	Position of key, present only for nodes of TYPE 9 (Key Switch), as follows: 0 - Centre position 1 - Right position 2 - Left position 254 - Tamper 255 - Unknown position
audio_type	Integer	Audio type as follows: 0 - Not fitted 1 - Capture and playback Present only for nodes of type Multi Area Keypad

Example: GET xbusnode


```
{
	"status": "success",
	"data": {
		"xbusnode": [
			{
				"id": "1",
				"sn": "9999999",
				"name": "Extra I/O",
				"type": "2",
				"hardware_id": "1",
				"icount": "8",
				"ocount": "2",
				"version": "1.09 13DEC10",
				"rf_type": "0",
				"rf_version": "0",
```

```
                        "reader_type": "0",
                        "status": "00000000",
                        "position_1": "2",
                        "position_2": "0",
                        "psu_type": "0",
                        "aux_volt": "13.9V",
                        "aux_curr": "47mA",
                        "input": "0000",
                        "alert": "0000",
                        "inhibit": "0000",
                        "isolate": "0000"
                },
                {
                        "id": "2",
                        "sn": "FFFFFFFF",
                        "name": "Keypad 1",
                        "type": "1",
                        "hardware_id": "1",
                        "icount": "0",
                        "ocount": "0",
                        "version": "2.09 13MAR13",
                        "rf_type": "0",
                        "rf_version": "0",
                        "reader_type": "1",
                        "status": "00000004",
                        "position_1": "1",
                        "position_2": "0",
                        "psu_type": "0",
                        "aux_volt": "13.6V",
                        "aux_curr": "0mA",
                        "input": "0002",
                        "alert": "0000",
                        "inhibit": "0000",
                        "isolate": "0002"
                }
        ]
    }
}
```


3.15 X-BUS Map Info Resources

3.15.1 X-BUS Map Info Requests

Method	Resource	Description
GET	xbusmap	Returns info about the X-BUS map
GET	xbusmap/<ELEMENT>	Returns <ELEMENT> value of all X-BUS-nodes

Resource Parameters

Parameter	Description
ELEMENT	See valid element names in Return Values table below

Return Values

There will be two instances of these elements, one for each connected X-BUS port.

Element	Type	Description
port	Integer	X-BUS port, can be 1 or 2.
node_count	Integer	How many nodes connected on this port. In a ring configuration, this attribute will be the same for both ports.
topology	Integer	X-BUS topology. 0 - chain or ring, 1 - multi-drop

There will be one instance of these elements for each connected X-BUS node per X-BUS port.

Element	Type	Description
position	Integer	In a chain or ring configuration, this indicates the physical placing on the network. Counting starts at the panel that is assigned the 0 position. In a multi-drop configuration this attribute is assigned by the system but has otherwise no other meaning
switch_id	Integer	Rotary switch setting if the node has it, otherwise will be set to 255.
sn	Hexadecimal	Serial number
type	Integer	Node type as follows: 1 - Standard Keypad 2 - Standard I/O 3 - Analysed I/O 4 - IntelliPower PSU Interface 5 - Wireless 6 - Two reader door controller 7 - Multi Area Keypad 8 - Indicator 9 - Key Switch 10 - Audio Expander
hardware_id	Integer	Hardware version: 1: Original version. 2: Version with rotary switches.
icount	Integer	Number of inputs
ocount	Integer	Number of outputs
version	String	Firmware version
licensed	Integer	Node is licensed for use with the panel it is connected to. 0 – no, 1 - yes

Example: GET xbusmap

```
{
	"status": "success",
	"data": {
		"xbusmap": [
			{
				"port": "1",
				"node_count": "2",
				"topology": "1",
				"node": [
					{
```

```
                                        "position": "1",
                                        "switch_id": "2",
                                        "sn": "9999999",
                                        "type": "1",
                                        "hardware_id": "1",
                                        "icount": "0",
                                        "ocount": "0",
                                        "version": "2.09 13MAR13",
                                        "licensed": "1"
                                },
                                {
                                        "position": "2",
                                        "switch_id": "1",
                                        "sn": "FFFFFFF",
                                        "type": "2",
                                        "hardware_id": "1",
                                        "icount": "8",
                                        "ocount": "2",
                                        "version": "1.09 13DEC10",
                                        "licensed": "1"
                                }
                        ]
                },
                {
                        "port": "2",
                        "node_count": "0",
                        "topology": "0"
                }
        ]
    }
}
```


3.16 Door Resources

3.16.1 Door Requests

Method	Resource	Description
GET	door	Returns the status of all doors
GET	door/<ID>	Returns the status of door <ID>
GET	door/<ELEMENT>	Returns <ELEMENT> value of all doors

Resource Parameters

Parameter	Description
ID	Door ID
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each configured door.

Element	Type	Description
id	Integer	Door ID, from 1 to max number of doors
dps_input	Integer	DPS zone input as follows: 0 - Closed 1 - Open 2 - Short 3 - Disconnect 4 - N/A 5 - DC Substitution 6 - N/A 7 - Offline
drs_input	Integer	DRS zone input as follows: 0 - Closed 1 - Open 2 - Short 3 - Disconnect 4 - N/A 5 - DC Substitution 6 - N/A 7 - Offline
status	Integer	Door status as follows: 0 - OK 1 - Open too long 2 - Left open 3 - Forced 4 - Tamper 5 - Offline
mode	Integer	Door mode. 0 – Normal, 1- Locked, 2 - Blocked
zone	Integer	Zone ID corresponding to this door, from 1 to maximum number of zones. Present only if available.
zone_name	String	Zone name. Present only if available
area	Integer	Area number, from 1 to maximum number of areas. Present only if available
area_name	String	Area name. Present only if available

Example: GET door


```
{
	"status": "success",
	"data": {
		"door": [
			{
				"id": "1",
				"dps_input": "1",
				"drs_input": "0",
				"status": "0",
				"mode": "0",
				"zone": "5",
				"zone_name": "Door 1",
				"area": "1",
				"area_name": "Area 1"
			},
			{
				id": "2",
				"dps_input": "1",
				"drs_input": "0",
				"status": "0",
```

```
                        "mode": "1"
                    }
                ]
            }
}
```

3.16.2 Door Commands

Method	Resource	Description
PUT	door/<ID>/lock	Lock door
PUT	door/<ID</set_normal_mode	Set door to normal mode
PUT	door/<ID</open_permanently	Open door permanently
PUT	door/<ID</open_momentarily	Open door momentarily
PUT	door/<ID</isolate	Isolate door
PUT	door/<ID>/deisolate	Deisolate door
PUT	door/<ID>/inhibit	Inhibit door
PUT	door/<ID>/deinhibit	Deinhibit door

Example: PUT door/1/lock

```
{
   "status":"success",
   "data": "null"
}
```

3.17 Verification Resources

3.17.1 Verification Zone Requests

Method	Resource	Description
GET	vzone	Returns the status of all verification zones
GET	vzone/<ID>	Returns the status of verification zone <ID>
GET	vzone/<ELEMENT>	Returns <ELEMENT> value of all verification zones

Resource Parameters

Parameter	Description
ID	Verification zone ID
ELEMENT	See valid element names in Return Values table below

Return Values

There will be one instance of these elements for each verification zone.

Element	Type	Description

id	Integer	Verification zone ID, from 1 to max number of verification zones
name	String	Name of verification zone
audio	Integer	Audio state. 0 - No audio available, 1 - Audio online, 2 - Audio offline
audio_pre	Integer	Duration of pre-event recording, in seconds. Only present if a verification event is available and pre-event audio recording is enabled.
audio_post	Integer	Duration of post-event recording, in seconds. Only present if a verification event is available and post-event audio recording is enabled.
audio_volume	Integer	Volume for speaker, ranging from 0 to 7, where 0 means the speaker is disabled, 1 is minimum volume, 7 is maximum. Only present if audio is online.
video	Integer	Video status. 0 - No video available, 1 - Video online, 2 - Video offline
pre_images	Integer	Number of recorded prevent images. Only present if a verification event is available and pre-event video recording is enabled.
pre_interval	Integer	Interval between pre-event images, in seconds (1 -10). Only present if a verification event is available and pre-event video recording is enabled
post_images	Integer	Number of recorded postevent images. Only present if a verification event is available and post-event video recording is enabled.
post_interval	Integer	Interval between postevent images, in seconds (1 - 10). Only present if a verification event is available and post-event video recording is enabled.
vtime	Timestamp	Timestamp of the moment a verification event was triggered for this zone. This is normally the same as the SIA event timestamp, however for an entry event the timestamp will be that of the entry timer expiring, whereas this verification timestamp will refer to the moment of the opening of the entry zone. Present only if available. (FW3.1 and greater)
last_open	Timestamp	Timestamp of last time a physical zone assigned to this verification zone was open. This can be used for example to help with tracking movement inside a building that has PIRs, as zones open and close when a burglar moves around, and a second event for a zone will not be issued if the alarm for the first event has not been restored. Present only if available (a zone has opened).

Example: GET verification

```
{
	"status": "success",
	"data": {
		"vzone": [
			{
				"id": "1",
				"name": "Vzone 1",
				"audio": "0",
				"video": "1"
			}
		]
	}
}
```

3.18 Image Resources

3.18.1 Image Requests

Method	Resource	Description
GET	image/<VZONE_ID>	Returns a live image for verification zone <VZONE_ID>
GET	image/<VZONE_ID>/<IMAGE_ID>	Returns recorded image <IMAGE_ID> for verification zone <VZONE_ID>.

Resource Parameters

Parameter	Description
VZONE_ID	Verification zone ID
IMAGE_ID	ID -1 to -16 returns image saved before verification zone event. ID 1 to 16 returns image saved after verification zone event. IDs are ordered in time as follows: -16, -15, … ,-2,-1, (event), 1, 2, … , 15, 16. Image ID 0 will return the live image.

Return Values

Element	Type	Description
id	Integer	Image ID: -16 to -1 – Pre-event image 0 – Live image 1 to 16 – Post-event image
timestamp_s	Timestamp	Time when image was captured (seconds)
timestamp_ms	Integer	Fraction of a second for the timestamp, in milliseconds (10 milliseconds precision).
format	String	Image format. Currently only “jpeg/base64” is supported.
data	String	String containing base64 encoded jpeg image data

Example: GET image/1 or image/1/0

```
{
	"status": "success",
	"data": {
		"image": {
				"id": "0"
				"timestamp_s": "1390641422",
				"timestamp_ms":"250",
				"format": "jpeg/base64",
				"data": "…"
		}
	}
}
```

Example: GET image/1/-1

```
{
	"status": "success",
```

```
	"data": {
		"image": {
				"image_id": "-1"
				"image_timestamp_s": "1390641301",
				"image_timestamp_ms":"120",
				"format": "jpeg/base64",
				"data": "…"
		}
	}
}
```


3.19 System Log Resources

3.19.1 System Log Requests

Method	Resource	Description
GET	systemlog	Returns systemlog events (last 100 events)
GET	systemlog/<MAX_NUM_EVENTS>	Returns last <MAX_NUM_EVENTS>.

Resource Parameters

Parameter	Description
MAX_NUM_EVENTS	Number of requested events. 1 to 500.

Return Values

There will be one instance of these elements for each **event.**

Element	Type	Description
time	Timestamp	Event time
raw	Hexadecimal	Event raw data. Its encoding is not specified in this document.
text	String	Textual description of event.

Example: GET systemlog


```
{
	"status": "success",
	"data": {
		"systemlog": {
			"event": [
				{
					"time": "1390642515",
					"raw": "0800010000000000",
					"text": "EVENT TEXT 1"
				},
				{
					"time": "1390642159",
					"raw": "0800010001000000",
```

```
                                "text": "EVENT TEXT 2"
                        },

                        …

                        {
                                "time": "1390642515",
                                "raw": "0800010000000000",
                                "text": "EVENT TEXT 100"
                        }
                ]
        }
    }
}
```


3.20 Access Log Resources

3.20.1 Access Log Requests

Method	Resource	Description
GET	accesslog	Returns accesslog events (last 100 events)
GET	accesslog/<MAX_NUM_EVENTS>	Returns last <MAX_NUM_EVENTS>

Resource Parameters

Parameter	Description
MAX_NUM_EVENTS	Number of requested events. 1 to 500.

Return Values

There will be one instance of these elements for each **event.**

Element	Type	Description
time	Timestamp	Event time
type	Integer	Event type, as follows: 1 - Entry granted 2 - Entry denied 3 - Exit granted 4 - Exit denied 5 - Door release (the door release button is pressed while the door is in normal mode) 6 - Door open too long 7 - Door left open 8 - Door forced open 9 - Door normal 10 - Door locked 11 - Door unlocked 12 - Passback violation 13 - Card voided (as a Comment result of entering too many invalid PIN entries) 14 - Card added

		15 - Card deleted 16 - Card reset 17 - Card details change 18 - Card data 19 - Card voided at the keypad
card_format	Integer	Card type, present only for events of type 18 (Card Data): 0 - Wiegand 26 bits 1 - Wiegand 36 bits (EPX2) 2 - HID Corporate 1000 3 - EM4102 4 – COTAG
card_site	Integer	Site number for cards with CARD_FORMAT equal to 0, 1, or 2, otherwise zero. Present only for events of type 18 (Card Data).
card_number	Integer	Card number for cards with CARD_FORMAT equal to 0, 1, or 2, otherwise zero. Present only for events of type 18 (Card Data). Due to implementation reasons (flash structure) this number is wrong and should not be relied upon.
card_number_raw	String	Raw card number in the internal panel format, presented as “<high> <low>”, where <high> and <low> are both decimal numbers. Present only for events of type 18 (Card Data). Due to implementation reasons (flash structure) <low> is wrong and should not be relied upon.
detail	Integer	Event detail, present only if available (not zero). Currently this attribute provides additional detail only for entry denied events, as follows: 1 - Passback violation 2 - Escort required 3 - Custodian required 4 - Invalid PIN 5 - Area is fullset 6 - Door is locked 7 - Invalid card format 8 - Card not on system 9 - Door not authorized for this card 10 - Outside time/date limit 11 - Card is void 12 - Interlocked door is open
door_id	Integer	Door ID for this event,present only if available (not zero).
door_name	String	Zone name for the door. This is present only if there a zone associated with the door and if the zone has a name defined.
user_changed_id	Integer	ID of user for which a card was changed. Present only for events of type 14, 15, 16, 17 and 19 if there is an associated user. (For those type of events USER_ID, defined below, indicates who performed the card operation.)
user_changed_name	String	Name of user for which a card was changed. Present only for events of type 14, 15, 16, 17 and 19 if there is an associated user and it has a name defined. (For those type of events USER_NAME, defined below, indicates who performed the card operation.)
user_id	Integer	User ID for this event. This attribute is present only if there is an associated user.
user_name	String	User Name for this event. This attribute is present only if there is an associated user and it has a name defined

Example: GET accesslog

```
{
	"status": "success",
	"data": {
		"accesslog": {
```

```
                "event": [
                        {
                                "time": "1390642515",
                                "type": "1",
                                "door_id": "1",
                                "door_name": "Door 1",
                                "user_id": "1",
                                "user_name": "User 1"
                        },
                        {
                                "time": "1390642515",
                                "type": "2",
                                "door_id": "1",
                                "door_name": "Door 1",
                                "user_id": "3",
                                "user_name": "User 3"
                        }
                ]
        }
    }
}
```


3.21 Zone Log Resources

3.21.1 Zone Log Requests

Method	Resource	Description
GET	zonelog/<ZONE_ID>	Returns zonelog events for zone <ZONE_ID>

Resource Parameters

Parameter	Description
ZONE_ID	Zone ID. 1 to maximum number of zones.

Return Values

Element	Type	Description
zone	Integer	Zone ID

There will be one instance of these elements for each **event.**

Element	Type	Description
time	Timestamp	Event time
input	Integer	Zone state as follows: 0 - Closed 1 - Open 2 - Short 3 - Disconnected 4 - PIR Masked

		5 - DC Substitution 6 - N/A 7 - Offline 8 - Pulse Count 9 -Gross Attack

Example: GET zonelog/8


```
{
	"status": "success",
	"data": {
		"zonelog": {
			"zone": "8",
			"event": [
				{
					"time": "1389030757",
					"input": "1"
				},
				{
					"time": "1389030761",
					"input": "0"
				},
				{
					"time": "1389032060",
					"input": "1"
				},
				{
					"time": "1389032064",
					"input": "0"
				}
			]
		}
	}
}
```


3.22 Wireless Log Resources

3.22.1 Wireless Log Requests

Method	Resource	Description
GET	wirelesslog/<SENSOR_ID>	Returns wirelesslog events for sensor <SENSOR_ID>

Resource Parameters

Parameter	Description
SENSOR_ID	Sensor ID

Return Values

Element	Type	Description
sensor	Integer	Sensor ID

There will be one instance of these elements for each **event.**

Element	Type	Description
time	Timestamp	Event time
status	Integer	Sensor status as follows: 0 - Closed 1 - Tamper 2 - Open 3 - Fault
battery	Integer	Battery status as follows: 0 - OK 1 - Low
signal	Integer	Received signal strength indicator (RSSI). The range is 0-9. 0-3 is considered very low, 4-5 low, otherwise the strength is high
receiver_id	Integer	Node ID of receiving node.
receiver_type	Integer	Type of receiving node, present only if receiver is not the controller. 1 - Standard Keypad 2 - Standard I/O 3 - Analysed I/O 4 - N/A 5 - Wireless (hardware version 1 only). Obsolete. 6 - Two reader door controller 7 - Multi Area Keypad 8 - N/A 9 - N/A 10 - N/A
receiver_wireless	Integer	Indicates if the receiving node is an expander sold as being wireless (that is, type I/O with no inputs and outputs). This attribute can be used for example to show the type as being “Wireless” on a GUI if so desired. This attribute is present only if receiver is not the controller. Values: 0 - no, 1 - yes

Example: GET wirelesslog/1


```
{
	"status": "success",
	"data": {
		"wirelesslog": {
			"sensor": "1",
			"event": [
				{
					"time": "1390642515",
					"status": "0",
					"battery": "0",
					"signal": "6",
					"receiver_id": "0"
				},
				{
					"time": "1390642520",
```

```
                                    "status": "2",
                                    "battery": "0",
                                    "signal": "6",
                                    "receiver_id": "0"
                                }
                            ]
                        }
                    }
}
```

4 WebSocket API

The SPC Web Gateway provides a WebSocket interface that broadcasts events to "subscribing" clients in real time. To establish a WebSocket connection, the client sends a WebSocket handshake request to the URL:

```
ws[s]://<spc_web_gateway_host>:<port>/ws/spc/
```

Default <port> is 8088 for remote access and 8089 for local access, but it is configurable.

4.1 WebSocket Event Reports

All messages are reported as SIA events embedded in a JSON frame. Encoding is UTF-8. The format of the message is:

```
{
	"status": "success",
	"data": {
		"sia": {
			"device_id": "<device_id>",
			"timestamp": "<timestamp>",
			"sia_code": "<sia_code>",
			"sia_address": "<sia_address>",
			"description": "<description>",
			"flags": "<flags>",
			"verification_id": "<verification_id>"
		}
	}
}
```

Element	Type	Description
device_id	Integer	ID of the device
timestamp	Timestamp	Event timestamp
sia_code	String	Two character code specifying the event. Please see [SPC_INST_CONF] section 21.7 for valid SIA codes.
sia_address	Integer	Number that depend on the SIA code.
description	String	Textual description of the event
flags	String	Each flag is a single character, and more than one flag can be concatenated to form a string. If there are no flags the flags string will be empty. A – Area Fullset D – Area Unset I – Zone Isolated or Unisolated U – Door Unlocked V – Event has video verification data W – Event has audio verification data 1 – Event is being sent by primary modem 2 – Event is being sent by backup modem
verification_id	Integer	Zero means the panel has no audio or video information for the event, otherwise it is the Verification Zone ID.

Example: Burglary Alarm

```
{
       "status": "success",
       "data": {
              "sia": {
                     "device_id": "1000",
                     "timestamp": "1390645123",
                     "sia_code": "BA",
                     "sia_address": "1",
                     "description": "Front door",
                     "flags": "V",
                     "verification_id": "1"
              }
       }
}
```

Device 1000, timestamp (1390645123) 25 Jan 2014 10:18:43 GMT, Burglary Alarm, Zone 1, Zone Name is Front door, Video is available for this event, Verification Zone ID is 1.

4.2 JavaScript WebSocket example

This is a code example written in JavaScript showing how to establish and read messages on a SPC Web Gateway WebSocket connection. The code is based on node.js and websocket.js.

```
/* Accept self signed certificate */
process.env.NODE_TLS_REJECT_UNAUTHORIZED = "0";

var websocket_client = require('websocket').client;

// Connect to SPC Web Gateway websocket interface on 192.168.1.100:8088
var ws_client = new websocket_client();
ws_client.connect('wss://192.168.1.100:8088/ws/spc?username=<SPC_WEB_GATEWAY_USER>&
password=<SPC_WEB_GATEWAY_PWD>');

ws_client.on('connectFailed', function(error) {
    console.log('Connect Error: ' + error.toString());
});

ws_client.on('connect', function(connection) {
    console.log('WebSocket client connected');
    connection.on('error', function(error) {
        console.log("Connection Error: " + error.toString());
    });
    connection.on('close', function() {
        console.log('echo-protocol Connection Closed');
    });
    connection.on('message', function(message) {
        if (message.type === 'utf8') {
            manageSiaEvent(message.utf8Data);
        }
    });
});

// manageSiaEvent
function manageSiaEvent(message){
    var msg = JSON.parse(message);
```

```
    if (msg.status === 'success'){
        var sia_code = msg.data.sia.sia_code;

        // Take care of SIA event action
        switch (sia_code){
            case 'BA': /* Burglar Alarm */
                …
                break;
            case 'BR': /* Burglar Alarm Restore */
                …
                break;
            case 'BB': /* Inhibited or Isolated */
                …
                break;
            …
         }
     }
}
```

END OF DOCUMENT